

COASTAL DELAWARE RESILIENCY

Response, recovery and adaptation
by the tourism industry
to natural hazards and climate change
2017



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CONTENTS

Executive summary	1
Climate change and coastal hazards: What do we know?	3
Hurricane Sandy—impacts from an extreme storm	5
Projected impacts of sea-level rise and climate change on Delaware coastal tourism	6
Tourism in Delaware	6
Tourism in coastal Sussex County	7
Local climate change impacts	8
Weather changes in Sussex County	11
Hurricane impacts	12
Resilience: What does it mean?	13
Learning from others: Resilience initiatives in action	16
Developing strategies for resilience in Sussex County’s coastal tourism sector	19
The current state of resilience planning	19
Obstacles to overcome for resilience planning	21
Looking to the future: Recommendations for resilience planning	23
Delaware resources for climate change and resilience planning	27

References available at https://www.deseagrant.org/sites/default/files/product-docs/Coastal_DE_Resiliency_References.pdf



EXECUTIVE SUMMARY

First State facts

- ▶ Delaware's beaches were ranked 1st out of 30 coastal states for beach water quality from 2011 to 2013 (NRDC, 2013).
- ▶ Cape Henlopen State Park draws more than 1.5 million visitors each year and is the 4th most beautiful state park in the U.S. according to a survey by USA Today (State of Delaware, 2014).
- ▶ National Geographic ranked Rehoboth Beach boardwalk 6th in its top 10 list of U.S. boardwalks.

Bounded by the Atlantic Ocean and the sandy beaches and salt marshes along Delaware Bay, coastal Delaware is a welcome respite from the fast-paced metropolitan regions surrounding it. Plentiful access to the Atlantic Ocean and the calm waters of the Inland Bays offer abundant opportunities for recreational fishing, boating, and swimming. With 24 miles of ocean beaches, eight public boat ramps and fishing piers, a 15-mile multi-use trail connecting the towns of Lewes and Rehoboth, four state parks, and four state and federal wildlife management areas in the eastern half of the county, nature lovers and fitness enthusiasts can find plenty of open spaces for bird-watching, camping, cycling, or paddle boarding.

While the natural beauty of the region draws many of Delaware's eight million tourists annually, other major attractions are its tax-free shopping, restaurants, golfing, and entertainment venues such as the boardwalks in Rehoboth and Bethany Beach and the Freeman Stage in Fenwick Island. For many families who vacation near Rehoboth, riding Funland's carousel and buying salt water taffy at Dolle's have become generational traditions.

But a warming climate, changes in weather patterns, and rising sea levels will change how and where business is done in coastal Delaware. These factors may also provide new business opportunities.



Photo: Delaware Sea Grant/
University of Delaware

This report summarizes the current state of climate science and provides strategies to help coastal Delaware's tourism industry identify these vulnerabilities and opportunities and to promote long-term resilience planning. These strategies are outlined in detail on pages 23–26 and include the following:

- Increase outreach and awareness about climate change, sea-level rise, and natural hazards as they specifically relate to the tourism industry
- Identify and prioritize vulnerabilities to tourism sectors
- Conduct a tourism-related needs assessment
- Assist businesses in evaluating storm preparedness and flood risk
- Assist businesses in implementing adaptation, emergency response and resilience plans including strategies for electricity, sanitation, employee communication, water damage, types of insurance, and government assistance

- Take advantage of enhanced opportunities from climate change
- Develop a Housing Resilience Checklist for vacation homes and second home owners to include a storm preparedness kit, evacuation route map, emergency contacts for utilities, and reliable contractor lists
- Enhance public emergency communication services
- Highlight and celebrate climate smart businesses
- Incentivize climate smart actions
- Make tourism businesses greener
- Prioritize areas for tourism adaptation planning and funding

Web resources, including adaptation plan examples, flood maps, hazard planning and climate adaptation tool kits, and climate impact assessments for Delaware are included at the end of this report.



Photo: Delaware Sea Grant/University of Delaware

CLIMATE CHANGE AND COASTAL HAZARDS: What do we know?

Climate facts

- ▶ In the Mid-Atlantic region, sea-level rise was measured at more than double the rate of the global mean during the 20th century.
- ▶ Globally, average sea levels rose about 7 inches cumulatively through the 20th century, but more than 1 foot in coastal Delaware.
- ▶ By 2100, Delaware sea levels are projected to rise at least another 32 inches and possibly up to 4.3 feet above current sea levels.
- ▶ A 0.5° Celsius change in sea surface temperature will result in a 40% increase in hurricane activity in the North Atlantic.

Climate change is a natural process of warming and cooling that has been occurring for thousands of years. However, global industrialization over the past 150 years has accelerated the pace of change. Burning of fossil fuels, deforestation, and other industrial activities emit heat-trapping, or greenhouse gases such as carbon dioxide, methane, and nitrous oxide. As these gases accumulate in the atmosphere, they absorb heat from the sun and reflect it back to earth. According to the 2014 National Climate Assessment, human-induced emissions of carbon dioxide and other small particles are causing global temperatures to increase at rates faster than projected due to natural variation.

In the most recent analysis of the instrumental record, scientists at NASA's Goddard Institute for Space Studies conclude that "the earth's average surface temperature has warmed 1.4°F since 1880, with the majority of warming occurring during the past three decades" (NASA, 2015). The year 2016 was the warmest year on record, with the 10 warmest years on record having occurred between 2005 and 2016. Atmospheric concentrations of carbon dioxide have increased 40% relative to pre-industrial levels. This rate of change is outpacing the ability of the world's oceans and forests to absorb the excess carbon dioxide (Walsh et al, 2014). Left circulating in the atmosphere, the greenhouse gases reflect heat back to the oceans, contributing to sea-level rise and creating conditions ripe for the development of extreme storms like Hurricanes Sandy and Irene.



Nor'easters cause significant damage to Delaware shores. Photo: Delaware Sea Grant/ University of Delaware

Coastal areas are particularly prone to the impacts associated with climate change. As the concentration of atmospheric carbon dioxide increases, the oceans absorb some of the excess heat that is reflected from the atmosphere. As the heat is absorbed, sea surface temperatures increase, ocean waters expand, glacial sea ice melts, and sea levels rise along the coast.

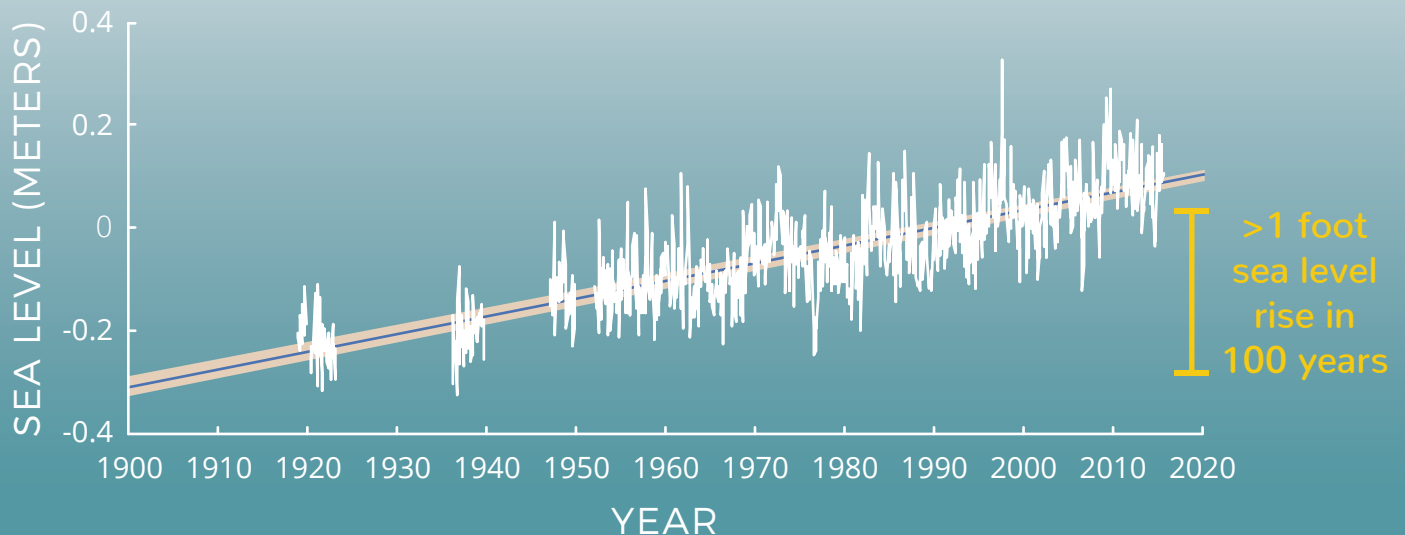
Globally, average sea levels rose about 7 inches cumulatively through the 20th century. As temperatures rise and sea ice continues to melt, that rate is expected to accelerate. By 2100, Delaware sea levels are projected to rise about 32 inches and possibly up to 4.3 feet above current sea levels (Delaware Geological Survey, 2016). As might be expected based on variations in land elevation and subsidence rates, some coastal areas will be more vulnerable to sea-level rise than others. For example, in the Mid-Atlantic region, sea-level rise was measured at more than double the rate of the global mean during the 20th century (Williams et al, 2009). With sea levels rising over 1 foot during the past century (Figure 1), a rate that is expected only to increase during the 21st century, the flooding of tidal wetlands,

erosion of beaches, and damage to infrastructure will be costly for coastal communities.

In addition to contributing to sea-level rise, warmer ocean waters also increase the energy available for the formation of storms and hurricanes (Knutson et al, 2010). As sea surface temperatures (SST) increase, the combination of warm, moist air with unstable conditions in the atmosphere (i.e. thunderstorms or wind shear) provides ideal conditions for hurricane formation (Graham and Barnett, 1987). Statistical models show that a 0.5° Celsius increase in SST could lead to a 40% increase in hurricane activity in the North Atlantic's tropical waters. Moreover, scientific models show that about 40% of the hurricane activity between 1996 and 2005, which was one of the most "active periods" for hurricanes in U.S. history, could be explained by local sea surface warming (Saunders and Lea, 2008).

The higher wind speeds associated with these extreme storms combined with rising sea levels are expected to magnify storm surge, flooding, and damage to coastal properties and businesses (Howard et al, 2013).

Figure 1. The mean sea level trend for Lewes, Delaware from 1919 to 2016. The mean change is 3.40 millimeters/year with a 95% confidence interval of +/- 0.24 mm/yr which is equivalent to a change of 1.11 feet in 100 years. Data from NOAA Tides and Currents Program; accessed August 10, 2016.



HURRICANE SANDY—IMPACTS FROM AN EXTREME STORM

Hurricane Sandy became one of the most damaging storms to hit the Eastern seaboard when it razed parts of the coast on October 29, 2012. Classified as a “superstorm”, it caused \$65 billion in damages and economic losses, left 8.5 million customers without power, damaged 650,000 homes, and led to 159 storm-related fatalities. Of the economic damages, the recreational fishing sector incurred \$58 million in losses and 200,000 small businesses, many of which supported coastal tourism economies, were closed due to damage or power outages (Hurricane Sandy Recovery Task Force, 2013).

While the major impacts of Sandy were felt by New Jersey and New York City, Delaware did not escape unscathed. Nearly 11” of rain fell at Indian River Inlet.¹ Storm surge and high waves hammered coastal highway near the Inlet, oceanfront properties in South Bethany Beach, and Gordon’s Pond natural wildlife area.² Not only were freshwater areas inundated with saltwater, but some dunes protecting oceanfront properties and the main thoroughfare connecting the area’s beaches were breached, prompting road closures and dune rebuilding efforts. Pier Point Marina in Dewey Beach suffered major damage from the storm, losing its



Delaware beach dunes, like this one, were breached during Hurricane Sandy. Photo by Delaware Sea Grant/University of Delaware

floating jet-ski dock and 135 of its 141 slips to the storm surge.

Following Delaware’s declaration as a disaster area, more than \$2.2 million was awarded by FEMA (the Federal Emergency Management Agency) for storm recovery efforts.³ Given the value of coastal beaches to tourism and the role that dunes and renourishment play in protecting critical infrastructure and private property from storm surge and flooding, beach nourishment along the Atlantic Coast and Delaware Bay beaches was a key part of post-Sandy recovery.

Small coastal communities relying on tourism for economic vitality need to rapidly return to “business as usual”, especially during the summer high season. Creating a plan and/or toolkit that promotes community resilience to future storm events and provides guidance for rapid rebuilding efforts, particularly for small business owners and tourism operations, is of utmost importance for Delaware’s coastal region. At the same time, care must also be taken to include beachfront and coastal property owners in resilience planning efforts.



Lewes Wharf after Hurricane Sandy. Photo by Delaware Sea Grant/University of Delaware

1. <http://climate.udel.edu/storm-events/hurricane-sandy-impacts-delaware>
2. <http://coastal.er.usgs.gov/hurricanes/sandy/photo-comparisons/delaware-maryland.php>
3. <http://www.fema.gov/disaster/4090>

PROJECTED IMPACTS OF SEA-LEVEL RISE AND CLIMATE CHANGE

on Delaware coastal tourism

TOURISM IN DELAWARE

Like many coastal states, Delaware's economy is driven by tourism. According to an industry report commissioned by the Delaware Tourism Office, Delaware attracted eight million visitors in 2014 (Delaware Tourism Office, 2015). Tourism alone generated \$3 billion of the state's gross domestic product (GDP), employed 40,830 people, and was the fourth largest private employer in the state (Delaware Tourism Office, 2015). Taking a closer look at Sussex County, more than \$630 million was generated by direct tourism sales (Southern Delaware Tourism Office, 2013).

Shopping, dining, and visiting Delaware's high quality beaches were among the most popular activities reported by Delaware's visitors. In the 2015 visitor survey for southern Delaware, visitors ranked "clean

What do visitors enjoy most about southern Delaware?

- ▶ Clean beaches and ocean
- ▶ Friendly atmosphere and people
- ▶ Tax-free shopping
- ▶ Restaurants and dining
- ▶ Scenery/wildlife/open space

Source: Southern Delaware Tourism Office, 2015

Direct coast-related spending contributed \$4.1 billion to Sussex County's economy in 2012. Photo: Delaware Sea Grant/University of Delaware



beaches and oceans” at the top of the list for what they enjoyed most about southern Delaware (Southern Delaware Tourism Office, 2015). The scenery, wildlife, and open spaces of southern Delaware were also ranked highly by visitors. Three other active outdoor categories: 1) fishing and crabbing, 2) boating and paddling, and 3) biking, were also listed as some of the top ten visitor activities according to the 2015 survey. Overall in Delaware, a 2011 US F&W survey showed wildlife-watching generated the most economic benefit of all types of recreation with more than 5 million park attendees spending \$169 million in 2011.

TOURISM IN COASTAL SUSSEX COUNTY

As the focus of our report centers on the impacts of climate change and/or extreme events to tourism in Sussex County's coastal areas, let's take a closer look at the economic value of tourism for this region. We use “value” to describe the dollars spent by visitors during their trips, including the income generated from rental properties, as well as the number of core jobs, i.e. jobs in the private sector, that directly touch Delaware's visitors.

While the average visitor spent \$573 in Delaware per trip, the collective value of visitor spending in Sussex County was more than \$1.7 billion in 2014 (Delaware Tourism Office, 2015). If the definition of tourism is extended to include long-term visitors and permanent residents who support area restaurants and businesses year-round, the value of the coastal economy increases even more. In a 2012 report on the contribution of the coastal economy to the state of Delaware, Latham and Lewis found that direct coast-related spending contributed \$4.1 billion to Sussex County's economy (Latham and Lewis, 2012).

Spending by tourists is also an important part of Delaware's tax base. State and local taxes related to tourism and coastal economic activity accounted for \$470 million in 2014 (Delaware Office of Tourism, 2015). Without this revenue source, each household would have to pay up to \$1,360 more in state and local taxes (Southern Delaware Tourism Office, 2015). Not only does tourism generate tax revenue to fund services such as education and infrastructure development, but it also provides employment opportunities.

At the county level, the Southern Delaware Tourism office reports that the tourism industry accounts for

16,630 jobs in Sussex County (Southern Delaware Tourism Office, 2015). This represents 41 percent of the state's tourism-related employment and 17 percent of employment opportunities in the county.

According to the Delaware Chamber of Commerce, 509 tourism-related businesses are currently operating in Sussex County, illustrating again just how essential tourism is to the economic vitality of Delaware.



According to the Delaware Office of tourism, state and local taxes related to tourism and coastal economic activity accounted for \$470 million in 2014. Without this revenue source, each household would have to pay up to \$1,360 more in state and local taxes. Photo by Kevin Fleming

Seasonal patterns in coastal tourism— Sussex County, Delaware


As a beach destination, the bulk of Delaware's tourists visit during the summer season. Yet targeted marketing of the shoulder seasons has shifted travel patterns, enticing visitors to come for long weekend getaways and to take advantage of the many festivals occurring in the spring and fall. The percent of respondents visiting in July and August high season has generally increased. Though the majority of tourism is associated with the summer months, 10 to 25 percent of tourists visited southern Delaware during September and October. The tourism-associated income generated during the fall festival weekends is a boon for local businesses. Rising air and sea surface temperatures could extend this season.

LOCAL CLIMATE CHANGE IMPACTS

The impacts of sea-level rise and climate change to wildlife, wetlands, and beaches has been the subject of much research over the past 20 years; however, the socioeconomic impacts of climate change to

marine resource dependent communities and economies are not well documented. The effects of sea-level rise and climate change on Delaware's natural resources and coastal economy have been discussed in only a few reports such as Kreeger et al 2010; Delaware Coastal Programs, 2012; Hayhoe et al. 2013. As the Mid-Atlantic is projected to be a hotspot for sea-level rise, with the relative sea level rising 3-4 times faster compared to other regions along the East Coast, the importance of planning for, and adapting to, sea-level rise cannot be overstated (CCSP, 2009).

DNREC Sea-Level Rise Technical workgroup report, *Preparing for Tomorrow's High Tide: Sea-Level Rise Vulnerability Assessment for Delaware* describes the vulnerability of 79 resources, including natural systems, public infrastructure, and cultural and historical assets to three sea-level rise scenarios that could occur between now and the year 2100. The report addresses both statewide and county-specific impacts arising from increased inundation and flooding associated with sea-level rise.



While potentially increasing the severity of hurricanes, rising air and sea surface temperatures could also substantially extend the shoulder seasons.

Photo: Delaware Sea Grant/University of Delaware

Low scenario projects the slowest rates of sea-level rise, increasing 0.5 meters relative to the current sea level by 2100. Intermediate scenario projects a more moderate rate, increasing 1 meter by 2100. Highest scenario projects the fastest rate of sea-level rise, approximately 1.5 meters by 2100. For all three scenarios, the vulnerability of each resource was mapped, scored, and ranked on a scale of minimal to high concern. Sea-level rise impacts to resources of particular concern to tourism and recreation in Sussex County are summarized in Table 1 and reviewed in more detail below.



Nearly 99% of the 21,090 acres of tidal saltwater wetlands in Sussex County are projected to be underwater by 2100. Photo: Delaware Sea Grant/University of Delaware

Impacts to tidal wetlands, beaches, and state park lands are projected to be large and costly. As such, natural resources are ranked as extremely vulnerable to sea-level rise under all three sea-level rise scenarios. For example, in Sussex County, nearly 99% of the 21,090 acres of tidal saltwater wetlands would be inundated under each of the three scenarios (Delaware Coastal Programs, 2012). The loss of tidal wetlands, beaches, and dunes due to sea-level rise is of particular concern, because tidal wetlands provide essential habitat for juvenile

fish and migratory waterfowl, contributing to recreational hunting, fishing, and wildlife viewing opportunities. In Delaware’s coastal areas, these recreational activities are valued at \$134 million annually (Kauffman et al, 2011). Tidal wetlands

Resource	Vulnerability	Current quantity	Quantity to be inundated by sea-level rise**	% to be inundated**
State Park lands	High	14,796 acres	6,069–8,316 acres	41–56%
Beaches	High	Data not available	Data not available	Data not available
Tidal saltwater wetlands	High	21,090 acres	20,949–21,073 acres	99%
Road infrastructure	High	3,556 miles of roads	79–357 miles of roads	2–10%
Evacuation routes	High	519 miles of evacuation routes	2–39 miles	1–7%
National Register and State Historic Sites	Low	2,361 historic sites	57–164 sites	2–7%
Piers and boat ramps	Low	27 piers and ramps	13–17 piers and ramps	48–63%
Tourist attractions and amenities *	Data not available	Data not available	Data not available	Data not available

Table 1. By the Numbers: Potential Sea-Level Rise Impacts to Sussex County Tourism and Recreation Resources by the Year 2100.

Data Source: Delaware Coastal Programs, 2012.

* Includes shops, restaurants, hotels, and other attractions.

** Quantity to be inundated by SLR reflects the range of SLR estimates from 0.5 to 1.5 m by the year 2100.

also minimize flooding and storm surge, providing flood protection for both public infrastructure and private businesses. With a conservative estimate of 97% loss of saltwater tidal wetlands by 2100, an estimated \$500 million in ecosystem services would be lost each year in flood protection, essential fish habitat, carbon sequestration, and water filtration (Delaware Coastal Programs, 2012).

Beach and dune systems also provide critical flood protection for beachfront homes, rental properties, and businesses, as well as opportunities for land and water-based recreation and ecotourism. The primary threat to beaches from sea-level rise is shoreline erosion. Another major threat is the flooding that occurs when storm surge breaches the dune system.

While the direct economic losses due to sea-level rise have not been enumerated for beaches and dunes, the cost of replenishing some of Delaware's beaches provides some context as to their tourism value. For the Atlantic Coast beaches (including, Rehoboth, Dewey, Bethany, South Bethany, and Fenwick), it cost about \$38 million to replenish the shoreline following damage from Hurricane Sandy (Delaware Coastal Programs, 2012). Nourishing the beaches is critical to Delaware's tourism industry, but it comes at a high cost. Moreover, the sources for borrowed sand are not inexhaustible.

In a panel meeting conducted by the United States Geological Survey (USGS), coastal scientists and managers in the Mid-Atlantic states reported concerns about the sustainability of nourishment and other erosion management practices. Due to the natural westward migration of barrier islands, the group questioned whether man-made changes to shorelines might affect the natural ability of shorelines to respond to future sea-level rise (Gutierrez et al, 2009).

In addition to beaches and dunes, nearly 40% of the state park land in Sussex County would be underwater if sea levels rose by 0.5 meters. To put this in perspective, Cape Henlopen State Park (CHSP) draws over 1.5 million visitors each year (Brown, 2013).

In all three of DNREC's sea-level rise scenarios, many roads and evacuation routes were ranked as highly vulnerable to sea-level rise by 2100 (Delaware Coastal Programs, 2012). In Sussex County,

between 27 and 39 miles of evacuation routes could be flooded with a sea-level rise of 1 to 1.5 meters. Inundation of coastal Highway/Route 1 is of particular concern as it is a major traffic artery and evacuation route for many of the county's beach communities and resort areas (see Table 1).

DNREC also estimates that 50-60% of state-owned ramps and piers in Sussex County are subject to inundation due to sea-level rise. Adaptation will likely be necessary to provide continued access to boat ramps, piers, and parking areas. Yet for the past two years there was no open space funding provided in Delaware and very little funding for maintenance, infrastructure improvements or climate adaptation.



Nearly 40% of state park land in Sussex County would be underwater if sea levels rose by just 0.5 meters. Photo: Delaware Sea Grant/University of Delaware



Surf Avenue in Rehoboth Beach floods during Hurricane Sandy. In Sussex County, between 27 and 39 miles of evacuation routes could be underwater with a sea-level rise of 1 to 1.5 meters. Photo: Delaware Sea Grant/University of Delaware

WEATHER CHANGES IN SUSSEX COUNTY

Climate change contributes to long-term sea-level rise, but in the short-term it also affects the daily weather of a region. Short-term changes in weather that can be attributed to climate change include increases in daily temperatures, rain and snowfall patterns, and the duration of heat waves.

For the Northeast region of the U.S., projected changes in weather include a warming trend of 4.5°F to 10°F by 2080 under a high greenhouse gas emission scenario; longer, more intense heat waves with more days per year above 90°F by 2050; and increased precipitation during spring and winter with more frequent heavy downpours by 2100 (Walsh et al, 2014). These changes have the potential to greatly impact the attractiveness of tourist destinations in Mid-Atlantic coastal regions.

How much will Delaware's climate change during the coming century? What are the implications of climate change for Delaware's weather outlook? In the report entitled, *Climate Change Projections and Indicators for Delaware*, data from 14 weather stations including several in coastal Sussex County were used to localize global climate change projections (Hayhoe et al, 2013). Climate change was examined for four metrics: average and seasonal temperatures; temperature extremes; average extremes; and rainfall extremes. Each metric was examined under a lower scenario, where human emissions of

greenhouse gases are reduced by shifting to cleaner energy sources, and a higher scenario, where human emission of greenhouse gases continue to accelerate. A summary of the findings from Hayhoe, Stoner, and Gelca's report is provided below:

Average **temperatures will increase**.

- Temperatures will rise 1.5 to 2.5°F (near-century); or from 3.5–5.5°F to 8–9.5°F (late-century) under lower and higher emissions scenarios.

Temperature increases will have a seasonal component, and the **increases will be higher in the spring and summer seasons**.

The number of hot days (over 100°F) will **increase**.

- Number of hot days will increase by 1–3 hot days (near-century), or 3–10 days to 15–30 days (late-century) under lower and higher emissions scenarios.
 - ▶ **Heat waves will be longer and more frequent.**
- In the late-century projections, heat waves are predicted to occur an average of three times per year and up to 10 times per year under lower and higher emissions scenarios.
 - ▶ **Summer heat index will increase twice as much as changes in maximum temperatures**, due to the influence of heat index, temperature, and humidity.
- Average **precipitation will increase 10%** by late-century.

Greenhouse gas concentrations

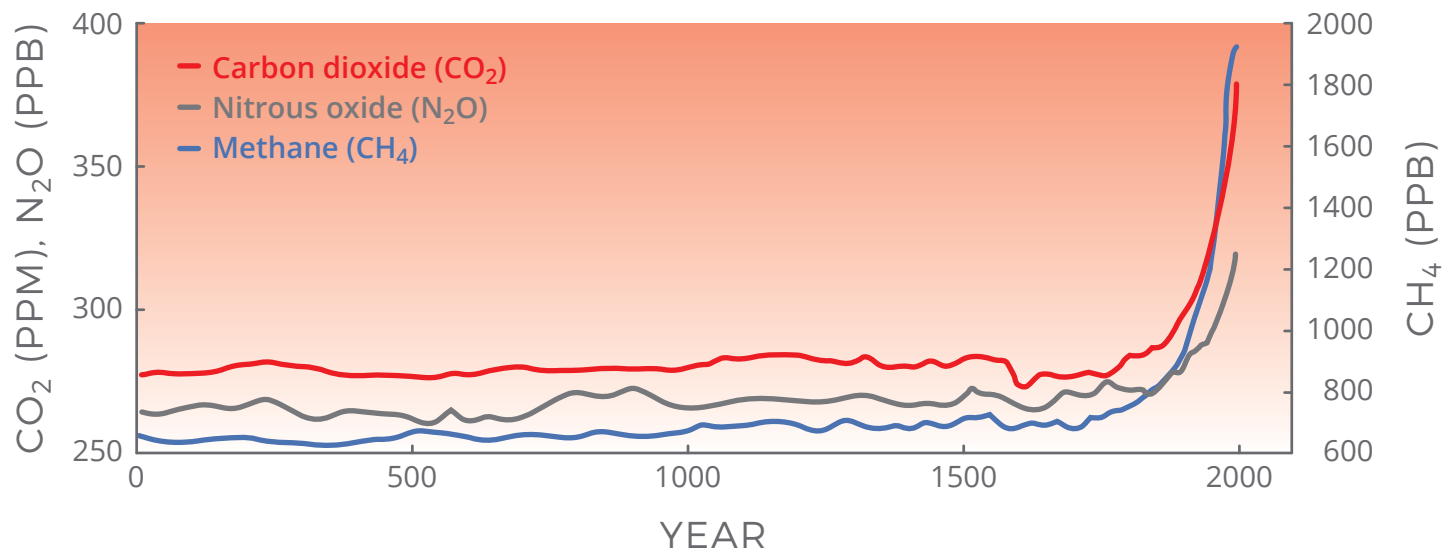


Figure 2. Greenhouse gas emissions have skyrocketed since the late 1800s. Ice cores dating back 800,000 years show a near-perfect causal relationship between increases in atmospheric CO₂ and temperature.

- Late-century projections indicate increases in both the frequency of extreme rainfall events and the amount of precipitation during the events.
- Heat and high temperatures may combine to impair water quality and create harmful algal blooms like the one seen in 2016 in Florida.

By late-century (2080–2099), the projections show that Delaware’s climate will be hotter, wetter, and more prone to heat waves during the summer months. While hotter summer temperatures and extended heat waves could send Delaware’s tourists north towards a cooler climate, a warmer spring shoulder season could lead to more favorable weather for outdoor recreation and tourism activities, increasing business revenue and expanding tourism business opportunities during what was previously considered an “off season” (Morris and Walls, 2009).

HURRICANE IMPACTS

Seasonal travel can be particularly sensitive to changes in weather patterns and extreme storm events. While the summer heat and numerous fall festivals attract many tourists to coastal Delaware, they also coincide with climate conditions that

are ripe for the development of hurricanes along the Atlantic Coast. Hurricane season runs from June–November, with the peak falling between August and October. According to NOAA’s record of hurricanes and tropical storm activity over the past 100 years, more than 90 hurricanes and tropical storms have been active in the Atlantic Ocean basin on September 10, the average annual peak of hurricane season.

If a hurricane, tropical storm, or other extreme weather event occurs during either the late-summer or fall shoulder season, it can have a major impact on tourism revenue, particularly if the timing coincides with one of the festival weekends.

As an example, if a hurricane forecast necessitates evacuation during a high-volume festival weekend, county officials, event planners, and the tourism industry should be familiar with plans in place for communicating early warning and evacuation orders, coordinating emergency response, re-opening businesses and restaurants as quickly as possible, and recouping financial losses due to event cancellation through some type of event or business interruption insurance. The cost of inaction can be expensive (Figure 3).

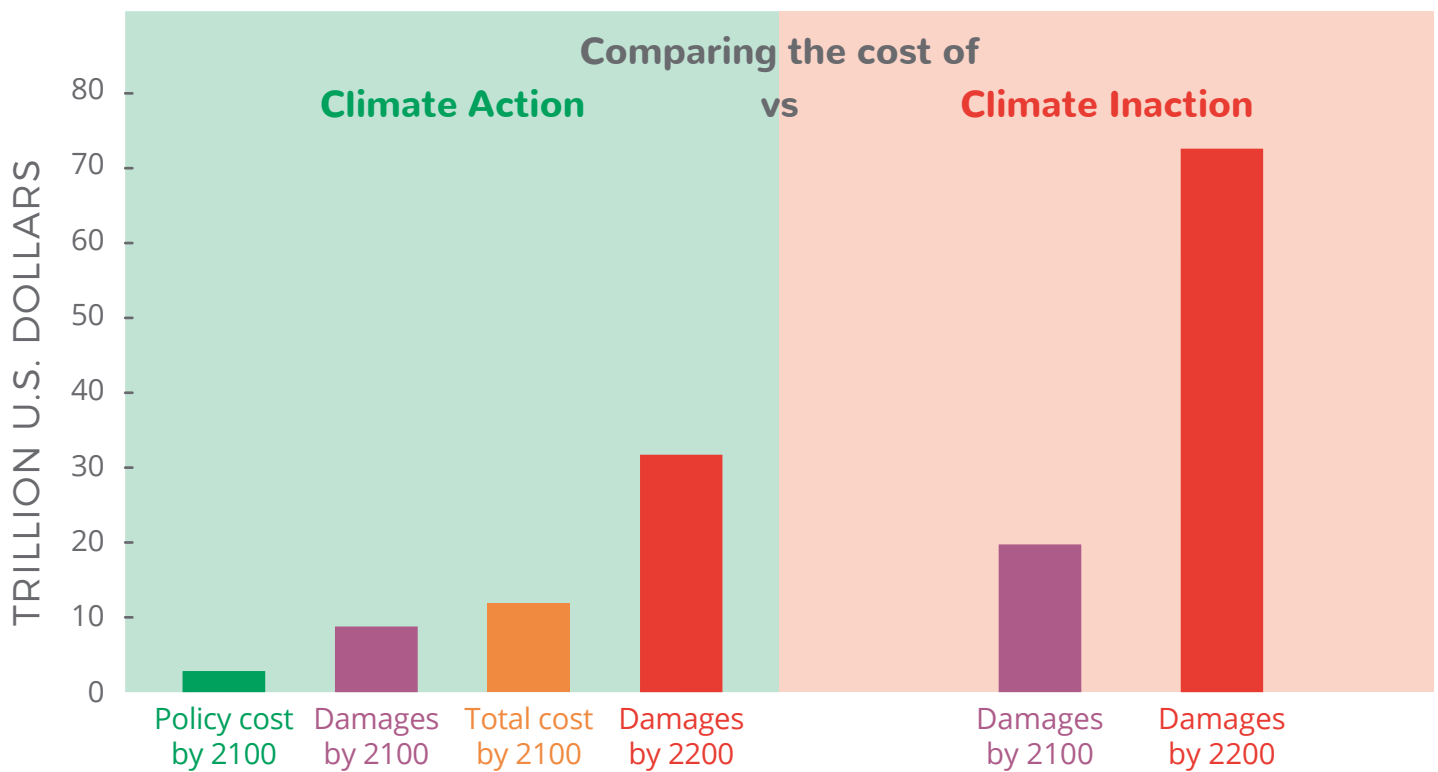


Figure 3. The benefits of reducing greenhouse gas emissions outweigh the costs by trillions of dollars. Combining the results of the [report by the German Institute of Economic Research](#) and [Watkiss et al.](#) studies, the total cost of climate action (cost plus damages) by 2100 is approximately \$12 trillion, while the cost of inaction (just damages) is approximately \$20 trillion.

RESILIENCE: What does it mean?

Preparing for changes

- ▶ Sussex County's population is expected to grow 30% in the next 30 years and much of this growth will be in flooding and storm surge-prone areas.
- ▶ Storm emergency plans and protective building codes helped spare many of New Jersey's newer structures during Hurricane Sandy.
- ▶ States like Maryland with adequate setbacks, stormwater, wetland, and zoning laws fare far better in storm events than other more permissive states.
- ▶ Communities without rebuilding plans take substantially longer to recover from storm events.
- ▶ Plans should also include how to allocate relief dollars so places like boardwalks, beaches, and Main Streets can quickly entice and reassure tentative tourists.

Over the next 30 years, Delaware's coastal regions are expected to face significant challenges due to sea-level rise and climate change. Regional climate models are predicting stronger hurricanes with higher wind speeds and heavier rainfall. Sea-level rise is anticipated to cause higher storm surges and increased flooding in low-lying areas, and heat waves are likely to increase in intensity and duration placing stress on both electricity demands and socially vulnerable populations. During this same time period, Sussex County's year-round population is expected to grow 30% and demands for water, housing, schools, and hospitals are expected to mount (Delaware Population Consortium, 2014). In the face of all this growth, how do coastal communities become more resilient? That is, how do they continue to provide amenities and services that attract and/or sustain tourism, while concurrently reducing their vulnerability to natural hazards and climate change?

The National Oceanic and Atmospheric Association (NOAA) defines **coastal resilience** as "the ability of a community to "bounce back" after hazardous events such as hurricanes, coastal storms, and flooding, rather than simply responding to impacts".⁴ It is not only the speed of the initial response to the event that is important, but also having plans in place to help the natural and built environments, businesses, and people living and working in the coastal community return to normal conditions and/or daily activities as quickly as possible, and also return more resilient.



Fenwick flooding during Hurricane Sandy. Photo by Delaware Sea Grant/University of Delaware

4. <http://oceanservice.noaa.gov/facts/resilience.html>, accessed 11/21/14

Hurricane Katrina (2005) and Superstorm Sandy (2012) pounded coastal communities throughout the Gulf Coast and Mid-Atlantic regions, exposing our vulnerability to extreme storms. Despite advanced warning from the National Weather Service and past experiences with strong storms, coastal communities were crippled by these intense storms. Regional economic impacts were costly, with New Orleans being effectively shut-down for six weeks post-Katrina.

New Orleans: a case study

In a case study of community resilience after Hurricane Katrina, Colten et al (2008) reported New Orleans had still not fully recovered three years after the hurricane due mostly to an inadequate labor pool and related shortage of affordable housing.

However the hospitality industry exhibited more resilience. Despite the damage to the city's infrastructure, just one year after the hurricane, 85% of hotels had re-opened and business and tourism travel had returned to 80% of pre-Katrina levels. By 2008, revenue from hotels and motels was nearing pre-Katrina levels (Liu et al., 2006; Colten et al, 2008).

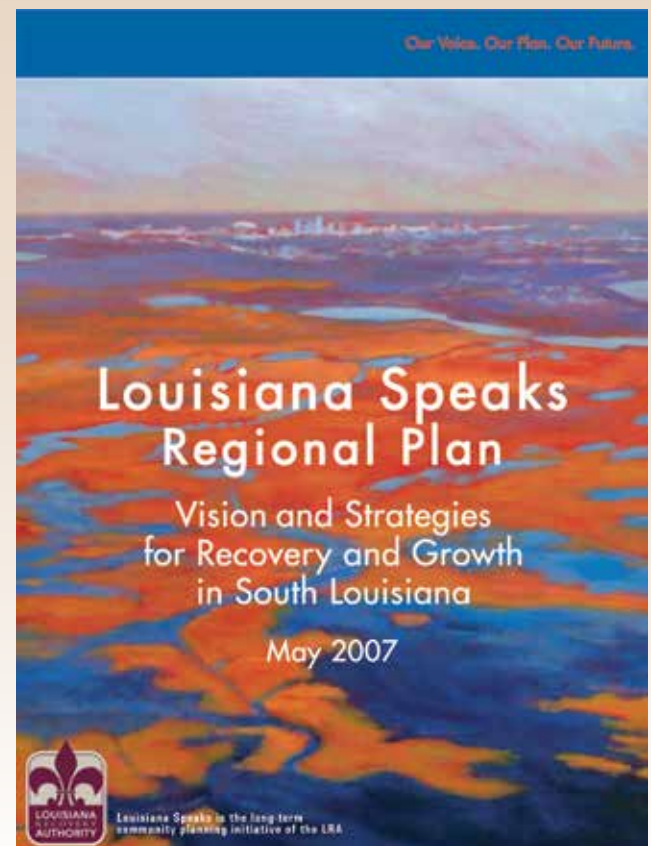
By resuming business as quickly as possible after the storm, the hotels and motels provided employment opportunities for city residents, created demand for businesses such as linen and cleaning services and plumbing and electrical contractors, and generated tax revenue to help New Orleans repair its damaged infrastructure.

Even with the resilience demonstrated by the hospitality industry, a full recovery is years away for New Orleans. Looking ahead, the city implemented a 10-year reconstruction plan for long-term recovery and is beginning to address economic resilience. In 2007, the state adopted Louisiana Speaks, a 50-year regional plan to address future storm and flood vulnerability by encouraging restoration of barrier islands and coastal wetlands, improving evacuation plans, and adopting FEMA flood maps and international building codes for wind-resistance to ensure that coastal residents and businesses meet the requirements for the National Flood Insurance Program (Colten et al 2008; Louisiana Recovery Authority, 2007).

Action 4.10: Restart, retain, and expand Louisiana's cultural- and tourism-related industries

To counter the uncertainty that remains in many people's minds across the country and beyond about the status of New Orleans' recovery, and the adverse effects this may be having on the tourism-and-convention industry, fund a massive campaign to promote (and potentially re-brand) New Orleans and Louisiana. Provide and expand tax incentives to artists and cultural industries and encourage the creation of cultural districts that support the residents and firms that produce Louisiana cultural products, attract creative talent and businesses, create new jobs, and make Louisiana a national center of the film, music, digital media, literary, and visual arts industries."

—Louisiana Speaks Regional Plan, 2007



New Jersey better prepared

In contrast to New Orleans' experience with Hurricane Katrina, some coastal New Jersey business owners were better prepared to bounce back in the aftermath of 2012's Hurricane Sandy. While they still suffered losses due to business interruption and flood damage, those that already had storm emergency plans in place or had adhered to new, stricter building codes during renovations were poised for a quicker return to business-as-usual. Older structures nearby required extensive repairs and the owners lost several months of revenue.

Recognizing the collective economic value of boardwalks and the amusements, shops, and restaurants that draw tourists to the shore, many of the affected municipalities aggressively pursued federal funding to restore the boardwalks for the 2013 summer tourism season. The proactive building codes, the push to rapidly repair tourism attractions, and the innovative dune protection measures employed during boardwalk

reconstruction illustrate several ways New Jersey's coastal communities bounced back, while also enhancing resilience towards future storm events. By reflecting on the experiences of New Jersey and Louisiana's coastal communities, the value of proactive planning to reduce vulnerability and increase resilience to future hurricanes and other coastal hazards is clearly demonstrated.

Crowds inundate Rehoboth Beach, Delaware in the summer. Proactive building codes and aggressive plans to restore the Boardwalk substantially hasten recovery from storm events.

Photo: Delaware Sea Grant/
University of Delaware



LEARNING FROM OTHERS:

Resilience initiatives in action

A detailed description of the following initiatives can be found on-line at https://www.deseagrant.org/sites/default/files/product-docs/Coastal_DE_Resiliency_Cases.pdf

Below is a summary of resilience planning efforts initiated by regional, state, or local planning bodies, with an infusion of funding from state or federal agencies. The planning efforts follow similar approaches—first conducting a vulnerability assessment, and then prioritizing vulnerabilities based on climate or sea-level rise predictions, and finally identifying adaptation actions. This approach has worked well for coastal communities in the Gulf region and the regional and state initiatives described below, and could be applied to tourism resilience planning efforts for Sussex County.

Climate change and the visitor industry (Hawaii)

In 2012, Hawaii Sea Grant published a report on Climate Change and the Visitor Industry to analyze the vulnerability of Hawaii's tourism resources, provide an estimate of their economic value, and identify priority sectors for adaptation to climate change (Cristini et al., 2012). The report used a 5-step analytical approach to identify the principal drivers of climate change and link them to specific adaptation or sustainable development actions for each sector of the tourism industry. The Hawaii case study is interesting because it is one of the few reports to discuss the opportunities associated with climate change adaptation. The opportunities identified by Hawaii Sea Grant include: economic growth, educational training, and awareness, as well as environmental enhancements to natural areas and recreational resources.



Hawaii is the only state to take an in-depth look at climate impacts on the tourism industry and create a multi-step climate adaptation plan. Photo: Delaware Sea Grant/ University of Delaware

Communities take action

- ▶ Gulf region communities have identified a process of 1) conducting a vulnerability study, 2) prioritizing based on the study's results, and 3) identifying actions to take to better prepare for storms and climate change.
- ▶ Vulnerable counties in Florida joined forces to work with the Sunshine State's legislature to designate areas most susceptible to sea-level rise. This helped provide a legal basis for county planners to discourage dangerous land use plans and activities.
- ▶ In 2012 Hawaii Sea Grant published a report that linked each sector of the tourism industry with adaptation and sustainable development actions.
- ▶ Utilizing key stakeholders in a series of workshops, Lewes, Delaware adopted a Hazard Mitigation and Climate Action Plan in 2011 that addresses homebuilding, zoning and aquifer protection.

Delaware Business Resiliency Workbook

In 2016 the Delaware Small Business Development Center created a streamlined business continuity booklet for small businesses that do not have the time or resources to create an extensive plan to recover from business interruptions such as natural disasters. The simple 20-page workbook helps owners 1) identify business activities that are essential for continued operation, 2) prepare for risks, and 3) create a recovery plan. The booklet's Q&A format with easy-to-fill sections and checklists is a must-have for resilience-ready businesses. To download it, go to <http://delawaresbdc.org/special-programs/business-resiliency-initiative/>

Coastal Community Resilience Index: A community self-assessment

In 2010 Mississippi-Alabama Sea Grant developed [The Coastal Community Resilience Index](#) as a self-assessment tool for community leaders. It has been widely utilized by Gulf Coast communities. The assessment tool focuses on six categories: critical infrastructure and facilities, transportation, community plans, mitigation measures, business plans, and social systems. Further work is being done to update the index with new indicators for environmental health, natural systems, and climate change and a stronger focus on specific businesses. More at: <http://seagrants.noaa.gov/News/FeatureStories/TabId/268/ArtMid/715/ArticleID/284/www.laseagrant.org/>

Climate-ready North Carolina: Building a resilient future

With a sea-level rise about twice the global average, which is similar to Delaware's projections, scientists are predicting the loss of many of North Carolina's recreational beaches. Visitor spending by non-residents is projected to decline 16-48% between 2030 and 2080. In 2012, North Carolina's Interagency Leadership Team published a report titled, "Climate Ready North Carolina: Building a Resilient Future." The strategy provides a framework for collaborative response to climate adaptation planning and outlines options that can be taken for adaptive response.

The Southeast Florida Regional Climate Change Compact: Pioneering climate resilience through regional action

In 2009, four counties (Broward, Miami-Dade, Monroe, and Palm Beach) joined forces to develop

a Regional Climate Change Compact. One of the key efforts of the Compact was to encourage the state legislature to designate Adaptation Action Areas (AAA's), i.e. "areas deemed most vulnerable to sea-level rise and other climate change impacts" (SFRC, 2012). Using the tool, Broward County has already created Priority Planning Areas maps for sea-level rise to illustrate areas at increased risk of flooding over the next 50 years. The element also provides a legal basis for the County to discourage land-use plans that would create additional flood risk for residential and non-residential developments (SFRPC, 2013). For a review of recommended planning tools and initiatives to implement the adaptation action areas plans, see [Adaptation Action Areas: Policy Options of Adaptive Planning for Sea-Level Rise](#).

City of Lewes (Delaware) hazard mitigation and Climate Action Plan

In coastal Delaware, Lewes is the first of Sussex County's seven coastal towns to take a proactive community-wide approach towards hazards mitigation and resilience planning. The City held a series of workshops with key stakeholders and conducted a comprehensive vulnerability analysis, ultimately adopting the Hazard Mitigation and Climate Action Plan in 2011. Using GIS technology, vulnerabilities to flood exposure in the 100-year and 500-year FEMA floodplains were mapped and assessed across four categories: critical infrastructure, societal, economic, and environmental. The City selected six adaptation actions that provide forward-looking strategies for home building, zoning, and protection of the aquifer.



Using GIS capabilities Lewes, Delaware is looking at flood risk exposure and has created a plan to remain resilient. Photo: Delaware Sea Grant/University of Delaware

Assateague Island National Seashore climate change adaptation planning

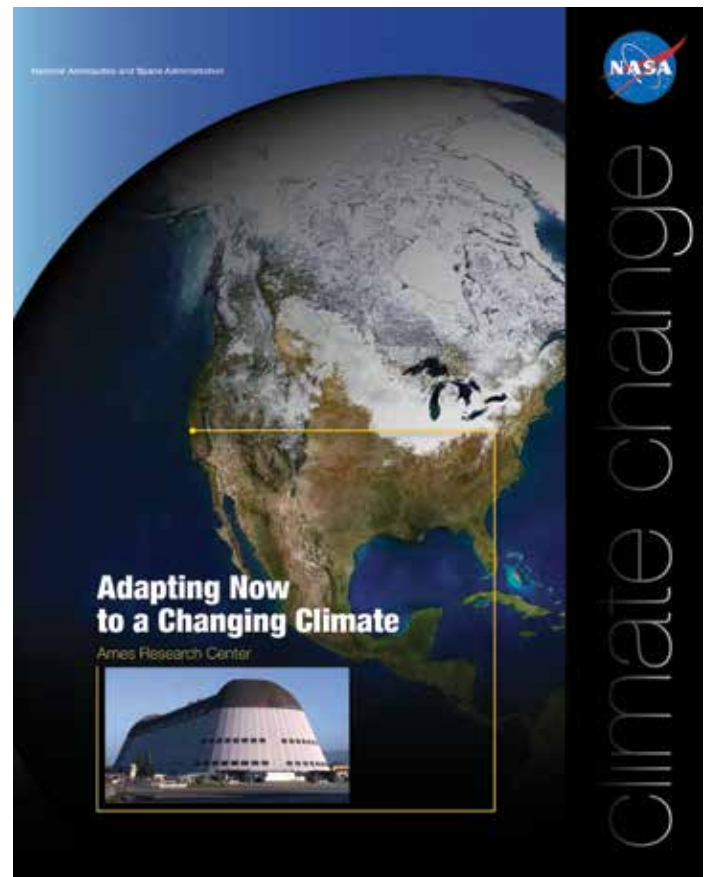
Assateague Island National Seashore (AINS) is taking a completely different approach to resilience planning. Rather than building seawalls or artificial dunes to protect the recreational assets that draw in the 2 million tourists who spend their money in nearby communities, park managers are taking a laissez-faire attitude of “minimal interference” to sea-level rise (Guo, 2014). To develop its management plan for climate change, AINS used a scenario planning process to visualize Assateague’s future, prioritize management needs, and implement adaptation measures. One of the proposed adaptive measures for adapting to island rollover and possible fragmentation is building moveable facilities for tourists and ferrying tourists to cut-off infrastructure. The AINS’s novel adaptation actions are being incorporated into the National Park Services’ coastal adaptation handbook as a model for other parks and recreation areas across the country (Guo, 2014; Zimmerman, 2010).



Assateague Island National Seashore is taking a minimal interference approach to sea-level rise and storm events. Photo: Maryland Coastal Bays Program

NASA Wallops Flight Facility

Wallops Island is home to NASA’s Wallops Flight Facility (WFF). Shoreline erosion continues to be a significant threat to WFF’s infrastructure, valued at \$1 billion in federal and state government assets. Several erosion management techniques have been tested, including wooden groins, artificial berms, and geotubes; however, none have been effective in slowing the rates of erosion. In 2012, NASA nourished the beach with 3 million cubic yards of sand and other protective measures with the intent to withstand “anything from potential sea-level rise to the proverbial 100-year storm” (Town of Chincoteague, 2012). Their plans call for biannual shoreline monitoring and adaptive management, along with periodic maintenance dredging for beach renourishment over the 50-year horizon.



NASA has taken pro-active measures at a number of its facilities nationwide to adapt and cope with climate change.

DEVELOPING STRATEGIES for resilience in Sussex County's coastal tourism sector

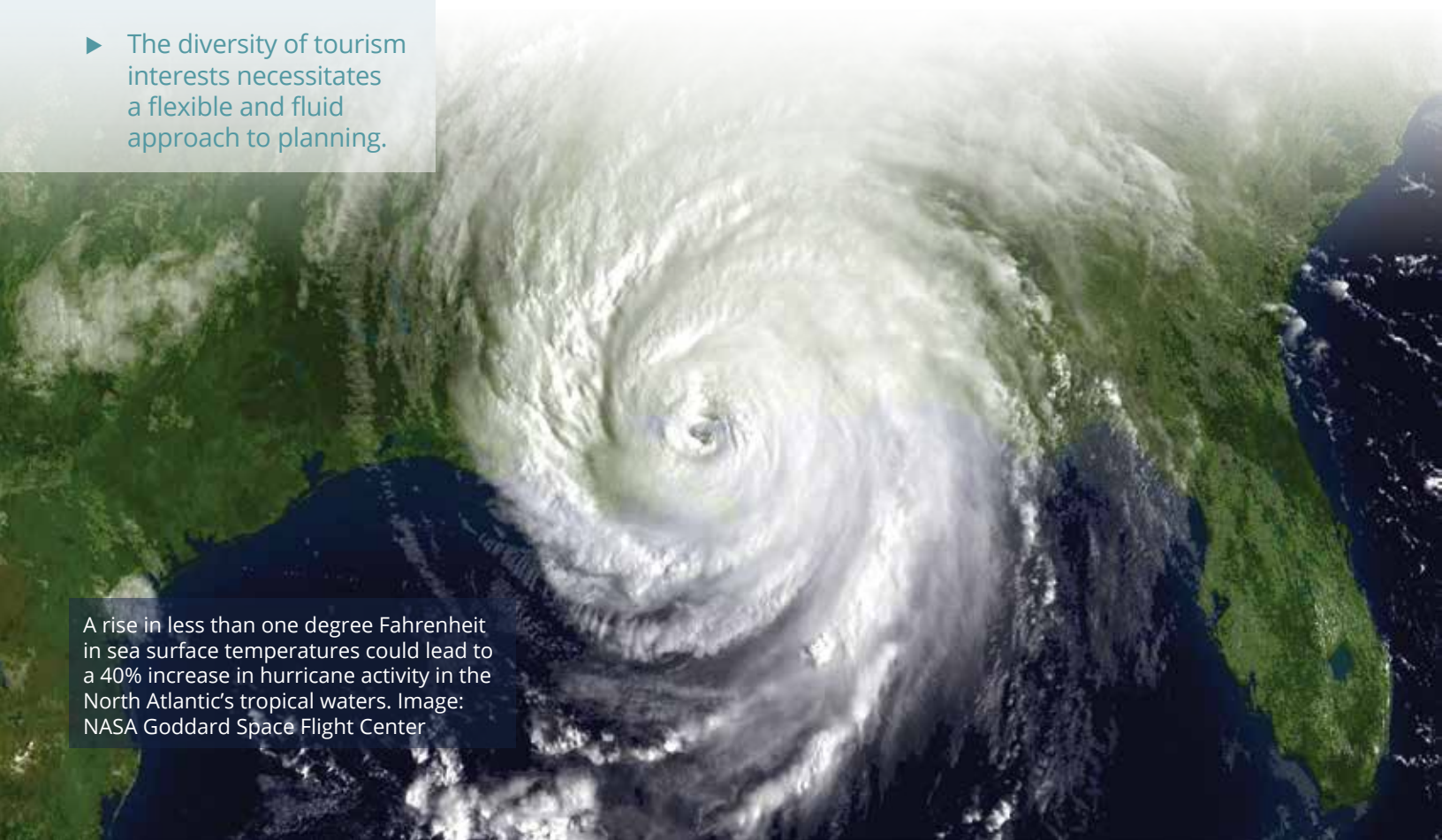
Planning needs

- ▶ The speed at which a community recovers from a storm can substantially affect its reputation as a tourist destination.
- ▶ While the state of Delaware does have a sea-level rise adaptation plan, the state does not have any such plan relating specifically to the tourism industry.
- ▶ Raising tourism operators' awareness of climate impacts is a critical need.
- ▶ The diversity of tourism interests necessitates a flexible and fluid approach to planning.

THE CURRENT STATE OF RESILIENCE PLANNING

For Sussex County's tourism-dependent communities, an extreme storm could be devastating. Not only would storm damage impact the direct tourism businesses, such as the hotels, restaurants, and boardwalk shops, but it would also cascade to the support businesses, such as the linen services, the waste haulers, and the food delivery operations. If the businesses close for an extended period of time, their employees may relocate, making it harder to return to business-as-usual. A shortfall in the hotel tax revenue would strain the state budget. As illustrated in the New Orleans and New Jersey shore examples, the speed at which a community recovers from a storm can substantially affect its reputation as a tourist destination.

Developing strategies for resilience to storms and sea-level rise is the key to reducing potential impacts to the tourism sector and the surrounding community. Instituting adaptive actions now will help Sussex County's tourism sector recover more rapidly.

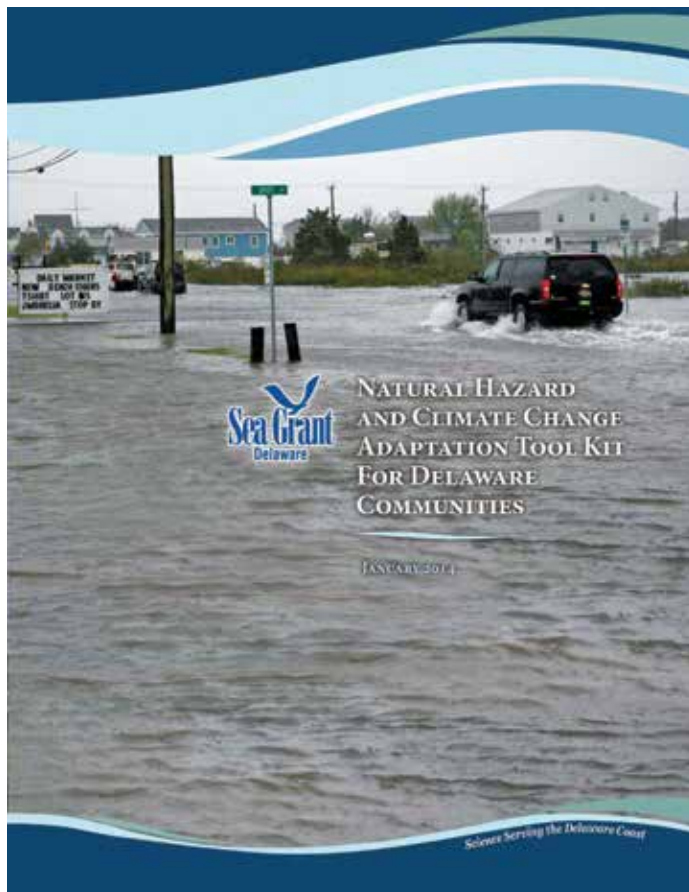


A rise in less than one degree Fahrenheit in sea surface temperatures could lead to a 40% increase in hurricane activity in the North Atlantic's tropical waters. Image: NASA Goddard Space Flight Center

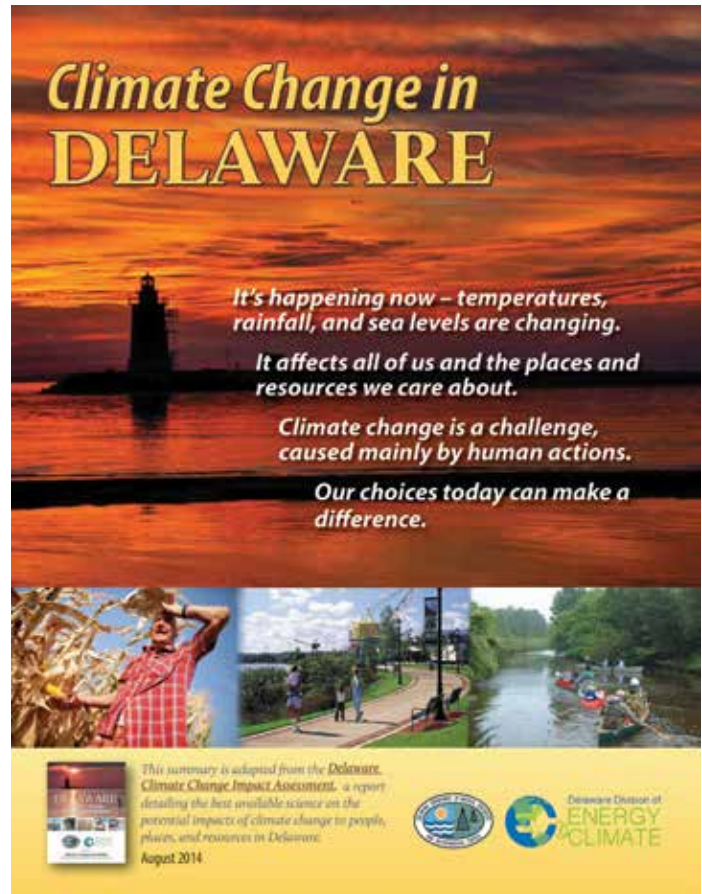
The state of planning in Delaware

Planning for sea-level rise and climate change in Delaware is in the early stages at the state, regional, and local levels. Delaware's Department of Natural Resources and Environmental Control conducted a statewide vulnerability assessment and developed an [adaptation plan in 2013](#) (Love, Arndt, and Ellwood, 2013). The plan lists 55 recommendations for building state capacity to adapt to sea-level rise and provides maps of projected sea-level rise on natural and cultural resources and public infrastructure, but it does not address local adaptation planning or plans specific to the tourism sector.

Regionally, the Center for the Inland Bays included climate change planning in its [2012 Addendum to the Comprehensive Conservation and Management Plan](#), with the primary objective of integrating projected sea-level rise into land use planning and proposed development to protect shore zone ecosystems and bay water quality (Center for



The Natural Hazard and Climate Change Adaptation Tool Kit for Delaware Communities was developed to assist communities in identifying planning, adaptation, and mitigation opportunities that will help reduce vulnerabilities to natural hazards and climate impacts.



The Delaware Department of Natural Resources and Environmental Control has a 12-page summary of the 2014 Delaware Climate Change Impact Assessment that provides a user-friendly explanation of the best available climate science and the potential impacts to people, places, and resources in Delaware.

the Inland Bays, 2012). While this plan addresses the habitats that support outdoor recreation in the Inland Bays watershed, it also is not tourism-specific. Likewise with the Delaware Climate Change Impact Assessment and summary report above, it provides good information on the science and effects of climate change, but it is light on resilience and adaptation strategies. Several communities in Delaware are beginning to look at long-term climate resilience planning, with the City of Lewes being the first community in Sussex County to develop a [Natural Hazards and Climate Adaptation Action Plan](#) (City of Lewes, 2011). Their plan assesses impacts of inundation and flooding on Lewes' water supply, homes, and infrastructure, but again does not specifically address tourism. Delaware Sea Grant has published several handbooks on natural hazards planning, including the [Natural Hazard and Climate Adaptation Tool Kit for Delaware](#)



A bad nor'easter or hurricane could close Rt. 1 near the Indian River Inlet for weeks. Tourism and emergency services should have contingency plans to fix and cope with such an eventuality. Photo: Delaware Sea Grant/University of Delaware

[Communities](#) (Delaware Sea Grant, 2014) and the [Delaware Homeowners Handbook to Prepare for Natural Hazards](#) (Delaware Sea Grant, 2012). They also recently released an [interactive web-based flood risk visualization tool](#) for 10 Sussex County communities and funded a collaborative project to improve coastal flood monitoring and share data collected on peak storm tide and high water marks via an interactive, publicly accessible website.

While the tools for resilience planning are gaining use throughout the state, the tourism sector has not been the focus of these planning and outreach efforts. Vulnerabilities for the tourism sector have not been identified; storm surge and sea-level rise maps specific to tourism-related businesses, recreational resources, and infrastructure have not been prepared; and outreach on climate change and natural hazards has not been provided to tourism operators.

The lack of planning may be due, in part, to the fact that the tourism industry in coastal Delaware does not have a strong central organizational body to spur planning and provide funding for resilience actions. It's a loosely knit group of independent business owners, supported by each town's chamber of commerce and the regional tourism offices. Sussex County's tourism assets are

diverse, ranging from nationally ranked beaches, to recreational and cultural opportunities, to restaurants, lodging, and retail establishments. As such, forming strategies to address climate and natural hazards resilience will likely not be a one-size-fits-all plan, but rather a suite of continuously evolving best practices that tourism operators, restaurant and hotel owners, and park managers can test and adapt as needed.

OBSTACLES TO OVERCOME FOR RESILIENCE PLANNING

In a review of the climate change literature related to the tourism industry, three major obstacles to resilience planning were identified.

- The first is lack of knowledge or awareness by tourism operators about regional climate change impacts. If Delaware Sea Grant can provide targeted outreach about climate change impacts to the local region, ranging from beach erosion, to flooding of business districts, to loss of vacation homes and rental income and also provide access to flood zone and sea-level rise maps that reflect the most current scientific consensus, they can help raise tourism operators' awareness about future impacts. An initial step to practicable resilience planning

is arming tourism-based businesses with the most up-to-date information on climate change and sea-level rise so they can begin to identify what impacts climate change may have on their business operations.

- The second obstacle to resilience planning is the timeframe for weather and climate change projections. How relevant is a 5-day vs. a 30-day weather forecast to a surfing instructor or for event promotion? How relevant is a 50 or 100-year sea-level rise forecast to a marina operator or vacation rental home owner? In interviews with tourism managers and participants, researchers have found that most respondents feel that marine and weather information is important to their decision-making process, but few use the information on a climatological scale (month or longer).

While sea-level rise and climate projections for a longer time horizon can help guide resilience planning for the tourism industry, the predictions need to be relevant to business operators' timeframes. The Scott and Lemieux report (2010) encourages a 25–30-year horizon as the basis for business investment and government policy. In the Natural Hazard and Climate Change Adaptation Toolkit, Delaware Sea Grant also suggests identifying actions that benefit today as well as in the future and working on actions that are stepping stones

to long-term actions to overcome concerns about planning for the future. At the same time, resilience planning must also take into account the service life of public infrastructure such as state park visitor centers, or public beach bathhouses. In an analysis of Florida's policy tools for local adaptation to sea-level rise, Lausche (2009) recommended an even longer time horizon for local comprehensive plans, based on the discrepancy between local planning guidelines, long-term sea-level rise projections, and the 50 to 100-year service life typical of public infrastructure. Planning horizons should factor in the nature of the businesses or infrastructure being addressed.

- The third obstacle is the scale for resilience planning. Do the plans address disaster events primarily, or do they take into account slower rates of change, i.e. those associated with climate change? Do they reflect the needs of the community-at-large while also acknowledging the roles of individual business owners? Lew (2014) developed a Scale, Change, Resilience Model (SCR) to address these planning challenges, noting that private entrepreneurs have a different focus in addressing resilience issues than do public interests. Working with the tourism industry to address resilience across all sectors, from private business owner to state park facilities manager or tourism marketing organization director, necessitates a flexible and fluid approach to planning.

Photo: Delaware Sea Grant/University of Delaware



LOOKING TO THE FUTURE: Recommendations for resilience planning

The businesses, local governments, and park managers that support tourism in Delaware's coastal areas must prepare in advance for the challenges associated with a changing climate to minimize the costs and uphold coastal Delaware's image as a premier tourism destination.

To help coastal Delaware's tourism industry identify vulnerabilities to natural hazards and to encourage and promote long-term resilience planning to mitigate climate change impacts, the following strategies are recommended:

- 1. Develop a Tourism Resilience Index for Sussex County's coastal tourism industry.** Delaware Sea Grant should offer a series of climate change and adaptation planning workshops to increase awareness about climate change and natural hazards, provide the most up-to-date information for long-term planning, and develop a Tourism Resilience Index for Sussex County. Components of the workshops should:



Norida floods Bethany Beach in 2009. Photo: Delaware Sea Grant/University of Delaware



- Provide outreach on climate change impacts and sea-level rise projections for our region.
 - Conduct an informal needs assessment for tourism-related businesses and climate information, i.e. information sources for extreme weather events, relevant timeframe for planning (10, 30, 50 years), etc.
 - Provide updated flood maps (500-year and 100-year flood plain) and sea-level rise projection maps highlighting areas of importance to tourism (recreational, economic, cultural etc) with input from UD Institute for Public Administration, DNREC's Sea-Level Rise Advisory Board and Flood Mitigation Program, DEMA (Delaware Emergency Management Association), and FEMA.
 - Provide computer access/training for the interactive community flood risk awareness maps developed by DE Sea Grant, USGS, and DNREC.
 - Ask tourism business owners, chambers of commerce, etc. to share existing plans for storm preparedness through a round-table format, or examples of how they responded to recent storms like Hurricane Sandy.
 - Share case studies of resilience planning efforts, i.e. Assateague Island National Seashore, Chincoteague 1-2-3 Plan, etc.
- Identify and prioritize vulnerabilities for tourism sectors using Sea Grant's Natural Hazard and Climate Change Adaptation Tool Kit for Delaware Communities, or the Tourism Resilience Index from MS-AL Sea Grant. Identify specific business owners or tourism sectors to pilot the Tourism Resilience Index.
 - Encourage each workshop participant to take away three to five adaptation actions (a combination of short and long-term) they can implement in their operations.
- 2. Address vulnerabilities for the tourism industry.** At this time, the following vulnerabilities have been identified. Additional vulnerabilities may come out of the workshops.
- A. Develop community maps for the seven coastal towns that illustrate tourism assets (businesses, natural areas/state parks, key recreational sites, emergency services, evacuation routes) overlaid with flood zones and sea-level rise projections.
 - B. Encourage small business owners to create an Emergency Response and Resilience Plan that includes an evaluation of current

storm preparedness and practicability of re-opening after a storm as well as potential strategies for long-term adaptation to climate change. As part of the plan, complete a Business Resilience Checklist. Checklist components should include:

An evaluation of current storm preparedness

- ✓ What plans do you already have in place for storm preparation? Does rental equipment or retail merchandise need to be moved? Do you have a back-up generator to keep food cold or operated sump pumps?
- ✓ What basic services do you need to operate after a storm, i.e. electricity, sanitation, clean water?
- ✓ How do you communicate with employees? Many of the boardwalk businesses hire seasonal employees from foreign countries. Some are without transportation. In the event of a storm, how do you communicate with your employees to know they are either safe or able to evacuate, or to let them know when it's safe to come back to work?

Plans to re-open after a storm

- ✓ How fast can you clean-up the damage and return to business?
- ✓ Do you have adequate personnel and contracted services to repair electrical lines, water damage, etc?
- ✓ Do you have any business interruption insurance in place if you have to close for several days due to a storm, or if it takes you several weeks to repair damage and reopen for business?
- ✓ Do businesses, destination marketing organizations, and tourism interests have a marketing communications plan to inform potential visitors that the area is safe and open for business?

Long-term resilience planning

- ✓ Based on past experiences with Hurricane Sandy, or other major storms, what steps can you take to better prepare for the next big storm?
- ✓ What is your business planning horizon (monthly, annual, multi-year) and how do climate projections impact your planning? For example, if your

ecotourism experience depends on a specific location or resource, will that resource still be accessible, or offer the same quality of experience with the environmental changes predicted?

- ✓ Are there enhanced opportunities for your business with the projected changes in climate, i.e. as land and sea temperatures warm can you market longer seasons for outdoor recreational activities?
- ✓ Can your business contribute to sustainability by conserving water, energy, or educating your customers about green actions they can take while they're visiting and dining in coastal Delaware?

C. Develop a Housing Resilience Checklist for Vacation Rentals, or Second Home Owners. Checklist components should incorporate

The Delaware Small Business Development Center has created a Delaware Business Resiliency Workbook that provides information on continuity planning and “ready kit” preparation to protect and prepare businesses for a host of potential disasters.

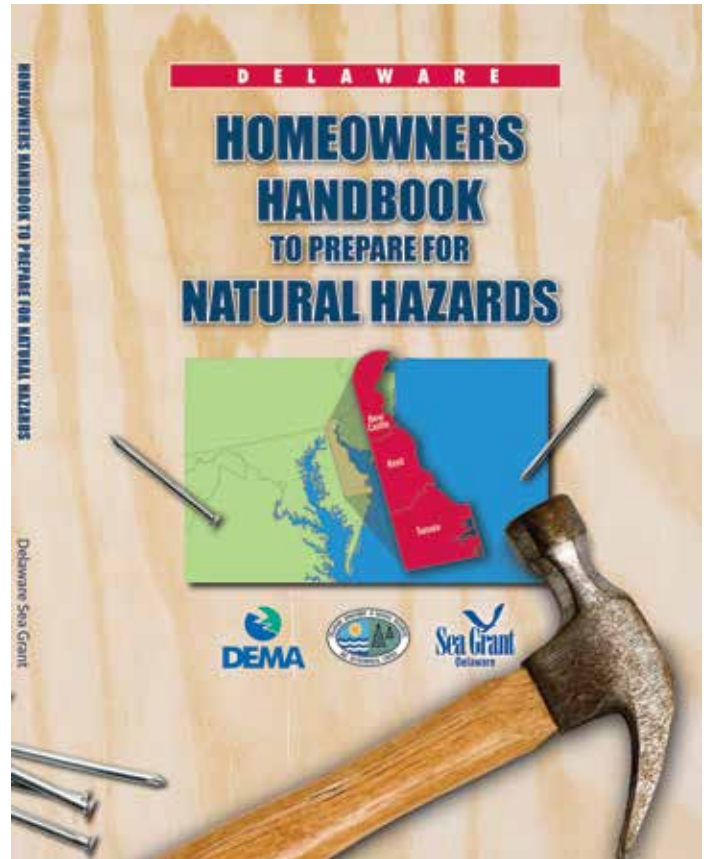
recommendations from Delaware Sea Grant Homeowner Handbook, including:

- ✓ Evacuation Route Map
- ✓ Storm preparations (hurricane shutters, sandbags, water or gas supply, back-up generator)
- ✓ County Contact List for Electricity, Water, Sewer, Emergency Services
- ✓ Contractor phone numbers for plumbing, heating and A/C, construction, mold remediation, and water damage
- ✓ Storm and flood resistant renovation guidelines (comply with County code)
- ✓ Rental income insurance information

- D. Evaluate emergency communication services for visitors to coastal Sussex County, i.e. how do we reach tourists with severe weather forecasts, evacuation information, etc?

3. Facilitate long-term resilience planning initiatives

- A. Encourage each of the seven coastal communities to identify priority areas for tourism adaptation planning, similar to SE Florida's Adaptation Action Areas. For example, an adaptation area could include the businesses (restaurants, hotels, marinas, and markets) that line Route 1 in Dewey Beach, or the stretch of Cape Henlopen Drive encompassing Lewes Public Beach, the Cape May-Lewes Ferry Terminal, and the Cape Henlopen State Park.
- B. Provide adequate funding for state park upgrades related to climate adaptation and rapid recovery.
- C. Encourage business owners or managers within priority areas to implement adaptation actions to support business and recreation opportunities.
- D. Support and highlight "climate smart" coastal tourism businesses, organizations, and/or individuals that design innovative adaptation measures or promote sustainability and reduce greenhouse gas emissions, through water and energy conservation, use of alternative energy sources, etc.
- E. Establish a county or regional program to provide incentives for businesses who implement climate-smart actions.



Delaware Sea Grant's Homeowners Handbook is an essential resource for preparing for storm events.

DELAWARE RESOURCES FOR climate change and resilience planning

Management plans

[Center for the Inland Bays Comprehensive Conservation and Management Plan](#)
[City of Lewes Hazard Mitigation and Climate Action Plan](#)

Community flood maps

[Community Flood map Visualization Project](#)
[Coastal Flood Exposure Maps](#)

Handbooks for hazard planning and business resilience

[University of Delaware Small Business Development Center Business Resiliency Initiative](#)
[Delaware Homeowners Handbook to Prepare for Natural Hazards](#)
[Natural Hazard and Climate Adaptation Tool Kit for Delaware Communities](#)

[Delaware Database for Funding Resilient Communities](#)
[Creating Flood-Ready Communities: A Guide for Delaware Local Governments](#)

Sea-level rise assessments

[Preparing for Tomorrow's High Tide: Recommendations for Adapting to Sea-Level Rise in Delaware](#)
[Sea-Level Rise Vulnerability Assessment for the State of Delaware](#)

Climate Change Impact Assessment summary

[Climate Change in Delaware](#)

Energy and climate websites

[Energy and Climate Portal](#)
[Climate Change in Delaware](#)



Photo: Delaware Sea Grant/University of Delaware



