

The economic value of beach nourishment in South Carolina

By

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ABSTRACT

Tourism has become increasingly important in South Carolina's economy, particularly beach tourism that accounts for two-thirds of tourist spending. Maintaining beaches is a requirement for a successful beach tourism industry. In the past 30 years, about 1.7 million yd³ of sand has been placed annually on South Carolina beaches. The annual cost has been \$20.2 million in 2019 dollars or \$13.9 million (2019 dollars) if federal mitigation and emergency sand placements are not included because their purpose was not in support of tourism. Beach nourishment has been very successful in combating shoreline recession. From 1984-1987 through 2006, South Carolina shorelines that were not nourished receded 101 ft on average, and shorelines that were nourished advanced 110 ft on average — and tourism boomed. South Carolina beach tourists generate \$16.6 billion annually in South Carolina economic development and about \$1.8 billion in taxes. For each \$1 spent on beach nourishment, South Carolina receives over \$1,200 in economic development generated by beach tourists and federal, state, and local governments receive almost \$130 in taxes. Beach tourists have options, and with the state government spending only \$3.1 million annually on beach nourishment versus the Florida state government spending \$50 million on Florida beaches, South Carolina must be careful to maintain its beaches to continue attracting tourists at record levels.

KEYWORDS: Travel and tourism, jobs, tax revenue, return on investment, equilibrium profile.

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South Carolina has 187 miles of shoreline on the Atlantic Ocean (Figure 1). Tourism in South Carolina began developing significantly in the 1920s and 1930s as interest grew in the charm and historic architecture of Charleston and South Carolina became a transportation corridor for tourists traveling from the Northeast and Midwest to Florida (Mitchell 2016). After World War II the increased U.S. population, disposable income, mobility, and leisure time resulted in the rapid growth of tourists passing through and also vacationing in the state. In particular, tourism grew in the three coastal destinations of Myrtle Beach, Charleston, and Hilton Head Island that had an advantage of a shorter

distance from the Northeast and Midwest than Florida (Mitchell 2016).

SOUTH CAROLINA TOURISM

Tourism is not generally associated with South Carolina. However, South Carolina's economy has been changing rapidly. Congressional Majority Whip Jim Clyburn of South Carolina said that South Carolina "used to thrive on supplying textile and tobacco (but) now leans on two very different 't's': tourism and transportation" (ExploreBeaufortSC.com 2019). Because of booming tourism, the Director of South Carolina Park, Recreation, and Tourism received the National 2019 State Tourism Director of the Year Award (U.S. Travel Association 2020a).

South Carolina has a goose that lays proverbial golden eggs, and that goose is tourism (Figure 2). The "golden eggs" are economic impact, jobs, economic growth, and tax revenue (Figure 3). Direct tourist spending was \$15.1 billion in 2019 (U.S. Travel Association 2020a), and Willis and Straka (2017) used IMPLAN to show that coastal tourism has a 1.67 multiplicative factor to convert direct spending to total economic impact that includes indirect and induced effects. IMPLAN (2020) is a highly-respected model commonly used for state-level estimation of economic impact. The U.S. Travel Association (2020b) in a separate analysis obtained the same direct and induced factors for overall tourism in South Carolina. Therefore, the total economic impact of South Carolina tourism in 2019 was \$25.2 billion. One of every 10 jobs in the state is in the tourism industry (South Carolina Parks, Recreation, and Tourism 2020). South Carolina's economic growth from tourism over the five years from 2015 through 2019 was about 150% greater than the U.S. national economic growth over the same period (South Carolina Parks, Recreation, and Tourism 2014; U.S. Travel Association 2020a; Reuters 2020). South Carolina tourists generate \$2.65 billion in taxes to the federal, state, and local governments with the state receiving the greatest share of \$1.204 billion, the federal government \$876 million, and local governments \$571 million (U.S. Travel Association 2020a, b).

Charleston is an example of the popularity of South Carolina tourism. *Travel and Leisure* (2020) named it the best tourism city in America in 2019. Even more significantly, *Conde Nast Traveler* named



Figure 1. South Carolina's location on the Atlantic Ocean and shoreline length.

it the best city in the world in 2019 and for the ninth consecutive year the best small city in America (*Conde Nast Traveler* 2020; ABCNews4 2019). However, the beaches near Charleston at Isle of Palms, Sullivan’s Island, Folly Beach, Kiawah Island, and Seabrook Island (Figure 4) have tourist accommodation receipts that are 75% of those of Charleston, although they are not the main beach destinations in South Carolina (South Carolina State Library 2020). More significantly, the Grand Strand and Hilton Head Island (Figure 5) have accommodation receipts almost 500% greater than Charleston (South Carolina State Library 2020), making beaches the most popular tourist destination in South Carolina.

Beaches are key to South Carolina tourism. “Coastal beaches are the state’s greatest single attraction” (South Caro-



Figure 2. The proverbial tourism goose that lays golden eggs.

lina Parks, Recreation, Tourism 2019). “South Carolina planners point out that wide sandy beaches are the central attraction of the state’s coastal tourism, which draws billions in revenue each year” (Sea Grant 2003). Chris Brooks, Deputy Commissioner of the South Carolina Office of Ocean and Coastal Resource

Management, noted that beach tourism and coastal growth have been the only positive areas in South Carolina’s economy over the past several years (Sea Grant 2003). Myrtle Beach is South Carolina’s greatest beach attraction, and its power in attracting tourists is illustrated in a survey by Booking.com (2020) of the five top places where people want to go after the pandemic. Orlando was No. 1 with Disney World and its other attractions. But Myrtle Beach (Figure 6) was No. 2, beating out all other beaches in the nation along with the third- through fifth-ranked attractions of Miami Beach, New York, and Las Vegas.

The popularity of South Carolina beaches can be gauged by comparing the number of day trips to these beaches versus the number of day visits to national and state parks. There are 26.4 million beach visitors to the five beach areas near



Figure 3. South Carolina’s “golden eggs” of tourism.

Table 1.

A page of quarterly costs for 1990-1991 from the Corps of Engineers Civil Works Construction Index (Corps of Engineers 2019b).

Base year 1967 = 100		1Q90	2Q90	3Q90	4Q90	1Q91	2Q91	3Q91	4Q91
02 Relocations	5%	397.70	402.35	406.27	405.48	407.61	409.79	415.17	412.51
03 Reservoirs	5%	426.62	432.72	440.03	441.87	443.75	445.396	448.72	449.50
04 Dams	15%	389.13	392.24	396.69	397.57	400.37	402.16	404.98	404.39
05 Locks	2%	386.61	389.75	393.42	393.88	396.33	398.06	400.61	399.93
06 Fish & wildlife facilities	5%	382.10	385.48	388.93	389.01	391.31	393.28	396.94	395.33
07 Power plant	10%	382.72	385.98	390.04	392.37	395.96	398.37	400.46	401.16
08 Roads, railroads & bridges	10%	397.70	402.35	406.27	405.48	407.61	409.79	415.17	412.51
09 Channels & canals	3%	408.91	412.18	419.85	421.37	423.64	426.24	429.12	429.87
10 Breakwaters & seawalls	5%	416.23	418.83	426.15	427.58	431.75	434.02	436.95	437.42
11 Levees & floodwalls	5%	405.46	408.36	414.01	415.03	417.23	419.02	421.70	422.01
12 Navigation ports & harbors	10%	390.24	388.71	385.42	423.17	409.44	394.25	398.68	406.79
13 Pumping plant	5%	383.69	386.00	388.53	388.78	390.85	391.74	394.01	392.82
14 Recreation facilities	5%	383.69	386.00	388.53	388.78	390.85	391.74	394.01	392.82
15 Floodway control & diversion structure	2%	382.10	385.48	388.93	389.01	391.31	393.28	396.94	395.33
16 Bank stabilization	2%	386.68	391.12	394.94	396.05	398.72	402.16	404.24	405.03
17 Beach replenishment	2%	408.11	411.77	417.43	418.79	421.46	424.52	427.62	429.07
18 Cultural resource preservation	2%	383.69	386.00	388.53	388.78	390.85	391.74	394.01	392.82
19 Buildings, grounds & utilities	5%	383.69	386.00	388.53	388.78	390.85	391.74	394.01	392.82
20 Permanent operating equipment	2%	383.69	386.00	388.53	388.78	390.85	391.74	394.01	392.82
Composite Index (weighted average)	100%	393.28	396.19	399.75	404.15	405.07	405.25	408.48	408.68

Charleston (Figure 4), Myrtle Beach, and Hilton Head Island (College of Charleston 2019; HiltonHeadChamber.org 2020; Myrtle Beach Area Convention and Visitors Center Bureau 2020; South Carolina State Library 2020). Visitors at Myrtle Beach stay an average of 5.3 days (Equation Research 2020). It is assumed that this is true at the other beach locations and these visitors go to the beach at least once a day. Therefore, these beach areas have 140-million day visits annually. This compares in Figure 7 to the annual 83-million day visits to America's 59 National Parks (National Park Service 2020; Pleacher.com 2018) and the 8-million day visits to state parks (South Carolina State Parks 2018). Moreover, the Myrtle Beach and Hunting Island beach parks are the most visited of the 47 state parks with about a third of all visits to state parks (TheState.com 2016).

SOUTH CAROLINA BEACH NOURISHMENT

Of course, some gold must be used to feed the proverbial goose that lays the golden eggs. Beach nourishment is the "food" that sustains South Carolina beach tourism. Dr. Tim Kana and others have studied extensively the evolution of South Carolina's shoreline and its beach nourishment projects (Kana 1990, Kana 2012, Kana *et al.* 2013, Kana 2020).



Figure 4. Major areas beaches in the Charleston area.

For this analysis, beach nourishment volumes and cost were obtained from South Carolina's database of beach nourishment projects from 1954-2019 (South Carolina Department of Health and Environmental Control 2020). The database does not include emergency sand placement projects following hurricanes from 2017-2019 that were funded by the federal government. Sand volume and cost data for these were obtained from the Corps of Engineers (2019a).

Figure 8 shows sand volumes placed on South Carolina beaches from 1970-2019. Almost 95% of the sand was placed during the 30 years from 1990 to 2019, and this modern time period will be the focus of the analysis.

Figure 9 shows where beach nourishment sand was placed 1990-2019. About

60% of the sand was placed on Hilton Head Island and the Grand Strand that stretches from Garden City to North Myrtle Beach. These two areas account for about 80% of beach tourism in South Carolina (South Carolina State Library 2020). Folly Island accounts for less than 3% of beach tourism, but 16% of nourishment sand was placed on its beaches because the federal government has agreed that the jetties built in 1882-1895 at the entrance channel to the Port of Charleston have caused shoreline recession on the island (South Carolina State Library 2020). The federal government pays 85% of Folly Island nourishment costs and the State of South Carolina (with some municipal funds) pays 15%.

Beach nourishment costs were converted to 2019 dollars using the Corps of Engineers' Civil Works Construction Index that has quarterly costs from 1980-2019 (Corps of Engineers 2019b) and annual costs from 1967-2019 (Corps of Engineers 2019c). Table 1 is an example of the quarterly cost indexes for 1990 and 1991, showing costs specifically for "beach replenishment" compared to the base year of 1967. It is assumed all beach nourishment projects are represented by the middle of the year in which they were completed and their costs are converted to mid-2019 dollars using Corps of Engineers (2019b, c).

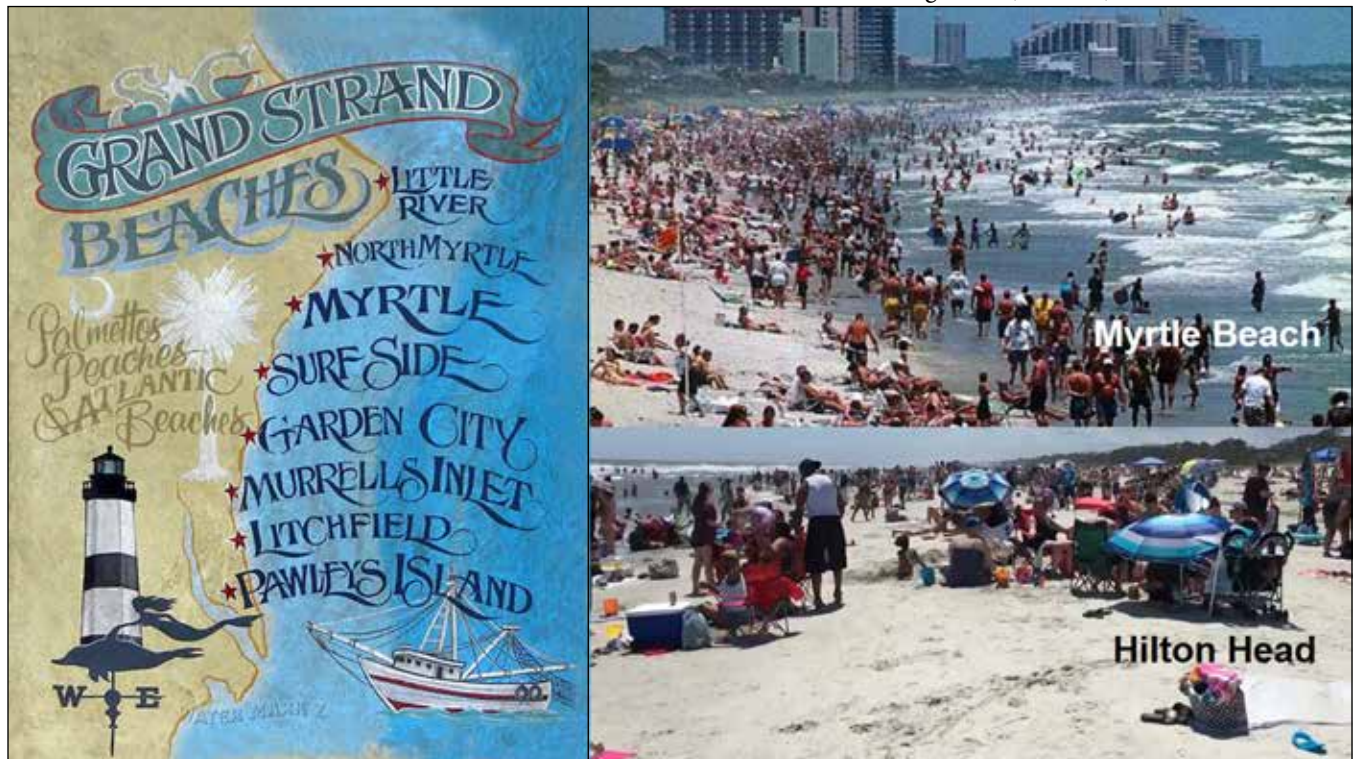


Figure 5. Grand Strand, anchored by Myrtle Beach at the northern end of the state and by Hilton Head Island at the southern end of the state.

Table 2.**Beach nourishment in South Carolina for 30 years from 1990 to 2019. Totals for volume and cost are in millions.**

Location	Year	Volume (yd ³)	Cost \$s	Cost 2019 \$s	State 2019 \$s	Federal 2019 \$s	Local 2019 \$s
Acadian Shores	1999	446,000	4,093,218	7,234,933	1,767,542	0	5,467,391
	2009	331,574	4,097,223	5,156,462	872,159	0	4,284,304
	2019	475,000	8,940,000	8,940,000	4,291,200	0	4,648,800
Daufuske	1998	1,410,000	6,000,000	10,903,564	0	0	10,903,564
Debidue	1990	191,693	862,000	1,926,194	0	0	1,926,194
	1998	262,386	950,000	1,726,398	0	0	1,726,398
	2006	590,000	5,600,000	7,827,034	0	0	7,827,034
	2015	650,000	10,000,000	10,754,852	0	0	10,754,852
Edisto Beach	1995	148,414	1,500,000	2,923,757	1,949,172	0	974,586
	2006	877,647	7,700,000	10,762,172	6,569,118	0	4,193,054
	2016	1,006,000	18,850,932	19,837,900	9,830,553	2,640,852	7,366,495
Folly Beach	1990	240,000	600,000	1,340,738	0	1,340,738	0
	1993	2,695,900	14,500,000	29,609,263	6,126,054	23,483,208	0
	1998	40,000	120,000	218,071	0	218,071	0
	2000	101,513	307,610	532,721	0	532,721	0
	2005	2,395,200	12,500,000	18,361,795	1,468,944	16,892,851	0
	2007	486,100	8,185,000	10,967,657	0	10,967,657	0
	2013	415,000	2,300,000	2,593,816	0	0	2,593,816
	2014	1,500,000	30,700,000	33,732,343	1,098,773	27,139,703	5,493,867
	2018	1,200,000	15,000,000	15,299,345	0	15,299,345	0
Garden City	1990	163,500	1,640,000	3,664,685	0	3,664,685	0
	2017	519,000	6,000,000	6,174,710	0	6,174,710	0
Hilton Head	1990	2,338,000	9,700,000	21,675,271	14,524,666	0	7,150,605
	1997	3,383,000	11,000,000	20,449,975	0	0	20,449,975
	1999	245,000	1,200,000	2,121,050	0	0	2,121,050
	2007	2,724,900	19,000,000	25,459,435	0	0	25,459,435
	2012	1,000,000	10,000,000	11,517,910	921,433	0	10,596,477
	2014	35,000	1,059,233	1,163,857	0	0	1,163,857
	2016	3,350,000	29,200,000	30,728,808	0	0	30,728,808
	2016	60,000	2,700,000	2,841,362	0	0	2,841,362
Hunting Island	1991	757,644	2,876,250	6,233,072	6,233,072	0	0
	2003	230,031	2,480,250	3,900,104	0	3,900,104	0
	2005	87,092	1,666,324	2,447,736	0	2,447,736	0
	2006	644,222	4,379,300	6,120,880	6,120,880	0	0
Isle of Palms	2008	933,895	10,600,000	13,822,958	912,837	0	12,910,121
	2018	2,285,000	14,247,266	14,531,589	3,615,183	3,020,066	7,896,340
Myrtle Beach	1990	395,960	2,667,600	5,960,923	0	5,960,923	0
	1997	2,249,916	16,870,194	31,363,186	5,488,558	20,386,070	5,488,558
	2009	1,497,975	17,612,822	22,166,196	2,822,874	14,408,027	4,935,295
Myrtle/North Myrtle/ Garden City/Surfside	2018	3,000,000	45,000,000	45,446,078	0	45,446,078	0
	2019						
North Myrtle	1990	376,920	1,937,000	4,328,350	0	4,328,350	0
	1997	2,622,904	20,154,213	37,468,468	6,556,983	24,354,501	6,556,983
	2008	902,725	9,554,008	12,458,929	2,446,403	8,098,305	1,914,221
North Myrtle/Garden/Surfside	2017	1,200,000	21,000,000	21,611,484	0	21,611,484	0
Pauley Island	1990	220,000	612,000	1,367,553	0	1,367,553	0
	1999	270,000	1,300,000	2,297,804	2,297,804	0	0
	2019	300,000	3,935,727	3,935,727	0	3,935,727	0
Seabrook Island	1990	684,474	1,660,000	3,709,376	0	0	3,709,376
Sullivan's Island	1998	35,000	230,000	417,970	417,970	0	0
Surfside/Garden	1998	1,115,000	14,294,634	25,977,075	4,545,981	16,885,077	4,546,017
	2008	857,663	10,448,954	13,625,986	2,384,548	8,856,891	2,384,548
Surfside	1990	70,000	581,250	1,298,840	0	1,298,840	0
Total		50.0	448.4	606.9	93.3	294.7	219.0



Figure 6. Myrtle Beach, South Carolina.

Table 2 shows beach nourishment locations, placement years, volumes, costs at the time of placement, and costs in 2019 dollars for the state and federal governments and local interests. Local interests include local governments and private organizations (for example, homeowner associations). Local governments have provided over 75% of the funding expended by local interests.

From Table 2, a volume of 1.67 million yd³ of sand has been placed annually on South Carolina beaches. Average annual spending on beach nourishment was \$20.2 million in 2019 dollars. The federal government annually funded an average of \$9.8 million, local interests \$7.3 million, and the state \$3.1 million. Figure 10a shows percentages funded by each government level. The federal funding percentage of 48% in Figure 10a is greater than is typical in other states. For example, the federal government provides about 28% of Florida beach nourishment funding (Houston 2018). However, 64% of the federal funding in Figure 10a is for mitigation or emergencies. The mitigation is for Folly Island, where the federal government has spent almost \$96 million in 2019 dollars to combat erosion produced by the entrance-channel jetties leading into the Port of Charleston (Table 2). The purpose of the emergency

beach nourishment was to reduce risk of flooding and structural damage following hurricanes. Beach nourishment for the purpose of mitigation or for emergencies is not meant specifically to support recreational beaches for tourists. If mitigation and emergency nourishments are eliminated from spending, the total annual spending on beach nourishment in support of tourism is \$13.9 million with the federal share being 25%, the state 22%, and local interests 52% (Figure 10b).

Beach nourishment has been very successful in maintaining and advancing South Carolina shorelines. London *et al.* (2009) showed that shorelines that were not nourished from 1984-1987 through 2006 lost 1,467 acres of area, but during the same period, shorelines that were nourished gained 903 acres in area. Nourished shorelines have a length of 67.6 miles and shorelines that have not been nourished have a length of 119.4 miles (Kana 2020). Therefore, shorelines that were not nourished receded 101 ft on average, whereas those that were nourished during the same period advanced 110 ft and tourism boomed.

After beach nourishment is placed, it takes approximately 1-3 years for the profile extending from the beach berm to closure depth to come to approximate equilibrium and reach the designed

shoreline advance (Figure 11). Equilibrium profile theory gives the designed shoreline advance, X , due to adding a sand volume, V , to the active littoral zone by the following simple equation (Dean and Dalrymple 2002):

$$X = V/[(h_c + B)*L] \quad \text{Equation (1)}$$

h_c is closure depth, B is berm elevation, and L is shoreline length (Figure 11)

How does the shoreline change with time after it has reached equilibrium and the designed shoreline advance? The South Carolina Department of Health and Environmental Control (2020) database shows 27.2 million yd³ of beach nourishment were placed on South Carolina shorelines from 1984-1987 through 2006. Kana (2020) estimates that adding one yd³ of sand to South Carolina's shoreline increases shoreline area after equilibrium is reached by 1.3-1.5 ft². Using Equation (1), this yields $h_c + B = 18-20.8$ ft. Profile survey measurements agree with these values. Kana *et al.* (2013) show that based on profile surveys down to 25 ft and with $B = 6$ ft (Kana 2020), $h_c + B$ varies from 16-21 ft at Kiawah Island, Hunting Island, and Myrtle Beach. Using $h_c + B = 18-20.8$ ft, $V = 27.2$ million yd³, and $L = 67.6$ miles in Equation (1) yields $X = 99-114$ ft. Houston (2019) estimated the uncertainty in $h_c + B$ as 1 meter, the uncertainty in

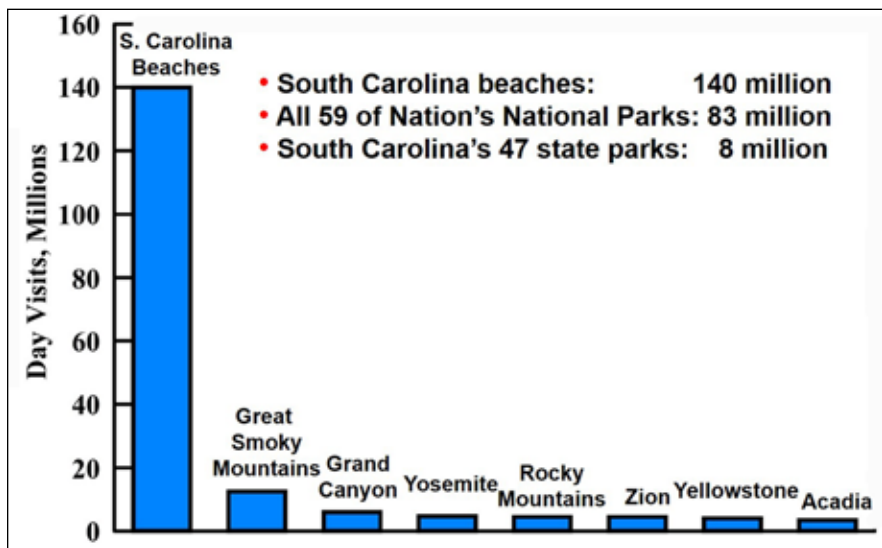


Figure 7. Day visits to South Carolina beaches compared to the seven most visited National parks, all 59 National Parks, and all 47 South Carolina state parks.

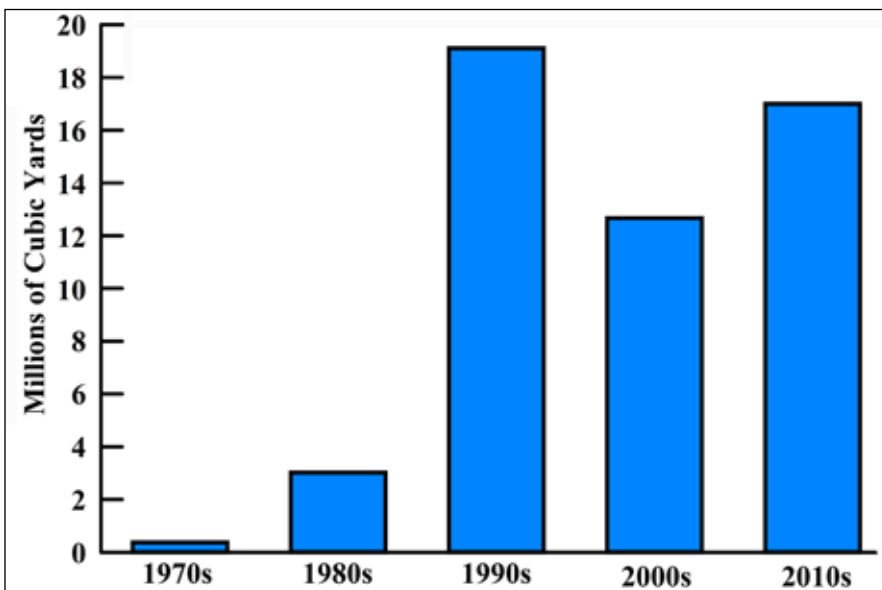


Figure 8. Volume of beach nourishment placed on South Carolina's each decade from 1970-2019.

V as 10%, and no significant uncertainty in *L*. Using standard propagation of error gives $X = 99 \pm 21$ ft and $X = 114 \pm 24$ ft. These values are close to the actual change in beach width from 1984-1987 through 2006 of 110 ft from London *et al.* (2009). This means that after more than 20 years, the beach nourishment sand still remains in place with the shoreline advanced by the amount predicted by Equation (1). This is a remarkable success story.

The shoreline advance has not always been just in beach width, but sometimes an increase in the width and height of dunes and buffer zones between the ocean and structures. For example, Figure 12 shows a 1994 aerial photograph of two buildings in Myrtle Beach and a 2020

aerial photograph of the same two buildings. In 1994 the buildings were almost right on the ocean and protected by what appears to be a rock revetment. Between 1994 and 2020, sand was placed that provided a 150-ft buffer of sand dunes and recreational paths. The beach also widened, but much of the nourishment went to provide the buffer zone.

Placing sand to cover revetments and provide buffers has been typical at Myrtle Beach. For example, Figure 13 shows two photographs of the beach at 17th Avenue South in Myrtle Beach. The left photograph was taken in 1985 at low tide. At high tide there was no beach with the ocean up to the rock revetment. After nourishment, the right photograph shows

the same perspective in 2001 at high tide. In 2020 the beach at high tide is about 100 ft wide at this location and over 250 ft wide at low tide (Google Earth 2020).

Of course, wide beaches and dunes produced by beach nourishment reduce storm damage. Following Hurricane Sandy in New Jersey, Dr. Stewart Farrell, Director of Stockton College's Coastal Research Center, led surveys in New Jersey and said: "It really, really works. Where there was a federal beach fill in place, there was no major damage -- no homes destroyed ... Where there was no beach fill, water broke through the dunes" (InsuranceJournal.com 2012). The Corps of Engineers said: "Post-Sandy analysis shows that the Army Corps' beach nourishment projects in the States of New York and New Jersey saved an estimated \$1.3 billion in avoided damages" (Corps of Engineers 2016).

THE ECONOMIC RETURN ON INVESTMENT IN BEACH NOURISHMENT

Most economic development and taxes generated by tourists in South Carolina are generated by beach tourists. "The beach/dune system provides the basis for a tourism industry that generates approximately two-thirds of South Carolina's annual tourism industry revenue" (South Carolina Legislature 2020). It was shown earlier in the South Carolina Tourism section that South Carolina tourists generate \$25.2 billion in economic development and \$2.65 billion in tax revenue. With beach tourism generating two-thirds of revenue, South Carolina beach tourists generate about \$16.8 billion in South Carolina economic development and \$1.77 billion in tax revenue.

For each dollar spent on beach nourishment in South Carolina (not including mitigation and emergency spending), beach tourists generate \$1,209 in South Carolina economic development and \$127 in taxes to federal, state, and local governments (Figure 14).

Assuming the federal and state governments receive the same percentage of taxes generated by beach tourists as they do for all tourists, the federal and state governments annually receive \$584 million and \$803 million respectively from beach tourists or 78% of the taxes (Figure 15). Yet, if mitigation and emergencies are eliminated, the combined payments of federal and state governments are only

about 47% of nourishment costs (Figure 11b), amounting to only \$6.5 million annually versus tax income generated by beach tourists of \$1.38 billion.

Figure 16 shows that beach tourists generate \$127 in tax revenue for each dollar spent on beach nourishment by all levels of government. However, the state government receives \$259 for every \$1 it invests, the federal government receives \$172, and local governments only \$53.

Figure 16 shows that beaches are clearly great investments. Given the low level of state funding, the value of beaches seems least appreciated at the state level. However, some in state government understand the value. Steve Moore, the Director of Planning, South Carolina Office of Ocean and Coastal Resource Management (OCRM) said: "If you look at the tourism industry and the money it brings in, it makes sense economically to nourish beaches" (Sea Grant 2003). Chris Brooks, South Carolina OCRM Deputy Commissioner said: "Through nourishment, we are protecting our most important economic asset" (Sea Grant 2003).

MISPLACED PRIORITIES

Both the South Carolina state and federal governments have misplaced priorities relating to the Port of Charleston versus South Carolina beaches. They are paying \$548.9 million (the state \$203.5 million and the federal government \$345.4) to deepen the channel into the Port of Charleston from 45 to 52 ft (Corps of Engineers 2020). The state's share is 66 years of what it pays for South Carolina beach nourishment benefiting tourism, and the federal share is 99 years of what it pays. Of course, in addition to the Port flooding the country with imports, its jetties have caused thousands of feet of shoreline recession on Morris Island and significant recession on Sullivan's and Folly Islands (Bush *et al.* 2001).

The Port imports \$48 billion of goods and exports \$27 billion for a trade deficit of \$21 billion (South Carolina Ports 2020) (Figure 17). The deepening will allow foreign competitors to import goods more cheaply. Manufacturing jobs in South Carolina as a percentage of private sector jobs has declined from 28.1% to 14.4% from 1994-2018 due to imports (Citizen.org 2018). The top five shipping routes to the Port are Ho Chi Minh City, Vietnam; Jawaharlal Nehru, India; Manila, Philippines; Mumbai, India; and Penang,

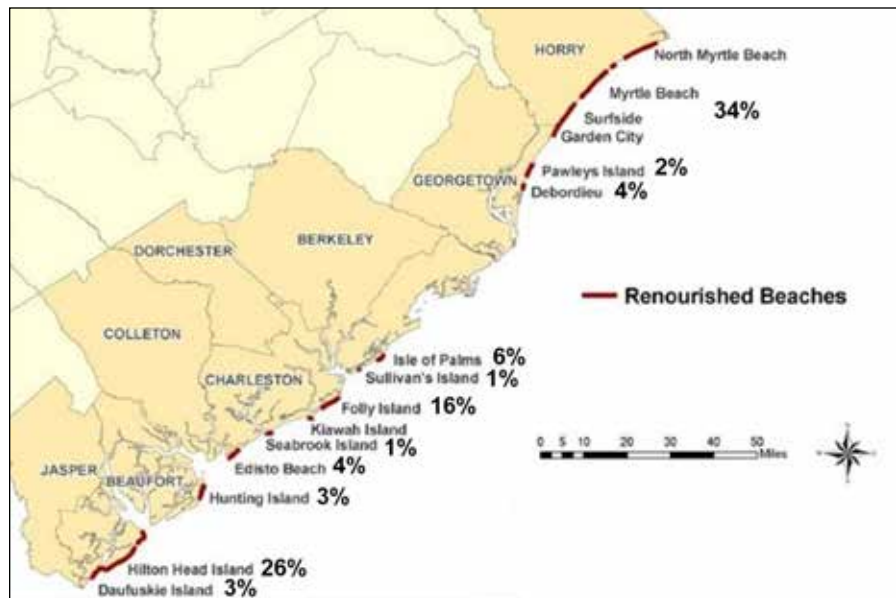


Figure 9. Percentages of beach nourishment placed at beaches in South Carolina from 1990 to 2019.

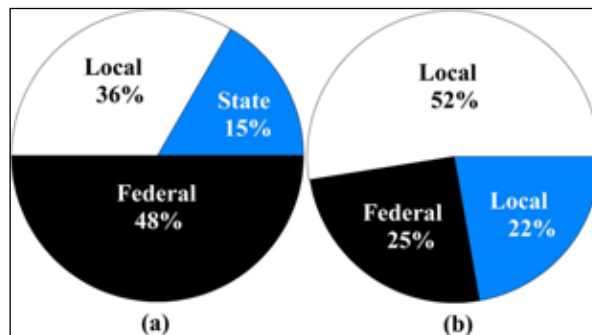


Figure 10. Percentages of beach nourishment funding from 1990 to 2019 paid by federal and state governments and local interests. Pie chart (a) includes all nourishments, but pie chart (b) excludes federal mitigation and emergency nourishments.

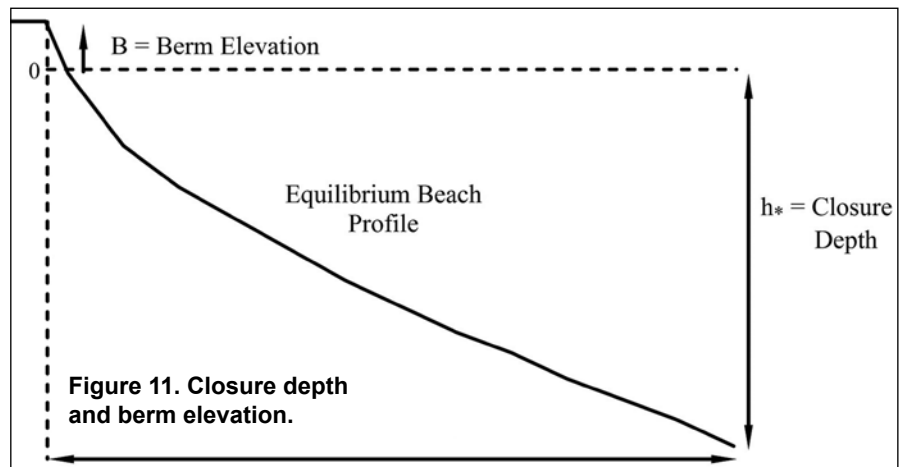


Figure 11. Closure depth and berm elevation.

Malaysia (Icontainers.com 2020). All are routes from Asia. If foreign competitors want deeper channels to import goods more cheaply into the U.S., they ought to pay to deepen them rather than the state and federal government paying.

Foreign companies, countries, and consumers benefit from reduced import costs. But American workers and America's balance of trade are harmed. Ports ran a 2019 trade deficit of \$475 bil-

lion (South Carolina Ports 2020), costing tens of millions of jobs, whereas tourism in America ran a \$59 billion surplus (U.S. Travel Association 2020c), providing millions of jobs. It does not make sense for the federal government to give a high priority to importing goods more cheaply, thereby costing American jobs, but a low priority to tourism that creates American jobs. Since the Water Resources Development Act of 1986, if over one-half of benefits required for project justification

Figure 12 (right). Aerial photos in 1994 and 2020 showing two buildings in Myrtle Beach (Google Earth 2020).



Figure 13 (below). The left photograph is in 1985 at low tide and the right photograph is in 2001 at high tide (Kana et al. 2013).

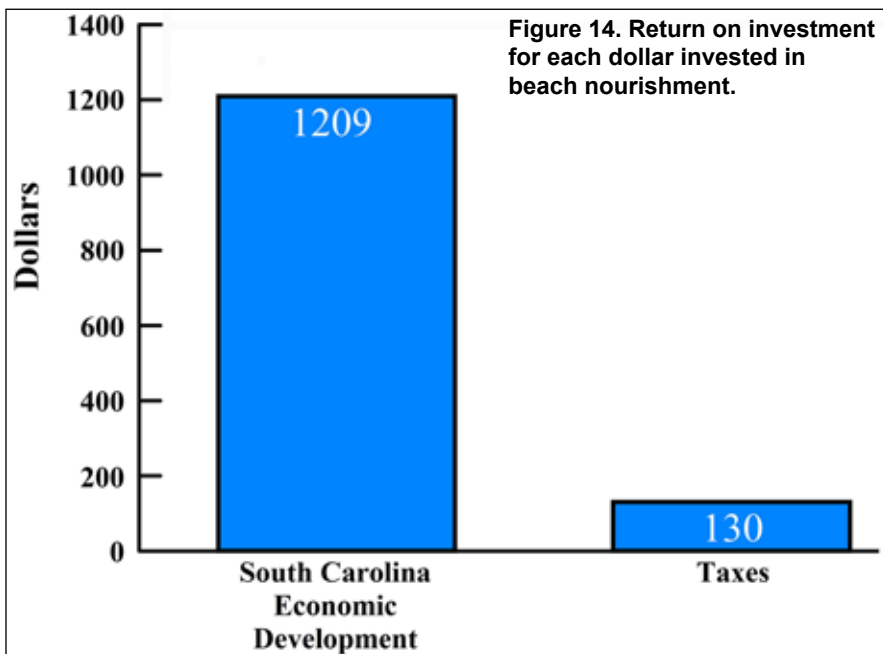
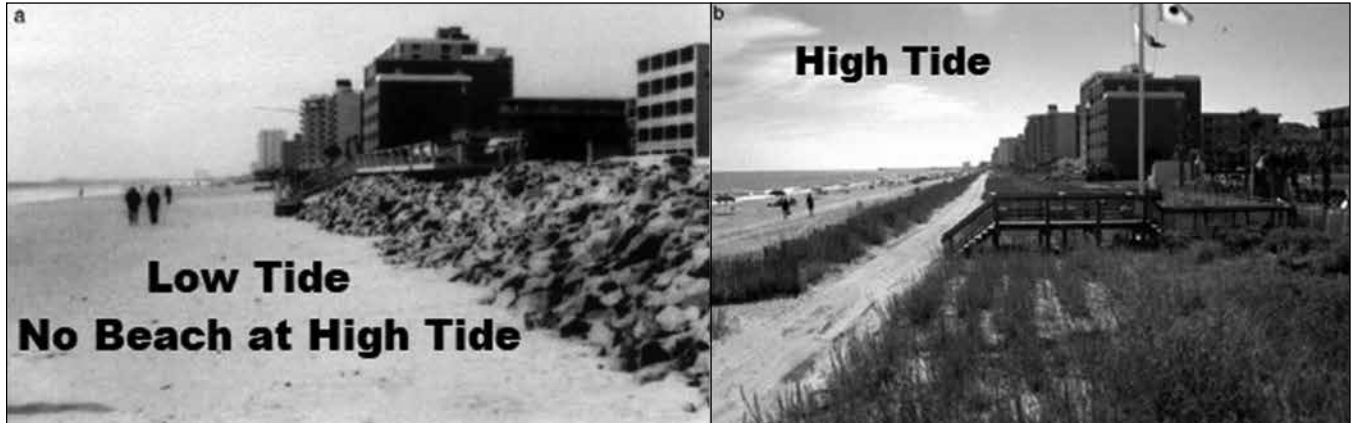


Figure 14. Return on investment for each dollar invested in beach nourishment.

(TripAdvisor 2020). If South Carolina beaches become run down, tourists have plenty of options and will go elsewhere.

CONCLUSIONS

1. Beach tourism is very important.

It generates two-thirds of all tourist spending in South Carolina, contributes \$16.8 billion annually to South Carolina economic development, and provides \$1.77 billion in tax revenue to federal, state, and local governments.

2. Beach nourishment has been remarkably successful.

Shorelines that were nourished from 1984-1987 through 2006 advanced 110 ft on average, whereas those not nourished during the same period receded 101 ft on average (London et al. 2009).

3. Beach nourishment is a great investment.

For every \$1 invested in South Carolina beach nourishment, beach tourists have generated over \$1,200 in South Carolina economic development and \$127 in taxes. The state government has notably benefited the most annually from taxes generated by beach tourists (\$803 million), but provided the least funding for beach nourishment (\$3.1 million).

are for recreation, Department of Army budgetary policy precludes federal participation (Corps of Engineers 1996). Both the federal and state governments should rethink their priorities on port versus nourishment funding.

Tourists have many options. The Florida state government invests \$50 million a year in beach nourishment (Florida Shore and Beach Preservation Association 2020), whereas the South Carolina

state government invests only \$3.1 million. Florida has about four times the Gross National Product of South Carolina but invests more than 16 times as much money into beach nourishment (Statista 2020). Millions of tourists vote on TripAdvisor's Traveler's Choice Awards. According to the Traveler's Choice Awards, of the 15 best beaches in the U.S., eight are in Florida (including four of the top five) and 1 in South Carolina, the ninth ranked

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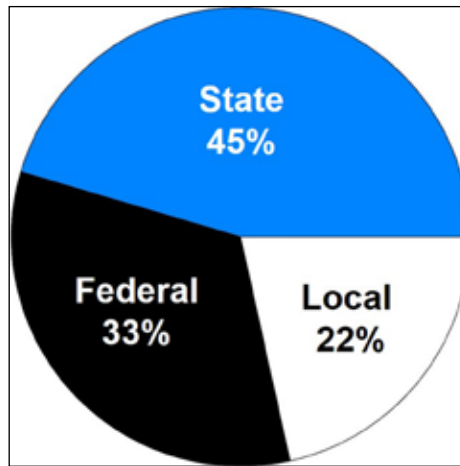
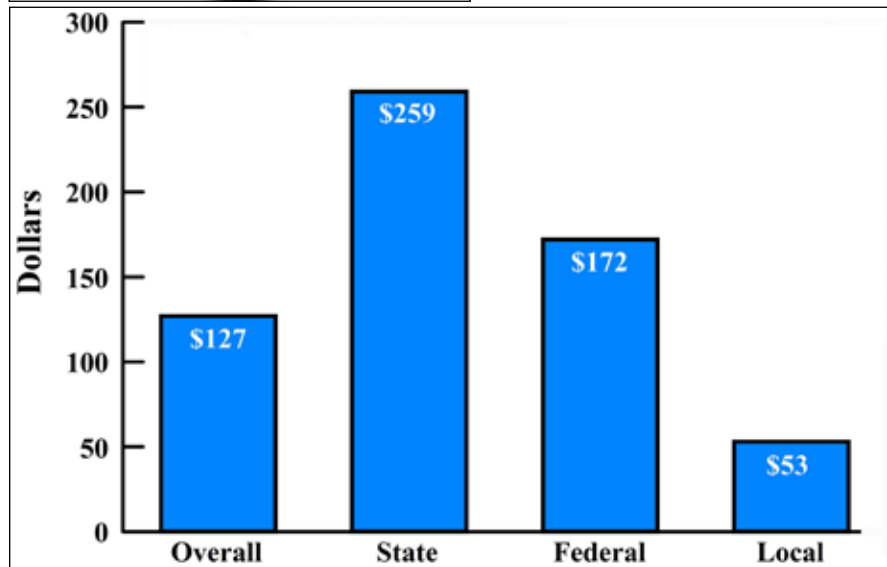


Figure 15 (left). Share of taxes generated by beach tourists.

Figure 16 (below. Return on investment in taxes for each dollar invested in beach nourishment.

Figure 17 (bottom). Containers piling up at the Port of Charleston.



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