POPULATION: DISTRIBUTION, DENSITY AND GROWTH

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Coastal areas are the most developed in the nation. This narrow fringe–comprising 17% of the contiguous U.S. land area–is home to more than 53% of the nation's population. Further, this coastal population is increasing by 3,600 people per day, giving a projected total increase of 27 million people between now and 2015.

The following reference format is suggested:

National Oceanic and Atmospheric Administration (NOAA). 1998 (on-line). "Population: Distribution, Density and Growth" by Thomas J. Culliton. NOAA's State of the Coast Report. Silver Spring, MD: NOAA.

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INTRODUCTION

Coastal areas are crowded and becoming more so every day. More than 139 million people–about 53% of the national total–reside along the narrow coastal fringes. This population is expected to increase by an average of 3,600 people per day, reaching 165 million by the year 2015. This rate of growth is faster than that for the nation as a whole.

Photo 1. More than 53% of the U.S. population lives in the coastal zone.

Their population growth and related development place many of the Nation's coastal areas under increasing pressure. Growth brings jobs, creates economic prosperity, adds new industries, improves regional infrastructure, enhances educational opportunities, and increases tax revenues. It also burdens local environments, however. For example, population pressures include increased solid waste production, higher volumes of urban nonpoint runoff, loss of green space and wildlife habitat, declines in ambient water quality, and increased demands for wastewater treatment, potable water and energy supplies. Ironically, as the coastal population grows, the natural features that may have attracted people to the coast are lost or diminished.

The challenges of assimilating increasing numbers of people along the coast while minimizing the potential environmental degradation from development are considerable. Communities are trying new ways to mitigate the impact of population growth. Maryland's "Smart Growth" program, for example, restricts state spending on roads, sewers, schools, and other public infrastructure to areas adjacent to Washington, DC and Baltimore, and established cities and towns across the state. The objective is to preserve over 500,000 acres of open space and farmland. In Florida, Oregon, and New Jersey, rules have been adopted to lessen the environmental impacts of development and to preserve open space. In

Photo 2. Population growth brings economic prosperity to the coast, but diminishes the natural features of the coastal environment.

Orlando, Florida, the city government has entered into partnership with the owners of several tracts southeast of the city. The purpose is to develop the large parcel (12,000 acres) in a manner that preserves more than 40% of the total land area as parks or natural open spaces in a clustered pattern (Ewing, 1997).

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NATIONAL PICTURE

The Crowding of Our Shorelines

Coastal areas are becoming more crowded every year in the United States. In 1960, an average of 187 people were living on each square mile of coastal land (excluding that in Alaska). This population density increased to 273 persons per square mile by 1994, and is expected to reach 327 by 2015. Population densities are highest along the East Coast, especially in the Northeast.

Photo 3. The coastal zone is only 17% of the land area of the United States, yet its population outnumbers the interior by 16 million.

There are 673 coastal counties in the United States: 285 in the Atlantic, 142 in the Gulf of Mexico, 88 in the Pacific, and 158 in the Great Lakes region. These counties are classified as coastal because they are located entirely or partially within the nation's coastal watersheds. Coastal counties account for about 17% of the land area in the contiguous United States. Counties that are located inland from coastal watersheds, i.e., the 2,470 noncoastal counties, account for 83% of the land area.

The population on the coast outnumbers the population of the nation's vast noncoastal interior by over 16 million people. The noncoastal population, numbering about 122 million, is distributed across the majority of the national land area. The noncoastal population today is similar in density to the coastal population of the early 1980s. Appendix A lists population data by coastal county between 1960 and 1994.

Photo 4. The coastal zone contains 14 of the Nation's 20 most populous cities.

The coast includes the nation's most populous cities. In fact, 14 of the 20 largest cities are located in the coastal zone. The population in seven of these cities exceeds one million people. The surrounding suburban areas, however, are experiencing the most rapid growth. For example, Howard and Charles Counties in Maryland and Prince William and Fairfax Counties in Virginia–all located within the Washington, DC metropolitan area–have grown considerably during the past 20 years.

Coastal counties lead in many demographic indicators. During the last decade, 17 of the 20 fastest growing counties were located along the coast. In addition, the coast accounts for 19 of the 20 most densely populated counties in the country. Coastal counties are also undergoing more development than noncoastal areas, as they include 16 of the 20 counties with the largest number of new housing units under construction. With 18 of the 20 leading counties in per capita income located along the coast, these counties are also among the nation's wealthiest (Bureau of the Census, 1994a).
(top)

Photo 5. The populations of seven Florida counties will increase over 45% by the year 2015 (see Table 1).

Hot Spots of Growth

Between 1994 and 2015, the largest coastal population increases are expected to be in southern California, Florida, Texas, and Washington (Figure 1). Ten counties will account for almost one-third of all anticipated coastal population growth (Table 1). The largest population increases are projected for Los Angeles (1.6 million) and San Diego (1.3 million) Counties in California and Harris County (Houston, 1.3 million) in Texas.

Table 1. Leading counties in population growth, 1994-2015

County	Population Change, 1994-2015	County	Percent Change in Population, 1994-2015
1. Los Angeles, CA	1,603,499	1. Flagler, FL	55
2. San Diego, CA	1,280,284	2. Hernando, FL	54
3. Harris, TX	1,264,147	3. Citrus, FL	51
4. Orange, CA	825,281	4. Charlotte, FL	50
5. Riverside, CA	813,505	5. Osceola, FL	50

6.	San Bernardino, CA	760,098	6.	Collier, FL	50
7.	Broward, FL	633,323	7.	Dillingham, AK	49
8.	Dade, FL	585,892	8.	Pasco, FL	46
9.	Palm Beach, FL	575,424	9.	Prince of Wales-Outer Ketchikan, AK	45
10.	King, WA	572,869	10.	Matanuska-Susitna, AK	45

Sources: Bureau of the Census, 1997; NPA Data Services, Inc., 1995.

Many areas along the coast have grown rapidly from a small population base in the past few decades. Rapid population growth has occurred since 1960 in vacation and retirement communities in Florida, especially along its western coast. Rapid rates of growth have also occurred in "exurban" counties such as Prince William (VA), Stafford (VA) and Calvert (MD), located along the Washington, DC metropolitan area's outer fringe. Dare (NC), Dorchester and Berkeley (SC) and Virginia Beach (VA) Counties typify southeastern counties where economic development and relocating retirees are fueling rapid population growth.

Many of the nation's most rapidly growing counties are in Florida.During the past several years, the state's population has increased by about 4,400 people per week. Large numbers of people have flocked to the Miami-Ft. Lauderdale metropolitan area, as well as to Florida's southwest coast.

Growth along the southern California coast–from Santa Barbara to San Diego–has also been rapid, averaging about 4,000 newcomers every week. This area's population is expected to increase by 5.6 million people over the next 20 years. The southern California coastal population is projected to reach almost 24 million by 2015.
(top)

Trends in Growth

Coastal population growth includes both a movement toward the shore and the expansion of a large population base. Coastal population grew rapidly in the 1960s and 1980s. In the 1960s, coastal population soared by 16%, from 95 million people to over 110 million; in the 1980s, the population grew another 11% (14 million). Population increases during the 1990s and between 2000 and 2010 are projected to increase be about 9% (12 to 13 million people) in each decade.

Photo 6. Coastal areas are projected to gain 12 to 13 million people in each of the next two decades.

Noncoastal population grew most rapidly in the 1970s, when it increased by more than 13 million people. In the 1960s and 1980s, population increases in noncoastal areas averaged about 8 million per decade. The noncoastal population is projected to increase by 13 million in the 1990s and 11 million in the following decade.

The coastal portion of the U.S. population has been, and will continue to be, relatively stable. It has averaged between 53% and 54% of the national population total since 1960. This proportion is expected to remain the same by 2015. Currently, 53.2% of the U.S. population resides in coastal counties.

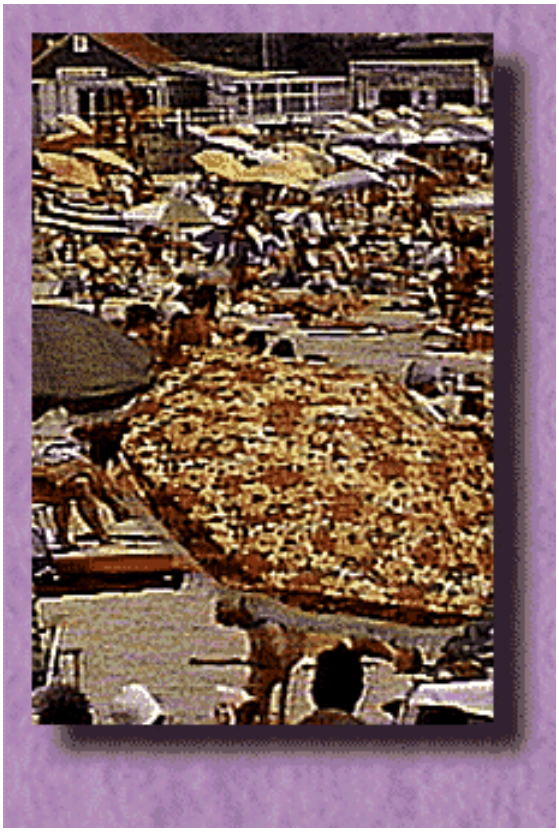

Photo 7. Between 1960 and the year 2015, coastal population is expected to increase by 71 million people, more than double the current population of California.

As coastal areas become more crowded, sprawling suburban and exurban patterns often characterize development. In addition to the 5,800 housing units in multi-unit buildings that are built every week, about 8,700 new single-family homes are constructed along the coast. Single-family housing developments frequently include large homes on large lots. For example, almost one-third of all new home construction is for houses with more than 2,400 sq ft of floor area (Bureau of the Census, 1994b). Further, the median lot size in the United States is about 17,000 sq ft (Culliton et al., 1992).

The number of people living in this increasingly crowded space will be dramatic. From 1960 to 2015, the coastal population will have increased by 71 million people. This is more than twice the size of California's current population. The noncoastal population, by comparison, will have increased during this time period by about 59 million people across a much larger area.

Coastal population is expected to grow at a slightly faster pace and account for more people than the rest of the Nation over the next 20 years. Between 1994 and 2015, coastal population is projected to increase by 28 million people (20%), compared to a 22 million increase (18%) in noncoastal areas.

From 1960 to 2015, the population density in all coastal counties (excluding those in Alaska) will have grown from 187 to 327 persons per sq mi. This is about three times the national average (Figure 2). The most crowded portion of a coastal area is generally that part bordering an ocean or estuary. These locations are primary areas for residential and commercial development. The population density for counties located directly along a tidal shoreline reveals the demand–an average of 360 people live within every sq mi of land in these counties. These counties are more densely populated than the coastal nations of Denmark, Portugal and Indonesia.
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REGIONAL CONTRASTS

The following discussion addresses contrasts among five regions: Northeast (Maine to Maryland); Southeast (Virginia to eastern Florida); Gulf of Mexico (western Florida to Texas); Pacific (California to Washington, plus Alaska and Hawaii); and Great Lakes (western New York to Minnesota).

Coastal population trends show that the regions with warmer climates–the Southeast, Gulf of Mexico, and Pacific–have grown most rapidly in recent decades and will continue to do so in the near future. The Northeast and Great Lakes regions have experienced far less rapid growth.

Population Distribution

The Northeast currently accounts for about one-third of the coastal population (44 million people). Its population density of 654 persons per sq mi is more than double that of any other region. The Pacific region (25%) is the next most heavily populated, with a density of 266 persons per sq mi (excluding Alaska). The Great Lakes (19%), Southeast (12%), and Gulf of Mexico (12%) account for a smaller share of the coastal population. Of these three regions, population density is highest in the Great Lakes (229 persons per sq mi) and lower in the Southeast (209 persons per sq mi) and the Gulf of Mexico (142 persons per sq mi).
(top)

Photo 8. The Northeast region, including this area of Maryland, has the highest population density in the United States.

Population Trends

Coastal population changes over time reveals several interesting trends. For example, projections indicate that the Pacific (28%), Southeast (14%), and Gulf of Mexico (13%) regions will account for larger shares of the coastal population in 2015. Each region is expected to increase by about one-third. The Northeast and Great Lakes regions will account for a smaller share of the coastal population. Although the population of the Northeast is projected to increase by 2.9 million people between 1994 and 2015, it will account for only 29% of the U.S. coastal population, a decrease from 32% in 1994. The Great Lakes share of the coastal population will show a similar trend by declining from 19% in 1994 to 17% in 2015 (Figure 3).

The Pacific region, with the third highest population among the regions in 1960, is projected to have a population almost equal to the Northeast's by 2015. From 1960 to 2015, the Pacific region's population will grow by more than 28 million people–a 158% increase. The Southeast and the Gulf of Mexico regions can also expect rapid increases. The coastal Southeast accounted for about 8 million people in 1960, but the number will soar to almost 23 million by 2015–a 188% population increase. Likewise, the Gulf of Mexico is projected to increase from 8 million in 1960 to 22 million (175%). The Northeast will increase by 30%, from 37 million to 48 million, and the Great Lakes by 17%, from 24 million to almost 28 million during this time frame.
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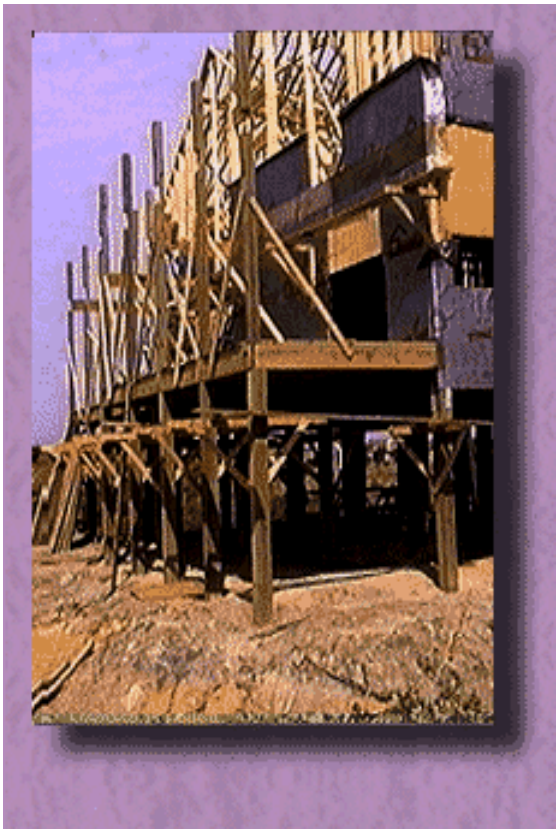

Trends in Housing Construction

The growth in housing construction dovetails with population trends. The Northeast and Southeast regions together accounted for 8.2 million new housing units between 1970 and 1994. The Pacific region accounted for 5.2 million new units; the Gulf of Mexico region, 2.9 million units; and the Great Lakes region, 2.6 million units.

Single-family homes make up about 60% of all new housing along the coast. About 453,000 new single-family homes are constructed in coastal areas every year. Multi-unit dwellings (e.g., duplexes, condominiums, apartments) are built at the rate of 303,000 units per year.

More than 62% of all new housing starts along the Atlantic Coast and in the Great Lakes region are for single-family dwellings. Multi-unit buildings are more common in the Pacific Region; only 55% of new housing construction is for single-family homes.

The most dramatic growth since 1970 has occurred in Florida and California, where an estimated 7.6 million housing units were authorized for construction. Nearly 40% of all new housing construction along the U.S. coast occurs in these two states.
(top)

Photo 9. Construction in Florida and California has accounted for 40% of all new housing in coastal areas since 1970.

Seasonal Housing

The heaviest concentration of seasonal housing lies along the Northeast Coast, particularly on the barrier islands. In 1997, about 484,000 seasonal homes (e.g., single-family homes, cottages, condominiums) are located along the northeastern seaboard. More than one-fifth of these seasonal dwellings are concentrated along the New Jersey shore. Massachusetts (18%), New York (17%) and Maine (16%) also account for large shares of second homes along the Northeast Coast.

Photo 10. Forty-one percent of all seasonal homes in the Southeast region are found in the area between West Palm Beach and Miami.

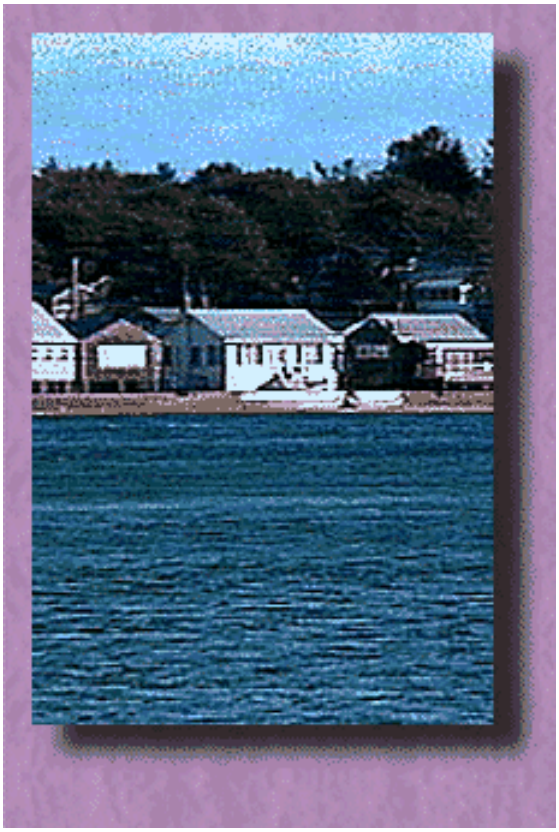

Photo 11. Seasonal housing in the United States is most heavily concentrated in the Northeast.

More than 63% of seasonal housing in the Southeast is located along the Florida coast. The area from West Palm Beach to Miami is one of the nation's leading tourist destinations, and accounts for 41% of all seasonal homes from Virginia to Florida's southeast coast. North Carolina and South Carolina account for much of the remaining seasonal housing in the region.

In the Gulf of Mexico, western Florida accounts for almost 70% of all seasonal dwellings. Rapid development has occurred along the state's southwest coast in recent decades. For example, almost 14,000 new seasonal homes were constructed near Ft. Myers in the 1980s. Another 10,000 seasonal dwellings were constructed in Collier County, home to such beach resorts as Marco Island and Naples.

Seasonal housing in Pacific coastal counties is most heavily concentrated in California, with about 60% of all seasonal dwellings in the Pacific region located in the state. Most of the state's seaside homes are in the greater San Diego and Los Angeles areas. The state of Washington accounts for about 19% of second homes in this region. Hawaii, a tourist mecca, surprisingly represents only 6% (12,876 units) of the regional total.

Michigan's extensive shoreline rimming the Great Lakes makes it the regional leader in seasonal housing. It accounts for 56% of all coastal seasonal dwellings in the region. New York (16%) and Wisconsin (13%) host many of the remaining second homes in the region.
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CASE STUDIES

South Florida

The 16 counties of South Florida lie roughly within the area that extends from Lake Okeechobee, south through the Everglades, and into the Florida Keys. This diverse ecosystem includes wetlands, forested uplands, mangroves, beaches, and coral reefs. At one time, wetlands dominated the ecosystem, covering much of central and southern Florida (South Florida Ecosystem Restoration Task Force, 1994).

Photo 12. The population explosion in South Florida has dramatically changed the landscape from expansive wetlands to heavily developed communities.

Florida's population explosion began after World War II. In 1940, the state had a population of 1.8 million; by 1996, the population had reached 14.3 million, an increase of almost 700%. Much of this growth has been along Florida's lower east coast, an area that currently accounts for about 4.5 million people. Dade County, which includes Miami, grew from more than 267,000 in 1940 to over 2 million people by 1994 (Bureau of the Census, 1996).

This expanding human presence has dramatically changed the South Florida ecosystem. The construction of canals, levees, pumping stations and water diversion/flood control structures that began in the late 1800s and continued through the 1960s has altered the area's natural hydrology. As a result, problems in both water quality and water quantity have developed in

South Florida's natural systems, including the Everglades and its associated estuaries. In addition, while agricultural and urban demands on water sources have been increasing, the conversion of land to agricultural and urban uses, and the shunting of fresh water formerly stored in wetlands, soils and aquifers have reduced the water supply (South Florida Ecosystem Restoration Task Force, 1994).
(top)

Puget Sound

Another rapidly developing coastal area is Puget Sound, Washington. In 1940, the area's population totaled 860,000. It has increased by about 400,000 people every 10 years since then. The area is now home to about 3.2 million people. Rural areas are being engulfed by housing and commercial developments. Forests and meadows are being replaced by roads, homes, office buildings and shopping malls. Keeping Puget Sound healthy is a more and more difficult task.

Photo 13. Seattle has grown by 1.5 million people over the last 30 years.

The area's population is expected to increase by another 1.4 million people, reaching 4.6 million in the year 2015. The fastest growing areas include Island County to the north and Thurston County to the south. The population of King County, in which Seattle lies, is expected to increase by 26% to 2.2 million people by 2015. It already ranks 10th among coastal counties in terms of absolute population, which makes it larger than the coastal population for 11 states.

Seattle comprises about 9% of the Pacific population total. The Seattle area's population has increased by 98% or 1.5 million people since 1967. An average of 1,100 people are moving into the Seattle metropolitan area every week.

Development is also rapid along the Puget Sound coast. An average of 500 new homes are constructed every day, with single-family homes accounting for about 55% of all new housing development in the region.

Growth along the edges of Puget Sound has created a number of concerns. Monitoring studies have shown significant increases of chemical contaminants in the tissues of birds and salmon. Fecal contamination has claimed over 40% of Puget Sound's commercial shellfish beds (more than

half of the restrictions coming in the last decade) (Puget Sound On-line, 1997). Nearshore habitats are also being lost; for example, studies have documented a 73% decline in the Puget Sound salt marshes.

To combat these problems, the State of Washington developed a series of water quality initiatives that started in the 1980s. Monitoring has revealed that the status of the Sound has not changed much since 1991. The fact that water quality has stabilized may be due to the ongoing efforts of state and local governments, citizens, tribes, businesses and others to prevent pollution. The state legislature recently provided $4.4 million in additional funding for technical assistance to local governments to improve the health of Puget Sound's shellfish; correct failing on-site sewage systems; and improve scientific monitoring of water quality, habitat and resources (Puget Sound On-line, 1997).
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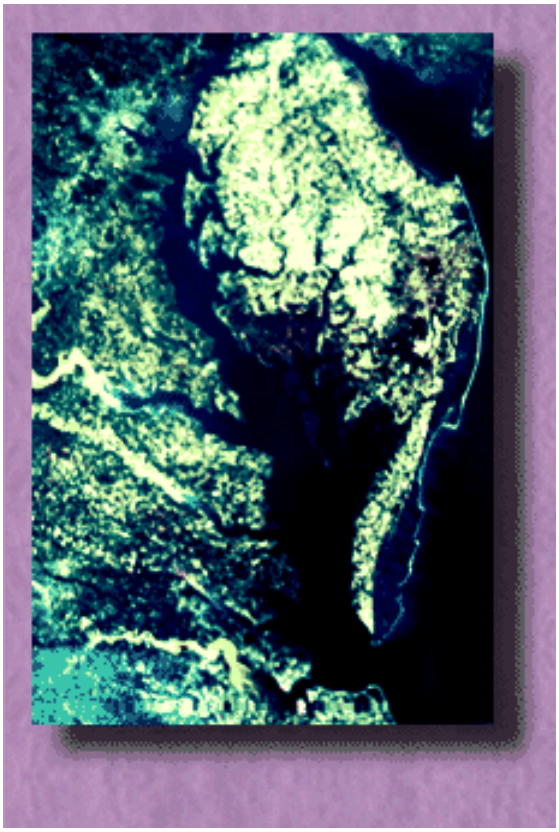

Photo 14. An expanding population increases wastewater flows to the Chesapeake Bay. Improved wastewater treatment and a ban on phosphorus-containing detergents have reduced point sources of phosphorus by 70% since the 1970s.

Chesapeake Bay and Maryland

The population of Maryland changed from about 3.6 million in 1960 to almost 5.2 million in 1994–an increase of about 3,900 people per month. This growth has yet to abate; to the contrary, an increase of 880,000 people is projected for the state's coastal counties between now and 2015.

Such growth had an enormous impact on the Chesapeake Bay, the largest estuarine system in the United States. The Bay's watershed, radically changed by European settlement three centuries ago, continues to undergo changes that reflect land use across this 64,000-sq-mi expanse. Urban, suburban and agricultural lands all leach more pollutants into the Bay than natural forests or wetlands. About 40% of the land is no longer in its natural state, and wetlands are still being lost at a rate of about 8 acres per day (Chesapeake Bay Program Home Page, 1997).

An ever-expanding population has resulted in higher wastewater flows to the Bay. Through increased wastewater treatment and a ban of phosphorus-containing detergents, point sources of phosphorus have been reduced by 70% since a peak in the 1970s–despite a 40% increase in flows. Recently implemented controls of nitrogen are already reducing the levels of this pollutant entering the Bay from point sources, such as industries and municipal sewage treatment plants (Chesapeake Bay Program Home Page, 1997).

The Maryland state legislature recently passed a bill, referred to as the "Smart Growth" legislation, to discourage low-density suburban development. The legislation earmarks state funding of infrastructure (e.g., roads, sewers, schools) for new development to "growth areas" along the Washington-Baltimore metropolitan corridor and to established cities and towns. Any development outside these growth areas would not receive state support (Sustainable Communities Network, 1997).

A major objective of the legislation is to preserve Maryland's agricultural lands and green space. Without the legislation, it was feared that some half-million acres of open space and farmland would be lost over the next 20 years (Sustainable Communities Network, 1997). Land use in the watershed is far more than an aesthetic concern; it is a basic factor in the ecological "health" of the Bay. Trees filter sediment and nutrients from runoff, and their roots stabilize the shoreline and reduce erosion. By shading the water, riparian forests also reduce summer water temperatures, increasing dissolved oxygen levels. Limits on development reduce pollutant levels carried in stormwater runoff, as well as the volume of wastewater and solid waste requiring disposal (Chesapeake Bay Program, 1995).

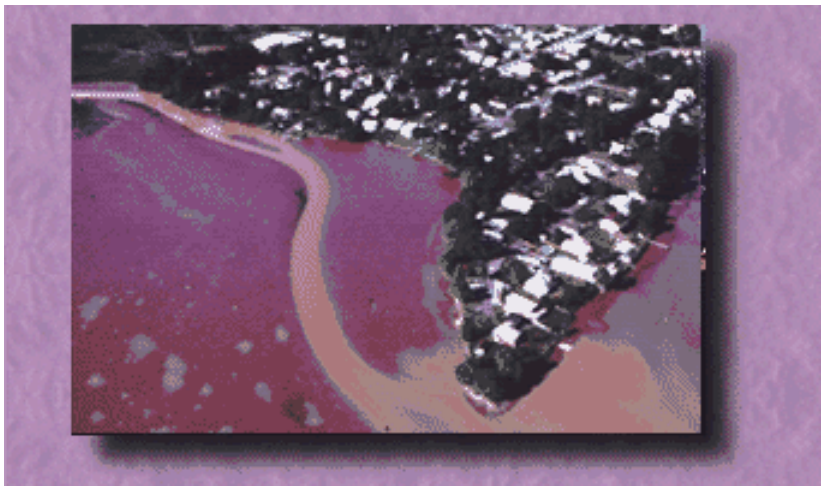

Photo 15. Maryland's "Smart Growth" legislation was passed to preserve agricultural lands and open space by earmarking state funds for public infrastructure to designated "growth areas" and established cities and towns.

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EXPERT INTERPRETATION

The four individuals below are experts in the topic of Population: Distribution, Density and Growth. Here they voice their opinions on two questions relevant to that topic.

Question 1 – What can we do to limit the environmental impacts from increasing population growth in coastal areas? Please provide examples.

Question 2 – How do increases in seasonal population affect coastal environmental quality? What examples can you provide?

Experts

			
Sarah Cooksey	William Matuszeski	Orrin Pilkey	Niels West

Sarah Cooksey

Administrator, Delaware Coastal Management Program, Delaware Department of Natural Resources and Environmental Control

Ms. Cooksey has been involved in environmental protection for the past 15 years. For the past five years, she has been head of the Delaware Coastal Management Program; for the past two years, manager of the Delaware National Estuarine Research Reserve. Ms. Cooksey was also employed for a number of years by the U.S. Environmental Protection Agency in Washington, D.C. where she worked with state governments on water pollution control.

Response to Question 1

Response to Question 2

(top)

Question 1. What can we do to limit the environmental impacts from increasing population growth in coastal areas? Please provide examples.

Click here for audio response

(audio requires RealPlayer, see Using this Site)

To limit environmental impacts from increasing population, managers must do two things. We must provide incentives for responsible stewardship and liability for environmental impacts. The incentives range from financial compensation for environmental protection to instilling in people a sense of good will toward coastal resources. Specific incentives would:

- Provide mass transit at low cost and convenient locations to entice people out of their cars.
- Instill in all citizens an environmental stewardship ethic.
- Make people aware that they are causing the impacts and that they can help minimize them.
- Use our systems of reserves to provide lawmakers, homeowners, business owners, and developers education about sustainable coastal resources.

The provision for liability generally involves money. It would mean:

- For every parcel of critical habitat lost or significantly altered, require double in compensation.
- Not allowing development that impacts water or beaches that is non-water/beach dependent.
- Requiring all housing developments to be on sewers, then require nutrient removal, then limit discharge capacity.
- Enacting stream corridor protection requirements.
- Requiring open space for wildlife in all developments.
- Practicing pollution prevention.

Education is critical; enforcement is required; funding is mandatory.
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Question 2. How do increases in seasonal population affect coastal environmental quality? What examples can you provide?

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I have a lot of personal experience with seasonal population increase since I live near the "Summer Capital of the U.S.," Rehoboth Beach, Delaware. Seasonal population increases affect all aspects of the coastal environment. When the season starts, there is a noticeable decrease in wading birds and

shorebirds along our tidal and beach areas. This is due to boating traffic and people traffic. Solid waste increases along our roadsides. Cigarette butts clog storm drains. Sewer discharges increases two orders of magnitude, exacerbating the nutrient loads of our already eutrophic Delaware Inland Bays. We continue to be in an "ozone nonattainment area" because even though stationary air pollution controls are decreasing emissions, mobile sources are increasing.

We are also losing a sense of a coastal heritage. In many ways, people aren't coming to the beach to enjoy coastal resources. They are coming to shop. Outlet malls are becoming a large land use. Some people come to the beach and don't even see the water. Coastal environmental quality decreases, and some people don't even know what they are missing. While some impacts are lessened by the end of September when most of the people leave, the market for second homes has caused permanent loss of coastal resource habitat.
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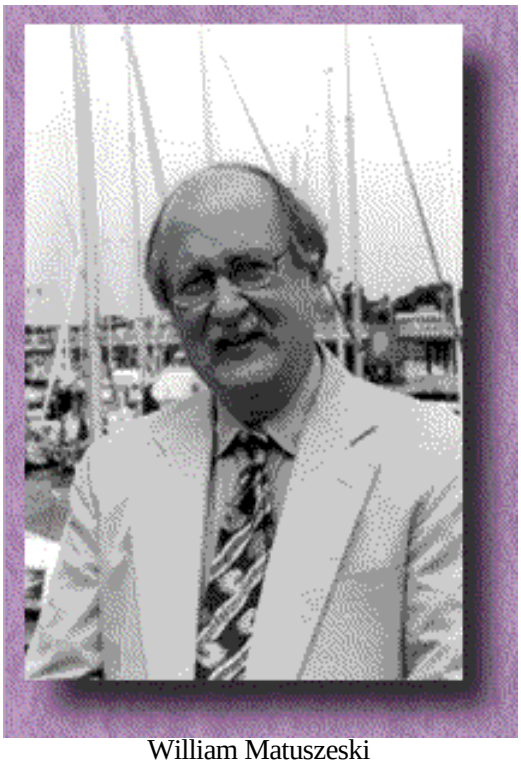

William Matuszeski

Director, Chesapeake Bay Program, U.S. Environmental Protection Agency

Mr. Matuszeski has been with the Chesapeake Bay Program Office since 1991. Prior to that, he spent several years with water programs at the headquarters office of the U.S. Environmental Protection Agency. From the late 1970s to late 1980s, he was with the National Oceanic and Atmospheric Administration, where he served as Director of State Programs in the Office of Ocean and Coastal Resources Management and as the Executive Director of the National Marine Fisheries Service.

Response to Question 1

Response to Question 2

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Question 1. What can we do to limit the environmental impacts from increasing population growth in coastal areas? Please provide examples.

Click here for audio response

(audio requires RealPlayer, see Using this Site)

It's important to realize that the problems we face in coastal areas are less related to the numbers of people than to the way we choose to live. Certainly, we have the technology to accommodate even larger numbers of people in even fragile areas like our coastlines, provided we are willing to change our patterns of land consumption, auto dependency and housing design. But these are very big "ifs." Our underlying challenge is to change people's values. Ten years ago no one would have predicted that Americans would buy wholesale the idea of recycling bottles and cans. We need to bring about a similar change in thinking about how we live on the land and share the limited natural resources of our coasts. The big home on the oversized lot with a lawn down to the water should become as out-of-date as throwing beer cans out of the gas guzzler. It shows the same level of respect for our environment.
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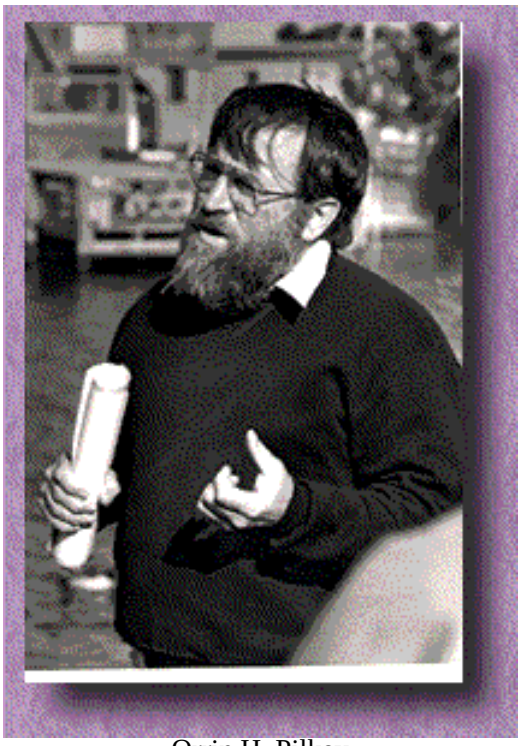
Question 2. How do increases in seasonal population affect coastal environmental quality? What examples can you provide?

Click here for audio response

(audio requires RealPlayer, see Using this Site)

One major effect of seasonal development relates to the handling of

wastewater. Influxes of people require that these systems be capable of handling high flows. Continued reliance on septic tanks can overload coastal waters with nitrogen, exacerbating the largest single estuarine water quality problem in the U.S., which is eutrophication. If modern sewer systems are introduced, the capacity required to handle seasonal influxes can overburden the small number of taxpayers, thereby creating pressures for more development to share the cost of the large capacity systems. This can quickly change the character of coastal areas and cause the loss of the very amenities and natural resource values which attract people.
(top)



Orrin H. Pilkey

James B. Duke Professor of Earth Sciences, Division of Earth and Ocean Sciences, Duke University and Director of the Duke University Program for the Study of Developed Shorelines

Dr. Pilkey has taught and conducted research at Duke University for over 30 years. Prior to joining the faculty at Duke University, he spent three years at the University of Georgia Marine Institute. His expertise centers on both basic and applied coastal geology, primarily on barrier island coasts. Specific topics of Dr. Pilkey's research include beach nourishment, validity of mathematical models in predicting beach behavior and hazard mapping.

Response to Question 1

Response to Question 2

(top)

Question 1. What can we do to limit the environmental impacts from increasing population growth in coastal areas? Please provide examples.

Click here for audio response

(audio requires RealPlayer, see Using this Site)

The best way to limit the environmental impact from increasing population is to limit the increasing population. This is a very difficult thing to do. Perhaps one way to go about this is to slow down development, especially high-density development such as high rises and multifamily buildings that are not there now. It would be very, very useful not to allow them to be built.

Another way to limit population's environmental impact is not to rebuild destroyed buildings after storms. In my view, Hurricane Fran was an urban renewal project for Topsail Island, North Carolina. We should understand how the islands "work" and try to live with them rather than live on them. For example, when storm overwash pushes sand onto an island, it should not be dumped back to the sea. The elevation of that island should be allowed to rise by the height of the sand that was deposited during the storm. In Rodanthe, North Carolina, a recent storm put four to five feet of sand over many sections of the town. The island is trying to increase its elevation in order to respond to the rising sea level.

Another approach is to work with nature on the back sides of barrier islands or along the lagoon shorelines. Instead of building seawalls, construction of salt marshes will help improve water quality, provide habitat for fishery resources and, at the same time, prevent or at least greatly reduce shoreline erosion.
(top)

Question 2. How do increases in seasonal population affect coastal environmental quality? What examples can you provide?

Click here for audio response

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In my view, most coastal communities, especially tourist communities, and this is most of the coastal communities, are really very small villages during most of the year. They become big and high-density villages during the tourist season. The tourist season may vary. Along most of the coast, the major increase in population density occurs during the summer and early fall. In Florida, density increases during the winter.

Everything that impacts the coastal environment is a function of the high population that occurs during the tourist season. This is the situation that puts the most pressure on water quality on all sides of the barrier islands where many coastal communities are located. This is the situation that puts the pressure on the local politicians to come up with money to pay for beach nourishment. This is the population that calls for or is responsible for the pressure on politicians to build sea walls, which eventually destroy the very beach that they want to enjoy. So overall, the increase in seasonal population is, in my view, totally responsible for environmental problems on the coast.
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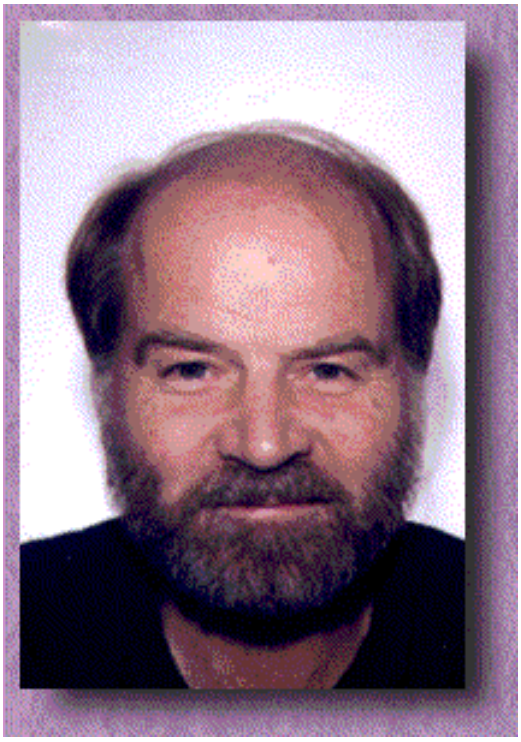

Neils West

Professor, Department of Marine Affairs, University of Rhode Island

Professor West has been with the University of Rhode Island Department of Marine Affairs for over 20 years, specializing in coastal environmental impact analysis, marine recreation and coastal demography. He has written extensively in his field and most recently completed a book entitled *Statistical Methods for Marine Affairs Professionals* . Professor West is also on the editorial board of the journals *Coastal Management* and *Journal of Shoreline Research* .

Response to Question 1

Response to Question 2

(top)

Question 1. What can we do to limit the environmental impacts from increasing population growth in coastal areas? Please provide examples.

Click here for audio response

(audio requires RealPlayer, see Using this Site)

Environmental impacts caused by increasing coastal population can be reduced by providing more public access; a better regulatory system; construction standards; better inspection of septic systems; and greater emphasis on developing coastal managers, scientists and policy makers. Given the high densities in most coastal areas and the influx of seasonal visitors, there is a great need to improve the use of open space without significantly reducing environmental quality for permanent residents and seasonal visitors. Accessibility to some popular coastlines has placed severe demands on existing roads and parking lots. The solution appears to be fast, inexpensive and comfortable public transportation, much the same way some cities have facilitated commuting to and from the city.

The second area where coastal impacts could be reduced is by improving local zoning and providing more open space. While state and local government budgets are tight, we need to look at new ways in which acquistion of open space on all governmental levels can continue. Many local, nongovernmental organizations realize the important role they play in providing initiative,

expertise and, in some instances, short-term loans to acquire valuable properties.

Where coastal environmental problems are severe, improved enforcement should be increased. Many coastal areas have been subjected to severe damage from hurricanes and floods that might have been minimized had building inspectors done their jobs properly. Many coastal waters have been contaminated by non-point source pollution, a significant portion of which could have been prevented had the septic systems been properly maintained.

The final factor relates to public education and information. This should be developed from kindergarten through college and include extension services. Such efforts should be directed toward local issues to enable citizens to place such messages in the context of their own environments.
(top)

Question 2. How do increases in seasonal population affect coastal environmental quality? What examples can you provide?

 Click here for audio response

(audio requires RealPlayer, see Using this Site)

Coastal impacts from seasonal population shifts can be divided into two groups. One relates to the biophysical environment; the other, to the socioeconomic systems.

The seasonal influx of people to the nation's shores has increased both quantitatively and qualitatively. As a result of more leisure time, increased longevity and income, a larger number of people spend time away from home. Recreational pursuits have also undergone significant change. At the turn of the century, coastal recreation was limited to sunbathing, beachcombing and fishing, and a very small number of recreational boaters. Today, this has changed. Coastal recreation encompasses a wide range of activities from diving to the use of personal water craft and off-road vehicles.

The growth of recreational activities has resulted in a rapid increase in threats to coastal resources. These include dune destruction; tire ruts from overland recreational vehicles which, in turn, threaten endangered species (e.g., piping plover); and destruction of seabed resources. Inexperienced divers and boaters have significantly impacted coral reefs. Some of this is inadvertent, caused more by ignorance than intent. Examples include damage of coral reefs by touching and dropping anchors on coral or seagrass beds rather than in nonvegetated areas.

Socioeconomic impacts have been significant as well. A century ago, the coastal environment included some of the poorest areas, settled by fishers and marginal farmers. This has changed dramatically, and not necessarily for the better. The popularity of coastal areas has resulted in increased land costs with corresponding increases in property taxes. This has resulted in a major out-migration of the less well-to-do. Now, many coastal areas have become "standardized" to where regional characteristics have disappeared. That much of the infrastructure is insured, with significant support from the federal government, in some ways represents welfare to those who need it least.
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Note: Population is a broad topic, as evidenced by the thousands of addresses generated from a WWW search. The following references are not exhaustive; rather, they provide specific supplementary information related to the text.

Population

Center for Neighborhood Technology/The Metropolitan Initiative. Briefing Paper: Southeast Florida Metropolitan Area.

http://www.cnt.org/mi/se_fla.htm

Describes the physical, environmental, economic, social and governmental structure of Southeast Florida, including Palm Beach, Broward, Dade and Monroe Counties, and how population growth has affected the region.

Lew, Alan A. 1996. Geography USA: A Virtual Textbook. Northern Arizona University.

http://www.for.nau.edu/~alew/ustxtwlc.html

Provides historical and current information on the economic and geographic factors that drive development and the distribution of population centers in the major geographic regions of the United States. See chapter 4, the Mid-Atlantic; chapter 5, the Eastern Mountain Regions: New England and

Appalachia - Part 1. New England and the Maritime Provinces; chapter 6, the South; chapter 10, the Pacific; and chapter 7, the Midwest.

Population Action International. Why Population Matters.

http://www.populationaction.org/why_pop/whypop.htm

Web-based version of Population Action International's "Why Population Matters" providing links to sections with information on the effects of population on the economy, environment, and human health and safety.

Princeton University. Princeton's Population Index Service.

http://popindex.princeton.edu/

Web site with search and browse links to Princeton's On-line Population Indices from 1986 to 1996. Indices have citations of numerous studies on many different aspects of population.

United Nations Population Division. United Nations Population Information Network (POPIN).

http://www.undp.org/popin/popin.htm

Many links to worldwide information sources on population and development.

U.S. National Aeronautics and Space Administration/Goddard Spaceflight Center. Ocean Planet: Perils - Swarming the Shores.

http://seawifs.gsfc.nasa.gov/OCEAN_PLANET/HTML/peril_coastal_develo

Brief statements on the effects of human activities on coastal beaches and shorelines in the United States and the Mediterranean. The Mediterranean Oceanic Database is also accessible. Has links to printed references on population and coastal impacts.
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Management

Florida State University. Atlas of Florida - Population.

http://cartlab-www.freac.fsu.edu/FloridaAtlas/Population/pop18.html

Presents, as part of a larger work, The Atlas of Florida World Wide Web, a section on population within Florida. The section has maps, graphs and text on population growth, population distribution for 1980 and 1990, population density for the year 1990, population change and migration of population by county within Florida between 1960 and 1990 and population change by metropolitan statistical areas between 1980 and 1990.

The Heinz Center. The Heinz Center: Program on Sustainable Coasts.

http://www.heinzctr.org/Programs/sustainable_coasts.htm

Discusses some factors that are affecting the overall health conditions of coastal regions of the United States.

Puget Sound Water Quality Action Team. Puget Sound On-line.

http://www.wa.gov/puget_sound/

Presents several resources devoted to maintaining and improving the quality of the waters within Puget Sound. Gives recent news; maps of the estuary and its surroundings; indications of the current environmental status of Puget Sound, estuary-wide and by county; status of important projects designed to protect or improve the water quality; and library resources with information about the Sound.

Sustainable Communities Network. Smart Growth: Development That Serves Economy, Community, and Environment.

http://www.smartgrowth.org/

Presents information on how intelligent community design and function can affect and improve the quality of life in urban environments. Has a list of printed references, a list of other Internet sites with related information, and a forthcoming link to on-line case studies.

U.S. Department of the Interior/National Park Service. Population Growth: Everglades National Park.

http://www.nps.gov/ever/eco/crowds.htm

Explains the demands on water in South Florida and in the Everglades from overdevelopment and population growth. Offers data on daily population increases and tourism, and describes effects from alterations to the land. Also, has information about threats to the Everglades, water management, water quality, non-native species, loss of species and conservation actions.

U.S. Environmental Protection Agency. The Chesapeake Bay Program Home Page.

http://www.chesapeakebay.net/bayprogram/

Gives general information about the U.S. EPA's Chesapeake Bay Program. The Bay and Ecosystem section contains a downloadable report, Population Estimates and Projections for States, Counties and Modeling Segments within the Chesapeake Bay Watershed, as well as other information on the region's projected population growth into the next century.
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Internet Data Bases

U.S. Department of Commerce/NOAA/NOS/Office of Ocean Resources and Conservation Assessment. Coastal Trends: Population and Development in Coastal Areas SQL Data.

http://www-orca.nos.noaa.gov/../cgi-bin/orca_prod_details.pl?3_SEA_Coast

On-line searchable data sets for Coastal Population (1960 - 1990) and Coastal Development in the United States. Two types of spatial searches are possible: Population and Building Permits by Coastal County, and Population by Estuary. Results of searches can be viewed on-line and downloaded.

U.S. Department of Commerce/Bureau of the Census. Population in Coastal Counties: 1960 to 1980.

http://www.census.gov/population/estimates/county/6080cstl.txt

Table shows population in U.S. coastal counties for the years from 1960 to 1980.

U.S. Department of Commerce/Bureau of the Census. Population in Coastal Counties: April 1, 1990 and July 1, 1994.

http://www.census.gov/population/estimates/county/9094cstl.txt

Table shows population in U.S. coastal counties for the years from 1990 to 1994.
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Appendix A Coastal County Population Data

Appendix Preview

Following is a segment of Appendix A.

Click here to view the full Appendix A (490K).

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Coastal County Population Data

COASTAL_COUNTY	STATE	FIPS CODE	LAND AREA (sq. miles)	POPULATION 1960	POPULATION 1970	POPULATION 1980	POPULATION 1990	POPULATION 1994
Maine	ME		20,228	845,822	883,359	1,016,065	1,125,548	1,139,744
Androscoggin, ME	ME	23001	470	86,312	91,279	99,509	105,358	103,878
Cumberland, ME	ME	23005	836	182,751	192,528	215,789	243,661	247,990
Franklin, ME	ME	23007	1,698	20,069	22,444	27,447	29,122	29,644
Hancock, ME	ME	23009	1,589	32,293	34,590	41,781	47,109	48,836
Kennebec, ME	ME	23011	868	89,150	95,306	109,889	116,262	117,258
Knox, ME	ME	23013	366	28,575	29,013	32,941	36,417	37,074
Lincoln, ME	ME	23015	456	18,497	20,537	25,691	30,447	31,023
Oxford, ME	ME	23017	2,078	44,345	43,457	49,043	52,740	53,030
Penobscot, ME	ME	23019	3,396	126,346	125,393	137,015	146,997	146,495
Sagadahoc, ME	ME	23023	254	22,793	23,452	28,795	33,727	33,868
Somerset, ME	ME	23025	3,927	39,749	40,597	45,049	49,992	51,216
Waldo, ME	ME	23027	730	22,632	23,328	28,414	33,182	35,002
Washington, ME	ME	23029	2,569	32,908	29,859	34,963	35,426	35,868
York, ME	ME	23031	991	99,402	111,576	139,739	165,108	168,562

FIELD DEFINITIONS	
COASTAL_COUNTY	Name of coastal state or county.
STATE	State and/or region in which a particular coastal county is located.
FIPS CODE	County FIPs identification code.
LAND AREA (sq miles)	Total square miles of land area.
POPULATION 1960-1980	Number of persons: U.S. Bureau of the Census.
POPULATION 1990-1994	Number of persons: U.S. Bureau of the Census; http://www.census.gov/population/estimates/county/coast94.txt

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coastal county: A county is defined as coastal if: 1) at least 15% of its total land area is located within the nation's coastal watershed; or, 2) a portion of its land accounts for at least 15% of a coastal cataloging unit. The United States has 673 coastal counties.

coastal zone: all U.S. waters subject to the tide, U.S. waters of the Great Lakes, specified ports and harbors on inland rivers, waters that are navigable by deep-draft vessels, including the contiguous zone and parts of the high seas, and the land surface or land substrata, ground waters, and ambient air proximal to those waters.

ecosystem: a discrete environmental unit, consisting of living and nonliving parts that interact to form a stable system. The term can be applied at any scale, from a drop of pondwater to the entire biosphere (i.e., the Earth can be viewed as a single ecosystem).

mitigation: restoration to compensate for a specific environmental impact, usually off-site.

nonpoint urban runoff: precipitation-related discharge of septic leachate, animal wastes, etc. from impervious surfaces, lawns, and other urban land uses.

uplands: the elevated, typically forested lands beyond the lowlands that border rivers and coasts.

watershed: the entire region that drains into a river, river system or water body.

wetland: a habitat or vegetative community dependent on seasonal, intermittent or permanent flooding.

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Acknowledgments

NPA Data Services, Inc. provided the population projection data for this paper. The Bureau of the Census, U.S. Department of the Interior, provided historical information on coastal counties. Craig Russell of NOAA's Strategic Environmental Assessments (SEA) Division assisted in compiling and organizing the data and producing the graphics. David M. Lott, also of SEA, produced the population maps.
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Others were contributed from outside of NOAA, and we gratefully thank the following institutions and individuals:

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Photo 8. Chesapeake Bay Foundation
Photo 13.Courtesy, Corel Corporation. Note: This image may not be saved or downloaded and is only to be used for viewing purposes.
Photo 14. Chesapeake Bay Foundation
Photo 15. Chesapeake Bay Foundation
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About the Authors

Thomas J. Culliton is a physical scientist with the Human Activities Assessment Branch of NOAA's Strategic Environmental Assessments Division. Since coming to the SEA Division in 1984, he has authored three widely recognized publications on coastal population: Selected Characteristics of Coastal States, 1980-2000; 50 Years of Population Change Along the Nation's Coasts, 1960-2010; and Building Along America's Coasts, 1970-1989. He received his bachelor's and master's degrees in geography from the University of Maryland.

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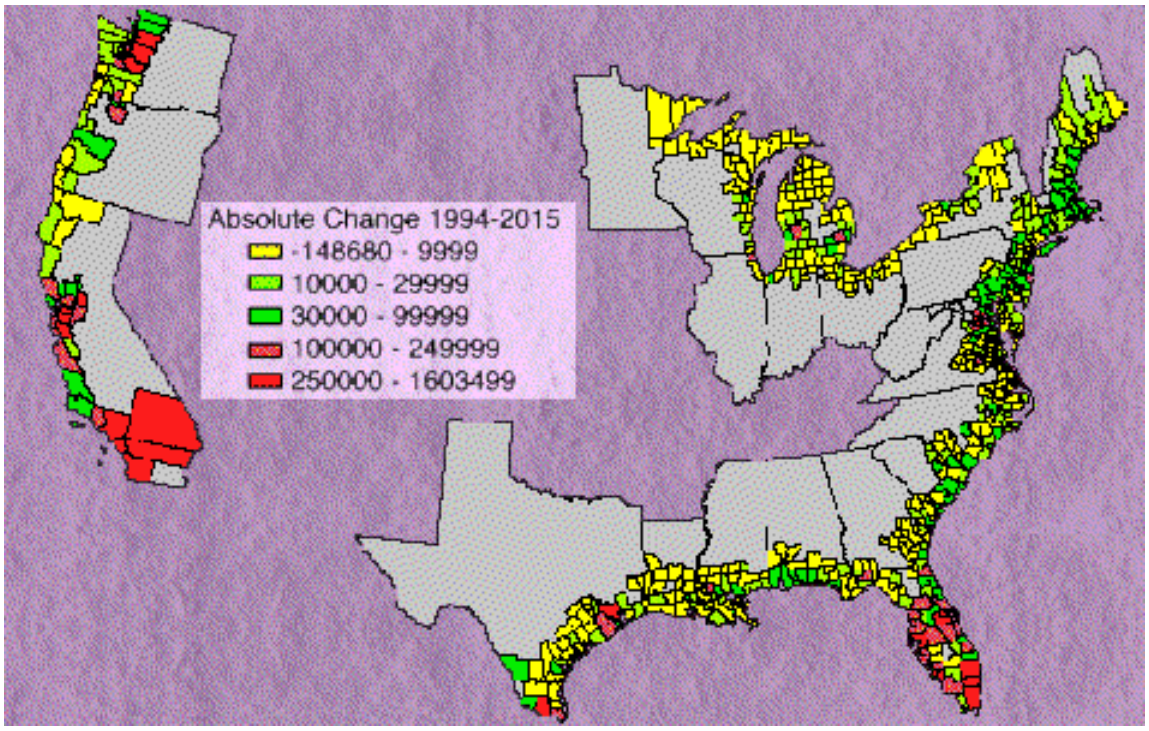

Figure 1. Projected population change from 1994-2015: absolute numbers

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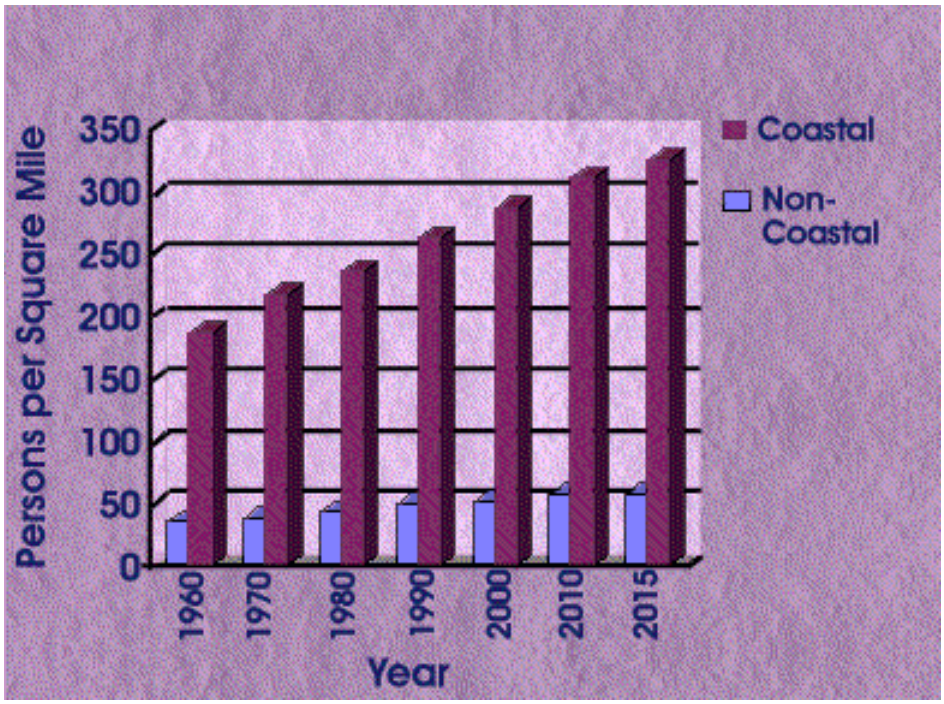

Figure 2. Population Density, 1960-2015

Note: Does not include Alaska
Sources: U.S. Bureau of the Census, 1997; National Planning Association, 1995

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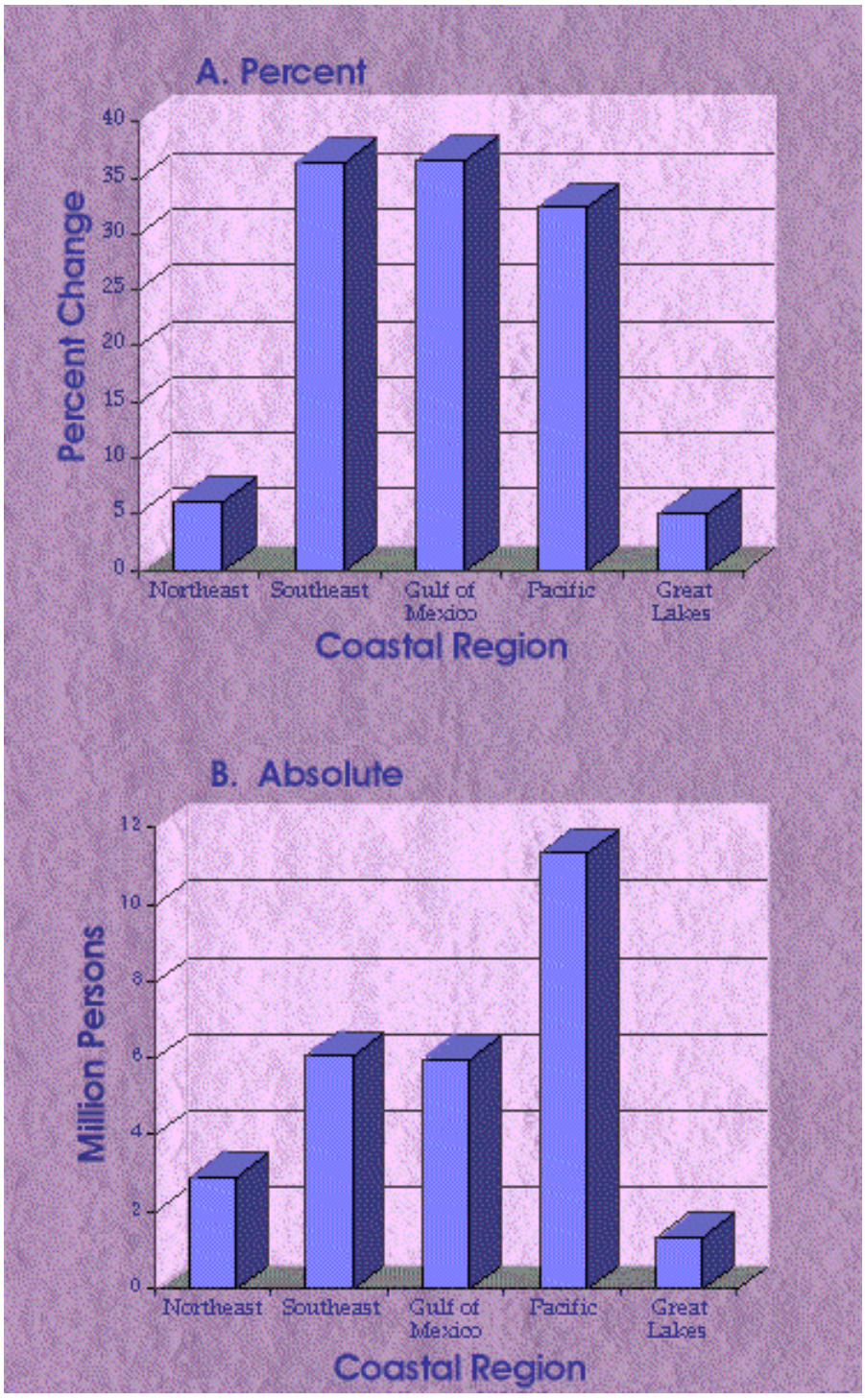

Figure 3. Projected population change by Coastal Region, 1994-2015