

# Sea Level Rise Near Humboldt Bay

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## Methods

Data for Humboldt County parcels and a digital elevation model (DEM) for the area around Humboldt Bay were provided. The projections were checked and projected to NAD83 UTM Zone 10 North, if needed. From the DEM raster, new rasters were created to show areas below specific elevation values from mean sea level (MSL). The elevations selected were 1m, 2m, 5m, and 10m, with the resulting rasters having boolean values, indicating whether the area is below the specified elevation. An additional boolean raster was created by the same method to show the areas below MSL. The MSL raster was subtracted from each of the other boolean elevation rasters to generate rasters indicating what areas would flood from sea level rise, hereby referred to as “flood rasters.”

The parcels shapefile was summarized by land use into a new table. The land use classifications were simplified further into: city, agriculture & timber, residential, commercial, industrial, recreational (including camps, golf courses, and open space), tribal, public, and other. Each of these new classifications was manually done with integers in a new field. The summarized table was rejoined back to the source parcels shapefile to assign the new land usage classification integers to all parcels. The new land use field was used to convert the polygon file to a raster, using the same cell size as the original DEM file. The new land use raster was then multiplied against each of the flood rasters to identify which areas would be inundated from each scenario. To estimate how many hectares of land would be affected, each of those inundation rasters had a new field added, with the formula shown below, in both original and simplified forms.

$$AreaSquareMeters = NumberOfPixels \left( \frac{8.964m * 8.964m}{1 pixel} \right)$$

$$AreaHectares = NumberOfPixels * 0.008035$$

Finally, a sea level rise risk map was created from the original DEM file. The image was reclassified into 6 classes coinciding with MSL, the above sea level rise values, and the original file's max value. The classifications were then adjusted further, shifting the first and last classes were turned to NODATA, such that only the inundation areas in the listed 4 scenarios were shown in the final raster.

## Results

As expected, 1 meter of sea level rise affects little land. Even though there's a much larger jump in sea level rise between 5 and 10 meters, the most difference in hectares of affected land seems to be between 2 and 5 meters of rise. Agricultural zoned land takes the biggest hit with the jump to 5 meters of sea level rise, with recreational and city zonings as the next two largest areas affected.

The table below shows the affected hectares, though there's a few notes to make about the revised zoning. Agricultural zoning also includes timber. Recreational zoning includes camps, golf courses, and general open spaces. Industrial zoning also includes mining. Residential and commercial zones are inclusive of all forms of their respective types of zoning.

*Table 1: Affected Hectares of Land by Land Use and Sea Level Rise*

	1 Meter Rise	2 Meter Rise	5 Meter Rise	10 Meter Rise
City	34.832	603.091	1504.216	2007.039
Agriculture	20.674	2837.938	9458.456	13234.906
Residential	3.182	26.379	301.200	833.607
Commercial	0.048	2.941	35.627	54.606
Industrial	6.227	82.801	259.892	592.075
Recreational	50.444	1103.856	1794.890	2309.637
Tribal	0.072	0.233	0.691	1.422
Public	3.720	56.229	287.356	530.535
Other	0.161	7.497	65.461	180.185

The map below shows the risk assessment for the Humboldt Bay area, showing the areas affected by each amount of sea level rise. The grey colored regions are the Humboldt County parcels, with some of them protruding into areas of the bay and not being counted in the areas affected. These are areas that were already part of parcels and zoned but were already below MSL.

Looking at the map, the biggest amount of land affected by sea level rise is an area south of the bay. This aligns with the Eel River and the delta near its outlet into the Pacific Ocean. Notably, the orange and yellow areas, of 2 and 5 meter rise, are largely farmland, creating the massive increase in hectares of affected agricultural land seen in the table. The largest affected area in the north, just north of the bay, is also largely farmland. The City of Eureka, near dead center on the map, seems to be minimally affected until 10 meters of seal level rise comes in, though 5 meters also affects a sizeable amount of land. On the northern end of the bay, Arcata seems to have large portions of its land at risk from further sea level rise.

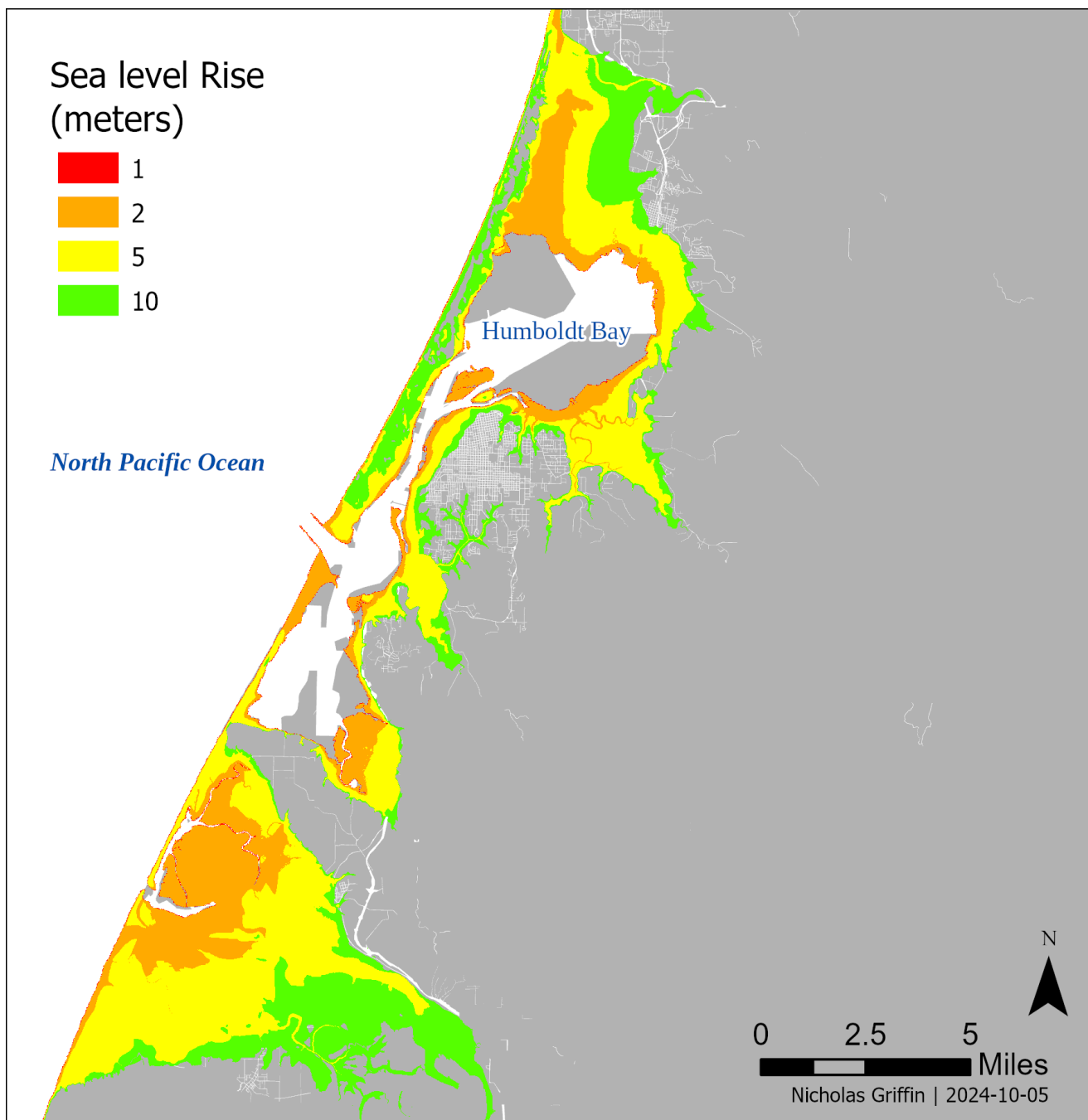


Figure 1: Sea Level Rise Risk Assessment of the Humboldt Bay Area