



## **We are *Not* in this Together: The Unequal Impacts of Climate Change**

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### **Introduction/Rationale**

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If I were to ask my middle school multilingual learner students how climate change is affecting people around the globe, I am certain they could generate an impressive list of effects that have been covered extensively in the modern news cycle: record-breaking temperatures, melting glaciers, powerful storms, and rising sea levels, for starters. While both inspiring and alarming, my students vigorously engage in climate-related discussions; their interest in environmental issues seems to be driven by an anxiety that they are inheriting a world plagued by climate disasters.

To that end, I am also confident my students would propose some solutions that highlight the importance and effort of individuals to make more environmentally-conscious choices such as choosing to walk rather than drive, using less plastic, or recycling diligently. Most of my middle school language learner students have lived in the United States for the majority of their lives and have no doubt been influenced by the powerful advocacy campaigns to save the planet, which often focus on the importance of individual responsibility. While these campaigns have certainly contributed to a heightened awareness of the importance of environmental health, they do not illuminate deeper, systemic issues of environmental justice that are perpetuated by government and corporate decision-makers. I also anticipate that many of my students are unfamiliar with the government policies that have created segregated communities, which are often more vulnerable to environmental injustices, including the effects of climate change.

It is with these ideas in mind that I aim to develop a curriculum unit to more deeply teach the meaning of environmental justice and injustice, specifically how the effects of global climate change have, and will likely continue to have, an unequal impact on low-income populations and communities of color. According to the U.S. Commission on Civil Rights, environmental justice is “the fair treatment of people of all races, income, and cultures with respect to the development, implementation and enforcement of environmental laws, regulations, and policies, and their meaningful involvement in the decision-making processes of the government.”<sup>1</sup> Students will examine a local example of environmental injustice, thereby adding relevance, meaning, and motivation to the unit of study. Students will study how flooding, fueled by climate change and sea level rise, has disproportionately impacted the primarily Black community of Southbridge in Wilmington, Delaware. Through data collection, reading and class discussion, students will gather evidence about how

flooding has stunted economic growth, created unsafe housing and exposed residents to health hazards, like mold. Students will evaluate maps, articles, and interviews to more fully understand the racial and class makeup of flood-prone Wilmington neighborhoods versus flood-prone coastal communities. Additionally, students will learn about the policy of redlining and use evidence of racial and class makeup in these communities to make claims about the formation of racially and economically segregated communities in Delaware. The evidence and data students collect about these different communities, the effects of climate change, and the government action or inaction in response to chronic flooding in these communities will help students form evidence-based claims about the unequal impacts of climate change.

My overall, immediate goal for this unit is to deepen student understanding of climate change and its disproportionate impacts on communities both locally and globally. I also aim to develop students' evidence-based reasoning and argumentation skills to support claims in response to a local environmental justice issue. My long-term goal is for students to use argumentation skills to act as informed advocates to identify environmental injustice, and potentially influence environmental policy to resolve environmental inequities. I hope to capitalize on my students' existing funds of knowledge about climate change and their intrinsic motivation to respond to the increasing prevalence of environmental justice issues. I aim for students to understand that individual actions are not the only means of resolving the complex environmental issues affecting their communities; rather, arguing for equitable policies and solutions that provide lasting environmental protections for all is an essential piece to achieving environmental justice.

## Demographics

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I am a multilingual learner (MLL) teacher at The John Dickinson School, a combined middle and high school located in the suburbs surrounding the city of Wilmington, Delaware. Our school is in the Red Clay Consolidated School District, the largest school district in the state of Delaware which serves the second largest population of MLL students, about 15% of students enrolled across the district.<sup>2</sup> The district's population of MLL students has grown four percent since 2016, a statistic that is reflective of the overall trend that MLL students are the fastest growing population of students in Delaware schools. Similarly, my school's population of MLL students is steadily growing; our number of MLL students was reported at just over 16% in the 2022-23 school year.<sup>3</sup> While the majority of MLL students in my school are native Spanish-speakers, their families come from a wide range of Spanish-speaking countries in central and South America, as well as the Caribbean. Additionally, my MLL students represent a wide range of previous educational experiences and English proficiency levels.

I teach English language development (ELD) classes in the middle and high school to MLL students. These classes are intended to support MLL students in achieving advanced English language proficiency on the annual state ACCESS test, which measures English proficiency across academic content areas and the four language domains: listening, reading, writing, and speaking. Students must achieve a composite score of 4.7 to exit the MLL program and no longer receive language development support. Therefore, the focus of my class is the teaching of academic language, including vocabulary and grammar features, that students apply across content areas in all four language domains. The majority of my middle school MLLs are long-term English learners. A long-term English learner is a student who has not exited the MLL program in six or more years. These students often demonstrate advanced fluency in listening and speaking skills in English, but

remain “stuck” at an intermediate level of reading and writing in English, preventing them from testing out of the MLL program.

Because students must show English proficiency across content areas, such as science and social studies, much of the vocabulary, grammar, and language that I teach in my ELD class must be cross-curricular by nature. The language focus of this unit will draw on science vocabulary and concepts that students will apply when writing arguments. Though typically considered a feature of English language arts classes, the structure and language used in argumentation is also a common feature of science and social science writing. Scientists gather and analyze data to develop evidence-based claims. Explicitly teaching students argument structure in the context of environmental justice will provide them with rich practice in a highly useful academic writing form that cross-curricularly supports their English proficiency in both English language arts and science content areas. Moreover, this curriculum unit will support students’ language proficiency development, most especially in the domain of academic writing, as they work toward testing out of the MLL program on the annual state ACCESS test.

## Content Objectives

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This 3-4 week curriculum unit will be organized into three sections to scaffold the content and language that students will use in the culminating task. Upon the conclusion of the unit, students will write an argument about the disproportionate impact of flooding on the primarily Black population of Southbridge in Wilmington, Delaware. In the first part of the unit, students will learn key, content-specific vocabulary and build background knowledge about the effects of climate change, both globally, and locally. Students will also begin learning argument structure, and practice the form in writing and discussion activities related to readings and key content. In the second phase of this unit, students will analyze data and gather evidence of environmental injustice in the community of Southbridge. This evidence will prepare students to form and support claims for their culminating task. In the final section of this unit, students will apply what they have learned about argument structure to form an evidence-based argument about the unequal way in which the Southbridge community has been impacted by climate change. Additionally, students will develop a counterclaim with an effective rebuttal. Finally, students will study the advocacy and civic engagement of Southbridge residents that has resulted in a new storm and wastewater system to mitigate flooding in the next few decades. Students will study long-term climate change solutions to increased flooding as they develop the concluding paragraph of their argument, which will offer long-term solutions to flooding in Southbridge.

### Climate Change

Climate change is defined by the United Nations as the “long-term shifts in temperature and weather patterns,” primarily caused by human action, such as fossil-fueled transportation, and industrial and agricultural activities.<sup>4</sup>

Climate change is driven by “the greenhouse effect.” With the help of “greenhouse gasses” like carbon dioxide, earth’s atmosphere traps outgoing infrared radiation and retains heat. As the sun shines on the earth, some of the solar radiation is absorbed by the earth’s surface. Some infrared radiation escapes the earth’s atmosphere into space, and some is absorbed by greenhouse gasses like carbon dioxide, methane, and nitrous oxide. This natural process is essential to keep the planet warm enough to support human, animal, and

plant life. However, since the 1950s, human activities, specifically the burning of fossil fuels, have increased greenhouse gasses in the earth's atmosphere. As a result, less infrared radiation escapes into space through earth's atmosphere and more is re-emitted to warm the earth's surface and lower atmosphere, causing the planet to warm.<sup>5</sup>

Global climate change has caused significant shifts in weather patterns, ecosystems, and oceans. For example, the warming climate is changing ecosystem patterns that affect plants, lifecycles and migration of animals, and growth of crops. Melting glacier ice and thermal expansion in warming oceans are contributing to sea level rise, which in turn has increased coastal inundation. Powerful storms and "extreme weather events", especially in the eastern United States are growing in frequency, intensity, and duration, posing serious risks to human lives, housing, and health.<sup>6</sup>

### Impacts of Climate Change in Delaware

Climate change will have multiple impacts on Delaware with serious implications for infrastructure, agriculture, natural resources, and human health in the state. Delaware is a mid-Atlantic, coastal state that has and will continue to experience increased flooding due to sea level rise caused by melting glaciers, subsidence (or sinking of land), and thermal expansion as ocean water warms.<sup>7</sup> Due to the combination of land sinking, sea level rising, and ocean currents unique to the mid-Atlantic region, Delaware and other mid-Atlantic states are experiencing sea level rise that is "faster and higher than elsewhere."<sup>8</sup> The Delaware Department of Natural Resources and Environmental Control (DNREC) has projected three potential sea level rise scenarios: low, intermediate, and high (Figure 1). The intermediate sea level rise scenario predicts approximately 3 feet of sea level rise by 2100. The intermediate scenario also predicts the high sea level rise scenario in which the sea level will rise by 3 feet by 2080.<sup>9</sup> This projection puts many coastal and urban waterfront communities at risk for partial or total inundation by the end of the century.

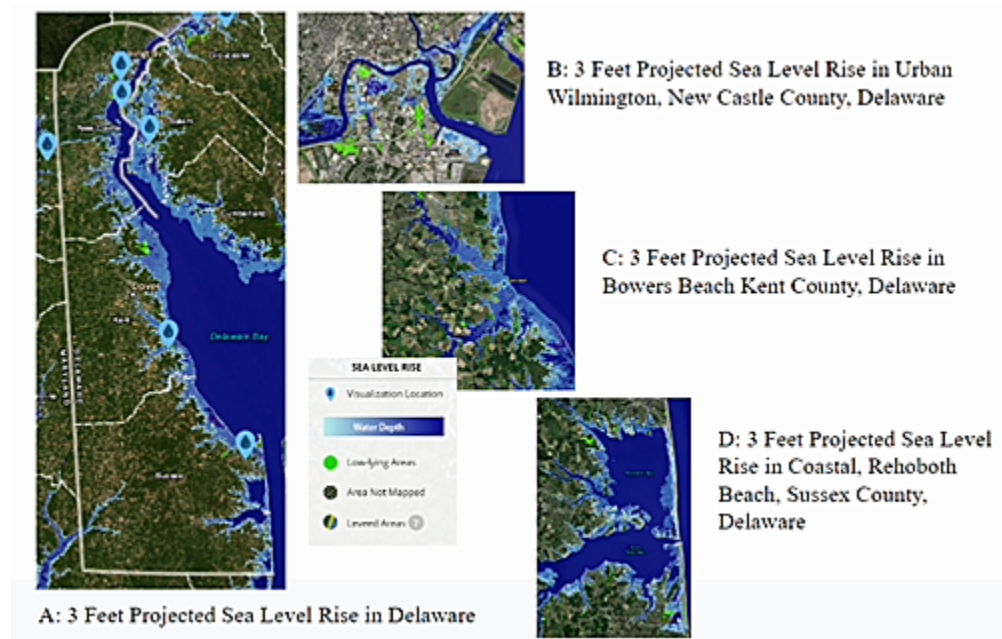


Figure 1: 3 Feet Projected Sea Level Rise in Delaware, NOAA Sea Level Rise Viewer<sup>10</sup>

Precipitation in Delaware is also projected to increase by 10% by 2100. Rising average temperatures will produce more rainfall during winter months than snow. Additionally, the number of very wet days, defined as

“2 inches or more of rainfall in 24 hours,” are expected to become more frequent.<sup>11</sup> Coupled with sea level rise, heavier and more frequent precipitation will result in more flooding events.<sup>12</sup> Moreover, conditions caused by more frequent rainfall puts agricultural crops and livestock at risk, threatens drinking water, sewer, and storm management systems, and poses risks to infrastructure like roads and bridges.<sup>13</sup>

## **Impacts of Flooding on Individuals and Communities**

A study conducted in 2018 by the University of Maryland’s Center for Disaster Resilience found that urban flooding “is a growing source of significant economic loss, social disruption, and housing inequality.”<sup>14</sup> Additional studies have concluded that flooding is the “costliest” of natural hazards when considering the amount of human lives lost or disrupted, as well as total cost of property damage.<sup>15</sup>

### **Loss of Property or Property Values**

Vulnerable communities characterized by low-income status and higher percentages of people of color “suffer greater property loss in disaster events,” including floods. Many factors contribute to this finding, including a higher likelihood of geographic proximity to “disaster-prone areas” and older, less structurally-resilient residences.<sup>16</sup>

Costs associated with repairing or preventing flood damage place an added financial burden on residents living in flood-prone communities. Homeowners who seek to flood proof their homes to increase their property values are faced with costs ranging from “tens to hundreds of thousands of dollars.” This added financial burden often prevents many residents from moving away from flood-prone areas, or forces homeowners to sell property at a loss.<sup>17</sup>

Flood insurance is a measure intended to relieve the financial burden associated with flood damage and repairs. However, purchase of flood insurance is itself a financial burden. According to a 2018 study by the Federal Emergency Management Agency (FEMA), of households located in Special Flood Hazard Areas, 51% of non-policyholder households are identified as low income.<sup>18</sup> This statistic is concerning, considering the fact that many households in proximity to flood-prone areas are low-income. Households that do not have flood insurance due to affordability or lack of access to financial assistance to participate in the national flood insurance program are therefore placed at even greater financial risk.

Both residences and local infrastructure are affected by flooding events. Nearby residences not directly affected by flood damage may still experience effects of flooding by connected infrastructure, like roads. One study found that “a standard 2,400 square foot home with 4% of the nearby roads impacted by tidal flooding experienced a nearly 4,000 dollar loss in property appreciation.” Residences in proximity to a larger percentage of roads impacted by flooding saw even larger decreases in property appreciation.<sup>19</sup>

A decrease in property value causes a subsequent decrease in tax revenue which affects local services and economic investment in the community.<sup>20</sup> Thus, proximity to flood-prone areas can also lead to economic disinvestment in entire communities. Communities characterized by low-income status and exposure to environmental hazards like flooding are made more vulnerable by the increasing frequency of flooding, decreasing property values, lower tax revenues, and flight of economic investment.

## **Mold Exposure and Respiratory Illnesses**

Buildings and residences affected by flooding and water damage are more likely to have mold contamination. One of the most notorious examples of mold contamination after flooding is in the New Orleans area after Hurricanes Katrina and Rita. It is estimated that approximately 46% of residences were contaminated with mold after hurricane-related flooding, and 17% of residences showed “heavy mold contamination.”<sup>21</sup>

Inhaling mold is associated with respiratory infections, especially in immuno-compromised individuals, pregnant women, young children, asthmatics, and the elderly.<sup>22</sup> Studies have also linked exposure to mold in water-damaged facilities, like schools, with respiratory symptoms such as wheezing, asthma development or increased severity, and other respiratory illnesses.<sup>23</sup>

Cleaning a residence to prevent mold contamination after water damage is expensive and time consuming. Recommendations include discarding all items that cannot be washed, as well as removing and disposing of drywall and insulation affected by flooding. Floodwaters in areas with old infrastructure may also contain sewage.<sup>24</sup>

For communities that experience flooding frequently, the time and expense of clean-up to prevent mold contamination is extensive, and often not feasible. Additionally, chronic flooding leads to chronic exposure to mold contamination. This presents an additional environmental health hazard to flood-prone communities.

## **Stress, Anxiety, and Mental Health Outcomes**

Residents of communities that experience flooding also experience higher levels of stress and anxiety and “in more extreme cases, depression and post-traumatic stress disorder” in the short and long term after a flooding event.<sup>25</sup> For instance, Southbridge resident and community activist Marie Reed describes the fear of flooding she has developed since childhood in an interview with Delaware Public Media. Reed notes that when it rains, she doesn’t sleep and she looks out of her window “constantly.”<sup>26</sup>

Flooding events may negatively affect relationships within families due to financial burdens associated with repairing flood-damaged residences. Residential displacement after a flood event also leads to “poor mental health outcomes,” especially for residents lacking adequate insurance and access to financial assistance.<sup>27</sup>

## **Segregation of Urban Communities in Northern Delaware**

Wilmington is Delaware’s largest city. Much like cities across the United States, it is broken into racially and socioeconomically segregated communities due to overt discriminatory practices, often supported or wholly endorsed by federal and state government agencies.

In the early 20th century, many Black Americans moved from the rural South to northern American cities, like Wilmington. Black Americans seeking to buy or rent property faced limited housing options, in part due to the discrimination of private property owners who refused to sell to racial and religious minorities, or who added a private covenant to their property deed which prevented the transfer of that property deed to a person of color. As a result, Black Americans, and other people of color, were “confined to discrete residential districts in which the prominent features were substandard housing and overcrowded conditions”<sup>28</sup>

Additionally, the Federal Housing Administration created and endorsed the policy of “redlining” in the 1930s. Though now illegal after the passage of the Fair Housing Act of 1968, redlining was a government-supported



policy in which mortgage lenders in more than 200 cities and towns across the U.S. used color-coded maps to approve or deny homeownership loans. This policy denied federally-insured loans to citizens living in communities deemed less than desirable where housing values were projected to decline. Racially diverse and all-Black communities were frequently identified with the lowest, “D-rating” and were outlined in red, thus systematically barring residents of redlined neighborhoods from obtaining mortgage loans.<sup>29</sup>

In addition to the devastating socioeconomic, intergenerational effects of redlining, residents of redlined neighborhoods are also disproportionately exposed to environmental hazards. When redlined communities were identified, government and businesses worked together to place polluting industries in these redlined neighborhoods, thereby disproportionately exposing the community to a significant burden of environmental hazards. For instance, to this day, redlined communities suffer from higher levels of air pollutants, regardless of population size or location. A recent study concludes that “pollution levels were higher in 80% in communities” that had been redlined compared to communities identified as more “desirable.”<sup>30</sup> As a result of government policies like redlining, the effects of climate change, like flooding, are not shouldered equally. In fact, “people of color are more likely to live in neighborhoods with higher levels of pollution, increased flooding, and power outages caused by heat waves—all directly connected to climate change.”<sup>31</sup>

According to a study prepared for the Delaware State Housing Authority in 2003, Wilmington, Delaware is no exception to the national trend of highly segregated cities. The review concluded that residential segregation is not only evident in all three counties of Delaware, but “Wilmington has the highest level [of residential segregation], a condition that has remained virtually unabated over the past 30 years.”<sup>32</sup> The community of Southbridge, located on the east side of Wilmington, demonstrates the way in which systemic housing discrimination of the past continues to impact the lives of residents today by exposing them to a disproportionate number of environmental hazards, some of which have been intensified by climate change (Figure 2). Southbridge is an historic, urban community of just over 2,000 residents located on a low-lying floodplain along the Christina River in close proximity to the Port of Wilmington. The community, which has existed for over a century, has seen major shifts in demographic data over time. In the late 1800s, Southbridge was a majority White community, with about 20% of residents identifying as Black. In the early to middle 20th century, a shift in racial demographics resulted in the current majority Black population.<sup>33</sup> This demographic shift aligns chronologically with patterns in national and state-level housing discrimination and post-WWII suburbanization trends. The community has also been shaped by a number of industrial, agricultural, and residential uses. Moreover, Southbridge boasts a proud and well-documented history of civic engagement, “religious participation, and Black political leadership.”<sup>34</sup>

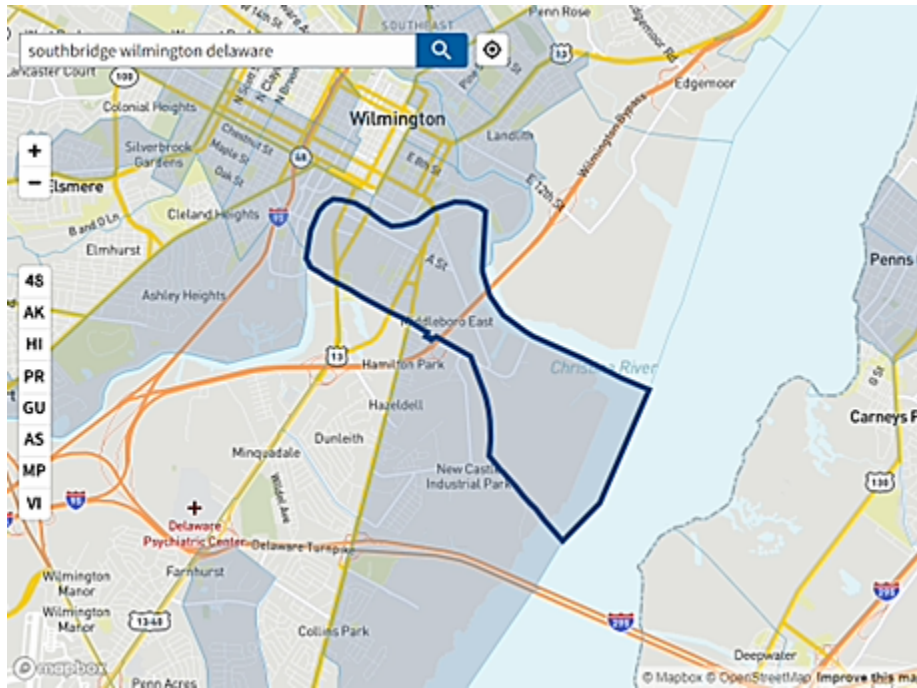


Figure 2: Southbridge, Wilmington, Delaware, Climate and Economic Justice Screening Tool<sup>35</sup>

As of 2023, the community is predominately Black, with 69% of residents identifying as Black, 20% identifying as White, 6% identifying as Asian, and 2% identifying as Latino.<sup>36</sup> When narrowed geographically to the core community that excludes the recently developed, more affluent Christina Landing in the same census tract, 83% of the 1,430 residents identify as Black.<sup>37</sup> The community is identified as disadvantaged based on the prevalence of burden thresholds and majority low-income household classification. Burden thresholds include a number of factors including, but not limited to, a community’s exposure to climate-related threats, excessive energy costs, health risks, housing conditions, and exposure to legacy pollution. Communities identified as “disadvantaged” are at or above a 90th percentile for one or more burden thresholds, in addition to being at or above the 65th percentile for residents identified as low-income.<sup>38</sup>

Southbridge is in the 83rd percentile of low-income households across the United States. Southbridge residents are in the 90th percentile of people who have been diagnosed with asthma. Residents are in the 93rd percentile of residents located within five kilometers of hazardous waste facilities, and in the 96th percentile of residents located within five kilometers of one or more superfund sites.<sup>39</sup> A superfund site is a tract of land that has been contaminated by hazardous waste that has been improperly or illegally dumped in an area.<sup>40</sup> In addition, Southbridge residents are in the 98th percentile of U.S citizens with a projected flood risk to residential properties and businesses.<sup>41</sup>

This data suggests that the historically unfair housing practices by private and government actors created racially and socioeconomically segregated communities like Southbridge, both directly and indirectly resulting in an unequal share of economic and health burdens, as well as a disproportionate exposure to environmental hazards including both legacy pollution and climate-fueled flooding.

### Unequal Impacts of Flooding in Southbridge

Flooding in Southbridge is a case study of the increased frequency of flooding statewide due to the effects of climate change. Though flooding is occurring and of increasing concern in census tracts across the state, the



community's vulnerability contributes to an uneven distribution of health and economic burdens in the wake of flooding events. Additionally, resources to prevent or mitigate the effects of flooding have historically flowed to wealthier communities with more economic resilience.

One issue that has contributed to the prevalence of flooding in Southbridge is its aging stormwater infrastructure. Southbridge's "century-old" storm and waste-water management system has failed with increasing frequency during heavy rains and subsequent high river tides or tidal surges.<sup>42</sup> The system is known as a "combined sewer overflow system."

In this system, both storm and wastewater flow into the same pipes. Under dry conditions, wastewater flows unobstructed to a wastewater treatment facility. However, when the system becomes overburdened during wet conditions, excess water that combines stormwater and untreated wastewater flows into water sources, exposing nearby residents to water pollution including "bacteria, debris, and other hazardous substances."<sup>43</sup>

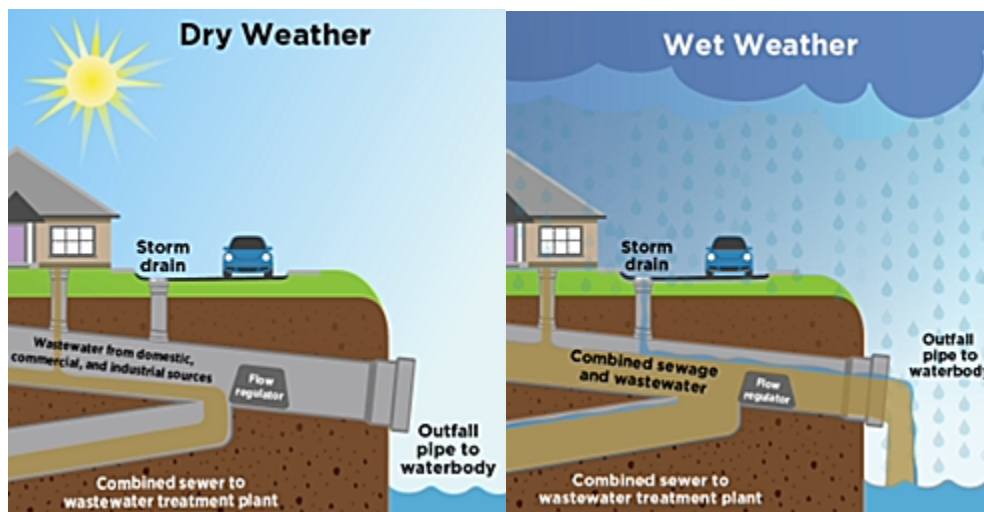


Figure 3a and 3b: Combined Sewer Overflow Basics, Environmental Protection Agency<sup>44</sup>

This issue is compounded by the periodic opening and closing of old tide gates in the Christina River, which were initially intended to mitigate flooding of surrounding industry, businesses, and residences. However, during a heavy rain in Southbridge, if the combined sewer system overflows during a high tide or tidal surge when the Christina River tide gates are closed, the combined stormwater and wastewater can back up into residents' homes and streets in the community.<sup>45</sup>

Until very recently, the issue of aging infrastructure contributing to the flooding in Southbridge had not been addressed by state and city officials. When the nearby Wilmington Riverfront, including the more affluent Christina Landing, began to experience fast-paced redevelopment and economic investment in the early 2000s, Southbridge community activists refused to be excluded from development projects while their community continued to experience decades of chronic flooding.<sup>46</sup> Lifelong residents like Marie Reed can recall decades of serious flooding incidents dating back to her childhood in 1947.<sup>47</sup>

This is a stark contrast to the myriad of federal and state-funded measures taken to address the effects of flooding in some wealthy, and largely White, communities along Delaware's coastline about an hour and a half south of Wilmington.

For example, in a census tract composed of residences in close proximity to the beach and oceanfront homes

stretching from Bethany Beach to Fenwick Island, the 589 residents who live there are in the 98th percentile for risk from climate-change related flooding, like Southbridge residents. However, this community is not identified as disadvantaged because it does not meet the 65th percentile low-income characteristic of a disadvantaged community; in fact, the community is in the 22nd percentile of low-income households. The community is also 98% White.<sup>48</sup> Though the community is at a significant risk of flooding due to the effects of climate change, many of these homeowners have much better access to resources to repair damage to their homes, or relocate entirely. Despite this, the state and federal government have historically spent millions of tax dollars to protect this community, and other wealthy coastal communities along Delaware's coast. Recent expenditures on beach nourishment suggest this spending and investment in protecting these communities will continue into the future, also.

Beach nourishment, or beach replenishment, is the movement of sand to replace sand lost during erosion events caused by sea level rise, storms, ocean currents, and wave action. Without sufficiently wide beaches and dunes, beach communities would experience devastating floods. There are two ways to rebuild beaches and dunes. Sand can be trucked from an inland source onto a beach and spread by earth moving equipment. Alternatively, sand can be dredged from offshore and pumped back onto the beach through pipes; the sand is then shaped by earth moving equipment to rebuild the beach and/or dune.<sup>49</sup>

According to DNREC, beach nourishment has occurred since the 1950s, but has accelerated since the early 2000s to protect coastal communities.<sup>50</sup> In a 2001 study of the cost of maintaining Delaware's beaches, authors note the economic consequences of beach nourishment on local property owners, Delaware residents, and visitors to Delaware beaches. The study estimates that beach nourishment costs totaled over 18 million dollars from projects in 1989, 1992, 1994, and 1998 alone.<sup>51</sup> Moreover, the study described the invested interest of real estate and property owners as beach nourishment raised property values. Of the projected 15 million dollars in benefits resulting from the proposed beach nourishment in 2001, "benefits to residential beachfront property owners totaled \$12.7 million."<sup>52</sup>

In addition to the millions of dollars spent in beach nourishment since the 1950s, the state recently approved a 50-year project facilitated by the Army Corps of Engineers that will replenish beach and dune areas stretching from Rehoboth Beach to Fenwick Island to mitigate the effects of coastal inundation. The project, started in 2023, is estimated to cost the state and federal government a total of 24 million dollars that "includes initial construction costs, periodic nourishment, major rehabilitation, and project monitoring."<sup>53</sup>

The ways in which flood-prone communities in Delaware have historically received or been denied government intervention to protect lives, homes, and businesses vividly demonstrates environmental injustice as it relates to the effects of climate change. In an urban, low-income, and primarily Black community like Southbridge, flooding has caused unsafe housing and economic disinvestment, as well as increased prevalence of health issues for decades. Meanwhile, in higher income, largely White communities on Delaware's coastline, millions of state and federal tax dollars have been spent and continue to be spent to mitigate flooding; this action has simultaneously increased the value of private and commercial residences while also stimulating development and economic investment that benefits the wealthy local community of beachfront property owners.

### **Advocacy and Action in Southbridge: Past, Present, and Future**

Due to the advocacy of Southbridge residents and efforts made by the Southbridge Civic Association in partnership with the South Wilmington Planning Network and other organizations, a new, 26-million-dollar

wetlands park opened in June of 2022 to provide recreational opportunities to local residents and mitigate future flooding. In addition, the project will update and separate the combined sewer and stormwater management system in Southbridge to prevent further contamination of local water sources and mitigate potential flooding of residential basements. The updated sewer and stormwater management system is expected to be completed by the end of 2023.<sup>54</sup>

This is undeniably a positive outcome for Southbridge residents, and a formal neighborhood action plan highlights the importance of resident leadership and involvement in further development of the area. Most specifically, recommendations include protections for Southbridge residents against the gentrifying effects of new residential and commercial development on the Wilmington Riverfront that is already shifting the community's racial and income demographics.<sup>55</sup>

Moreover, sea level rise and legacy pollution continue to pose a risk to the Southbridge community. For example, if sea level rises four feet, about one foot above DNREC's intermediate projection for the state of Delaware, the new wetlands park will be underwater by 2100. Harmful pollutants from Southbridge's industrial legacy will also pose risks for residents if sea levels rise and overburden new systems intended to prevent residential exposure to pollutants in the soil.<sup>56</sup>

Additional solutions to sea level rise exist, and will likely be innovated upon as the effects of climate change become more intense and put more citizens at risk. One such solution to sea level rise is the use of "freeboarding" in new housing development, or adding freeboard to existing homes. A house that is freeboarded is elevated so that the lowest floor of the home is above predicted flood elevations, usually between 1 to 3 feet. Residents who freeboard their homes are at a decreased risk to flood damage and are eligible for a reduced rate of flood insurance.<sup>57</sup>

The financial responsibility of who should bear the burden of updating homes with freeboard in places like Southbridge is complex. While local government may argue that financial responsibility should be entirely shouldered by residents of Southbridge, others may argue that government practices directly and indirectly segregated the community to a vulnerable floodplain that faced systemic disinvestment as a result. Moreover, millions of federal and state tax dollars have been spent, and continue to be spent, on beach nourishment to protect wealthy, oceanfront communities from the effects of sea level rise.

## Teaching Strategies

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### Accessing and Engaging Prior Knowledge

My students are aware, and often concerned, about climate change and its effects on the world they are living in. While I do not want to heighten student anxiety, I plan to capitalize on students' interest in climate change and the environment by accessing and engaging their prior knowledge on these subjects. I will engage students in discussion and short writing activities in the beginning of the unit to assess how much they know about climate change and how the effects of climate change affect human populations.

This strategy serves several purposes. First, research suggests that students learn more effectively when they are able to connect new knowledge to something they already know.<sup>58</sup> Second, prioritizing students' existing

knowledge, rather than their knowledge deficits, is a student-centered approach that validates students' experiences and motivates them to engage in less familiar content. Finally, activities that elicit students' background knowledge about the causes and effects of climate change is an assessment strategy that will guide my selection of texts to build additional background knowledge and skills necessary to successfully complete learning activities as the unit progresses.

Activating prior knowledge is a teaching strategy that can be accomplished through a number of activities including informal class discussions, anticipation guides, KWL (Know-Want to Know-Learn) charts, or quick-writes about a topic.

### **Building Background Knowledge with Text Sets**

Many of my students struggle to comprehend complex, academic texts, which tend to be content-specific, like science or social studies texts. Often, my middle school MLL students will read quickly through an entire text and comprehend very little of what they read, limiting their ability to complete associated learning activities that become increasingly complex as the unit progresses. Further, schema theory suggests that a student's background knowledge influences what information they "find relevant" when reading.<sup>59</sup> Students with little to no background knowledge will have difficulty identifying and making connections to information that is key to understanding and comprehending the text.

One way to help students build background knowledge prior to engaging with complex texts is by using text sets. Text sets can include any type of media, such as visuals, maps, videos, articles, or short stories, to scaffold student background knowledge to meaningfully engage with and comprehend a more complex, target text. Text sets generally include four texts, including the target text, and range in accessibility and challenge levels to build key content knowledge. Text sets are also a useful teaching strategy for teaching key vocabulary in context. Text sets scaffold vocabulary and content so that when students read the more difficult target text, they are able to identify and build upon previously learned vocabulary and content to notice key information essential to comprehending the target text.

### **Scaffolding Academic Language: Using Sentence Frames to Analyze Data**

In order to support students' academic language abilities in my English language development classroom, it is essential to intentionally teach academic language, including vocabulary and grammatical functions, in the context of content-specific topics and texts. Not only will this method of teaching support students in achieving advanced English proficiency to exit the MLL program, but cross-curricular teaching supports their academic success and communication skills in content area classes.

Sentence frames are a scaffold intended to support students' academic language development and effective communication of ideas. Moreover, sentence frames model "ways of using language characteristic of that community," such as in the disciplines of science or social science.<sup>60</sup>

A critical component to effective argumentation is using evidence-based reasoning to support a claim, or claims. In science, the collection and interpretation of data is essential to forming claims; therefore, students must not only learn skills for data collection, but must be able to use language to communicate their analyses. In this unit, students will make observations and comparisons of multiple data points to form and support claims about inequity related to the effects of climate change. I will use sentence frames to model and provide the framework for this type of communication as students develop and practice the skills to produce evidence-based arguments independently.

## Teaching Activities

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### Activating Prior Knowledge and Building Background

Activating prior knowledge and building background knowledge is an essential element of introducing students to complex academic texts and content. This activity is expected to span three to four 90-minute class periods.

I expect that students will have some knowledge about climate change and the related effects of climate change prior to beginning our learning unit. To assess this prior knowledge, I will lead an informal class discussion while projecting a concept map with “climate change” as the map’s central topic. As students respond, I will fill out the concept map. I will pose the following questions, and may ask additional questions, depending on student responses:

- What is climate change?
- What causes climate change?
- What are the effects of climate change?

Students will then complete an anticipation guide with statements about climate change. Students must agree or disagree with a statement and give an explanation about why they agree or disagree with a given statement. Students will share their responses and respond to classmates in a modified Socratic Seminar-style discussion. The anticipation guide will include 8-10 statements, such as the following:

- Climate change will impact everyone equally.
- Climate change would happen with or without human activities.
- Every place will see similar effects from climate change.
- People can move away to escape the negative effects of climate change.

After the discussion has concluded, students will complete a quick-write activity in which they form an initial claim to the question: *Will climate change impact all people in the same way?* Students will support their claims with material from the class discussion, prior knowledge and personal experiences. The goal of this quick-write activity is to illustrate the importance of revising and forming claims based on evidence. This will become clear for students upon the conclusion of the unit when they form evidence-based claims in a formal written argument.

In the next part of this activity, students will engage with a text set that illustrates the science of climate change, the global impacts of climate change, and the local effects of climate change in Delaware. Students will view infographics, science articles, and graphs in the text set to support student understanding of climate change and how it will impact geographic areas in different ways. Specifically, students will use interactive maps and graphs to determine that increased rainfall and sea level rise will cause damaging floods in Delaware. I will model and provide students with guided practice opportunities and sentence frames to form evidence-based claims about how climate change-fueled flooding will impact Delaware communities.

### Gathering Data: Comparing Flood-prone Communities in Delaware

In this part of the unit, students will learn how communities experience climate change differently, especially along racial and socioeconomic lines. I expect this activity to occur over two to three 90-minute class periods.



Racial housing discrimination practices like redlining have segregated many communities that, to this day, experience higher burdens of environmental hazards, including those created by climate change. Delaware is no exception to this trend, which is evident when viewing census tract data as it relates to climate change vulnerability.

I expect that many students will understand the concept of segregation, but have little to no knowledge of redlining. Therefore, students will complete a KWL chart before, during, and after viewing a short video that explains the policy of redlining and its lasting effects on communities of color.

Students will then begin exploring an online climate and economic justice screening tool. We will discuss the meaning of a “census tract,” and explore different census tracts around Delaware. Students will learn how communities are identified as “disadvantaged” and make observations about census tracts in their own city, including those identified as disadvantaged, and those that are not.

Students will then use the online screener tool to gather census tract data for two flood-prone communities in Delaware. One community is the predominately Black community of Southbridge in Wilmington, Delaware, located along the Christina River. Another community is a predominately White community located in coastal Bethany Beach, Delaware. Both communities are located in areas that are in the 98<sup>th</sup> percentile for risk from climate change-fueled flooding events; however, Southbridge is identified as disadvantaged due to the community’s high percentage of families with low-income economic status. As a result, residents of Southbridge are less likely to be protected by flood insurance, less able to make necessary repairs after flood events, and less able to sell their flood-damaged residences and move elsewhere. In addition, economic investment has declined in the community due to increased flooding, further hampering residents’ efforts to relocate.

Students will gather data and then use sentence frames to interpret and compare data from both communities. This data comparison will be supported by news stories and resident interviews from both communities. Students will note the structural and mental health effects of flooding in Southbridge, compared to that in Delaware’s beach communities, which have historically been repaired and protected by beach nourishment activities funded by the state and federal government. As students interpret the data, they will revisit, and potentially revise, their claims from their quick-write activity at the beginning of the unit. Students will conclude, based on the evidence they gathered, that climate change is not impacting all people equally. They will use evidence gathered from the video on redlining, local news stories, and the census tract comparison to support their claim and develop reasoning to explain how racial make-up and economic status of a community can contribute to the community’s vulnerability to the effects of climate change.

### **#3 Forming and Supporting an Evidence-Based Argument**

The final, summative assessment in the curriculum unit is an argument essay in which students will demonstrate what they have learned in the unit. The essay will include an introduction, body paragraphs, a counterclaim and rebuttal, and a conclusion. The pre-writing, drafting, and revising of this essay will occur over three to four 90-minute class periods.

In the introduction, students will summarize and provide background about the effects of climate change on Delaware communities and state a main claim about the disproportionate burden of flooding on the community of Southbridge. Students will then develop body paragraphs that state related claims supported by evidence and reasoning. Students will use evidence gathered during the census tract data comparison to demonstrate the disproportionate physical, economic, and mental health impacts of flooding on the

predominately Black and low-income community of Southbridge compared to a similarly flood-prone beach community in Bethany Beach. In this part of the unit, students will authentically apply language skills to analyze and explain how data supports their claims.

Students will demonstrate their understanding of redlining and racial housing discrimination to respond to the counterclaim that residents in flood-prone communities could simply move to another location. This section of the argument essay provides students with the opportunity to demonstrate their understanding of policies like redlining, but also requires students to think deeply about how discriminatory systems impact the health and safety of whole communities and often limit individual choice in escaping or avoiding environmental hazards.

Before students begin the conclusion of their argument essays, they will learn about the advocacy of Southbridge residents, and the ways in which the community fought for protection from the increased frequency of flooding. If possible, students will have the opportunity to interview a resident and activist from the community about their efforts to secure the recent 26-million-dollar, flood-mitigating wetlands project. Alternatively, students will watch interviews with community activists and view images and videos of the project. In addition, students will consider the longevity of the wetlands project as a way to prevent flooding, considering the continued projection of sea level rise along the Delaware coast. They will investigate and discuss additional, longer-term solutions to flooding in communities like Southbridge. Then, students will summarize their claims and describe their long-term solutions to flooding in communities like Southbridge in the conclusion of their argument essays.

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## Appendix on Implementing District Standards

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Several standards inform the writing of this curriculum unit and serve as benchmarks for student achievement of the curriculum goals. The Common Core English Language Arts standard that students will achieve is CCSS.ELA-LITERACY.W.8.1 in which students will “Write arguments to support claims with clear reasons and relevant evidence.”<sup>61</sup> Skills and learning activities will be spiraled throughout the unit to support students before the culminating task in which they will write evidence-based arguments supported by concise reasoning. Additionally, this unit is designed for Multilingual Learner (MLL) students and thus focuses on developing students’ academic language to effectively communicate an analysis of data to support a claim across the domains of listening, speaking, reading, and writing. The unit’s language-focused standards are informed by the WIDA Consortium language development standards two and four which state that students will be able to use academic language to communicate effectively in the content areas of English language arts and science, respectively.<sup>62</sup>

## Notes

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