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Coastal Restoration and Community Economic Development in North Carolina

Final Report

Prepared for—

North Carolina Coastal Federation
3609 N.C. 24 (Ocean)
Newport, North Carolina

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EXECUTIVE SUMMARY

Coastal restoration and economic development are closely tied together. Healthy shorelines boost industry growth, particularly in tourism and fishing, and directly create jobs through project work. Research shows that local businesses and workers are consistently sourced for products and services to complete projects, thus ensuring that the economic benefits are retained within the coastal communities. To better document how coastal restoration in North Carolina also affects community and economic development, the North Carolina Coastal Federation (Federation) contracted with RTI International to assess the links between coastal restoration and economic development, perform an economic impact analysis of related projects, review how other states benefit from coastal restoration, and identify how coastal restoration fits within the state's larger economic development strategies. Key findings include the following:

- With just over $8 million in investments that RTI International evaluated, the Federation implemented four projects that have
  - created 116 jobs,
  - generated $13.8 million in revenue to coastal county businesses, and
  - produced an added $4.1 million to coastal household earnings.
- Federation project reports demonstrate extensive engagement with area schools, community events, and large numbers of volunteers. These efforts are building civic capacity in the region's youth population and creating hands-on learning opportunities for students and the public while simultaneously improving one of North Carolina's most revered natural assets—its coastline.
- Research shows that for every $1 million invested in coastal restoration 10 to 30 jobs are created depending on the type of project implemented. In North Carolina, for the projects analyzed, about 15 jobs are created per $1 million invested.
- Economic developers may want to consider coastal restoration as part of their economic development portfolio. Coastal restoration
  - is relatively low cost but creates jobs and affects industries and households for workers in sectors such as construction, fisheries, tourism, and landscaping; and
  - offers a fresh approach for supporting small homegrown businesses, investing in rural areas, and supporting tourism and fishing industries—all of which are documented areas of importance within key state economic development strategic plans.
- Four federal agencies (U.S. Department of Agriculture, U.S. Department of Commerce, U.S. Department of Interior, and U.S. Environmental Protection Agency) routinely fund projects related to state coastal restoration and economic development. These programs offer opportunities for North Carolina to pursue this kind of work at reduced or no cost to the state.

1. INTRODUCTION

North Carolina's coast is a natural and economic asset to the state. It provides a remarkable shoreline for people to experience and a diverse fish and wildlife habitat. It also serves as the infrastructure supporting two important industries for North Carolina—fishing and hunting and tourism and recreation. The North Carolina Coastal Federation (the Federation) works to ensure the coast and shoreline are healthy and productive so that the coast can continue to maintain its status as a significant natural asset to the state.

Population growth, increased tourism and recreation, residential and commercial development, and storm water runoff are all stressors to the coastline and contribute to degrading water quality and wetlands across the United States. The Federation is dedicated to protecting and restoring North Carolina's coast so that its waters remain a productive natural economic asset.

Appreciating that coastal restoration is much more than an environmental undertaking, the Federation wanted to better understand the economic benefits of coastal restoration activities in the 20-county region of coastal North Carolina. The Federation contracted with RTI International to review some of its coastal restoration projects and their relationship to the coastal economy in North Carolina. This report presents our findings, which are based on literature reviews, economic impact analysis, and best practice research from other states. Through this research we have found that coastal restoration offers a fresh approach for community economic development. Coastal restoration projects create jobs, boost industries important to coastal North Carolina, and build civic capacity through educational outreach and volunteerism while simultaneously fostering a healthy shoreline for all North Carolinians to experience.

1.1 What is Coastal Restoration?

Coastal restoration, as examined in this report, is an effort to repair, replicate, and protect the environmental conditions of coastal waters, their shorelines, and surrounding habitats that have degraded over time. Healthy coasts provide clean water, provide productive fisheries, support fish and wildlife, and protect coastal communities from storm damage.[1] The restoration process may involve any number of activities to restore or improve an area's ability to filter water and runoff, reduce erosion, and provide a sustainable habitat for indigenous species.

[1] Restore American's Estuaries. (2011, September 14). Retrieved from http://www.estuaries.org/images/stories/rae17.pdf

Coastal restoration projects examined generally fall into one of the following categories or a combination thereof:

- oyster reef restoration and creation
- estuarine shoreline restoration, and
- freshwater and saltwater wetland restoration (see **Figure 1-1**).

Figure 1-1. Types of Coastal Restoration in North Carolina

Oyster reef creation is the placement of oyster shells or other hard substrate (such as marine limestone (marl), granite, clam shellsrock, concrete oyster domes or broken concrete) in the subtidal and intertidal system to create reefs. Examples of techniques for oyster reef restoration are distributing shells in thin layers or in mounds spread out over the estuary's bottom from a barge with high-pressure hoses or excavator. The reef material, also known as cultch, provides a place for oyster larvae to attach to and grow on and form a complex living reef. In areas with limited existing natural oyster population, created reefs may be "seeded" with oyster larvae from a hatchery attached to reef material. The restored reefs may be harvested or designated as no-take oyster sanctuaries. Linear reefs, made of loose or bagged shell, concrete oyster domes, and rock, can be constructed along estuarine shorelines to protect marsh and sea grass plantings behind the reef.[2,3]

Estuarine shoreline restoration is accomplished by placing materials or planting native vegetation in the nearshore to reduce wave energies and stabilize the shore. Methods incorporate plantings or organic materials such as sand. Some projects use a hybrid approach by combining soft and hard structural elements. This is common in projects referred to as "living shorelines." Living shorelines use ecological principles and mostly natural elements to protect the shoreline from erosion and protect marsh areas. Specific materials commonly used in the construction of living shorelines include materials such as oyster shells, native marsh grasses, sand, submerged aquatic vegetation, wood, and rock.[4] Living shoreline projects are an alternative to shoreline hardening techniques such as bulkheads, which have been shown to accelerate erosion and result in the loss of fringing marshes and the resources marshes provide.[5]

Freshwater and saltwater wetland restoration involves undoing past hydrologic modifications in coastal watersheds caused by land clearing and drainage activities. Restored water tables in headwater areas of coastal estuaries regulate the flow of runoff to protect the delicate salinity balance in coastal waters and to protect water quality from sediment, bacteria, and nutrient pollution.

[2] National Oceanic and Atmospheric Administration, National Marine Fisheries Service. (n.d.). Habitat conservation: Oyster restoration. Retrieved from http://www.habitat.noaa.gov/restoration/techniques/oysterrestoration.html

[3] The Nature Conservancy. (n.d.). Communities restoring oyster reefs. Retrieved from http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/florida/tnc-noaa-crp-ml-fact-sheet-final.pdf

[4] North Carolina Coastal Federation. (n.d.). Living shoreline. Retrieved from http://www.nccoast.org/uploads/documents/factsheets/FS_LivShorlines.pdf

[5] Currin, C. A., Chappell, W. S., & Deaton, A. (2010). Developing alternative shoreline armoring strategies: The living shoreline approach in North Carolina. In H. Shipman, M. N. Dethier, G. Gelfenbaum, K. L. Fresh, & R. S. Dinicola (Eds.), *Puget Sound shorelines and the impacts of armoring—Proceedings of a State of the Science Workshop, May 2009* (pp. 91–102). U.S. Geological Survey Scientific Investigations Report 2010-5254.

Coastal restoration activities provide a significant amount of spillover and long-term benefits to a given area. Consider oyster restoration, the practice of creating additional habitat for oysters by dumping oyster shells and cultch[6] into areas where oysters are known to live. Abundant oyster populations filter enormous quantities of water, which promotes fish habitats and health providing commercial and recreational fisherman the benefits of thriving and sustainable fishing sites. The economic development benefits from this activity are threefold:

1. Direct employment from the restoration projects
2. Employment in businesses that support coastal restoration projects and their workers, or indirect employment
3. Support to industry-related "infrastructure" that underpins the success of industries such as tourism and fishing important to North Carolina's rural economy

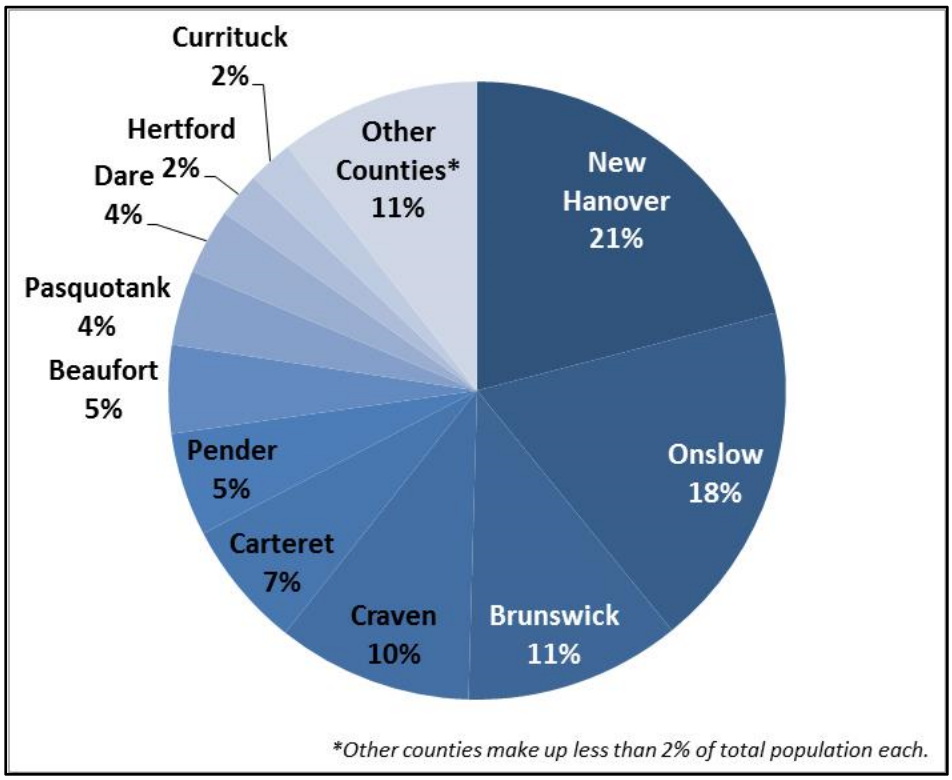
Coastal restoration projects require on-the ground work and employment of developers, engineers, contractors, heavy equipment operators, construction workers, and barge operators, depending on the project type. Beyond the creation of jobs at the project site, restoration projects also create jobs indirectly by supporting industries that supply equipment and materials for restoration such as plant nurseries and construction and engineering firms. Finally, industries important for employment and income generation—fishing and tourism and recreation—rely on coastal restoration to ensure adequate harvests and quality coastlines for sustaining and growing businesses in coastal counties. The North Carolina coast is a popular destination for vacationing, fishing, and hunting. Restoration projects support these industries by making the areas more accessible, abundant, and attractive. Finally, coastal restoration projects typically leverage a lot of federal and foundation grants with relatively small investments from the state, thus attracting investments from outside of the state that would otherwise not be circulating throughout the North Carolina economy.

1.2 Coastal North Carolina

The 20 counties that comprise coastal North Carolina have a total population of 1.02 million people, which is 10% of the population of North Carolina. Coastal North Carolina's population is concentrated in the southern coastal area in New Hanover County (Wilmington metropolitan area), Onslow County (Jacksonville metropolitan area, Camp Lejeune military base), and Brunswick County (part of Myrtle Beach-Conway, South Carolina-North Carolina metropolitan area, adjacent to Wilmington, North Carolina's metropolitan area). These three counties make up approximately half of the population of coastal North Carolina (see **Figure 1-2**).

[6] Cultch is material of rock and shells that oyster larvae attach to.

Figure 1-2. Population Distribution in Coastal North Carolina

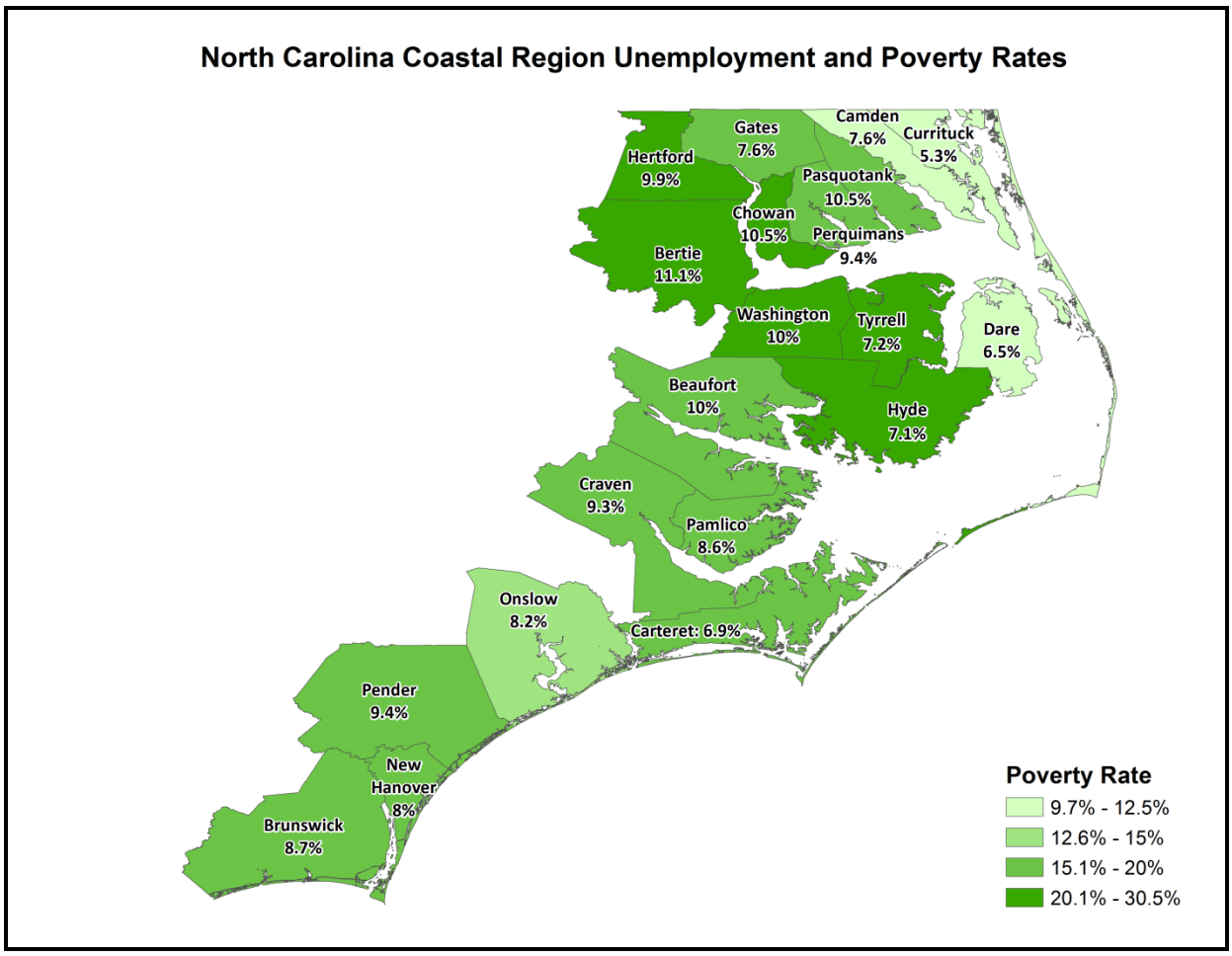


Source: U.S. Census Bureau. 2013. American Community Survey (3-year estimates). Table Number DP05. Washington, DC: U.S. Census Bureau.

Coastal North Carolina counties tend to have slightly lower levels of poverty than the state as a whole. The average poverty rate in the region is 16.7% compared with 18% statewide, showing that the coastal region as a whole is fairly similar to the state. However, there is substantial variation across coastal North Carolina. For example, Camden County has a low poverty rate at 9.7%, while Hertford County's poverty rate is 30.5%. Put differently, only 1 in 10 people in Camden County are below the poverty line, while 1 in 3 people in Hertford County are below the poverty line.

A similar narrative emerges for unemployment. The unemployment rate is a key indicator of economic vitality in a region. In coastal North Carolina, the average unemployment rate is 8.4%, slightly above the statewide unemployment rate of 8.1%. However, the unemployment rate ranges from as low as 5.3% in Currituck County to as high as 11.1% in Bertie County. Other counties with unemployment rates of 10% and higher are Chowan (10.5%), Pasquotank (10.5%), and Washington (10.0%). Counties with higher unemployment tend to have higher poverty rates on average, but there are exceptions (see **Figure 1-3**).

Figure 1-3. Unemployment and Poverty Rates in Coastal North Carolina



Sources: U.S. Census Bureau, 2012. American Community Survey (5-year estimates). Table Number B17001 Washington, DC: U.S. Census Bureau; Bureau of Labor Statistics. (2013). Local Area Unemployment Statistics. Table 3. Washington, DC: Bureau of Labor Statistics. Unemployment rates show as text within each county. Poverty rates shown by color shading according to the poverty rate legend.

Table 1-1 illustrates that while some counties have high unemployment *rates*, the number of unemployed *people* in some counties is actually quite low because their populations are much smaller compared with more urban counties. As mentioned above, Bertie County has the highest unemployment rate in the region, but that only represents 905 unemployed people. In contrast, New Hanover County has a much lower unemployment rate than Bertie County, but the number of unemployed people in New Hanover County is 8,939.

Nevertheless, the unemployment rate is widely used to compare the economic conditions of different regions and counties rather than the total number of unemployed people. The unemployment rate appears to be partially related to differences in the underlying education levels of the county's population. As **Table 1-2** demonstrates, more educated counties in

Table 1-1. Unemployed People and the Unemployment Rate in Coastal North Carolina

County	Unemployed People	Unemployment Rate
Beaufort	2,076	10.0
Bertie	905	11.1
Brunswick	4,571	8.7
Camden	348	7.6
Carteret	2,386	6.9
Chowan	599	10.5
Craven	4,008	9.3
Currituck	696	5.3
Dare	1,793	6.5
Gates	364	7.6
Hertford	964	9.9
Hyde	225	7.1
New Hanover	8,939	8.0
Onslow	5,484	8.2
Pamlico	460	8.6
Pasquotank	1,833	10.5
Pender	2,372	9.4
Perquimans	513	9.4
Tyrrell	187	7.2
Washington	682	10.0
North Carolina	382,200	8.1

Source: Bureau of Labor Statistics. (2013). Local Area Unemployment Statistics, 2013. Table 3. Washington, DC: Bureau of Labor Statistics.

coastal North Carolina have lower unemployment rates, on average, than less educated counties.

The percentage of the coastal population with a 4-year degree or higher is 16.2%, compared with 17.8% for North Carolina, but educational attainment varies greatly from county to county in the region. For example, Tyrrell County and New Hanover County lie at the opposite extremes of the educational attainment spectrum. Only 1 out of every 15

people in Tyrrell County has a 4-year degree, while in New Hanover County, 1 out of every 4 people has a 4-year degree.

Table 1-2. Educational Attainment and Unemployment

Educational Attainment Category (percentage of 25-year and older population with a bachelor's degree)	Counties	Average Unemployment Rate
Less than 10%	Bertie, Gates, Hertford, Tyrrell, Washington	9.7%
10% to 19.9%	Beaufort, Brunswick, Camden, Carteret, Chowan, Craven, Currituck, Hyde, Onslow, Pamlico, Pasquotank, Pender, Perquimans	8.6%
20% or more	Dare, New Hanover	7.7%

Sources: U.S. Census Bureau. 2012. American Community Survey (5-year estimates). Table Number S1501. Washington, DC: U.S. Census Bureau; Bureau of Labor Statistics. (2013). Local Area Unemployment Statistics, 2013. Table 3. Washington, DC: Bureau of Labor Statistics.

1.3 The Need for Coastal Restoration

Natural ecosystems are sustainable by design. They filter bacteria and pollutants, control erosion, and distribute excess rainfall quickly and efficiently. As these ecosystems get disrupted by stressors, they lose their ability to sustain themselves over time. Over the past 30 years, North Carolina's coastal population has grown exponentially and the coast continues to attract tourists.[7] New residential and commercial development has degraded the water quality in many creeks, rivers, and sounds through excess storm water runoff, which pushes unfiltered rainfall directly into creeks, sounds, and the ocean. The loss of wetlands, which is estimated at 80,000 acres per year in the United States, also contributes to disruption in the natural hydrology process. Rainfall and storm water are, therefore, left largely unfiltered and contaminate surrounding bodies of water with pollutants, bacteria, and other sediment, which eventually flow into the ocean.[8]

Much like the vegetation that filters ground water from rainfall, oysters can filter large volumes of water. A medium- to large-sized oyster can filter up to 50 gallons of water per day, and oyster reefs provide habitats for other marine life, including important commercial and recreational finfish and shellfish.[9] Oyster reefs also provide a vital link in the estuarine

[7] North Carolina Coastal Federation. (2008). *State of the coast report*. Retrieved from http://www.nccoast.org/uploads/documents/socreports/2008SOC.pdf

[8] North Carolina Coastal Federation. (n.d.). Living shorelines. Retrieved from http://www.nccoast.org/Content.aspx?Key=76664726-1d0d-4f30-a6b0-c2702bf97ee3&title=Living+Shorelines

[9] North Carolina Coastal Federation. (2002). *State of the coast report*. Retrieved from http://www.nccoast.org/uploads/documents/socreports/2002SOC.pdf

food chain, stabilize and protect shorelines and adjacent essential fish habitats, and help sequester carbon. However, oysters were overharvested in the late 1880s. Since then, oysters have been affected by disease and toxic algae, and the quality of water in many coastal regions has steadily declined, becoming more polluted and less able to sustain healthy marine life.[10] In North Carolina, oyster harvests have declined by over 90% since the start of the 20th century.[11] Water quality is not only an ecological issue, but also an economic issue: there are significant adverse impacts to local and regional economies when, for example, the habitat for a fisherman's catch is unable to sustain an abundant number of healthy fish.

Other industries also observe negative impacts from polluted waters that affect tourism, such as the potential declining aesthetic and recreational enjoyment of beaches and estuaries.

Restoration activities are needed to preserve and restore oyster reefs, wetlands, living shorelines, and other ecosystems and natural habitats and retrofit drainage systems and urban development to redirect storm water runoff.[12] Coastal restoration efforts resupply and sustain healthy quantities of oysters and facilitate the creation of oyster reefs.

1.4 The North Carolina Coastal Federation

The Federation is the state's only 501(c)(3) that focuses solely on protecting and restoring the coast through education, advocacy, and habitat preservation and restoration. Founded in 1982, the Federation aims to conserve the natural beauty and productivity of the state's coastline so that it remains a great place to live work and visit. The Federation operates three main programs: advocacy for stronger environmental standards and law enforcement, restoration and habitat protection for water quality and the environment, and education of people and community leaders on effective stewardship of the coast's natural resources.

Headquartered in Ocean, North Carolina, the Federation also has offices in Manteo and Wrightsville Beach. There are 25 staff and 1,200 volunteers who have partnered with over 150 organizations to execute the Federation's work.

1.5 Analysis Scope and Objectives

RTI is an independent nonprofit research institute that provides research, development, and technical services to governments, commercial clients, and nonprofit organizations

[10] North Carolina Coastal Federation. (2002). *State of the coast report*. Retrieved from http://www.nccoast.org/uploads/documents/socreports/2002SOC.pdf

[11] North Carolina Coastal Federation. (2002). *State of the coast report*. Retrieved from http://www.nccoast.org/uploads/documents/socreports/2002SOC.pdf

[12] North Carolina Coastal Federation. (2013, June 14). *Super-sized restoration projects begin in Hyde County*. Retrieved from http://www.nccoast.org/Article.aspx?k=cface84d-deeb-4905-93ee-5cd9bc89d88e

worldwide. Headquartered in Research Triangle Park, North Carolina, RTI's mission is to improve the human condition by turning knowledge into practice. For this report, RTI leveraged staff expertise in economic development and environmental economics to offer a fresh perspective on the role that coastal restoration plays in regional economic development.

To better understand the role that coastal restoration has on coastal North Carolina's economy, RTI conducted research and analysis to determine the impacts of coastal restoration projects on the 20 counties that comprise the coastal region in North Carolina.

To complete this work, RTI performed the following tasks:

- Conducted an extensive literature review on coastal restoration and economic development to ascertain the types of coastal restoration projects implemented and the kinds of impacts these projects tend to have on economic development.
- Completed a socioeconomic scan of the 20-county coastal North Carolina region.
- Reviewed the state's main economic development strategies for job creation.
- Examined the economic impact of four coastal restoration projects in North Carolina, including oyster restoration in the Pamlico Sound; creation of a living shoreline, oyster reef sanctuaries, and multiuse pier at Morris Landing in Onslow County; stormwater capture systems in New Hanover County; and wetland restoration at North River Farms in Carteret County.
- Deciphered examples in other states with best practice coastal restoration and economic development initiatives.

1.6 Report Organization

The report begins with a description of how coastal restoration is linked to the economy in **Section 2**. Here we use the literature to describe the kinds of economic impacts that coastal restoration projects have on a region. In **Section 3,** we describe coastal restoration and economic development projects across the United States, highlighting impacts other states have experienced and ways that states have developed programs in support of coastal restoration and economic development. **Section 4** lays out the approach for describing the community economic impacts from four coastal restoration projects, and **Sections 5** through **8** detail the community economic impacts through short summaries for each project. **Section 9** describes how coastal restoration fits within the state's main economic development strategies and the key partners for implementing related projects. We also summarize federal funding sources for coastal restoration and conclude the report in this last section.

2. THE BUSINESS OF COASTAL RESTORATION

Coastal restoration ties into the regional economy in two main ways. First, coastal restoration project design and implementation create jobs across a range of occupations. Next, these projects and initiatives support industries that are critical for the economic health of coastal North Carolina, tourism and recreation, and fishing.

To better understand how the different types of coastal restoration projects link to the economy, we show the kinds of projects that comprise coastal restoration, describe the types of work coastal restoration entails, highlight documented economic impacts, and note key occupations used to conduct the work. We summarize this information in **Table 2-1**.

Table 2-1. Types of Coastal Restoration Initiatives

Type	Description	Noted Economic Impacts	Key Occupations
Shellfish (oysters and clams)[a]	Reef restoration and sanctuary creation	Total jobs created per million dollars spent on a reef project range from 16.6[13,14] to 25.33[15]	Barge operators and loading crews; fishermen; scientists, technicians, biologists, project managers, administrative positions, monitoring, community outreach, restaurant/food services, and construction[16,17]
Wetlands	Increasing wetland quality and area ranging from small-scale projects to entire coastlines	Jobs created per million invested in projects range from 10.4[18] to 29.54.[19] Positive impacts on shellfish populations that rely on clean waters[20]	Construction, engineering, natural resource sciences, maintenance and repair, education, finance, leisure and hospitality, public administration, and transportation trade and utilities[21,22,23]

(continued)

[13] Edwards, P. E. T., Sutton-Grier, A. E., & Coyle, G. E. (2013). Investing in nature: Restoring coastal habitat blue infrastructure and green job creation. *Marine Policy*, *38*, 65–71.
[14] Conathan, M., Buchanan, J, & Polefka, S. (2014). *Economic case for restoring coastal ecosystems*. Washington, DC: Center for American Progress, OXFAM America.
[15] The Nature Conservancy and OXFAM America. (2012, November). *Rebuilding our Economy, Restoring our Environment*. Metairie, LA. Retrieved from http://www.nature.org/ourinitiatives/regions/northamerica/areas/gulfofmexico/rebuilding-our-economy-restoring-our-environment.pdf
[16] Conathan, M., Buchanan, J, & Polefka, S. (2014). *Economic case for restoring coastal ecosystems*. Washington, DC: Center for American Progress, OXFAM America.
[17] Kroeger, T. (2012). *Dollars and sense: Economic benefits and impacts from two oyster reef restoration projects in the Northern Gulf of Mexico*. Arlington, VA: The Nature Conservancy.
[18] Division of Ecological Restoration, Massachusetts Department of Fish & Game. (2012). *The economic impacts of ecological restoration in Massachusetts*. Boston, MA.
[19] Mather Economics. (2012). *Job creation from Gulf Coast wetlands restoration*. Roswell, GA: Mather Economics.
[20] NC Coastal Federation. *Jones Island.* Newport, NC. Retrieved from http://nccoast.org/uploads/documents/factsheets/FS_JonesIsland.pdf
[21] Kellon, C. P., & Hesselgrave, T. (2014). Oregon's restoration economy: How investing in natural assets benefits communities and the regional economy. *Surveys and Perspectives Integrating Environment and Society*.
[22] Division of Ecological Restoration, Massachusetts Department of Fish & Game. (2012). *The economic impacts of ecological restoration in Massachusetts.* Boston, MA.
[23] Mather Economics. (2012). *Job creation from Gulf Coast wetlands restoration*. Roswell, GA: Mather Economics.

Table 2-1. Types of Coastal Restoration Initiatives (continued)

Type	Description	Noted Economic Impacts	Key Occupations
Coastal water quality	Many strategies, including restoring wetlands, riparian zones, and areas around rivers and streams	Generates 23.1[24,25] to 28.8[26] jobs per million dollars spent on the restoration project. Groundwater purification can have a benefit cost ratio of 4.04.[27]	In addition to occupations in shellfish restoration and wetlands projects, site surveyors, archeological consultants, graphic designers, nursery workers, and environmental consultants[28,29,30]
Living shorelines	Reducing erosion by combining aspects of wetland and shellfish restoration—a technique replacing the use of bulkheads and jetties	Creates 19 jobs per million dollars invested[31,32]	Engineering and ecological planning, construction workers (including foremen, surveyors and survey assistants, heavy equipment operators, laborers, dump truck drivers), nursery workers, and project managers.[33,34]

[a] Costs for this oyster restoration are $52,000 to $260,000 per hectare.[35]

2.1 Direct Links to Job Creation

As Table 2-1 indicates, job creation is a function of coastal restoration projects. Similar to construction or other infrastructure-related work, the jobs created cross several kinds of occupations and provide work opportunities to individuals who may be in between other project work. Added benefits of employment through coastal restoration includes the fact

[24] Kellon, C. P., & Hesselgrave, T. (2014). Oregon's restoration economy: How investing in natural assets benefits communities and the regional economy. *SAPI EN. S. Surveys and Perspectives Integrating Environment and Society.*

[25] Nielsen-Pincus, M., & Moseley, C. (2013). The economic and employment impacts of forest and watershed restoration. *Restoration Ecology*, *21*(2), 207–214.

[26] Nielsen-Pincus, M., & Moseley, C. (2009). Briefing Paper #13: A preliminary estimate of economic impact and job creation from the Oregon Watershed Enhancement Board's restoration investment. Eugene, OR: Ecosystem Workforce Program, University of Oregon.

[27] McCormick, B., Clement, R., Fischer, D., Lindsay, M., & Watson, R. (2010). *Measuring the economic benefits of America's Everglades restoration: An economic evaluation of ecosystem services affiliated with the world's largest ecosystem restoration project*. Roswell, GA: Mather Economics.

[28] Kellon, C. P., & Hesselgrave, T. (2014). Oregon's restoration economy: How investing in natural assets benefits communities and the regional economy. *SAPI EN. S. Surveys and Perspectives Integrating Environment and Society*.

[29] Conathan, M., Buchanan, J, & Polefka, S. (2014). *Economic case for restoring coastal ecosystems*. Washington, DC: Center for American Progress, OXFAM America.

[30] Edwards, P. E. T., Sutton-Grier, A. E., & Coyle, G. E. (2013). Investing in nature: Restoring coastal habitat blue infrastructure and green job creation. *Marine Policy*, *38*, 65–71.

[31] Conathan, M., Buchanan, J, & Polefka, S. (2014). *Economic case for restoring coastal ecosystems*. Washington, DC: Center for American Progress, OXFAM America.

[32] Edwards, P. E. T., Sutton-Grier, A. E., & Coyle, G. E. (2013). Investing in nature: Restoring coastal habitat blue infrastructure and green job creation. *Marine Policy*, *38*, 65–71.

[33] Conathan, M., Buchanan, J, & Polefka, S. (2014). *Economic case for restoring coastal ecosystems*. Washington, DC: Center for American Progress, OXFAM America.

[34] Edwards, P. E. T., Sutton-Grier, A. E., & Coyle, G. E. (2013). Investing in nature: Restoring coastal habitat blue infrastructure and green job creation. *Marine Policy*, *38*, 65–71.

[35] Atkinson, D. (2012). Ecological and societal benefits derived from coastal restoration in southern Louisiana. Thesis for Master of Science in Environmental Studies, College of Charleston.

that many of these noted occupations are within industries and regions where employment tends to fluctuate highly based on the time of year or season (e.g., employment in tourism-related businesses is higher in the summer than the winter) and within sectors that are highly dependent on larger economic trends (e.g., construction). Thus, jobs provided by coastal restoration projects help stabilize employment throughout the year for workers in sectors such as construction, heavy equipment operators, and restaurants. Job creation figures range from 19 jobs to 30 jobs created per $1 million invested.

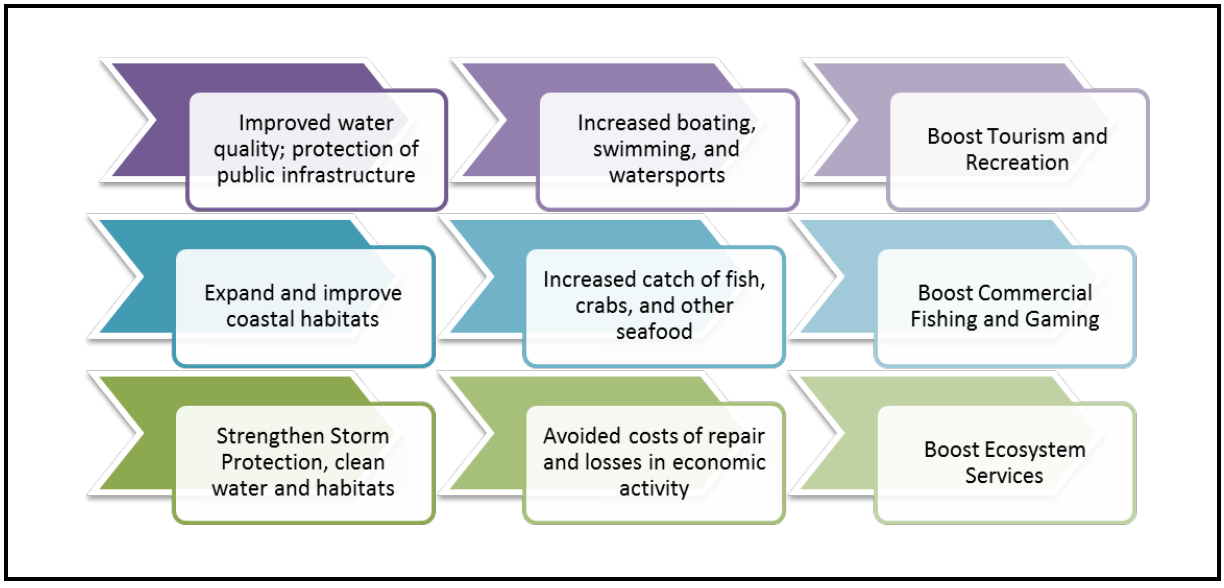
2.2 Indirect Links to Broader Industry Growth

Job creation, though, does not capture the main economic benefits of coastal restoration. Research shows that direct and indirect impacts of coastal restoration are wide-ranging, but overall coastal restoration improves business for three industries:

1. tourism and recreation
2. fishing and gaming
3. ecosystem services

We summarize the relationship between coastal restoration and these industries in **Figure 2-1** and document the benefits in detail based on the peer-reviewed literature by industry below.

Figure 2-1. Relationship Between Industry and Coastal Restoration

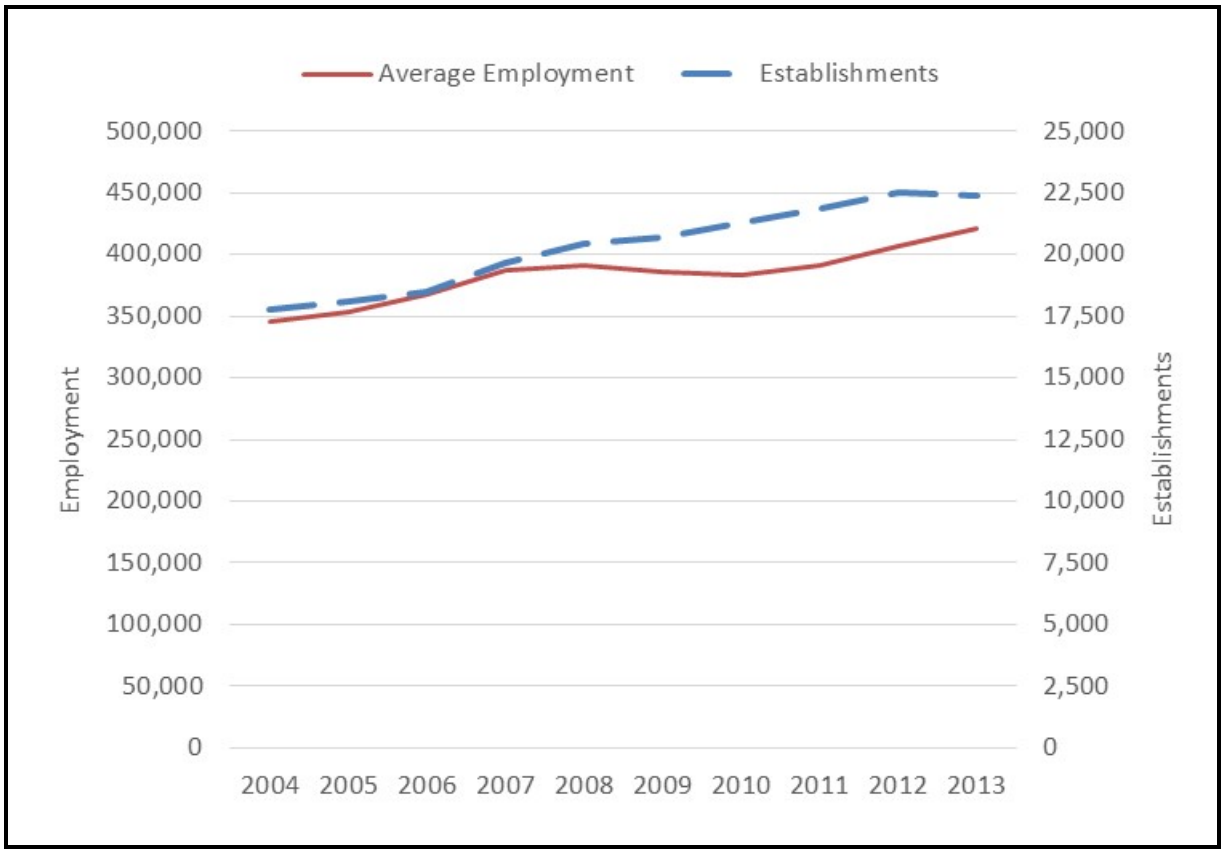


2.2.1 Tourism and Recreation

Tourism and Recreation in Coastal North Carolina

Figure 2-2 depicts employment and establishment growth in tourism since 2004 for North Carolina. For the purposes of this report, we have defined tourism and recreation using multiple industries, while noting that this is a proxy for true tourism and recreation trends.[36,37,38]

Figure 2-2. North Carolina Tourism and Recreation Trends



Source: North Carolina Commerce Quarterly Census of Employment and Wages, 2004-2013. D4 System. Raleigh, NC: North Carolina Commerce. Retrieved from http://esesc23.esc.state.nc.us/d4/QCEWSelection.aspx

[36] Tourism cuts across many industry sectors that are used in standard data sources such as hotels, restaurants, and entertainment and most of which serve both local residents and visitors; as a result, it is somewhat more difficult to analyze with standard employment data sources.

[37] Specifically, we combined three industry codes: NAICS 72 Accommodation and Food Services; NAICS 712 Museums, Parks and Historical Sites; and NAICS 713 Amusement, Gambling & Recreation.

[38] County-level data for this sector was often suppressed making it difficult to analyze this industry in a meaningful way for the 20-county coastal region.

Employment increased from 346,000 in 2004 to 421,000 in 2013, with growth occurring before and after the 2007–2009 recession. The number of establishments has also grown at a similar pace. Over 22,000 establishments are involved in these industries.

To underscore the role of tourism in coastal North Carolina, we looked to the U.S. Travel Association's Travel Economic Impact Model[39] (which uses a more comprehensive definition of tourism and recreation and a model to estimate spending at the county level). It estimates that coastal North Carolina had $3.0 billion in travel-related sales in 2013.

How Coastal Restoration Benefits the Industry

Research shows that coastal restoration benefits boating, swimming, and watersports and can increase tourism and park visitation revenues from improved water quality and natural aesthetics. For example, the restoration of the Everglades in Florida through the Comprehensive Everglades Restoration Project is expected to generate an estimated increase in park visitation and tourism, which is equivalent to an increase in expenditures of $2.1 billion over the next 50 years.[40] Increases in park visitation ripple through the state economy to benefit other industry sectors. In this instance, the hotel and lodging, eating and drinking, transportation, retail trade, and entertainment industries are expected to be recipients of a portion of the increased expenditures.[41] In another example, the U.S. Army Corps of Engineers found that an improvement of 20% in water quality in the Chesapeake Bay for oyster reef restoration would generate an estimated increase of $8 million in recreational boating.[42] Thus, the heathier the shoreline is in North Carolina, the more likely there will be positive impacts to the tourism and recreation industry in the state.

2.2.2 Fishing and Related Coastal Industries

Employment and establishment trends in fishing and related coastal industries are described in **Figure 2-3**.[43] This group of industries is composed of commercial activities in fishing and gaming, animal aquaculture, and seafood processing. Deciphering employment in this industry is difficult because of the large number of small businesses that comprise this sector and the likely informal working agreements with employees. Thus, the data presented here are likely underreported.

[39] TIEM Methodology. (2011). NC Department of Commerce. Retrieved from http://www.nccommerce.com/Portals/8/Documents/Research/EconomicImpact/TEIM/TEIM_Methodology.pdf

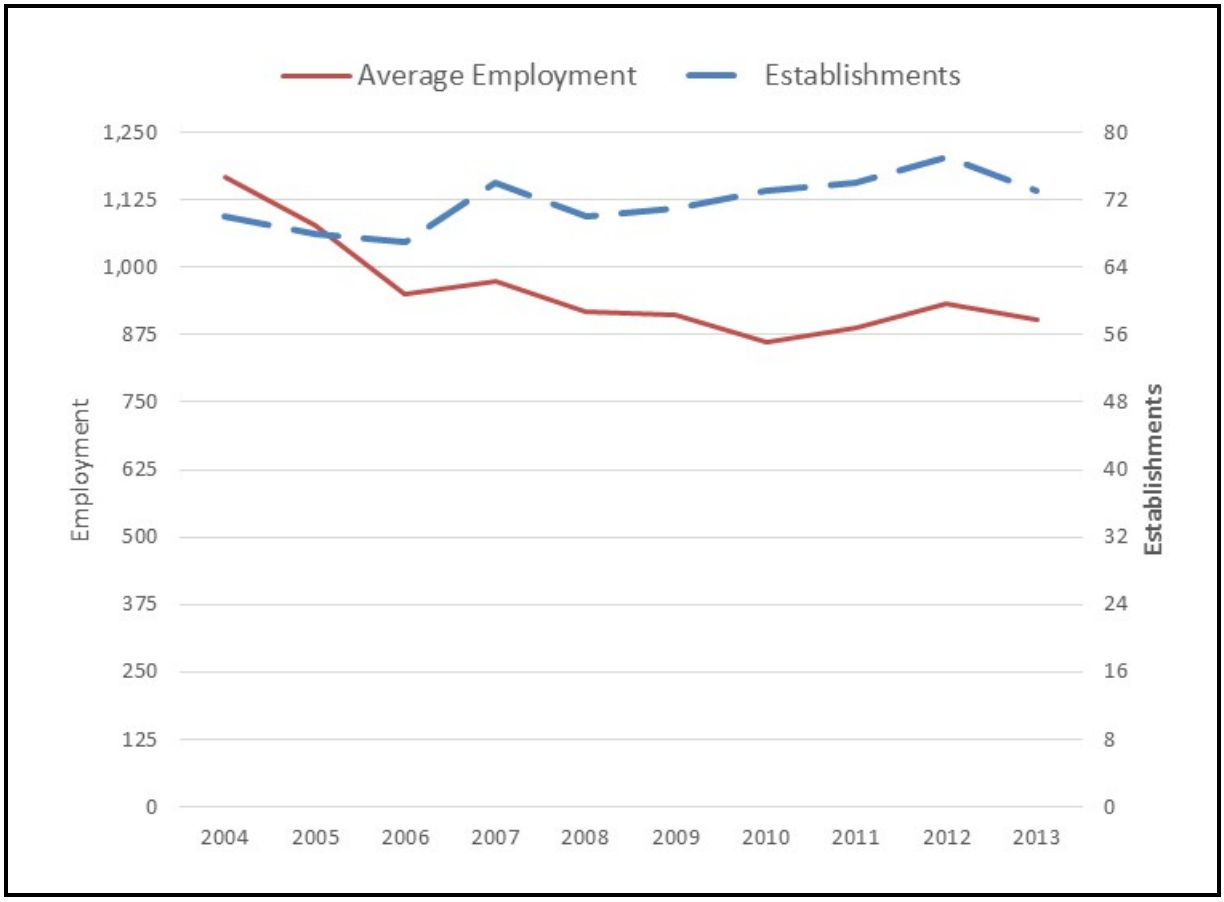
[40] McCormick, B., Clement, R., Fischer, D., Lindsay, M., & Watson, R. (2010). *Measuring the economic benefits of America's Everglades restoration: An economic evaluation of ecosystem services affiliated with the world's largest ecosystem restoration project*. Roswell, GA: Mather Economics.

[41] Ibid

[42] Henderson, J., & O'Neil, J. (2003). *Economic values associated with construction of oyster reefs by the Corps of Engineers* (No. ERDC-TN-EMRRP-ER-01).

[43] NAICS code 114 was used for this analysis.

Figure 2-3. North Carolina Fishing and Related Coastal Industries[44]



Source: North Carolina Commerce. Quarterly Census of Employment and Wages, 2004-2013. D4 System. Raleigh, NC: North Carolina Commerce. Retrieved from http://esesc23.esc.state.nc.us/d4/QCEWSelection.aspx

According to the Bureau of Labor Statistics, statewide employment in this industry has declined somewhat since 2004, falling from 1,167 jobs to 902 jobs. The largest individual industry within fishing and related coastal industries is seafood processing (651 jobs) followed by animal aquaculture (217) and fishing and gaming (34 jobs). The industry includes about 73 establishments, which is a slight increase since 2004. It is important to note that these data capture only recorded employment figures from commercial establishments.

[44] "Fishing and Related Coastal Industries" is defined as the total of three industries: NAICS 114 Fishing, Hunting and Trapping; NAICS 1125 Animal Aquaculture; and NAICS 3117 Seafood Product Preparation & Packaging.

To get a stronger sense about business operations in the industry, we also looked at North Carolina Aquaculture Update 2013[45] (presented at the 2014 North Carolina Aquaculture Development Conference). The North Carolina aquaculture industry accounts for $58 million in revenue from production and processing. This includes both freshwater activities and some marine activities. Processing facilities alone generate a total of $18 million in revenue. Most fish farms are small operations with a handful of employees, while processing facilities are much larger operations. For example, Carolina Classics in Ayden, North Carolina, employs over 100 people. There are also 342 active licensed freshwater fish farms in the state and over 170 shellfish leases and 268 active crab permit holders in the state. Revenue from shellfish leases and crab permit holders accounts for $4 million.

It is interesting to note that Virginia has a much more productive and lucrative oyster aquaculture market than North Carolina. In 2012, oyster aquaculture generated $9.5 million in Virginia compared with $595,446 in North Carolina. Oyster growers in Virginia increased the number of cultured oysters from 800,000 in 2005 to 28.1 million in 2012, realizing a revenue growth of $9.3 million over that time period. Researchers attribute this growth to state policies that have embraced modern techniques for preserving and harvesting shellfish aquaculture.[46]

Coastal recreation expands and improves habitat that ultimately results in higher yields for fishing and hunting businesses. Research in Alabama estimated that two oyster reef restoration projects with a total length of 3.6 miles will generate an additional catch of over 6,900 pounds per year of fishes and crabs with an estimated net benefit of $38,000 to $46,000 per year to the commercial and recreational sectors.[47,48] These benefits are distributed among producers (harvesters, processors, wholesalers, distributors, retailers, and restaurants) and consumers (seafood consumers and recreational fishers) and are sustained over the functional lifetime of the reef, which can be decades.[49,50] Atkinson applied these results to two similar restoration projects in Louisiana with a total length of 3.4 miles and estimated that oyster reef creation will enhance finfish and shellfish harvest

[45] Pentair Aquatic Eco-Systems, North Carolina Cooperative Extension, and North Carolina Department of Agriculture and Consumer Services. (2014, February 20–22). *North Carolina aquaculture update 2013*. Presented at the 2014 NC Aquaculture Development Conference. New Bern, NC.

[46] Kros, J., Rowe, W., & Nash, B. (2013). A comparative case study of Virginia and North Carolina's oyster and aquaculture development. Briefing paper. Raleigh, NC: North Carolina Rural Economic Development Center.

[47] Peterson, C. H., Grabowski, J. H., & Powers, S. P. (2003). Estimated enhancement of fish production resulting from restoring oyster reef habitat: Quantitative valuation. *Marine Ecology Progress Series*, *264*, 249–264.

[48] Kroeger, T. (2012). *Dollars and sense: economic benefits and impacts from two oyster reef restoration projects in the northern Gulf of Mexico*. Arlington, VA: The Nature Conservancy.

[49] Peterson, C. H., Grabowski, J. H., & Powers, S. P. (2003). Estimated enhancement of fish production resulting from restoring oyster reef habitat: Quantitative valuation. *Marine Ecology Progress Series*, *264*, 249–264.

[50] Kroeger, T. (2012). Dollars and sense: economic benefits and impacts from two oyster reef restoration projects in the northern Gulf of Mexico. Arlington, VA: The Nature Conservancy.

by over 10,000 pounds per year.[51] This same study estimated that wetland creation and protection would enhance shrimp production by as much as 31,539 pounds per year.[52] McCormick et al. estimated the Everglades restoration will increase wildlife habitat and hunting services by $407.4 million annually.[53] With improved coastal habitats, there is more yield to benefit North Carolina's fisheries.

2.3 Ecosystem Services

Of course, coastal restoration also benefits the environment. Coastal restoration increases the benefits that wildlife and the environment provide to people, or what is often referred to as ecosystem services. A healthy, functioning ecosystem is able to provide more services to people than an ecosystem in disrepair. Coastal restoration provides a number of ecosystem services, including healthy fisheries, clean water, and protection of coastal communities from flood and storms. Coastal wetlands provide an estimated $1,861 per hectare annually of enhanced storm protection by reducing the height of storm surges and reducing the distance inland that storm surges travel.[54,55] This value represents the avoided costs of replacing damaged infrastructure, property, and equipment in addition to the loss of economic activity. Created marshes also provide capitalized cost savings of $785 to $15,000 per acre over traditional waste treatment methods because marshes are efficient at nutrient and pollution uptake and retention.[56] Oyster reefs provide similar benefits to marshes because oysters are efficient in filtering pollutants and suspended sediment from the water column, and the reef structures provide shoreline stabilization and erosion protection.[57] Grabowski et al. estimated that oyster reefs provide an average of $860 per hectare annually in shoreline protection with some reefs providing up to $85,998 per hectare annually in locations where property owners demand protection from erosion and an oyster reef is a suitable substitute

Ecosystem Services

Refers to the benefits that wildlife and the environment provide to people and communities.

[51] Atkinson, D. (2012). Ecological and societal benefits derived from coastal restoration in southern Louisiana. Thesis for Master of Science in Environmental Studies, College of Charleston.
[52] Ibid
[53] McCormick, B., Clement, R., Fischer, D., Lindsay, M., & Watson, R. (2010). *Measuring the economic benefits of America's Everglades restoration: An economic evaluation of ecosystem services affiliated with the world's largest ecosystem restoration project*. Roswell, GA: Mather Economics.
[54] Costanza, R., Pérez-Maqueo, O., Martinez, M. L., Sutton, P., Anderson, S. J., & Mulder, K. (2008). The value of coastal wetlands for hurricane protection. *AMBIO: A Journal of the Human Environment*, *37*(4), 241–248.
[55] Atkinson, D. (2012). Ecological and Societal Benefits Derived from Coastal Restoration in Southern Louisiana. Thesis for Master of Science in Environmental Studies, College of Charleston.
[56] Barbier, E. B., Hacker, S. D., Kennedy, C., Koch, E. W., Stier, A. C., & Silliman, B. R. (2011). The value of estuarine and coastal ecosystem services. *Ecological Monographs*, *81*(2), 169–193.
[57] Henderson, J., & O'Neil, J. (2003). *Economic values associated with construction of oyster reefs by the Corps of Engineers* (No. ERDC-TN-EMRRP-ER-01).

for a human-made structure.[58] There is also savings from restoration before further environmental degradation leads to significantly more costly restoration efforts.

[58] Grabowski, J. H., Brumbaugh, R. D., Conrad, R. F., Keeler, A. G., Opaluch, J. J., Peterson, C. H., ... & Smyth, A. R. (2012). Economic valuation of ecosystem services provided by oyster reefs. *BioScience*, *62*(10), 900–909.

3. COASTAL RESTORATION AND ECONOMIC DEVELOPMENT ACROSS THE UNITED STATES

Other states are using coastal restoration as an economic development tool to simultaneously assist struggling economies and degrading coasts. States are using their resources to leverage federal funds that require a state match. We describe several examples from other states using project-specific information to describe the benefits from direct and indirect job creation, and the benefits to the broader industries that coastal restoration supports.

This information is relevant because until recently the economic development-related benefits and impacts have not been well documented in regard to restoration activities in general, thus making it more difficult to understand the role of restoration in local and regional economies. As BenDor and his colleagues note, for years a tension between industry growth and environmental restoration has been fueled by the media and business associations, but "What has been almost entirely missing from this public debate is a detailed accounting of the economic output and jobs in the U.S. that are actually created through environmental conservation, restoration, and mitigation actions."[59] The authors note that there is a growing amount of evidence that restoration contributes to national economic growth and employment in addition to providing environmental benefits. They cite estimates of restoration projects generally supporting 33 jobs per $1 million invested and that these figures are comparable with investments in other industries for job creation.[60,61] BenDor and his colleagues also find that the benefits from restoration tend to be highly localized because projects employ local workers and purchase goods from local vendors. Furthermore, workers in this sector likely experience the fluctuations of seasonal employment, similar to construction jobs, but the pay for restoration jobs is higher than average wages.[62]

In this section, we detail the positive relationship between job creation, industry growth, and coastal restoration by examining projects that other states have pursued to maximize the positive relationship between coastal restoration and economic development. First, we summarize economic and environmental benefits that other states have experienced from coastal restoration and economic development projects. Next, we add a dimension to how

[59] BenDor, T. K., Lester T. W., Livengood, A., Davis, A., & Yonavjak, L. (2014). Exploring and understanding the restoration economy. p. 1. Chapel Hill: University of North Carolina, Center for Urban and Regional Studies.

[60] Edwards, P. E. T., Sutton-Grier, A. E., & Coyle, G. E. (2013). Investing in nature: Restoring coastal habitat blue infrastructure and green job creation. *Marine Policy*, *38*, 65–71.

[61] Pollin, R., Wicks-Lim, J., & Garrett-Peltier, H. (2009). *Green prosperity: How clean-energy policies can fight poverty and raise living standards in the United States* (No. green_prosperity). Amherst, MA: Political Economy Research Institute, University of Massachusetts.

[62] Shropshire, R., & Wagner, B. (2009). An estimation of the economic impacts of restoration in Montana. Helena, MT: Research and Analysis Bureau, Montana Department of Labor and Industry.

states are approaching coastal restoration through more comprehensive statewide strategic plans, and finally we highlight examples of how states have leveraged federal funding opportunities to benefit local coastal economies and their shorelines.

3.1 Economic and Environmental Benefits Experienced in Other States

Examples of states employing coastal restoration for dual economic development and shoreline benefits are shown in **Table 3-1** and illustrate the variety of projects and their ranges in costs and benefits. The important point from this information is to recognize the tie from the coastal restoration project to direct economic benefits accrued to the local community. For example,

- In Mobile Bay, Alabama, an oyster reef breakwater project created 35 fishery jobs in a community with high unemployment in the fishing industry while simultaneously protecting 10,000 feet of shoreline.
- In Seaside Bays, Virginia, 57 jobs were created or retained in the county where 22.4% of its population lived in poverty while also increasing the scallop stocks and protecting and restoring 385 acres of marshland.
- In Fog Point, Maryland, fishing stocks were protected to support the local fishing industry while also protecting close to 21,000 feet of living shoreline. Similarly, in Hail Cove, Maryland, waterfowl and fishing populations were protected to enhance the hunting and fishing industry while creating 4,000 feet of shoreline.
- In Ferry Point, Maryland, restoring 2,600 acres of wetlands has bolstered both the tourism and hunting and fishing industries.
- In Grand Isle and St. Bernard Louisiana, 92 jobs were created in hard-hit areas that suffered economically and environmentally from Hurricane Katrina while also creating 3.4 miles of oyster reef.

More details about each of these projects are summarized in **Table 3-1**.

3.2 States with Coastal Restoration and Economic Development Plans

Some states are using a strategic planning approach to ensure that coastal restoration is planned and implemented in ways that maximize the economic benefits and impacts from such activities. We describe examples from three states to illustrate the breadth and depth of coastal restoration and economic development efforts.

Table 3-1. Examples of Coastal Restoration and Economic Development Projects

Project	Key Features	Cost	Economic Development Benefits	Environmental Benefits
Mobile Bay, Alabama	Created 2,250 meters of oyster reef breakwaters	$2,956,446	▪ Created 35 fishery-related jobs targeted primarily to the local fishing community that has seen major declines in these kinds of jobs and unemployment since 200563 ▪ Fishery production enhancement and protecting/stabilizing shoreline (multiple benefits with one technique)	▪ Protects approximately 10,000 feet of shoreline in an area where more than 30% of coastline is armored with hardened shorelines and, as a result, has experienced huge losses of nursery habitat and increased erosion of adjacent shoreline
Seaside Bays, Virginia	Created 22.1 acres of oyster reef; seeded 133 acres of bare seabed with eelgrass; placed 15,000 bay scallops on spawning brood stock[64]	$2,167,000 (2009)[65]	▪ Maintained or created 57 jobs including research scientists and students, marine contractors, boat and barge operators, divers and watermen ▪ Located in a county with a 22.4% poverty rate with a reliance on the commercial fishing industry and a current focus on ecotourism and recreational fishing for economic development	▪ Increase wild bay scallop stocks ▪ Designed to protect 350 acres of existing marsh ▪ Build approximately 35 acres of marsh through accretion
Fog Point, Maryland	Created 20,950 feet of living shoreline	$9,000,000	▪ Focus on protecting fisheries resources to provide economic benefits to the local fishing communities ▪ Builds resiliency of habitats and the local economy to storm events (soft crab fishery and other fisheries)	▪ Directly protects over 1,200 acres of quality tidal marsh, submerged aquatic vegetation, and clam beds; increases resiliency of refuge estuarine habitats important to the island's soft crab fishery

(continued)

[63]Grants – Award Summary. American Recovery and Reinvestment Act of 2009. Retrieved from http://www.recovery.gov/arra/Transparency/RecoveryData/pages/RecipientProjectSummary508.aspx?AwardIDSUR=37759&qtr=2012Q4

[64] Conathan, M., Buchanan, J, & Polefka, S. (2014). *Economic case for restoring coastal ecosystems*. Washington, DC: Center for American Progress, OXFAM America.

[65] Ibid

Table 3-1. Examples of Coastal Restoration and Economic Development Projects (continued)

Project	Key Features	Cost	Economic Development Benefits	Environmental Benefits
Hail Cove, Maryland	Created 4,000 feet of living shoreline	$1,550,000	▪ Protects migratory waterfowl habitat, marsh, and submerged aquatic vegetation to ensure continued community and economic benefits in the Chesapeake Bay, including protection from storms	▪ Protects more than 400 acres of high-quality tidal marsh and submerged aquatic vegetation ▪ Living shoreline provides dual benefits of habitat and shoreline protection
Ferry Point, Maryland	Enhanced and restored 2,600 acres of wetlands	$638,000	▪ Supports public hunting and fishing opportunities and an emerging nature tourism industry ▪ Increases wetland ability to protect nearby manmade structures	▪ Improves wetland habitat strength to effects of sea level rise ▪ Removal of invasive species, including along the river system, will decrease funds needed to maintain habitat quality in the future

Louisiana

Louisiana approved a 50-year, $50 billion plan for restoring the state's eroding coast. A study found that this initial investment would translate into billions of dollars in additional economic benefits including the following:

- $12.35 billion in annual spending,
- $757 million in annual state and local tax revenues, and
- 109,360 permanent jobs created with $3.61 billion in annual earnings.[66]

This plan builds on recent successes in the state, including leveraging of over $14 billion in federal funds for storm protection and coastal restoration from 2007 to 2012.[67]

[66] Ryan, T. P. (2014). *The economic impact of coastal restoration and hurricane protection*. Retrieved from http://www.law.tulane.edu/uploadedFiles/Institutes_and_Centers/Water_Resources_Law_and_Policy/Content/The%20Economic%20Impact%20of%20Coastal%20Restoration%20and%20Hurricane%20Protection%20by%20Dr%20Timothy%20Ryan%20FINAL%20V2.2.pdf

[67] Coastal Protection & Restoration Authority (CPRA). (2012). Louisiana's comprehensive Master Plan for a sustainable coast. Retrieved from http://www.coastalmasterplan.louisiana.gov/2012-master-plan/final-master-plan

Florida

Florida is employing a similar strategy through the enactment of the Comprehensive Everglades Restoration Plan. An analysis of this plan estimates that Everglades restoration as described and planned will generate an increase in economic benefits of approximately $46.5 billion in net present value terms (with a range of this estimate as high as $123.9 billion).[68] With an initial investment expected of $12.1 billion, this would correlate to a benefit-cost ratio of 4.04 (with a range as high as 9.78), meaning for every $1.00 invested in Everglades restoration, $4.04 dollars are generated in return.[69] The Army Corps of Engineers estimates that 22,000 jobs will be created as a result of actual Everglades restoration projects. It is estimated that the projects will also have an incremental impact on employment of approximately 442,000 additional workers over 50 years within a number of sectors including commercial fishing, recreational fishing, residential construction and real estate services, tourism, and wildlife habitat and hunting.[70]

Gulf Coast

The Gulf Coast region has benefited from the passing of the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act), which allocates funds from Clean Water Act penalties paid by British Petroleum and other companies responsible for the Deepwater Horizon oil spill to the five Gulf States to be used for ecological restoration, economic development, and tourism promotion.[71] A study conducted in 2012 forecasted the employment growth as a direct result of the funding from this project using $25 billion[72] over a 50-year period as the funds to be received from the RESTORE Act.[73] The results of their analysis suggest that, for the moderate case, 77,453 incremental jobs will be created over the 50-year period due solely to restoration funding. This correlates to 29.54 jobs created per million dollars of investment.[74] The greatest number of jobs is expected to be in the transport, trade, and utilities sector, but other sectors such as construction, manufacturing, mining, business services, public administration, leisure and hospitality, and education are expected to see additional jobs created as well.[75]

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[68] McCormick, B., Clement, R., Fischer, D., Lindsay, M., & Watson, R. (2010). *Measuring the economic benefits of America's Everglades restoration: An economic evaluation of ecosystem services affiliated with the world's largest ecosystem restoration project*. Roswell, GA: Mather Economics.

[69] Ibid

[70] Ibid

[71] Restore the Mississippi River Delta. The RESTORE Act. (2013). Retrieved from http://www.mississippiriverdelta.org/files/2013/02/RESTOREtheGulfCoastStatesAct.pdf

[72] The exact amount of penalties has not yet been determined. It is currently estimated to be closer to $17.6 billion.

[73] Mather Economics. (2012). *Job creation from Gulf Coast wetlands restoration*. Roswell, GA: Mather Economics.

[74] Ibid

[75] Mather Economics. (2012). *Job creation from Gulf Coast wetlands restoration*. Roswell, GA: Mather Economics.

3.3 Leveraging Federal Resources

Other states have been successful in coastal restoration and economic development efforts by leveraging resources from federal programs. In fact, the federal government acknowledged economic development benefits of coastal restoration when it invested $167 million in 50 coastal restoration projects throughout the United States as part of the economic stimulus package during the recent recession,[76] including the North Carolina restoration effort described in **Section 6**. Because grantees are required to monitor and report on economic impacts and other project details, these kinds of projects provide an excellent source of economic development and environmental outcome-related data spearheading the call to recognize the economic potential within restoration work. For example, recent research reveals findings such as the following:

- The 50 coastal restoration projects across the United States resulted in 1,409 jobs in the first 18 months of the project.[77]
- Seventeen jobs were created per $1 million invested within these 50 projects, which is much higher job creation than other industries such as coal and oil and gas.[78]

The authors note that these are short-term impacts; it will be interesting to note if and how longer term employment impacts result from such efforts. Benefits documented from individual projects underscore the connection of coastal restoration to supporting the growth in fishing and tourism industries and income accrued to households. For example:

- Oyster reef creation in Mobile Bay, Alabama, created a net present value of $38,902 for commercial fin-fisheries and $99,834 for recreational fin-fisheries in a region of Alabama that has experienced a decline in fishery-related jobs.[79]
- Oyster reef creation and bay scallop placement in Virginia resulted in an estimated annualized value of $34,113 for commercial fin-fisheries and $3,439 to $22,696 for recreational fin-fisheries in a county that has a poverty rate of 22.4% and where residents rely on commercial and recreational fishing for their livelihood.[80]

[76] The Nature Conservancy. *Investing in nature: Creating jobs and restoring coastal habitats*. Retrieved from http://www.habitat.noaa.gov/pdf/tnc_noaa_arra_restoration_summary.pdf
[77] Edwards, P. E. T., Sutton-Grier, A. E., & Coyle, G. E. (2013). Investing in nature: Restoring coastal habitat blue infrastructure and green job creation. *Marine Policy*, *38*, 65–71.
[78] Ibid.
[79] The Nature Conservancy. *Investing in nature: Creating jobs and restoring coastal habitats*. Retrieved from http://www.habitat.noaa.gov/pdf/tnc_noaa_arra_restoration_summary.pdf
[80] Abt Associates. (2014). *Estimating the change in ecosystem service values from coastal restoration*. Prepared for the Center for American Progress and OXFAM America.

- Salt pond restoration in the San Francisco Bay is estimated to have an annualized benefit of $23,332 to $29, 967 in income for commercial and recreational fishing with an overall annualized value that the enhanced ecosystem provides of $3,037,349 to $9,582,656.[81] This project occurred in an area with a disproportionately high percentage of the population living below the poverty line.[82]

[81] Ibid.

[82] Conathan, M., Buchanan, J, & Polefka, S. (2014). *Economic case for restoring coastal ecosystems*. Washington, DC: Center for American Progress, OXFAM America.

4. North Carolina Coastal Restoration and Community Economic Development Projects in North Carolina

In this section, we describe in detail four projects that underscore the community economic development traits inherent in coastal restoration:

- living shoreline creation, oyster and salt marsh habitat restoration, and a multiuse piers at Morris Landing in Onslow County
    - oyster restoration at Pamlico Sound in Carteret, Hyde, New Hanover, and Onslow Counties
    - stormwater capture systems at Bradley Creek Elementary School in New Hanover County
    - wetland restoration at North River Farms in Carteret County

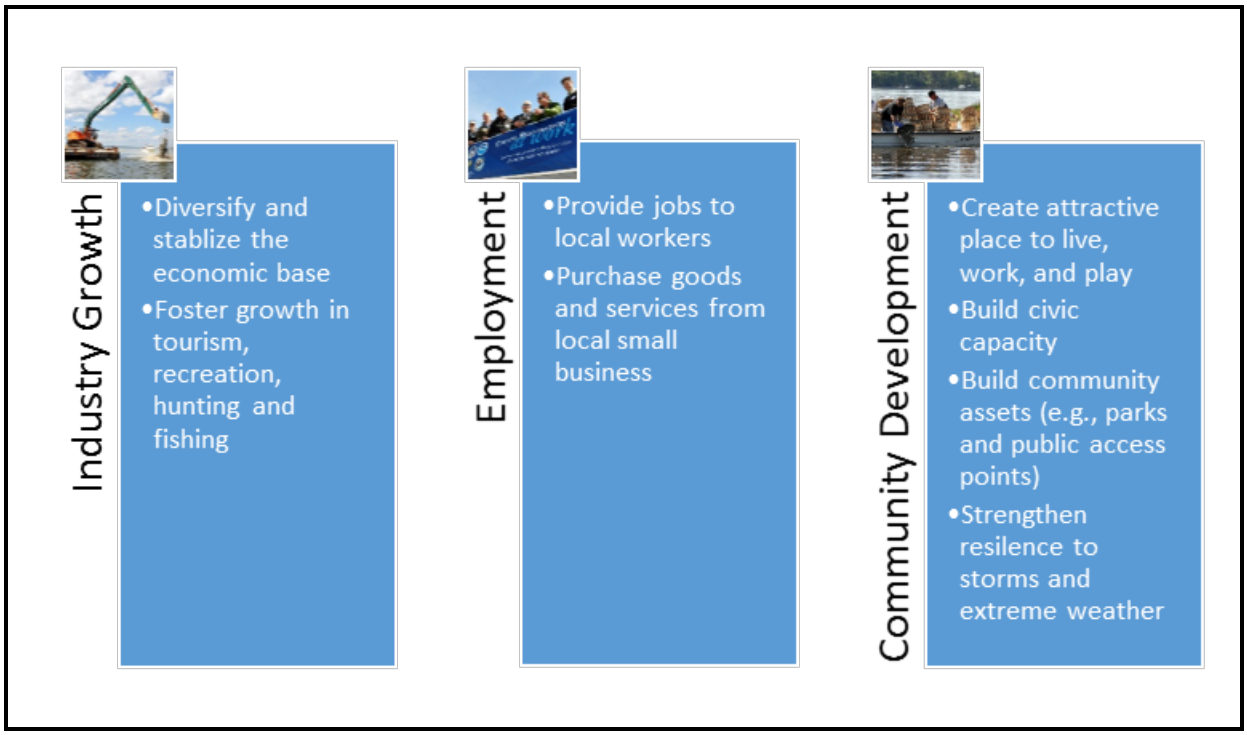
After a thorough review and analysis of these cases we found that these projects support industry growth (as also documented in **Sections 2** and **3**), create employment opportunities for local workers, and foster community development through educational outreach, volunteerism and creating local parks and public access points for public use. Restoration also increases a community's resilience to storms and other extreme weather events. This is summarized in **Figure 4-1**.

Methods

RTI reviewed detailed notes and contracts on the projects to distill qualitative and quantitative results. First, we noted how the features of the project stand apart from a community economic development perspective and what the needs for the project were at the outset. We then documented the businesses and organizations engaged to perform the work and highlighted the degree to which the project provided a community asset, such as a park or school-related program. Finally, to quantify the employment and economic impacts, RTI used Regional Input-Output Modeling Software (RIMS II) to generate economic impacts for the coastal region based on dollar amounts of funding for restoration projects.

RIMS II provides industry multipliers that reflect changes in the economic landscape for a region based on monetary or employment changes in a given industry. For example, $1 produced (or received as is the case in funded projects) by the Forestry, Fishing, and Relative Activities industry generates $1.79 of output across all industries and across the entire observed region, which RTI specified as 20 North Carolina coastal counties. Considering the four case studies for which RTI conducted economic impact analyses, the activities involved in the respective restoration processes differ and therefore so do their industries. RTI accounted for this by reviewing each of the activities and mapping the type of work to prespecified RIMS II industries.

Figure 4-1. Summary Community Economic Development Impacts of Coastal Restoration



The RIMS II multipliers and project budget data provided by the Federation enabled RTI to generate three economic impact metrics:

1. Output: total value added to the coastal region per $1 produced (or received) by a given industry.
2. Household income: total increase in household earnings in the coastal region per $1 produced (or received) by a given industry.
3. Full- and part-time jobs: total number of full- and part-time jobs created per $1 million produced (or received) by a given industry.

These measures are estimates and are intended to provide insight into the spillover benefits of coastal restoration. Each of these cases is summarized in **Sections 5** through **8**.

5. CASE STUDY: MORRIS LANDING

The habitat restoration work by the Federation and its project partners at the Morris Landing Clean Water Preserve on Stump Sound in Onslow County is a prime example of how coastal restoration is improving habitat and water quality in addition to fostering tourism by ensuring quality public access to water access at the coastal restoration site and building civic capacity in coastal North Carolina through its educational and outreach capacity.

In 2005, the Federation began to improve public access at Morris Landing, initiate a multiphase shoreline restoration project, and partner with the North Carolina Division of Marine Fisheries (DMF) to create the oyster shell stockpile area and barge loading facility. The Federation worked to maintain and enhance the public's access to Morris Landing by building a walkway, fishing pier, and education platform and maintained the use of the site for swimming, fishing, and launching small boats. Furthermore, the Federation and its partners have proactively engaged students, teachers, community members, volunteers, and state and local regulators in relevant aspects of its restoration work. The Federation provides courses about living shorelines to students and engages classrooms through activities like constructing wetland nurseries at school, cultivating wetland plants from seed, and using those plants to restore local shorelines. Community members and volunteers, along with students and teachers, participate in the actual plantings and bagging of oyster shells for final placement in the marshes. Technical training to regulators on living shorelines has helped both reduce impediments to improving living shorelines and provide property owners with better information options for fostering a living shoreline on their personal property. Finally, these activities are punctuated with community events, news articles, and TV spots that highlight how the community comes together to learn about and implement efforts to improve North Carolina's coast.

The Morris Landing Clean Water Preserve has over 3,000 feet of shoreline along Stump Sound. Stump Sound is unique because it is considered an exceptional location for water quality, estuarine habitats, and fishing value. In recent years though it has experienced increased strain on natural resources and habitat. In order to reverse course and maintain the area's premier coastal ecosystem, the Federation, its project partners, and hundreds of volunteers have worked to restore oyster reefs and marsh habitats along the Morris Landing shoreline and in Stump Sound.

In 2004, the Federation purchased 52 acres at Morris Landing with a grant from the North Carolina Clean Water Management Trust Fund. Since the purchase of the site, a number of projects have protected and restored Stump Sound:

- 2005: A National Oceanic and Atmospheric Administration (NOAA) Community Based Restoration Program grant led to the construction of a 600-foot living shoreline project by volunteers. A contractor built the 600' x 6' low-profile stone sill to protect and restore

the eroding estuarine shoreline and saltmarsh habitat. The protection afforded by the sill, coupled with plantings of *Spartina alterniflora* seedlings by volunteers behind the sill, resulted in the restoration of a vibrant saltmarsh habitat.

- 2005: Funding from a court settlement on a wetlands destruction case on a property near Morris Landing was used to construct a wooden walkway for education and small fishing pier. A private contractor, Coastal Area Contracting, was paid $45,800 to build the educational walkway and pier.

- 2008: As part of the North Carolina Department of Justice's Stump Sound Oyster Habitat Restoration Environmental Enhancement Grant (EEG CF 06), the Federation worked with contractors and engineers to construct a heavy-duty concrete pier for loading oyster shells onto North Carolina DMF barges. The pier and stockpile area represent the only permanent such facilities for DMF between Carteret and Brunswick Counties. The stockpile area and pier at Morris Landing have allowed the Federation and DMF to get more shells in Stump Sound and the waters of Onslow and Pender Counties. The oyster shell-loading pier enabled DMF to increase the amount of oyster shell deployed annually into Stump Sound and adjacent waters from 9,000 bushels to 20,000 to 30,000 bushels annually. An additional component of the grant enabled the Federation to partner with DMF to create 8.03 acres of oyster habitat in Stump Sound and adjacent waters in 2009 and 2010.

- 2010: Part of NOAA's American Recovery and Reinvestment Act of 2009 (ARRA) $5 million project "Putting Private Industry to Work Rebuilding North Carolina's Oyster Habitat" for oyster reef construction was used at Morris Landing. The North Carolina DMF purchased about 18,000 bushels of shell to stockpile at Morris Landing. Twenty-three local commercial fishermen were paid $2.00/bushel to deploy the shells into 4 acres of shallow subtidal bottom in Stump Sound. In 2014, the area was opened to harvest.

This project cost $527,000, as shown in **Table 5-1**. It is remarkable that the Federation leveraged more than $500,000 of outside funding with just $20,000 investment from the state.

Table 5-1. Project Funding for Morris Landing Living Shoreline and Oyster Restoration

Funder	Project Funding
Community Conservation Assistance Program	$19.8
North Carolina Department of Justice Environmental Enhancement Grant Program	$370.7
Fish America Foundation	$43.7
National Oceanic and Atmospheric Administration	$14.8
Restore America's Estuaries	$78.0
Total	$526.9

Note: Sums may not add to totals because of independent rounding.

Table 5-2 presents the economic impacts across the coastal region from the living shoreline and oyster restoration project at Morris Landing. The $526,890 project generated $945,520 of revenue for coastal businesses, which includes $324,765 in household income. The project supported 11 jobs.

Table 5-2. Economic Impacts of Morris Landing Living Shoreline and Oyster Restoration

Impact	Value
Project funding	$526.9 thousand
Business revenue	$945.5 thousand
Household income	$324.8 thousand
Jobs	11 jobs

The bulk of the work at Morris Landing, 61% of the total funding amount, was used to build the concrete pier that serves as a barge-loading facility for the North Carolina DMF to conduct its oyster cultch planting program in southeastern North Carolina. The remaining funds were used for materials, plantings, reef cultch, and planning and monitoring for sill construction and shoreline regrading. The Federation contracted with local companies to support the project, including Intercoastal Diving (Castle Hayne, North Carolina), Inc.; Billet's Tractor Works (Surf City, North Carolina); North Carolina Department of Marine Fisheries (Morehead City, North Carolina); Coastal Stormwater Services (Wilmington, North Carolina); and others (truck companies, quarries) that all experienced increases in business from this work.

6. CASE STUDY: OYSTER RESTORATION

North Carolina received a $5 million grant that perhaps best demonstrates the interconnections among coastal businesses, commercial fishing, and coastal restoration. Entitled Putting Private Industry to Work Rebuilding North Carolina's Oyster Habitat, this large-scale initiative built 79 acres of oyster habitat. Once mature, this habitat could provide a $3.2 million per year revenue opportunity for North Carolina's fisherman, given current prices.

With healthy and resilient oyster reefs, North Carolina's coastal waters support recreational and commercial fisheries and provide income opportunities to local—and largely rural—communities through more abundant supply of a popular shellfish product. Oyster reefs also improve water quality through natural filtration; protect shoreline habitats from potentially destructive wave energy; and serve as critical habitats for numerous species of fish, birds, and mammals. Thus, healthy and sustainably managed oyster reefs provide blue-collar job opportunities while protecting the Carolina coast.

Project Partners for Putting Private Industry to Work Rebuilding North Carolina's Oyster Habitat

- North Carolina Coastal Federation
- Department of Marine Fisheries
- Stevens Towing
- Pungo River Lime
- Cape Dredging
- E&J Trucking
- Martin Marietta
- Yancey Trucking
- NC State University
- UNC Wilmington
- UNC Chapel Hill

This restoration project was primarily located in Pamlico Sound, North Carolina, at the oyster sanctuary sites Crab Hole and Clam Shoal. In total, 21 sites were targeted for oyster reef construction or restoration, more than 78 acres received restoration activities to grow oyster populations, and over 1,100 tons of oyster shells and 65,000 tons of marl rock were used as part of the restoration effort.

Recognizing the potential for job creation and economic benefit through coastal restoration, $5 million in stimulus funding enabled the DMF, the Federation, and other partners to pursue oyster restoration initiatives much more quickly and effectively than would have otherwise been possible.

The project engaged local businesses, fisherman, and deckhands during the off season, as well as local laborers. In total, between 203 and 213 people worked on this one project at some point, and their earnings certainly supported other people in the community (see **Table 6-1**). Note that this table describes the kinds of positions and the number of people who filled the positions over a 2-year time frame. The table is important because it highlights the broad range of workers restoration projects tend to employ. These figures do

not reflect full-time employees; instead, they show the breadth of occupations in which people are employed on a temporary part-time basis to help complete restoration projects.

Table 6-1. Number of Working People and Hours for Oyster Reef Reconstruction, by Position, 2009–2011

Category	Job	Number of People	Number of Work Hours
Reef construction and site preparation	Barge loader	1	81
	Conveyor and loader operator	1	545
	Machine and excavator operator	1	583
	Material handler operator	1	1,925
	Mechanic	1	92
	Oiler/spotter	2	2,004
	On-site supervisor	1	154
	Reef builder and shell planter	5	1,673
	Technician	23	15,283
	Truck driver	1	581
	Welder	4	459
Site design, research, and planning	Principal investigator	5	1,707
	Research assistant (university)	22	3,515
	Research assistant (high school)	5	291
	Research technician	2	1,991
Administrative support	Administrative assistant	1	254
	Office administrator	2	1,907
	Program administrator	1	59
Transportation	Fisherman	72	888
	Ship captain	6	5,695
	Ship mate	2	2,620
	Deckhand	4	7,854
Other	Unknown positions	40 to 50	37,946
Total		203 to 213	88,104

Note: Sums may not add to totals because of independent rounding.

The materials used to build the deep water reefs were mined near New Bern, North Carolina, and transported by truck and barge to the sanctuary sites in Pamlico Sound. Once the limestone rock reached the sanctuary sites, the material was deployed to construct the reefs. The oyster shell used by the fishermen to create the small patch reefs was purchased from shucking houses in North Carolina and Virginia, and it was trucked to stockpile

locations along the coast. As such, the positions employed for the project included planning, mining, transportation, deployment, and monitoring. Barge and tug boat operators, loading crews, fishermen, divers, truck drivers, mining and quarry workers, scientists, technicians, students, project managers, and outreach specialists were hired to fill these positions. Between 203 and 213 people worked on this project.

Table 6-2 presents the economic impacts from ARRA funding for oyster reef sanctuaries. Note that these impacts are estimates using current statistics for the state's economy (see Section 4). The more than $5 million grant resulted in $7.5 million of revenue to the 20-county coastal region. Funding amounts for the industries include salaries and benefits, supplies (oyster shells and other materials), equipment (boat rental), and disbursements to local project partners and contractors. This oyster restoration project also contributed to $1.9 million in household earnings across coastal North Carolina. It is estimated that the project created a total of 50 jobs. (Note this figure is different than the figure in **Table 6-1** because the 50 jobs is an estimate of full-time jobs created over the course of 1 year based on the investments made to complete the oyster restoration work).

Table 6-2. Economic Impacts of Oyster Restoration Project by Industry

Industry	Funding Received (thousands)	Business Revenue Generated (thousands)	Household Income Generated (thousands)	Jobs
Inland water freight transportation	$3,762	$5,331	$1,072	22
Administration of conservation programs	$653	$1,102	$405	18
Environment, conservation, and wildlife organizations	$289	$505	$198	5
Environmental consulting services	$326	$570	$224	5
Total	$5,030	$7,507	$1,900	50

Note: Sums may not add to totals because of independent rounding.

Healthy oyster reefs provide valuable revenue opportunities for fisherman. One oyster farmer reported that a sustainably harvested acre can provide 100,000 oysters per year. Assuming $0.40 on the half-shell market, that acre provides a $40,000 revenue opportunity. For 79 acres, the value is $3.2 million.

The University of North Carolina at Chapel Hill's Institute of Marine Sciences developed an economic study of the medium- to long-term impacts of the oyster restoration project. The findings estimated that a 1-acre reef sanctuary that lasts 50 years would yield an additional $40,000 from commercial finfish and crustacean fisheries. Additionally, the annual value of ecosystem services provided by the oyster reefs totaled more than $11,000 per acre.

7. CASE STUDY: NORTH RIVER FARMS

North River Farms is the largest coastal restoration project in North Carolina's history and has become an excellent demonstration and applied learning site for a large-scale restoration of multiple habitat types, agricultural runoff treatment, adaptive management, and educational outreach. The project has served as a teaching site for area middle and high schools, state universities, and restoration-related organizations. Those involved with the work have presented the project's methods and outcomes at national conferences and have also hosted national leaders in conservation and tours to the site for educational outreach.

For years the 6,000-acre North River Farms in Carteret County, North Carolina, produced agricultural runoff polluting nearby creeks that feed into the North River, Wards Creek, and Jarrett Bay watersheds. The water quality and estuaries have suffered from excess erosion from the land, as well as fertilizers, pesticides, and other nutrients and bacteria. With little wetland and marshland to protect the watersheds, the polluted water and soil effortlessly flow into bays and rivers, which result in declining oyster populations; poor water quality; and unsustainable fishing, hunting, and sporting industries.

The Federation and dozens of partners have worked to restore the farms back to forested wetlands through design, planning, land excavation, shellfish bed enhancements, plantings, and construction of water control systems and structures. The Federation began its wetlands restoration work at the North River Farms in Carteret County in 1999.[83] Its first project, funded by North Carolina's Clean Water Management Trust Fund, involved the purchase of 1,991 acres at the farm for more than $1 million. In 2002, the Federation purchased 2,168 acres for a second wetland restoration project and has recently also acquired an additional 1,435 acres at the farm that had already been restored by the U.S. Department of Agriculture's (USDA's) Natural Resources Conservation Service Wetlands Reserve Program.[84]

Like many restoration projects, work at North River Farms engaged workers and suppliers from the coastal counties in North Carolina. For example, from 2007 to 2009 a grant from North Carolina's Clean Water Management Trust Fund was used to plant over 14,000 shrubs and bushes and 13,000 trees that were supplied from three nurseries located in Edenton, Clinton, and Raleigh. The plant installation company was contracted out of Clinton, North Carolina, and the construction contractor is located in Pittsboro.

[83] North Carolina Coastal Federation. (2012, March 21). *North River Farms: Making the land work again*. Retrieved from http://nccoast.org/article.aspx?k=59c23ef8-82d2-4e91-a252-929fee18923f

[84] Ibid

We detail additional economic impacts from this work by estimating the employment, income, revenue, and gross domestic product impacts. Funding and restoration of wetlands at North River Farms has been ongoing since 1999.[85] As **Table 7-1** presents, the total funding attracted for the restoration work was $2.4 million between 2005 and 2009. However, this funding amount is an underestimate because it only encompasses part of the restoration efforts at North River Farms. Additionally, the number of funders, matched contributions, and restoration phases in what is considered to be the largest wetland restoration project in the United States makes it difficult to calculate an exact dollar value for funds contributing to this particular project.

Table 7-1. Project Funding for Wetland Restoration at North River Farms

Funder	Funding Received (Thousands)
Restore America's Estuaries	$130.3
Fish America Foundation	$81.3
NOAA	$264.0
North Carolina's Clean Water Management Trust Fund	$1,961.9
Total	$2,437.4

Note: Sums may not add to totals because of independent rounding.

As a result of the $2.4 million investment in coastal North Carolina, business revenue increased by $5.2 million and household income increased by $1.8 million. Wetland restoration at North River Farms also created 66 full-time jobs, jobs that include both direct hires to the project and jobs that result from the additional spending resulting from the project. Other grants from the U.S. Fish and Wildlife Service, the NC Attorney General's Environmental Enhancement Program (EEG), and the North American Wetlands Conservation Act also helped support this work, but these grant values are not known and thus are not accounted for in this impact analysis. **Table 7-2** shows the funding to and economic impacts from the Morris Landing Living Shoreline and Oyster Restoration project.

Table 7-2. Economic Impacts of North River Farms Wetland Restoration

Impact	Value
Project funding	$2,437.4 thousand
Business revenue	$5,248.0 thousand
Household income	$1,832.7 thousand
Jobs	55

[85] Ibid.

8. CASE STUDY: BRADLEY CREEK ELEMENTARY SCHOOL

The Bradley Creek Elementary school project demonstrates how coastal restoration projects engage local business, build civic capacity, and support the development of North Carolina's shellfish industry. The school is located on a 19-acre site at the headwaters of Hewlett's Creek. The waters of the creek are high-quality shellfish waters and flow into Myrtle Grove Sound, but they are closed to shellfishing because of impaired water quality and degraded estuarine habitats.

Because of the school's location and the potential of the site, the Federation and a diverse group of project partners used $76,000 to design and construct a series of stormwater reduction projects that would capture as much stormwater runoff as possible during a 1.5-inch rain event. This project is part of a multiphase, multiyear initiative (Bradley & Hewletts Creek Watershed Restoration Plan) that reduces, captures, and treats runoff from the largest and most urbanized tidal creek watershed in New Hanover County. The project provided an opportunity for the school's third-grade classes, teachers, school administrators, and parents to work with the project team and community volunteers to install plants and learn how to be stewards of coastal North Carolina's unique ecology.

Total Project Budget: $76,200
Project Partners

- North Carolina Coastal Federation
- New Hanover Soil and Water Conservation District
- City of Wilmington
- North Carolina State University, Biological and Agricultural Engineering Stormwater Group
- New Hanover County Schools
- Withers and Ravenel Engineering (Cary, North Carolina)
- Coastal Stormwater Services (Wilmington, North Carolina)
- Coastal Carolina Resource Group (Leland, North Carolina)

Volunteers

- 135 Third-Grade Students and their Teachers
- 250 Community Volunteers, including Those from
  - First Citizens Bank
  - NC Ports Authority
  - UNC Wilmington
  - Wachovia-Wells Fargo
  - Wilmington Crossfit
  - Work on Wilmington

Because stormwater is the primary cause of pollution in the creek, rain gardens and other stormwater reduction measures were designed and landscaped on the school's campus. The project partners designed and constructed rain gardens, stormwater wetlands, and bioretention areas. A local contractor completed all the major excavation, grading, and utility work for all of the projects. One hundred thirty-five third graders, their teachers, and parents and about 250 volunteers landscaped the rain garden site, including laying sod; planting grasses, shrubs, flowers, and trees; spreading mulch; and installing fencing. The project culminated in a field day that permitted students to test their knowledge and learn about how the project affects the creek adjacent to their school and the shellfish that they

may one day eat.

Rain Gardens
Natural or manmade depressions in the ground used to soak up stormwater runoff. Trees, shrubs, flowers, and other plants are planted with the rain garden to soak up the excess water.

Bioretention
Planting of more trees, shrubs, flowers, and other plants in areas that are prone to heavy runoff without the presence of a depression in the ground.

The project has become a magnet for stormwater managers, planners, and engineers to learn about creative partnerships. With all the projects in place and functioning it is estimated that they are capturing almost 120,000 gallons of polluted stormwater whenever 1.5 inches of rain fall on the school. This project will aid in the restoration of Hewletts Creek, enabling it to be used once again for shellfishing and other economic activities.

Funding for the project, shown in **Table 8-1**, came from the National Fish and Wildlife Foundation, North Carolina Community Conservation Assistance program, Cape Fear Garden Club, and Landfall.

Table 8-1. Project Funding for Rain Gardens and Increased Vegetation at Bradley Creek Elementary School

Funder	Funding Received (Thousands)
Community Conservation Assistance Program	$58.8
National Fish and Wildlife Foundation	$10.6
Cape Fear Garden Club	$1.8
Landfall	$5.0
Total	$76.2

Note: Sums may not add to totals because of independent rounding.

Table 8-2 provides the economic impacts from this project. Seventy-six thousand dollars invested in this effort generated $136,979 in revenue for coastal businesses, added $37,236 to household incomes. The grant funds for the project created one additional job within the region. This project demonstrated that even small-scale coastal restoration projects generate economic impacts for Coastal North Carolina.

Table 8-2. Economic Impacts of Rain Gardens and Increased Vegetation at Bradley Creek Elementary School

Impact	Value
Project funding	$76.2 thousand
Business revenue	$137.0 thousand
Household income	$47.4 thousand
Jobs	1 job

9. COASTAL RESTORATION AS A COMMUNITY ECONOMIC DEVELOPMENT TOOL FOR NORTH CAROLINA

9.1 Summary of Economic Development Impacts of Coastal Restoration

The four North Carolina projects we highlight in **Section 4**, in addition to the examples from other states in **Section 3**, document the positive relationship between job creation, industry growth, and coastal restoration. With this understanding we offer that coastal restoration provides a fresh approach for economic developers to add to their tool kits. In terms of community economic development, restoration projects help

- stabilize employment in communities that experience fluctuations from seasonal employment (e.g., tourism and construction);
- support broader industry growth in sectors important to coastal and rural North Carolina (e.g., tourism and recreation, and fishing and hunting); and
- build community and civic capacity by developing community assets such as local parks and access facilities, by engaging in educational outreach in area schools and with hundreds of local volunteers, and by hosting community events.

Further, these projects generate economic impacts. We summarize the economic impacts of the four projects for the coastal region in **Table 9-1**. In total, more than $8 million in grants were received from various funders, which generated an estimated $13.8 million in business revenue, $4.1 million in the coastal region's household income, and $6.5 million in the coastal region's business income for industries directly related to project activities and created 116 jobs.[86] The economic impacts from the North River Farms project are significantly higher relative to the actual investment in the work because of the large amount of construction work involved in this project. Spending in the construction industry has relatively high economic multipliers, meaning that economic activity in this industry has a stronger ripple effect throughout the coastal economy.

These estimates are conservative because not all funding data for each project were available. It is important to note that these jobs figures represent a full-time job for a full year of work. They do not reflect the actual number of people hired to work on these projects. The actual number of people hired is much higher because they worked for less than a year and on a part-time basis. The following sections describe the individual projects and their economic, social, and environmental impacts on the coastal region.

[86] The number of jobs created is a result of the amount of funding for the restoration projects and is often referred to as "jobs per output."

Table 9-1. Economic Impacts by Coastal Restoration Project

Project	Funding Received (thousands)	Business Revenue (thousands)	Household Income (thousands)	Jobs
Oyster restoration	$5,030	$7,507	$1,900	50
Morris Landing	$527	$946	$325	11
North River Farms	$2,437	$5,248	$1,833	55
Bradley Creek Elementary School	$76	$137	$47	1
Total	$8,071	$13,837	$4,104	116

Note: Sums may not add to totals because of independent rounding.

Restoration has been shown to increase the attractiveness of a region to tourists and outdoor enthusiasts, which also generates positive spillovers for the economy, boosting such sectors as hotels and lodging, restaurants, retail, and fishing. (Refer back to **Section 2.2** for details on these benefits.) Finally, the case studies in North Carolina show how the engagement and educational outreach activities from coastal restoration both build community assets locally and foster civic capacity building for students, teaching them about their environment and how to work with others across the community to improve local quality of life.

9.2 How Coastal Restoration Fits within the State's Economic Development Strategies

Understanding that coastal restoration can enhance an area's economic development, how can coastal restoration projects factor into state and local strategic planning? Three statewide strategies provide guidance on future directions for how policy makers and economic developers are targeting efforts for growth and development.[87] We relied on these strategies to understand how coastal restoration aligns with the larger job creation and business development initiatives underway in coastal North Carolina:

- The North Carolina Jobs Plan[88] is a 10-year strategic plan that focuses on industry clusters and branding, business climate, innovation and entrepreneurship, talent and retiree attraction, education and workforce development, rural prosperity, community development, and service delivery and metrics.

[87] These strategies were identified by the Rural Development office at the North Carolina Department of Commerce and the North Carolina Rural Economic Development Center as most important for guiding rural economic development.

[88] North Carolina Jobs Plan. (2013, December). *North Carolina Economic Development Board*. Retrieved from http://www.nccommerce.com/Portals/0/Documents/AboutOurDepartment/BoardsCommissions/NC%20Jobs%20Plan%20Report_Final.pdf

- The *2014 Report: North Carolina Regional and Statewide Strategies for Comprehensive Community Economic Development*[89] summarizes the community economic development strategies from regions across North Carolina into one strategy. This report addresses four goals: build on each region's competitive advantages and leverage the marketplace; establish and maintain a robust regional infrastructure; create revitalized, healthy, and vibrant communities; and develop talented and innovative people.

- The *Economic and Social Trends Affecting Rural North Carolina*[90] provides a broad understanding of rural counties in North Carolina with summary profiles of related conditions. By describing these conditions the report also points the way for opportunities to change.

Coastal restoration aligns with three main economic development strategies documented within these reports:

1. **Industry sector growth**: The North Carolina Jobs Plan and the *2014 Report* identify tourism and hospitality as a target industry for growth. Coastal restoration supports this industry by creating healthier coastlines for recreational use by tourists.

2. **Investment in rural North Carolina**: The NC Jobs Plan also addresses how to create jobs and encourage investment in rural areas of the state. Coastal restoration supports the call for the recruitment and homegrown development of seafood value-add production. With improved coastlines, fishing yields increase, encouraging greater supply of seafood; rural assets are enhanced, encouraging tourism and outdoor activity; and quality of life is improved with cleaner water and environment.

3. **Small business growth**: The North Carolina Rural Economic Development Center and the *2014 Report* underscore the importance of small businesses in the rural economy. The report cites that "business establishments with fewer than 50 workers provide more than half of all rural jobs."[91] Coastal restoration and the businesses that supply goods and services to support the work of coastal restoration are predominantly small businesses. Further, businesses in tourism, recreation, hunting and fishing—industries that benefit from a healthy shoreline—also comprise a healthy number of small businesses.

In these three ways, coastal restoration enhances aspects of leading state economic development strategies and facilitates desired outcomes from these statewide strategic plans.

Based on the state's current economic development strategies, there is ample opportunity to maximize coastal restoration for economic development. **Figure 9-1** illustrates how two of the state's leading strategies call for economic development practices where coastal

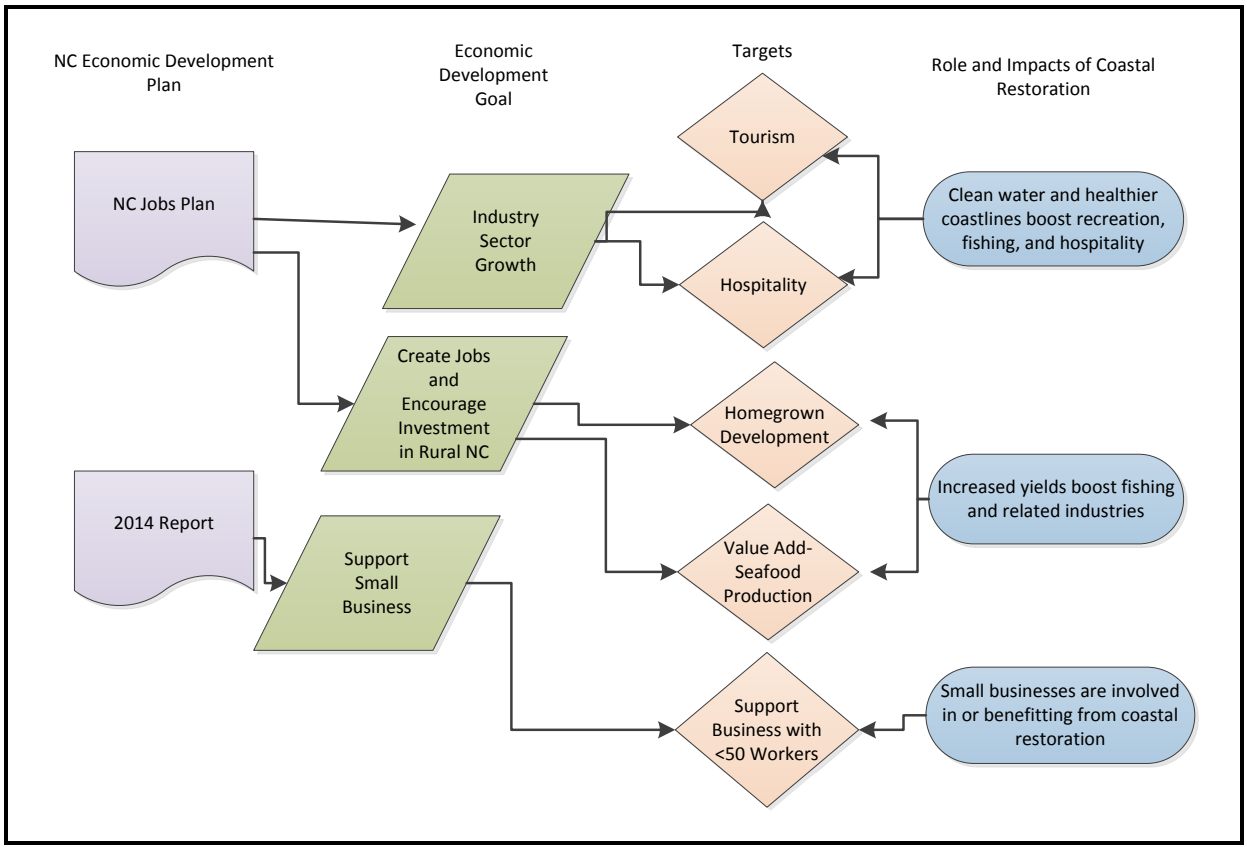
[89] North Carolina Association of Regional Councils with the U.S. Economic Development Administration, U.S. Department of Housing and Urban Development, and the North Carolina Department of Commerce. 2014. *2014 report: North Carolina regional and statewide strategies for comprehensive community economic development.*

[90] North Carolina Rural Economic Development Center. (2013, February). North Carolina rural profile: Economic and social trends affecting rural North Carolina. Raleigh, NC: North Carolina Rural Economic Development Center.

[91] Ibid

restoration can play a role in regional economic development. On the left are the two state strategies with alignment for coastal rural North Carolina—The NC Jobs Plan and the *2014 Report*. To the right of these documents are the economic development goals outlined in the strategies, and their specific targets within those goals are represented as triangles in the third column. The right column then shows how coastal restoration aligns and can affect these targets for economic development.

Figure 9-1. Coastal Restoration's Role in Economic Development Strategies



Coastal restoration has a demonstrated ability to positively impact the tourism and hospitality sectors, bolster homegrown development and benefit value-added seafood production specifically, and support small to medium-sized business in the region.

9.3 Partners in Coastal Restoration and Economic Development

It often requires a mix of partners to implement coastal restoration projects. Projects are funded, designed, executed, and evaluated by a collection of nonprofit organizations, government agencies (local, state, and federal), universities, and the private sector. This is helpful to understand because coastal restoration becomes further recognized as a tool for economic development in coastal North Carolina. We summarize the types of participants,

their general role in projects, and the specific organizations and agencies involved in **Table 9-2**. These partners are described in detail in Appendix A. We highlight the federal funding opportunities in **Section 9.4**.

Table 9-2. Partners in Coastal Restoration

Participant	General Role	Example Organizations or Agencies
Nonprofits	▪ Implement, monitor, and maintain projects	▪ North Carolina Coastal Federation ▪ The Nature Conservancy ▪ Pender Watch Conservancy Inc.
Local government	▪ Implement projects ▪ Community engagement ▪ Provide conservation and education programs ▪ Leverage state and federal resources ▪ Permitting	▪ Stormwater management division ▪ Soil and water conservation division
State government	▪ Leverage federal funding ▪ Support NC localities	▪ North Carolina Department of Natural Resources ▪ North Carolina Wildlife Resources Commission
Federal government	▪ Extensive funding opportunities	▪ U.S. Fish and Wildlife Service ▪ U.S. Environmental Protection Agency ▪ National Oceanic and Atmospheric Administration
Universities	▪ Research ▪ Project implementation and evaluation	▪ Duke University ▪ East Carolina University ▪ North Carolina State University ▪ University of North Carolina Chapel Hill
Private sector	▪ Project implementation ▪ Funding	▪ Consulting firms ▪ Corporate sponsors ▪ Mitigation banks

9.4 Federal Funding Opportunities

The federal government has proven to be an effective funding partner to states pursuing coastal restoration activities. **Table 9-3** lists the two agencies and their respective programs that offer mechanisms for states to develop coastal restoration strategies and implement related projects. Requirements and funding priorities within each of these programs fluctuate, but these programs remain a reliable funding source for North Carolina

to pursue economic development through restoration work. Two programs require state matches for grants and two do not. Regardless, these resources decrease the costs of economic development-related coastal restoration by half at minimum, or they can be implemented at no expense to the state. Thus, coastal restoration is a relatively low-cost effort for economic developers or others to pursue to generate jobs and support important industries while also preserving the state's shoreline.

Table 9-3. Federal Programs that Provide Grants for Coastal Restoration and Economic Development Projects

Agency	Program	Purpose	State Match Required	Other Notes
U.S. Fish and Wildlife Service	National Coastal Wetlands Conservation Grants Program	Eligible to all coastal states to restore and conserve coastal wetlands	Yes	NC did not access these grants in 2013
National Oceanic and Atmospheric Administration	National Estuarine Research Reserve System	Research grants estuarine conservation and restoration	No	28 states receive funding
	Coastal and Estuarine Land Conservation Program	Protect coastal and estuarine areas of significant value	Yes	Funds tend to go to state and local governments
	Coastal Zone Management Program	Addresses the economics and ecology of coastal changes	No	Funding supports planning and projects that seek to improve coastlines and related industries that benefit from healthy coastlines (e.g., tourism and fishing)
U.S. Department of Agriculture	Natural Resources Conservation Service	Reduce erosion, improve water supply and quality, increase wildlife habitats, and reduce potential damages caused by natural disasters	No	Funding is for agricultural producers and other landowners

(continued)

Table 9-4. Federal Programs that Provide Grants for Coastal Restoration and Economic Development Projects (continued)

Agency	Program	Purpose	State Match Required	Other Notes
U.S. Department of Agriculture	National Water Management Center	Focal point for water resources information	No	Technical assistance on compliance, planning, rehabilitation, and conservation techniques
	Voluntary Public Access and Habitat Incentive Program	Encourages private landowners to voluntarily make their land available to the public for wildlife-dependent recreation	No	To enroll, the state must participate in the program

More detail about these funding mechanisms, their goals, and the intent of the grants is in **Appendix A**.

9.5 Conclusion

A diverse portfolio of economic development tools and strategies is needed to foster job creation and a diverse industry mix, both of which are critical for a healthy economy. This research shows that there is an opportunity for coastal restoration to be a part of that economic development portfolio. Coastal restoration is relatively low cost but creates jobs and affects industries and households for workers in sectors such as construction, fisheries, tourism, and landscaping. These sectors offer jobs and positive economic spillovers for workers, demonstrating that restoration can be a source of economic opportunity. Furthermore, research and case studies demonstrate that the jobs and businesses supported are almost all local to the project, thus ensuring spillovers are accrued to the community.

In North Carolina, coastal restoration also offers a fresh approach for supporting small homegrown businesses, investing in rural areas, and supporting tourism and fishing industries—all of which are documented areas of importance within key state economic development strategic plans.

Case studies within the state demonstrate that in the short term, grant funds for restoration projects kick-start job creation both directly and indirectly; they increase levels of community engagement through volunteering and educational initiatives and help support broader industry growth. Eight million dollars in funding to four projects in North Carolina created 116 jobs, generated almost $14 million in revenue to coastal businesses, and

sparked $4 million in additional income to coastal households. Simultaneously, these projects preserved oyster and expanded beds and restored habitats, improving miles of the North Carolina coastline. Furthermore, local schools and hundreds of volunteers engaged in these activities, building local civic capacity. These impacts and outcomes demonstrate that coastal restoration and community economic development are compatible and reinforce positive economic and environmental returns to North Carolinians.

APPENDIX A:
PARTNERS IN COASTAL RESTORATION PROJECTS

A.1 Nonprofits

North Carolina's nonprofit sector is robust compared with many other states because of the state's unique and valuable natural assets and ecosystems. These nonprofits play a vital role by serving as partners with a variety of stakeholders to implement coastal restoration initiatives. Nonprofits often partner with local and state-level governments and organizations to receive and implement funding granted by the federal government. They have the volunteer base and connection with local communities to help implement, monitor, and maintain projects at a lower cost than other agencies or organizations may be able to. In some cases, nonprofits can help agencies and organizations gain access to funding reserved specifically for nonprofits but that can be used for larger projects and goals.

In North Carolina the main nonprofit organizations are:

- The North Carolina Coastal Federation—the state's only 501(c)(3) to focus solely on protecting and restoring the coast through education, advocacy, and habitat preservation and restoration.
- The Nature Conservancy—an international organization with a North Carolina chapter. Its mission is to conserve land and water by partnering with other individuals and organizations to implement collaborative approaches for conservation.
- Pender Watch and Conservancy Inc.—a volunteer organization that advocates for the environment generally but its work is significantly focused on building oyster reefs.[92]

A.2 Local Agencies

Local governments provide expertise to successfully implementing a project in the context of each distinct local North Carolina community where coastal restoration occurs. These departments provide valuable conservation and education programs, and are well positioned to leverage relevant state and federal resources to augment restoration initiatives. They are a crucial partner for ensuring effective community-engagement, logistical support, such as appropriate permits. Stormwater management and soil and water divisions within local governments tend to be the most involved in coastal restoration.

A.3 State Agencies

There are many state agencies in North Carolina either directly or indirectly involved in coastal restoration initiatives. State agencies can play an integral role in facilitating federal funding and initiatives on a local level, as well as support various environmental initiatives

[92] Pope, J. W. (2011, July 10). Pender Watch builds oyster reefs to benefit environment. Star News online. Retrieved from http://www.starnewsonline.com/article/20110710/articles/110719983

for local municipalities. The two overarching agencies involved in coastal restoration are the North Carolina Department of Environmental and Natural Resources (NCDENR) and the Wildlife Resources Commission. Nested underneath DENR are many divisions and programs that are involved in coastal restoration initiatives. They are as follows:

- NCDENR
  NCDENR has five main programs related to coastal restoration.
  - North Carolina Ecosystem Enhancement Program[93]
    This program aims to "provide cost-effective mitigation alternatives that improve the state's water resources." They offer four "In-Lieu Fee mitigation programs" that assist "private and public entities [to] comply with state and federal compensatory mitigation for streams, wetlands, riparian buffers, and nutrients." Mitigation bankers, discussed later in this section under "Private Sector," can be a valuable partner and tool in participating in this program.
  - North Carolina Division of Coastal Management[94]
    Division of Coastal Management "works to protect, conserve, and manage North Carolina's coastal resources through an integrated program of planning, permitting, education and research." They are involved in Coastal Area Management Act (CAMA) permits. This division includes the Coastal Resources Commission, manages oceanfront and estuarine shorelines, facilitates land use planning, and works with the Coastal Reserve Program in North Carolina.
  - North Carolina DMF[95]
    Marine Fisheries works to sustain marine and estuarine fisheries and habitats; because of their inclusion of "habitats" as part of their mission, Marine Fisheries has many resources and programs for coastal restoration and management efforts such as the "Shellfish Sanitation and Recreational Water Quality Proclamations."
  - North Carolina Division of Energy, Mineral and Land Resources[96]
    The Land Quality Section within this Division "regulates and provides technical assistance related to mining, dams, sediment and erosion control, and stormwater management." Another program included in this Division that is relevant to coastal management and restoration is the North Carolina Geological Survey, which provides maps of the coast and various resources.
  - North Carolina Division of Water Resources[97]
    The Division protects North Carolina's surface water and groundwater resources. They conduct water monitoring programs, issue pollution control permits, and carry out enforcement on state and federal water quality laws, including those that affect coastal waters and watersheds.

The North Carolina Wildlife Resources Commission[98] is a state agency that works to "conserve and sustain the state's fish and wildlife resources through research, scientific management, wise use, and public input. The Commission enforces the North Carolina

[93] http://portal.ncdenr.org/web/eep/at-a-glance
[94] http://portal.ncdenr.org/web/cm/
[95] http://portal.ncdenr.org/web/mf/
[96] http://portal.ncdenr.org/web/lr/
[97] http://portal.ncdenr.org/web/wq
[98] http://www.ncwildlife.org/

fishing, hunting, trapping, and boating laws" and is also involved in outreach, education, and research.

A.4 Federal Agencies

Though federal agencies are directly involved in coastal restoration efforts, they are also indirectly involved by providing a plethora of funding options for local and state agencies and nonprofits to work on coastal restoration. The main agencies involved are the

- U.S. Fish and Wildlife Service (USFWS),
- U.S. Environmental Protection Agency (USEPA),
- National Oceanic and Atmospheric Administration (NOAA), and
- U.S. Department of Agriculture (USDA).

While the USEPA's focus is more regulatory in nature, the USFWS and in particular NOAA both offer grants and programs through which states can receive funding for initiatives related to coastal restoration. These opportunities are discussed below.

USFWS

The National Coastal Wetlands Conservation Grants Program was established by the Coastal Wetlands Planning, Protection, and Restoration Act of 1990. To date, they have granted $183 million to states, with a required state match,[99] to restore and conserve coastal wetlands. All coastal states are eligible for funding under this Program. Local economies can benefit from this grant through jobs created during restoration projects, as well as through a protected and enhanced tourism industry. In 2013, North Carolina did not access these grants, suggesting that this Program is an untapped yet valuable resource that can benefit rural coastal North Carolina.

NOAA

Federal funding for coastal restoration is available primarily through NOAA, which is part of the Department of Commerce. The Coastal Zone Management Act (CZMA), passed by Congress in 1972, outlines three national programs that work to support NOAA's Next Generation Strategic Plan (NGSP):

- National Estuarine Research Reserve System (NERRS)
- Coastal and Estuarine Land Conservation Program (CELCP)
- National Coastal Zone Management Program

[99] http://www.fws.gov/coastal/coastalgrants/docs/2013_awards_%20list.pdf

Created to help plan for a changing future where an ever-growing percentage of the world's population lives on the coast, the NGSP aims to bring together goals of ecological and economical preservation, growth, and sustainability. The NGSP establishes four priorities in this Plan.

1. coastal communities that can adapt to the impacts of hazards and climate change
2. greater understanding of and preparation for the risks of climate impacts to coastal communities and ecosystem resources (i.e., sea level rise, change in hydrology, ocean acidification)
3. sound ocean management
4. maintain and improve coastal water quality

NERRS and CELCP are both targeted at understanding the ecological changes and responses coastal ecosystems are undergoing, as well as conserving coastal lands. NERRS provides funds to 28 state reserves to support estuarine conservation and restoration research. CELCP requires a one-to-one federal:state match and provides funds to eligible states and local governments to protect coastal and estuarine areas that have significant value.

The Coastal Zone Management Program aims to address both the economics and ecology of a changing coast and provides important opportunities for states to receive funding that supports sustainable economic development and growth. A partnership between states and NOAA, the Coastal Zone Management Program invites states to draft and submit for approval state coastal management plans (CMPs). The criteria, approval process, funding, and priority details are contained primarily within Sections 306, 306(A), and 309 of the CZMA. Of particular importance are the funding priorities for these sections, which can be leveraged to obtain funding for economic development opportunities.

Generally, these priorities offer opportunities to enhance the tourism sector through improved beach access, beach aesthetics, and waterfront and port quality. Through the achievement of these objectives, jobs are created across multiple sectors, including professionals to produce plans for the project; management of the project and location, construction; monitoring throughout project and afterwards (e.g., scientific, structural); and, finally, upkeep of the area and project infrastructure. These projects also have a positive impact on industries of particular importance to coastal towns, such as fishing (both recreational and commercial), aquaculture, and shipping.

The Coastal Zone Management Program offers two mechanisms that allocate grants to states in support of coastal management and economic development: Section 306/306A and Section 309.

Section 306/306A

- Section 306 authorizes grants to states with approved coastal management programs to administer their management programs.
- Section 306A awards grants to eligible states to support the following objectives, which can in turn support economic development initiatives:

1. Preservation or Restoration of Designated Areas of Importance [Section 306A(b)(1)]. Areas can qualify for this designation of importance for two main reasons: 1). it is an area of "conservation recreational, ecological, or esthetic value" or 2) it is in support of "restoring and enhancing shellfish production by the purchase and distribution of culch material on publically owned reef tracts." Both reasons indicate areas likely to be affected by growth or decline in tourism and fishing industries. Areas that qualify for "conservation, recreational, ecological, or esthetic value" designations also tend to be prime areas for tourism.

2. Redevelopment of Underutilized Urban Waterfronts and Ports of Particular Concern [Section 306A(b)(2)]. In addition to creating more areas of interest to tourists, using this funding to address waterfronts and ports that need repair can revitalize both shipping and aquaculture businesses. In the process of redeveloping underused waterfronts, jobs in design, construction, and management of waterfronts and ports are supported and potentially created.

3. Public Access to Beaches and Coastal Areas [Section 306A(b)(3)]. This objective has a clear link to the coastal tourism and recreational fishing industry. North Carolina is endowed with a coast full of beautiful beaches that draw people from around the country and the world; what is lacking in some parts of the coast is public access points. Using this funding to increase the number of public access points can augment the attractiveness of North Carolina beaches to tourists and recreational fishers by reducing the time to access the beach or overcrowding of public access points.

4. Development of Coordinated Process Between State Agencies for the Regulation and Issuance of Aquaculture Facility Permits [Section 306A(b)(3)]. A common malady that plagues the permitting process for coastal areas is coordination between departments and agencies on the federal and state levels. The permitting process can inhibit business owners and workers from engaging in coastal restoration-related business at all. By streamlining and coordinating the permitting process on the state level, state and local governments can make it easier to do business in the aquaculture industry.

Section 309

Section 309 establishes a grant program, Coastal Zone Management Grants, for state and Territory CMPs to aid in developing and implementing program changes within coastal zone enhancement plans.

Funding is available to CMPs that have completed and received approval for their Assessment and Strategy document and does not require a state match. Funds are allocated through the use of a weighted formula or through competitive award as a "Project of Special Merit." The weighted formula uses a "weighting factor" based on the quality of a state's Assessment and Strategy document, which takes into consideration the value of proposed program changes, technical merits of the Strategy and needs of the state, and cost-effectiveness and likelihood of success of the proposed program changes.

The enhancement areas for Section 309 offer ample opportunities to gain funding for economic development along the coast. NOAA has established nine enhancement areas that qualify for Section 309. They are each described in turn below.

1. Aquaculture. Funding has been used in many ways to support aquaculture. For example, Alabama has used Section 309 funding to perform a geospatial analysis of the coast so oyster farmers can determine prime locations for oyster farming that have minimal conflict with other permit holders and public areas. Thus, the funds have enhanced the knowledge and efficiency for maximizing the economic opportunities for oyster farming on the Alabama coast.

As mentioned in Section 306 funding, the permit process is often a barrier to people who would otherwise be participating in this industry. The ability to obtain funding to streamline this process could have positive impacts along the entire coast.

2. Coastal Hazards. Coastal hazards refer to factors related to development that can pose hazards to both economic and ecological resources on the coast. One example of how this funding is leveraged for economic gain is through addressing flood risk management and planning. Creating and implementing these plans result in construction and management jobs in addition to reducing risk of property and infrastructure damage.

Funding is also awarded to assess policies and implement change. North Carolina recently used this funding to assess and revise the Ocean Setback Policy and Inlet Management Plan. Through the evaluation of policy effectiveness, restrictions on specific development activities can be assessed for their efficiency and effectiveness, thus ensuring that an updated arsenal of economic development tools and opportunities are at hand at all times.

3. Cumulative and Secondary Impacts. Funding can be obtained to develop plans that support effective and efficient coastal management. This funding can include coastal

development, resource use, and other aspects that are directly tied to economic development. Having access to a source of funding that will allow for an assessment of different available coastal management plans can facilitate strategies that have the greatest positive local economic impact.

4. Energy and Government Facility Siting. This enhancement area allows officials and managers to understand the current status of energy sources within the state. Having this information allows for planning future initiatives, infrastructure development, and awareness of locations that may have a changing economic structure as a result of the introduction or removal of an energy industry.

5. Marine Debris. Marine debris in the ocean or on the beaches is unsightly and can therefore affect the desirability of these locations for tourists. Providing funding and planning for mitigation and removal of marine debris can provide permanent jobs through the removal of the debris and protect aspects of the economy that depend on the tourism industry.

Larger marine debris can pose a threat to infrastructure as well as watercrafts that local economies may rely on as a source of jobs or resources. Planning for the monitoring and removal of larger marine debris can provide jobs, protect the means of other local economic gains (jobs and resources), and prevent economic costs due to infrastructure and property damage.

6. Ocean Resources. Invasive species pose a threat to coastal states and economies by threatening local industries. Section 309 funding can provide a large number of jobs per dollar invested through invasive species removal with 33.3 jobs created per million invested.100 This will also protect the resources that other aspects of the economy depend on (tourism, fishing, aquaculture).

Further, monitoring resources that the economy depends on, such as specific fishes that the fishing or aquaculture industry relies on, can ensure long-term economic sustainability and continued growth. If the status of these resources is known over time, changes can be made to permitted takes to ensure that these resources can be relied on for the future to allow for continual economic growth.

7. Public Access. Increasingly public access has positive implications for tourism and recreational fishing (see Section 306/306A number 3 above).

[100] BenDor, T. K., Lester T. W., Livengood, A., Davis, A., & Yonavjak, L. (2014). Exploring and understanding the restoration economy (p. 14). Chapel Hill, NC: University of North Carolina, Center for Urban and Regional Studies.

8. Special Area Management Planning. This enhancement area specifically calls for creating a plan that provides natural resource protection, as well as reasonable coastal-dependent economic growth. Section 309 funding is a readily available resource allowing state officials to determine the best strategies to comply with natural resource protection policies, while at the same time allowing for economic growth initiatives.

9. Wetlands. Funding to monitor and manage the status of wetlands along the coast allows state officials to know at all times what development options are available to them in specific areas, based on the status of or presence of wetlands. Because wetlands draw both tourist and research monies into local economies, it is vital to stay aware of the status of this resource.

USDA

The Natural Resources Conservation Service is a program led by USDA that funds conservation and restoration efforts to reduce erosion, improve water supplies and quality, increase wildlife habitats, and reduce potential damages caused by natural disasters.[101] There are several smaller, more focused programs operating under USDA, including the National Water Management Center (NWMC) and Voluntary Public Access and Habitat Incentive Program (VPA-HIP).[102,103] The NWMC supports water initiatives toward water conservation and provides leadership, direction, information, and technology necessary for water and natural resources conservation. The VPA-HIP encourages private landowners—namely farm, ranch, and forest owners—to make available their land to the public for recreational activities dependent on wildlife such as hunting and fishing.

A.5 Universities

Five major universities in North Carolina play a major role in coastal restoration through research, restoration projects, and partnerships with other organizations and agencies. The primary universities and their specific areas of contribution are as follows:

- Duke University: Duke University Marine Lab[104]
  The Duke Marine Lab conducts research and coursework for university students year-round on marine systems, conservation, and restoration focused on a variety of topics including coastal and wetland ecology, ocean governance, and community-based conservation. Researchers and students affiliated with the Duke Marine Lab have been actively involved in monitoring restoration projects for organizations such as the Federation.

- East Carolina University: Institute for Coastal Science and Policy[105]
  The Institute for Coastal Science and Policy seeks to better understand the complex

[101] http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/
[102] http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/nwmc/
[103] http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=pahp
[104] http://nicholas.duke.edu/marinelab
[105] http://www.ecu.edu/icsp/ICSP/ICSP.html

interactions between human behavior and the marine environment and its resources for developing sound public policy. Research includes topics such as the relationship between climate change and oyster abundance, coastal ecology, coastal geoscience, social science and coastal policy, and maritime studies.

- North Carolina State University: Sea Grant[106]
  North Carolina State University's Sea Grant office has program areas in coastal hazards (construction and future flooding risk), healthy coastal watersheds, fisheries and aquaculture, sustainable communities, education, and training. Sea Grant seeks to provide unbiased scientifically sound research, education, and outreach for the state's coastal ecosystem.

- University of North Carolina: Coastal Studies Institute[107]
  University of North Carolina Coastal Studies Institute (UNC-CSI) conducts research, provides educational programs, conducts community outreach, and fosters communication among those interested in the history, culture, and environment of coastal North Carolina. Research areas are five: estuarine ecology and human health, coastal engineering and ocean energy, public policy and coastal sustainability, maritime heritage, and coastal processes. UNC-CSI connects and collaborates with universities all along the coast.

- University of North Carolina–Wilmington: The Center for Marine Science[108]
  University of North Carolina–Wilmington provides a multidisciplinary approach to marine research. One of their four main research areas is coastal and wetland studies, which includes a shellfish research hatchery (in partnership with NCDENR) and a water quality and environmental assessment program called the "Lower Cape Fear River Program," which aims to understand the "fundamental scientific processes shaping and controlling the ecology of the Cape Fear River system and provide a mechanism for information exchange and public education."

A.6 Private Sector

The private sector is mainly involved in coastal restoration on a consultancy basis, working with agencies and organizations that have received funding to perform restoration, conservation, or research, or through providing funding and resources to carry out this work. Three overarching categories are involved in the private sector: consulting firms, corporate sponsors, and mitigation banks.

- Consulting Firms
  Consulting firms are typically involved in coastal restoration projects when specific technical expertise is required that an agency or organization may not have in house. Examples of such services include assessments for wetlands or to meet a variety of CAMA requirements; surveys for species diversity and endangered species; permit assistance; and general project management. Many environmental consulting firms are located throughout North Carolina that specialize or have experience with coastal ecosystems.

[106] http://ncseagrant.ncsu.edu/
[107] http://csi.northcarolina.edu/
[108] http://www.uncw.edu/cms/index.htm

- Corporate Sponsors
  Many local and nonprofit organizations rely on corporate sponsorships and donations in their annual budget or are able to grow because of these sponsorships. Corporations can also be key partners for all levels of government in regulating various laws, connecting with local communities, and increasing technical knowledge and resources in environmental protection and restoration.

- Mitigation Banks
  Mitigation banks are essentially "credits" created when wetlands, or other aquatic resource areas, have been restored, established, or preserved, to compensate for "unavoidable impacts to aquatic resources permitted under Section 404 [of the Clean Water Act] or a similar state or local wetland regulation."[109] There are organizations that will place land under permanent easements, restore it, and then sell the mitigation credit to developers that require them by law; the sale of these credits allows for these organizations to continue their work. Typically these organizations are limited liability companies.

[109] http://water.epa.gov/lawsregs/guidance/wetlands/mitbanking.cfm