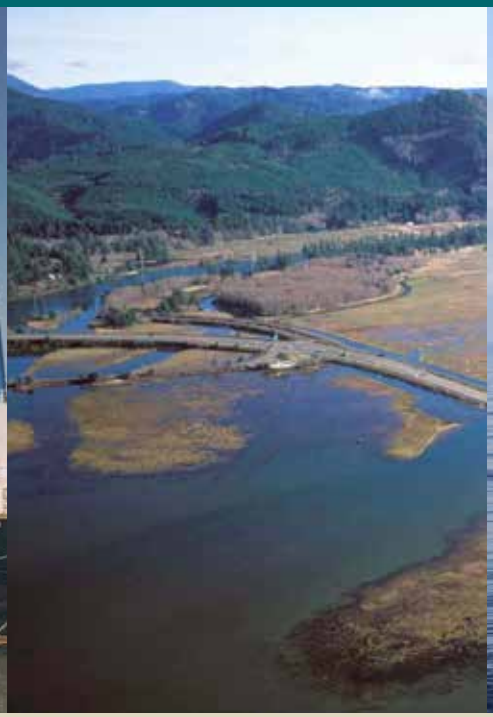
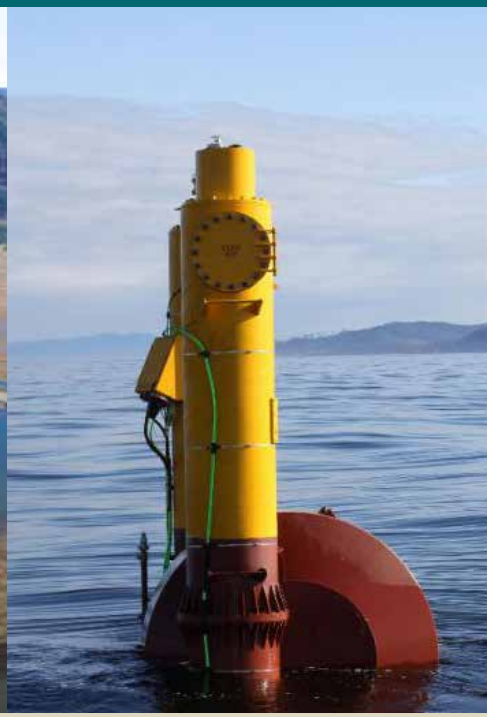
ASSESSMENT OF TRENDS AFFFECTING PLANNING FOR OREGON'S ESTUARIES AND SHORELANDS





PREPARED FOR THE OREGON COASTAL MANAGEMENT PROGRAM, OREGON DEPARTMENT OF LAND CONSERVATION AND DEVELOPMENT

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ACRONYMS

DEQ	Oregon Department of Environmental Quality
DLCD	Oregon Department of Land Conservation and Development
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
NOAA	National Oceanic and Atmospheric Administration
North Coast	Clatsop, Tillamook and Lincoln counties
OCZMA	Oregon Coastal Zone Management Association
ODFW	Oregon Department of Fish and Wildlife
OMCP	Oregon Coastal Management Program of the Department of Land Conservation and Development
R&D	Research and development
South Coast	Coastal portions of Lane and Douglas counties, plus Coos and Curry counties

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EXECUTIVE SUMMARY

WHAT IS THE PURPOSE OF THIS ASSESSMENT?

The Oregon Coastal Management Program (OCMP) in the Department of Land Conservation and Development (DLCD) has contracted for this assessment of trends affecting planning for coastal estuaries and shorelands as part of a series of projects to compile the available information about estuaries and shorelands in order to improve planning for these resources. The identification of trends over the next several decades is intended to identify changes in social, economic, environmental and energy factors that may affect planning for future estuary and shoreland uses and activities. It highlights the more significant trends that should be considered by state and local planners and officials and is not intended to be an in-depth analysis of their causes or implications.

The assessment is designed to provide information to the OCMP and coastal communities to help develop a better understanding of the likely forces that communities may need to consider in planning for estuarine resources and coastal shorelands. It is intended to help inform reviews of comprehensive land and water-use management plans that, pursuant to the requirements of Statewide Planning Goal 16 - Estuarine Resources and Statewide Planning Goal 17 - Coastal Shorelands, guide where and how development and other uses may occur in estuaries and shorelands.

This assessment is one of several projects being undertaken by the Oregon Coastal Management Program to improve the foundation for planning in Oregon's estuaries and estuarine shorelands. Other projects include re-mapping of estuary habitats using recent aerial imagery and other data, and an assessment of the existing framework for planning for future estuary and shoreland uses.

HOW WAS THE ASSESSMENT PREPARED?

Available data on coastwide economic, social and environmental trends is limited and outdated. Thus, that information has been supplemented with input obtained through interviews with a broad array of knowledgeable coastal stakeholders on a variety of topics affecting the long-term management of Oregon's estuaries and shorelands. This expert opinion supplements information gleaned from past and current planning studies, academic research, assessments of the Oregon Coastal Zone Management Program, socioeconomic analyses, port business plans, local government comprehensive plans, and other documents. The product is a brief overview of what is happening on the coast currently and what can be expected over the next two to three decades.

The study area includes non-Columbia River estuaries and shorelands from the Necanicum River in the north to the Winchuk River in the south. For comparison purposes, where feasible, distinctions are made between the "North Coast" and "South Coast." The North Coast area includes Clatsop, Tillamook and Lincoln counties; the South Coast consists of coastal Lane, coastal Douglas, Coos, and Curry counties.

WHAT OVERALL THEMES EMERGE FROM THE ASSESSMENT?

Interviews conducted for the assessment and a long history of interactions with coastal communities confirm that "We Oregonians love our coast" and, at the same time, that the coastal economy faces a number of difficult challenges. The mix of positive and negative themes that emerge from the assessment suggests that the coast will continue to be a popular place to visit and play and an increasingly difficult place to live and work for workforce-aged (generally, ages 25-64) individuals and families. Key observations follow:

- *Limited data:* Data on coastal economic, social, environmental and energy trends is limited, outdated, and inconsistent across geographic areas. The most recent comprehensive demographic and economic data was prepared by the Oregon Coastal Zone Management Association (OCZMA) in 2006, based on 2003 data. The last "report card" on the environmental health of estuaries was published in 2000; no similar assessment of shorelands was found in the literature review. There is no known analysis of existing environmental conditions at a coastwide level and very limited trend information available. The best impartial energy trend information is that collected as part of DLCD's recent Territorial Sea Plan amendment.
- *Tale of two coasts*: An assessment of coastal trends is a tale of two coasts in the sense that there are discernible economic, social and political differences between the North and South coasts, largely driven by access to I-5 and Portland. Among the key differences are the types of employment opportunities, levels of investment in infrastructure, access to markets, access to a skilled workforce, and the apparent willingness to pay for government services.

- *Coast lags behind state:* In most demographic and economic categories, the coast continues to lag behind the rest of Oregon and the South Coast lags behind the North Coast.
- *Graying of population:* Demographic trends point to a "graying" of the coastal population and a decline in the middle age sector that, when combined, have significant social, economic and political implications for the coastal workforce, homeownership, government services, and other factors. Projected growth in the health care services sector and in second homes are among the indicators of a shift toward a tourism and transfer payment-based economy.
- *Ongoing economic transition:* There is an ongoing transition in the makeup of the coastal economy from resource-based industries to tourism, marine research, education, and health care services. Ports, in particular, can be expected to be affected by the increasing growth in the service sector, as well as by reductions in available federal and state funding and declining local tax revenues. At the same time, ports generally do not appear to be constrained by their land bases from accommodating emerging markets such as marine sciences and eco-tourism.
- *Environment improving:* The coast's environmental health is generally perceived to be improving, attributable in large part to federal and state funding of localized habitat restoration programs and an increased awareness and concern for the environment by coastal residents and visitors. Water quality and quantity issues are likely to be at the forefront of environmental challenges.
- *Estuaries more affected than shorelands:* Except for limited residential and tourism development and natural hazards such as earthquakes/tsunamis, coastal shorelands are expected to be minimally impacted by economic, social, environmental and energy trends. Estuaries, on the other hand, are subject to a variety of economic and environmental factors that potentially affect their functions and health. Chief among these are growth in tourism and second homes.
- *Plans generally functioning well:* The management direction for estuaries and shorelands established in estuary management and comprehensive plans appears to be functioning as intended by Goals 16 and 17 in that, according to coastal planners, the supply of available developable land is generally adequate to accommodate projected demand. With the growth in the renewable energy sector on the coast, evaluation is needed of how local plans accommodate energy production facilities.
- *Local governments challenged:* The significant reduction in government services at all levels over the past decade makes it increasingly challenging for local governments to monitor and respond to change and to provide the services that their citizens demand. An indirect consequence over time may be the capacity of local governments to manage and protect estuaries and shorelands.

WHAT ARE THE KEY TRENDS AFFECTING PLANNING FOR ESTUARIES AND SHORELANDS?

Four types of trends affecting planning for Oregon's estuaries and shorelands over the next 20-30 years are identified – demographic, economic, environmental, and energy. These categories roughly correspond to the economic, social, environmental, and energy (ESEE) factors in Statewide Planning Goal 5 commonly used to assess the impacts of land use actions on natural resources, scenic and historic areas, and open spaces. The most significant trends among the wide range identified in the assessment follow.

Photo: new-oregonct-overview

Demographic/Social Trends

The Oregon coast has seen significant demographic changes over the past 30 years and even in the past 10 years, including an increase in population of almost 40% since 1970. However, this increase is considerably lower than the statewide increase of over 80% for the same period. This and other demographic trends are expected to have significant social and economic implications for the coastal workforce, homeownership, government services, and other factors. For example, demand for public services geared towards children and young adults will likely increase at a slower pace, whereas demand for elderly care and services will increase rapidly. Among other key demographic and social trends:

- While positive population growth is projected for most coastal counties over the next three decades, it will continue to lag behind state averages. Population growth on the North Coast will generally be significantly greater than that on the South Coast, which may experience relatively stagnant growth in the short to medium-terms.
- The coastal population is aging at a proportionally faster rate than the state as a whole. At the same time, a significant number of middle-age persons (30-50 years old) are leaving the coast to find employment opportunities elsewhere.
- Areas such as Astoria and Newport that are successful in attracting and retaining younger segments of the population have advantages of relatively available employment and a perception of being more progressive than other coastal communities.
- Second homes will continue to increase as a percentage of the total coastal housing stock, with higher growth on the North Coast than the South Coast.
- Both median household income and per capita income will likely remain between 10-20% lower than the statewide average. At the same time, median home values in all coastal counties have been increasing at a rate higher than the statewide average, resulting in concerns about housing affordability.

Photo: Oregon Coast Aquarium

Economic Trends

Throughout most of the 20th century, the coast's economy was based on natural resources, most notably agriculture, fishing and timber. A shift began in the 1990s as limits were placed on logging and fishing. While still dependent on natural resources, tourism and retirement provide much of today's economic growth on the coast. In addition to these traditional industries, emerging markets include processed food products, marine research, and energy. Like the state as a whole, the coast's long-term economic growth prospects are closely tied to expanding markets in the western U.S. and the Pacific Rim. Economic trends suggest steady but continued employment growth in most non-resource based sectors, especially tourism. Other key trends include:

- As the coast continues to transition from an historic dependence on resource-based industries to a more diverse economy, the tourism, education and health care sectors in particular will see significant growth. North Coast economic growth will continue to proportionately outstrip that on the South Coast in all sectors except tourism.
- Employment will be affected by two key factors: continuing automation that results in fewer jobs in resource-based industries even as revenues rise; and an increasing number of jobs in the tourism sector accompanied by a continuing decline in per capita income. These trends result in lower levels of tax revenues to fund education and other services, further contributing to declines in jobs and incomes.
- Renewable energy research and development (R&D) will be one of the fastest growing economic sectors on the coast. The health care sector can also expect significant growth.
- Particularly on the South Coast, declining federal and state revenues will be at least a short-term challenge. Except for the information sector, government services will see the smallest projected increase in employment over the next decade. Marine research can be expected to grow in conjunction with renewable energy R&D.
- The lack of infrastructure, especially transportation networks to and from the coast, and funding for maintenance of existing infrastructure will remain key limitations to the growth of the coastal economy.

Bandon, Oregon

Photo: www.bandon-oregon.com

Environmental Trends

Based on the limited information about the historic and current conditions of coastal estuarine ecosystems and shorelands, major trends affecting the health of the coast's environment are expected to include population growth, growth of tourism, second home development, demand for fresh water, efforts to control pollution and prevent the introduction of aquatic nuisance species, and initiatives to restore and enhance estuarine habitats and coastal watersheds. Some of the more significant trends are:

- While available evidence on the health of Oregon's coastal environment is mixed, it appears to be improving, due in large part to increased awareness and concern for the environment, habitat restoration programs, and environmental policy initiatives at the state and local levels to provide protection to sensitive estuarine resources and shorelands. There is also increased awareness and concern about catastrophic natural hazards and climate change.
- Historical estuary habitat change trends have reversed, with the large losses experienced up through the 1960s being replaced by modest gains in estuary habitat in recent years. Some indicators of estuarine health reveal significant adverse effects of past and present human activities; conversely, others show the positive impact of recent protective measures. Other indicators suggest continued threats and risks to estuaries or raise concerns about long-term, cumulative effects of change.
- Estuary management plans and environmental regulations generally restrict the location and scale of development in estuaries and shorelands; however, pressure for protective shoreline structures (e.g. revetments, rip-rap) is likely to increase with future development and with concerns about protection of existing development from the impacts of climate change and natural hazards. While there may be some pressure to convert urban industrial shorelands to commercial and residential land uses, the amount of such development and associated environmental effects are expected to be limited by federal, state and local environmental and land use regulations.
- More intense and frequent winter storms, with greater wave heights, will likely be the most observable and pronounced climate change-induced effects over the next few decades. Estuaries and shorelands may be affected to varying degrees by increased erosion and inundation of low-lying areas, wetland loss resulting from changes in wetland hydrology, and increased estuarine salinity ranges. Increasing nearshore ocean acidification may have significant cultural and economic effects on several key commercial marine species, most notably oysters and salmon. The Oregon coast is likely to be less affected than other parts of the country by climate-related sea level rise; however, sea level rise caused by events ranging in scale from major storms to tsunamis are a significant threat to coastal communities.

- Water supply is expected to become a critical concern on the coast due to increasing demand and its seasonality, limited and deteriorating infrastructure, lack of water rights, and the absence of significant surface water storage capacity.

Energy Trends

The assessment of energy trends focuses primarily on the energy sectors most likely to affect planning for estuaries and shorelands – wave energy, offshore wind energy, and Liquid Natural Gas (LNG). The coast is a net energy consumer, with the vast majority of its power being imported from outside the region and making it susceptible to transmission line/pipeline limitations or disruptions and to outside-the-region decisions on the amount and cost of available power. Unreliable power supply has been a deterrent to attracting some high-tech and other high energy consuming industries. In the short and medium-terms, trends in energy use will likely be limited to greater demand associated with population growth. Longer-term trends include:


Photo: NOAA.gov

- Without significant federal and private sector funding, it is expected that the current energy infrastructure will remain insufficient for any significant renewable energy production. Economically, the potential for R&D may be much more significant than actual renewable power generation over at least the next decade.
- While wave energy, in particular, is the focus of significant R&D investment, this industry is not expected to be catalytic in terms of economic development or cause significant estuary and shorelands impacts over the next 20-30 years.
- In addition to having promising wave energy potential, the Oregon coast is identified as an outstanding resource for offshore wind development. At least in the short-term, offshore wind energy development is being hindered by diminishing federal tax incentives for wind energy, continued low natural gas prices, and modest electricity demand growth. On-shore wind energy development is constrained by coastal topography, erratic wind patterns, and concerns about visual, wildlife and land use impacts.
- Evolving natural gas markets have spurred the increased use of natural gas for electric power generation and transportation and expanded the natural gas export market, with natural gas consumption in the Pacific Northwest expected to grow at over 10% over the next decade. LNG terminals have been proposed at two locations on the coast. These are likely have little effect on the coastal energy supply, as they are being designed as bulk import-export facilities.

WHAT ARE THE IMPLICATIONS FOR PLANNING FOR ESTUARIES AND SHORELANDS?

Updated Data

Because available data is limited and outdated, trends identified in this report are based in large part on interview results and the consultant's extrapolation of the limited information available. Updated demographic and economic data is especially needed for to a more scientifically-based understanding of social and economic trends. An empirical assessment of environmental trends also necessitates additional data collection and analysis. To obtain a more comprehensive understanding of the trends affecting planning for coastal estuaries and shorelands, the following information is needed at a minimum:

- A comprehensive update of OCZMA's 2006 demographic and economic description of the coast.
- Either as part of an update of the OCZMA study or as an independent study, an economic assessment of the strengths and weaknesses of local communities.
- A comprehensive study of the state of the coastal environment and trends affecting it.

Given the recent information collected for the Territorial Sea Plan amendment and the expectation that energy trends will have limited impact on estuaries and shorelands over the next two to three decades, further assessment of energy trends is considered a lower priority.

Demographic Trend Implications

Key demographic trends that should be considered in planning for estuaries and shorelands relate most directly to population growth and associated new development, including increasing numbers of second homes and commercial tourism activities. More people mean new development, with waterfront locations being desired locations for both primary and second homes and tourism-related development. Federal, state and local development regulations will restrict the amount and type of new development that can occur within estuaries and shorelands. Thus, new development has the potential to impact estuaries and shorelands more indirectly than directly through increased potential for stormwater runoff pollution, increasing water withdrawals, and the effects of land conversions on botanical and wildlife resources, etc. While development regulations may limit some of the negative effects associated with development, pressure to develop in sensitive areas may increase.

Demographic trends also suggest the need to pay attention to the coast's aging population. As the population ages, requiring more services but paying lower income taxes, a younger and more ethnically diverse group will become the primary wage earners and tax payers. These demographic changes can be expected to have sociopolitical implications for planning for estuaries and shorelands, the nature of which would be speculative to define.

Economic Trend Implications

Estuaries support many important economic activities, such as deep-water shipping, commercial fishing, charter fishing, aquaculture, marinas and a variety of recreational activities. As the economy grows and becomes increasingly focused on tourism-related development, the demand for developable land will likely increase. However, given the inventory of undeveloped and underdeveloped lands designated for industrial and commercial development, the available land base is not generally considered a deterrent to economic development. The lack of infrastructure, especially transportation networks to and from the coast, is a greater limitation to expansion of the coastal economy.

Redevelopment or new development stimulated by economic growth may pose some risk to estuarine and shoreland resources through shoreline modifications for upland development, dredging for navigation projects, or other land disturbance activities. However, estuarine and shoreland habitats are generally well protected by federal, state and local regulations, such as estuary management plans. The risks associated with economic development opportunities would, in most cases, be limited in area and scope.

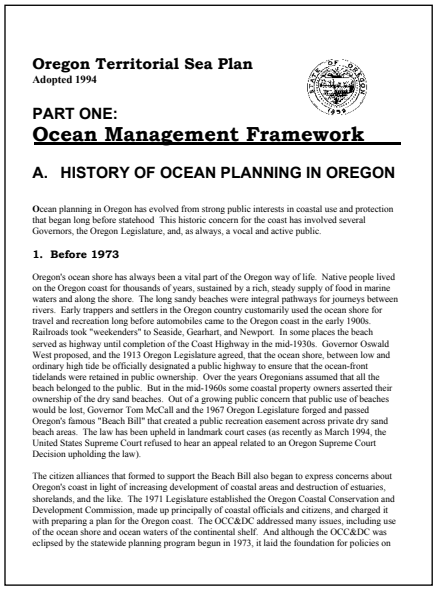
Environmental Trend Implications

The need for a comprehensive study of the coastal environment is based in part on the lack of any quantification or critical evaluation of individual and cumulative effects of land uses on Oregon's estuarine ecosystems and shorelands. There has also been no assessment of how comprehensive plans and estuary management plans address climate-induced changes to estuaries and shorelands. Among the research needs are an inventory and assessment of the overall coastal environmental ecosystem, comprehensive water quality monitoring and assessment of water quantity demand, research on estuary/ocean linkages, and monitoring and research on invasive species. This information can then serve as the basis for updated estuary management plans, most of which are now more than a decade old.

With most current coastal development concentrated in areas having a lower potential for natural hazards, some degree of increased pressure to locate new development in areas with a higher potential for landslides, flooding and erosion can be expected. At the same time, hazard insurance for development near coastal beaches and estuaries is becoming more expensive and difficult to obtain as the insurance industry and the Federal Emergency Management Agency (FEMA) exert a greater level of influence on development in sensitive areas by limiting availability of coverage.

Industrial-related pollution, such as food processing wastes, pulp and paper mill wastes, sediment from construction and logging operations and spilled oil and marine debris, continue to impact shorelands and estuaries, along with freshwater withdrawals for municipal and industrial uses. Water quality is perceived by some to be insufficiently monitored to assess the impacts of point source and runoff pollution. Research is needed to determine impacts and the need for minimum estuary inflows.

Energy Trend Implications



Oregon Territorial Sea Plan
Adopted 1994

PART ONE:
Ocean Management Framework

A. HISTORY OF OCEAN PLANNING IN OREGON

Ocean planning in Oregon has evolved from strong public interests in coastal use and protection that began long before statehood This historic concern for the coast has involved several Governors, the Oregon Legislature, and, as always, a vocal and active public.

1. Before 1973

Oregon's ocean shore has always been a vital part of the Oregon way of life. Native people lived on the Oregon coast for thousands of years, sustained by a rich, steady supply of food in marine waters and along the shore. The long sandy beaches were integral pathways for journeys between rivers. Early trappers and settlers in the Oregon country customarily used the ocean shore for travel and recreation long before automobiles came to the Oregon coast in the early 1900s. Railroads took "weekenders" to Seaside, Gearhart, and Newport. In some places the beach served as highway until completion of the Coast Highway in the mid-1930s. Governor Oswald West proposed, and the 1913 Oregon Legislature agreed, that the ocean shore, between low and ordinary high tide be officially designated a public highway to ensure that the ocean-front tidelands were retained in public ownership. Over the years Oregonians assumed that all the beach belonged to the public. But in the mid-1960s some coastal property owners asserted their ownership of the dry sand beaches. Out of a growing public concern that public use of beaches would be lost, Governor Tom McCall and the 1967 Oregon Legislature forged and passed Oregon's famous "Beach Bill" that created a public recreation easement across private dry sand beach areas. The law has been upheld in landmark court cases (as recently as March 1994, the United States Supreme Court refused to hear an appeal related to an Oregon Supreme Court Decision upholding the law).

The citizen alliances that formed to support the Beach Bill also began to express concerns about Oregon's coast in light of increasing development of coastal areas and destruction of estuaries, shorelands, and the like. The 1971 Legislature established the Oregon Coastal Conservation and Development Commission, made up principally of coastal officials and citizens, and charged it with preparing a plan for the Oregon coast. The OCC&DC addressed many issues, including use of the ocean shore and ocean waters of the continental shelf. And although the OCC&DC was eclipsed by the statewide planning program begun in 1973, it laid the foundation for policies on

Written long before the arrival to the coast of wave and wind energy R&D and proposed projects, estuary management and comprehensive plans do not directly address the siting of energy production facilities in estuaries and shorelands. Goal 16 specifically requires that comprehensive plans address pipelines and associated dredging as uses within estuarine management units. Prepared to help implement Goal 19, the Territorial Sea Plan now guides the location of offshore energy facility siting within the Territorial Sea but its scope does not include estuaries or shorelands. Most coastal comprehensive plans/zoning codes encourage renewable energy while regulating the siting and design of energy facilities, renewable and non-renewable. Whether local plans foster or hinder energy development has not really been tested. Given the changing dynamics of coastal energy issues, it may be timely to undertake a review of those plans to determine whether amendments are merited to accommodate wave, wind and other renewable energy production, as well as appropriately respond to potential associated impacts.

While the attention has been focused on the siting of wave and wind energy devices in deep or shallow waters off the coast, on-shore and nearshore energy generation is more directly relevant to planning for estuaries and shorelands. On-shore wave energy infrastructure could include production facilities powered by offshore devices, as well as facilities driven by tides or currents in ocean waters. On-shore wind energy infrastructure could include wind turbines or energy production facilities powered by offshore turbines. Transmission lines or pipelines are associated with both renewable and non-

renewable energy production. Most effects of wave and wind energy power development (whether offshore, nearshore or on-shore), will be limited to the communities where such facilities are ultimately located. There may be a broader effect, however, on the coast's growing tourism industry if such facilities are aesthetically unpleasing. Such impacts would likely be slow to exhibit themselves and be difficult to measure.

Commercial ocean wave energy development within the next several decades may be optimistic. If it occurs, effects on estuaries and shorelands would be limited and include visual impacts; spills during construction, maintenance and operations; and construction, maintenance and operation impacts associated with on-shore supportive facilities and transmission lines. Effects to estuaries would be associated with water-dependent industrial development for operations/maintenance facilities and most likely concentrated at Coos Bay or Yaquina Bay.

The two currently active LNG development proposals at Astoria and Coos Bay are being reviewed for conformance with local comprehensive plan and estuary management plans and regulations. That review process includes analysis of effects on estuaries and shorelands. The impacts of pipelines associated with LNG transport will be largely in upland areas, with some shoreland impacts. Terminal development will have the most direct impact to estuarine areas, including dredging, development of in-water structures, and shoreline stabilization/hardening. While development will be confined to a limited area, overall aquatic resource impacts could be fairly significant. Direct impacts to shorelands would be very limited.

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I. INTRODUCTION

A. OVERVIEW

The Oregon Coastal Management Program (OCMP) in the Department of Land Conservation and Development (DLCD) is working on several projects to update the foundation for planning in Oregon's estuaries and estuarine shorelands. These projects are intended to help support updates to local estuary and shoreland plans and include re-mapping of estuary habitats using recent aerial imagery and other data, assessing the existing framework for planning for future estuary and shoreland uses, and investigating trends that will affect the use of estuaries and shorelands over the next 20 to 30 years.

Four of the 19 Statewide Planning Goals pertain to the coast (the "Coastal Goals"). Goal 16 addresses Estuarine Resources; Goal 17, Coastal Shorelands; Goal 18, Beaches and Dunes; and Goal 19, Ocean Resources. Collectively, these Coastal Goals guide how development occurs on the Oregon coast. This assessment focuses exclusively on trends affecting planning for estuaries and coastal shorelands as required by Goals 16 and 17.

Along the Oregon coast, 33 estuaries comprise 89,281 ha (including the Columbia River estuary). There are 363 miles of coastal shorelands. The study area includes coastal estuaries and shorelands from the Necanicum River in the north to the Winchuk River in the south. Although the Columbia River estuary is one of the larger estuaries on the West coast and provides significant habitat for salmon and other estuarine-dependent species, it is excluded from this assessment for several reasons. It differs significantly from smaller coastal estuaries both in physical scale and function and in the scope and scale of economic, social and environmental attributes and indicators. Additionally, most of the Columbia River watershed lies outside of the Pacific Northwest coast ecoregion and its hydrologic regime is driven by snowmelt and the operation of the Columbia River Power System, as opposed to the winter rain-driven hydrologic regime of the coastal estuaries.

Land uses within estuaries are subject to comprehensive land and water-use management plans that guide where and how development and other uses may occur. These plans were developed through collaborative efforts in the late 1970s and early 1980s to classify estuaries according to the most intensive level of development or alteration which may occur within each estuary. They are implemented through local comprehensive plans and development ordinances and state and federal regulation of filling, dredging, in-water construction, and other activities. This assessment focuses on trends affecting estuaries designated as development, where changes in economic and environmental characteristics are likely to first appear.

Lands contiguous with the ocean, estuaries, and coastal lakes are identified through Goal 17 and local comprehensive plans as coastal shorelands. Inventoried coastal shorelands are generally either areas protected for their natural values or designated for water-dependent recreational, commercial, and industrial uses. Among other things, Goal 17 encourages maintaining and enhancing historic, unique, and scenic waterfront communities through appropriate nonwater-dependent uses.

B. PURPOSE

This investigation of trends affecting planning for estuaries and shorelands over the next several decades is intended to identify changes in key social, economic, environmental and energy factors that could affect planning for future estuary and shoreland uses and activities. It is designed to provide information to OCMP and coastal communities to help develop a better understanding of the likely forces and actions for which communities may need to plan.

Multiple trends could affect planning for estuaries and shorelands. The assessment highlights the more significant trends that should be considered by state and local planners and officials; it is not intended to be an in-depth analysis of their causes or implications. Rather, it is a high-level look at what may be occurring over the next several decades that coastal communities should be aware of in planning for the use and protection of these important resources.

C. APPROACH

Under contract to OCMP, the Portland, Oregon planning firm of Cogan Owens Cogan, LLC (COC) conducted this assessment in two phases. An initial phase entailed interviews with 40 key coastal stakeholders, followed by a review of available technical literature and data. The trends identified through the literature review were then compared to those identified in interviews in order to highlight, where feasible, differences between perceptions and data. COC was assisted in both phases by two strategic advisors: Mitch Rohse, consultant in land use planning, and Lisa Phipps, Executive Director of the Tillamook Estuaries Partnership.

A cursory literature review at project initiation indicated that much of the information on trends would need to be derived from interviews with practitioners and others knowledgeable about coastal demographics, economics and environmental issues. Through consultation with OCMP staff, key coastal stakeholders in a variety of fields were identified as potential

interviewees and invited by OCMP to participate in interviews. Parties interviewed are identified in Appendix A; interview results are provided in Appendix B (separate file).

The research phase entailed review of past and current planning studies, academic research, assessments of the Coastal Zone Management Program, socioeconomic analyses, port business plans, local government comprehensive plans, etc.

To help focus interviews and research, a representative sample of management plans for shallow draft and deep draft estuaries, as defined by the state's estuary classification system, were reviewed. These included the ports (and their associated estuaries) of Astoria, Warrenton, Garibaldi, Tillamook, Newport, Umpqua, Coos Bay, and Brookings-Harbor.

D. STRENGTHS AND LIMITATIONS OF THIS ASSESSMENT

This assessment has represented a unique opportunity to obtain input from a broad array of knowledgeable coastal stakeholders on a variety of topics affecting the long-term management of Oregon's estuaries and shorelands. It has also provided the opportunity to verify this on-the-ground knowledge with scientific findings. The product is a brief overview of what is happening currently and what can be expected over the next two to three decades on the coast. However, the project's timeframe and funding have, by necessity, constrained the scope of the assessment. An even greater constraint has been the limited and outdated data on coastal economic, social, environmental and energy trends. Specific limitations include:

- Information that is available is often not consistent across geographic areas.
- The most recent comprehensive demographic and economic data was prepared by the Oregon Coastal Zone Management Association in 2006, based on 2003 data. It was prepared prior to the recession in the late 2000s and the trends it reflected cannot be extrapolated 20-30 years into the future.
- There is no known analysis of existing environmental conditions at a coastwide level and very limited trend information available.
- The best impartial energy trend information was collected as part of DLCD's recent Territorial Sea Plan amendment.
- While there was a goal to differentiate among sections of the coast, the amount of data varies among regions and most regional or local data is not comparable to other regions.

Due to the lack of available data, some trends identified in this report are based on interview results and the consultant's extrapolation of the limited data available. Updated demographic and economic data is essential to a more scientifically-based understanding of the social and economic trends affecting Oregon's estuaries and shorelands. A comprehensive study of a wide range of environmental factors is required to better understand environmental trends.

II. TRENDS ASSESSMENT

The assessment of trends over the next 20 to 30 years affecting planning for Oregon's estuaries and shorelands is divided into four components – demographic and social, economic, environmental, and energy. These categories roughly correspond to the social, economic, environmental, and energy (ESEE) factors in Statewide Planning Goal 5, which are commonly used to assess the impacts of land use actions on natural resources, scenic and historic areas, and open spaces.

Two distinct portions of the coast are referenced. The North Coast consists of Clatsop, Tillamook and Lincoln counties. The South Coast includes Coos and Curry counties and the coastal portions of Lane and Douglas counties. A central coast is sometimes cited in research documents, but it does not lend itself to being separated out for this assessment due to a lack of distinctive traits.

A. DEMOGRAPHIC/SOCIAL TRENDS

A.1 Assessment

A.1.1 Population

The Oregon coast has seen significant demographic changes over the past 30 years and even in the past 10 years. As shown in Tables 1 and 2, the coastal population has grown from 148,068 people in 1970 to an estimated population of 206,590 in 2012, an increase of 39.4%. However, this increase is considerably lower than the statewide increase of 83.2% for the same period. This comparatively lower growth rate continued for the 2000-2010 decade, with coastal population growth being 3.2% in comparison to a statewide growth rate of 12%.[1]

The population in all coastal counties has grown since 1970, with rates varying from 2.8% in coastal Douglas County (City of Reedsport) to nearly 277% in coastal Lane County (City of Florence). The population of coastal Douglas County has seen negative growth in each decade since 1980, with an overall decline of 16.7%. While Coos County's population grew over the 1970-2010 timeframe, it has been relatively flat over the past decade. Coastal Lane County and Lincoln and Curry counties have each grown by more than 70% since 1970, just under the state average. Clatsop and Tillamook counties have seen more moderate growth of 30.1% and 40.0%, respectively.

[1] Population Research Center, Portland State University.

Table 1. Coastal Population, 1970 – 2012						
County	**1970**	**1980**	**1990**	**2000**	**2010**	**2012 Est.**
Clatsop	28,473	32,489	33,301	35,630	37,039	37,190
Tillamook	18,034	21,164	21,570	24,262	25,250	25,305
Lincoln	25,755	35,264	38,889	44,479	46,034	46,295
Coastal Lane*	2,246	4,411	5,162	7,340	8,466	8,470
Coastal Douglas*	4,039	4,984	4,796	4,370	4,154	4,145
Coos	56,515	64,047	60,273	62,779	63,043	62,890
Curry	13,006	16,992	19,327	21,137	22,364	22,295
Coast	148,068	179,351	183,318	199,997	206,350	206,590
Oregon	2,091,533	2,633,105	2,842,321	3,421,399	3,831,074	3,833,735

Source: U.S. Census Bureau, American Fact Finder, May 2013.
*Cities of Florence and Reedsport represent coastal Lane and Coastal Douglas counties, respectively.

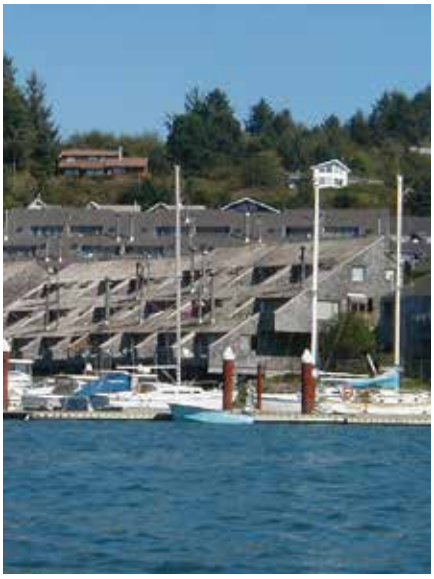


Table 2. Percentage Change in Population, 1970 – 2010				
County	**1970-2010**	**1980-2010**	**1990-2010**	**2000-2010**
Clatsop	30.1%	14.0%	11.2%	4.0%
Tillamook	40.0%	19.3%	17.1%	4.1%
Lincoln	78.7%	30.5%	18.4%	3.5%
Coastal Lane*	276.9%	91.9%	64.0%	15.3%
Coastal Douglas*	2.8%	-16.7%	-13.4%	-4.9%
Coos	11.6%	-1.6%	4.6%	0.4%
Curry	72.0%	31.6%	15.7%	5.8%
Coast	39.4%	15.1%	12.6%	3.2%
Oregon	83.2%	45.5%	34.8%	12.0%

Source: U.S. Census Bureau, American Fact Finder, May 2013.
*Cities of Florence and Reedsport represent coastal Lane and Coastal Douglas counties, respectively.

As illustrated in Table 3, positive growth is projected for most coastal counties over the next three decades. Tillamook County is projected to experience the greatest growth rate over the 2010-2020 and 2030-2040 periods, with Lincoln County having the greatest growth rate in 2030-2040. Coos County is projected to have the smallest growth rate, with a decrease in population from 2030-2040.

Table 3. Population Projections, 2010 – 2040

County	2010	2020	2010-2020	2030	2020-2030	2040	2030-2040
	Pop.	Pop.	% Change	Pop.	% Change	Pop.	% Change
Clatsop	37,039	38,430	3.6%	40,041	4.0%	40,720	1.7%
Tillamook	25,250	30,750	17.9%	32,713	6.0%	34,117	4.1%
Lincoln	46,034	49,434	6.9%	53,755	8.0%	54,586	1.5%
Coos	63,043	64,106	1.7%	65,218	1.7%	64,943	-0.4%
Curry	22,364	23,096	3.2%	24,449	5.5%	24,921	1.9%
Coast	206,350	214,436	3.8%	223,797	4.2%	227,907	1.8%
Oregon	3,831,074	4,245,874	9.8%	4,761,774	10.8%	5,196,774	8.4%

Source: Population Research Center, Portland State University.

Climate refugees (defined as populations displaced from their current locales due to climate-induced impacts on livability) are frequently identified in interviews as a long-term demographic factor, but not one creating any significant short-term demographic or social changes. With relatively large populations in the Southeast and Southwest now vulnerable to prolonged drought and consequent water shortages, some people expect the Oregon coast to be an area where populations displaced by climate change may seek to relocate. There is no available trend data on coastal climate refugees and it is impossible to predict whether they will become an important stream of in-migrants in coming decades and what kinds of values or expectations for lifestyle they might bring with them. It is a demographic factor, however, that merits monitoring.

What the assessment suggests:

- The rate of coastal population growth will continue to lag considerably behind that of the state as a whole.
- The most consistent and robust growth has been and will continue to be in Tillamook and Lincoln counties.
- Whereas Curry County experienced the highest relative growth over the past four decades, that growth rate started declining over the past decade and is not expected to significantly grow over the next several decades.
- Growth in Coos County has been and will continue to be stagnant at best.
- Population in Clatsop County is expected to continue to grow at a very consistent rate.
- Climate refugees are not expected to cause short-term demographic or social changes.

A.1.2 Age

With the exception of 20-29 year-olds, all age groups have shown significantly less growth in coastal counties than statewide. The 0-19, 30-39 and 40-49 year-old age groups have all decreased between 2000 and 2010. As shown in Table 4, 0-19 year-olds decreased by 11.7%, 30-39 year-olds by 12%, and 40-49 year-olds by more than 22%.

In the last detailed review of coastal demographics (OCZMA, 2006), Tillamook and Coos counties were identified as attracting the most retirement age people. Current Census data indicates that those counties, along with Curry County, now have the lowest relative growth in retirees. Clatsop and Lincoln counties are experiencing the greatest influx of retirees. Trends and interview perceptions suggest a continuation of these age patterns, with the exception that marine research employment in the Newport area may help reduce the decline in the 30-39 and 40-49 age classes in Lincoln County.

Table 4. Percentage Change in Population by Age, 2000 – 2010

County	0 to 19	20 to 29	30 to 39	40 to 49	50 to 59	60 to 64	65+
Clatsop	-10.3%	17.6%	-7.9%	-21.3%	32.4%	69.6%	10.8%
Tillamook	-7.0%	13.8%	-9.2%	-20.3%	26.7%	50.1%	10.2%
Lincoln	-15.1%	16.8%	-12.4%	-25.0%	29.4%	66.6%	14.3%
Coos	-12.2%	16.4%	-14.9%	-23.8%	20.0%	41.4%	11.9%
Curry	-11.7%	30.7%	-16.9%	-18.0%	26.9%	48.4%	11.6%
Coast	-11.7%	17.6%	-12.3%	-22.5%	26.2%	54.0%	12.0%
Oregon	2.8%	11.4%	3.4%	-5.9%	33.9%	78.3%	21.1%

Source: U.S. Census Bureau, American Fact Finder, May 2013.

The demographic, social and economic effects associated with the "baby-boom" and "echo" generations are expected to be very pronounced during the 2010-2020 timeframe. A diminished migration of the working age population and elderly retirees is also expected. The State's May 2013 Economic Forecast suggests that, after a period of slow growth during the 1990s and early 2000s, the elderly population (aged 65+) has picked up a faster pace of growth and will surge as the baby-boom generation continues to enter this age group. The youngest elderly (aged 65-74) will grow at an extremely fast pace during this period, averaging an annual increase of 5% statewide. The oldest elderly (aged 85+) will continue to grow at a moderate but steady rate due in part to improving longevity. The once fast-paced growth of the population aged 45-64 will gradually taper off to below zero percent and will remain at slow or below zero growth for several years. The size of this older working-age population will remain virtually unchanged through the decade.

The young adult population (aged 19-29) will change only a little over the forecast period and remain virtually unchanged for most of the years into the future.

Growth in the K-12 population (aged 5-17) will remain low, which will translate into slow growth in school enrollments. This school-age population has actually declined in size in recent years and will grow in the future at well below the state average.

Interviewees believe that the coastal population is getting older due to an increase in retirement age residents and an exodus of younger people, except in the Astoria and Newport areas. They believe that more people are choosing to spend their retirement years on the coast and young people are moving away due to a lack of jobs. The demographic data bears this out to a certain degree, at least in terms of the "graying" of the coastal population. The number of people 50 and over has increased significantly over the past decade. While the number of youth (under 20 years of age) is decreasing, there is close to 18% growth in the 20 to 29-year old age group in all coastal counties. The data suggests that it is actually the middle age sector (30 and 40 "somethings") that is moving away to seek higher paying jobs. Coastwide, there has been more than a 20% decline during the 2000-2010 decade in the 40-49 year age class, close to four times the state average.

Photo: www.baycrest-village.com

What the assessment suggests:

- A significant number of middle-age persons (30-50 years old) are leaving the coast to find employment opportunities elsewhere.
- An increasing number of older adults are choosing to spend their retirement years on the coast, with Clatsop and Lincoln counties experiencing the greatest influx of retirees.
- Overall, the elderly population over age 65 will increase rapidly in all coastal counties, whereas population groups under age 65 will experience slow growth in the coming decade.
- Demographic trends are expected to have significant social and economic implications for the coastal workforce, homeownership, government services, and other factors. For example, demand for public services geared towards children and young adults will likely increase at a slower pace, whereas demand for elderly care and services will increase rapidly.

A.1.3 Race and Ethnicity

In line with the statewide trend, the Hispanic population has increased in all coastal counties, though slightly less than in Oregon overall. The one exception is Tillamook County, where the Hispanic population grew by 3.9%. The white population in coastal counties decreased by 3.4%, less than Oregon's 5% decrease.

Table 5. Percentage Change in Population by Race and Ethnicity, 2000 - 2010

County	White	Black or African American	American Indian & Alaska Native	Asian	Native Hawaiian & Pacific Islander	Other	Two or More*	Hispanic or Latino	Non Hispanic or Latino
Clatsop	-3.6%	0.0%	-0.2%	0.0%	0.1%	0.1%	0.4%	3.2%	-3.2%
Tillamook	-4.3%	0.0%	-0.2%	0.7%	0.0%	0.1%	0.2%	3.9%	-3.9%
Lincoln	-3.9%	0.0%	0.2%	0.1%	0.0%	0.0%	0.2%	3.1%	-3.1%
Coos	-3.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.9%	2.0%	-2.0%
Curry	-2.2%	0.2%	-0.2%	0.0%	0.0%	0.0%	0.5%	1.8%	-1.8%
Coast	-3.4%	0.1%	-0.1%	0.2%	0.0%	0.0%	0.4%	2.8%	-2.8%
Oregon	-5.0%	0.1%	-0.1%	0.7%	0.1%	0.0%	0.5%	3.7%	-3.7%

Source: U.S. Census Bureau, American Fact Finder, May 2013.
*Respondents identifying as more than one race or ethnicity.

What the assessment suggests:

- Hispanic populations will continue to increase in all coastal counties; with the exception of Tillamook County, this increase will be at a rate lower than the statewide trend, however.
- The ratios of populations of other races and ethnicities will remain low and similar to statewide trends, except that the white population percentage will remain higher on the coast.

A.1.4 Housing

Nearly 18,000 housing units were developed in coastal communities between 2000 and 2010. This growth is due in part to an increase in the number of second homes. As shown in Table 6, the percentage of second homes as a proportion of total housing stock increased by over 3% for the decade, as compared to a statewide average of less than 1%. Second homes tend to make up a higher percentage of overall housing units in the North Coast than in the South Coast. Tillamook County has the highest percentage of second homes at 33.8%, followed by Lincoln County at 25.1%, and Clatsop County at 19.9%. Based on 2000-2010 trends and other indicators, second homes are expected to grow to an even higher percentage of the total coastal housing stock, especially on the North Coast. The growth in second homes is identified as a contributor to an increasing demand for coastal property and a reduction in the stock of affordable housing.[2]

Table 6. Total Housing Units and Second Homes, 2000 – 2010

	2000		2010		Change	
County	Total Units	Second Homes	Total Units	Second Homes	Total Units	Second Homes
Clatsop	19,685	15.7%	21,546	19.9%	1,861	4.2%
Tillamook	15,906	28.9%	18,359	33.8%	2,453	4.9%
Lincoln	26,889	19.1%	30,610	25.1%	3,721	6.0%
Coastal Lane*	8,523	10.9%	5,103	7.3%	-3,420	-3.6%
Coastal Douglas*	3,370	4.9%	2,207	2.8%	-1,163	-2.1%
Coos	29,247	2.9%	30,593	4.0%	1,346	1.1%
Curry	11,406	7.2%	12,613	9.0%	1,207	1.8%
Coast	103,133	14.1%	121,031	17.3%	17,898	3.2%
Oregon	1,452,709	2.5%	1,675,562	3.3%	222,853	0.8%

Source: U.S. Census Bureau, American Fact Finder, May 2013.

*Cities of Florence and Reedsport represent coastal Lane and Coastal Douglas counties, respectively.

[2] *A Demographic and Economic Description of the Oregon Coast: 2006 Update*, The Research Group for Oregon Coastal Zone Management Association, March 2006.

Over the past decade, the median home values in all coastal counties have increased slightly more than the statewide average of 39.8%. The 49.2% increase in Coos County was the greatest increase among coastal counties.

Table 7. Median Home Value, 2000 – 2010

County	2000	2010	Change
Clatsop	$142,400	$261,600	45.6%
Tillamook	$143,900	$242,400	40.6%
Lincoln	$148,800	$253,100	41.2%
Coos	$98,900	$194,500	49.2%
Curry	$148,000	$254,800	41.9%
Coast	$136,400	$241,280	43.5%
Oregon	$152,100	$252,600	39.8%

Source: U.S. Census Bureau, American Fact Finder, May 2013.

A significant perception among interviewees is the negative effect on housing affordability of an increasing number of second homes. This effect is felt to be exasperated by a growing income disparity between residents who depend upon lower-paying service sector employment and second home owners who have greater disposable income. Because of a lack of available data, this perception can be neither confirmed nor refuted. Data does indicate that second homes in coastal counties became a greater percentage of total housing units between 2000 and 2010. During that same time period, coastal communities experienced increases in median home values greater than the statewide average. These trends also suggest that coastal median home values will continue to rise at a rate higher than the state average. As explained in the section below, the growth in per capita income of coastal residents has been slightly higher than the statewide average, making it difficult to directly connect housing affordability to the number of second homes.

What the assessment suggests:

- Second homes will increase as a percentage of the total coastal housing stock, with higher growth on the North Coast than the South Coast.
- Median home values in all coastal counties will increase at a higher rate than the statewide average.
- While supporting data is limited, there is a strong perception that the increasing percentage of second homes is driving up the median home value and thus affecting housing affordability. Close monitoring of the effects on housing affordability of changes in median home value and per capita income is merited.

A.1.5 Income

As shown in Table 8, median household incomes has increased in all coastal counties since 2000, ranging from a 19.8% increase in Coos County to a 31.8% increase in Curry County. While the 24.3% average increase for all coastal counties is slightly greater than the 21.8% statewide increase for the same period, median household incomes is lower in all coastal counties than the statewide average. Over the past decade, coastal income averaged approximately 80% of Oregon's median household income.

Table 8. Median Household Incomes, 2000 – 2010

County	2000	2010	Change
Clatsop	$36,301	$43,670	20.3%
Tillamook	$34,269	$41,400	20.8%
Lincoln	$32,769	$41,764	27.4%
Coos	$31,542	$37,789	19.8%
Curry	$30,177	$39,787	31.8%
Coast	$32,893	$40,882	24.3%
Oregon	$40,916	$49,850	21.8%

Source: U.S. Census Bureau, American Fact Finder, May 2013.

Like median household income, per capita income increased in all coastal counties between 2000 and 2010. While the coastwide rate of growth exceeded the statewide rate, it was lower than the state average in Tillamook, coastal Douglas, and Coos counties. The per capita income level coastwide was only approximately 88% of the statewide average for this period.

Table 9. Per Capita Income, 2000 – 2010

County	2000	2010	Change
Clatsop	$19,515	$25,395	30.1%
Tillamook	$19,052	$22,706	19.2%
Lincoln	$18,692	$24,799	32.7%
Coastal Lane*	$18,724	$25,163	34.4%
Coastal Douglas*	$16,006	$19,583	22.3%
Coos	$17,547	$21,771	24.1%
Curry	$18,138	$24,190	33.4%
Coast	$18,395	$23,372	27.1%
Oregon	$20,940	$26,561	26.8%

Source: U.S. Census Bureau, American Fact Finder, May 2013.

*Cities of Florence and Reedsport represent coastal Lane and Coastal Douglas counties, respectively.

Due in part to the aging of the coastal population, investments (e.g. 401k accounts) and transfer payments (retirement pensions, social security and other governmental assistance) account for about 46% of total personal income coastwide. This means that a sizable portion of spending is not tied to salaries and wages from local businesses or industries. This percentage of non-earned or non-wage income is greatest in Curry County at close to 60% and lowest in Clatsop County at 39%. Non-wage income as a part of total income has been growing steadily since the 1970s.[3] Growth in retirement-related transfer payments has positive effects in terms of local spending for goods and services. Consumer behavior studies indicate that the elderly have a high propensity to spend in local markets when the goods and services they desire are available, resulting in a higher income multiplier than for other age groups.

As shown in Table 10, the percentage of households in poverty, as defined by the U.S. Census Bureau, increased in coastal counties by 1.5 % between 2000 and 2010, slightly less than the statewide increase of 3.2%. The percentage of people in poverty was greatest in Tillamook County, at 17.6% in 2010.

Table 10. Percentage of Households in Poverty, 2000 – 2010

County	2000	2010	Change
Clatsop	13.2%	14.2%	1.0%
Tillamook	11.4%	17.6%	6.2%
Lincoln	13.9%	16.2%	2.3%
Coastal Lane*	14.1%	12.5%	-1.6%
Coastal Douglas*	16.2%	14.8%	-1.4%
Coos	15.0%	16.0%	1.0%
Curry	12.2%	14.2%	2.0%
Coast	13.6%	15.1%	1.5%
Oregon	11.6%	14.8%	3.2%

Source: U.S. Census Bureau, American Fact Finder, May 2013.

*Cities of Florence and Reedsport represent coastal Lane and Coastal Douglas counties, respectively.

[3] *A Demographic and Economic Description of the Oregon Coast: 2006 Update*, The Research Group for Oregon Coastal Zone Management Association, March 2006.

What the assessment suggests:

- While median household income and per capita income have both increased in all coastal counties over the past decade, they have been and are expected to remain between 10-20% lower than the statewide average.
- With the anticipated graying of the coast population, non-earned income will likely constitute an increasingly greater share of total personal income in all coastal counties, and particularly South Coast counties.
- The percentage of coastal households in poverty can be expected to increase but remain close to the statewide average.

A.1.6 Education

On average, 89.7% of coastal adults have attained a high school degree or higher, slightly more than the Oregon average of 88.9%.

In line with the statewide average, the ratio of the population with high school degrees averaged almost 90% among coastal counties in 2010. The percentage of those who have high school degrees increased by an average of 6.1% in coastal counties between 2000 and 2010, higher than the statewide average of 3.8%. Curry County experienced the greatest increase in the percentage of adults with high school degrees at 10.0%, while Tillamook County saw the lowest increase at 4.0%.

During this same period, coastal counties experienced a lower percentage of adults with a bachelor degree (or higher) at about 21%, compared to the state average of almost 30%. However, percentages increased for all coastal counties between 2000 and 2010, with an average gain of 3.0%, largely attributable to investments in a system of community colleges over the

decade. In addition, Oregon Community Foundation has invested in adult education through grants to local community colleges to provide scholarships to students and for training for teachers and administrators.

Table 11. Percentage of Population with High School and Bachelor Degrees, 2000 – 2010

	2000		2010		Change	
County	High School	Bachelors	High School	Bachelors	High School	Bachelors
Clatsop	85.6%	19.1%	91.5%	22.1%	5.9%	3.0%
Tillamook	84.1%	17.6%	88.1%	19.3%	4.0%	1.7%
Lincoln	84.9%	20.8%	89.9%	24.4%	5.0%	3.6%
Coos	81.6%	15.0%	87.4%	18.5%	5.8%	3.5%
Curry	81.7%	16.4%	91.7%	19.6%	10.0%	3.2%
Coast	83.6%	17.8%	89.7%	20.8%	6.1%	3.0%
Oregon	85.1%	25.1%	88.9%	29.0%	3.8%	3.9%

Source: U.S. Census Bureau, American Fact Finder, May 2013.

What the assessment suggests:

- The proportion of the population with a high school degree increased by a significant percentage over the past decade and, at 90%, is slightly higher than the statewide average.
- The coast's system of community colleges is expected to contribute to continuation of the trend over the past decade of growth in the proportion of the population having college degrees. The overall percentage will likely continue to lag behind the statewide average, however.

A.2 Key Demographic/Social Trends and Implications for Estuaries and Shorelands Planning

Demographic trends are expected to have significant social and economic implications for the coastal workforce, homeownership, government services, and other factors. For example, demand for public services geared towards children and young adults will likely increase at a slower pace, whereas demand for elderly care and services will increase rapidly. Among the key demographic and social trends:

- While positive population growth is projected for most coastal counties over the next three decades, it will continue to lag behind state averages. Population growth on the North Coast will generally be significantly greater than that on the South Coast, which may experience relatively low growth in the short- to medium-terms.

- The coastal population is aging at a faster rate than the state as a whole, with Clatsop and Lincoln counties experiencing the greatest influx of retirees. At the same time, a significant number of middle-age persons (30-50 years old) are leaving the coast to find employment opportunities elsewhere.
- Areas that are most successful in attracting and retaining younger segments of the population, such as Astoria and Newport, have advantages of relatively available employment and a perception of being more progressive than other coastal communities.
- Second homes will continue to increase as a percentage of the total coastal housing stock, with higher growth on the North Coast than the South Coast.
- Both median household income and per capita income will likely remain between 10-20% lower than the statewide average. At the same time, median home values in all coastal counties have been increasing at a rate higher than the statewide average, resulting in concerns about housing affordability.

Key demographic trends that should be considered in planning for estuaries and shorelands relate most directly to population growth and associated new development, including increasing numbers of second homes and commercial tourism activities. More people mean new development, with waterfront locations being desired locations for both primary and second homes and tourism-related development. Federal, state and local development regulations will restrict the amount and type of new development that can occur within estuaries and shorelands. Thus, new development has the potential to impact estuaries and shorelands indirectly through increased potential for stormwater runoff pollution, increasing water withdrawals, and the effects of land conversions on botanical and wildlife resources, etc. While development regulations may limit some of the negative effects associated with development, pressure to develop in sensitive areas may increase.

Demographic trends also suggest the need to pay attention to the aging and diversification of the coast's population. As the population ages, requiring more services and paying lower income taxes, a younger and more ethnically diverse group will become the primary wage earners and tax payers. These demographic changes can be expected to have sociopolitical implications for planning for estuaries and shorelands, the nature of which would be speculative to define.

B. ECONOMIC TRENDS

B.1 Assessment

B.1.1 General Economic Characteristics

As previously noted, the Oregon coast is often described as having two distinct regions, each with a unique economy. Clatsop, Tillamook and Lincoln counties on the North Coast are known for their fishing, agriculture and tourism industries. Dairy farms and agricultural products are particularly prominent in Tillamook County, while the commercial fishing and tourism industries are a foundation of Clatsop County's economy. Like all coastal counties, Lincoln County's economy was once based on natural resources, with an emphasis in logging, lumber and wood products manufacturing. Today, Lincoln County has strong tourism and commercial fishing industries, in addition to marine research-based industries. The National Oceanic and Atmospheric Administration (NOAA) recently located a new Marine Operations Center in Newport, the county seat. The scenic beauty of the coast is also attractive to retirees, adding employment in retail trade and services, especially health care.

On the South Coast, retirees (in the form of transfer payments) and tourism are becoming increasingly important economic factors as natural resource-based industries decline. While forest products, tourism, fishing and agriculture have historically dominated the Coos County economy, tourism, especially that associated with Bandon Dunes Golf Resort, is replacing the former lumber-driven economy. If developed, the Jordan Cove Energy Project at the Port of Coos Bay would have significant economic impact in the area. A recently announced pilot project off Coos Bay will be the West Coast's first offshore wind energy farm. Mining operations proposed by Oregon Resources Corporation also represent economic growth potential in the county. Agriculture specialty products, including cranberries and Easter lilies, are important economic sectors in both Coos and Curry counties.

Approximately 25-30% of the Curry County labor force is employed in the forest products industry. Agriculture – mainly field crops, orchards, and livestock (particularly sheep ranching) – is also an important component of the economy. The forest products industry also dominates the economies of coastal Lane and Douglas counties.

The overall coastal economy is transitioning, with increasing emphasis on marine research, tourism, education and health care services. Employment in resource-based industries (timber, agriculture, fishing and mining) has been in a steady decline since the 1970s. While this overall decline in resource-based industries is expected to continue, timber will remain a sustainable part of the North Coast economy, with agriculture remaining an important industry, most notably in Tillamook County. Likewise, commercial fishing has declined, but not in the value of the harvest. Rather, the industry has become more industrialized, resulting in fewer local jobs. Approximately 350 new jobs were created in the leisure and hospitality industries between 2001 and 2011. However, the education and health services industries provided a much greater economic impact with 1,810 new jobs created during the same time period. While tourism is an important and growing segment of the coastal economy, it is a relatively small segment. With its lower wage rates and seasonality, tourism employment does not replicate resource-based industry employment in terms of personal income.

Lack of funding for infrastructure improvements and maintenance and lack of a skilled workforce are perceived by many interviewees as inhibiting economic growth. Convenient access to Portland and other I-5 markets is clearly a dominant factor in the economy of the North Coast which outpaces that of the South Coast in all indicators.

What the assessment suggests:

- The timber, agriculture and fishing sectors remain key elements of the coastal economy, even though the overall coastal economy is transitioning from resource-based industries to tourism, marine research, education, and health care services.
- This transition is somewhat more pronounced on the South Coast than the North Coast, which is favored by better access to Portland and other I-5 markets.

B.1.2 Employment

According to the 2010 U.S. Census, the largest industries in terms of employment in coastal counties are: retail trade; education, health care and social science; and arts, entertainment, recreation, accommodation and food services. As shown in Table 12, manufacturing and professional services make up much smaller percentages of the coastal economy than they do statewide.

Table 12. Industry as a Percentage of Overall Employment, 2010

Industry	Clatsop	Tillamook	Lincoln	Coastal Lane*	Coastal Douglas*	Coos	Curry	Coast	Oregon
Agriculture, forestry, fishing and hunting and mining	6.6%	9.8%	4.0%	0.2%	3.9%	6.2%	7.9%	5.5%	3.5%
Construction	7.7%	8.1%	8.9%	8.0%	5.5%	7.2%	8.8%	7.7%	6.5%
Manufacturing	8.4%	12.5%	5.2%	7.7%	6.6%	7.2%	5.1%	7.5%	11.5%
Wholesale trade	2.0%	2.5%	1.1%	2.3%	1.2%	1.9%	1.1%	1.7%	3.1%
Retail trade	14.4%	14.2%	18.1%	15.2%	17.3%	15.0%	13.7%	15.4%	12.3%
Transportation and warehousing and utilities	4.0%	6.0%	3.9%	8.2%	2.0%	4.6%	4.5%	4.7%	4.3%
Information	1.6%	0.4%	1.4%	0.5%	0.0%	1.8%	1.4%	6.7%	2.0%
Finance and insurance and real estate	5.1%	3.8%	4.7%	7.8%	8.2%	4.5%	5.6%	5.7%	6.2%
Professional, scientific and management	7.7%	6.3%	7.8%	3.2%	7.3%	7.2%	4.7%	6.3%	10.0%
Education, health care and social science	16.5%	15.0%	17.3%	15.9%	21.2%	21.9%	16.7%	17.8%	21.6%
Arts, entertainment, recreation, accommodation and food services	17.4%	11.5%	15.6%	20.9%	16.7%	11.0%	16.3%	15.6%	9.4%
Other except public administration	4.1%	3.8%	4.9%	6.4%	5.3%	5.2%	6.3%	5.1%	5.0%
Public administration	4.4%	6.1%	7.1%	3.5%	4.8%	6.4%	7.8%	5.7%	4.6%

Source: U.S. Census Bureau

*Cities of Florence and Reedsport represent coastal Lane and Coastal Douglas counties, respectively.

As with the rest of Oregon, coastal employment during the 2000-2010 decade was characterized by early rapid growth, followed by deep recession, followed by very slow recovery. From 2001-2011, about 2,190 nonfarm payroll jobs were added in the five counties, as shown in Table 13. The North Coast added a combined 2,860 jobs – 1,460 in Clatsop County alone – while the South Coast lost 790 jobs. The education and health services industry cluster experienced the greatest increase in jobs over the 10-year period and was the only industry cluster to add jobs in all five counties. Manufacturing employment decreased in all five coastal counties, with a total loss of 600

jobs. The information industry also reported losses all along the coast. The mining and logging industries lost 230 jobs during the same time period, experiencing growth only in Tillamook County. Coos County is the sole jurisdiction reporting job gains in government employment.

Table 13. Change in Nonfarm Payroll Employment (Jobs) by Industry, 2001-2011

Industry	Clatsop	Tillamook	Lincoln	Coos	Curry	Coast
Mining and Logging	-100	40	-40	-60	-70	-230
Construction	60	-70	40	30	-70	-10
Manufacturing	-70	-80	-80	-240	-130	-600
Trade, Transportation and Utilities	360	-30	-30	30	-110	220
Information	-20	-50	-90	-140	-60	-360
Financial Activities	130	60	40	-30	80	280
Professional and Business Services	180	60	10	-40	110	320
Educational and Health Services	450	120	840	320	80	1,810
Leisure and Hospitality	320	180	-180	100	-70	350
Other Services	0	70	30	-60	-20	20
Government	-90	-70	-470	80	-130	-680
Change in Nonfarm Payroll Employment	1,180	230	50	0	-390	1,070

Source: Oregon Employment Department.
Note: Nonfarm payroll employment is by place of work. Totals may not sum due to rounding.

Despite an overall increase in nonfarm payroll employment, the percentage increase in unemployment outpaced the percentage increase in total employment between 2001 and 2011.

Table 14. Change in Unemployment as Compared to Change in Employment, 2001-2011

	Clatsop		Tillamook		Lincoln		Coos		Curry	
	Jobs	%	Jobs	%	Jobs	%	Jobs	%	Jobs	%
Unemployment	745	17%	428	59%	770	50%	1,029	46%	481	76%
Total Employment	2,249	13%	770	7%	1,295	7%	1,055	4%	-4	0%

Source: Oregon Employment Department.
Note: Unemployment and total employment by place of residence.

The coastal economy is beginning to recover from the economic recession that began in 2007. The five coastal counties have seen an increase in employment from a low of 66,800 payroll employees in 2010 to 71,970 in April 2013. Total nonfarm employment grew by approximately 370 jobs between April 2012 and April 2013, as shown in Table 15. Lincoln County accounted for 340 new jobs during that time period, while Clatsop County was the only county to see negative job growth, losing 180 jobs. The leisure and hospitality sector showed the greatest amount of growth, while trade, transportation and utilities employment decreased by 210 jobs. Coastal employment currently represents 4.2% of total Oregon employment.

Table 15. Change in Total Nonfarm Employment, April 2012-April 2013

Industry	Clatsop	Tillamook	Lincoln	Coos	Curry	Coast
Mining and Logging	-10	-10	10	-30	20	-20
Construction	-50	30	80	0	50	110
Manufacturing	-50	30	10	100	50	140
Trade, Transportation and Utilities	-180	20	0	10	-60	-210
Information	0	-20	0	10	0	-10
Financial Activities	-10	-10	-10	0	-10	-40
Professional & Business Services	40	10	70	0	40	160
Education & Health Services	-110	50	50	-10	30	10
Leisure & Hospitality	140	-50	90	40	70	290
Other Services	-40	-10	-10	0	10	-50
Total Government	-10	-10	50	-60	-80	-110
Change in Nonfarm Employment	-180	30	340	60	120	370

Source: Oregon Employment Department.
Note: Nonfarm payroll employment is by place of work. Totals may not sum due to rounding.

The unemployment rate for the five coastal counties combined averaged 10.1% in 2011. It has been trending downward and is significantly less in all counties than in January 2010, when it reached a high of 11.6%. As shown in Table 16, all coastal counties showed a steady decline in unemployment rates since 2012, keeping in line with the statewide trend.

Table 16. Seasonally Adjusted Unemployment Rates: April 2012-April 2013		
	April 2012	April 2013
Clatsop	7.9%	7.1%
Tillamook	8.9%	7.5%
Lincoln	9.7%	8.5%
Coos	10.8%	10.3%
Curry	11.8%	10.8%
Oregon	8.8%	8.0%

Source: Oregon Employment Department.

The latest available information on Oregon's economic recovery is mixed, with the percentage of adults in the workforce in May 2013 (61.8%) at its lowest level since the state started tracking it in 1976, despite a decline in unemployment and an increase in hiring. Workforce participation among the coastal counties reflected this mix, with Clatsop County showing the highest participation rate and Lincoln, Coos and Curry counties the lowest. Demographics are behind at least part of the decline. Baby boomers are reaching retirement age and young adults are waiting longer to enter the job market. Areas with stronger economies, such as Clatsop County, have higher rates of adults in the workforce. The opposite is true for counties with higher unemployment rates and smaller populations. In Curry County, for example, fewer than one in two adults is either working or looking for employment. This is in largely attributable to the county's large retiree population (its median age is 53.5).[4]

The Oregon Employment Department's 2010-2020 employment forecast predicts that total Oregon payroll employment will grow by 18% over the decade, adding 298,000 jobs to Oregon's economy. The private sector will grow by 20% over the period, while government payrolls will expand by only 7%. Private-sector employment will account for 92% of all new jobs in the state. While all of Oregon's major industrial sectors are anticipated to grow in the coming years, more than half of all growth is anticipated to occur in the state's three largest industry sectors: educational and health services; trade, transportation, and utilities; and professional and business services. Construction is expected to be the state's second fastest growing industry over the next decade. Despite the fast growth rate, this and the manufacturing sector are not anticipated to reach pre-recession employment levels during the next decade. The slowest growth in payrolls over the next decade will likely occur in eastern Oregon, south central Oregon, and the South Coast.

[4] *Oregon's recovery up and down*. Holly Young. *The Oregonian*. June 19, 2013.

Although employment projections by county are not readily available, employment projections available for the 2010-2020 period are provided by the Oregon Employment Department on a regional basis.

Region 1 is comprised of Clatsop and Tillamook counties, as well as Columbia County, and is influenced significantly by the Portland metropolitan economy. Total employment in Region 1 is projected to increase by 15% by 2020, with the greatest gains coming in the professional and business services industry. Other projected growth industries include education and health services and construction. Little to no growth is expected from the information and government sectors.

In Region 4, which includes Lincoln County as well as Benton and Linn counties, total employment is projected to increase by 16% by 2020. As in Region 1, growth industries are anticipated to include: professional and business services, education and health services, and construction. The information and government sectors are projected to see the smallest amount of growth.

In Region 7, which mirrors the South Coast assessment area, overall employment is projected to grow 11% by 2020, lower than in Regions 1 and 4. The education and health services and professional and business services clusters are projected to experience the greatest amount of growth, while the information industry is expected to shrink by 14%.

What the assessment suggests:

- The coastal economy is beginning to recover from the economic recession, with increases in employment over the next decade occurring in all counties.
- Trends suggest that employment growth will be stronger in the North Coast than the South Coast.
- The strongest employment growth on the coast will be in professional and business services; education and health services; and construction. The trade, transportation and utilities sector is expected to grow at a slower rate than the statewide average.
- Unemployment rates have been declining since 2012, keeping in line with the statewide trend.

B.1.3 Key Economic Sectors

Throughout most of the 20th century, the coast's economy was based on natural resources, including agriculture, fishing and timber. A shift began in the 1980s as limits were placed on logging and fishing. While still dependent on natural resources, tourism and retirement income (transfer payments and investments) provide much of today's economic growth on the coast. Emerging markets include processed food products, marine sciences, live fish, eco-tourism and energy.

B.1.3.1 Ports

There are 15 ports, large and small, along Oregon's coast. Working waterfronts are found in Astoria/Warrenton, Garibaldi, Depoe Bay, Newport, Winchester Bay, Coos Bay/Charleston, Port Orford, Gold Beach and Brookings. There are three deep draft ports – Astoria, Newport, and Coos Bay.

Oregon's coastal ports are important economic generators along the coast and throughout the state and support thousands of jobs. In some port towns, commercial fisheries provide a quarter or third of all the annual earned income. The seafood industry supports a cluster of fish processing plants, mechanics, machine shops and welders, refrigeration specialists, marine electronics sales and service firms, professional services (attorneys and accountants), and marine suppliers. Marine cargo transportation facilitated by these ports is of critical importance statewide. Furthermore, ports support commercial and recreational fishing, land and marine-oriented recreational activities, and commercial and industrial enterprises. Key markets for coastal ports include food processing, commercial and recreational fishing, property development, bulk commodities, and recreation. Emerging markets include agriculture, marine sciences, live fish, eco-tourism and energy sources.[5]

Because of the interrelationship between ports and planning requirements under Goal 16, a representative sampling of management plans for both deep draft development and shallow draft estuaries was reviewed. Key factors related to estuaries and shorelands planning include:

- There is an adequate inventory of undeveloped and underdeveloped industrially-zoned lands; the available land base is not considered a deterrent to economic development at many ports.
- The Port of Astoria is focusing on replacing deteriorated facilities in order to maintain the ability to support commercial berthing (including

[5] *Ports 2010: A New Strategic Business Plan for Oregon's Statewide Port System*. Parsons Brinkerhoff for Oregon Department of Transportation and Oregon Infrastructure Finance Authority, April 2010.

cruise ships), cargos ships and storage, and seafood processing. It is also continuing efforts to clean up contaminated areas. It plans to dredge and maintain marina infrastructure as needed. If a proposed liquid natural gas (LNG) operation moves forward, the Port plans to consider revenue generating opportunities for the Port on Skipanon Peninsula, including leasing additional parcels, financing tugs, or applying harbor fees.

- The Port of Garibaldi plans to rehabilitate harbor facilities to accommodate eco-tourism activities, maintain rip-rapped seawalls, and continue dredging the bay as needed. The Port is also completing a feasibility study for expansion of its boat basin and, if feasible, intends to pursue funding to construct a 200-slip expansion with parking and needed fisheries support facilities, such as an emergency repair dock and new dry dock. The Port's management plan also contains provisions to pursue acceptable wave energy projects. The City of Garibaldi recently adopted changes to water-dependent zoning at the Port to facilitate waterfront tourism development.
- The Port of Newport plans include replacement of the South Beach/Fishing Pier storm sewer outfall and pump station, filling of an old boat ramp, reconstruction of marina docks, replacement of piers, and improvements and replacements of most of the commercial docks. Dredging of the north and south marina areas is also planned.
- The Port of Toledo is considering a future marine haul-out to attract vessels that otherwise would pass Yaquina Bay.
- At the Port of Umpqua, an engineering study is underway to replace the Salmon Harbor D Dock. Also planned is dock maintenance and Umpqua River dredging. In downtown Reedsport, stormwater and levee improvements are planned.
- Completion of the Coos Bay Rail Line Rehabilitation Project and development of the Jordan Cove LNG terminal are the major focus of the Port of Coos Bay. The success or failure of LNG terminal development at the Port is expected to significantly affect the economic future of that area of the coast but have minimal effect on other areas (with the exception of pipeline effects). Other plans include completion of permitting for deeper channel dredging and a multi-use cargo berth. The Port seeks to secure funding for Phase II of the Rail Lines Rehabilitation Project and for North Jetty rehabilitation.
- The Port of Port Orford is focused on retaining High Dock shoaling maintenance dredging, installing High Dock jetty modifications and implementing upland redevelopment.
- The current focus of the Port of Gold Beach is to lobby for dredging and jetty construction funds to maintain ingress and egress to ocean and river. The Port is also seeking funds to improve and develop recreational boating infrastructure, including a permanent dyke within the boat basin for wave attenuation. It also plans to complete a commercial high dock.

Oregon's coastal ports face a number of challenges. They are located in smaller markets, which limit their ability to compete with larger ports along the West Coast. This challenge is further compounded by limited transportation access across the Coast Range. Many ports face financial and regulatory/environmental barriers to making capital improvements and continuing maintenance dredging. Most ports continue to be involved in operations in declining or threatened markets, such as forest products and shrinking commercial fishing fleets. All ports are experiencing increased competition for the industrial use of waterfront properties from residential and commercial uses. Some interviewees suggest that land use and environmental regulations are hindering economic growth and adaptability. Others suggest that the decline in resource-based industries has resulted in excess capacity coastwide. Research suggests that emerging markets, such as local farm-to-market agriculture, marine sciences, eco-tourism and energy sources, may help offset losses from traditional industries.

A major emerging challenge for ports is the decline in available federal funding for harbor and side channel dredging and jetty repairs and maintenance. In 2013, the Oregon Legislature provided stop-gap funding for small port dredging. However, with the overall decline in federal funding for infrastructure, there is great uncertainty about the effects on ports. Dredging and jetty maintenance at the Columbia River, Coos Bay and Yaquina Bay are likely to be better financed than at other ports due to their greater volume of commerce.

B.1.3.2 Fishing[6 7]

Commercial and recreational fisheries are an important part of the lifestyle and economy of the Oregon coast. Commercial fishing fleets are located in Astoria, Garibaldi, Newport, Florence, Coos Bay, Port Orford, Gold Beach and Brookings. The seafood processing industry is concentrated in Astoria, Newport and Coos Bay. Each year, the OCZMA works with the Oregon Department of Fish and Wildlife (ODFW) to document the economic contribution of sports and commercial fishing. In terms of volume, 285.1 million pounds of fish were delivered to Oregon ports in 2011, up from 216.6 million pounds in 2010. Higher prices in most fisheries and higher volumes in some fisheries resulted in a 23-year high of $145.5 million in earnings in 2011. The total wholesale estimated value of Oregon on-shore harvests was $291 million. While the Oregon commercial fishing industry production is substantial, the State and the U.S. are net importers of seafood for consumption. Most of Oregon's production is shipped elsewhere to satisfy niche and commodity markets.

[6] *Oregon Commercial Fishing Industry Economic Contributions in 2011 and Outlook for 2012.* Oregon Department of Fish and Wildlife and Oregon Coastal Zone Management Association. February 2012.

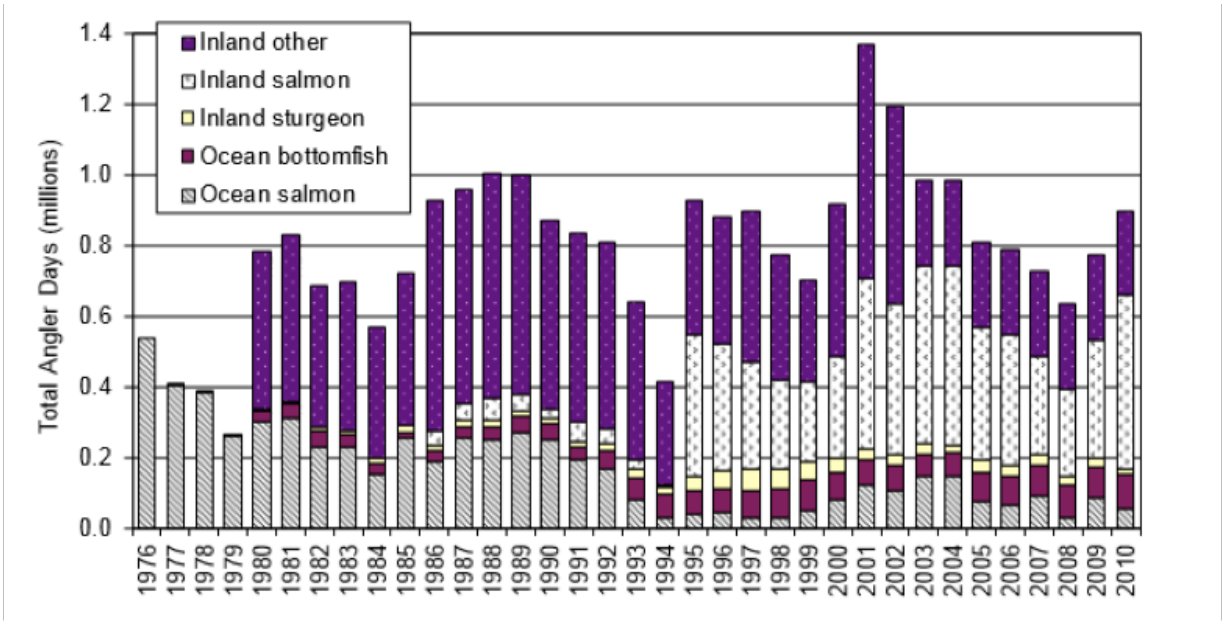
[7] *Oregon Marine Recreational Fisheries Economic Contributions in 2009 and 2010.* Oregon Department of Fish and Wildlife and Oregon Coastal Zone Management Association. September 2011.

The commercial fishing industry generated $284 million in total personal income in 2011 from on-shore landings, compared to a 2010 economic contribution of $228 million and a previous five-year average of $244 million. The estimated total personal income generated by the Oregon commercial fishing industry (on-shore and offshore) in 2011 exceeded $518 million. This economic contribution is equivalent to approximately 16,000 jobs, about a 13% increase in economic impacts over the previous five years.

While the number of commercial vessels making deliveries to Oregon ports declined in 2011, the average per landing revenue increased by approximately 30% over 2010. However, 70-80% of the harvest revenue, depending on the fishery, is gained by 20-30% of vessels. In addition to a trend of declining numbers of vessels and consolidation of processor ownerships, there is a shift in landings from small ports to regional fisheries centers. The landings that still occur at small ports are purchased by large processors and hauled to centralized plants for processing and warehousing. Minimal use of the local labor force or port facilities is required.

The limited information available on recreational fisheries indicates that trips peaked in the early 2000s during periods of salmon abundance before declining through much of the decade, and more recently rebounding somewhat. However, recreational angling still contributes substantially to the coastal economy. Coastwide, trip spending contributed $32.2 million of total personal income in 2009 and $37.2 million in 2010. There were 771,000 total trips in 2009 and 896,000 total trips in 2010.

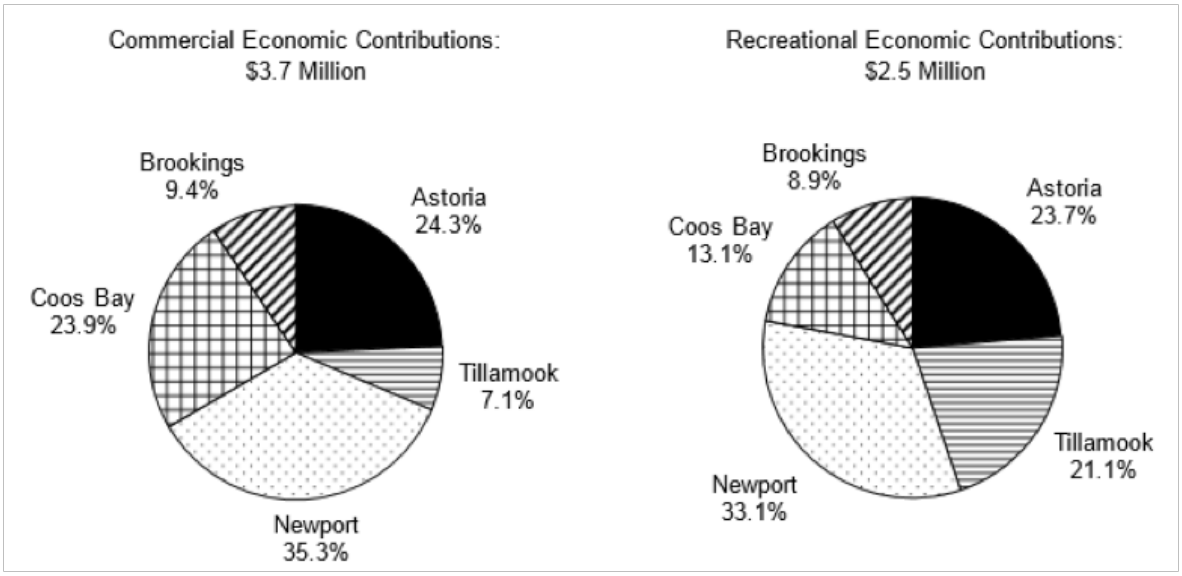
FIGURE 1: RECREATIONAL ANGLER DAYS FOR SELECTED FISHERIES, 1976-2010



Source: Oregon Marine Recreational Fisheries Economic Contributions in 2009 and 2010. The Research Group for Oregon Department of Fish and Wildlife and Oregon Coastal Zone Management Association. 2011.

The commercial and recreational fishing sectors combined represent about 4% of the total coastal economy and about 0.5% of all Oregon net earnings. Local net earnings attributable to these sectors range from 16% of total earnings in Lincoln County to less than 2% in Tillamook County. Figure 2 compares ocean salmon commercial and recreational fisheries at five ports.

FIGURE 2: RECREATIONAL OCEAN AND INLAND FISHERIES ECONOMIC CONTRIBUTION, 2010



Source: Pacific Marine Fisheries Council, 2011.

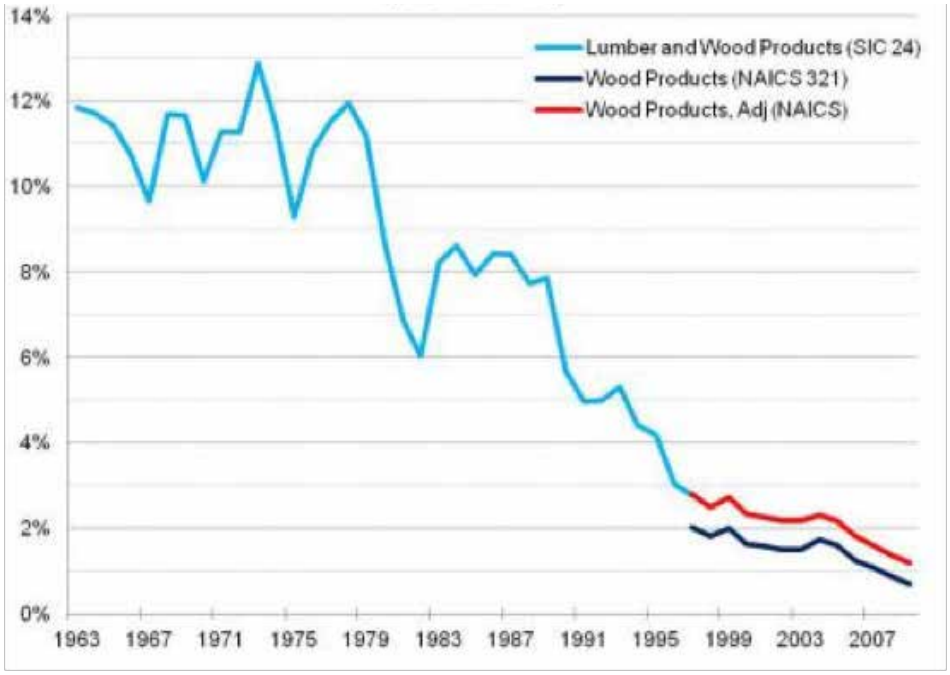
The economic contribution of commercial fishing has been declining on the South Coast as tourism becomes a greater economic driver. On the North Coast, fishing remains a significant industry and has seen moderate growth in recent years. While the overall economic contribution of commercial fishing is likely to continue to grow, the number of jobs generated by the commercial and recreational fishing industries will continue to decline due to fleet and fish processing industry consolidation, restrictions on harvest levels, increasing operational costs, and other factors. Near-term threats identified by the industry include no-take marine protection areas, energy generation and other conflicting uses.

B.1.3.3 Forestry

While still a primary component of the coastal economy, the forest industry has changed and declined over the past few decades, affecting many coastal communities. While the industry has historically been highly cyclical, industry employment statewide held steady in the 70,000 – 80,000 range until it took a large hit during and after the early 1980s recession. Harvest restrictions on federal lands resulted in a second large hit to the industry in the early 1990s. Employment in the industry has been on a steady downward trend both on the coast and statewide over the past 20 years, except for a couple

of years during the housing boom. During this same period, productivity increased substantially, an industry trend that has continued to this day. The combination of increased efficiencies (standardization of logs, mills, equipment, etc) and federal land restrictions contributed to declining employment in the industry, even as value-added output has held steady. Industry output has remained at approximately the same level since the mid-1970s in nominal terms (with some business cycle fluctuations). However, as a share of the state's total gross domestic product (GDP), wood products has declined due to growth in all other industries. The graph below shows the wood products industry output as a share of total Oregon GDP through 2009 (the latest year for which industry detail data is available).[8]

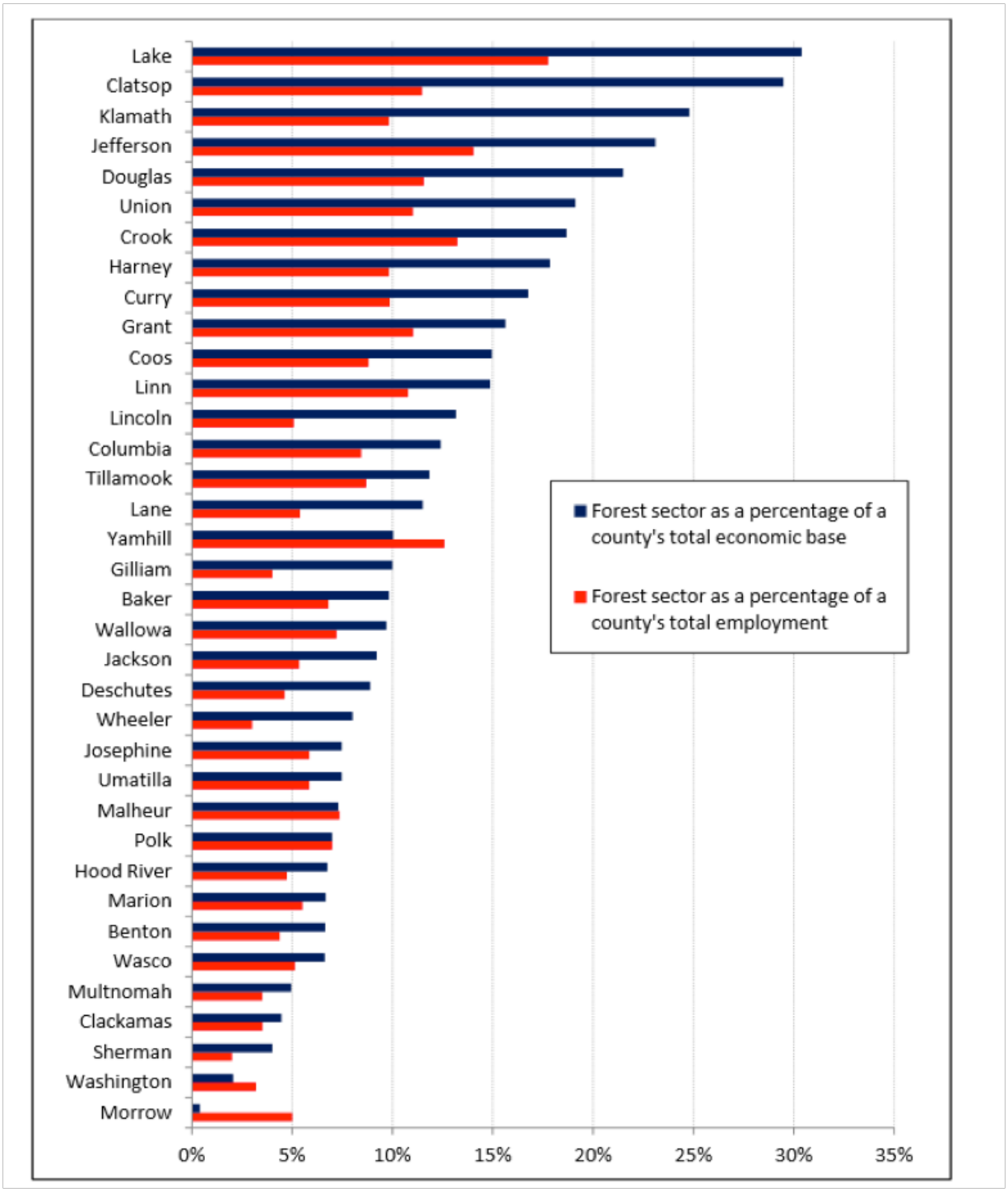
FIGURE 3: WOOD PRODUCTS AS PERCENT OF OREGON GDP (1963-2009)



Much of the industry's decline has occurred on the South Coast, where the industry has been impacted to a greater degree by the reductions in harvest levels on federal lands. Historically, the South Coast was one of the nation's most productive regions in terms of timber production and processing. The forest sector has been more stable on the North Coast due to the presence of Tillamook State Forest and a healthy mix of private industrial forestlands. Timber harvests have not declined on these lands, and the forest sector is much more vigorous in this region than in others. Forest industries make a proportionately greater contribution to the economic base on the coast than in many other regions of the state, as illustrated in Figure 4.

[8] Oregon Office of Economic Analysis, 2012.

FIGURE 4: CONTRIBUTION OF THE FOREST SECTOR TO OREGON'S ECONOMY BY COUNTY, 2012



Source: Forest Econ Inc. The 2012 Forest Report. 2012.

For the coastal counties (excluding coastal Lane and Douglas), timber harvest by volume and its percentage of the statewide total in 2008 is compared in Table 17.

Table 17. Timber Harvest By County, 2008

County	Harvest Volume MMBF	% of Total
Clatsop	441.1	12.2
Tillamook	201.5	5.6
Lincoln	159.3	4.4
Curry	79.8	2.2
Coos	303.5	8.4
Coast	1,185,2	32.6
State	3,616.8	100

Source: USDA Forest Service, 2012.
MMBF = Million board feet

The slow recovery of the housing market is still being felt by the forest sector and by rural counties where timber is an economic mainstay. Industry specialists indicate that the forest industry sector is positioned to grow again as the economy continues to recover from the recession, and that there is an array of opportunities to expand markets for Oregon's wood products.[9] In 2011, the statewide timber harvest jumped 13%, with two-thirds of the total harvest coming from private industrial timber landowners taking advantage of the hot export market to China. However, total harvest remained less than half of the 25-year historic high.[10]

The future of the forest products industry is dependent on infrastructure and innovation. Infrastructure to support the timber economy is needed both at ports and to transport goods across the Coast Range. To be successful, the industry will also need to innovate to become more efficient and diversify the product base. Renewable energy markets are seen as an especially promising opportunity, whether in the production of electricity, thermal energy, cellulosic bio-fuels, or other forms of renewable energy from forest biomass.

[9] *The 2012 Forest Report: An Economic Assessment of Oregon's Forest and Wood Products Manufacturing Sector*. Oregon Forest Products Institute. 2012.

[10] Eric Mortenson. *The Oregonian. Oregon timber harvest jumps 13 percent, but still way below historic levels.* July 9, 2012.

B.1.3.4 Agriculture

Agriculture is a relatively minor component of the coastal economy, with the exception of Tillamook County, where meat, dairy products, vegetables, berries, and nursery crops are key components of the local economy. Agriculture employment accounts for less than 2% of total personal income coastwide. Table 18 shows the latest available gross farm and ranch sales for coastal counties (excluding coastal Lane and Douglas counties).

Table 18. Gross Farm & Ranch Sales ($000) by County, 2011

County	All Crops	All Animal Products	Total Sales
Clatsop	5,043	46,825	51,868
Tillamook	5,611	131,913	137,524
Lincoln	13,407	30,335	43,742
Curry	12,304	12,967	25,271
Coos	15,599	42,760	58,359
Coast	51,964	264,800	316,764
State	3,521,237	1,678,335	5,199,572

Source: Oregon Agricultural Information Network, Extension Economic Information Office, Oregon State University.

Over the past decade, the agriculture sector has experienced the same declines in earnings generated as other key industries on the coast and in the state. In 2008, an all-time high of $5 billion was reached in statewide farmgate value (the total value of agricultural products coming off the farm). In 2009, that value crashed due to the recession but was back up to $4.4 billion in 2010 and exceeded $5 billion in 2011. While agricultural sale values have been steadily increasing, expenses have been climbing faster than income. Compared to neighboring states, Oregon's average net farm income is lower, fewer farms have positive net income, and the average income for those farms that are positive is lower. One of the effects of the decline in agriculture income has been increasing diversification.[11] At the same time, diversification has been hindered by ongoing reductions in the state's agriculture research stations and Extension Service programs that threaten research and development. While the industry may diversify in the future, it is not likely to show significant growth on the coast due to climate restrictions and land base limitations.

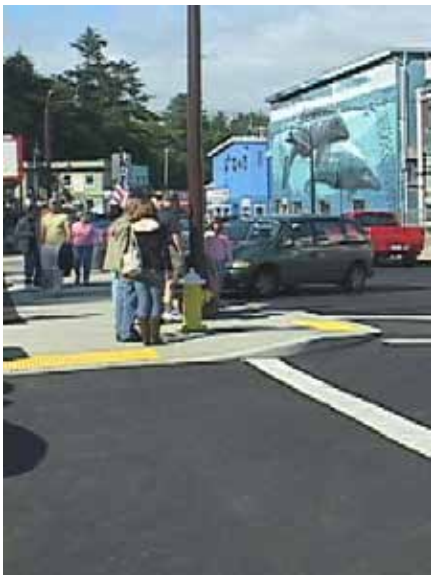

Photo: oregonlive.com

As elsewhere in Oregon and other areas of the country, coastal counties are experiencing growth in the local food movement. A growing number of small farms, many owned and/or operated by young and beginning farmers, serve

[11] *2013 State of the Agriculture Industry.* Oregon Board of Agriculture. 2013.

this market, helping create a potential new generation of farmers. Farmer markets are flourishing and restaurants are focusing on local food. Oregon leads Idaho and Washington in the number of farmer markets and direct sales to consumers and establishments. Another trend positively affecting the coastal agricultural economy is the growth in production of agriculture specialty products. For example, commercially cultivated cranberries in Coos and Curry counties account for approximately 7% of total U.S. production, and the cranberry ranks twenty-third among Oregon's top fifty agricultural commodities.[12] The temperate climate along the southern Oregon coast affords a long growing season, giving the berries a darker pigmentation than berries grown in other states.

B.1.3.5 Tourism



In 2012, more than 15 million people are estimated to have visited the Oregon coast to enjoy sightseeing, fishing, kayaking, nature watching, surfing, camping, hiking and other tourist activities. Coastal tourism is a multi-billion dollar industry, with $1.6 billion generated in travel spending alone (not including employment and tax revenue). Recreation-based tourism is expected to see continued growth, including a significant eco-tourism industry on the South Coast. Second homes and vacation rentals also represent a significant component of the tourism industry in coastal communities.

A 2011 survey of visitors to Oregon indicates that over 34% (9.8 million) of the 28.8 million overnight trips included a visit to the coast, with spending of $1.4 billion. Over 70% of those trips were for two or more nights. Almost 65% of overnight visitors participated in beach or waterfront activities.[13]

Data from the Oregon Department of Revenue (Figure 5) show that, outside of the Portland region, the North Coast generates the highest lodging receipts in the state.

[12] http://www.oregonencyclopedia.org/entry/view/cranberry_industry/.

[13] *Oregon 2011: Regional Visitor Report: The Coast*. Longwoods International. 2013.

FIGURE 5: TOURISM LODGING RECEIPTS BY REGION, 2012

Source: Oregon Office of Economic Analysis, 2013

Table 19 shows the average annual change in key economic indicators for tourism over the 1991-2012 period. Data is also provided for 2011-2012 to illustrate the most recent trends as compared to the preceding two decades. Tourism continues to grow in coastal communities and is a core industry in the coastal economy. Key tourism indicators show the greatest positive change in Clatsop, Tillamook and Coos counties. Spending is increasing in all areas except coastal Lane and Douglas counties. Growth in earnings is greatest in Clatsop and Lincoln counties. Tourism employment earnings, however, show little or negative growth. As the tourism sector grows, its lower wages than those in historic industries has negative effects on local economies and personal income.

Clatsop and Lincoln counties are two of the three counties in the state where leisure and hospitality accounts for more than 20% of total private employment. The other three entirely coastal counties (Tillamook, Coos, and Curry) also have higher-than-average employment concentrations in leisure and hospitality. The majority of this employment (60%) is in accommodation and food services, i.e., places of lodging and restaurants. An additional 15% of the industry's jobs are in travel and transportation, including ground transportation, some air transportation, and travel agencies. The remaining 25% is divided between retail trade and arts, entertainment, and recreation. Lodging and restaurant employment is characterized by low wage rates and seasonality. Employment in the coastal tourism sector generally shows the same seasonality as employment in natural resource-based industries.[14]

[14] *A Demographic and Economic Description of the Oregon Coast: 2006 Update,* The Research Group for Oregon Coastal Zone Management Association, March 2006.

Table 19. Average Annual Change in Travel Trends by County, 1991-2012 (percent)				
County	**Spending**	**Earnings**	**Employment**	**Local Tax Receipts**
Clatsop				
1991-2012	4.0	4.0	1.2	4.5
2011-2012	5.2	8.1	1.5	5.0
Tillamook				
1991-2012	4.7	5.1	1.8	7.2
2011-2012	4.6	6.9	-3.2	6.2
Lincoln				
1991-2012	4.8	4.8	1.9	5.9
2011-2012	1.7	7.8	2.1	-1.1
Coastal Lane				
1991-2012	2.5	2.7	-0.9	7.3
2011-2012	0.9	4.1	-0.3	-9.0
Coastal Douglas				
1991-2012	2.9	2.7	-0.7	4.9
2011-2012	-1.0	-3.1	-6.1	7.4
Coos				
1991-2012	4.3	4.4	0.9	3.2
2011-2012	5.0	5.5	0.4	2.4
Curry				
1991-2012	2.1	1.8	-1.0	1.3
2011-2012	3.1	4.5	-1.8	-0.4
Coast				
1991-2012	4.0	4.0	0.9	5.5
2011-2012	3.4	6.5	0.2	1.1
State				
1991-2012	4.5	4.1	1.2	7.0
2011-2012	3.2	6.4	1.7	5.4

Notes: Spending includes visitor spending and other travel spending (travel agencies and transportation to other Oregon destinations). Earnings include wage and salary disbursements, benefits and proprietor income. Employment includes full- and part-time payroll employees and proprietors. These direct travel impacts do not include secondary (indirect and induced) impacts. The multiple year percentage change refers to the average annual change.

Source: Oregon Travel Impacts, 1991-2012. Dean Runyan Associates. April 2013.

A major trend affecting coastal tourism is the growth in international visitors. Overall, Oregon's international markets (Asia, Europe, Oceana, Canada) have been trending upwards for the past five years. International tourist visitation in 2012 was up 13% over 2011. Canada continues to be Oregon's number one international market, with an increase in visitation of 22% in 2012 over 2011. China is Oregon's fastest growing international market, seeing a 41.5% increase in 2012 vs. 2011. It is also the state's top spending overseas market at over $30 million in 2012.

B.1.3.6 Government Services

Historically, Oregon tends to have a higher concentration of state and local government employment than the nation. Oregon's consistently low concentration of federal government employment is likely due to the state's relatively rural nature, smaller population, and fewer major economic hubs compared with its West Coast neighbors.

Government employment tends to be counter-cyclical, meaning that government employment levels rise when private-sector employment goes down, and vice versa. Government often adds jobs during recessions because of an increase in demand for social services. However, in Oregon, the slow post-recession job growth in the private sector has been accompanied by a steady decline in government employment.

On the coast, the government services sector had the greatest change (loss) of employment among all industries over the 2001-2011 decade. Except for the information sector, it also has the smallest projected increase in employment (2% or 150 employees) over the next decade. The bright spot is growth in marine-based research. The recent relocation of the NOAA fleet to Newport, in conjunction with the existing Hatfield Marine Center and the Oregon Coast Aquarium, establishes a major marine research center there.

With its support for marine-based research being an exception, the Federal government is reducing its support for historic resource-based industries. As noted above, declining federal funding for dredging and jetty repairs and maintenance has the potential for significant effects on ports. Any decline in federal revenues is a significant issue on the coast due to its narrow economic base.

Especially in the South Coast, the local tax structure is inadequate to finance needed government services and voters have not been receptive to increases in local tax bases to do so. The consequence is an increased pressure on state government to provide services. As noted in the discussion of demographic trends, the coastal population is "graying" and transfer payments are increasing as a percentage of total income. Based upon historical trends and recent voting patterns, an increasing reluctance by voters to fund government services can be expected, likely more so on the South Coast than the North Coast.

B.1.3.7 Clean Economy

The clean economy has been identified as the single most important global opportunity on the medium-term horizon, with revenues expected to reach $2.3 trillion by 2020. Clean economy represents an economic focus on less carbon-intensive and longer-term, sustainability-based economic activities. "In broad terms, the clean economy is about creating and retaining wealth and jobs, reducing the carbon footprint of societies, restoring the natural environmental balance of critical ecosystems, and implementing improvements in energy and industrial efficiency, all of which contribute to enhanced economic competitiveness."[15] Clean economy jobs occur in multiple sectors of the economy, rather than being a discrete sector.

Research by the PEW Charitable Trust shows that between 1998 and 2007, clean economy jobs in the U.S. grew by 9.1%, while total jobs grew by only 3.7%. In terms of resiliency to market volatility, the clean economy in the U.S. lost fewer jobs than did the overall economy during the recent recession. The West Coast is well advanced in terms of clean economy. Of the total new clean economy jobs created in the U.S. in 2007, 21% were in California, Oregon and Washington. A conservative estimate of current clean economy GPD contributions and employment on the West Coast is $47.2 billion and more than 508,000 full-time equivalent jobs. In Oregon, clean economy GPD in 2010 was estimated at $5.0 billion, producing 57,928 direct jobs statewide. [16]

The areas of highest potential job growth in the clean economy have been identified to be energy efficiency and green building, environmental protection and resource management, clean transportation, clean energy supply , and knowledge and support.[17] The Oregon coast is well positioned to take advantage of clean economy growth, especially given the potential for wave and wind energy development. As discussed further under Energy Trends (Section D), renewable energy R&D is one of the fastest growing economic sectors on the coast, particularly but not exclusively in Newport.

15 *Globe Advisors and the Center for Climate Strategies. 2012. The West Coast Clean Economy: Opportunities for Investment & Accelerated Job Creation.*

16 Ibid.

17 Ibid.

What the assessment suggests:

- Ports will continue to be critical economic generators for the coast, supporting commercial and recreational fishing, land and marine-oriented recreational activities, and commercial and industrial enterprises. While some ports are refocusing on tourism or marine-related research, a number continue to rely on declining or threatened markets, such as forest products and commercial fishing.
- Many ports have plans for facility improvements targeted to either commercial recreational fishing or tourism. The available land base is not generally considered a deterrent to additional economic development at most ports.
- A major emerging challenge for ports is a reduction in available federal funding for harbor and side channel dredging and jetty repairs and maintenance.
- The economic contribution of commercial fishing is expected to modestly grow on the North Coast but decline on the South Coast as tourism becomes a greater economic driver there.
- As the commercial fishing industry becomes more industrialized and vertically integrated, the number of jobs generated by the commercial and recreational fishing industries will continue to decline and higher revenues will be realized by fewer vessels, reducing the local multiplier effect.
- Timber employment will continue to decline even while productivity increases. At the same time, forest industries will continue to make a proportionately greater contribution to the economic base on the coast than in any other region of the state
- Federal harvest level reductions can be expected to remain in place for at least the short term and continue to affect the South Coast more than the North Coast.
- Agriculture will continue to be a relatively minor component of the coastal economy, with the exception of Tillamook County.
- Much of the coast's economic growth will be in the tourism sector, both in terms of recreation activities and second homes and vacation rentals.
- Tourism employment in several counties (Clatsop and Lincoln) will account for more than one-quarter of total private employment and be higher than the state average in the other coastal counties. Tourism employment earnings, however, show little or negative growth.
- International tourism will continue to grow as a proportion of all coastal tourism.

- Over the past decade, the government services sector had the greatest relative loss of employment among all industries and an extremely small increase (2%) is expected over the next decade.
- With its support for marine-based research being an exception, the Federal government is reducing its support for historic resource-based industries.
- Serious challenges to funding government services and infrastructure improvements will likely continue on the South Coast, further contributing to the differences in economic vitality between the North and South coasts.
- Significant job growth potential is expected in the clean economy, with the areas of highest potential being energy efficiency and green building, environmental protection and resource management, clean transportation, clean energy supply , and knowledge and support.

B.2 Key Economic Trends and Implications for Estuaries and Shorelands Planning

Numerous factors affect the coastal economy, including but not limited to access to the I-5 corridor, dependence on natural resource-based industries, demographic changes such as a declining middle-age population and increasing "graying," declining federal contributions for harbor dredging and maintenance, and a growing tourism sector. Like the state as a whole, the coast's long-term economic growth prospects are closely tied to expanding markets in the western U.S. and the Pacific Rim.

Economic trends suggest steady but continued employment growth in most non-resource based sectors, especially tourism. Other key trends include:

- The lack of infrastructure, at both the state and local levels, and funding for maintenance of existing infrastructure will inhibit economic growth; transportation networks to and from the coast will remain key limitations to the growth of the coastal economy.
- As the coast continues to transition from an historic dependence on resource-based industries to a more diverse economy, the tourism, education and health care sectors in particular will see significant growth. North Coast economic growth will continue to proportionately outstrip that on the South Coast in all sectors except tourism.

- Employment will be affected by two key factors: (1) continuing automation that results in fewer jobs in resource-based industries even as revenues rise; and (2) an increasing number of jobs in the tourism sector accompanied by a continuing decline in per capita income. These trends result in lower levels of tax revenues to fund education and other services, further contributing to declines in jobs and incomes.
- According to the PEW Center on the States, Oregon now has a larger share of total employment coming from clean technology than any other state. Renewable energy R&D will be one of the fastest growing economic sectors on the coast. The health care sector can also expect "tremendous" growth.
- Particularly on the South Coast, declining federal and state revenues will be at least a short-term challenge due to its narrow economic base. Except for the information sector, government services will see the smallest projected increase in employment over the next decade. Marine research can be expected to grow in conjunction with renewable energy R&D.

Estuaries support many important economic activities, such as deep-water shipping, commercial fishing, charter fishing, aquaculture, marinas and a variety of recreational activities. As the economy grows and becomes increasingly focused on tourism-related development, the demand for developable land will likely increase. However, given the inventory of undeveloped and underdeveloped lands designated for industrial and commercial development, the available land base is not generally considered a deterrent to economic development. The lack of infrastructure, especially transportation networks to and from the coast, is a greater limitation to expansion of the coastal economy.

Redevelopment or new development stimulated by economic growth may pose some risk to estuarine and shoreland resources through shoreline modifications for upland development, dredging for navigation projects, or other land disturbance activities. However, estuarine and shoreland habitats are generally well protected by federal, state and local regulations, such as estuary management plans. The risks associated with economic development opportunities would, in most cases, be limited in area and scope.

Ongoing impacts to estuaries can be expected from industrial-related pollution, such as food processing wastes, pulp and paper mill wastes, sediment from construction and logging operations and spilled oil and marine debris. Some feel that water quality is insufficiently monitored to assess the impacts of point source and runoff pollution and that research is needed to determine impacts and the need for minimum estuary inflows.

C. ENVIRONMENTAL TRENDS

C.1 Assessment

C.1.1 Overall Environmental Conditions

There is limited information about the historic and current conditions of coastal estuarine ecosystems; there is even less information on trends affecting shorelands. Individual and cumulative effects of land uses on estuaries and shorelands have not been quantified or critically evaluated. The last comprehensive analysis of the environmental status of estuaries (Good, 2000) was published more than a dozen year ago. That analysis issued the following report card on estuarine ecosystem health: [18]

Available evidence on the health of Oregon's estuaries is mixed. Some estuarine indicators demonstrate the significant adverse effects of past and present human activities; conversely, others show the positive impact of recent protective measures. Other indicators suggest continued threats and risks to estuaries, or raise concerns about long-term, cumulative effects of change. Limited data availability for most indicators makes for high scientific uncertainty and underscores the need for more focused research and regular monitoring.

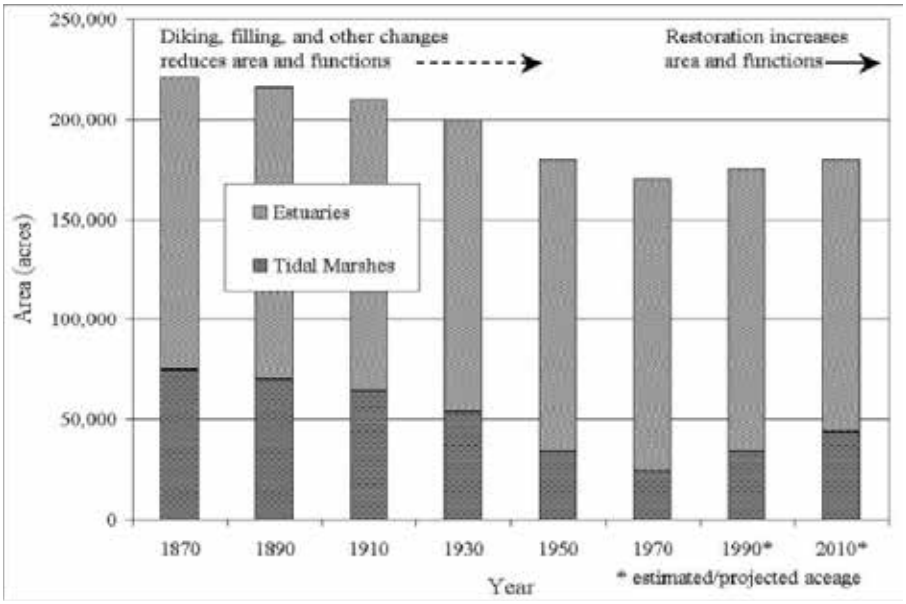
- *Historic loss of tidal wetlands is high, but restoration of diked former wetlands is reversing loss trends, increasing habitat availability and the functionality of estuaries for juvenile salmon and other estuary-dependent species.*
- *Estuarine habitats are well protected from some potential disturbances like dredging, filling, and other major physical alterations.*
- *Aquatic nuisance species are already well established in most Oregon estuaries; new arrivals and potential introductions pose unknown threats to native species and estuarine ecosystem function generally.*
- *Freshwater inflow to estuaries is below historic levels, particularly during summer months, based on appropriated withdrawals. The ecological impacts of these changes are not known, but projected growth in coastal population and water use suggest the need for research to determine impacts and the need for minimum estuary inflows.*
- *Water quality is insufficiently monitored to draw conclusions about the condition and risks associated with increasing point source and runoff pollution introductions that can be expected as population grows.*
- *Principal threats to estuaries today are continued physical alterations, mostly shoreline modifications for upland development and dredging for navigation projects; invasions of aquatic nuisance species; excessive sediment and runoff pollution from local and watershed sources, and other pressures associated with population and tourism growth.*

[18] *Summary and Current Status of Oregon's Estuaries, James W. Good, Oregon Sea Grant and Oregon State University, September 2000.*

Most Oregon estuaries have been significantly altered historically, mostly through the diking and draining of estuarine marshes in the early to mid-1900s for pasture and other agricultural use. Filling of intertidal lands for urban and port development up through the late 1960s further reduced the area of estuaries, as ports grew and navigation channels were deepened to support that growth. At the time, these changes stimulated economic growth and there was little concern or appreciation for the ecological damage being done. Not until the 1960s did growing public concern over these practices lead to new laws that dramatically reduced filling and prohibited new diking. In recent years, preliminary evidence suggests that restoration of tidal wetlands has begun to reverse loss trends. Implementation of salmon and watershed recovery plans will likely accelerate this trend.

Between 1971 and 1987, just 19 acres of estuarine intertidal habitat was filled (0.03 percent of the 1970 base). About five acres of habitat were restored or created to compensate for part of that loss. Dredging between 1971 and 1987 involved about 111 acres of estuary area, mostly subtidal areas for navigation channel maintenance.[19] Although data have not been compiled by the state since 1987, it is estimated that filling and dredging acreage have continued to decline since then.

FIGURE 6: ESTIMATED CHANGE IN ESTUARIES AND TIDAL MARSHES, 1870-2010.



Source: Good, 2000.

[19] Fishman Environmental Services, 1987.

In addition to the above, the most useful information available on the overall condition of estuaries is estuary-specific and limited to the Tillamook and Yaquina estuaries and to the South Slough National Estuarine Research Reserve. The environmental conditions and areas of concern identified in these studies can be considered to be indicative of other coastal estuaries and shorelands. No distinction can be made between North Coast and South Coast estuaries and shorelands.

In 2000, the U.S. Environmental protection Agency (EPA) assessed conditions in the Tillamook estuaries as part of its National Estuary Program (NEP) Coastal Condition Report. That study found that, based on four indices of estuarine condition, the overall condition of Tillamook Bay estuary is rated good, the highest rating received by any of the six West Coast NEP estuaries monitored. The water quality index is rated fair, and the sediment quality, benthic, and fish tissue contaminants indices are rated good. Elevated bacteria levels have closed oyster beds to shellfishing, and loss of habitat and increasing stream temperatures have impacted local salmonid populations.[20]

While focused on recommendations for future conservation actions within the Lower Yaquina watershed, including acquisition and restoration projects that address critical watershed and estuary restoration opportunities, the 2011 Yaquina Estuary Conservation Plan provides information on factors affecting the health and viability of the estuary. It indicates that, although overall water quality is believed to be high in the Yaquina Basin, the Oregon Department of Environmental Quality (DEQ) has identified particular threats to water quality such as elevated stream temperatures. It also notes that emergent intertidal wetlands, primarily salt marsh, have been most heavily impacted by human development. While the overall loss of wetlands in the estuary is less than 15%, large portions of salt marsh have been converted to farmed wetlands. Invasive species have slightly degraded estuarine quality.[21]

The South Slough National Estuarine Research Reserve (NERR) is routinely monitored for changes in environmental conditions. The Reserve's latest Management Plan indicates that while the habitats within the Reserve are protected and the watershed is relatively undeveloped, issues that could affect its resources and/or ecological integrity include biological invasions, water quality, threatened and endangered species, commercial oyster cultivation, vegetation and sediment management, forest management and fire, harvest of secondary forest products, disaster prevention and response, and archeological artifacts and historic structures.[22]

[20] *National Estuary Program Coastal Condition Report – Chapter 6: West Coast National Estuary Program Coastal Condition*. Tillamook Estuaries Partnership. June 2000.

[21] *Yaquina Estuary Conservation Plan*. The Wetlands Conservancy. June 2011.

[22] *South Slough National Estuarine Research Reserve Management Plan: 2066-2011*. South Slough National Estuarine Research Reserve.

Today's report card on coastwide estuarine health would replicate most of the observations in the 2000 *Summary and Current Status of Oregon's Estuaries* study. Absent more recent trend data and given the broad scope of environmental issues that are relevant to estuaries and shorelands, this assessment focuses on a select set of key environmental challenges identified through review of available literature. These include climate change, natural hazards, air quality, water quality and quantity, and habitat and species.

What the assessment suggests:

- Based upon the limited information that is available, the current health of estuaries would be expected to have improved over the past several decades and to continue to improve in the future, due primarily to environmental regulations, habitat restoration measures and an increasing awareness and concern for the environment.
- Estuaries and shorelands will continue to be impacted by population growth, threats to water quality, demand for fresh water, tourism development, aquatic nuisance species, and loss or diminishment of habitat values.

C.1.2 Climate Change

A large body of literature and interviews suggest that climate-induced change is expected to have physical impacts along the Oregon coast, including direct and indirect effects on estuaries and shorelands, ranging from increased erosion and inundation of low lying areas to wetland loss and increased estuarine salinity. The specific climate changes that are likely to affect estuaries and shorelands include rising sea levels, increased occurrences of severe storms, rising air and water temperatures, and ocean acidification. Changes in these conditions affect (among other things) beach and property erosion, flood probabilities, and estuarine water quality. However, due to the complexity of estuarine systems, it is difficult to predict with anything more than modest confidence how they might be affected by changing climate conditions.

The 2010 *Oregon Climate Assessment Report*, issued by the Oregon Climate Change Research Institute (OCCRI), summarizes some of the key climate change trends that are predicted to impact Oregon's estuaries and shorelands (Table 20).

Table 20. Hypothesized Climate Change Effects on Oregon's Estuaries	
Climate Change Trends	**Potential Effects**
Sea level rise and extreme water levels	Increased inundation of estuarine habitats including tidal flats, marshes. Increased intrusion of oceanic water into estuaries. Extent of effect will vary with relative river flow, location in the estuary, and relative sea level rise rates in the vicinity of the estuary.
Increased winter precipitation and decreased summer precipitation	Increased winter-early spring flow of Coastal rivers and creeks and reduced flow during summer. Extent of effect relates to relative river flow, with a greater impact on river-dominated estuaries (e.g., Umpqua) and tidal Coastal creeks (e.g., Yachats) than on tide-dominated estuaries (e.g., Netarts).
Increased air temperature	Potentially high vulnerability of intertidal organisms because of the high proportion of intertidal area in Oregon estuaries that may be exposed to elevated temperatures. Air temperatures also have the potential to influence water temperatures particularly in the upriver portions of estuaries.
Increased upwelling	Increased advection of high nutrient ocean water into the lower estuary during summer. Possible increase in the advection of low dissolved oxygen and low pH water into the lower estuary during the summer. Changes associated with upwelling may be more important in tide versus river-dominated estuaries.
Increased storm activity	Potential breaching of barrier dunes at mouth of estuaries without jetties (e.g., Alsea, Siletz) and episodic input of sediment to estuaries. Estuaries with jetties may be less impacted (e.g., Yaquina, Coos, and Rogue).
Ocean acidification	Unknown effect on estuaries or how alternations may vary across estuary classes.

Source: Oregon Climate Change Research Institute, 2010.

A 2009 Oregon Sea Grant analysis of the understanding of opinions, attitudes and information needs of Oregon coast decision-makers confirms that there is wide recognition of the potential effects of climate change and how it may affect the coast, with the most frequently cited risks involving physical processes (e.g. sea level rise and erosion), ecosystem effects and specific social and economic impacts.[23]


Photo: oregon.gov (OCMP)

C.1.2.1 Increasing Average Annual Temperatures

According to the Intergovernmental Panel on Climate Change (IPCC), global average temperature has increased 1.3 degrees Fahrenheit (F) during the last century and is expected to increase up to 11.5 degrees F over the next 100 years (IPCC, 2007). Ocean temperatures are expected to increase as well. Overall, the Pacific Northwest has warmed during the last century. Average temperatures along the coast have risen about .8°C (1.5°F) in the last 100 years.[24]

[23] *An Analysis of a Survey of Oregon Coast Decision Makers Regarding Climate Change*. Jenna Borberg et al. Oregon Sea Grant, Oregon State University. 2009.

[24] Mote P. , 2003.

Average annual temperatures in the Pacific Northwest are projected to increase over the 1970-1999 average by almost 2 degrees F in the2020s, almost 3 degrees F in the 2040s, and more than 5.5 degrees F in the 2080s. Seasonally, summer temperatures are projected to increase the most.

Table 21. Temperature Projections, 2010-3000

	2020s*	2040s*	2080s*
Low	.4°C (0.7°F)	0.8°C (1.4°F)	1.6°C (2.9°F)
Average	1.1°C (1.9°F)	1.6°C (2.9°F)	3.1°C (5.6°F)
High	1.8°C (3.2°F)	2.6°C (4.6°F)	4.9°C (8.8°F)

*In this table "2020s" means the 2010-2040 average minus the 1970-2000 average, similarly for 2040s and 2080s

Source: Mote and Salathé, 2010.

While warmer temperatures are projected to cause more precipitation to fall as rain, this is not expected to be a significant factor in Coast Range streams, where snow is a minor factor in annual hydrological cycles.

Photo: astoriaoregondailyphoto.blogspot.com

C.1.2.2 Seasonal Precipitation Variations

Projected changes in annual precipitation for the Pacific Northwest region are small (+1 to +2%), but projected to increase after midcentury. However, projections show enhanced seasonality towards wetter autumns and winters and drier summers.

Changes in coastal stream hydrology have the potential to affect estuarine systems, in particular the "drowned river mouth" estuaries. Increased runoff has the potential to deliver increased amounts of sediments and nutrients to estuaries. Increased nutrient loading could increase the potential for algae blooms, which deplete the water of oxygen and increase stresses on estuarine organisms.[25]

Oregon Global Warming Commission's guide entitled *Preparing Oregon's Fish, Wildlife, and Habitats for Future Climate Change* points out that precipitation changes will impact the natural environment in the following ways:[26]

- Decreased water availability and quality in freshwater systems, including increased water temperature and sediment levels in streams.
- Degradation or destruction of habitat for native fish and other aquatic species.
- Increased flood and streambed scouring events in winter.
- Drying of wetlands and headwater streams.

[25] National Oceanic and Atmoshperic Administration, 2000.

[26] Oregon Global Warming Commission, 2008.

Heavier winter rainfall suggests an increase in saturated soils and, therefore, an increased number of landslides. Increased frequency and/or severity of landslides are expected to be especially problematic in areas where there has been intensive development on unstable slopes.[27]

C.1.2.3 Spreading Invasive Species

Climate change is predicted to increase the spread of harmful non-native species that outcompete native varieties. Five priority estuarine invasive species have been identified as having already invaded Oregon estuaries:[28]

- Zostera japonica (Japanese seagrass)
- Carcinus maenus (green crab)
- Invasive benthic species
- Invasive Spartina species (cordgrasses)
- Phalaris arundinaceae (Reed canarygrass)

Temperature and precipitation changes can enhance non-native species' transportation pathways while decreasing ecosystem resilience, making habitats more vulnerable to invasion.[29] Invasive species already cause a tremendous amount of economic and environmental damage to coastal ecosystems and communities. Climate change will likely lead to greater struggles to combat invasive species and keep coastal ecosystems intact.

C.1.2.4 Increasing Nearshore Ocean Acidity

As the ocean absorbs carbon dioxide from the atmosphere, seawater is becoming less alkaline (its pH is decreasing) through a process generally referred to as ocean acidification. The pH of seawater has decreased significantly over time and is projected to drop much more dramatically by the end of the century if carbon dioxide concentrations continue to increase. Oregon has recently been found to be particularly susceptible to ocean acidification due to the upwelling of deep waters having high carbon dioxide content and low pH values. Upwelling systems along the Oregon coast already show pH values that are as low as those expected for most open ocean waters several decades from now. As a result, the coast will likely experience ocean acidification.[30]

[27] U.S.Global Climate Research Program, 2009.
[28] Oregon Global Warming Commission, 2008.
[29] U.S. Environmental Protection Agency, 2008.
[30] Hauri, et al., 2009.

Ocean acidification threatens culturally and commercially significant marine species directly affected by changes in ocean chemistry (e.g., oysters) and those affected by changes in the marine food web (e.g., Pacific salmon).[31] Northwest coastal waters are among the most acidified worldwide, especially in spring and summer with coastal upwelling combined with local factors in estuaries.[32]

A potential decline of oyster farming attributed to ocean acidification is identified in recent media coverage. Commercial oyster producers on the West Coast collect $100 million a year in sales, generating an estimated $273 million in economic activity, according to Oregon State University (OSU). Oysters are commonly considered an indicator species that predicts problems for other aquatic life. Recent OSU research found that in Netarts Bay ocean acidification is affecting oyster larval development at a critical life stage. The production of oyster seed has declined, resulting in oysters taking longer to reach their larval stage of development, which is part of their cycle of hatching into a farm-ready oyster. More acidic water affects the formation of calcium carbonate, the mineral that oyster shells are made of. Researchers indicate that the predicted rise of atmospheric CO_2 in the next two to three decades may push oyster larval growth past the break-even point in terms of production. Every year, the Oregon Coast has an "upwelling," in which more acidic deep water comes up and brings nutrients. Recently, tests found the water to be .1 pH units lower than it used to be, which translates to 30% more acidic.[33]

C.1.2.5 Sea Level Rise

There is strong evidence that global average sea level gradually rose during the 20th century and is currently rising at an increased rate. According to the recent IPCC projections, the total increase in the average global sea level by the end of the 21st century will be significantly greater than the 15 to 20 centimeter rise during the 20th century. Projections range anywhere from 0.18 to 0.59 meters of sea level rise by 2100 (IPCC, 2007). More recently, an expert panel convened last year by NOAA identified four sea-level scenarios for 2100, ranging from a low of 0.6 to 6.6 feet (2 meters).[34]

[31] Ries, Cohen, & McCorkle, 2009.

[32] Feely, Sabine, Hernandez-Ayon, Ianson, & Hales, 2008.

[33] *Oyster revival may be shucked.* Jennifer Anderson, Pamplin Media Group, June 14, 2012. California Current Acidification Network. Also, *Acidifying Oceans are Killing Oysters and Oyster Farms in Oregon.* Moir's Environmental Dialogues, VoiceAmerica. November 16, 2011.

[34] *Rising Seas.* National Geographic. September 2013.

Localized rates of sea level rise are greatly influenced by local conditions, so sea level rise projections need to factor in things like tectonic uplift or subsidence. The entire coast is rising, some places more rapidly than others; thus, the local or relative sea level rise largely depends on the amount of rise or fall of coastal surfaces. Land elevations on the South Coast have been rising at about the same rate as ocean water levels, while on the North Coast elevations have risen more slowly and have not kept up with sea level rise. Projected sea level rise for Newport is 6.8 ± 5.6 cm (2.7 ± 2.2 in) for 2030 and 17.2 ± 10.3 cm (6.8 ± 4.1 in) for 2050, relative to 2000. Rates to the north and to the south of Newport will be slightly different.

In the long term, low-lying coastal areas will eventually be inundated by seawater; the question is when. There is not enough current knowledge about the effects of sea level rise on Oregon's estuaries or particulars about their circulation patterns, changes in water chemistry, and estuarine sediment regimes to make any projections of change with confidence. There is a need for focused investigations that will increase understanding of the response of Oregon's estuaries to sea level rise. In the meantime, the threat of sea level changes is greatly overshadowed by the threat of a tsunami from a Cascadia subduction zone earthquake.


Photo: oregonlive.com

C.1.2.6 Changes in Storm Frequency, Magnitude, and Direction

Climate change has been hypothesized to induce changes in storm frequency, magnitude, and direction. A number of climate models predict a northward shift in the North Pacific storm track over the course of the 21st century, which could increase the impact of winter storms in Oregon in the next few decades (OCCRI, 2010). Observational studies indicate that storminess and extreme storm events have been increasing. The averages of all significant wave heights measured during the winter have been increasing at a rate of 0.023 m/year while the maximum significant wave heights of the strongest storms have been increasing at the substantially higher rate of 0.095 m/year.[35]

Sea level rise is projected to magnify the adverse impact of storm surges and high waves on the coast. Increased extreme wave heights and more intense storms are projected to increase beach and bluff erosion and lead to shoreline retreat, loss of coastal habitat, and damage to coastal infrastructure.[36]

[35] Oregon Climate Change Research Institute, 2010.

[36] U.S. Global Change Research Program, 2009.

What the assessment suggests:

- There is wide recognition of the potential effects of climate change, with the expectation that different areas will be affected differently. For example, Seaside is expected to be more susceptible to flooding than Coos Bay or Astoria.
- Estuaries and shorelands may be affected to varying degrees by a variety of climate-induced changes, including the potential for increased erosion and inundation of low-lying areas, wetland loss resulting from changes in wetland hydrology, and increased estuarine salinity ranges.
- More intense and frequent winter storms, with greater wave heights, will likely be the most observable and pronounced climate change-induced effects over the next few decades.
- Increasing nearshore ocean acidification may have significant cultural and economic effects within the next several decades on several key commercial marine species, most notably oysters and salmon.
- The Oregon coast is likely to be less affected than other parts of the country by climate-related sea level rise; however, sea level rise caused by events ranging in scale from major storms to tsunamis are a significant threat to coastal communities.

C.1.3 Natural Hazards

Development to date on the Oregon coast largely occupies less-hazardous areas. As these areas become built out, pressure to locate new development can be expected in more-hazardous areas such as on steep slopes, ocean bluffs, landslide-prone areas, and low-lying areas subject to flooding and coastal erosion.

Planning for natural hazards has become an increasingly important element of the OCMP. To assist coastal planners and developers understand such risks, detailed erosion and hazard maps and analyses have been completed by the Oregon Department of Geology and Mineral Industries (DOGAMI) for the ocean shores of Clatsop, Tillamook, Lincoln, and portions of Curry and Coos counties. The DOGAMI maps, overlaid on aerial photos, delineate areas of Active, High, Moderate, or Low Hazard Risk on the ocean shore. The OCMP has developed a model ordinance for local governments that can be used in conjunction with the DOGAMI risk zone maps.

Annual costs from property damage in the U.S. caused by natural hazards such as coastal flooding and erosion are increasing. For example, in 2013, Congress provided $60 billion in supplemental relief funds for areas of the Northeast damaged by "Superstorm Sandy." These cost increases are generally attributed to two trends: (a) increased development in areas at risk from hazards; and (b) increased frequency and severity of hazard events, such as coastal flooding. Likewise, costs for mitigation measures such as seawalls and levees are rising.[37]

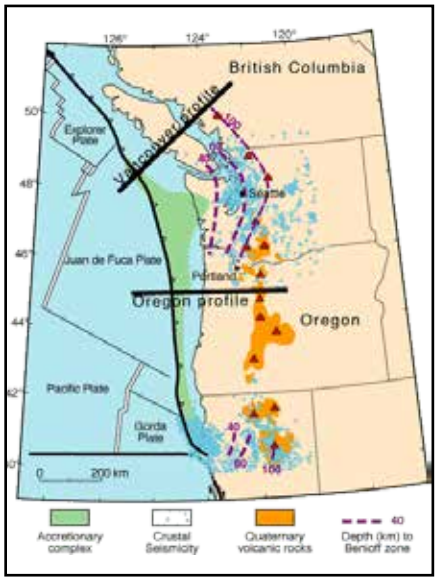
A direct consequence of the rising costs of property damage resulting from coastal hazards is that hazard insurance for development near coastal beaches and estuaries nationwide is becoming much more expensive and difficult to obtain (e.g., limited number of insurers, reduced policy coverage, higher deductibles). Many private insurers suffered huge losses from hurricanes Katrina and Rita in 2005 and from various other storms more recently. Some companies (including large insurers like State Farm) withdrew from coastal markets nationwide, refusing to write new homeowner policies for properties within a specified distance to the sea. The distances typically range from 1,000 to 2,500 feet. Almost all insurers raised their rates. The problem of getting hazard insurance for coastal properties was so severe in the Southeast that several states (Florida, Texas, etc.) created public agencies to make hazard insurance affordable. Congress created the Federal Emergency Management Acency (FEMA) and the National Flood Insurance Program in 1968 to deal with a similar problem, namely that private insurers would not cover flood damage. Although the Southeastern U.S. is the region most dramatically affected by recent coastal hazard events (mainly hurricanes), the changes to insurers' policies and practices extend nationwide. As a result, property insurance for residential and commercial development near the ocean in Oregon has gotten more expensive and difficult to obtain.

In 2012, Congress enacted the Flood Insurance Reform Act, which institutes changes to the National Flood Insurance Program that are causing significant increases in the cost of flood hazard insurance nationwide, particularly for older buildings located in the regulated flood zones that had benefitted from a subsidy to full-risk rates. The subsidy will not be offered on new policies and it will be phased out over time for second homes, residential rental property, and commercial structures with existing flood insurance policies.

[37] *New York Times, "Post-Storm Cost May Force Many from Coast Life."* November 28, 2012.

At the same time that hazard insurance is becoming more difficult and costly to obtain, the risk from coastal hazards is increasing. As described above, Oregon is experiencing more severe erosion of coastal bluffs and beaches and more extensive coastal flooding. Thus, the need for hazard insurance is increasing at the very time when it is becoming harder to get. This combination of forces is likely to constrain development and growth in coastal areas prone to natural hazards and increase the potential for uninsured losses to property owners in such hazard-prone areas.

Specific natural hazards potentially impacting coastal estuaries and shorelands are described below.



C.1.3.1 Seismic Hazards and Tectonics

The Oregon coast is susceptible to earthquakes from three sources: (1) the offshore Cascadia Subduction Zone (CSZ); (2) deep intra-plate events within the subducting Juan de Fuca Plate; and (3) shallow crustal events within the North American Plate. While all three types of quakes have the potential to cause major damage, subduction zone earthquakes pose the greatest danger. CSZ earthquakes have the potential to produce an earthquake of over madnitude 9.[38] In the next 50 years, the probability of a catastrophic subduction zone earthquake is between 10 to 20%, assuming that the recurrence is on the order of 400 +/- 200 years (Oregon Geology, 2002). The last CSZ event occurred in January 1700.

The coastal region's vulnerability, defined as a percentage of population or regional assets likely to be affected by a major emergency or disaster, is high (more than 10% affected) for all counties except Tillamook, where the vulnerability score is moderate (1-10% affected).[39]

The effects of a catastrophic earthquake and subsequent tsunami on estuaries cannot be predicted, but the potential exists for a sudden, catastrophic drop in coastal land elevations by as much as six to eight feet, and immediate inundation of low-lying coastal areas by a tsunami. Earthquake-triggered landslides will likely interrupt transportation services for some time.

Currently, the North Coast is subsiding while the South Coast is lifting. Abrupt subsidence of the shoreline will significantly alter landforms associated with bays, spits, and river mouths. Conservative subsidence predictions of 1 to 1.5 meters would result in permanent flooding of some low lying areas along the coast.

[38] Oregon Department of Geology and Mineral Industries, http://www.oregongeology.org/pubs/ofr/p-O-13-22.htm.

[39] Oregon Natural Hazards Mitigation Plan, Oregon Partnership for Disaster Resilience, 2012.

C.1.3.2 Flooding

The coastal region is susceptible to three types of flooding: (1) riverine flooding, caused mostly be prolonged, high intensity rainfall events; (2) ocean flooding from high tides and large, wind-driven waves; and (3) flooding associated with a tsunami event. The greatest period of risk for riverine and ocean flooding ranges from late fall to early spring. Areas along the coastline are subject to flooding from high tides and ocean storms; while inland areas experience flooding due to high river flow. In estuaries, these two sources of flooding combine to create flooding hazards. Flooding associated with a tsunami event is more infrequent, but potentially devastating for estuaries.

All of the coastal counties have a high probability (one incident likely within a 10 – 35 year period) of a future major riverine flooding emergency or disaster. Tillamook and Curry counties have the highest flood risk scores because they are lower in elevation and have more rivers emptying into them.[40] All coastal counties are also at some risk from the coincidence of high tides and storm surge. This risk is increased during El Niño events, when ocean water elevations can be raised by as much as a half meter for a period of weeks or months. FEMA flood maps reveal that all coastal counties have experienced ocean flooding.

Tsunami destruction can come from tsunami inundation and the rapid retreat of the water, which occurs repeatedly over a period of several hours. Tsunami waves tend to be fast moving rising surges of water. As a tsunami enters coastal bays and rivers, it may move as a high velocity current or a breaking wave that travels up an estuary. Depending on wave direction and velocity, sediments carried inland by tsunamis will be deposited where wave energy begins to dissipate. Much of the deposition will occur in shallows currently occupied by low and high tidal marsh. Some marshes may be completely buried by deep sediments.

DOGAMI predicts a 10-14% chance that a Cascadia tsunami will be triggered by a shallow, undersea earthquake offshore Oregon in the next 50 years. While the entire coastal region is susceptible to tsunami hazards, hazard assessments have revealed that exposure and sensitivity to tsunami hazards is highest in the North Coast, particularly in the City of Seaside.

[40] Oregon Natural Hazards Mitigation Plan, Oregon Partnership for Disaster Resilience, 2012.

C.1.3.3 Drought

The 2008 Oregon Natural Hazard Mitigation Plan indicates that there is a high probability that Coos and Lincoln counties will experience drought conditions (one incident likely within a 10 to 35 year period). The probability that Tillamook County will experience drought is low. In Clatsop, Curry, Coastal Douglas, and Coastal Lane counties, no drought hazard has been identified. These assessments are based on the perceptions and judgment of local officials; in fact, a drought is probably equally likely to occur across all coastal counties, even if the probability is somewhat low. Droughts can have a profound effect on river discharge, freshwater inflows, water level, and water table depth, the severity depending upon the longevity and recurrence interval of drought event(s). Documented effects from reduced inflow include changes in estuarine geomorphology due to loss of sediments and changes to water quality due to changes in the delivery of dissolved and particulate material and in their concentrations in the estuary itself.[41]

Photo: usgs.gov

C.1.3.4 Landslides

The Oregon coast is highly susceptible to landslides and debris flows. Landslides accompany almost every major storm that impacts western Oregon, especially severe winter storms. Increased rainfall during major storms in January and February induce debris flows. Additionally, storm surges have caused considerable coastal damage by eroding sand and cutting away at headlands, which leads to sliding. The coastal counties with the highest percentage of reported landslides in the state are: coastal Lane (24%), Tillamook (9%), and Lincoln (8%). A vulnerability assessment of rain-induced landslides and debris flows reveals that Tillamook County has a more than 10% chance that the population or assets are likely to be affected by a major landslide emergency or disaster. Lincoln, Lane, Douglas, and Clatsop counties have 1-10% chance of the population or assets being affected by a major landslide emergency or disaster. There is less than 1% chance that Coos and Curry county population or assets would be affected by a major landslide emergency or disaster.[42]

Photo: usgs.gov

[41] Alber, 2002.

[42] Oregon Partnership for Disaster Resilience, 2012.

C.1.3.5 Windstorms

High winds are a regular occurrence on the coast and often accompany winter storms. Windstorms with destructive force are less frequent, though their pattern is fairly well known. These storms form over the North Pacific during the cool months (October through March), move along the coast and swing inland in a northeasterly direction. Wind speeds vary with the intensity of the storms. Gusts exceeding 100 miles per hour have been recorded at several coastal locations. All of the coastal counties have a high probably (one incident within a 10 to 35 year period) for severe weather, which combines both wind and winter storms. All of the counties except for Douglas also have a high vulnerability score (more than 10% of the population or assets likely to be affected by a major emergency or disaster). The vulnerability score for Douglas County is moderate (1-10%). High winds that occur along the coast can cause increased flooding in estuaries. In some estuaries, local wind causes wave setup that increases flood levels by as much as two feet.[43]

C.1.3.6 Coastal Erosion

Erosion is a natural process that continually affects the entire coast. Erosion is caused by various combinations of large waves, storm surges, high winds, or increased water levels and ocean conditions caused by El Nino events. Beaches, sand spits, dunes and bluffs are constantly affected by waves, currents, tides and storms resulting in episodic and recurrent erosion. Shoreline retreat may be gradual over a season or many years, or it can be drastic, with the loss of substantial upland area during the course of a single storm event. The damage caused by coastal erosion is usually gradual and cumulative, and seen mostly along ocean shorelines. However, storms that produce large winter waves, heavy rainfall, and/or high winds may result in vary rapid erosion or other damage to estuaries.

Climate change, particularly sea level rise, is expected to increase coastal erosion and loss of shorelands.[44] Heavier winter rainfalls could increase the risk of landslides on coastal bluffs. The combination of saturated soils and sea level rise could increase the number and severity of landslides, especially

[43] Tillamook County Flood Insurance Study, 2011.

[44] U.S. Global Change Research Program, 2009.

in highly developed areas or areas with unstable slopes. The OCCRI has identified a number of significant hot-spot erosion problems along the Oregon coast, including:[45]

- Neskowin, with the hot-spot area of maximum beach and foredune erosion having occurred immediately north of Cascade Head.
- The erosion and flooding impacts to Cape Lookout State Park at the south end of Netarts Spit, to the north of the Cape, during both the 1982-83 and 1997-98 El Niños.
- Impacts to The Capes condominiums that were constructed on a high sand bluff eroded by the northward migration of the inlet to Netarts Bay.
- Extensive erosion of the Bayshore development on Alsea Spit during both major El Niños, caused by the northward migration of the Bay's inlet.
- The erosion of the beach and foredunes in Port Orford north of The Heads, resulting in the loss of the community's sewage disposal facility, and leading subsequently to a breach through the dunes that carried water into Garrison Lake that was the source of fresh water.

What the assessment suggests:

- The coastal region is particularly vulnerable to natural hazards, including earthquakes; riverine, ocean and tsunami flooding; landslides; destructive windstorms; and erosion.
- Climate change is expected to increase the overall risk and intensity of natural hazards.
- With development to date concentrated in areas having a lower potential for natural hazards, some degree of increased pressure to locate new development in areas with a higher potential for landslides, flooding and erosion can be expected.
- Hazard insurance for development near coastal beaches and estuaries is becoming more expensive and difficult to obtain as the insurance industry and FEMA exert a greater level of influence on development in sensitive areas by limiting availability of coverage.

[45] Oregon Climate Change Research Institute, 2010.

C.1.4 Water Quality and Quantity

The two most common types of water quality impairment in estuaries are nutrient loading that leads to eutrophication and contaminant loading that results in sediment contamination. Too much or too little sediment also can affect water quality. Data for assessing water quality in Oregon's marine and estuarine environment are sparse. For example, NOAA's National Estuarine Eutrophication Survey found that 10 of 12 Oregon estuaries surveyed could not be assessed because data were lacking.[46] Despite this, the study suggested that Oregon estuaries, having large tidal prisms that promote good flushing, had low to moderate susceptibility to eutrophication, although the trend was probably toward worsening conditions.

Water quality measurements in estuaries and nearshore waters reflect the combination of highly variable natural background conditions and human-caused pollution. The Oregon Water Quality Index (OWQI) is used to assess water quality data collected from large river monitoring sites. A large number of the rivers feeding coastal estuaries are listed as impaired or water quality limited in the 2010/2012 reporting cycle. Significant water quality problems in coastal rivers include low dissolved oxygen, high temperature, and bacterial contamination. Water quality impacts are attributed to rural and urban residential development (failing septic systems), urban stormwater runoff, livestock management and other agricultural activities, and several wastewater treatment plants that discharge either to the rivers or the bay. These impairments affect beneficial uses, including salmonid fish spawning, salmonid fish rearing, resident fish and aquatic life, anadromous fish passage, water contact recreation, and shellfish growing.[47] Estuaries surrounded by significant agricultural land uses (e.g., Tillamook Bay and the Coquille) have relatively high to moderate fecal coliform concentrations, although other estuaries exhibit occasional high levels following periods of high runoff.[48]

Ensuring adequate water supply is a growing issue on the coast, especially given the need to restore instream flows to improve coastal salmon and steelhead runs and meet water quality standards. Demand for water to support population and economic growth continues to increase in most areas, although, in many areas new water supply sources are unavailable. The vast majority of public water systems on the coast rely on surface water. While a portion of Oregon's coastal population utilizes a domestic or private source, the vast majority of residents rely on small public systems for their

[46] NOAA, 1998; EPA, 2005.

[47] Oregon Department of Environmental Quality, 2011.

[48] Skelton, 1999.

drinking water. For example, in Curry County more than 90% of residents are served by such systems.[49] Nearly all of these systems are constrained in their ability to deliver water of consistent quality and quantity due to technical limitations and deteriorating quality of infrastructure. Small systems tend to have low storage capacity and often the treatment components cannot accommodate water with heavy sediment loads, which frequently occurs following exceptionally heavy precipitation events. Although limited in its review of coastal water systems, a recent DEQ study found turbidity to be a common and generally worsening problem in Coast Range drinking water systems.[50]

Coastal communities' water demand is highly seasonal. Demand in the winter is often one-third of that in the summer, even though lawn and garden watering is fairly limited in most communities. Demand can jump anywhere from two- to five-fold from the winter months to the summer. The summer peak corresponds to low flow periods in surface water sources. This peak demand occurs during the time of lowest supply. A qualitative analysis of water availability for coastal basins reveals that all coastal basins have no water available for appropriation for at least three months between July and November.[51] The standard response to meeting the peaks is to increase storage by building reservoirs or using aquifer recharge and storage. However, developing new storage facilities is challenging because of the presence of Federally-listed species and the societal value of coastal fisheries. Geomorphology limits the opportunity for aquifer storage and recharge on much of the coast. Despite the challenge of water availability during the critical summer months, community representatives indicate that peak water needs are manageable today. However, with medium to rapid population growth, there is a growing concern that existing water rights on current sources cannot continue to meet the demand, even in the short-term. In addition, coastal communities face an infrastructure funding gap as water systems built over the last century deteriorate.[52]

[49] *Planning for Resilience in Oregon's Coastal Drinking Water Systems*. Bridget Brown, Oregon Sea Grant, Oregon State University. 2012.

[50] *Turbidity Analysis for Oregon Public Water Systems: Water Quality in Coast Range Drinking Water Sources*. Oregon Department of Environmental Quality. 2010.

[51] *Oregon Coastal Community Water Supply Assessment*. Achterman et al, Institute for Natural Resources, Oregon State University. June 2005.

[52] Ibid.

- Water quality in estuaries and nearshore waters will continue to be affected by rural and urban residential development, livestock management and other agricultural activities, and several wastewater treatment plants that discharge either to rivers or bays.
- Water supply is expected to become a critical concern on the coast due to increasing demand and its seasonality, limited and deteriorating infrastructure, lack of water rights, and the absence of significant surface water storage capacity.

C.1.5 Habitats and Species

Estuaries contain a matrix of habitats that range in tidal position from the subtidal to the supratidal, and include distinct habitats such as mud flats, eelgrass beds, and salt marshes. In many estuaries, habitat has been "reclaimed" for upland uses, resulting in a decrease in the areal extent of tidal swamps and marsh habitats over time. Over the past several decades, restoration efforts have been reversing this trend. No calculation of changes to estuarine habitat was found in the literature review, but watershed councils and other groups are known to be collecting data on and monitoring such changes. Both the U.S. Forest Service and Oregon Department of Fish and Wildlife (ODFW) are also in the process of mapping habitat change over time and priorities for habitat restoration. The Oregon Watershed Enhancement Board and The Wetlands Conservancy have developed habitat restoration priorities, including for estuarine habitats.

No comprehensive coastwide-level inventory of federal and state threatened, endangered and sensitive species of plants, fish, animals, and birds was found during the literature review. However, a quick perusal of estuary management plans suggests that there are at least 24 such species. Although populations of some of these species (e.g., bald eagles) are slowly recovering, others (e.g., coho salmon) are not. A variety of factors including harvest, predation, and ocean conditions contributed to this population decline, with habitat loss and degradation cited as the leading cause.

Recovery of salmon and steelhead stocks is a major coastal environmental issue, with both federal and state conservation and management planning efforts underway. The Oregon Coast Coho Conservation Plan (ODFW, 2007) represents the state's conservation program for the Coast Coho Evolutionary Significant Unit (ESU), a federally-listed species under the Endangered Species act (ESA). The purpose of this Conservation Plan is to ensure the continued viability of this ESU. As part of its Coastal Coho conservation

planning, ODFW's Aquatic Inventory Project has systematically evaluated stream habitat in the ESU since 1990. That evaluation indicates that stream and riparian habitat conditions were relatively stable during the last period of evaluation (1998-2008).

ODFW is currently engaged in preparing a Coastal Multi-Species Conservation and Management Plan, which is unique from other planning efforts in that it addresses six distinct groups of fish species, none of which are listed under the ESA, and it addresses both conservation and utilization of these fish. All of the species being addressed, with the possible exception of chum, have been identified by ODFW as currently viable and healthy, though not necessarily at historical abundance levels. The preliminary draft Plan indicates that caution is warranted for coastal species, but no crisis is evident. One of the Plan's goals is to increase abundance and productivity of populations as a hedge against uncertainty and potential threats, including climate change.

Most fish recovery efforts have focused on improving freshwater stream and riparian habitats, but new information is bringing increased attention to the role of estuaries. Studies at South Slough National Estuarine Research Reserve, the Salmon River estuary, and other locations in the state [53] indicate that estuaries play a very important role in salmon survival, diversity, and productivity. Migrating juvenile salmon require a continuum of habitats from freshwater spawning grounds to the ocean. Certain estuarine habitats, such as the brackish-freshwater interface, may be particularly important to salmon.[54] Research has shown that rapid estuarine growth and the resulting larger size of juvenile salmon when they enter the ocean result in increased ocean survival rates.[55]

Numerous invasive species (e.g., American shad, purple loosestrife, Chinese mystery snail, eastern snapping turtle, nutria) have been introduced to coastal estuaries. The majority of these species originated in North America, and domestic shipping is most likely an important vector for the introduction of new species. The rate at which new species are discovered has increased from one every five years between the 1880s and the 1970s to one every five months since 1994.[56] Although this rate of increase can be attributed to more new species being introduced, an increasing number of improved surveys to monitor invasive species has also contributed to the growing number of species detected.

[53] Bottom et al. 2004, Miller and Sadro 2003, Gray et al., 2002.
[54] Simenstad and Bottom, 2004.
[55] Reimers 1973; Solazzi et al., 1991.
[56] Sytsma et al., 2004.

What the assessment suggests:

- Estuary health will be improved by ongoing federal, state and local efforts to sustain inland and marine fisheries and their habitats.
- With the exception of coho and chum, coastal fish stocks are currently viable and healthy, though not necessarily at historical abundance levels; while caution is warranted for coastal fish species, no crisis is evident.
- The adverse impacts of introduced species will become better known as scientists continue to study their distribution, spread, and ecological interactions, but the ability to prevent or limit introductions will remain limited.

C.2 Key Environmental Trends and Implications for Estuaries and Shorelands Planning

The outlook for the future of the coastal environment depends on many factors. Among the more significant are population growth, growth of tourism, second home development, demand for fresh water, efforts to control pollution and prevent the introduction of aquatic nuisance species, and initiatives to restore and enhance estuarine habitats and coastal watersheds.

Photo: oregontidepools.org

While available evidence on the health of Oregon's coastal environment is mixed, the general perception is that the overall environmental health is improving, due in large part to habitat restoration programs, designation of marine reserves and other programs to protect sensitive areas, and federal and state environmental regulations. This perception is validated to some degree in the literature. A related perception that there is a paradigm shift occurring in a higher awareness and concern for the environment, largely attributable to a more educated population and media publicity of environmental issues, is validated by the environmental policy initiatives that have been implemented at the state and local levels to provide protection to sensitive estuarine resources and shorelands. Increased awareness and concern about catastrophic natural hazards and climate change is also evident in the literature, public policy, and community initiatives.

Historical estuary habitat change trends have reversed, with the large losses experienced up through the 1960s being replaced by modest gains in estuary habitat in recent years. Some indicators of estuarine health reveal significant adverse effects of past and present human activities; conversely, others show the positive impact of recent protective measures. Other indicators suggest continued threats and risks to estuaries, or raise concerns about long-term, cumulative effects of change. Limited data availability for most indicators makes for high scientific uncertainty and underscores the need for more focused research and regular monitoring.

Estuary management plans and environmental regulations tightly control development in estuaries and shorelands; however pressure for protective shoreline structures (e.g. revetments, rip-rap) is likely to increase with future development and with concerns about protection of existing development from the impacts of climate change and natural hazards. While there may be some pressure to convert urban industrial shorelands to commercial and residential land uses, the amount of such development and associated environmental effects are expected to be limited by federal, state and local environmental and land use regulations.

Other key environmental trends relevant to planning for estuaries and shorelands include:

- The effects of climate-induced change will impact estuaries and shorelands, with the potential for adverse effects on water-dependent industry, local fisheries, beaches and shoreline development.
- Natural resource industries that use coastal estuaries, despite a decline in recent decades, are expected to continue to be important economically and culturally.
- Efforts to control point sources of municipal and industrial pollution have been relatively successful, and policies and programs to control runoff pollution have been strengthened.
- Salmon recovery efforts have further raised awareness about the coastal environment through more focused planning, on-the-ground habitat restoration projects, and monitoring. Recent monitoring has demonstrated that juvenile salmon and many other species are using restored areas in Coos Bay, the Salmon River estuary, and other locations.
- Anecdotal evidence supports the perception that the insurance industry and FEMA are expected to more directly affect development in sensitive coastal areas by limiting availability of coverage. Either increases in cost or difficulties in obtaining hazard insurance are cited by assessment participants.

Limited information about the historic and current conditions of estuaries and the significant lack of information on trends affecting shorelands suggest that a comprehensive study of the coastal environment is needed. Individual and cumulative effects of land uses on Oregon's estuarine ecosystems and shorelands have not been quantified or critically evaluated. Interviewees noted that local governments often do not have the capacity to deal with estuary issues and their complexity. There has been no assessment of how comprehensive plans and estuary management plans respond to climate-induced changes to estuaries and shorelands. Among the research needs are an inventory and assessment of the overall coastal environmental ecosystem, comprehensive water quality monitoring and assessment of water quantity demand, research on estuary/ocean linkages, and monitoring and research on invasive species. This information can then serve as the basis for updated estuary management plans, most of which are now more than a decade old.

D. ENERGY TRENDS

D.1 Assessment

D.1.1 Overview

The coast is a net energy consumer, the vast majority of its power being imported from outside the region. Electricity and natural gas are the primary sources of energy for coastal communities. Most electrical energy is generated by hydropower facilities that are part of the Federal Columbia River Power System and marketed through Bonneville Power Administration to Pacific Power and Light or to local Public Utility Districts or Electric Cooperatives. All transmission lines to the coast are vitally important to deliver electricity; disruptions can have significant economic effects. Natural gas is marketed primarily by Northwest Natural Gas. Lincoln County illustrates the typical mix of coastal household energy sources with about 60% of households using electricity; 13%, natural gas; and 23%, wood.[57]


Photo: wikimedia.org

As elsewhere in the state, the share of energy provided through renewable energy projects is growing but quantifiable information is not available. For example, Coos-Curry Electric Cooperative, Inc. obtains a portion of its power from Coffin Butte Landfill north of Corvallis. Tillamook County is currently investigating the potential of bio-mass as a supplement to electricity. There is minimal solar energy generation at this time on the coast.

This assessment of energy trends focuses primarily on marine renewable energy – wave energy and offshore wind energy – and LNG terminal proposals. These are the energy sources most likely to affect planning for

[57] http://www.coastbusiness.info/utilities.htm.

estuaries and shorelands. Marine renewable energy represents a long-term opportunity to replace imported energy or current non-renewable energy use on the coast. In the short and medium terms, trends in energy use will likely be limited to greater demand associated with population growth.

What the assessment suggests:

- While the renewable energy sector is growing, the coast will continue to import electricity and natural gas as its primary sources of power. Increasing demand will be associated primarily with population growth.
- Marine renewable energy is the most likely source of replacement power in the long term. Proposed LNG terminals will likely have little effect on the coastal energy supply, as they are being designed as bulk import-export facilities.

Photo: noaa.gov

Photo: offshorewind.biz

D.1.2 Wave Energy

Wave energy is identified as the primary potential new source of energy on the coast. While solar and wind energy have many benefits, they are not considered to be as stable as wave energy. The Oregon coast is one of the most promising sites for the generation of wave energy in all of North America. The combination of high-energy waves, high demand for new renewable energy, capable seaports, an established marine and fabrication industry base, available nearby power grid connections, and a culture of interest in green innovation and environmental issues make the state a prime spot for the development of wave energy, according to the Oregon Wave Energy Trust.

With increasing public support for investments in clean and renewable sources of energy, wave energy is being considered as a critical component of the state's future energy portfolio. In 2007, the Oregon Innovation Council selected wave energy as an economic innovation focus. The Oregon Wave Energy Trust was subsequently established as a non-profit, public-private partnership to develop wave energy projects. The state has invested more than $10 million in the Trust to fund research and other projects to accelerate the development of wave power in Oregon. The Northwest National Marine Renewable Energy Center (NNMREC) at Oregon State University deployed the first wave energy test system in the United States off Newport and intends to site a larger, grid-connected testing facility in federal waters off Newport. Ocean Power Technologies is currently in the process of deploying the first federally-licensed commercial wave energy device off Reedsport.[58]

[58] *Governor Kitzhaber Thanks LCDC, Stakeholders for Adopting Guidelines on Limited Wave Energy Development*. News Release, Governor Kitzhaber Press Office. January 25, 2013.

A 2011 study by the Electric Power Research Institute (EPRI) identifies Oregon's total annual available wave energy in the inner shelf alone as equal to 143 terawatt-hours per year (TWh/yr), or 143 billion kilowatt-hours per year (KWh/yr), which is enough energy to power 28 million homes (EPRI, 2011). The outer shelf (200-meter depth) has another 179 TWh/yr.[59] Seven potential offshore sites along the Oregon coast have been identified by EPRI as viable locations for wave energy parks (EPRI 2004):

- Clatsop County – Astoria
- Tillamook County – Garibaldi
- Lincoln County – Newport
- Lane County – Florence/Cushman
- Douglas County – Reedsport
- Coos County – Coos Bay
- Curry County – Brookings

Wave energy development within three nautical miles of the coastline is regulated by Part 5 of the state's Territorial Sea Plan, adopted in January 2013 by the Land Conservation and Development Commission. The plan states that the state will give priority to renewable resources over non-renewable resources. Four offshore areas are designated as renewable energy suitability study areas: Camp Rilea (Clatsop County), Nestucca (Lincoln County), Reedsport (Douglas County), and Lakeside (Coos County). The four areas cover about 22 square miles, or less than 2% of the Territorial Sea.

Despite significant progress in recent years, ocean wave energy conversion technology remains in an early stage of development. Currently, a large number of very different device concepts are being pursued at various scales by different developers and there is no consensus as to which technology is superior.[60] In addition, only a few ocean deployments have been conducted in the U.S., all of which have been have only been in existence for a few years and are outside the Pacific Northwest. For this reason, there is little knowledge of the effects of wave energy deployment and its potential environmental impacts. Therefore, much effort has been directed towards establishing testing centers to help mature the technology and industry.

[59] http://www.oregon.gov/ENERGY/RENEW/Pages/hydro/Ocean-Wa.

[60] Previsic, 2012.

The Oregon coast is uniquely suited to support early test and demonstration activities, Newport being the home to the NNMREC and the Hatfield Marine Science Center. NNMREC is a joint effort between OSU, conducting wave energy research, and the University of Washington, conducting tidal energy research. NNMREC will test energy generation potential and environmental impacts of wave energy devices. The Hatfield Marine Science Center has experience in marine research and is working with NNMREC to assess the potential environmental impacts of wave energy to the coastal environment.

A Wave Energy Infrastructure Assessment Report compares the regional strengths of different parts of the coast:[61]

North Coast

- The North Coast, with its ports at Astoria, Garibaldi, Tillamook, and Newport, provides adequate resources to support the assembly and deployment of wave energy devices. Garibaldi has suitable space for assembly, and adequate draft for deployment, but its wooden dock is inadequate to support the deployment of large-scale wave energy devices. Astoria also provides tugboats, barges, diving, and salvage services with ready access to the ocean and Columbia River. The North Tongue Point development at Astoria is currently being built out and will have available land with modern deep-water piers and rail access.
- Newport has ready access to the ocean, sufficient area for assembly and deployment of wave energy devices, and an active science community. It is home to the OSU's Hatfield Marine Science Center, which conducts significant ocean research, including mammal migration, ocean currents, acoustic research, and a wide array of fishery studies. The Hatfield campus is also host to NOAA, ODFW, and EPA. As noted above, Newport is also home to NNMREC, which recently deployed the first wave energy test system in the United States off Newport.
- The ports of Alsea and Depoe Bay are not well suited to the development and deployment of wave energy devices in Oregon, due to limited harbor access and port facilities.

South Coast

- The South Coast has excellent capacity for manufacturing, assembly, and ocean access in and around the Ports of Umpqua and Coos Bay. This region has numerous marine related businesses, including naval architecture, marine engineering, vessel construction, tugboat and barge services, and stevedoring services. The Port of Coos Bay is limited in available space since the Port does not own the property on the waterfront and the recent land acquisition on the North Spit is slated to become a container and cargo facility.

[61] Advanced Research Corportation, 2009.

- In Reedsport, the Port of Umpqua has adequate area, capacity, and water access for the assembly and deployment of wave energy devices. There are also other commercial assembly sites with easy access to waterways available in this region.
- Other ports on the South Coast do not have the deep drafts or industrial capabilities necessary for the development of wave energy devices.

While much of the attention has been on the siting of wave energy devices in ocean waters, devices can also be mounted on on-shore infrastructure such as jetties. Some wave energy devices generate electricity at the site, others power an on-shore generator. Marine and hydrokinetic (MHK) technologies have the potential to generate power not only from waves but also from tides or currents in ocean waters. These on-shore wave energy facilities and transmission lines would have greater direct effects on estuaries and shorelands than offshore facilities. However, while there is an evolving and promising technology associated with generating energy from tides or nearshore ocean currents, research and testing is expected to continue to focus on offshore energy generation in the near term.

The impacts of wave energy facilities are not yet fully understood and limited analysis has been conducted addressing the land-sea connection. Extensive analysis was conducted in conjunction with the recent Territorial Sea Plan amendment, but it was primarily focused on offshore ocean impacts. In 2011, the U.S. Department of Energy (DOE) issued a final environmental assessment for the University of Maine's Deepwater Offshore Floating Wind Turbine Testing and Demonstration Project in the Gulf of Maine.[62] Although on a different coast with unique habitat and species, it may be useful as a reference for identifying potential impacts of future projects off the Oregon coast. Among the potential impacts it identifies applicable to estuaries and shorelands are visual impacts; spills during construction, maintenance and operations; and construction, maintenance and operation impacts associated with on-shore supportive facilities and transmission lines.


Photo: earthtimes.org

Of the four sites approved in Part 5 of the Territorial Sea Plan, the Nestucca site would be the estuary most likely affected given its location in front of the mouth of the estuary. Depending upon the siting of the actual structures, the estuary could be affected by sand transport, effects on migration, etc. This may also be the most sensitive of the four sites from a shorelands aesthetics perspective.

[62] http://mhk.pnnl.gov/wiki/images/1/11/EA_of_Maine's_Deepwater_Offshore_Floating_Wind_Turbine_Testing_and_Demonstration_Project.pdf.

What the assessment suggests:

- The Oregon coast has been identified as one of the most promising sites for the generation of wave energy in all of North America.
- Ocean wave energy technology remains in an early stage of development and commercial ocean wave energy development within the next several decades may be optimistic. Primary impediments to wave energy production include technical challenges, lack of infrastructure, and permitting challenges.
- Research and testing is expected to focus on offshore ocean energy generation; tidal and nearshore wave energy is not likely to be pursued in the near term.
- A concentration of research institutions has resulted in Newport becoming a hub of wave energy research and testing.

D.1.3 Wind Energy


Photo: boem.gov

Wind power is one of the cleanest renewable energy sources available, emitting no carbon dioxide or pollutants and using no significant water resources as with conventional energy. For the coast, most of the wind energy focus to date has been offshore.

Development of offshore wind has the ability to help meet both coastal and statewide energy demands, stimulate the economy and decrease dependency on foreign energy resources. The total gross United States offshore wind resource is estimated to be around 4,000 GW, potentially four times greater than the current electric capacity.[63] While the United States leads the world in land-based wind energy, there are no existing offshore wind farms. However, there are around twenty proposed projects in the planning/permitting stage that have the capacity to generate 2,000 MW. Locally, Principle Power Inc., a San Francisco and Seattle-based company, was recently awarded $4 million from DOE for engineering, design and permitting for five floating wind turbines 15 miles offshore of Coos Bay.[64]

[63] Musial and Ram 2010.

[64] Sustainable Business.com. 2014.

While land -based wind power is a potential energy source, winds across the ocean can be 20% higher, dramatically increasing the potential of renewable energy generation.[65] The Oregon coast has been identified as an outstanding resource for offshore wind development, due to the strong winds that regularly blow over the Pacific Ocean. Wind speeds tend to increase with increasing distance from shore, which makes offshore deep water wind farms appealing. However, at less in the short-term, several barriers impede the development of offshore wind energy devices:[66]

- Currently, capital costs for offshore projects are nearly double those for land-base wind projects. These higher costs accrue from, for example, the offshore turbine support structures, offshore electrical infrastructure construction, the high cost of building at sea, warranty risk adjustments, turbine cost premiums for marine locations, and a decommissioning contingency.
- The near-term technology is still immature, which is an obstacle to offshore wind development. The current technology limits the domain for offshore machines to shallow-water sites. New technology is needed to lower costs, increase reliability and energy production, solve regional deployment issues, develop infrastructure and manufacturing facilities, and mitigate known environmental impacts.
- High project risk has contributed to a cautious investment climate. These include uncertainty surrounding regulatory and permitting issues, the risks associated with construction and installation, and the operational risks that are associated with accurate energy production and long-term reliability.

The U.S. Department of Interior and DOE recently forecasted that diminishing federal tax incentives for wind energy, in concert with continued low natural gas prices, will dramatically slow the construction of new wind energy facilities. Their report entitled, *A National Offshore Wind Strategy*, points out that impediments to wind energy include: continued low natural gas and wholesale electricity prices; inadequate transmission infrastructure in some areas; modest electricity demand growth; existing state policies that are insufficient to support future wind power capacity additions at the levels witnessed in recent years and growing competition from solar energy in certain regions of the country.[67]

[65] Pelc and Fujita 2002.

[66] NREL, National Renewable Energy Laboratory, 2013.

[67] U.S. Department of Energy and U.S. Department of Interior, 2011.

Despite economic disincentives, there have been several recent on-shore wind power proposals on the coast. In the early 2000s, the wind development company RGI, Inc. unsuccessfully attempted to install between 57 and 75 wind turbines between Wheeler and Garibaldi overlooking U.S. Highway 101. The City of Coos Bay has been taking public comment on permitting land-based wind turbines no taller than 70 feet, much shorter than industrial wind turbines that are more than 250 feet high. The initiative is apparently being driven by micro wind turbine technology that enables turbines to be installed on rooftops and the edges of buildings.

Little analysis is available on the impacts of offshore wind energy development on Oregon's estuaries and shorelands. Like wave energy, impacts would be expected to be limited primarily to visual impacts and on-shore supportive activities and infrastructure.

On-shore wind turbines, where authorized, are not expected to significantly contribute to coastal communities' energy demands. Wind in most communities is slowed by hills, trees and buildings; in urban settings, the wind power generation potential would be very limited. The coast is a challenging region to build wind power facilities because of its complex topography of mountains, forests, bays, beaches and spits. These create challenges in determining how wind will react to diverse landscapes. Additionally, winter winds tend to be from a southerly direction, are episodic and potentially extreme. Summer winds are typically from a northerly direction, calm, and with little inland penetration. While land-based industrial wind power facilities would have potential to contribute to coastal power needs, they will likely be difficult to site due visual, wildlife and land use impacts.

What the assessment suggests:

- The strong winds that regularly blow over the Pacific Ocean create substantial potential for wind energy development off the Oregon coast.
- At least in the short-term, offshore wind energy development is being hindered by diminishing federal tax incentives for wind energy, continued low natural gas prices, and modest electricity demand growth.
- The potential for on-shore wind energy development on the coast is constrained by topography, erratic wind patterns, and concerns about visual, wildlife and land use impacts.

D.1.4 Liquid Natural Gas

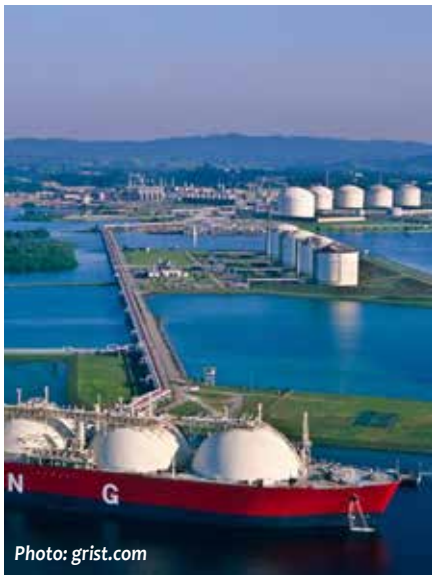


Photo: grist.com

The U.S. Energy Information Administration's *Annual Energy Outlook 2013* highlights that evolving natural gas markets have spurred the increased use of natural gas for electric power generation and transportation and expanded the natural gas export market. It is projected that:[68]

> *The U.S. natural gas production will increase 1.3 percent per year, outpacing domestic consumption by 2019 and spurring net exports of natural gas. Higher volumes of shale gas production are central to higher total production volumes and a transition to net exports. As domestic supply has increased in recent years, natural gas prices have declined, making the United States a less attractive market for imported natural gas and more attractive for export.*
>
> *Continued low levels of liquefied natural gas (LNG) imports, combined with increased U.S. exports of domestically sourced LNG, position the United States as a net exporter of LNG by 2016. The prospects for exports are highly uncertain, however, depending on many factors that are difficult to gauge, such as the development of new production capacity in foreign countries, particularly from deepwater reservoirs, shale gas deposits, and the Arctic. In addition, future U.S. exports of LNG depend on a number of other factors, including the speed and extent of price convergence in global natural gas markets and the extent to which natural gas competes with liquids in domestic and international markets.*

The Northwest Gas Association reports that over the next 10 years, natural gas consumption in the Pacific Northwest is expected to grow an average of 1.2% per year, with cumulative projected growth through 2022 at 10.3%[69]

No information was available for this assessment on plans by Northwest Natural Gas and other purveyors for expanded natural gas storage facilities and transmission lines on the coast. Land use restrictions would generally preclude new or retrofitted storage facilities and transmission lines within estuaries and shorelines.

[68] *Annual Energy Outlook 2013*. U.S. Department of Energy, Energy Information Administration. 2013.
[69] Northwest Gas Association, 2013.

There are currently two active proposals for LNG terminals on the coast under review by the Federal Energy Regulatory Commission. One terminal is located on state-owned land on the North Coast near Astoria and another is on the South Coast at Coos Bay. Oregon LNG proposes to construct, own and operate a liquefied natural gas peak-saving, liquefaction, and export facility on the Columbia River near Astoria. The Oregon LNG project has been designed to include a marine loading terminal, two full-containment 160,000 cubic meter LNG storage tanks, and facilities to support ship berthing and cargo loading.[70] Upon completion, the terminal will operate as a tolling facility, leasing peak-shaving and liquefaction capacity to industry partners. Oregon Pipeline, an affiliated company, is planning the construction of an 86-mile pipeline, which will connect to the regional pipeline in Woodland, Washington. The Jordan Cove Energy Project is a proposed LNG terminal and storage facility to be built on a 170-acre parcel of the Port of Coos Bay, on the north spit about five miles up Coos Bay from the Pacific Ocean (DEQ, 2008). The proposed facility would include:[71]

- A loading and off-loading terminal for an ocean-going LNG vessel.
- Two on-shore, state-of-the-art, full-containment LNG storage tanks.
- An associated natural gas-fired combined cycle power plant capable of supplying the electric requirements of the Jordan Cove Energy Project, as well as the capability to provide power to the local utility grid.

A proposed 231-mile natural gas pipeline (36-inch diameter) would link the Jordon Cove terminal with PG&E's interstate pipeline.

The Oregon Chapter of the Sierra Club recently highlighted five of the potential impacts of these LNG terminals:[72]

- Dredging: Each of these terminals will require dredging in the area where ships will be docked. Information was not available for this report on the amount of dredging to occur at the Oregon LNG site. At the Jordan Cove site, 4.25 million cubic yards would be dredged from the North Spit.
- Water usage: Each of these terminals would require the use of water at the site where they would operate. Water would be used to reheat the LNG into a gaseous state, re-fill the ballast of ships after off-loading their LNG cargo and cool LNG tanker engines. The National Marine Fisheries Service and state agencies have expressed concern over this intake of water and the likely entrainment of various aquatic species including endangered salmon.

[70] Oregon LNG, www.oregonlng.com, 2013.
[71] Jordon Cove Energy Project, LP, 2013.
[72] Oregon Chapter Sierra Club, 2013.

- Water Quality: The process by which the LNG tankers and re-gasification facilities would process the water they need for cooling their engines and reheating their LNG to gaseous state would impact water quality. By expelling hot water from their tanker engines and expelling cold, chemically treated water from their re-gasification terminals, the LNG facilities would raise the temperature of the water in their vicinity.
- Air Quality: The re-gasification terminals would emit greenhouse gases from the operation of re-gasifying the LNG. In addition, tankers and security vessels that accompany them are required to run their engines during the entire 24-hour cargo off-loading cycle. This will produce a greatly increased amount of exhaust and air pollutants that could impact surrounding communities. Lastly, LNG is commonly not pure methane; increased amounts of heavier hydrocarbons – such as ethane, butane and propane – can cause increased emissions from combustion of LNG-sourced gas.
- Public Safety: If just three million gallons of LNG (less than 10% of one ship cargo) were to escape and reach an ignition source, the resulting fire could reach three miles from the source. That puts communities near the terminals and along the tanker routes at risk. Because of this serious threat, there is a strictly enforced security zone accompanying each tanker and LNG terminal. This would require lighted 24-hour surveillance at each terminal, two gunboats accompanying each shipment and express permission by the Coast Guard for any vessel to pass within 1,500 feet of the ships. This could adversely impact commercial shipping on the Columbia River and Coos Bay, and could severely disrupt sport/commercial fishing and the public use of these waterways.


Photo: orsierraclub.com

LNG development also entails the construction of transmission pipelines. Potential impacts of LNG pipelines include:

- Construction and Permanent Right-of-Way (ROW): Each pipeline would require a 100-120 foot construction ROW. In some areas, that ROW would extend as far as 300 feet due to steep or difficult terrain. After construction, the permanent ROW would revert to 50 feet and would carry with it stringent restrictions on what can be planted within that corridor. Because the pipelines are non-odorized and running at high-pressure, there are severe restrictions for what can be grown or built over the permanent ROW. The permanent ROW would be a visible scar on the landscape and would require heavy maintenance to manage invasive species. Chemical spraying has been proposed to control invasive species in some areas.
- Waterways: Numerous waterways, including the Rogue and Umpqua rivers, would be crossed by these pipelines, representing a serious threat to fish habitat and watersheds.

- Hazard zone: There is a 700-foot hazard zone on either side of the pipeline that could be acutely impacted in the event of a pipeline rupture or leak. These leaks and ruptures may be caused by human error, corrosion of the pipeline, or by natural geologic movement. Because these pipelines cross dozens of active landslides and various fault lines, there is serious concern about the possibility of a pipeline leak. This represents a serious public safety threat for landowners and communities along the proposed routes, and indicates a potentially more serious threat of forest fire in areas where the pipeline corridor would build up fine fuels and act as a conduit for forest fire.

The greatest potential impact to estuaries and shorelands would be from activities associated with terminal development, including dredging, development of in-water structures, and shoreline stabilization/hardening. However, these impacts will be localized to the areas of the proposed terminals and pipelines and, from a geographic perspective, a very small proportion of the coast would be affected. Based upon the locations of the proposed terminals and pipelines, direct impacts to shorelands would be very limited.

What the assessment suggests:

- In response to projected growth in natural gas consumption in the Northwest and increasing international demand, LNG terminals have been proposed on the North Coast near Astoria and on the South Coast at the Port of Coos Bay.
- The success or failure of LNG terminal development at the Port of Coos Bay is expected to have a major impact on the economic future of that area of the coast but have minimal effect on other areas (with the exception of pipeline construction).
- The LNG proposals will have little effect on the coastal energy supply, as they are designed primarily as export facilities
- Localized but significant impacts to estuaries and shorelands could result from construction of the LNG terminals and associated pipelines.

D.2 Key Energy Trends and Implications for Estuaries and Shorelands Planning

Because the vast majority of its power is imported from outside the region, the coast is susceptible to transmission line/pipeline limitations or disruptions and to outside-the-region decisions on the amount and cost of available power. Interviewees perceive that economic growth is being constrained by the capacity of the existing power transmission infrastructure. Research validates that inconsistent power supply has been a deterrent to attracting some high-tech and other high energy consuming industries, especially on the South Coast, but there is no evidence that economic growth generally has been or is being stymied by lack of available power. Historic power infrastructure deficiencies on the South Coast are acknowledged by BPA, which has indicated its intent to invest in transmission line improvements there. While coastal communities are currently limited in their capacity to generate power, they are not constrained (except by cost) in continuing to purchase imported power from BPA, Northwest Natural Gas and other purveyors.

The interest in and research on renewable energy on the coast is as strong, maybe even stronger, than anywhere in the state. Wave energy, in particular, is the focus on significant investment in research and development (R&D). However, these industries are not expected to be catalytic in terms of economic development or cause significant estuary and shorelands impacts over the next 20-30 years. Without significant federal funding, it is expected that the current energy infrastructure will remain insufficient for any significant renewable energy production. Economically, the potential for R&D may be much more significant than actual power generation over at least the next decade.

The Oregon coast has been identified as one of the most promising sites for the generation of wave energy in all of North America. While there is potential to generate wave energy from tides or nearshore ocean currents, research and testing is expected to continue to focus on offshore ocean energy generation and tidal and nearshore wave energy is not likely to be pursued in the near term. Four areas within the Territorial Sea have recently been designated by the state as offshore renewable energy suitability study areas. However, ocean wave energy technology remains in an early stage of development and there is little knowledge of the effects of wave energy deployments and potential environmental impacts. Therefore, much effort has been directed towards establishing testing centers to help mature the technology and industry. Newport has recently become the West Coast hub of wave energy research and testing. Primary impediments to wave energy production include technical challenges, lack of infrastructure, and permitting challenges.

Photo: oregonlive.com

If and when wave energy facilities are eventually developed, effects on estuaries and shorelands would be limited and include visual impacts; spills during construction, maintenance and operations; and construction, maintenance and operation impacts associated with on-shore supportive facilities and transmission lines. Effects to estuaries would be associated with water-dependent industrial development for operations/maintenance facilities and most likely concentrated at Coos Bay or Yaquina Bay.

Photo: wikimedia.org

In addition to having promising wave energy potential, the Oregon Coast is identified as an outstanding resource for offshore wind development, due to the strong winds that regularly blow over the Pacific Ocean. Wind speeds tend to increase with increasing distance from shore, which makes offshore deep water wind farms appealing. At least in the short-term, offshore wind energy development is being hindered by diminishing federal tax incentives for wind energy, continued low natural gas prices, and modest electricity demand growth. On=shore wind energy development is constrained by coastal topography, erratic wind patterns, and concerns about visual, wildlife and land use impacts. Like wave energy, impacts would be expected to be limited primarily to visual impacts and on-shore support activities and infrastructure.

While the attention has been focused on the siting of wave and wind energy devices in deep or shallow waters off the coast, on-shore and nearshore energy generation is more directly relevant to planning for estuaries and shorelands. For wave energy, this could include on-shore energy production facilities powered by offshore devices, as well as energy facilities driven by tides or currents in ocean waters. For wind energy, it includes on-shore wind turbines or on-shore energy production facilities powered by offshore turbines. For both renewable and non-renewable energy, it includes transmission lines or pipelines. While most effects of wave and wind energy power development (whether offshore, nearshore or on-shore) will be limited to communities where such facilities are ultimately located, there may be a broader effect on the coast's growing tourism industry if such facilities are aesthetically unpleasing. Such impacts would likely be slow to exhibit themselves and be difficult to measure.

In the Pacific Northwest, natural gas consumption is expected to grow by at least 10% over the next decade. LNG terminals at two locations have been proposed at several locations on the coast. The success or failure of LNG terminal development at the Port of Coos Bay is expected to have a major impact on the economic future of that area of the coast but have minimal effect on other areas (with the exception of pipeline construction). It will also likely have little effect on the coastal energy supply, as it is being designed as a bulk import-export facility.

As land-based actions proposed for deep-water ports, the two active proposed LNG developments are being reviewed for conformance with local comprehensive plan and estuary management plan goals and regulations. That review process includes analysis of effects on estuaries and shorelands. The impacts of pipelines associated with LNG transport will be largely in upland areas, with some shoreland impacts. Terminal development will have the most direct impact to estuarine areas, including dredging, development of in-water structures, and shoreline stabilization/hardening. While development will be confined to a limited area, overall aquatic resource impacts could be fairly significant.

Written long before the arrival to the coast of wave and wind energy R&D and proposed projects, estuary management and comprehensive plans do not directly address the siting of energy production facilities in estuaries and shorelands. Goal 16 specifically requires that comprehensive plans address pipelines and associated dredging as uses within estuarine management units. Prepared to help implement Goal 19, the Territorial Sea Plan now guides the location of offshore energy facility siting within the Territorial Sea but its scope does not include estuaries or shorelands. Most coastal comprehensive plans/zoning codes encourage renewable energy while regulating the siting and design of energy facilities, renewable and non-renewable. Whether local plans foster or hinder energy development has not really been tested. Given the changing dynamics of coastal energy issues, it may be timely to undertake a review of those plans to determine whether amendments are merited to accommodate wave, wind and other renewable energy production and appropriately respond to potential associated impacts.

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APPENDICES

A. LIST OF STUDY PARTICIPANTS

Interviewees by Category			
	Affiliation	**Name**	**Title**
GENERAL			
Ports			
	Port of Coos Bay	Martin Callery	Chief Commercial Officer
	Port of Newport	Don Mann	General Manager
	Port of Reedsport	Charmaine Vitek	Harbor Manager
	Salmon Harbor Marina Breakwater Dock Port	Jeff Vander Kley	Director
	Port of Brookings Harbor	Ted Fitzgerald	Executive Director
Local Government			
	Clatsop County	Hiller West	Community Development Director
	Clatsop County (Also Oregon Coastal Zone Management Association)	Peter Huhtala	County Commissioner; OCZMA Director
	Tillamook County	Tim Josi	County Commission – Chair
	Tillamook County	Mark Labhart	County Commissioner
	Lincoln County	Onno Husing	Planning Director
	City of Newport	Derrick Tokos	Community Development Director
	City of North Bend	Terence E. O'Connor	City Administrator
	City of Coos Bay	Laura Barron	Planning Administrator
Tribes			
	Siletz Tribe	Stan van de Wetering	Aquatics Program Lead
Department of Land Conservation & Development			
		Tom Hogue	Economic Development Planning Specialist
		Paul Klarin	Marine Affairs Coordinator
Other			
	Oregon Sea Grant	Pat Corcoran	Coastal Hazards Outreach Specialist
	NW Power and Conservation Council	Bill Bradbury	Council Chair
		Vic Affolter	Former Tillamook County Planning Director
ECONOMIC DEVELOPMENT			
Business Oregon			
	North Coast (Serving Clatsop, Columbia, Lincoln and Tillamook counties)	Dennie Houle	Business Development Officer
	Central Coast (Serving Benton, Lane and Linn counties)	Sean Stevens	Business Development Officer
	South Coast (Serving Coos, Curry and Douglas counties)	Chris Claflin	Business Development Officer
Other			
	The Research Group	Hans Radtke	Natural Resources Economist

	Oregon Coast Visitors Association	Marcus Hinz	Executive Director
	Economic Development Alliance of Lincoln County (Central Coast Economic Development Alliance)	Caroline Bauman	
	Executive Director		
	South Coast Development Council	Sandra J. Geiser-Messerle	Executive Director
	Columbia River Pilots Association	Dan Jordan	
ENVIRONMENT			
Academia			
	Hatfield Marine Science Center	Gil Sylvia	Professor of Agricultural Resources and Economics
	Hatfield Marine Science Center	Janet Webster	Interim Director
Agencies			
	U.S. Army Corps of Engineers	Mike Ott	Manager, Regional Dredging Program
	Oregon Watershed Enhancement Board	Ken Bierly	Formerly Senior Partnership Specialist
	Oregon Parks & Recreation Department	Jim Morgan	Stewardship Division Manager
Environmental/Conservation Groups			
	Coos Watershed Association	Jon Souder	Executive Director
	Surfrider Foundation	Gus Gates	Oregon Policy Manager
	Oregon Shores Conservation Coalition	Phillip Johnson	Executive Director
	Curry Watershed Council	Kelly Sparks	Lower Rogue Watershed Coordinator
	Siuslaw Watershed Council	Liz Vollmer-Buhl	Council Coordinator & Executive Director
ENERGY			
Research / Non-profit Organizations			
	Northwest National Marine Renewable Energy Center	Dr. Belinda Batten	Director
	Oregon Wave Energy Trust	Jason Busch	Director - Program for Wind and Water Power
	Pacific Northwest National Laboratories	Simon Geerlofs	Principal investigator for DOE Wind and Water Power projects

B. COMPILATION OF INTERVIEWS

(Available as a separate file)