Sussex County, Delaware: Development and Sea-Level Rise

Kierstin Blatzheim
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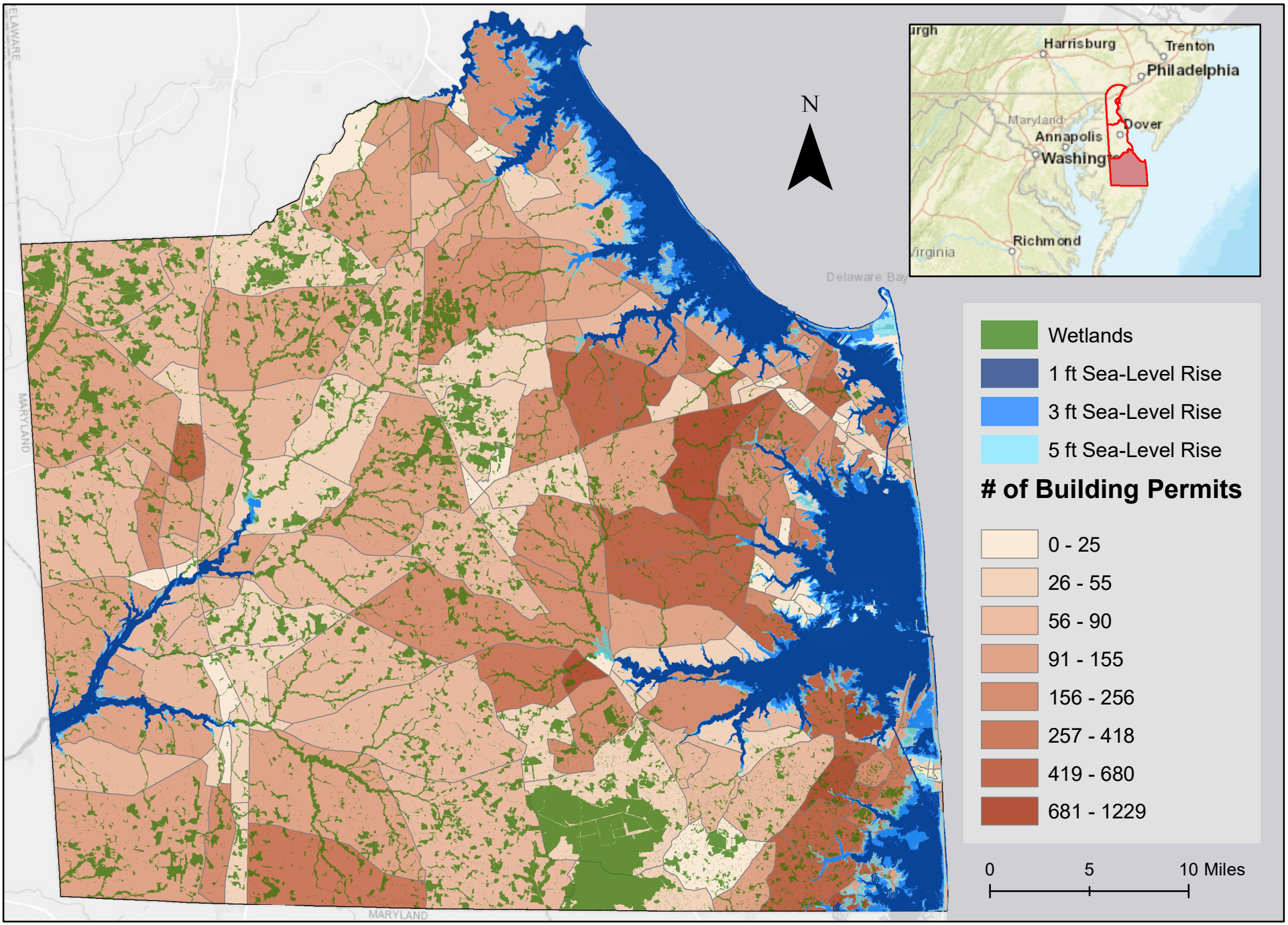
Sea Level Rise and Development Trends in Sussex County, Delaware



Data Courtesy of National Oceanic and Atmospheric Administration (NOAA), U.S Census Bureau, Delaware Office of State Planning and Coordination, and Delaware Department of Natural Resources and Environmental Control (DNREC)

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Introduction

Delaware is a small Mid-Atlantic state, home to three counties, current President Joe Biden, and a slew of nationally rated "best beaches."[1] Located in its southern-most part, Sussex County is 35 miles across and 35 miles north to south.[4]

Sussex County real estate is a hot commodity. With all of Delaware's oceanside beaches, no sales tax and major cities like New York, Baltimore, Philadelphia and Washington DC within a few hours drive, people can have a "low-cost" beach house in Sussex while still holding high-income jobs in the city. This opportunity has only increased with the COVID-19 pandemic bringing the option of remote work. According to a 2019 report, "Sussex County is expected to need to add 1,549 net new housing units each year over the next 10 years."[5] However, of those added, 520 will be vacant at any given time.[5]

Aside from the direct environmental impact this development will have on Sussex's 142,634.98 acres of wetlands ,which have been in decline for the past few decades,[3] as a low-lying peninsula state, Delaware is also threatened by sea-level rise. The question I aim to answer through this GIS analysis is: *How does development in Sussex County overlap with projected sea-level rise*?

Data & Methodology

This project consisted of 5 data layers from three different sources: county boundaries, census block group boundaries, development areas, sea-level rise, and wetlands areas. A description of each data layer can be found in Figure 1.

Figure 1:Summary of Data Layers Used

Layer	Source	Description
County Boundaries	Delaware First Map: Office of State Planning and Coordination	Polygon layer
Census Block Group Boundaries	US Census Bureau	Polygon layer from 2020 Census
Development Areas	Delaware First Map: Office of State Planning and Coordination	Point files for development applications and building permits. Polygon layer for PLUS areas.
Sea Level Rise	National Oceanic and Atmospheric Administration (NOAA)	Polygon layer for 1ft, 3ft and 5ft sea-level rise scenarios utilizing DEM
Wetland Areas	Delaware First Map: Delaware Department of Natural Resources and Environmental Control (DNREC)	Polygon layer for unofficial wetlands in 2017

Delaware First Map is the state of Delaware's hub for GIS data sharing. It contains data for boundaries, development areas, and wetland areas for the entire state. The development area geodatabase contained point file data for development applications and building permits as well as polygon layers for major land use change projects. In this project, the focus was on building permits since this gave a more accurate picture of where development is actively taking place.

The US Census Bureau provided census block group boundaries as a polygon layer. These were chosen for units of analysis instead of zip codes because they were smaller than Sussex County's large zip code areas yet large enough to show trends in development.

The National Oceanic and Atmospheric Administration (NOAA) provided data for sea-level rise between 1-10 feet via polygon layers. There were two types of data provided in the sea-level rise geodatabase: low-lying areas and connected areas. The low-lying areas took DEM data and, based on the sea-level rise scenario, filtered whatever was below that depth. This would be good to look at for flood-prone areas but doesn't necessarily show what areas would be flooded out from sea-level rise. The connected areas looked at the areas below the specified depth, then connected the ones that are neighboring existing bodies of water. This data is what was used for this project because sea-level rise would affect water-neighboring areas first. The scenarios of 1ft, 3ft, and 5ft were chosen based on current projections of likely sea-level rise by 2100.[2]

Initially, data from Delaware First Map was filtered using the "Select by Attributes" tool and filtering by data labeled in the county "Sussex." However, there were some points and polygons mislabeled, and thus this could not be used. Instead, after filtering the county boundary layer to only show the Sussex County boundary, the point and polygon shape files were clipped to the boundary layer. This provided building permits only within Sussex County. Next, the Census Bureau Block Group layer was clipped to the Sussex County boundary layer.

Since the building permit data was given in a point file, I wanted to combine it with the Block Group layer. To do this I created a "count" field in the attribute table of the building permits layer, then utilizing the field calculator, set it equal to 1. Next, I utilized the Spatial Join tool for the building permits layer and the block group layer. This created an output file that counted how many building permit points were within the block group boundary. The numbers were within the "count" field I created in the attribute table.

Finally, I clipped the sea-level rise shape file and the wetlands shape file to the Sussex County Boundary layer. At this point, all of the data files were uploaded to the map. I utilized the attribute tables and excel to analyze the layers.

Results

Looking at the map, it can be seen that some of the heaviest development in Sussex County is not necessarily oceanfront, but rather inland coastal communities which are situated along canals and bayfronts. This could partially be due to the fact that many coastal communities already have high density development, but "transition zone" communities which offer access to beaches while simaltainously offering higher acreage.[5]

Sea-level rise in the 1ft, 3 ft and 5ft scenarios threaten current wetland areas, with over 40% of current wetlands projected to be underwater if these scenarios play out. Wetlands are popular spots for development because they offer the ability to have a waterfront home without having to pay an oceanfront price tag.

Additionally, the map shows that sea-level rise threatens areas that are currently developing. Even with the the lowest projection for sea-level rise in Sussex County, 80 areas with current building permits would be underwater. Of those 80, 95% are considered residential buildings. The numbers rise as sea-level rise scenarios progress. With the 3ft rise scenario, 912 building permit areas would be underwater and with the 5ft rise scenario 2140 building permit areas would be underwater.

These findings are summarized in Figure 2.

Figure 2: Analysis of Sea-Level Rise and Impact on Wetlands and Building Permit Areas

Sea Level Rise Projection	Acres of Current Wetlands Underwater	Percentage of Total Current Wetlands Underwater	# of Building Permit Areas Underwater	% of Building Permit Areas Underwater which are Residential
1 ft	58558.47	41.05%	80	95.00%
3 ft	61121.57	42.85%	912	98.46%
5 ft	62909.04	44.10%	2140	98.41%

Discussion

These results show that current development in Sussex County is not taking into account sea-level rise to the extent that it should be. Wetlands offer important flood control protection, so their loss would mean more frequent flooding. Combined with development along wetland borders means that current wetlands have little opportunity to expand to adapt to changes in sea-level rise. This would result in flooding induced by sea-level rise exacerbated by the limited potential wetlands may have in the future to mitigate flooding.

Current development does not consider flooding hazards for sea-level rise. A majority of the building permits that are projected to be underwater by the end of the century are residential. This will result in climate migration in the near future for communities along the waterfront in Sussex County.

While my project looks into current development happening in Sussex County, it is limited in future projections of development. As development occurs, the ability for future development lessens. Therefore, waterfront communities may not continue along the same path for development as they are encountering now.

Next Steps

Future research should look into the impact of sea-level rise on Sussex County's water table. Simply because a house is not underwater does not mean it is not liveable. A majority of residential homes in Sussex County rely on private wells, and its shallow water table may make it more susceptible to salt water intrusion.[6] Analyzing salt water intrusion with sea-level rise scenarios should be studied to make suggestions for future development.

Additionally, future work should be done to advocate for the protection and restoration of remaining wetland areas in Sussex County. This may offer an important protection against future flooding given sea-level rise projections.

Finally, work should be done to quantify the environmental and social impact tourism has on Sussex County. Tourism is a major industry for Sussex County, and arguably is driving development in the area, so taking steps to make it sustainable will be important for the long term health of the county.

Map Data Sources

Census Bureau Block Groups

https://opendata.firstmap.delaware.gov/datasets/0a435290c7d7461d934f3466194ad5ed/explore?layer=2&location=38.898177%2C-75.577457%2C9.00

Delaware Development Areas

https://opendata.firstmap.delaware.gov/maps/delaware::delaware-planning-development-2-0-1/about

Delaware State and County Boundaries

https://opendata.firstmap.delaware.gov/datasets/delaware::state-and-county-boundaries/about

Delaware Wetlands

https://opendata.firstmap.delaware.gov/datasets/2017-wetlands-not-regulatory-/explore

Sea-level Rise Data

https://coast.noaa.gov/slrdata/

Report Sources

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