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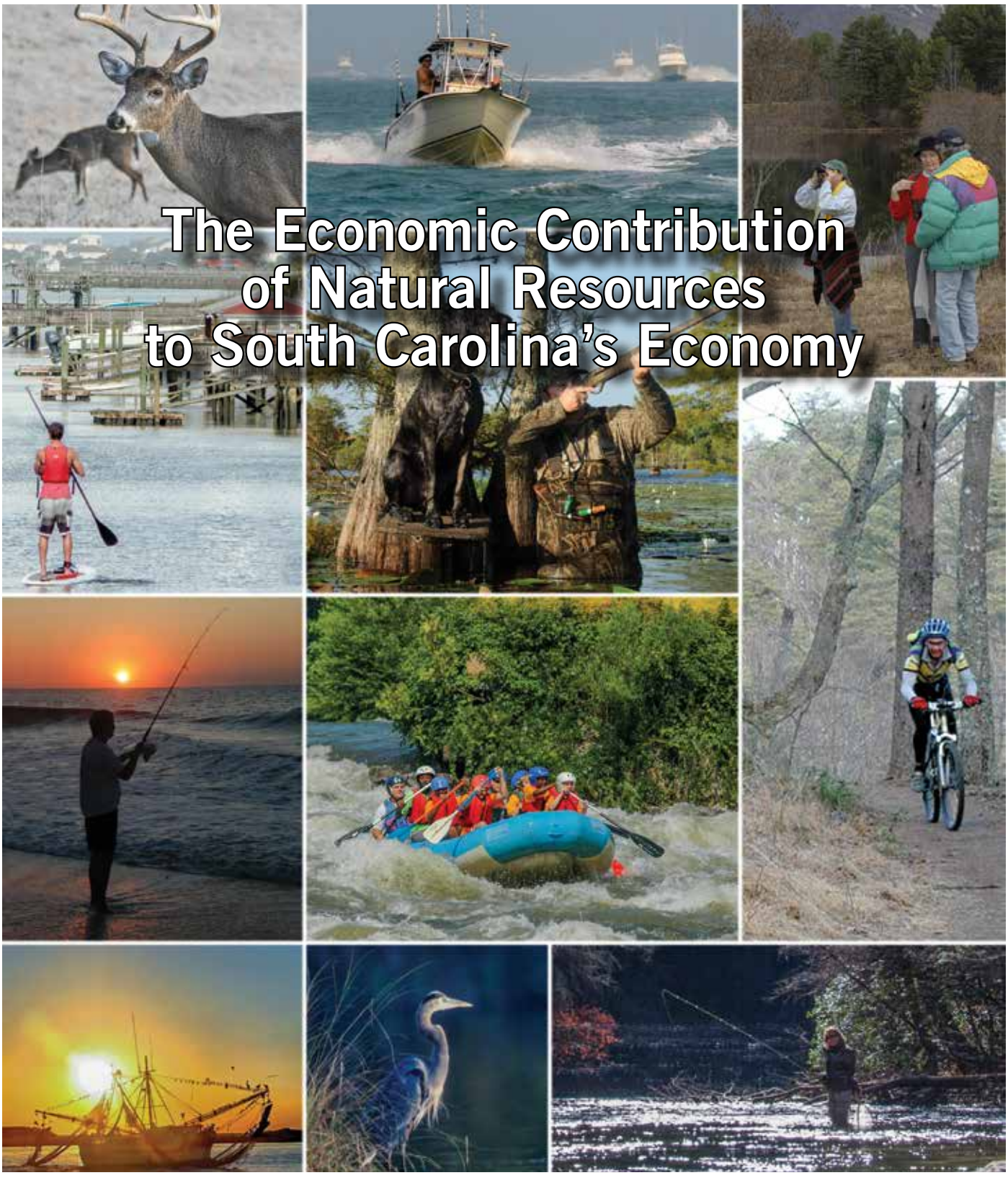
The Economic Contribution of Natural Resources to South Carolina's Economy



South Carolina is blessed with abundant natural resources and diverse landscapes, from the edge of the Blue Ridge Mountains in the northwestern part of the state, the rolling hills of the Piedmont, the Sandhills, the Coastal Plain, and the coast with its beaches and marshes. The beauty and abundance of its natural resources attracted the first European settlers. Any economy is based on natural resources, and South Carolina's culture, history, and development has its foundation in its natural resources.

Natural resources are raw materials from the earth that man extracts and employs for some use. Typically, they include air, water, land, minerals, and plant and animal life. Since they are building blocks for anything economic developed by man, much of South Carolina's economy could easily be tied to them. This report focuses on the economic impact of natural resources on South Carolina's economy. Rather than using a broad definition of natural resources and including much of the state's economy (for example, agribusiness that is directly tied to the land), our emphasis is on the traditional natural resources: outdoor recreation (hunting, fishing, wildlife watching, and nature-based tourism), forestry, mining, boat manufacturing, and commercial fishing. This definition builds on an earlier study that centered on those resources (Division of Research 2009).

These natural resources helped form the character of the state and its people. The coast, with its access to the bounty of the sea and its marshes, defined early settlement in the colony. Its earliest industries developed from those natural resources (rice and indigo culture and fur trade). Native plants and animals provided food and shelter. The state's economic development, continuing to today, hinged on its natural resources. South Carolina's diversified economy and competitive advantage will only thrive if its natural resources are protected, promoted, and developed to ensure sustained growth of its economy.

This pattern of resource development is ingrained in the state's character and economic development. The rice culture can still be seen in extant tideland rice fields along the coastal rivers. The Upstate of South Carolina supported at least 25 charcoal iron furnaces from the late seventeenth to the late eighteenth centuries. Thousands of acres of timberland became barren "coaling grounds" used to produce charcoal for the iron furnances (Ferguson and Cowan 1997). The coastal region had the naval stores industry that relied primarily on the longleaf pine for the production of tar, pitch, and turpentine (Harmon and Snedeker 1997). These products were first used for chalking and waterproofing ships and the name derives from that.

South Carolina's forests, rivers, and lakes are some of its most important Natural resources (Fairfield Economic Development).

South Carolina's natural resources are the foundation of its environment and economy. Large parts of its manufacturing economy rest upon that foundation, as well as huge non-manufacturing sectors like nature-based tourism and outdoor recreation. The state's rivers, lakes, forests, and coast do much to define its character. Forests cover just over two-thirds of the state and its lakes, rivers, and coastal waters account for about six percent of its area (Oswalt et al. 2014). These support a tremendous economic value (not well-measured in the traditional marketplace) based on outdoor recreation, including activities like hunting, fishing, bird watching, boating, and camping. Mining, boat manufacturing, and commercial fishing provide additional economic impact. This report summarizes an analysis of the contribution of that economic impact on the South Carolina economy.

The traditional natural resource-based industries are obvious. Pulp and paper mills, sawmills, and plywood and panel mills are tangible and easy to see. Agribusiness (traditional agricultural and forestry production, including food and wood processing, and their related support sectors) constitutes the state's largest industrial sector. Considering just manufacturing activity, and not non-market benefits and ecosystem services like air and water quality, it is responsible for roughly five percent of the state's economic activity. Sportsmen, recreationists, and tourists contribute to the economy in a less tangible way, but also represent a significant economic impact. Our analysis attempts to account for both types of natural resource economic impacts.

South Carolina has historically been a natural resource-based economy. Early examples are iron production in the Upcountry and naval stores production in the Lowcountry.

Background on South Carolina's Natural Resources

Before discussing input-output analysis (the methodology used to model the state's economy), economic impact, and specific analysis results, a general discussion of especially relevant sectors of South Carolina's economy will add perspective. The natural resources that form the foundation for this economic impact will be described. The literature contains much background that will add insight to later descriptions of economic impact (like numbers of hunters and anglers in the state) and it provides a valuable overview of the role of natural resources in the state's economy.

Outdoor Recreation – Economic Impact

Outdoor recreation is a broad area of economic activity and includes many activities: bicycling, camping, fishing, hunting, motorcycling, off-reading, snow sports, trail sports, water sports, and wildlife-viewing. Over half of South Carolinians participate in outdoor recreation each year (Outdoor Industry Association 2016) and the outdoor consumer has wide demographics, including all genders, ages, ethnicities, and income levels. Outdoor experiences range from backyards to wilderness. Consumer spending, economic impact, tax revenues generated, and job creation make it one of the nation's significant economic sectors. Snow sports provide a good example; Americans spend nearly as much on snow sports and they do on internet access (Outdoor Industry Association 2012).

Spending for outdoor recreation has two main components: the purchase of gear and vehicles and dollars spent on trips and travel. Gear purchases include items like outdoor apparel and footwear, bicycles, skis, fishing gear, tents, rifles and shotguns, and backpacks. Vehicles include boats, motorcycles, recreational vehicles, snowmobiles, and all-terrain vehicles. In order to use all this gear consumers must spend money on day and overnight trips, airfares, rental cares, lodging, campgrounds, restaurants, groceries, gasoline, and even souvenirs. They also pay for river guides and outfitters, lift tickets and ski lessons, entrance fees and licenses. These activities support many small businesses. Rafting outfitters on the Chattooga River in Oconee County provide a good example. As these consumers visit outdoor recreation areas they benefit from services provides by land managers, park rangers, wildlife managers, and non-profit organizations. This is what adds up to the economic contribution. In terms of direct sales, about one-fifth of expenditures are for outdoor recreation gear and vehicles and four-fifths are trips and travel-related spending (Outdoor Industry Association 2012).

Estimates for South Carolina, based on 2011-2012 data, show that the outdoor recreation economy has been increasing at about 5 percent annually (even during the last economic recession) and plays a huge role in the state's economy (Outdoor Industry Association 2016). Over one-third of South Carolinians participate in hunting, fishing, and wildlife viewing (U.S. Fish and Wildlife Service 2014).

South Carolina's Outdoor Recreation Resources - Water

The total land area of South Carolina (not including water bodies) is 19.2 million acres and just over two-thirds of that area, 13.0 million acres, is forested (Rose 2015). The other obvious resource is water. A little over 1.3 million acres of South Carolina is surface water. That equates to 6% of the state's surface offering water-based recreational opportunities.

South Carolina's total area is 20.5 million acres. Land accounts for 19.2 million acres and water for 1.3 million acres. Forests cover 13 million acres.

The state's major rivers rise in the Blue Ridge and generally flow from the northwest to southeast (Figure 1). There are four major river basins in South Carolina: the ACE River Basin with sub-basins consisting of the Ashepoo, Combahee and Edisto Rivers; the Pee Dee River Basin with sub-basins consisting of the Black, Little Pee Dee, Lynches, Great Pee Dee and Waccamaw Rivers; the Santee River Basin with sub-basins consisting of the Cooper, Santee, Congaree, Saluda, Broad, Wateree and Catawba Rivers; and the Savannah River Basin which spans portions of South Carolina, Georgia and North Carolina.

The Chattooga National Wild and Scenic Rivers is one of the state's best-known water-based outdoor recreation opportunities (USDA Forest Service).

South Carolina has no large natural lakes. However, reservoirs created for hydro-electric power form several large lakes (Figure 1). The state has 1,617 lakes larger than 10 acres in size that cover a total surface area greater than a half-million acres. Nineteen reservoirs larger than 1,000 acres account for more than 88 percent of that surface water (Table 1). While most of these lakes were created for power production, recreation is also a major use. The major lakes include: Lakes Jocassee, Keowee, Hartwell, Richard B. Russell, and Strom Thurmond (formerly Clarks Hill) on the Savannah River; Lakes Greenwood and Murray on the Saluda River; Monticello and Parr Reservoirs on the Broad River; Lakes Wylie and Wateree and Fishing Creek Reservoir on the Catawba and Wateree Rivers; Lakes Marion and Moultrie on the Santee and Cooper Rivers; and Lake Robinson on Black Creek (South Carolina Department of Parks, Recreation, and Tourism 2014).

South Carolina shares the Chattooga National Wild and Scenic River with Georgia and North Carolina. In addition, nine river segments in the state have been designated South Carolina State Scenic Rivers. They are (with length of river segment): Ashley River (24 miles), Black River (75 miles), Broad River (15 miles), Catawba River (30 miles), Great Pee Dee River (70 miles), Little Pee Dee River (62 miles), Lower Saluda River (10 Miles), Lynches River (102 miles), and Middle Saluda River (5 miles). Other river segments are eligible for inclusion in the system (South Carolina Department of Natural Resources 2016a).

Three of the largest lakes in Table 1 were developed by the U.S. Army Corps of Engineers as hydro-electric projects. Lakes Thurmond, Hartwell, and Russell are three of the largest Corps projects in the country and some of the most popular recreational lakes under their management. Their combined water surface area is over 150,000 acres that form part of the border between the Georgia and South Carolina. In addition, the Corps controls nearly 130,000 acres of land surrounding the lakes. These lands support recreation areas, campgrounds, picnic areas, and wildlife management areas (U. S. Army Corps of Engineers 2016).

Figure 1. Major rivers and lakes of South Carolina (U.S. Geological Service).

Table 1. Major reservoirs of South Carolina (South Carolina Department of Parks, Recreation, and Tourism 2014).

Reservoir	Surface Area (acres)
Lake Marion	110,600
Lake Thurmond	70,000
Lake Moultrie	60,400
Lake Hartwell	56,000
Lake Murray	51,000
Lake Russell	26,650
Lake Keowee	18,372
Lake Wateree	13,710
Lake Wylie/Catawba	12,455
Lake Greenwood	11,400
Lake Jocassee	7,565
Monticello Reservoir	6,800
Parr Reservoir	4,400
Fishing Creek Reservoir	3,370
Par Pond	2,700
Lake Robinson	2,250
Lake Bowen	1,600
North Saluda Reservoir	1,080
L-Lake	1,050

South Carolina has 11,000 miles of rivers and streams (almost one-half mile for each square mile of land surface), more than 1,600 lakes greater than 10 acres in size, including 19 reservoirs greater than 1,000 acres in size.

South Carolina's coast measures about 190 miles. But that is deceptive, if the outer coast, offshore islands, sounds, bays, rivers, and creeks to the head of tidewater are considered, the miles of coastal shoreline increases to 2,876 miles (eleventh longest in the nation). The coastal beaches are the basis of the coastal tourism economy. Myrtle Beach is the second-ranked national beach destination in the country and further coastal attractions dot the coast all the way to the Savannah River (South Carolina Department

of Parks, Recreation and Tourism 2014). The South Carolina coast represents a distinct economic sector supporting much of the coastal tourism.

South Carolina Outdoor Recreation Resources – Parks, Forests, and Wildlife Areas

South Carolina has 47 state parks (Figure 2). These parks trace their beginning to the Civilian Conservation Corps (CCC). Sixteen state parks were constructed by the CCC. Myrtle Beach State Park was the first to open in 1936. Each state park has a combination of natural and historical attractions. Regular activities are fishing, boating, paddling, golfing, hiking, biking, swimming, beaches, waterfalls, camping, lodging, picnicking, interpretive and educational programs, and equestrian trails. Historical sites include settlements sites, historical homes and plantations, battlefields, and burial sites and cemeteries. The state parks provide 80,000 acres of protected areas that provide diverse outdoor experiences that are representative of the state's rich foundation of natural, historic, and cultural resources (South Carolina Department of Parks, Recreation, and Tourism 2016a). Congaree National Park is South Carolina's only national park. The National Park Service also maintains a national monument, national battlefield, national military park, national historic trail, national heritage corridors, and national historic sites. Congaree National Park is the largest intact expanse of old-growth bottomland hardwood remaining in the southeastern United States. The park has 25 miles of hiking trails and 2.4 miles of boardwalk. It protects over 26,000 acres of forest (National Park Service 2016).

The South Carolina Forestry Commission manages five state forests that provide a wide range of forest

Figure 2. South Carolina has 47 state parks scattered across the state (South Carolina Department of Parks, Recreation, and Tourism).

Anglers make use of the state's many waters.

recreation opportunities: Sand Hills in Chesterfield and Darlington Counties (46,838 acres), Harbison in Richland County (2,137 acres), Manchester in Sumter County (28,675 acres), Wee Tee in Williamsburg and Georgetown Counties (12,403 acres), and Poe Creek in Pickens County (2,498 acres). The state forests are internationally-certified as providing for sustainable forest management (South Carolina Forestry Commission 2016).

South Carolina has two national forests that encompass over 630,000 acres. The Francis Marion National Forest is near the coast and the Sumter National Forest is in the Upstate (Figure 3). Recreational opportunities vary with the landscape, from the mountain to the coast, or from whitewater rafting, kayaking, and canoeing on the Chattooga River to Lowcountry experiences that include swamps and maritime forests (USDA Forest Service 2016).

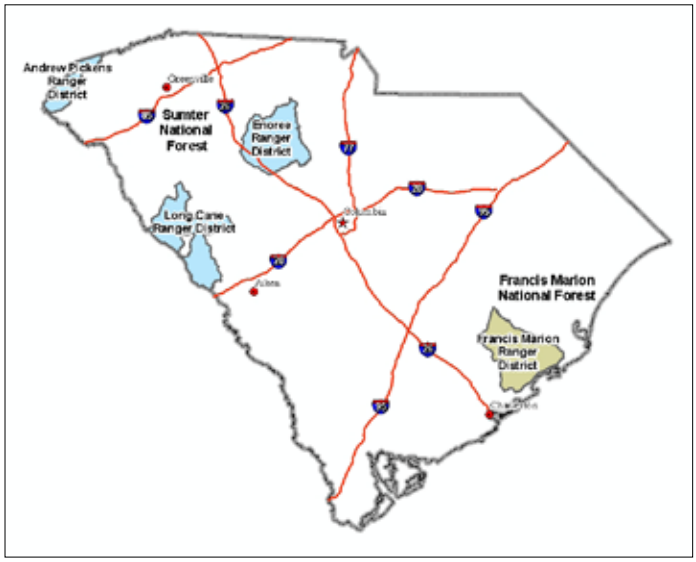


Figure 3. South Carolina's two national forests are divided into four ranger districts (USDA Forest Service 2016).

The South Carolina Department of Natural Resources (SCDNR) manages over 1.1 million acres in the state for wildlife. About 850,000 acres of Wildlife Management Areas are leased from private landowners and the USDA Forest Service (Figure 4). The additional acreage is state-owned lands managed as Wildlife Management Areas (including some State Forests and Heritage Preserves lands (South Carolina Department of Natural Resources 2015). The SCDNR also manages 74 Heritage Preserves that total over 90,000 acres throughout the state. These range from 1 acre to 24,000 acres. They are unique natural sites that are preserved, but recreational opportunities are allowed like trails, wildlife viewing, organized historical and natural events, and hunting (South Carolina Department of Natural Resources 2016b).

Figure 4. Wildlife Management Areas in South Carolina (SCDNR).

There are eight national wildlife refuges in South Carolina: ACE Basin, Carolina Sandhills, Cape Romain, Pinckney Island, Santee, Savannah, Tybee, and Waccamaw (Figure 5). They total just over 187,000 acres. Recreational opportunities are wildlife-oriented and include hiking trials, hunting, fishing, canoeing, kayaking, boating, birding, and picnic areas (U.S. Fish and Wildlife Service 2016).

There are close to 3,000 miles of trails in South Carolina. Many are managed by some of the groups already discussed. Some link existing trails into larger trail systems. When completed, the Palmetto Trail will cross the entire state from Oconee State Park in the Blue Ridge all the way to the sea north of Charleston (425 miles). Trails provide a variety of outdoor activities opportunities, like mountain bicycling, hiking, fitness walking, all-terrain vehicles, and equestrian use (South Carolina Department of Parks, Recreation and Tourism

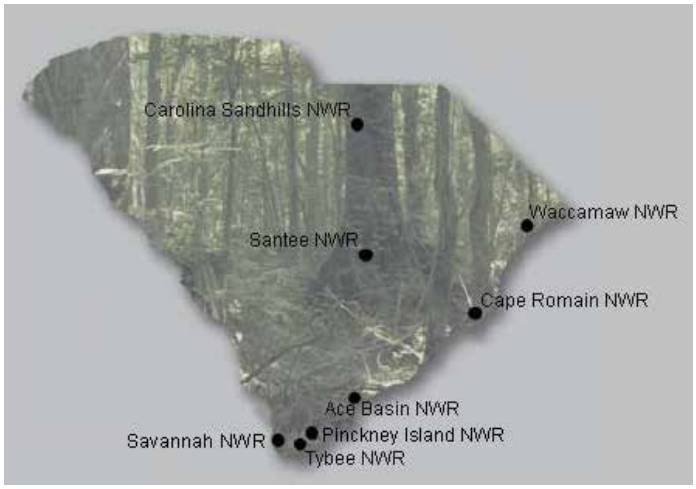


Figure 5. South Carolina's eight National Wildlife Refuges (U.S. Fish and Wildlife Service).

2016b). The state also has a system of scenic byways (South Carolina Department of Transportation 2016).

South Carolina established a Conservation Bank in 2002 that has conserved over 200,000 acres of forestland/wetlands, 8,000 acres of urban parks, 20,000 acres of farmland, and 500 acres of historical lands over the past ten years (South Carolina Conservation Bank 2016). In addition, over two dozen private non-profit land trusts have been organized across the state to preserve lands that are in danger from development pressure. Sometimes land is acquired by purchase or donation, or protection is provided by conservation easements. Over a quarter million acres have been conserved in South Carolina under these programs (Chang 2011).

South Carolina has 47 state parks, a national park, five state forests, two national forests, 1.1 million acres of wildlife management areas, 74 heritage preserves, eight national wildlife refuges, and nearly 3,000 miles of trails.

Fishing, Hunting, and Wildlife-watching as Economic Activities

The U.S. Fish and Wildlife Service conducts a national survey of fishing, hunting, and wildlife-associated recreation every five years in order to establish the economic impact of wildlife-related recreation in the United States. The most recent survey was completed in 2011 and the results included a report for the state of South Carolina (U.S. Fish and Wildlife Service 2014). Wildlife-related recreation includes fishing, hunting, and wildlife-watching activities (observing, photographing, or feeding fish or wildlife). Many individual engage in multiple activities, so the survey did not use mutually

Outdoor recreation involves many activities besides hunting and fishing.

exclusive categories. Thus, multiple responses (for example, someone who both hunted and fished) result in categories that do not sum up to totals.

The survey included state residents and nonresidents and was limited to those16 years of age and older. The number of participants in wildlife-related activities is listed below. State residents comprise three-quarters of anglers, 71 percent of hunters, and 85 percent of wildlife-watchers. Watching wildlife away from the home (more than one mile from the home) totaled 4.3 million days of activity. However, most people (83 percent) enjoyed wildlife-watching close to home.

Of the 1.7 million participants, 43% fish, 15% hunt, and 64% watch wildlife.

The most popular wildlife-watching activity around the home was wildlife feeding and away from the home was observing and photographing wildlife. Survey results were:

- **1.7 million** participants in wildlife-related activity in South Carolina.
- **744,000** state residents and nonresidents fished.
- **254,000** state residents and nonresidents hunted.
- **1.1 million** state residents and nonresidents wildlife-watched.

The amount of time spent in pursuing these activities relates to the economic impact. Average number of days per year spent by anglers was 15 days, by hunters was 17 days, and by wildlife-watchers (away from home) was 11 days. Popular activities involving wildlife-watching (away from home) include feeding, observing, and photographing wildlife, maintaining natural areas and plantings, and vising parks and natural areas. Total days of participation by activity for 2011 were:

- **11.2 million** days spent fishing.
- **4.4 million** days spent hunting.
- **4.3 million** days spent wildlife-watching (away from home).

Wildlife-related recreation has a huge impact on the state. The survey collects data on total expenditures, and breaks that down into trip-related (food, lodging, and transportation), equipment (rods, reels, lines, guns, ammunition, camping equipment, special clothing, boats, vans, and binoculars), and other categories (licenses and permits, magazines, land leasing and ownership).

Average expenditure per angler was $910; per hunter was $1,933; and per wildlife-watcher was $413.

For all activities the main expenditure was trip-related, with equipment being a strong secondary expenditure (Table 2). Note that these are direct expenditures and do not include any additional incremental impacts. Total expenditures for the three activities were: (U.S. Fish and Wildlife Service 2014)

- **$1.7 billion** spent on all wildlife-related recreation in South Carolina.
- **$686 million** spent on fishing-related activities.
- **$505 million** spent on hunting-related activities.
- **$467 million** spent on wildlife-watching activities.

Table 2. Wildlife-related activity expenditures in South Carolina by category, in millions of dollars, 2011 (U.S. Fish and Wildlife Service 2014).

	Expenditures		
	Trip-related	Equipment	Other
Fishing	$360	$319	$7
Hunting	$230	$192	$84
Wildlife-watching	$261	$191	$15

Wildlife photography is a popular wildlife-related activity in South Carolina (U.S. Fish and Wildlife Service).

Anglers spend over 11 million days annually fishing in South Carolina (U.S. Fish and Wildlife Service).

Forest Resources

Not only do forests represent the dominant landscape of the state, they also support its dominant manufacturing industry. Forests are renewable resources that contribute to the growth of the state, while providing its citizens desirable aesthetic, recreational, wildlife, water quality, and other environmental values. None of the vast outdoor recreation opportunities already discussed would exist without these forests.

Early settlers wrote of luxuriant forests covering most of the state, with the exception of salt marshes, occasional meadows, and Native American clearings. Most of the Piedmont was cleared for agriculture, and towards the end of the nineteenth century, lumbering grew as an industry in the coastal plain. By the end of World War II only scattered vestiges of the virgin forest remained, but a second-growth forest had reclaimed the cut-over lands and abandoned farmland. This second-growth forest supplied most of the commercial timber cut in the state from mainly pine stands growing on previously cultivated land.

The total land area of South Carolina (not including water bodies) is 19.2 million acres and just over two-thirds of that area, 13.0 million acres, is forested. Almost all of that forestland is productive timberland (Rose 2015). The acreage of forestland in the state has been relatively stable over the last fifty years. This has occurred while forestland acreage has steadily been lost to urban development (averaging roughly 36,000 acres per year). Afforestation of agricultural lands partially accounts for the relative stability of the forestland base (Harper and Rominger 2013). Urban development will continue to erode both the forest and agricultural land base and a stable forestland area cannot be expected in the long-run. A recent study of Southern Piedmont forests supported this conclusion with expectation of a declining forestland area due to increasing population and urban development (Rummer and Hafer 2014).

Since 1936 timberland acreage has increased by 2.3 million acres or by over 20 percent.

About 88 percent of South Carolina's forest area is privately-owned (Rose 2015). The private forest ownership produces roughly 95 percent of the state's timber harvest (Mo, Straka, and Harper 2013). Of the 12 percent that is publicly-owned, about two-thirds is federally-owned, about one-fifth is state-owned, and the rest is locally-owned (Butler 2008). Of the private forestland, about 63 percent is owned by family forest owners and the rest is owned by timberland investment management groups, corporations, and forest industry (Conner 2011). Family forest owners represent the major ownership group and the largest source of timber in the state (Williams, Straka, and Harper 2012). Figure 6 shows the distribution of public and private forestland in South Carolina.

About 88 percent of South Carolina's forest land is privately-owned and almost two-thirds of that is owned by family forests. These family forests are becoming smaller due to parcelization.

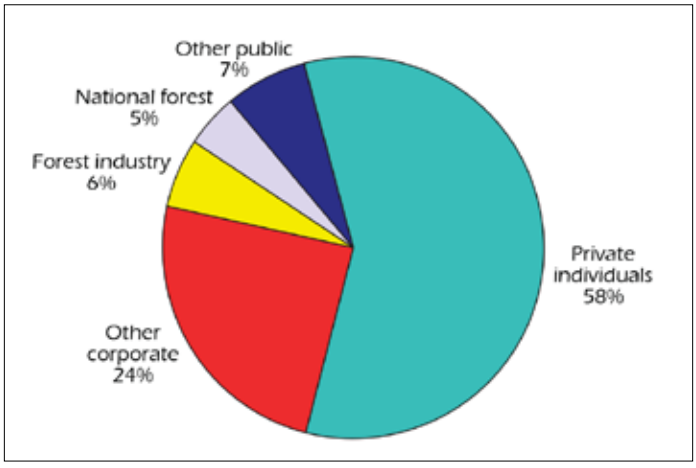


Figure 6. Public and private forestland in South Carolina (South Carolina, 2010. Forest Inventory & Analysis Factsheet, Conner, 2011).

Hunting activities in South Carolina account for over one half billion dollars annually of total expenditures.

Two trends in forest ownership have implications that will impact forestland. First, in 1986 forest industry owned or controlled 2.7 million acres of timberland (Tansey 1987); in 2012 forest industry owned just 200 thousand acres in the state (Harper and Rominger 2013). These acres are some of the most productive forestland in the state that tended to be intensively managed for timber production. They are now owned by real estate investment trusts and institutional investors and are still under intensive forest management. These new owners buy and sell holdings more often than the old stable forest industry owners, so there is a trend for land with development potential to be converted from forest use (Hatcher et al. 2012). Second, nearly two-thirds of the private forestland in the state is controlled by family forest owners, mainly individuals. Parcelization or the process of these tracts becoming smaller and smaller as they move through estates, is also leading to forest conversion for development. Even if the tracts are not developed, smaller tracts tend to be managed less intensively (Hatcher et al. 2013). Thus, the stable forestland base in South Carolina can be expected to erode under development pressures.

Timber production in South Carolina has increased steadily over the last 80 years. During the same time period, forest inventory has nearly doubled as the result of active forest management.

Mining, Boat Manufacturing, and Commercial Fishing

Our analysis focuses on the natural resources and recreational activities already discussed. In addition, directly related to natural resources, three other industrial sectors contribute to the economic impact of natural resources: mining, boat manufacturing, and commercial fishing.

The mining sector comprises establishments that extract naturally-occurring mineral solids and liquid minerals. Mining includes quarrying, well operations, beneficiating (e.g., crushing, screening, washing, and flotation), and all other preparations normally performed at a mine site. The *2012 Economic Census of the United States* found 75 mining establishments in South Carolina, employing 1,151 people, with a payroll of $63 million, and a value of shipments of $313 million (U.S. Census Bureau 2016). Notice these data reflect the recent recession, while our analysis shows the recent growth in this sector.

The recreational boating industry represents production of boats, engines, trailers, accessories, and gear used by boaters and anglers in South Carolina. A 2013 survey found almost 400,000 recreational boats in the state (National Marine Manufacturers Association 2016). In 2012, commercial fishermen in South Carolina landed12.3 million pounds of finfish (2.4 million pounds) and shellfish (9.9 million pounds), earing $24 million in landing revenue. (National Marine Fisheries Service 2014).

Input-Output Contribution Analysis

Natural resources and natural resource-based products generate a significant economic contribution to the well-being of South Carolina residents. This contribution is derived through the economic activity associated with both extractive consumptive uses (such as harvesting trees, mining, hunting, and commercial fishing) and non-consumptive uses (such as hiking, bird watching, water skiing, and camping) of the state's natural resources. Moreover, the direct expenditures on natural resource-based economic activities have spillover, or indirect and induced, effects on other sectors of the state economy which result in additional economic activity.

Input-Output (I-O) analysis is a technique commonly used to measure the total, or overall, economic impact of expenditures in one industry, or sector, of the economy on the overall level of economic activity. I-O models accomplish this task by tracing the economic linkages of consumer and/or industry expenditures in one or more industries to all other industries within the economy. I-O models also systematically capture expenditure linkages between industries and other economic agents, such as households and government. For example, consumer expenditures received by the producers of natural resource-based products cause those producers to purchase more inputs to produce additional natural resource-based products. This economic activity generates additional labor payments to both those employees working in the industry that supply the natural resource-based product or service, and those employees that supply the inputs used by natural resource-based industries to produce their final product. The additional labor payments received by households are then respent by the households and generate additional economic activity.

Expenditures tied directly to the primary economic activity or activities of interest are referred to as the direct effect in I-O analysis. For example the direct effect (expenditure) for a weekend fishing trip may consist of expenditures for transportation, dedicated fishing supplies, food, and lodging. But these direct effects only partially account for the total economic impact of the fishing trip. The direct effect generates indirect and induced effects which contribute to the total level of economic activity.

To continue with the fishing example, businesses affected by the direct fishing expenditure will purchase inputs from other businesses to produce the goods and services purchased by the fisherman. This secondary impact is referred to as the indirect effect. Moreover, the salaries and profits paid to employees and owners of the indirectly affected industries allow for additional purchases of South Carolina products by those individuals, thus setting off another round of economic activity that form the induced effect. The sum of the direct, indirect, and induced effects comprise the total economic impact of dollars directly injected into one sector of the state economy. This impact is summarized by the economic multiplier for the industry sector that translates one dollar of direct expenditure in the economic sector into a total statewide economic impact. To illustrate, an economic multiplier of 1.5 implies that a dollar of direct expenditure in a specific economic sector generates a total economic impact of $1.50 on the state economy.

Direct impacts are those effects generated within a particular sector that impact the state's economy.

Indirect impacts are effects between sectors. One sector causes additional (or less) activity in another sector.

Induced impacts are the domino effect of changes in expenditures rippling through the economy.

Due to its systematic accounting structure, I-O analysis is especially useful for capturing the total impact that the direct expenditure in one industry (or sector) of the economy has on the overall state or sub-state economy. Relying on the multiplier effect, economic impact analysis is commonly used to estimate the total impact that a specific increase or decrease in demand (expenditures) within a given existing industry or set of industries will have on total economic activity in a state or sub-state region. I-O analysis is also commonly used to estimate the total economic impact attributable to the introduction of a new firm or new tax policy into a local or state economy in regional policy analysis. An emerging new use of I-O analysis is to assess the economic CONTRIBUTION a particular industry sector, or group of industries, have on total economic activity within a state or sub-state regional economy (Watson et al. 2007). It is this latter I-O application that is used in this study. We use the contribution analysis interpretation to estimate the contribution that South Carolina's natural

resource-based sectors have on the overall state economy. Specifically we estimate the reduction in economic activity that would occur in South Carolina if the natural resource sectors ceased to exist. Hence, the contribution analysis estimates the economic contribution that specific sets of natural resource-based industries contribute to the overall South Carolina economy when all direct, indirect, and induced effects are accounted for. Alternatively stated, an I-O contribution analysis captures the ripple effect that dollar expenditures in each resource-based sector of the economy have on the overall level of state economic activity.

A South Carolina I-O model was developed to estimate the economic contribution of natural resource-based activities to the South Carolina's economy. The model was developed using the IMPLAN (Impact Planning) modeling system (IMPLAN 2016). IMPLAN is a highly-respected I-O model that is commonly used for state-level and sub-state level estimation of economic impacts. Other recent I/O analysis related to natural resources in the state have also used IMPLAN (Hughes 2015, London 2015), as did the prior study that addressed the economic contribution of natural resources to the South Carolina economy (Division of Research 2009).

The most recent version of IMPLAN (2014 version) divides economic activity into one of 536 mutually exclusive economic sectors (industry types). Our contribution analysis uses the IMPLAN industry structure to create six aggregate and mutually exclusive, natural resource-based sectors within the South Carolina Economy. The six constructed natural resource-based sectors are: (1) Fishing, Hunting, and Wildlife Viewing; (2) Coastal Tourism; (3) Commercial Fisheries; (4) Boating Industry; (5) Mining; and (6) Forestry.

The South Carolina input-output model uses IMPLAN to estimate economic contribution of natural resource-based activities in 2016 dollars. IMPLAN divides the state economy into 536 economic sectors which were used to construct the six mutually exclusive natural resource-based sectors to measure their economic contribution:

- *Fishing, Hunting and Wildlife Viewing*
- *Coastal Tourism*
- *Commercial Fisheries*
- *Boat Industry*
- *Mining*
- *Forestry*

Our contribution analysis of the economic contribution of each of the six natural resource-based economic sectors focusses on several key economic variables to summarize the economic contribution of each of the natural resource-based sectors to the overall economy. These key variables are value added (often called Gross State Product), employment (number of full-time and part-time jobs), earned income (labor and proprietor income), and total industry output (total dollar value of all sales).

Value added measures each sector's net contribution to the state's economy. It is the difference between a sector's total output (revenue from sales) and the cost of its intermediate inputs (exclusive of labor cost). Value added is generated when productive inputs (man-made resources and natural resources) are efficiently combined to produce products that are valued by society. Value added has three major components: (1) Earned income (labor and proprietor income); (2) property income (corporate profit); and (3) indirect business taxes. Earned income is a key component of value added (Gross State Product) and is also reported for each resource-based sector in this study because it is indicative of consumer purchasing power. Earned income is employee compensation, primarily in the form of wages and salaries, plus net profits to proprietors (non-corporate owner operators). Property income is another measure of value added and includes returns to capital in the form of corporate profits, depreciations charges, and other accounting measures

of corporate profitability. Indirect business taxes, the third value added component, consist of sales taxes, excise taxes and other business taxes. Total industry output is the value of total output or total sales revenue and is equal to the cost of intermediate inputs (exclusive of labor) plus value added.

This input-output study focuses on four key variables:

- *Employment*
- *Earned Income*
- *Contribution to Value Added*
- *Total Industry Output*

This economic contribution analysis considers both consumptive and non-consumptive uses of the South Carolina natural resource base. Consumptive use involves the extraction of natural resources for additional processing and sale to either other industries for their further productive use or consumers for final purchase. For example a logging company may harvest forest timber and subsequently process the timber into lumber. The lumber may in turn be sold to a furniture manufacturer for final conversion into a table and sold to a consumer as a final purchase. An example of non-consumptive use of the forest is the economic value recreationists receive from camping, hiking, and bird watching in a forested area. In some cases, recreation natural resource activities can be tied to service providers (such as guide services for hunting or boating) while in other cases the activities are linked to direct purchases by households for recreational supplies and permits.

The primary data used in the contribution analysis were taken from the 2014 IMPLAN data base, the most recent IMPLAN data base which were released in January 2016, and augmented with data collected from the 2011 National Survey of Fishing, Hunting and Wildlife-Associated Recreation for South Carolina (U.S. Fish & Wildlife Service 2014), and The Economic Impact of Travel on South Carolina Counties 2012 (U.S. Travel Association 2013). Data taken from sources external to IMPLAN were converted from retail prices to producer prices and subsequently distributed to the appropriate IMPLAN industry in each constructed natural resource-based sector. Moreover retail expenditure data were margined using the IMPLAN default values to account for expenditure leakages outside South Carolina. Retail, wholesale, and transportation expenses must be margined to account for the fact that a portion of purchase expenditure leak out of the state economy when goods are produced outside of the state. These expenditure leakages do not contribute to either indirect or induced state spending and must be netted out before applying the multiplier to calculate total economic contribution. Each direct expenditure item in each direct expenditure impact vector is divided by their respective diagonal element of the Leontief inverse matrix to control for the fact that many industries purchase from themselves (Watson et al. 2007). Failure to make this minor adjustment results in an overestimate of the total economic contribution. The IMPLAN GNP deflator tool was used to convert all reported dollar values into 2016 dollars. See appendix tables 1-6 for additional specification and discussion of the six direct effect impact vectors used in the IMPLAN contribution analysis.

In the next section we report the economic contribution analysis for the six defined natural resource-based sectors in the South Carolina. Clearly, the contribution of natural resources goes well beyond the economic contribution identified by these sectors. The agribusiness sector could have been included as natural resource-based, as well as parts of other sectors. It is also important to note that our analysis ignores the economic contribution of water resources. The preservation and maintenance of water resources is essential to all economic activity within the state. High water quality is essential for residential and recreational use and many commercial uses. Over time, the absence of safe drinking water supplies would result in the outmigration of human capital and cause all economic activity within the state to cease. Due to a lack of time and resources, this study does not address the value of maintaining the quality of South Carolina's water supply. Thus, our reported total estimate for the economic contribution of South Carolina's resource base is conservative and limited to the six resource-based sectors included in this analysis. The prior

study was the basis of our continued use of the six sectors identified in that analysis; we considered those sectors to be properly identified and continued to use them in this report to provide consistency over time.

Economic Contribution Results

To maintain consistency with the prior 2009 report completed by the South Carolina Division of Research for the South Carolina Department of Natural Resources this report estimates economic impacts in 2016 dollars using the same six resource groupings used in the earlier report. The six aggregate natural resource groupings are:

1. Fishing, Hunting and Wildlife Viewing;
2. Coastal Tourism;
3. Commercial Fisheries;
4. Boat Industry;
5. Mining; and
6. Forestry.

Fishing, Hunting, and Wildlife Viewing

In 2011 the United States Fish and Wildlife Service estimated 1.7 million individuals (total of in-state and out-of-state participants) over the age of 16 spent at least one day engaged in either fishing, hunting, or wildlife viewing. Many individuals participated in more than one of these three outdoor recreation activities as evidenced by the fact 774,000 individuals spent at least one day fishing, 244,000 individuals spent at least one day hunting, and 1.1 million individuals engage in wildlife viewing, which collectively sum to 2.1 million. Moreover, most individuals that participate in these natural resource dependent activities annually spend more than one day engaged in these activities as reported earlier.

Collectively, the annual direct effect (economic expenditure) by individuals engaged in fishing, hunting and wildlife viewing is over $1.6 billion as reported in Table 3. In the multiplier analysis the direct output effect consists of the payments made by South Carolina recreationalists that remain in South Carolina and, thus is subject to the within state multiplier effect. The numerical values for the four direct effect measures are reported in leftmost column of Table 3. In a row, the individual column effects (direct, indirect, and induced) sum to the total effect, or the total contribution fishing, hunting, and wildlife viewing contribute to the South Carolina Economy. The direct output effect supports 23,582 South Carolina jobs and provides $687 million in labor income. Value added, or gross state product, is $1.07 million. The indirect effect, jobs and income created in South Carolina resulting from purchases of inputs and services from South Carolina industries to support the direct effect, are reported in column 2. The indirect effect results in another 3,564 jobs and $0.50 billion of additional economic activity. The induced effect, which is primarily driven by additional household

Table 3: Annual Economic Impact of Fishing, Hunting, and Wildlife Viewing on the South Carolina Economy

Impact	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (Jobs)	23,582	3,564	4,812	31,958
Labor Income ($)	686,777,000	152,588,179	188,904,885	1,028,270,064
Value Added ($)	1,068,450,219	266,200,616	344,955,459	1,679,606,293
Output ($)	1,618,670,877	496,770,066	621,445,610	2,736,886,553

Employment is the number of jobs supported by the activity. Labor Income (wages paid to salaried employees and proprietors), Value Added (also referred to as Gross State Product is the sum of labor income, indirect business taxes, and property income), and Output (sum of value added and intermediate input cost) are reported in dollars. Individual column effects (direct, indirect, and induced) sum to each reported total effect. However, labor income and value added do not sum to output for two reasons. First, labor income is a component of value added. Secondly, the value (cost) of intermediate products purchased is not reported. Total sales (output) minus the value (cost) of intermediate goods is equal to value added.

labor income generated by the direct and indirect effect, plus any government spending of tax payments received via the direct and indirect spending effects, adds another 4,812 jobs and an additional increase in economic activity of $0.62 billion. The overall effect, or total economic contribution, of fishing hunting and wildlife viewing to South Carolina is $2.74 billion and 31,958 jobs. The contribution of saltwater fishing to the fishing, hunting and wildlife viewing total effect was excluded when estimating the total effect reported in Table 3 to avoid double counting. The impact of saltwater fishing is accounted for in the Coastal Tourism impact measure. If saltwater fishing was included the direct effect is increased by $195 million and the total effect would be increased by $329 million.

Coastal Tourism

In addition to using South Carolina's abundant natural resources for fishing, hunting, and viewing wildlife, many individuals (both in-state and out-of-state) vacation and/or engage in salt-water fishing opportunities provided by the state's scenic coastline. As presented in Appendix Table 2, coastal tourists generally spend dollars on hotels, fishing supplies, gasoline, guide services, and food. Eight South Carolina counties share a geographic border with the Atlantic Ocean and are designated coastal tourism counties. These counties are Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Jasper, and Horry, and accounted for 63.8% of all South Carolina tourism revenues in 2012 (U.S. Travel Association 2013).

The total direct impact of coastal tourism is $5.39 billion as reported in Table 4. This value is $1.68 billion less than the value for the direct output impact vector

reported in Appendix Table 2. The difference is created by the I-O margining process that subtracts out retail payment leakages accruing to out-of-state businesses. Not everything purchased in South Carolina is produced in-state. The IMPLAN default margin for each South Carolina retail business type was applied to each retail sector in the appendix direct impact vector before running the economic impact through the state IMPLAN model. Failure to margin the retail and wholesale industries that comprise part of the direct effect would result in an exaggerated multiplier effect when deriving the total effect, or economic contribution, of coastal tourism to the South Carolina Economy. Dollars that escape the state are not available to be respent in the state and thus cannot be included in the multiplier effect.

The annual $5.39 billion direct output effect results in 71,702 South Carolina jobs. The total annual economic contribution (effect) of Coastal Tourism on the South Carolina economy is $8.96 billion and 99, 325 jobs. Those jobs provide $2.88 billion of labor income to South Carolina households at an average annual salary of $29,000.

Table 4: Annual Economic Impact of Coastal Tourism on the South Carolina Economy

Impact	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (Jobs)	71,702	14,157	13,467	99,325
Labor Income ($s)	1,753,820,258	595,178,676	528,754,487	2,877,753,420
Value Added ($)	2,929,009,922	967,001,097	965,588,870	4,861,599,889
Output ($s)	5,390,047,354	1,866,273,416	1,739,545,696	8,995,866,466

Employment is the number of jobs supported by the activity. Labor Income (wages paid to salaried employees and proprietors), Value Added (also referred to as Gross State Product is the sum of labor income, indirect business taxes, and property income), and Output (sum of value added and intermediate input cost) are reported in dollars. Individual column effects (direct, indirect, and induced) sum to each reported total effect. However, labor income and value added do not sum to output for two reasons. First, labor income is a component of value added. Secondly, the value (cost) of intermediate products purchased is not reported. Total sales (output) minus the value (cost) of intermediate goods is equal to value added.

Commercial Fishing Industry

The annual economic use of the South Carolina natural resource base for commercial fishing is distinct from recreational fishing value and is an additional value that natural resources contribute to state economic activity. Moreover, maintaining a sustainable commercial fishing industry is essential to preserving the unique character of South Carolina's local seafood-base cuisine. The state's major fisheries are shrimp, shellfish, crabs, and offshore finfish. Sustaining an economic viable commercial fishing industry strongly compliments and promotes the long-run growth of South Carolina's growing coastal tourism industry.

The annual direct output contribution of the commercial fishing sector is $25.37 million as reported in Table 5. This is the direct price paid to the first purchaser of the product and is commonly referred to as ""ex-vessel' price. Thus the direct effect is not a margined value because it is in producer price. The direct output effect supports 720 jobs. After accounting for statewide respending of the direct effect, through the indirect and induced multiplier effect, the total economic contribution to the state economy is $42.36 million dollars in output and 840 jobs of which $21.3 million is in-state value added. Labor income of $12.27 million was received by South Carolina residents in value added as labor income, resulting in approximately $15,000 per job. The low annual average salary results from the fact that a large portion of all workers in the total employment effect consist of seasonal fishery employees. The average salary for fisherman (calculated as direct effect labor income divided by direct effect employment) is slightly under $10,000. Moreover the low average salary in the commercial fishery industry results in a small employment multiplier for the overall economy. Due to low purchasing power associated with the low salary, only 0.16 additional jobs are created in the broader state economy per job in the commercial fishery sector.

Boat Sector

South Carolina's varied natural resource base provides a cost-effective source of materials needed by the state's boat sector (timber), in addition to stimulating demand for boat sector products and services. The states abundant rivers, marshes, lakes, and coastline enhance demand for the products produced by the boat sector. Over the last decade, South Carolina's boat sector experienced additional product growth due to emerging national markets built upon its growing national reputation for building quality boats. As reported in Appendix Table 4, two IMPLAN industries comprise the aggregate South Carolina boat sector; ship building and repair, and boat building. Neither industry was margined in the contribution analysis because the IMPLAN data base reports these industry output values in producer prices.

Table 5: Annual Economic Impact of the Commercial Fishery Sector on the South Carolina Economy

Impact	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (Jobs)	720	63	57	840
Labor Income ($s)	6,748,846	3,270,117	2,247,978	12,266,940
Value Added ($)	12,753,626	4,400,029	4,102,040	21,255,695
Output ($s)	25,371,754	9,603,013	7,388,915	42,363,682

Employment is the number of jobs supported by the activity. Labor Income (wages paid to salaried employees and proprietors), Value Added (also referred to as Gross State Product is the sum of labor income, indirect business taxes, and property income), and Output (sum of value added and intermediate input cost) are reported in dollars. Individual column effects (direct, indirect, and induced) sum to each reported total effect. However, labor income and value added do not sum to output for two reasons. First, labor income is a component of value added. Secondly, the value (cost) of intermediate products purchased is not reported. Total sales (output) minus the value (cost) of intermediate goods is equal to value added.

The boat sector produces 2,450 direct jobs with an average salary of $74,000 due to the skill required to work in this industry. Sector direct output (sales) is $608 million and the total output effect (contribution) to the state economy is $1 billion, which if 50% larger than the value reported in the 2009 study. Overall, this sector contributes 5,401 jobs to the state economy, more than twice the direct number of jobs within the boat sector. The high employment multiplier is partially a function of the high salaries paid in this sector which provide a relatively high level of purchasing power to their employees. An additional 1.2 jobs are created in the broader state economy per job in the boat sector. The contribution analysis for the boat sector impact is summarized in Table 6.

Mining Sector

South Carolina's mining sector is concentrated in four broad mining industries. In descending order of current economic output (economic value) these industries are extracting natural gas and crude petroleum, stone mining and quarrying, sand and gravel mining, and the drilling of oil and gas wells (see Appendix Table 5). South Carolina's mines and quarries are distributed throughout the state and are found in both rural and urban areas. As opposed to biological natural resources, mining resources generally do not utilize renewable natural resources. Thus, there is no long-run sustainable steady state use value except for zero use because minerals extracted today are not available for future extraction. However, more than half of South Carolina's mining activities involve the quarrying sand gravel and stone which are very abundant resources.

The direct effect dollar value for the mining sector of the economy is $828 million and the total economic contribution (total output effect) to the state economy is $1.17 billion as reported in Table 7. The direct number of jobs in the mining sector is 3,718, and the sector contributes a total of 5,973 jobs to the overall economy. Relative to the 209 study, the mining sector contributes 133% more jobs (5,401 versus 2,558 jobs) and 197% more nominal dollars ($1.17 billion versus $0.39 billion) to the state economy.

Table 6: Annual Economic Impact of the Boat Sector on the South Carolina Economy

Impact	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (Jobs)	2,450	1,484	1,466	5,401
Labor Income ($s)	181,684,070	73,984,940	57,556,258	313,225,269
Value Added ($)	200,203,644	102,940,617	105,107,228	408,251,490
Output ($s)	607,762,496	202,442,770	189,354,882	999,560,148

Employment is the number of jobs supported by the activity. Labor Income (wages paid to salaried employees and proprietors), Value Added (also referred to as Gross State Product is the sum of labor income, indirect business taxes, and property income), and Output (sum of value added and intermediate input cost) are reported in dollars. Individual column effects (direct, indirect, and induced) sum to each reported total effect. However, labor income and value added do not sum to output for two reasons. First, labor income is a component of value added. Secondly, the value (cost) of intermediate products purchased is not reported. Total sales (output) minus the value (cost) of intermediate goods is equal to value added.

Table 7: Annual Economic Impact of the Mining Sector on the South Carolina Economy

Impact	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (Jobs)	3,718	1,324	931	5,973
Labor Income ($s)	94,436,943	67,997,518	36,545,425	198,979,8869
Value Added ($)	250,673,478	103,454,705	66,729,565	420,857,748
Output ($s)	828,422,766	223,702,962	120,213,107	1,172,338,835

Employment is the number of jobs supported by the activity. Labor Income (wages paid to salaried employees and proprietors), Value Added (also referred to as Gross State Product is the sum of labor income, indirect business taxes, and property income), and Output (sum of value added and intermediate input cost) are reported in dollars. Individual column effects (direct, indirect, and induced) sum to each reported total effect. However, labor income and value added do not sum to output for two reasons. First, labor income is a component of value added. Secondly, the value (cost) of intermediate products purchased is not reported. Total sales (output) minus the value (cost) of intermediate goods is equal to value added.

Forestry Sector

Given South Carolina's states heavy economic dependence on lumber and wood product production it is not surprising the forestry sector is the second largest natural resource-based sector in the state, behind only agriculture. The forestry sector consists of 29 tightly interrelated IMPLAN industries. The detailed specification for the IMPLAN Forestry direct effect output vector is presented in Appendix Table 6. The largest industries in the forestry sector direct effect are paper and paperboard mills, paperboard container manufacturing, sanitary paper product manufacturing, commercial logging, sawmills, veneer and plywood manufacturing, and reconstituted wood products. As reported in Table 8 the forestry sector has a direct output effect of $12.2 billion and provides 28,719 jobs. The total contribution of the forestry sector to the South Carolina economy is $19.4 billion and 75,222 jobs. Partially due to the economic recovery of the housing industry, the total dollar contribution to the state economy is 13.5% larger than in the 2009 study ($19.4 billion versus $17.1 billion).

Overall Economic Contribution of South Carolina's Natural Resources

The total economic contribution of South Carolina's six natural resource-based economic sectors considered in this study is summarized in Table 9. Total direct output expenditure is $20.7 billion and the total contribution to the state economy is $33.4 billion. The total contribution value represents an increase of $4.4 billion relative to the 2009 study, a 15% increase in total economic activity. As defined in this study, the six natural resource sectors are responsible for 8.3% of gross state product and 8.6% of all jobs in the state. Direct employment in the six natural resource sectors is 130,891 jobs at an average salary of $35,959. Overall, after accounting for the multiplier effect, the six natural resource-based sectors contribute 218,719 jobs to the state economy at an average salary of $39,337.

Table 8: Annual Economic Impact of the Forestry Sector on the South Carolina Economy

Impact	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (Jobs)	28,719	26,898	19,605	75,222
Labor Income ($s)	1,983,244,695	1,420,258,438	769,815,966	4,173,319,099
Value Added ($)	3,874,123,350	2,216,179,921	1,405,850,874	7,496,154,145
Output ($s)	12,245,088,639	4,629,076,071	2,532,703,852	19,406,868,561

Employment is the number of jobs supported by the activity. Labor Income (wages paid to salaried employees and proprietors), Value Added (also referred to as Gross State Product is the sum of labor income, indirect business taxes, and property income), and Output (sum of value added and intermediate input cost) are reported in dollars. Individual column effects (direct, indirect, and induced) sum to each reported total effect. However, labor income and value added do not sum to output for two reasons. First, labor income is a component of value added. Secondly, the value (cost) of intermediate products purchased is not reported. Total sales (output) minus the value (cost) of intermediate goods is equal to value added.

Table 9: Annual Economic Impact of All South Carolina Natural Resource Sectors on the South Carolina Economy

Impact	Direct Effect	Indirect Effect	Induced Effect	Total Effect
Employment (Jobs)	130,891	47,490	40,337	218,719
Labor Income ($s)	4,706,711,812	2,313,277,868	1,583,824,999	8,603,814,678
Value Added ($)	8,335,214,239	3,660,176,986	2,892,334,036	14,887,725,260
Output ($s)	20,715,363,886	7,427,868,297	5,210,652,061	33,353,884,245

Employment is the number of jobs supported by the activity. Labor Income (wages paid to salaried employees and proprietors), Value Added (also referred to as Gross State Product is the sum of labor income, indirect business taxes, and property income), and Output (sum of value added and intermediate input cost) are reported in dollars. Individual column effects (direct, indirect, and induced) sum to each reported total effect. However, labor income and value added do not sum to output for two reasons. First, labor income is a component of value added. Secondly, the value (cost) of intermediate products purchased is not reported. Total sales (output) minus the value (cost) of intermediate goods is equal to value added.

Summary and Conclusions

Over the last seven years, the collective economic contribution of South Carolina's natural resource-based sectors has grown by 15%. Today, the natural resource-based sectors annually contribute $33.4 billion dollars economic activity and 218,719 jobs to state economy. The state's valuable natural resource base needs to be managed in a sustainable manner to protect both long-run economic growth and the amenity values these resources provide.

Despite the significant economic contribution that the six natural resource-based sectors have on the South Carolina Economy, the estimated impact is conservative because the value of the states' water resources is not directly included in the analysis. The direct economic value of the state's water supply was not analyzed due to limited research funds, time, and the complexity of water resource valuation. Both the water supply level and the quality of the supply level affect water valuation. For example, an acre-foot of water appropriate for residential drinking has a much higher value than an acre-foot of water suitable for irrigation use. The timing of when water is available also effects economic valuation as different economic activities require water at different times of the year. Reservoir management policy can significantly influence the time when water can be utilized in alternative economic activities. Further compounding water resource valuation is some water uses are non-consumptive and thus the same water resource can support multiple economic activities.

In this analysis, some of the non-consumptive uses of water are indirectly captured in our analysis of the Fishing, Hunting and Wildlife Viewing; Coastal Tourism; and Boating sectors to the South Carolina Economy. It is important to note that over time, the absence of safe drinking water supplies would result in the outmigration of human capital and cause all economic activity within the state to cease. Thus it is imperative that water, our most essential natural resource, is carefully managed and attention is paid to assuring our increasingly scarce water resources are used in their highest valued economic uses.

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Appendix

Appendix Table 1. Allocation of Fishing, Hunting, and Wildlife Viewing Expenditures to IMPLAN Industry Accounts to Create Direct Effect for Fishing, Hunting, and Wildlife Viewing Sector ($s)

IMPLAN Ind. Code	Industry Description	Industry Output
18	Commercial hunting and trapping	29,796,601
258	Ammunition, except for small arms, manufacturing	1,104,059
259	Small arms, ordnance, & accessories manufacturing	14,718,504
395	Wholesale trade	65,511,696
396	Retail - Motor vehicle and parts dealers	173,810,360
398	Retail - Electronics and appliance stores	3,159,947
402	Retail - Gasoline stores	254,962,843
404	Retail - Sporting goods, hobby, and music	510,198,793
440	Real estate	30,304,110
443	Consumer good rental except video tape & discs	34,866,538
469	Landscape and horticultural services	6,141,806
496	Other amusement and recreation industries	5,069,937
499	Hotels and motels, including casino hotels	138,892,762
500	Other accommodations	6,312,128
501	Full-service restaurants	74,264,433
502	Limited-service restaurants	122,953,320
503	All other food and drinking places	25,507,973
516	Labor and civic organizations	8,808,105
531	Employment and payroll of state govt, non-education	112,286,976
	Total	1,618,670,891

Data for the constructed Fishing, Hunting, and Wildlife aggregate sector were taken from tables 17, 20, and 31 the U.S. Fish and Wildlife (USFW) 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation for South Carolina (Revised January 2014). To make the data amendable to IMPLAN the reported data were reallocated to the appropriate IMPLAN industry account to convert all expenditures to producer prices. All retail data were margined to account for leakages (South Carolina expenditures on items whose production and/or transportation cost are received by companies or individuals located outside of South Carolina) to avoid overestimating the multiplier effect of the direct effect to South Carolina. The default industry IMPLAN margins were applied to all retail and wholesale sales before converting the above direct expenditure vector. Given that all retail and wholesale expenditures were margined before constructing the direct industry output vector, the retail and wholesale sectors were not margined when calculating the total impact in IMPLAN because all prices had already been converted to producer prices. Doing so would have inappropriately reduced the estimated total effect. Within a very small numerical round-off error the total in the above table (the direct effect) is consistent with the reported direct effect reported in the summary table for Fishing, Hunting, and Wildlife viewing (text table 1). To avoid the double counting of saltwater fishing on the overall state economy it is excluded from this sector because it is included in Coastal Tourism Direct Expenditure Impact. The 2011 USFW expenditure values were converted into 2016 dollars before constructing the Fishing, Hunting, and Wildlife Viewing direct expenditure vector.

Appendix Table 2. Allocation of Coastal Tourism Expenditures to IMPLAN Industry accounts to Create Direct Effect for the Coastal Tourism Sector ($s)

IMPLAN Ind. Code	Industry Description	Industry Output
396	Retail - Motor vehicle and parts dealers	1,127,346,929
397	Retail - Furniture and home furnishings stores	34,002,410
398	Retail - Electronics and appliance stores	20,038,369
399	Retail - Building and equipment supply stores	93,082,896
400	Retail - Food and beverage stores	121,650,354
401	Retail - Health and personal care stores	70,410,126
402	Retail - Gasoline stores	573,350,541
403	Retail - Clothing and clothing accessories stores	81,509,783
404	Retail - Sporting goods, hobby, music	24,221,542
405	Retail - General merchandise stores	167,061,448
406	Retail - Miscellaneous store retailers	37,867,518
408	Air transportation	128,206,614
411	Truck transportation	89,635,663
414	Scenic transportation support activities	421,665,910
488	Performing arts companies	50,636,562
489	Commercial Sports Except Racing	19,491,282
490	Racing and Track Operation	1,348,172
491	Performing arts and sports	48,906,658
492	Independent artists, writers, and performers	37,930,892
493	Museums, historical sites, zoos, and parks	19,224,957
494	Amusement parks and arcades	11,177,008
495	Gambling industries (except casino hotels)	132,253,814
496	Other amusement and recreation industries	119,153,642
497	Fitness and recreational sports centers	55,382,877
498	Bowling centers	5,419,885
499	Hotels and motels, including casino hotels	1,429,089,611
500	Other accommodations	64,946,479
501	Full-service restaurants	696,653,983
502	Limited-service restaurants	1,153,390,880
503	All other food and drinking places	239,283,193
	Total	7,074,340,000

Data taken from table 5 and appendix A of The Economic Impact of Travel on South Carolina 2012, prepared for the South Carolina Department of Parks, Recreation & Tourism by the U.S. Travel Association. Washington D.C. 2013. Coastal counties consist of the eight South Carolina coastal counties of Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Jasper, and Horry. The tourism data were reported for five broad expenditure categories and the data were subsequently distributed over 30 IMPLAN industries to convert all prices into producer prices. The direct impact vector for Coastal Tourism represents 63.8% of all South Carolina tourism. The above direct impact vector was directly input IMPLAN and the IMPLAN margin defaults were used on all retail sectors to account for economic leakages outside of the state. The margining activity restricts the economic contribution (impact) of the direct effect to the state of South Carolina. As shown in text table 2, after margining the direct effect is $5,390,047,354. Impact data were converted to 2016 dollars using the U.S. CPI.

Appendix Table 3. IMPLAN Commercial Fisheries Direct Effect ($s)

IMPLAN Ind. Code	Industry Description	Industry Output
17	Commercial fishing	25,371,754
	Total	25,371,754

Reported value is the 2014 IMPLAN value for industry sector 17 (commercial fishing) inflated to 2016 values using the CPI and divided by 1.00002 the Leontief inverse diagonal element for industrial sector 17. The adjustment controls for the fact an industry often purchases from itself and failure to adjust for this economic outcome would overestimate the total impact (contribution) of the industry in the multiplier analysis. If an industry does not purchase from itself the diagonal element would have a value of 1. The IMPLAN industry output value for the commercial fishing is reported in producer prices and was not margined.

Appendix Table 4. IMPLAN Boat Sector Direct Effect ($s)

IMPLAN Ind. Code	Industry Description	Industry Output
363	Ship building and repairing	170,913,031
364	Boat building	436,849,492
	Total	607,762,523

Reported output values are the 2014 IMPLAN values for each industrial sector inflated to 2016 values using the CPI and divided by the Leontief inverse diagonal element for each industrial sector. The adjustment controls for the fact an industry often purchases from itself and failure to adjust for this economic outcome overestimates the total impact (contribution) of the industry in the multiplier analysis. If an industry does not purchase from itself the diagonal element would have a value of 1. All industry output values in the Boat sector are reported in producer prices and were not margined.

Appendix Table 5. IMPLAN Mining Sector Direct Effect ($s)

IMPLAN Ind. Code	Industry Description	Industry Output
20	Extraction of natural gas and crude petroleum	326,969,190
30	Stone mining and quarrying	229,332,309
31	Sand and gravel mining	143,424,211
33	Potash, soda, and borate mineral mining	1,303,644
35	Other chemical and fertilizer mineral mining	1,133,131
36	Other nonmetallic minerals	42,274,483
37	Drilling oil and gas wells	65,912,045
38	Support activities for oil and gas operations	13,035,098
39	Metal mining services	3,249,354
40	Other nonmetallic minerals services	1,789,319
	Total	828,422,785

Reported output values are the 2014 IMPLAN values for each industrial sector inflated to 2016 values using the CPI and divided by the Leontief inverse diagonal element for each respective industrial sector. The adjustment controls for the fact an industry often purchases from itself and failure to adjust for this economic outcome overestimates the total impact (contribution) of the industry in the multiplier analysis. If an industry does not purchase from itself the diagonal element would have a value of 1. All industry output values in the Mining sector are reported in producer prices and were not margined.

Appendix Table 6. Forestry Sector Direct Effect ($s)

IMPLAN Ind. Code	Industry Description	Industry Output
15	Forestry, forest products, and timber tract production	53,079,259
16	Commercial logging	454,191,874
19	Support activities for agriculture and forestry	71,551,335
134	Sawmills	592,460,995
135	Wood preservation	346,364,610
136	Veneer and plywood manufacturing	392,777,210
137	Engineered wood member and truss manufacturing	77,880,320
138	Reconstituted wood product manufacturing	463,751,685
139	Wood windows and door manufacturing	84,915,864
140	Cut stock, resawing lumber, and planning	36,785,038
141	Other millwork, including flooring	105,019,089
142	Wood container and pallet manufacturing	140,246,797
144	Prefabricated wood building manufacturing	53,590,258
145	All other miscellaneous wood product manufacturing	85,638,468
146	Pulp mills	1,316,133
147	Paper mills	1,340,058,504
148	Paperboard mills	2,554,104,947
149	Paperboard container manufacturing	1,918,173,403
150	Paper bag and coated & treated paper manufacturing	884,260,220
151	Stationery product manufacturing	90,909,010
152	Sanitary paper product manufacturing	1,854,917,671
153	All other converted paper product manufacturing	253,808,375
269	Sawmill, woodworking, and paper machinery	33,378,426
368	Wood kitchen cabinet and countertop manufacturing	196,996,176
369	Upholstered household furniture manufacturing	81,637,295
370	Non-upholstered wood furniture manufacturing	32,874,902
373	Wood office furniture manufacturing	4,919,584
374	Custom architectural woodwork and millwork	14,413,838
507	Commercial and industrial machinery & equipment repair and maintenance	24,815,996
	Total	12,245,837,286

Output values for all industries are the 2014 IMPLAN values for each industrial sector for each industrial sector inflated to 2016 values using the CPI and divided by the Leontief inverse diagonal element for each industrial sector except for sector 507 to avoid over estimation. Sector (industry) 507 output value is derived as the IMPLAN state sector value multiplied by sum of all other industries in the forestry direct impact vector divided by total state output. The multiplication scale factor is 0.0304. The direct industry output value for IMPLAN Industry 19 (support activities for agriculture and forestry) is calculated as IMPLAN state value multiplied by US Department of Labor Quarterly Census of Employment and Wage (QCEW) data (2015) for forestry workers divided by sum of forestry and agricultural workers). The calculated employment ratio used to rescale IMPLAN industry 19 is 0.3736. Industry output values in the forestry sector are in producer prices and were not margined.