

# Climate Change and Human-Nature Interactions as Drivers of Coastal Aquifer Salinization in Dover, DE



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## Importance

Globally, **climate change** and **sea level rise (SLR)** lead to negative impacts on coastal regions such as **salt water intrusion (SWI)** into coastal aquifers.

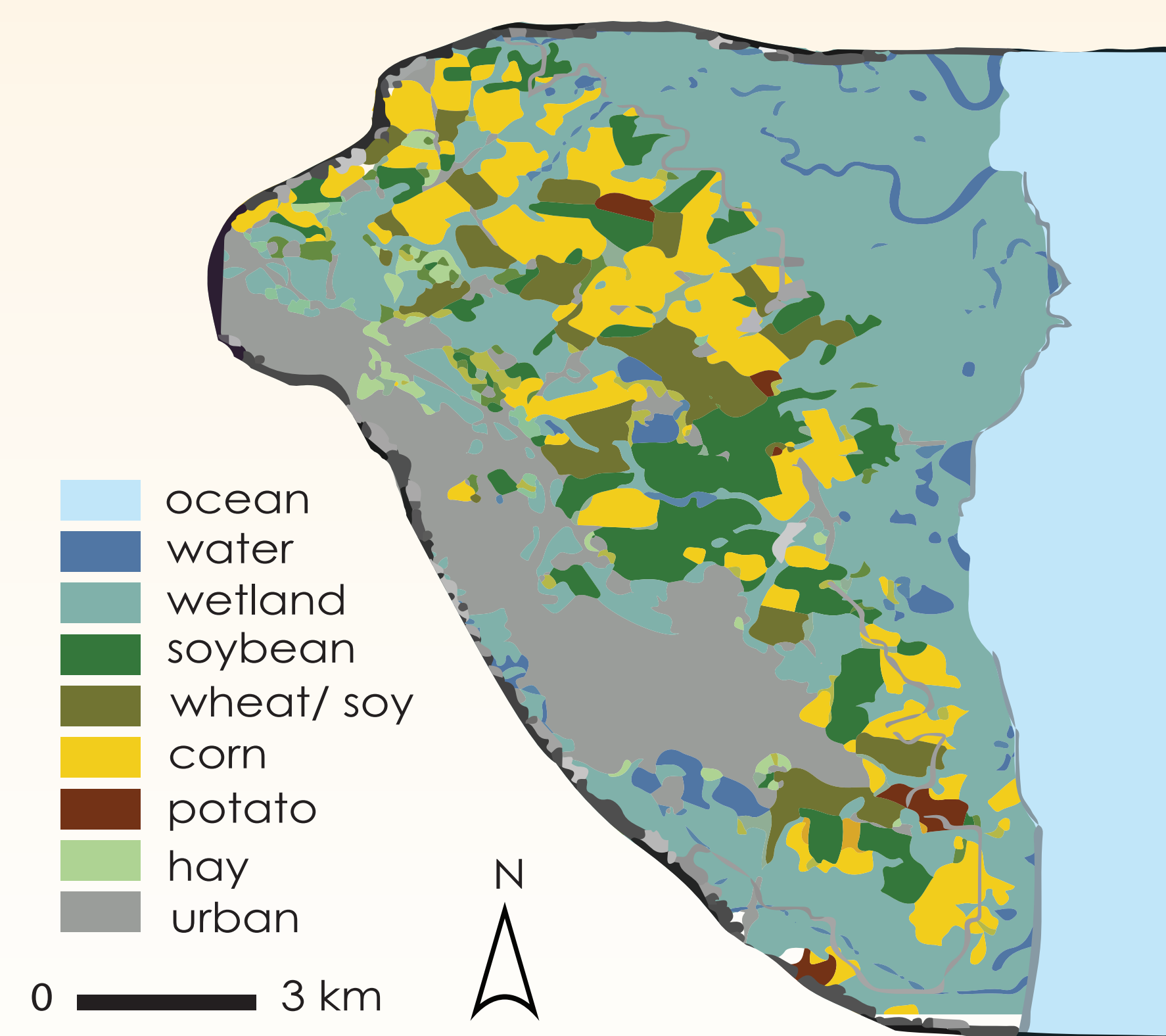
Many coastal aquifers are used as a source of freshwater for domestic, municipal, industrial, and agricultural use, and SWI threatens that use.

## Background

The Northeast USA is facing SLR at rates double that of the global average.

The Columbia Aquifer at the coast of Dover, DE, USA is vulnerable to SWI due to the uncertain effects of climate change and aquifer pumping.

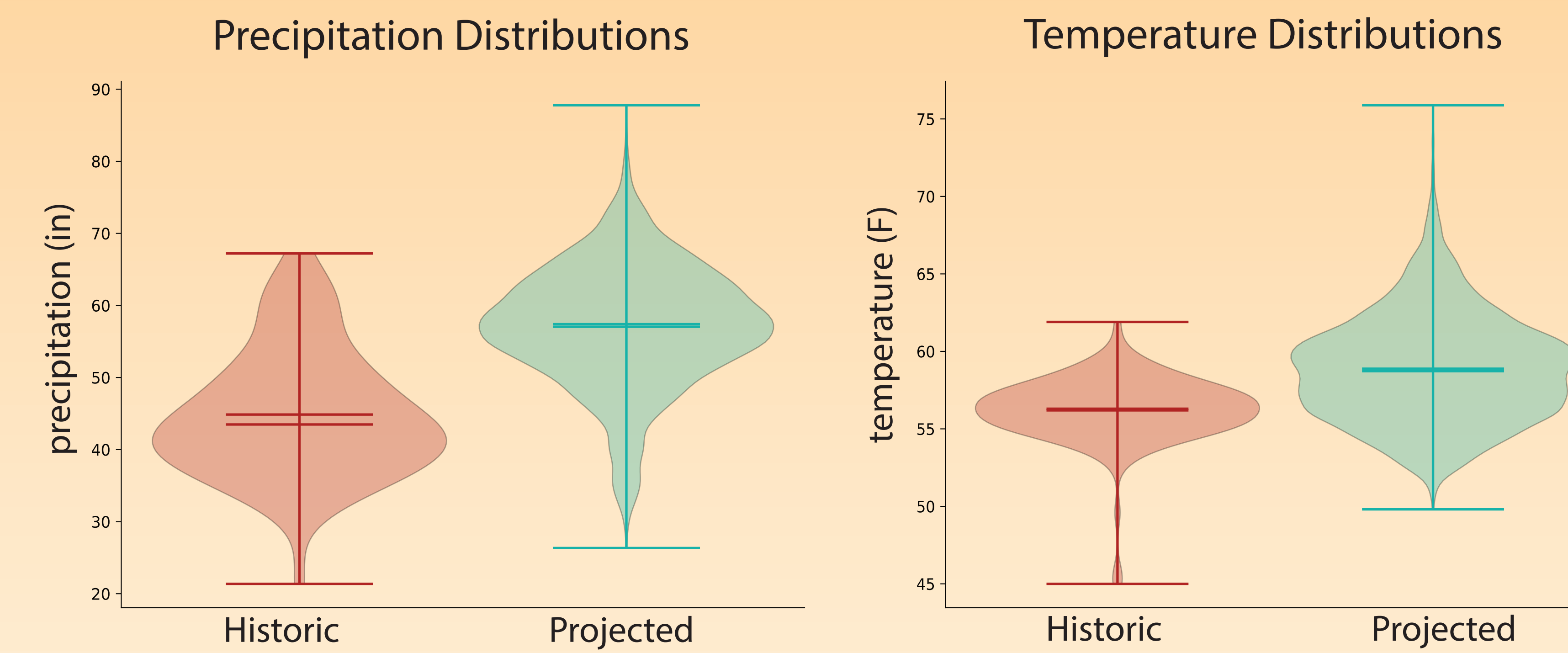
Understanding the uncertainty of SLR, climate change, and groundwater pumping in Dover can help reduce the vulnerability of the Columbia Aquifer.



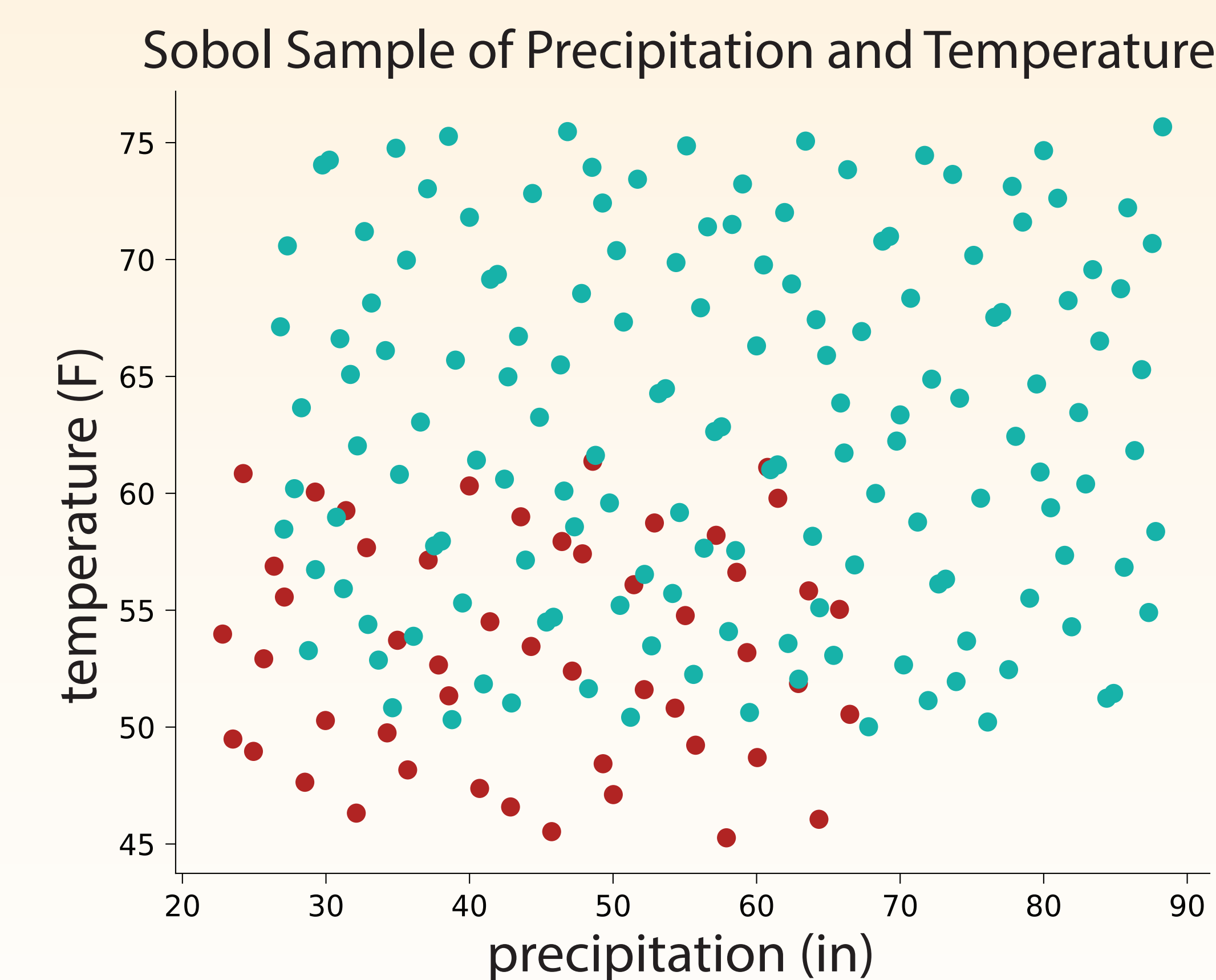
## Guiding Question

How will changes in precipitation, temperature, SLR, and aquifer pumping create a compounding effect leading to SWI in the Columbia Aquifer by the end of the century?

## Methods

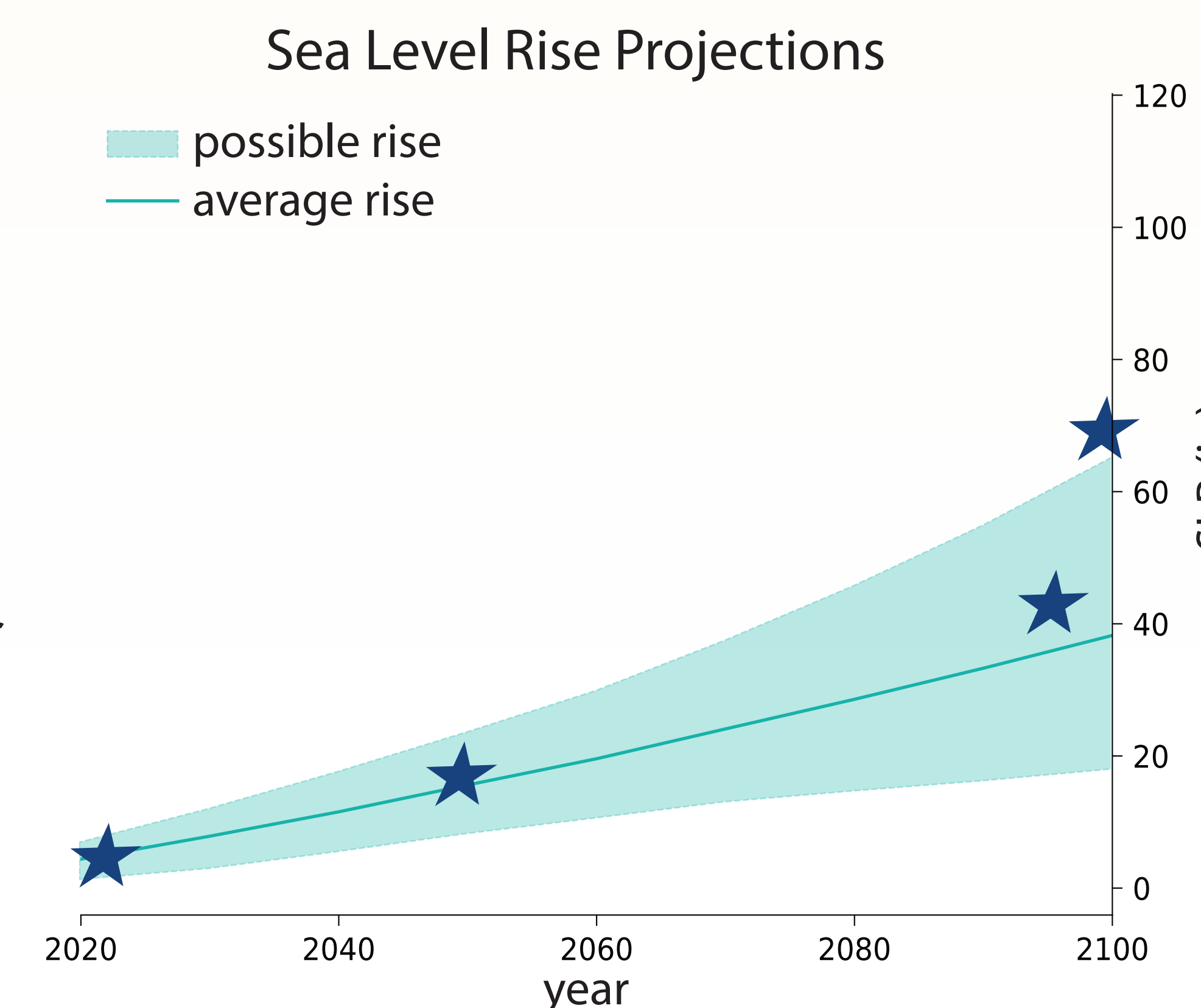


Using downscaled projection data and NOAA historic data, the distributions of precipitation and temperature were created to show possible values through the end of the century.

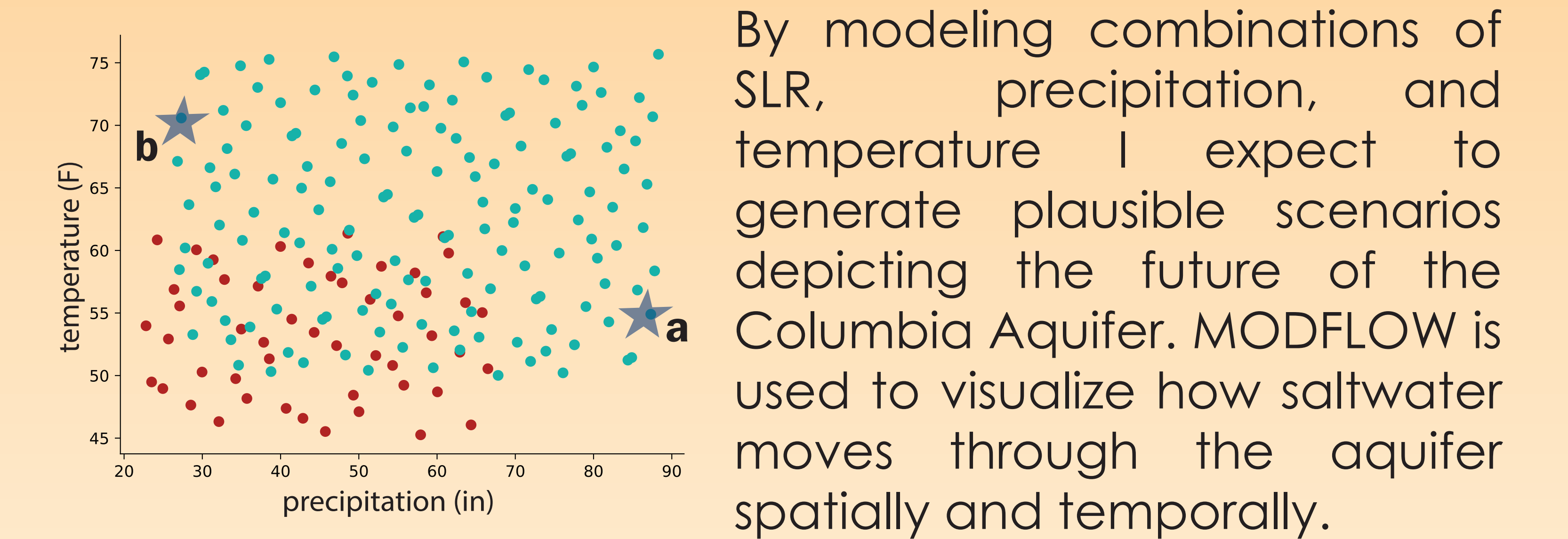


Using the Sobol sampling method, 50 historic and 150 projected samples were created for Visual MODFLOW Flex as model inputs.

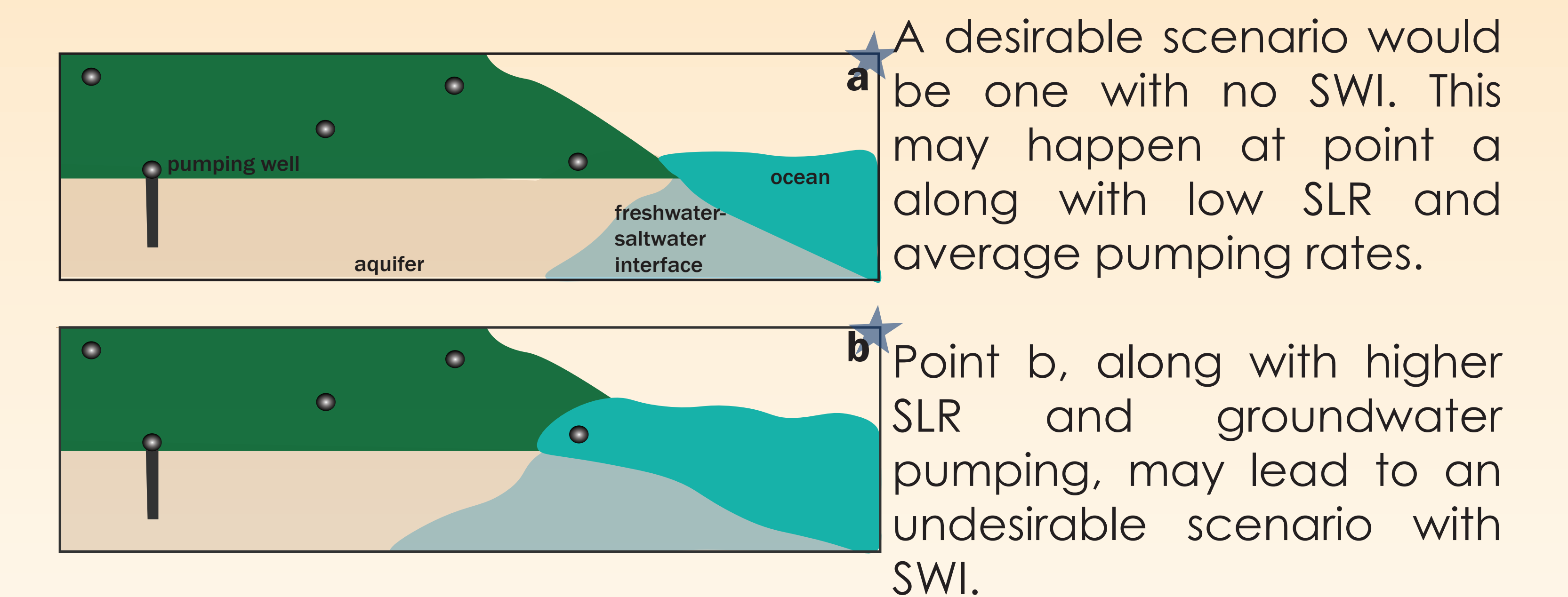
Using projected SLR in Dover, DE, four discrete values of rise were chosen to be added to the 200 sample combinations of precipitation and temperature for model inputs: 10, 20, 40, 70 inches.



## Anticipated Results



By modeling combinations of SLR, precipitation, and temperature I expect to generate plausible scenarios depicting the future of the Columbia Aquifer. MODFLOW is used to visualize how saltwater moves through the aquifer spatially and temporally.



## Future Work

The 800 combinations of SLR, temperature, and precipitation will be combined with various levels of groundwater pumping based on estimated soil moisture.

The model will run via Visual MODFLOW Flex on Penn State's high performance computer.

I will then visualize the scenarios that lead to SWI in the aquifer to better understand the extent of aquifer vulnerability to climatic changes and anthropogenic demand.

## Data Sources

NASA Sea Level Projection Tool  
NOAA Climate Change Web Portal: CMIP6  
NOAA Online Weather Data - NOWData