

A Brief History of Cape Cod Landcover

Cape Cod was among the first places in America to be colonized by Europeans. All Cape towns in the early 1700s were agricultural in nature and depended on locally grown or fished food, and wood for heat and materials. They were, to all intents, self-sufficient for good or for ill, due to a combination of low population density, abundant natural resources and a prodigious work ethic.

Initially the available land provided for all. For example, the town of Falmouth's population was around 1,000 in 1765 or about 250 families, who needed food, shelter, and firewood. With each home needing 30 or more cords of wood per year for heat, we can assume Falmouth was cut by 250 acres each year to provide the needed 7,500 (250 X 30) cords of wood. Since Falmouth covers about 40 sq.miles or 25,600 acres, each year about 1% of Falmouth would be logged for wood fuel alone. And, early agriculture had a much larger land requirement: 100 acres per family, so the 250 families would need 25,000 acres, almost exactly the size of Falmouth. Therefore, in 1765, one could say things were in balance. Despite this, extensive land clearing during the 1700's led to a wood shortage and to degrading and eroding of the fertile soils by the 1800s. Thereafter, colonists had to import wood by ship and eroding soils led to widespread siltation of bays and estuaries.

“They were driven by necessity ... to diminish the value of their lands by severe tillage, breaking up a large quantity at a time, giving it little or no manure, until a soil ... became reduced to the extreme of poverty.”

Reverend Simpkins, 1806

fishermen to return to farming. Of that time the Reverend Simpkins of Brewster wrote in 1806, “They were driven by necessity ... to diminish the value of their lands by severe tillage, breaking up a large quantity at a time, giving it little or no manure, until a soil ... became reduced to the extreme of poverty.” Thus, we see the outcome of a lack of land use planning and natural resource stewarding. Cape Cod was so transformed that in the mid-1800's Thoreau described it as an “exceedingly barren and desolate country” with “hardly a tree in sight”.

By the late 1800s, increased cranberry and strawberry farming maintained a significant agricultural presence on Cape Cod, but much of the land returned to forest. The reforestation of the Cape only lasted until the beginning of the automobile era. The land cover maps here shown, covering from 1951 to 2005, display how automobiles and roads led to increased accessibility of Cape Cod, which caused rapid land development especially in the 1970s and 1980s. In many ways, population growth on Cape Cod has mirrored the expansion of the interstate highway system.

2003  
515%  
GROWTH  
1940

excessive growth. In a 2005 survey, 96% of residents said there was either enough or too much development on Cape Cod and 79% said sprawl would be a problem over the next 5 years. (Bolton, Crow & Colten, 2006)

ACKNOWLEDGEMENTS

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For questions and further information about this project please contact 508-540-9900 or Thomas Stone, Sr. Research Associate, Woods Hole Research Center at [tstone@whrc.org](mailto:tstone@whrc.org). ([www.whrc.org/mapping/capecod](http://www.whrc.org/mapping/capecod)).

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NASA International Space Station photograph from June 27, 2011.

National Oceanic & Atmospheric Administration ([www.noaa.gov](http://www.noaa.gov))

Office of Geographic Information (MassGIS), Information Technology Services Division, Commonwealth of Massachusetts ([www.mass.gov/imgis](http://www.mass.gov/imgis)).

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1765  
*A delicate balance*



Early  
1800's  
*Merino Sheep Mania*



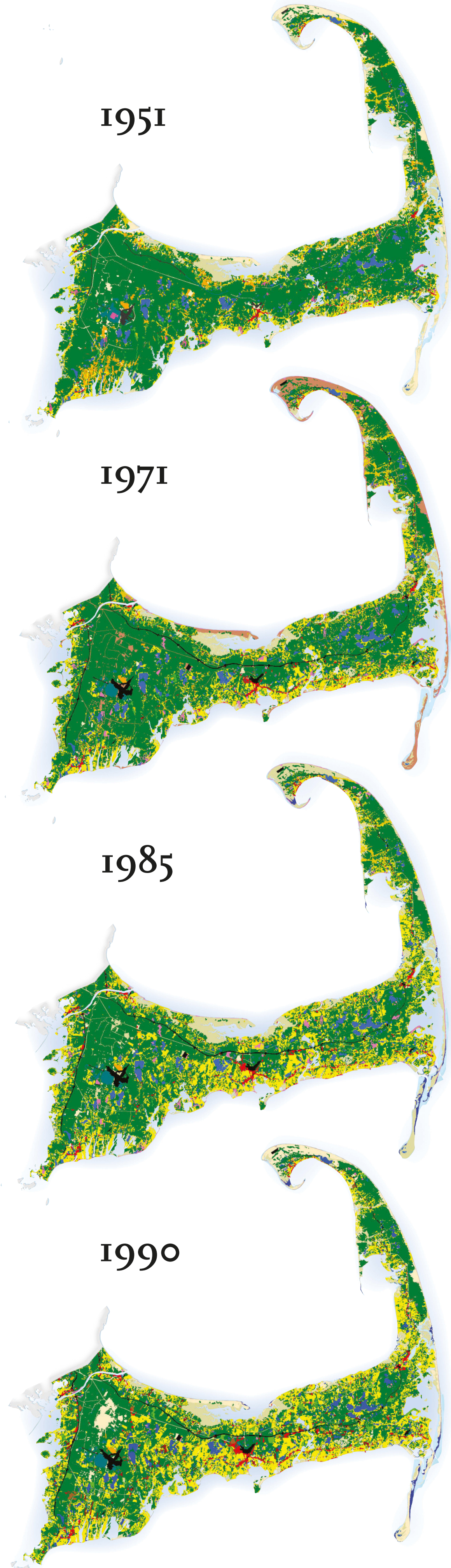
Mid  
1850's  
*Agriculture takes over*



Early  
1900's  
*A Return to Forest*



1951-  
Today  
*The Automobile Age*

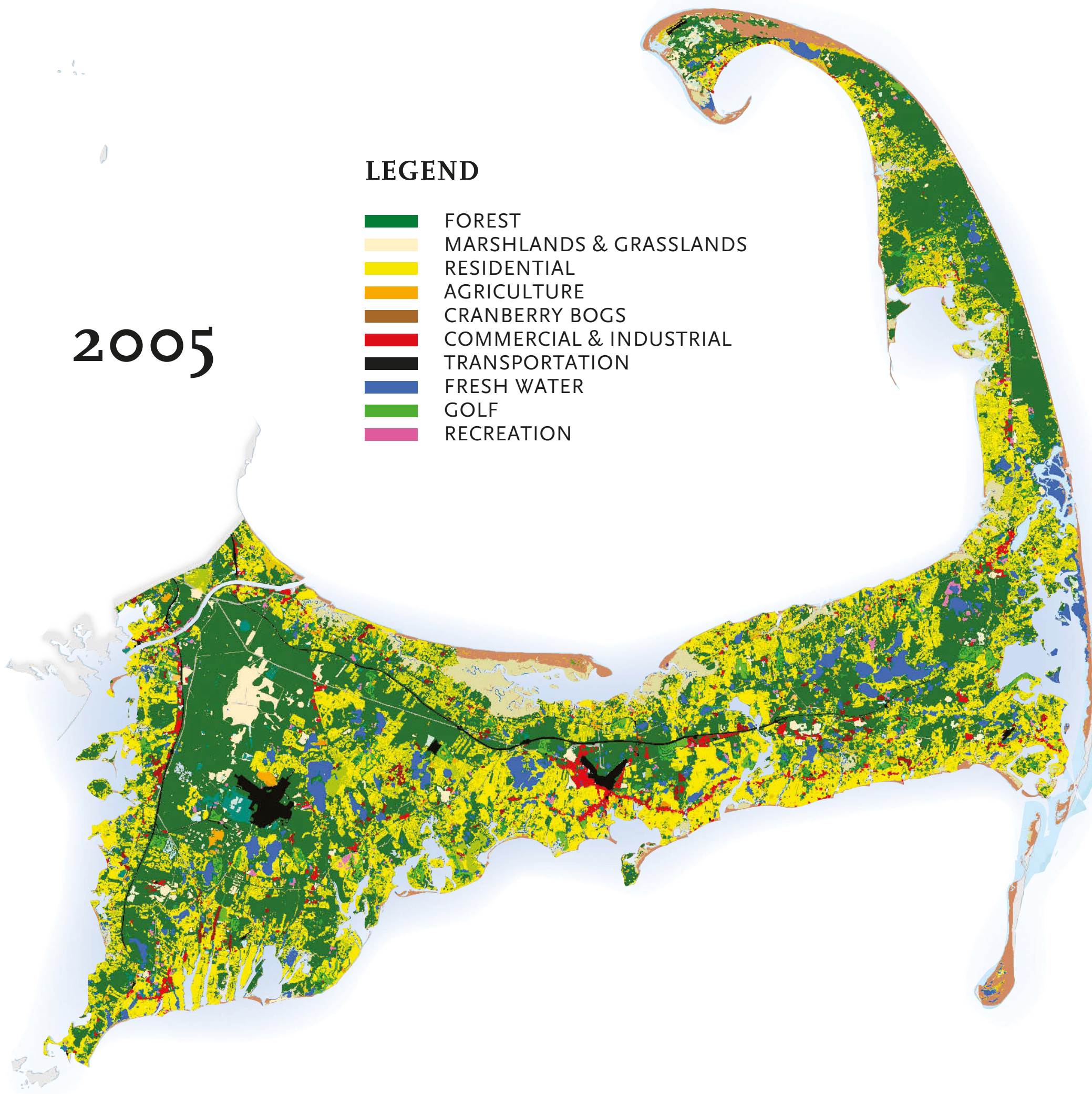


Land Use Changes Over Time

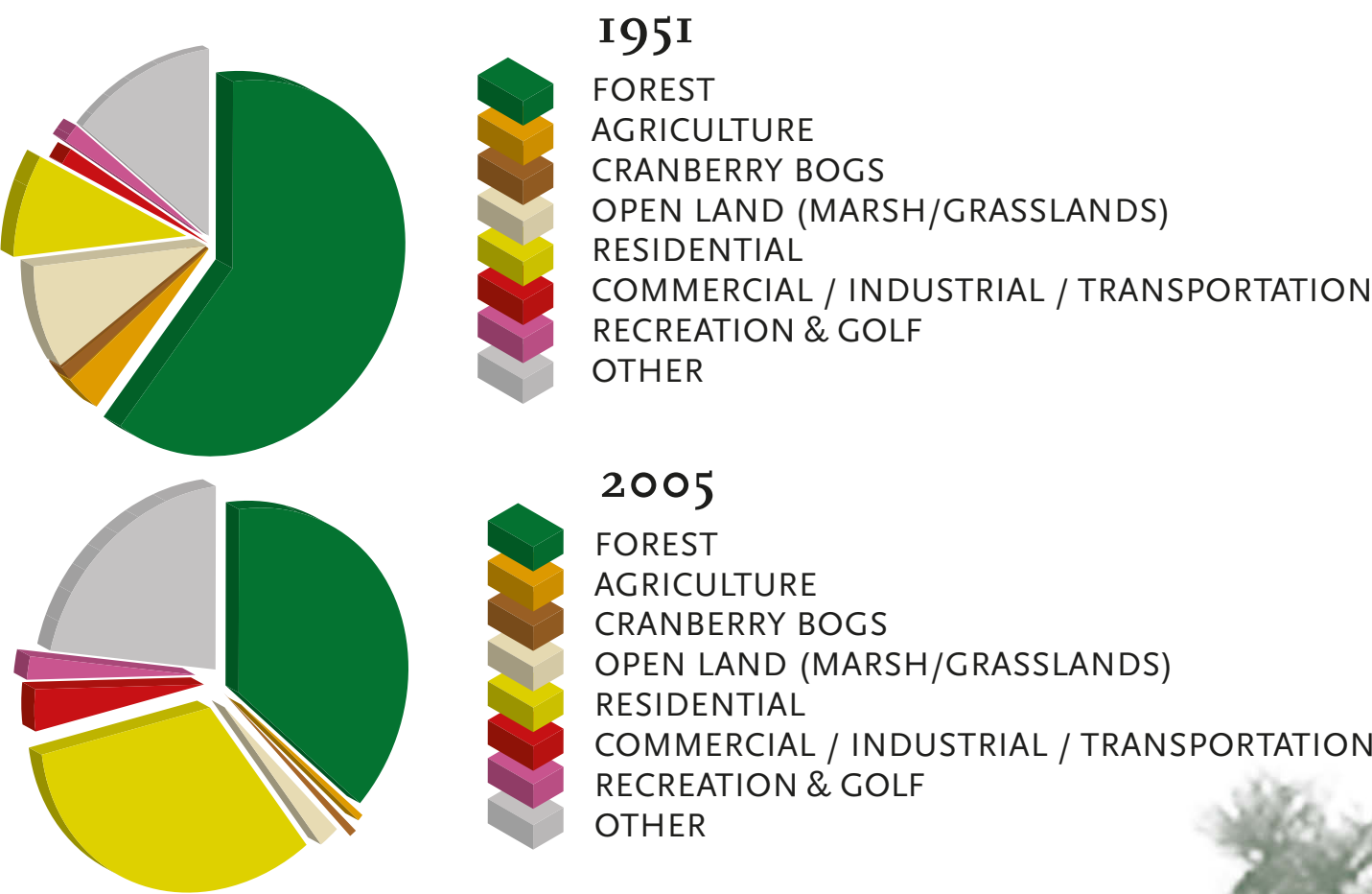
The Commonwealth of Massachusetts has had the foresight to fully and routinely map the State's land cover since 1951. Massachusetts' relatively small size and high population density makes mapping much more useful than it might be for larger, lower population states such as Maine. The Massachusetts land cover data, used here in a Geographic Information System (GIS) map, allows us to not only examine where the changes occurred but to say what types of changes have occurred.

And, this is particularly true for Cape Cod, which experienced explosive population growth from the early 1950's up until the last few years.

n.b. As the number of land cover classes defined by MASSGIS has increased over the years, it is difficult to assign a distinctive color to a class. In addition, recent methodological changes introduced by MASSGIS in their Landcover product make year to year comparisons more difficult. These values shown here should be seen as indicative and not definitive.



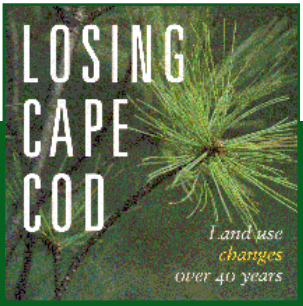
Comparing 1951 and Today



LOSING  
CAPE COD

LAND USE AND CLIMATE CHANGE OVER TIME

SAVING  
CAPE COD



This work builds off an earlier map “Losing Cape Cod” (left) that illustrated land cover changes from 1951 to 1990.

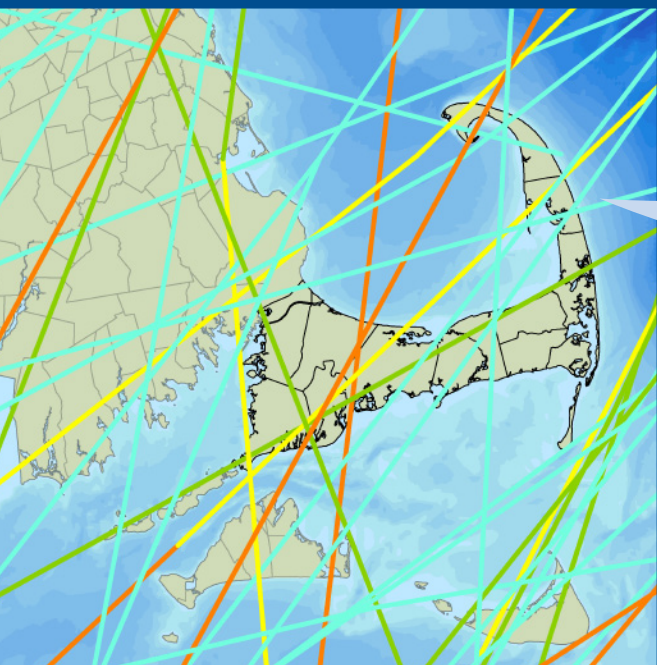


WOODS HOLE RESEARCH CENTER  
MAPPING THE WAY TO A SUSTAINABLE FUTURE

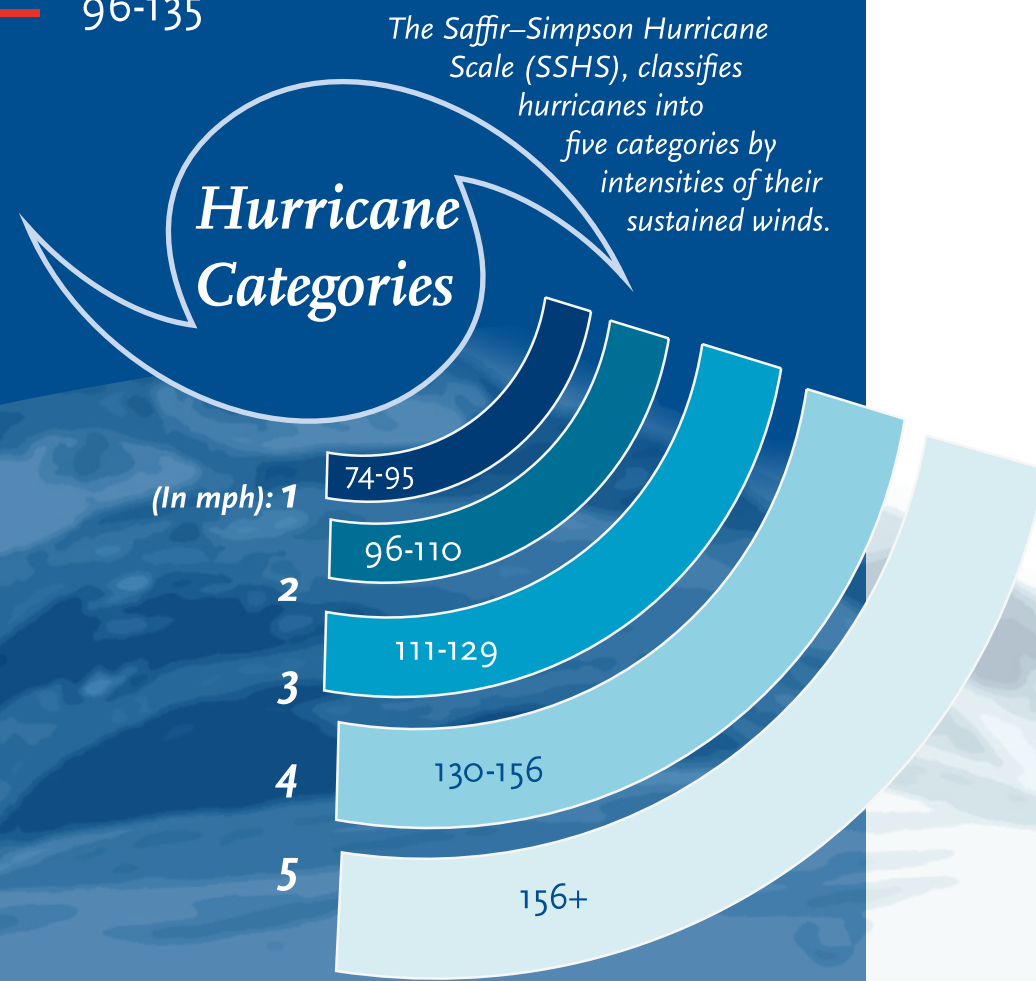


# What about Hurricanes?

The International Space Station photograph (to the right) shows Cape Cod jutting out into the Atlantic Ocean, highlighting both its attractiveness and its vulnerability to the sea. Among the several effects anticipated from climate change, sea level rise and increased storminess may have the most pronounced impact on the Cape. Sea level rise predictions vary but generally range from 8 to 16 inches by 2050 and from 20 to 79 inches (Rahmstorf 2007, Pfeffer et al. 2008) by 2100. Therefore, significant portions of the Cape will either be underwater or are much more likely to be damaged by storms, hurricanes, northeasters, and associated storm surges. The last severe storm – Hurricane Bob in August 1991 – caused an estimated **\$10 million** in property damage and was followed in October 1991 by the “Perfect Storm”. That storm caused severe coastal flooding which resulted in more that \$6 million of damages in Barnstable County alone. In 2011, Hurricane Irene did not directly hit Cape Cod but caused significant flooding. NOAA estimates that 14% of Cape Cod’s population now lives within the floodplain. Some 5% of the Cape’s critical facilities such as schools, fire stations and medical facilities and 7% of the Cape’s roads are also within the current floodplain.

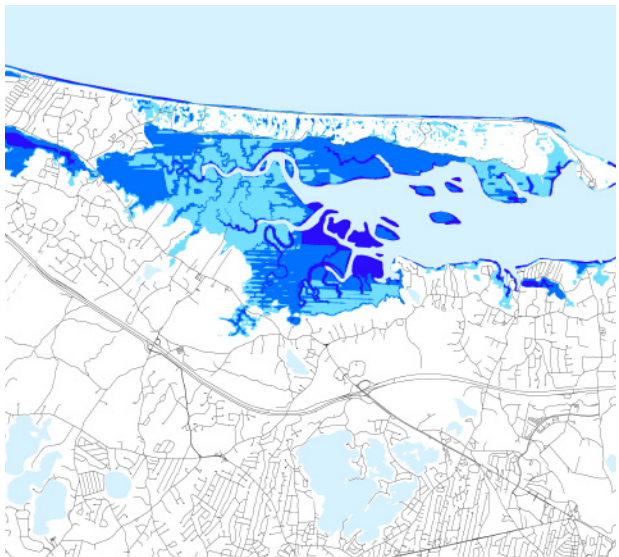


Historic regional hurricane tracks over the last 100 years (top). The recent Hurricane Irene in August 2011 over New England is seen in the NOAA satellite image (bottom).

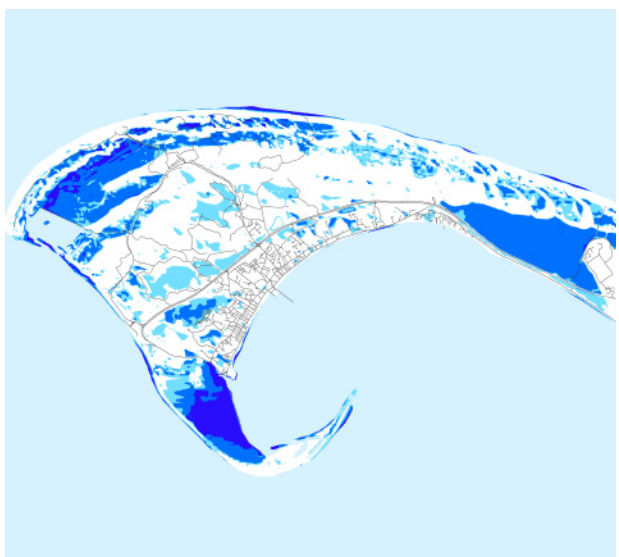


# Climate Change & Sea Level Rise

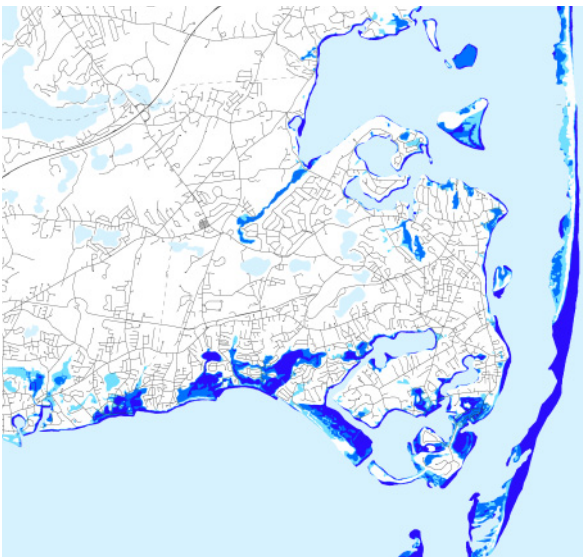
These inset maps to the right show example locations that have been magnified with the road network. The lighter blue the color, the higher the elevation. Where roads and flooding coincide is where direct damage to infrastructure and homes will be the greatest.



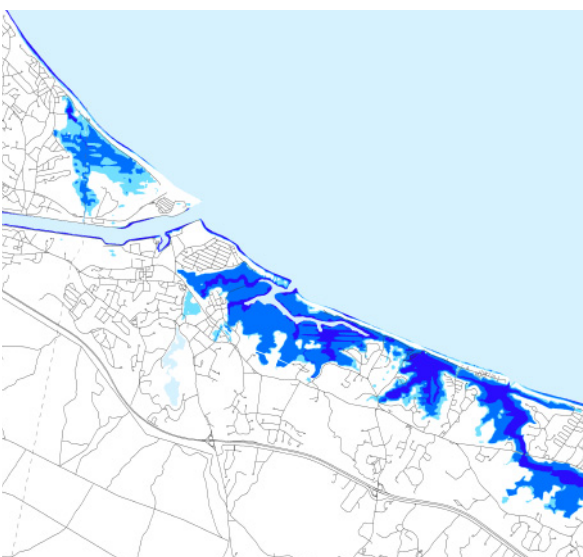
Barnstable Harbor



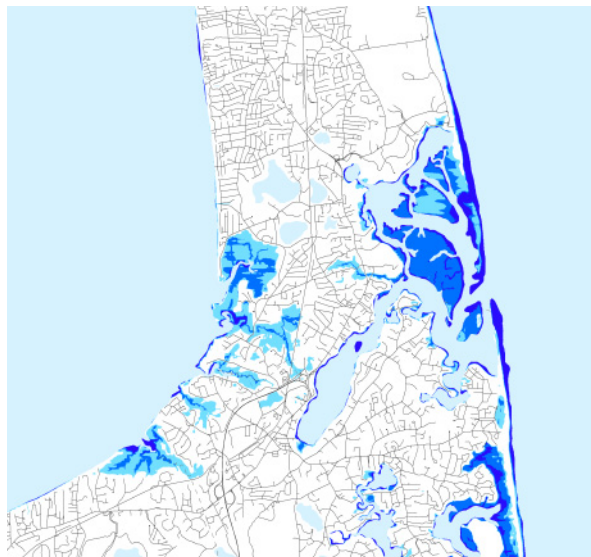
Provincetown



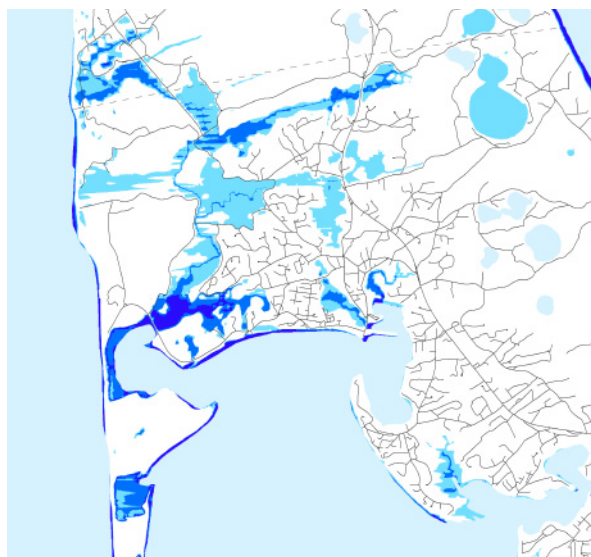
Chatham



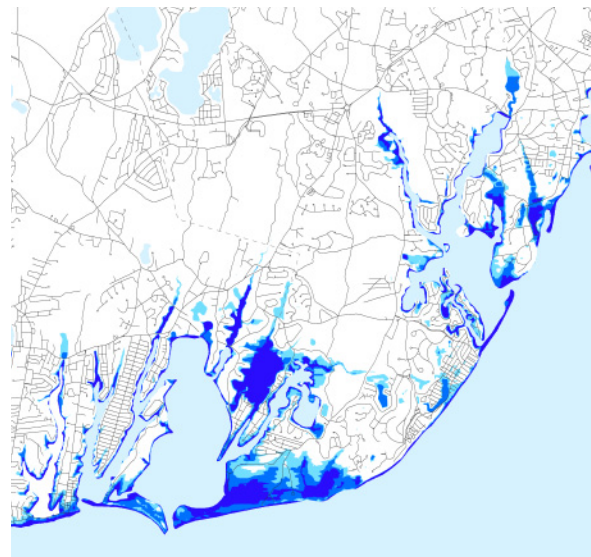
Sandwich



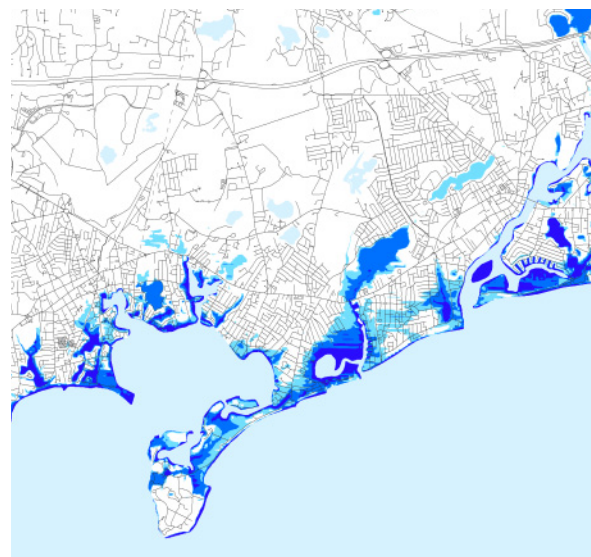
Brewster/Orleans/Eastham



Wellfleet Harbor



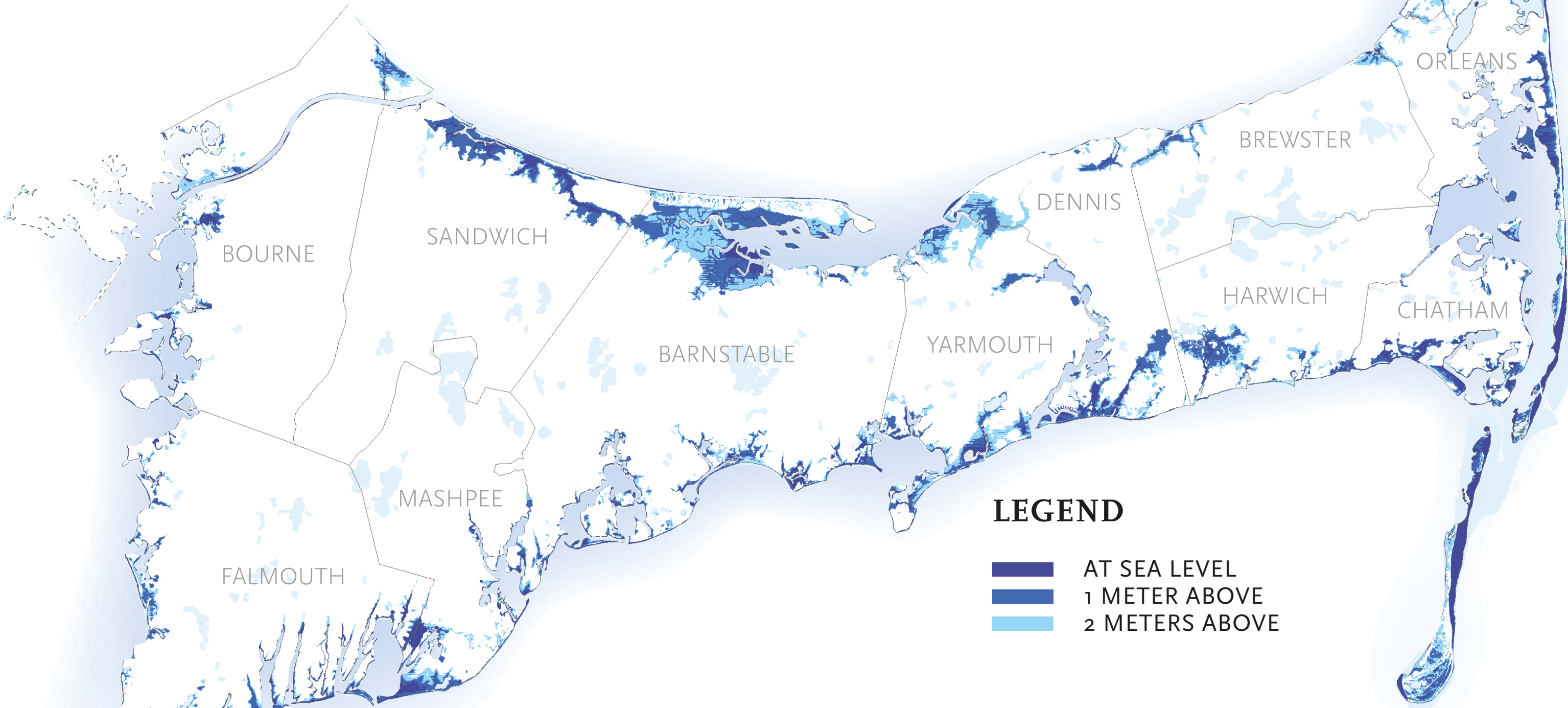
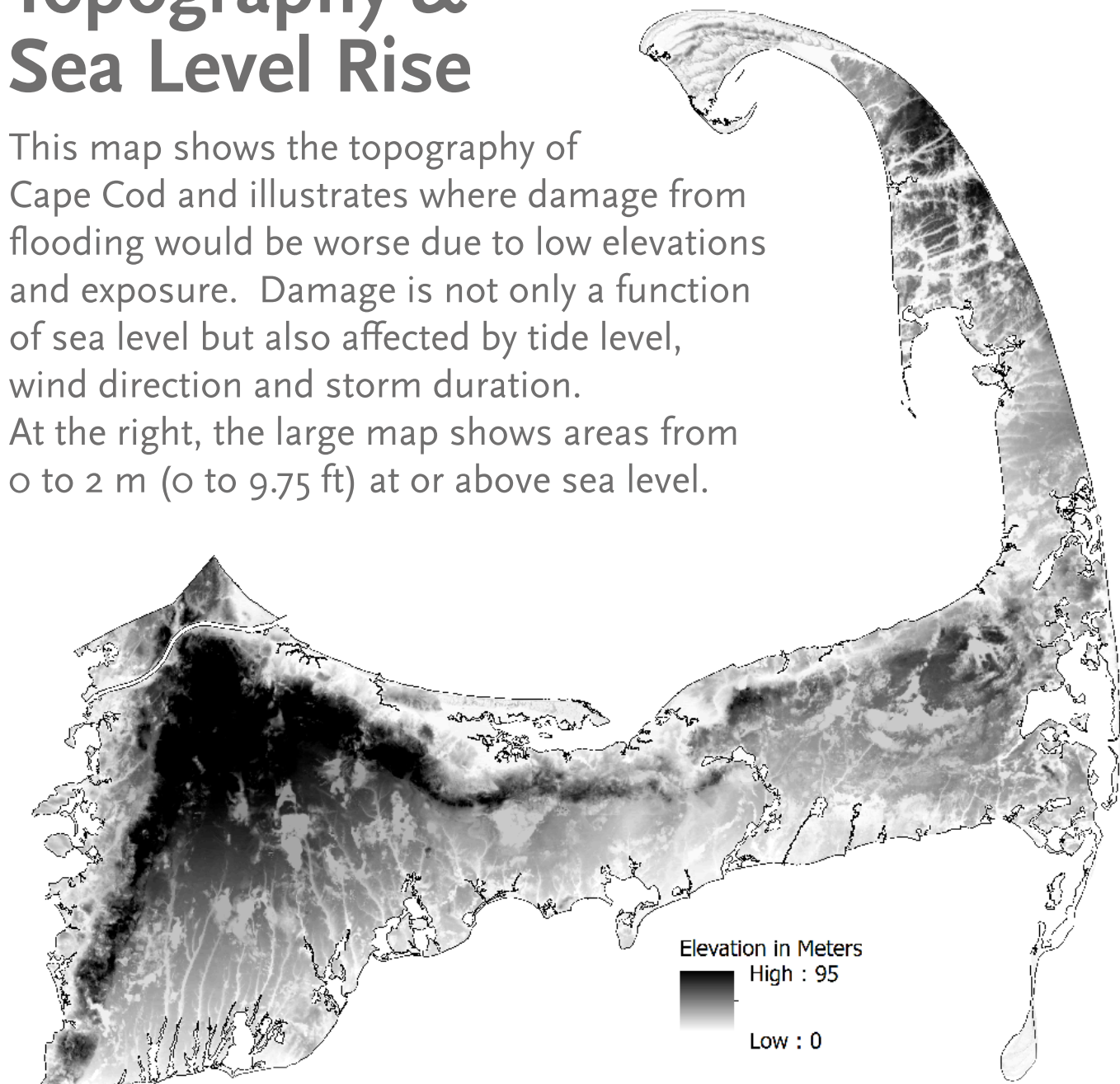
Waquoit Bay Area



Hyannis/Yarmouth

## Topography & Sea Level Rise

This map shows the topography of Cape Cod and illustrates where damage from flooding would be worse due to low elevations and exposure. Damage is not only a function of sea level but also affected by tide level, wind direction and storm duration. At the right, the large map shows areas from 0 to 2 m (0 to 9.75 ft) at or above sea level.



### LEGEND

- AT SEA LEVEL
- 1 METER ABOVE
- 2 METERS ABOVE

Through this poster the Woods Hole Research Center conveys the enormous changes in the land cover of Cape Cod over time with a particular focus on the last half-century. These direct pressures on natural landscapes are present but declining as the Cape gets “built-out”. However, new threats from climate change and sea level rise are emerging. Saving Cape Cod will require a new and intensive focus on reducing fossil fuel emissions, locally, nationally and globally while preparing our fragile coasts and communities for inevitable sea level rise and increased storminess.

## The Future of Cape Cod?

In August 2011, the effects of Hurricane Irene hit Cape Cod, flooding streets (shown here in Falmouth) and knocking down power lines. Will the future Cape Cod home need to be built on stilts like this coastal home?(right)

