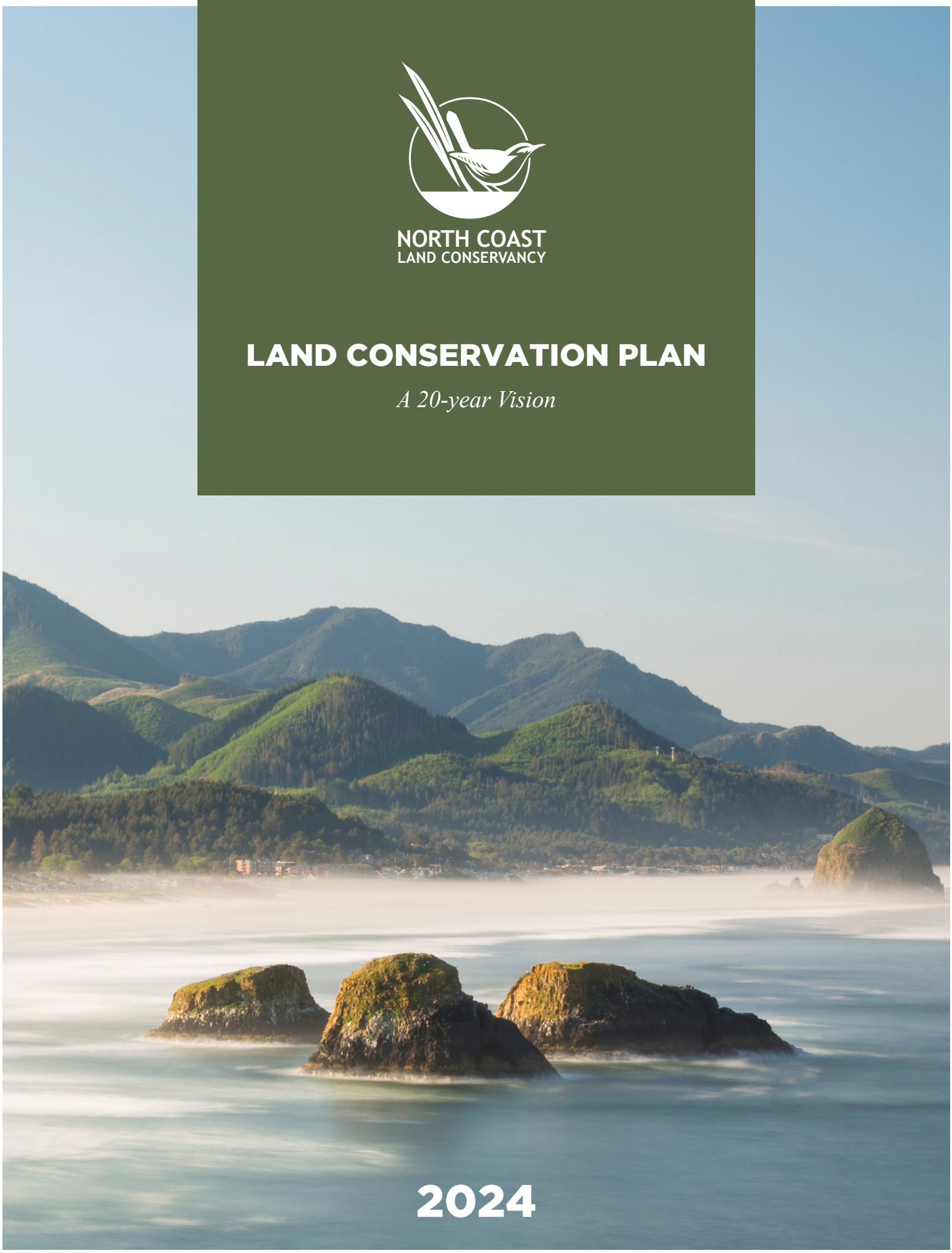
NORTH COAST
LAND CONSERVANCY

LAND CONSERVATION PLAN

A 20-year Vision



2024

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EXECUTIVE SUMMARY

Ours is a common goal: to conserve and protect land for current and future generations. North Coast Land Conservancy (NCLC) was founded on the belief that we are all part of Oregon's coastal landscape: the people, wildlife, plants, water, open space, and infrastructure. We are all active participants in the ecosystem and we all share the responsibility of stewardship now and into the future. Since its beginnings in 1986, NCLC has served as a resource for northwestern Oregon coastal communities and landowners to conserve and protect land for its ecological and cultural values, in perpetuity.

NCLC strives to build strong, lasting community relationships that not only build NCLC's capacity for conservation but build the community's capacity for stewardship of the North Oregon Coast. Whether discussing with property owners the economic benefits of protecting land, assisting other organizations to preserve ecologically sensitive areas, or offering public events on unique aspects of the coast, NCLC holds conservation at its core. NCLC's conservation strategy focuses on creating a system of green infrastructure that facilitates the connectivity needed to support wildlife populations and ecological processes.

NCLC's service area covers more than 2,600 square miles from the Columbia River south to Siletz Bay, from the peaks of the Coast Range to the nearshore ocean. As of 2023, NCLC has directly conserved more than 8,700 acres across 82 properties and has worked with partners to facilitate the protection of more than 5,300 additional acres. In order to focus our land conservation efforts within such a large and diverse service area, NCLC has developed a conservation plan that reflects three key organizational priorities: connectivity, community and climate resiliency.

The conservation plan builds on existing criteria used to select potential conservation projects by developing a system for ranking criteria using spatial data acquired from county, state, and federal agencies. Using these data and geographic information systems (GIS) software, we have created maps that focus our future conservation efforts on areas that meet specific criteria. These maps are used in combination with local knowledge from NCLC staff and committee members, government agencies, and community groups, as well as site visits to assist in the process of evaluating projects with high conservation values. They are utilized both proactively and in response to projects proposed by landowners and organizations.

The conservation plan and maps serve to establish a basis and rationale for habitat conservation within NCLC's service area. They are used as a first step in gauging the land trust's interest in a property and how the property advances our overall goals. The plan and maps, however, do not replace actual on-the-ground review of individual properties by staff, the Conservation Committee, and/or the Board of Directors. Our hope is that our work in the areas of climate resiliency, habitat connectivity, and community conservation will help sustain us all for generations to come.

BACKGROUND

Since 1986, North Coast Land Conservancy has worked to conserve and connect the landscape of the North Oregon Coast. The mission of NCLC is helping to conserve Oregon's coastal lands and waters, forever. To accomplish our mission, we seek to serve as a resource for northwestern Oregon coastal communities and landowners to conserve and protect land for its ecological and cultural values, in perpetuity. NCLC recognizes the need to approach land conservation with the goals of landscape-scale ecological connectivity, climate resiliency, and community partnership. Understanding the communities in our service area— including cultural, economic, and environmental values and concerns—is critical to the land conservancy's mission.

We further our mission through acquisition of land and conservation easements and land stewardship, made possible through partnerships with county, state, and federal agencies, tribes, watershed councils, individual property owners, and other public and private entities, as well as the support of our donors and funders. The successes that NCLC has had thus far, and will experience in the future, depend on our capacity to create and maintain partnerships and engage the community in stewardship of the North Oregon Coast.

WHERE WE WORK

NCLC's service area covers more than 2,600 square miles from the Columbia River south to Siletz Bay, from the peaks of the Coast Range to the nearshore ocean.

This region, the homeland of the Clatsop and Nehalem people, is one of abundance. Since time immemorial, their ancestors and descendants have cared for the land and sea, plants, animals, and fish in a reciprocal relationship rooted in gratitude for the bounty that the Creator, the Earth, provides.

HOW WE WORK

In order to achieve our mission and collaborate with cities and counties that face an array of challenges, NCLC works within the framework of statewide land-use planning goals and local Comprehensive Plans to implement conservation objectives. Oregon state law requires local Comprehensive Plans to be consistent with Oregon's 19 statewide planning goals, which were first adopted in 1973. These goals are meant to express the state's policies on land use and address topics such as citizen involvement, housing, and natural resources. Of the 19 statewide planning goals,[1] those most pertinent to NCLC's work include Goal 4: Forest Lands, Goal 5: Natural Resources, Scenic and Historic Areas, and Open Space, Goal 6: Air, Water, and Land Resources Quality, Goal 8: Recreational Needs, Goal 16: Estuarine Resources, Goal 17: Coastal Shorelands, Goal 18: Beaches and Dunes, and Goal 19: Ocean Resources.

Working within the framework of local comprehensive plans and statewide planning goals, as well as across a large and diverse service area, influences NCLC to approach land conservation and acquisition strategically. We look to establish connectivity in the landscape that will help maintain the health of ecosystems by meeting the habitat and range requirements of species and allowing plants and animals to move across the landscape, thereby promoting local migration and healthy populations.

This conservation concept has been referred to as conserving green infrastructure. The Conservation Fund defines green infrastructure as our natural life support system—an interconnected network of waterways, wetlands, wildlife habitats, and other natural areas that support native species, maintain natural ecological values and processes and provide associated benefits to human populations. Similar to the pipes and systems of gray infrastructure, where roadways connect, large areas are reserved for water storage, and sewage is filtered, our green infrastructure supports ecological processes such as wildlife migration, promoting natural water storage and filtration, and carbon sequestration. Streams, wetlands, parks, and other conserved lands could be considered the veins and arteries of the system, and priority should be given to conserving lands that provide the connectivity needed to support wildlife populations and ecological processes.

OVERARCHING THEMES

Stretching from the Columbia River to Siletz Bay and from the nearshore waters of the Pacific Ocean to the crest of the Coast Range, North Coast Land Conservancy's service area encompasses a diverse population of people, plants and wildlife. NCLC's Conservation Plan is centered around three main elements that serve as focal points of our coastal conservation work. These pillars are habitat connectivity, climate resiliency, and community conservation.

HABITAT CONNECTIVITY

We are dedicated to conserving the diversity of habitats that exist within our service area and maintaining connectivity between them. Connectivity is important for the health and function of ecosystems and the species they support. Most, if not all, remaining blocks of high-quality, natural habitat exist as a patchwork, often held together by unprotected areas that are essential to the movement of species and the natural processes that sustain these systems.

NCLC works within a green infrastructure model that prioritizes habitat connectivity at a landscape scale. This means we work to conserve the natural ecological systems and human-built elements that act as living infrastructure, providing ecological services, such as clean, dependable air and water, flood mitigation, climate change mitigation, and other benefits that flow from natural resources to people. One way that we do this is by prioritizing lands next to existing public and protected areas, such as those NCLC already holds, helping to create larger corridors of natural habitat and keeping these areas from becoming isolated islands. Together these connected lands can better contribute to a fully functioning landscape where healthy communities of people, plants and wildlife all thrive.

CLIMATE RESILIENCY

The climate resiliency of our landscapes is crucial given that the extreme events and changing patterns that come with climate change threaten the character and function of our ecosystems. Being climate resilient means that ecosystems are able to cope with and change in response to the disturbances and challenges that climate change brings, without losing their basic structure, diversity, or the functions they serve in the larger environment. The life cycles of our local plant and animal communities have been shaped over time by relatively consistent seasonal weather patterns.[2] However, rising air and water temperatures,[3] increased frequency of extreme heat events, stronger winter storms, rising seas, and more extreme seasonal droughts[4] are impacting and disrupting these species and communities.

If we do not protect our resilient landscapes and improve the ability of our region to withstand and adapt to the challenges of climate change, we face not simply a changing environment but the loss of species and the collapse of these natural systems. With this in mind, we are focusing on the most resilient portions of the marine, forest, stream, wetland and estuary habitats within our service area that provide critical ecosystem services. We put additional importance on those areas where these priority habitats connect, interact or overlap and provide added benefits, such as carbon sequestration and climate change mitigation.

COMMUNITY CONSERVATION

Coastal conservation must include and celebrate diversity amongst people, plants and wildlife. NCLC strives to be a local and regional leader by connecting people with place and providing learning and stewardship opportunities, as well as equitable and just access to land. To this end, NCLC is investing time and resources to broaden our network of partners and intentionally foster an inclusive, empathetic, diverse and equitable culture to better understand and serve the community.

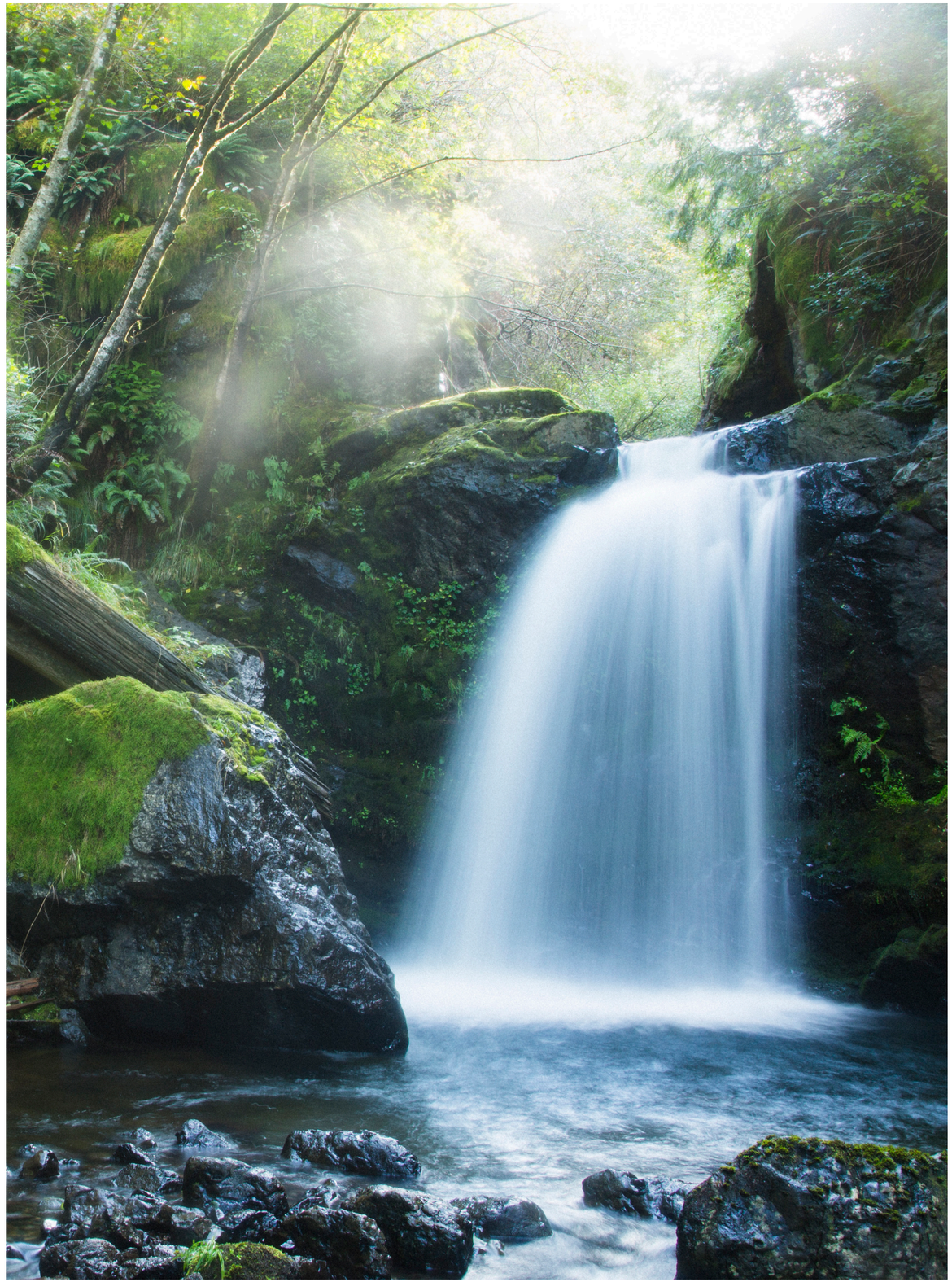
We are committed to supporting equitable and just conservation, including facilitating indigenous peoples' reconnection and access to their homelands; protecting underserved/underrepresented communities' access to clean drinking water; offering places where children can connect to nature; and facilitating communities' desires to create parks and open space. While some of these values cannot be mapped, quantified or ranked within our conservation plan, they are a core part of our overall approach to evaluating our conservation efforts.

These three pillars are ways in which we can look at and consider the different impacts that a given conservation project can have on the future of our communities and ecosystems. A given project will often provide multiple benefits, but thinking of each element can help us better understand and articulate the reasons for pursuing a given project. For example, protecting a property that includes a forested riverside path along an estuary as a county park would provide multiple benefits. The project would protect riparian habitat utilized by elk (habitat connectivity) and provide room for the landward migration of tidal wetlands as sea level rises (climate resilience), while ensuring that current and future generations have easy access to a place to exercise, fish, and connect to the world around them (community benefit).

PRIORITY LANDS AND HABITATS

The Oregon Conservation Strategy, developed by the Oregon Department of Fish and Wildlife, designated more strategy habitats in the Coast Range than any other ecoregion in the state, highlighting the importance of conservation efforts within NCLC's service area. The habitats that NCLC considers to be of highest importance are those where our priority lands connect, interact, or overlap, thus providing the most benefit and best reflecting NCLC's commitment to connectivity, climate resiliency, and community. These priority habitats, which align with many local, state, and federal conservation plans, are forests, tidal wetlands, estuaries, and freshwater aquatic systems.

Naturally, not all forest areas, wetlands, etc. are of equal importance for protection. For example, a forest that includes the source water area for a community, provides shade and contributes large woody debris to a salmon-bearing stream that runs through it, and serves as a corridor between two existing protected areas would be a higher priority for protection than a forest without these attributes.



FORESTS

The Pacific Northwest temperate rainforest, one of only seven temperate rainforests in the world, is one of the most diverse ecosystems and one of the foremost at sequestering carbon in the world. This is due to plentiful rainfall and a temperate climate, which contribute to high growth rates and unique habitats. Compared to forests throughout the western U.S., much of the forestland in our region is ranked as a high priority for mitigation of climate change because of its high potential for carbon sequestration and relatively low vulnerability to drought and fire.[5] These forests represent up to 20% of the global mitigation potential for temperate and boreal forests, or about 6% of the western U.S.'s current fossil fuel emissions.[6]

Nearly half of Oregon is covered by forestland. While this is close to historical levels, statewide the forests of today have less than 10% of the old growth that once stood. Defined as having complex and varied forest structure with trees that are hundreds of years old, old-growth forests support a wide range of species and store large amounts of carbon. We know that pockets of old growth remain in private lands throughout the region; these represent an opportunity to protect a globally rare ecosystem type and the carbon sequestered in those forests.

High-biomass forests like ours in Oregon, which store large amounts of carbon above and below ground, cover less than 3% of the contiguous U.S., but make up 56.8% of forests in the Pacific Northwest.[7] The forests of the Coast Range stand out as being among the best in the United States at sequestering carbon now and into the future.[8]

In addition to carbon sequestration, forests provide habitat and a range of ecosystem services such as improving water quality and supply through capture, storage and filtration, and contributing to stream health and complexity. Forests' abilities to reduce flooding by soaking up water and slowing down runoff has the potential to reduce the anticipated increase in flood-related damage to our communities and infrastructure in years to come.[9]

It is imperative that we act now to protect our forests as increasing drought[10] and heat events[11] are beginning to exceed the tolerance of our trees and other species that make up our coastal forests, as seen in the documented foliage scorching that occurred during the heat dome event in June 2021.[12] With temperatures in our area expected to average six degrees higher and to exceed 10 dangerous heat days per year by 2050,[13] the negative impacts on our forests are likely to increase. Our forests also face growing wildfire risks, with high-fire-danger days in Clatsop County expected to increase by 27% by 2050.[14] As the disruptions from these changing conditions compound, the ability of our forests to continue to absorb these impacts will degrade, further reducing their ability to help provide the ecosystem services that we and other species depend on. NCLC's forest management work within our habitat reserves seeks to increase species diversity and put them on a trajectory toward old growth conditions, with the goal of increasing the resiliency of our forests in the face of climate change.

The forest canopy of the Coast Range in Oregon is dominated by Sitka spruce and western hemlock, however, western redcedar, big leaf maple, Douglas-fir and red alder are also prevalent. The understory is often brimming with sword fern, deer fern, salmonberry, salal, evergreen huckleberry, and vine maple mingled amongst mosses, lichens and mushrooms. High annual rainfall has meant that fires are rare and the most common disturbances stem from factors like high winds during storms.

This environment sets the stage for a host of species, who have adapted to our forests, to thrive. The coast range is home to black-tailed and mule deer, Roosevelt elk, cougar, American black bear and iconic species like the bald eagle, marbled murrelet and salmon. Forests are also home to the lesser-known Oregon Department of Fish and Wildlife's Coast Range priority species such as American Marten, Coastal Tailed Frog, Western Pond Turtle, Fisher, Olive-sided Flycatcher, Fringed Myotis, and the Red Tree Vole.

ESTUARIES AND TIDAL WETLANDS

Tidal salt marshes and forested wetlands provide valuable ecosystem services on both the local and global scale. While providing habitat for wildlife and protection from coastal flooding, tidal wetlands are also responsible for half of all carbon stored in marine ecosystems (known as “blue carbon”), despite constituting less than 1% of the ocean surface.[15]

Salt marshes are disproportionately effective at carbon sequestration because of their high rates of primary productivity and their ability to efficiently trap and bury sediments and associated carbon from sources outside their ecosystem boundaries.[16] In the Pacific Northwest, tidal forests can store two to five times the carbon than other tidal wetlands areas thanks in part to the added ability to store carbon above ground.[17] Because of the ability of these habitat types to act as a carbon sink, their protection and restoration has been identified as an important climate change mitigation strategy.

Despite what we now understand about their ecological significance, half of the world’s tidal wetlands have been lost or degraded,[18] and on the West Coast of the United States, roughly 85% of tidal wetlands, particularly forested wetlands, have been lost to development or converted for alternative use.[19]

The ecosystem services provided by tidal wetlands, as well as the severity of their loss in our region, elevate this habitat as a conservation priority. However, there is a need to find a balance between protecting and restoring existing tidal wetlands and securing areas on the landscape where these habitats could possibly migrate in response to sea-level rise (SLR). By 2160, 100% of Oregon’s tidal marshes could be displaced from their current locations by rising sea levels (8.2 ft and 11.5 ft sea level rise scenarios). [20] Tidal wetlands may be able to adapt by migrating upslope to “landward migration zones” (LMZs) as sea levels rise, but if SLR occurs too rapidly or site conditions—such as impervious surfaces—prevent plant establishment, this vital habitat could become severely imperiled.

Sites potentially suitable for future tidal wetlands (LMZs) under six sea level rise scenarios have been identified for 23 Oregon estuaries.[21] LMZs for the 4.7ft (2100) SLR scenario were incorporated into our overlay analysis.

The estuaries and tidal wetlands of the Oregon coast are complex and dynamic places that range from tidal flats to salt marshes and forested tidal wetlands. The plants and organisms that live in these areas must be adapted to survive frequent and periodic changes in water level, salinity, sunlight, and oxygen, along with factors like predation exposure and seasonal flooding.

Those that can survive these swings in environmental conditions through their adaptations and behaviors include various life stages of salmon, crabs, invertebrates like polychaete worms, and bacteria. Mudflats that are most often underwater provide habitat for eel grass and algae, while low-growing salt marshes are host to plants like plants like arrowgrass and pickleweed. Upland areas can feature yarrow, mosses, shrubs such as salal, and trees ranging from willows to Sitka spruce. These myriad environments are also host to migratory and wintering birds, along with clams and oysters, river otters, herons, raptors, deer and elk, as well as Oregon Department of Fish and Wildlife priority species such as Black Oystercatcher, Caspian Tern, Harlequin Duck, Leach’s Storm Petrel, Purple Martin, and the Western Snowy Plover.

FRESHWATER AQUATIC SYSTEMS

Clean, abundant water is critical to human, animal, and plant communities. The freshwater aquatic systems of our region—our rivers, streams, wetlands, seeps and springs—contribute to the climate resiliency of our natural environments while providing ecosystem services and other community benefits.

The ecosystems and species present in our region are adapted to the seasonal temperature and rainfall patterns[22] that have been in place for millennia. Climate change brings disruptions to these patterns that threaten the health of these systems and the species that are part of them. For example, increasing precipitation and heavy rainfall events[23] during winter lead to more erosion[24] and scouring out of stream beds, while warmer summers[25] and more frequent seasonal drought conditions raise stream temperatures and reduce streamflow.[26]

Keystone species like salmon depend on cold, clean water. Rising seasonal stream temperatures[27] negatively impact the survival of salmon by lowering oxygen levels in the water, disrupting their metabolisms, increasing vulnerability to disease, decreasing ability to avoid predation, and reducing food supply.[28] The thermal stress can lead directly to die-offs when water temperatures exceed tolerance at around 80 degrees, depending on species and population.[29] Salmon have been shown to seek refugia when water temperatures warm towards their tolerance limits, while temperatures around 70 degrees can block migration to spawning grounds.[30] Side streams, seeps, and wetlands that contribute cooler water, along with cold deep pools, help keep stream temperatures down and provide refugia, thus helping to reduce stress and increase the survival of these species.

Riparian areas serve as transition zones between aquatic and terrestrial habitats, providing critical refuge to many species. Of the 414 wildlife species in western Oregon, 359 or 87% extensively use riparian ecosystems, while 29 species are tied exclusively to this area.[31] Protection and restoration of riparian areas allows for natural processes that contribute to ecosystem health, such as giving channels room to migrate, providing sources of nutrients, woody debris, and shade that helps streams stay cool. Channel migration and recruitment of dead wood into channels contribute to stream health by increasing the complexity of the aquatic environment, providing more cold deep pools and other hiding and resting places for both rearing and returning salmon.[32] At the same time, natural stream structure helps to mitigate climate impacts by absorbing energy and slowing stream flow during increasingly common heavy precipitation events, thus reducing scouring, incisement, bank erosion, and sediment movement, which can negatively impact water quality for salmon and other aquatic species.[33] Within these riparian areas, streamside wetlands also serve as natural filters; provide off-channel refuge during high-flow events; and store water that helps maintain summertime flows and cooler water temperatures. Protection of riparian areas is essential for the health of our rivers and streams.

The flowing waters, wetlands, seeps, and riparian systems are hallmarks of the north Oregon coast. Shaped and driven by seasonal patterns that can deliver up to 80 inches of annual rainfall, these environments are both host to, and influenced by the species that live in them. Alder, big leaf maple, Sitka Spruce and shrubs like willows and elderberry, along with grasses and sedges, line and stabilize the banks while providing shelter, shade and filtration of water that flows off of the adjoining lands.

Our aquatic systems support beaver, coastal coho, chinook, chum salmon, river otters, herons and other water birds, but also include amphibians like salamanders and a host of invertebrates, from snails to crayfish and mayflies, that all play roles balancing these ecosystems. Priority Oregon Department of Fish and Wildlife priority species in freshwater aquatic systems include Coastal Tailed Frog, Columbia Torrent Salamander, Cope’s Giant Salamander, Purple Martin, Western Toad, and the Northwestern Pond Turtle.

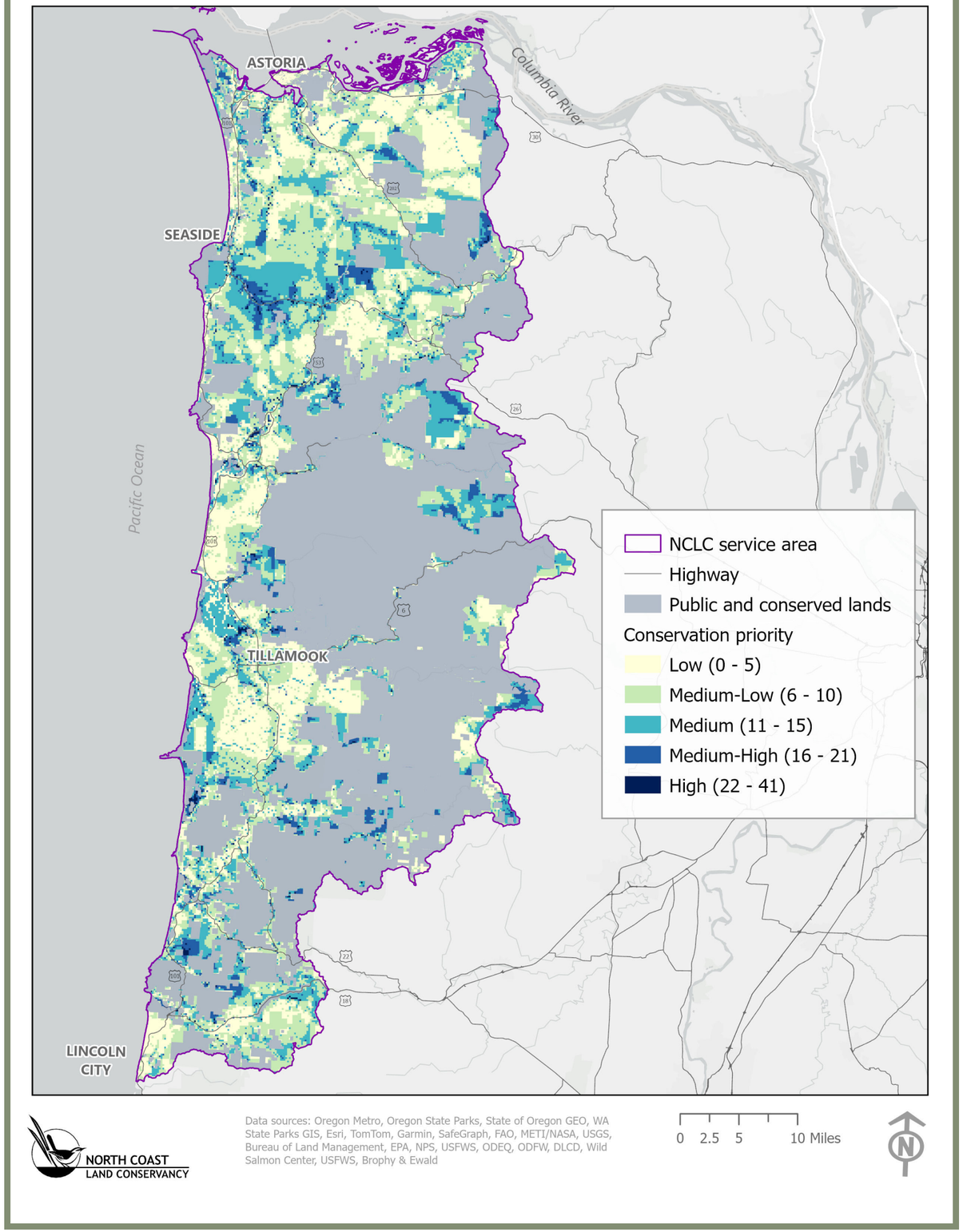
FINAL MAP PRIORITIZATION

UTILIZING GIS MAPPING AS A PRIORITIZATION TOOL

This conservation plan lays out the land trust's conservation priorities and utilizes GIS software to identify the lands and waters that best reflect these priorities, providing NCLC a basis for evaluating potential conservation projects. The plan builds on existing criteria used by NCLC to select potential conservation projects; a property's location, natural resource value, condition and size are some of the factors that influence the review process. To evaluate NCLC's large service area for lands that best reflect the land trust's priorities, we gathered relevant datasets from county, state, and federal agencies and conservation organizations and developed a system for ranking these criteria, giving more weight to our priority habitats. By overlaying these ranked datasets, GIS highlights specific areas that would most effectively advance the conservation goals and priorities of NCLC.

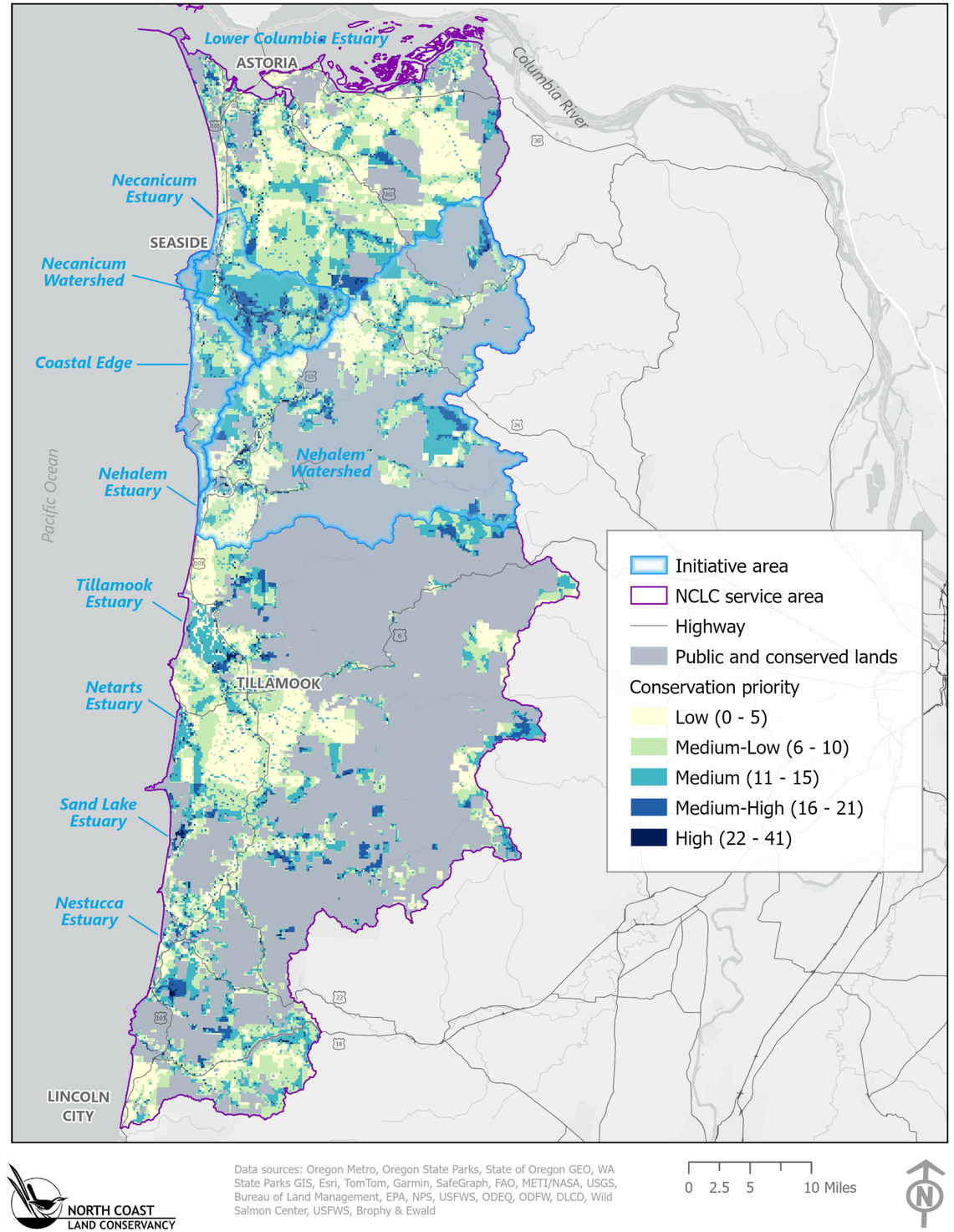
The maps created using this strategy highlight priority conservation areas, allowing NCLC to proactively identify lands with the highest potential conservation value. The maps can serve as a starting point for evaluating projects when NCLC is approached by landowners about conservation of their property. However, nothing can replace visiting the land and speaking with the landowners, partners, and community members to understand the ecological and cultural significance of a property. Additionally, the conservation plan and the maps it contains serve as a communication tool that enables NCLC to share its goals and establish a basis and rationale for specific conservation efforts.

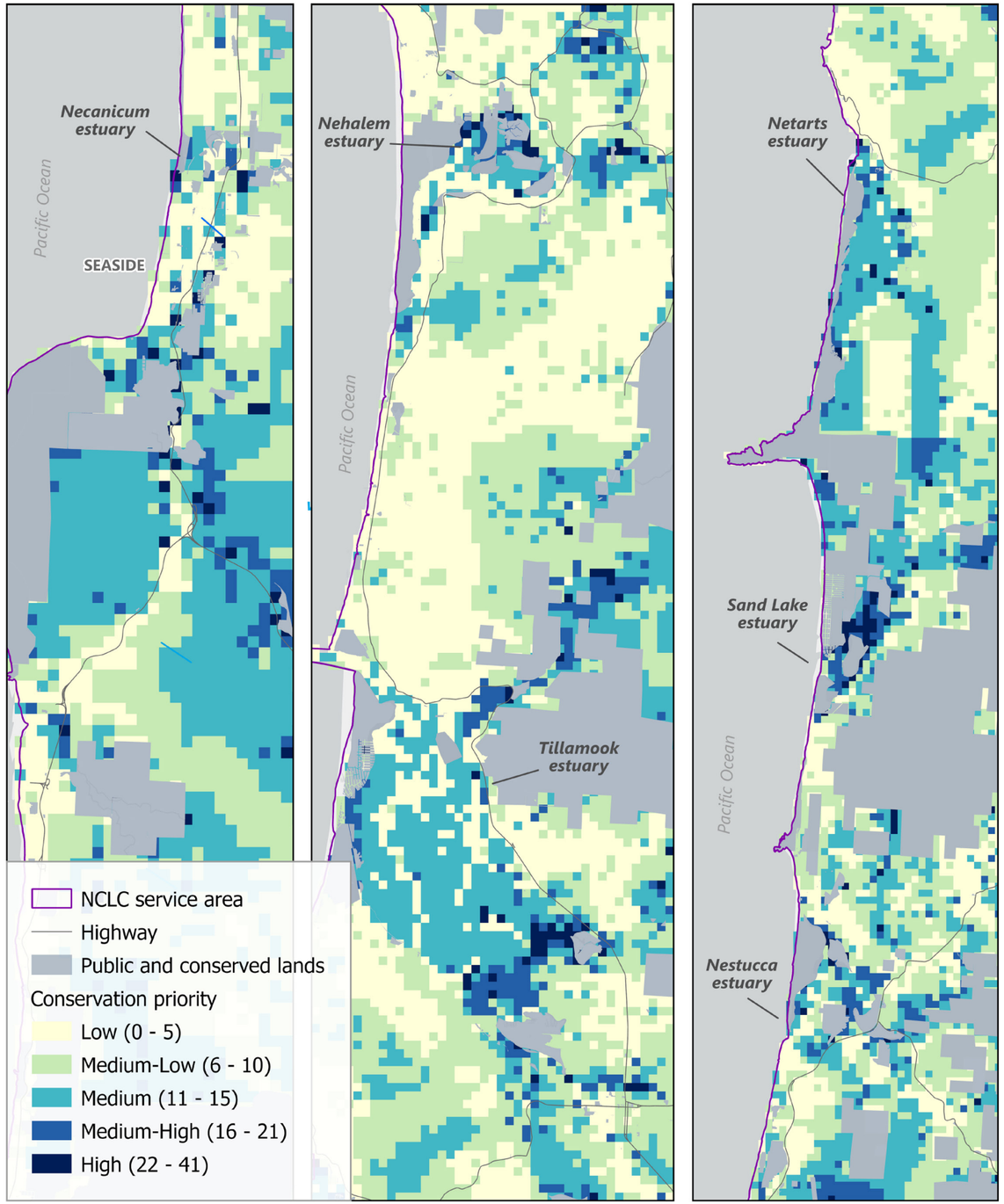
See Appendix 2 to view the conservation ranking criteria.



CONSERVATION INITIATIVES

The landscape of our service area is unlike anywhere else on the Oregon Coast. Here, the mountains rise sharply from the sea and wild rivers feed large estuaries where freshwater and saltwater mingle. The unique geology and direct land-sea interface of these coastal-fronting watersheds results in habitat that is also unique, home to rare mixes of plants and animals. NCLC's initiatives seek to preserve complete contiguous coastal watersheds, allowing the temperate rainforest, river systems, and estuaries indigenous to this coastline to again thrive. We seek to create corridors of ecological connectivity of unprecedented scale along the Oregon Coast, stretching from the tips of the coast range to the nearshore-ocean, in one of the world's most biodiverse regions. NCLC will work with partners and landowners to protect sensitive habitats and build upon already conserved lands to create strongholds of protected land representing an array of habitat types. With this vision in mind, this conservation plan identifies the following initiatives within our service area that constitute the highest priority for conservation.





NORTH COAST LAND CONSERVANCY

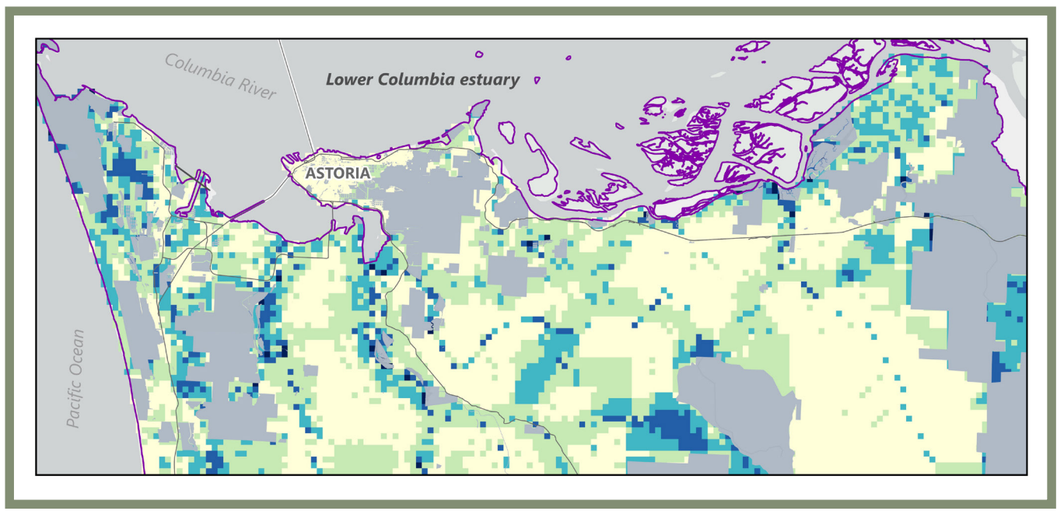
Data sources: Oregon State Parks, State of Oregon GEO, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, Oregon State Parks, State of Oregon GEO, WA State Parks GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, ODEQ, ODFW, DLCD, Wild Salmon Center, USFWS, Brophy & Ewald

ESTUARIES AND TIDAL WETLANDS

The estuaries within our service area contain tidal salt marshes and forested wetlands, which support the life cycles of a myriad of species from salmon and elk to seabirds and other migratory birds. They also reduce flooding impacts on our communities by giving rising waters room to spread out, and play an important role in climate mitigation both locally and globally by sequestering carbon at 10 to 100 times greater rates than most forests in the United States, thanks largely to their ability to capture and store sediment and associated carbon from outside the ecosystem.[34]

85% of tidal wetlands along the west coast of the United States have been lost to development, adding critical importance to protecting the remaining tidal wetlands within our service area. These essential wetlands lie within the estuaries of the Necanicum, Nehalem, Tillamook, Netarts, Sand Lake, Nestucca and lower Columbia River, and have been designated as Conservation Opportunity Areas by the Oregon Department of Fish and Wildlife. Forested wetlands such as Sitka spruce swamps, which are able to store even more carbon than other tidal wetlands and are important to salmon, historically made up the majority of tidal wetlands in Oregon. Diking and conversion have since led to the loss of 95% of tidal forested wetlands,[35] making protection of remaining forested wetlands an even higher priority.

We will work to protect estuaries within our service area, prioritizing building upon existing protected areas, conserving existing high-quality habitat, landward migration zones, areas with high habitat restoration potential, and adjacent lands that directly contribute to the quality and function of these wetlands.



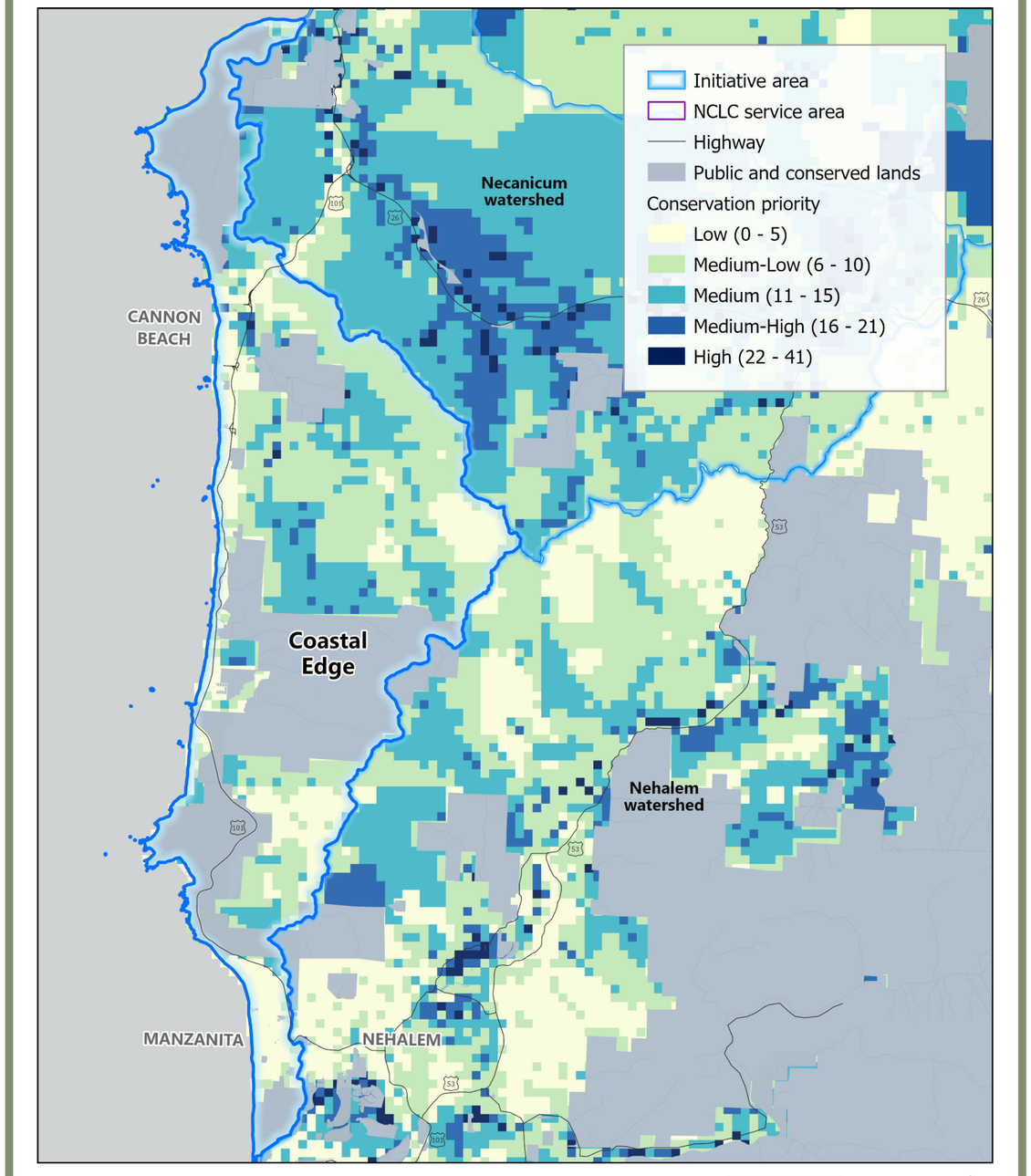
COASTAL EDGE

With mountain summits rising to above 3,000 feet abruptly from the ocean shoreline, and salmon streams flowing directly into the sea rather than large estuaries, the region we call the Coastal Edge, stretches from Tillamook Head to Nehalem Bay, is an unusually compressed, biogeographically concentrated ecosystem, unlike anywhere else on the Oregon Coast.

The unique geologic history and geographical isolation along the Coastal Edge created unusually diverse ecosystems that host rare plant and animal species: Oregon's own "Galapagos Islands". The landscape we see today in the Coastal Edge is the product of geologic forces at work over millions of years. From the slope of mountains to the sediment in the streams, geology influences habitats and consequently, the plants and animals present in the initiative area. The highest elevations in the Coastal Edge are rocky peaks made of Columbia River Basalt (CRB) that formed underwater in the submarine canyon of the Columbia River. The alignment of this now uplifted former Columbia River channel and the rocky peaks that now rise from it create the coastal-fronting watersheds of the Coastal Edge and define its eastern flank.

Steeper slopes tend to develop higher in these watersheds, where it is common to find large ridges of cinnamon brown earth comprised of decomposed breccia (basalt conglomerates cemented together like concrete) and large blocks of rounded basaltic breccia. These deposits on the flanks of peaks creep or occasionally cascade downslope during heavy rains or strong regional earthquakes. As a result, these basaltic highlands tend to have thin soils with numerous rocky outcrops or balds, which along with moist seeps and abundant sunshine, result in unique habitat niches that support species like the Black Petaltail dragonfly and Chambers paintbrush, a species endemic to the high peaks of our Coastal Edge and Necanicum watershed initiative areas.

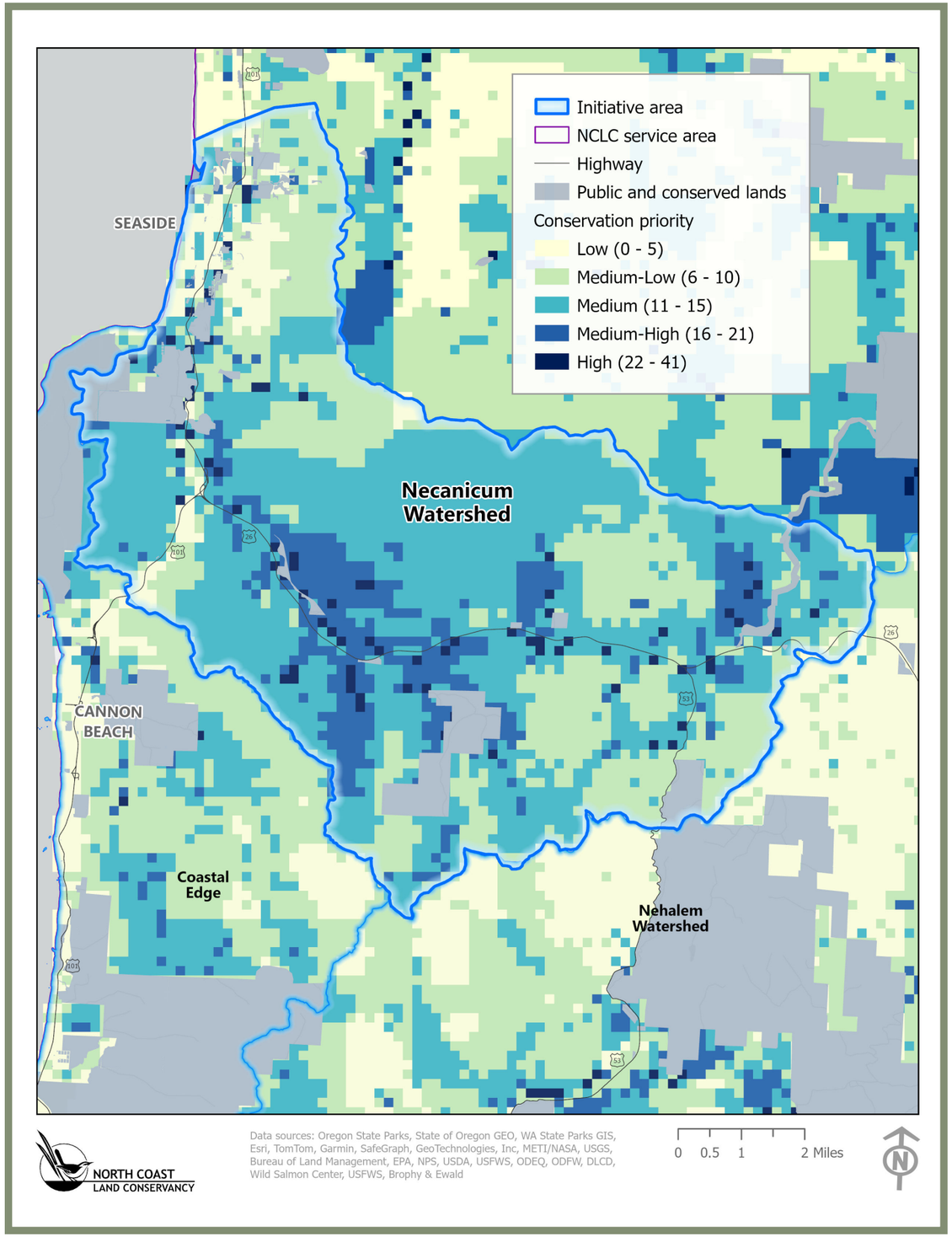
Much of this landscape has been intensively managed for forest products over the decades, but it is also home to a number of state parks, the Cape Falcon Marine Reserve, The City of Cannon Beach's Ecola Creek Forest Reserve, the Arch Cape Community Forest and NCLC's Rainforest Reserve. NCLC's Coastal Edge Initiative seeks to link these conserved areas into large, connected corridors, complete watersheds, and thriving temperate rainforest. Our goal is to support a Coastal Edge where both people and wildlife thrive.



NECANICUM WATERSHED

The Necanicum Wildlife Corridor initiative targets land within the nearly 49,000-acre Necanicum River watershed. The watershed includes land and tributaries contributing water to the Necanicum River as it flows from its headwaters 2,800 feet above sea level in the Coast Range to the Pacific Ocean. The watershed, which is nearly entirely forested (92%) and overwhelming owned by industrial timber companies, provides critical habitat for many coastal plant and animal communities. The Necanicum watershed supports the endangered coho salmon, as well as coastal cutthroat and steelhead. Two species of lamprey are also present, (Brook and Pacific) as well as a handful of other fish species like sculpin, flounder and perch in the Necanicum estuary. Clinging to the peaks of Sugar Loaf and Saddle Mountain are several plant species that exist nowhere else on earth, like the Chambers paintbrush, that benefit from habitat created by the unique geology of Columbia River basalt. Floodplains and associated wetland and riparian ecosystems provide important flood protection for the downstream communities of Seaside and Gearhart and act as corridors allowing wildlife to move along and between habitat areas. More than 70% of all terrestrial species utilize riparian corridors in some way, making the rivers and surrounding areas vital to the watershed's inhabitants.

The Necanicum watershed includes the community of Seaside's drinking watershed and is some of the most productive forestland in our service area and the world, highlighting the importance of these forests in mitigating climate change due to their high potential to sequester carbon.

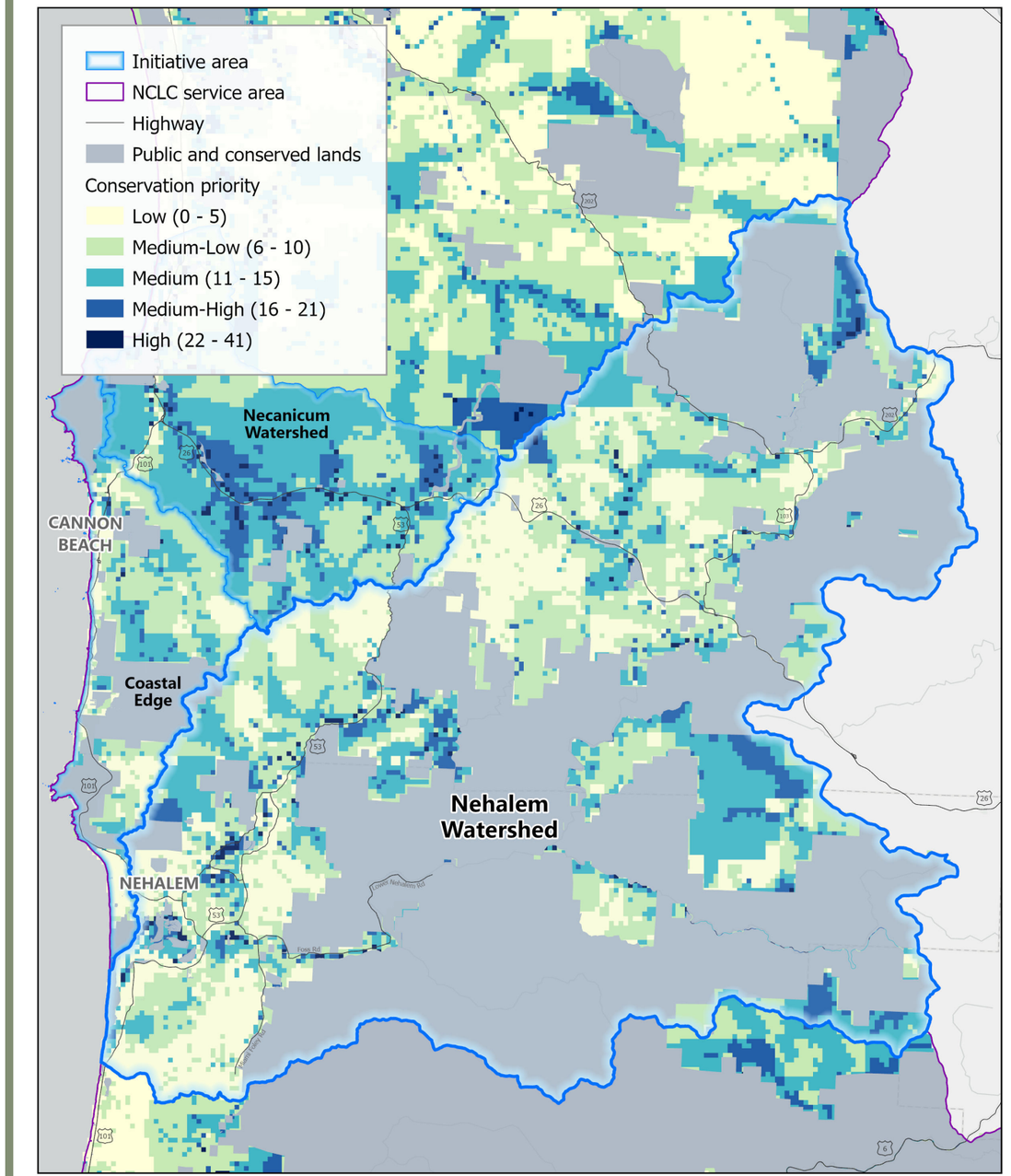


NEHALEM WATERSHED

The Nehalem watershed is a vital salmon ecosystem and presents an opportunity to protect and support the recovery of some of the best wild salmon and steelhead runs in the continental United States. 290,000 acres of the Nehalem River Basin lies within our service area, roughly half of which is owned by the Oregon Department of Forestry.

These lands contain forests that support a range of terrestrial species and overwintering seabirds, while the tributaries that flow from these forests provide cold water refugia that support salmon survival during warmer months and benefit from the nutrients brought back by returning salmon. These forests also have the ability to capture carbon from the atmosphere and are able to increase the amount of water that enters the watershed, including the water sources for the towns of Manzanita, Nehalem, Wheeler and neighboring unincorporated communities.

The Nehalem River estuary portion of the watershed supports salmonids, migratory birds, provides flood mitigation for our communities, and serves as a very important carbon sink. Forested wetlands such as Sitka spruce swamps historically made up 60% of tidal wetlands in the Nehalem Estuary, however diking and conversion have since led to the loss of 88% of this important habitat.[36] Despite these high levels of loss, the Nehalem River estuary still contains some of the larger forested wetland areas in the region. Protecting these remaining spruce swamps and their landward migration zones will help to protect existing habitat and carbon stores, as well as ensure that these systems can continue to provide off-channel habitat for salmon, flood mitigation, and carbon storage now and into the future.



COMMUNITY CONSERVATION INTITATIVE

We understand that coastal conservation must include and celebrate diversity amongst people, plants and wildlife. NCLC strives to be a local and regional leader by connecting people with place and providing learning and stewardship opportunities, as well as equitable and just access to land. To this end, we will work with our partners, including tribal entities, communities, other conservation groups and natural resource agencies to listen, learn, and identify common ground where we can advance and support the goals of others.

We are committed to supporting equitable and just conservation, including facilitating indigenous peoples' reconnection and access to their homelands; protecting underserved/underrepresented communities' access to clean drinking water; offering places where children can connect to nature; and facilitating communities' desires to create parks and open space. While some of these values cannot be mapped, quantified or ranked within our conservation plan, they are a core part of our overall approach to evaluating our conservation efforts. To help with this, NCLC will consider wealth inequality, demographic and census data, and other information when considering conservation projects.

The Arch Cape Community Forest is an example of how NCLC has been able to build partnerships that benefit communities without being the ultimate owner or steward of a property. In early 2017, NCLC began negotiations with the landowner to purchase 5,000-acres, which now forms NCLC's 3,500 acre Rainforest Reserve and the 1,500-acre Arch Cape Community Forest. Early in the process NCLC identified that the lower 1,500-acres, which encompasses Arch Cape's drinking watershed, should be returned to public ownership to allow citizens the opportunity to make decisions on how their drinking water source area is managed. In order to accomplish this goal, NCLC partnered with the Arch Cape Water and Sanitary District and partners to investigate the community's capacity to own and manage the property. Over the next five years, NCLC and its partners wrote grants, led tours, and completed due diligence on the 1,500-acre property. NCLC worked with the Oregon Department of Forestry and the U.S. Forest Service to secure funding through the Forest Legacy Program to purchase the property. The Project also received funding through The American Rescue Plan Act, from the Clatsop County Commission and private donations to finalize the transaction. In 2022, the Arch Cape Water and Sanitary District took ownership of the property and now manages the property for the plant, animal and human communities that depend on clear, cold, abundant water.

MARINE PROGRAM

Through our Marine Program we work for the protection of rocky intertidal and nearshore marine environments, highlighting the importance of healthy land/sea connectivity through education and community engagement to build support for existing marine reserves and expanding protections in the nearshore environment.

Land and sea are inextricably interconnected and affect one another in continuous feedback loops. The ocean provides the land with fresh water released from clouds evaporated from the ocean surface. It serves as a climate regulator, absorbing excess heat trapped by greenhouse gasses, and absorbs excess CO2 emissions while providing 50% of the oxygen in the Earth's atmosphere.

Many species, including humans, depend upon healthy land sea connectivity. Salmon require high quality freshwater streams to begin life, and spend months to years in these systems before migrating to the ocean. After years in saltwater, they return to the stream where they originated from, to spawn and die - providing surrounding ecosystems with nutrients gathered in the ocean. Seabirds such as puffins and the endangered marbled murrelet also depend on both the land and sea for survival. They live and forage on the open ocean, returning to land to nest and raise their young.

Protected marine areas have proven to increase biomass within their boundaries, which in turn supports the larger food web on land and sea. They promote healthy kelp forests, which are important areas for carbon sequestration (blue carbon). Additionally, kelp forests provide food and shelter for a diverse range of marine species, and help reduce coastal erosion by absorbing wave impact.

Rocky intertidal areas, where the land and sea meet, provide a unique interface between marine and terrestrial ecosystems. These zones contain communities of highly diverse species existing in an extreme environment that covers only a small percentage of the earth's surface. The communities that thrive here are unique and contain a very high level of biodiversity.

CAPE FALCON MARINE RESERVE
OREGON

OREGON
MARINE RESERVES
OREGON DEPARTMENT OF FISH & WILDLIFE

APPENDIX 1:

LAND CONSERVATION & STEWARDSHIP STRATEGIES:

NCLC employs a variety of strategies for land conservation and stewardship in perpetuity. Strategies vary depending on land ownership and the condition of the land, including existing and potential conservation values. NCLC selects land and conservation easement projects through a defined process using selection criteria consistent with our mission. NCLC inspects properties before buying or accepting donations of land to ensure that they meet the organization's criteria. Before pursuing a conservation project, NCLC evaluates whether the organization has the necessary skills and resources to protect the property's conservation values and, if not, NCLC engages in partnerships to accomplish shared goals.

LAND ACQUISITION STRATEGIES

ACQUISITION:

NCLC strives to build lasting relationships within the community that not only build our capacity for conservation but also build strong partnerships. Working with willing landowners, NCLC looks to conserve high value resource lands. This strategy not only includes fee simple acquisition of properties but also encompasses working with willing landowners on land donations.

FACILITATION:

NCLC works on projects in which the ultimate holder of the land is not NCLC, but rather an entity such as a local municipality, tribe, water district or other partner that lacks the experience or resources to secure land on their own. When the goals and benefits of the project fit with NCLC's mission and the partner is seen as the best entity to hold and steward the land, NCLC provides its experience with land transactions and securing acquisition funding. Facilitation may consist of simply sharing information, helping to explore project feasibility and providing introductions to partners or it can involve more extensive help such as grant assistance, map development, and due diligence work.

CONSERVATION EASEMENTS:

NCLC's preference is to pursue fee simple acquisition but we understand that this might not always be an option for NCLC or the landowner. In certain situations, NCLC will work with willing landowners to develop and place a conservation easement on their property.

A conservation easement is a traditional tool in land conservation. A conservation easement is a legal agreement between a landowner and a land trust or government agency that permanently limits uses of the land in order to protect its conservation values. It allows landowners to continue to own and use their land, and they can sell or pass the land onto their heirs.[37]

STEWARDSHIP STRATEGIES & FRAMEWORK

The management of NCLC's conservation lands is guided by what is ecologically appropriate and what is feasible given the human and financial resources available. NCLC considers the long-term funds and staff-time required to enhance and conserve each piece of land it considers purchasing or accepting, and does not accept properties unless the board is confident that the needed resources are available. NCLC's stewardship program is designed to protect and enhance the conservation values of NCLC's properties and to maintain good relationships with landowners.

In order to fulfill the purposes of the stewardship program, when a property is acquired and NCLC becomes responsible for its stewardship, a management plan is created. Each management plan is guided by one of the following stewardship strategies that inform NCLC's land management practices.

ECOSYSTEM PROTECTION BY LAND OR CONSERVATION EASEMENT ACQUISITION

Protection by acquisition or easement is a stewardship strategy involving securing and connecting functioning, healthy ecosystems and implementing actions necessary to maintain natural functions within these systems over the long-term (e.g., protecting buffer areas). Protection can also be a management tool, providing a potential natural condition reference system to serve as a guide during the planning of enhancement activities on nearby degraded systems.

ECOSYSTEM PROTECTION BY PASSIVE ECOLOGICAL ENHANCEMENT

Passive ecological enhancement is a stewardship strategy that removes all ecosystem-degrading disturbances (e.g., livestock grazing, wildlife barriers, invasive species infestations, dikes, and culverts) in order to allow an ecosystem to recover through natural processes. Allowing time for a degraded ecosystem to recover through natural processes is a tool that allows NCLC to evaluate ecosystem health and assess if there may be a need to intervene with more active habitat development.

ECOSYSTEM PROTECTION BY ACTIVE HABITAT DEVELOPMENT

Active habitat development may be necessary if passive ecological enhancement is unsuccessful. Using preserved, intact ecosystems as a guide, habitat development activities may include the reintroduction of native plant and animal species (e.g., keystone species, rare species) and adding structure (e.g., large woody debris).

In addition to NCLC taking on the full responsibility of stewardship by implementing one of the above strategies, we also work with partners to create a network of community support for stewardship of the North Oregon Coast.

APPENDIX 2: CRITERIA & SCORING MATRIX

CRITERIA	DATA SOURCE	CATEGORY & SCORE
Connectivity	Various federal, state, local agencies and land trusts	Adjacent = 5 Non adjacent = 0
Priority Wildlife Connectivity Area	ODFW	Within PWCA = 5 Outside PWCA = 0
Wetland Type	USFWS (NWI), PMEP	Estuarine and marine wetland = 10 Tidal forest/woodland = 10 Emergent tidal wetland = 10 Freshwater forested/shrub = 3 Freshwater emergent = 3 Riverine = 1 Lake/freshwater pond = 1 Estuarine/marine deep water = 0 Upland = 1
Landward Migration Zone	Brophy and Ewald	Non-impervious LMZ = 2 Impervious LMZ = 1 Not LMZ = 0
Conservation Opportunity Area	ODFW	Within COA = 2 Outside of COA = 0
Drinking Water Source Area (surface)	ODEQ	Within DWSA = 5 Outside DWSA = 0
Drinking Water Source Area (ground)	ODEQ	Within DWSA = 5 Outside DWSA = 0
Parcel Size	DLCD	1800-4499 acres = 4 480-1799 acres = 3 120-479 acres = 2 0-120, 4500-13,000 acres = 0
Land Use	DLCD	Unimproved vacant = 2 Improved (any use) = 0
Cold Water Refugia	Wild Salmon Center, ODFW	Cold water refugia = 2 Not cold water refugia = 0
Coastal Coho Habitat*	ODFW	Habitat = 2 Not habitat = 0
Fall Chinook Habitat	ODFW	Habitat = 2 Not habitat = 0
Chum Habitat	ODFW	Habitat = 2 Not habitat = 0
Coastal Cutthroat Habitat	ODFW	Habitat = 2 Not habitat = 0
Winter Steelhead Habitat	ODFW	Habitat = 2 Not habitat = 0
Pacific Lamprey Habitat	ODFW	Habitat = 2 Not habitat = 0

*Streams Buffered 100ft on either side to capture adjacent parcels.

APPENDIX 3: INDIVIDUAL SCORING MAPS

MAPS AS AN INITIAL GUIDE

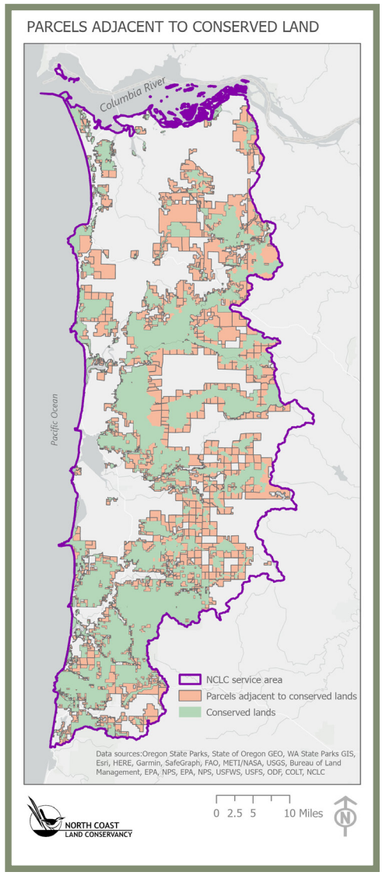
GIS analysis has become a method commonly utilized by land managers to visualize areas and develop conservation plans. These maps are an important piece of NCLC's science-based, initiative-driven conservation planning model and help prioritize and focus our work. The maps not only highlight high value areas already known to NCLC through fieldwork and working with landowners, but they also highlight high conservation potential in areas where NCLC has not worked. The maps also allow NCLC to take a step back and visualize, at a landscape level, how we can augment wildlife corridors or prioritize individual parcels within our initiatives. That said, the GIS modeling in this conservation plan should be considered only a first step in gauging the land trust's interest in a property and how the property advances NCLC's overall goals within our initiatives. NCLC is a conservation organization firmly rooted in the ground and nothing can replace the importance of on the ground site visits and the detailed knowledge of the land that is derived from these visits.

CONNECTIVITY TO CONSERVED LANDS

NCLC works within a green infrastructure model that prioritizes habitat connectivity at a landscape scale. One way to approach this concept is to build upon the existing network of public and conserved lands. In this vein, we highly prioritize land adjacent to parcels in public ownership or otherwise already conserved, thereby building green infrastructure and creating larger continuous corridors and limiting the fragmentation of habitats.

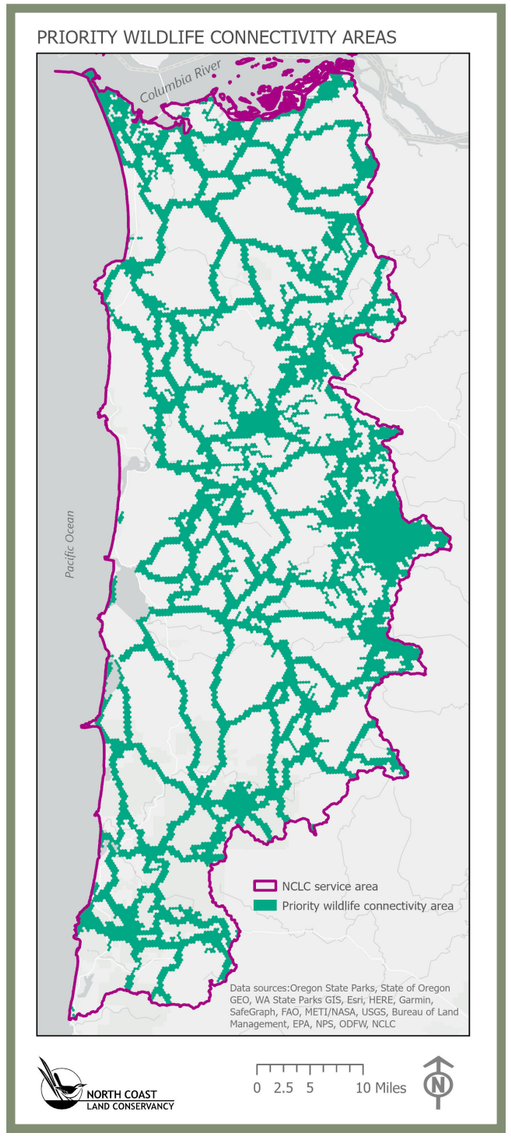
Parcels owned by local, county, or state government or conservation organizations such as North Coast Land Conservancy were identified using data obtained from Clatsop County, Tillamook County and Lincoln County GIS Departments. These parcels, as well as parcels with which they share a boundary, were highlighted and ranked highly in our model.

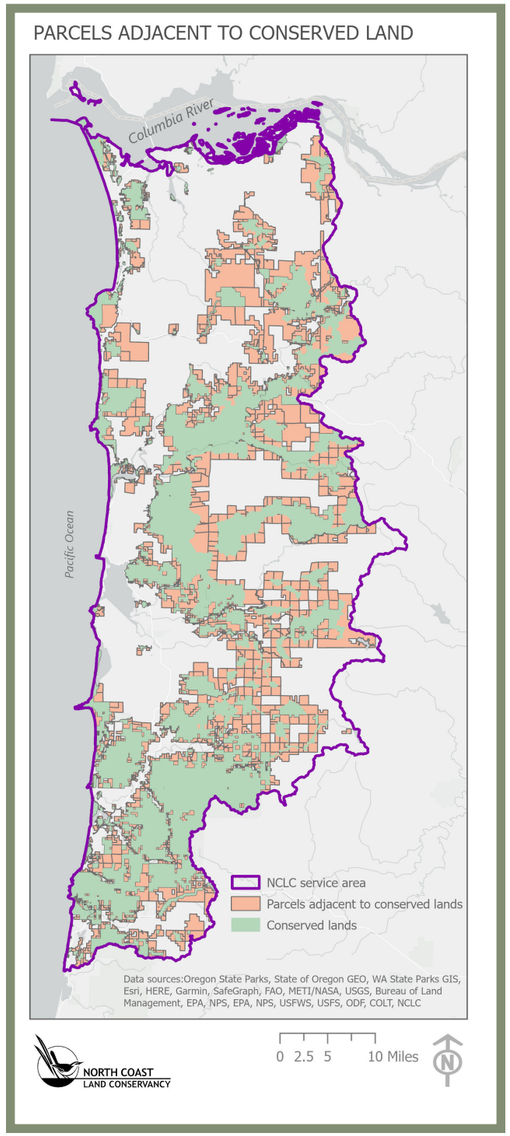
This model yields an initial picture of possible opportunities to enhance habitat connectivity.

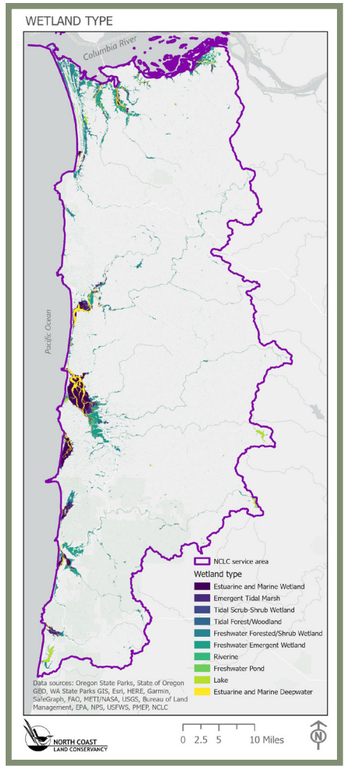


PRIORITY WILDLIFE CONNECTIVITY AREAS

ODFW Priority Wildlife Connectivity Areas (PWCAs) provide information on the parts of the landscape expected to have the highest overall value for facilitating wildlife movement. The network of PWCAs serves as a science-based, informational tool to support planning for habitat enhancement, restoration, conservation, transportation mitigation, land-use, and development projects and was created by the Oregon Department of Fish and Wildlife. NCLC used this data to identify wildlife corridors within our service area, giving priority to areas that facilitate the movement of species. If the area is within a PWCA then it received a score of five, if the area is outside of a connectivity area it received a score of zero.





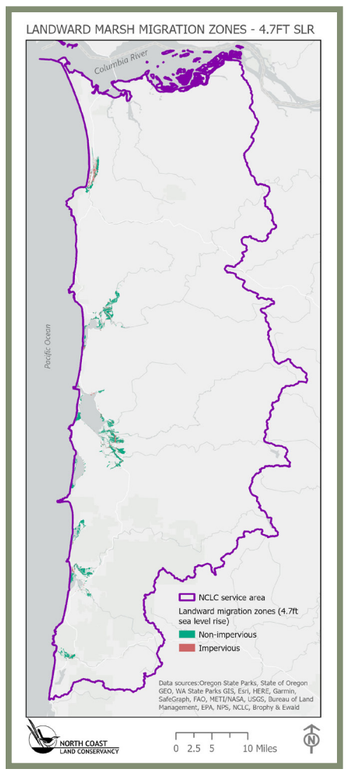


WETLAND TYPE

National Wetland Inventory (NWI) data created by the U.S. Fish and Wildlife Service was used to provide a coarse overview of jurisdictional wetlands within our service area. The NWI provides the most comprehensive, easily mapped representation of wetlands in our service area.

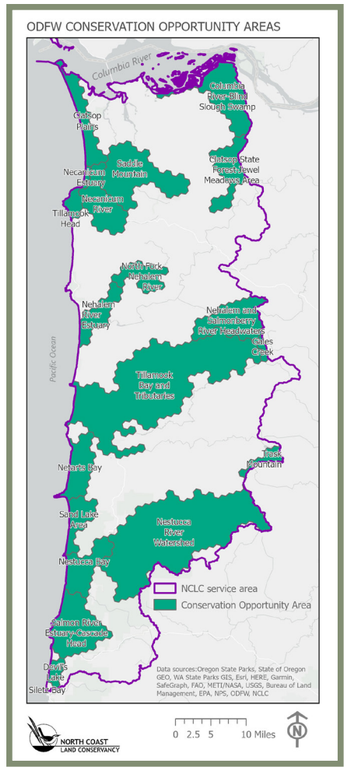
The topography of our service area is such that wetlands are generally restricted to low gradient areas found in the narrow band along the coast. Moving eastward, slopes increase up towards the ridges and peaks of the Coast Range.

Wetlands of all types are important for protecting water quality and providing wildlife habitat. In this model we have prioritized estuarine and marine wetlands, tidal forest/woodland, tidal scrub-shrub wetlands and emergent tidal wetland as the highest priorities for protection due to their ability to sequester carbon and help mitigate climate change.



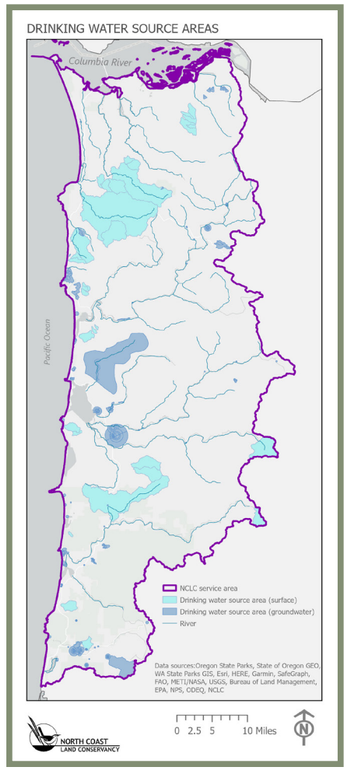
LANDWARD MIGRATION ZONES

As sea level rises wetlands are expected to migrate landward, however due to differences in topography and development, estuaries vary greatly in ability to adapt and allow for inland migration of wetlands. In our analysis we used information from Brophy and Ewald to identify landward migration zones (LMZs) in several estuaries in our service area. In the model we gave the highest priority to the areas that were most adaptable, giving non-impervious LMZs a score of two, impervious LMZs a one and everywhere else a zero.



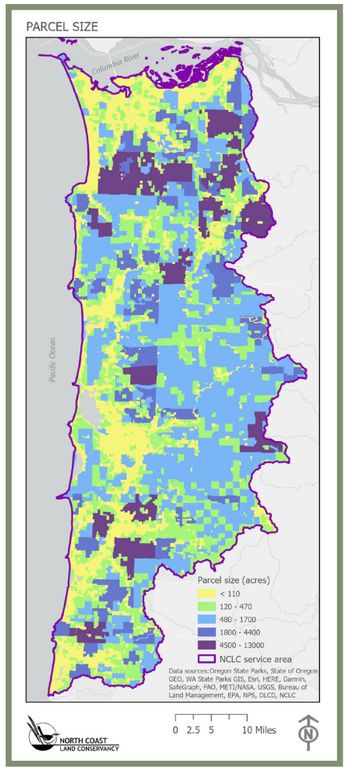
CONSERVATION OPPORTUNITY AREAS

Conservation Opportunity Areas (COAs) were developed by the Oregon Department of Fish and Wildlife (ODFW) to guide voluntary conservation actions in Oregon. Conservation Opportunity Areas are places where broad fish and wildlife conservation goals would best be met, and they have been designated for all ecoregions within the ODFW's Conservation Strategy, except the Nearshore ecoregion. COAs were delineated through a spatial modeling analysis and expert biologist review (COA Methodology). Within our model NCLC has chosen to give weight to the COA's that ODFW has identified in our service area. COAs scored a two in our model, while lands outside scored a zero.



DRINKING WATER SOURCE AREAS

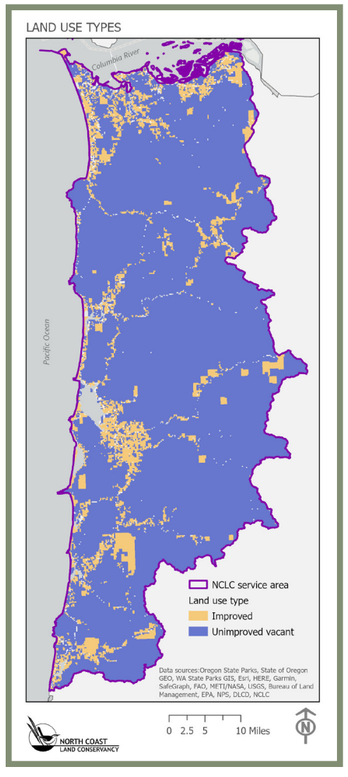
Clean water is critical to human, animal, and plant communities. Creating source water protection areas that buffer surface and groundwater sources of drinking water limits the impacts of land management activities conducted on surrounding lands. Management of the land upstream of city and rural water district intakes for the protection of water quality and quantity reduces water treatment costs and health concerns often attributed to other land management strategies. Building off of North Coast Land Conservancy's drinking water protection work in Cannon Beach and Arch Cape, we hope to continue to work with communities to provide clean abundant water for people and wildlife. These same systems contain salmon populations, which would also benefit from the same land management measures that would protect drinking water. Within our model both surface water and ground water source water areas scored a five, while lands outside of drinking water source areas scored a zero.



PARCEL SIZE

Habitat size is an important factor in healthy populations and ecosystems. Habitat requirements vary greatly by species and conservation objective, but habitat conservation has a trickle-down effect. If we aim to protect larger pieces of habitat, species with the greatest need for space and resources will benefit along with the other members of their communities. Additionally, the smaller a habitat reserve, the greater the influence of the surrounding areas. Since land ownership is delineated by parcels, the protection of larger parcels contributes to the conservation of not only more overall habitat but also potentially larger core areas buffered from external conditions.

Using parcel data obtained from Clatsop, Tillamook, and Lincoln Counties' GIS departments, parcels were divided into four size classes. Larger parcels were assigned higher scores. However, when parcels were over 4,500-acres they were scored a one, the same as parcels sized 0-121 acres, to account for the lower feasibility of acquiring thousands of acres in one transaction



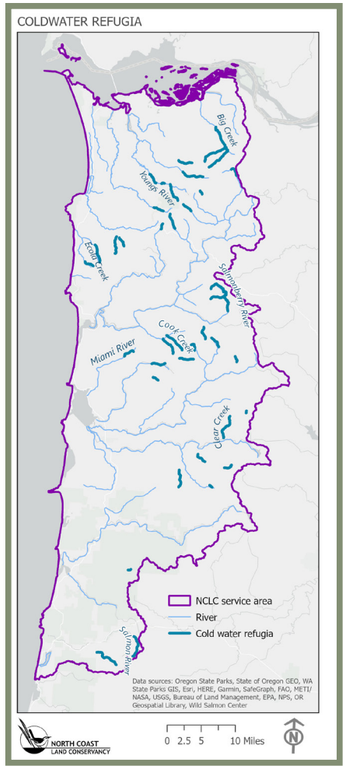
LAND USE/LAND COVER

Land use/land cover data was acquired from the National Land Cover database managed by the U.S. Geological Survey. This dataset categorizes land cover using aerial photography. We found this to be an accurate representation of land use patterns in our service area. Land use categories distinguish between developed and undeveloped areas and identify broad vegetation types. However, in the model we have chosen to focus on developed vs undeveloped land.

While undeveloped "barren lands" have the potential to provide connectivity between habitats, the areas designated as barren lands by this dataset are generally quarries or beaches. Quarries provide little to no ecological value and beaches are already in the public domain.

Developed areas are identified as roads or building footprints. These developed areas can impede or obstruct connectivity between habitats and therefore are treated as a loss of green infrastructure and thus score a zero in our model, whereas unimproved vacant land scored a two.

COLD WATER REFUGIA



The cold water refugia model was provided by Wild Salmon Center. Underlaying data for stream temperatures from the NorWeST Stream Temp,[38] which is produced by the U.S. Forest Service's Rocky Mountain Research Station was used to generate the model, along with streamflow metrics from National Hydrology Dataset (NHD)[39] produced by the U.S. Geological Survey. Methodology for the cold water refugia model was developed by Spencer Sawaske, Instream Scientist and Hydrologist at the Oregon Department of Fish and Wildlife.

The model identifies stream reaches that provide cold water to refugia areas for salmonids during the most important times of year - when stream flows are lowest and water temperatures are the warmest.

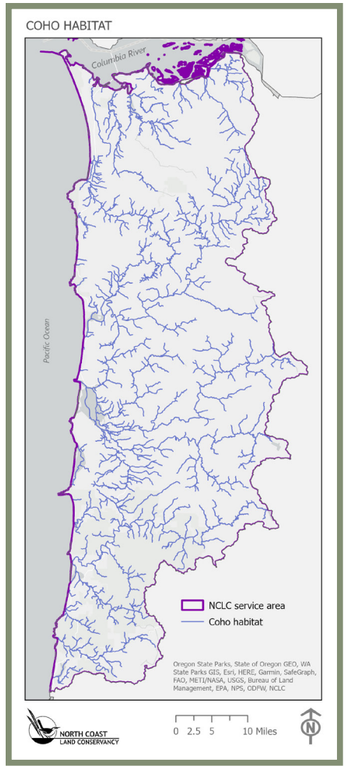
These cold water refugia and the sources of these waters are increasingly important to both juvenile and adult salmonids as seasonal temperatures, rainfall, and streamflow patterns are impacted by climate change. Lower summer rainfalls, steam flows, and higher air temperatures result in higher stream temperatures that can block salmonid migrations, negatively impact their health or even cause die-offs.

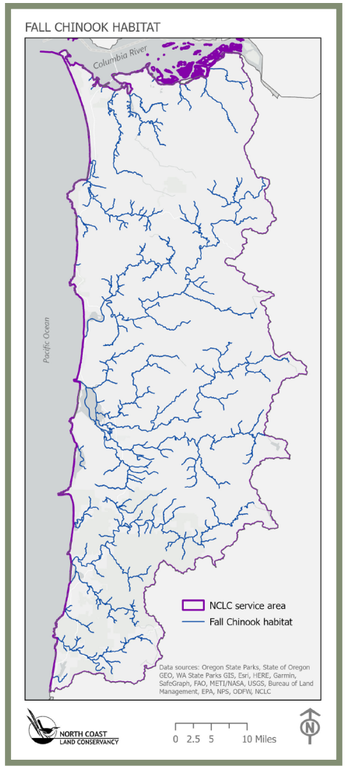
Parcels associated with old water refugia areas scored a two in our model, while areas not associated with cold water refugia scored a zero.

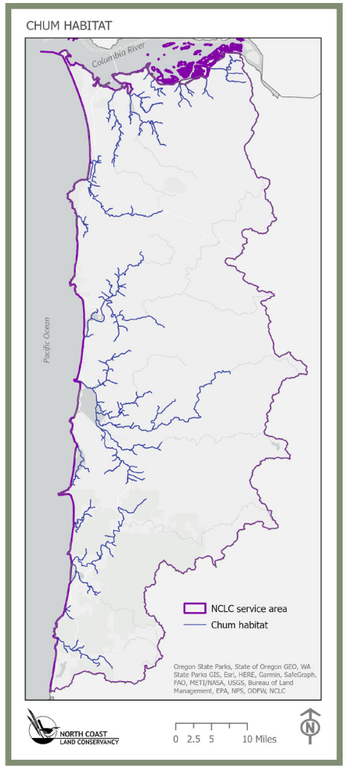
Parcels associated with old water refugia areas scored a two in our model, while areas not associated with cold water refugia scored a zero.

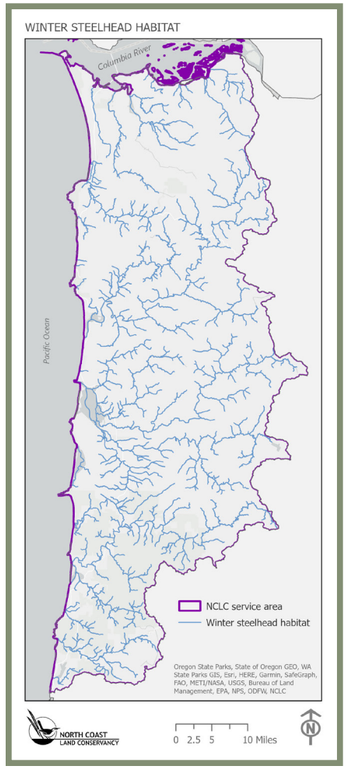
SALMONID HABITAT

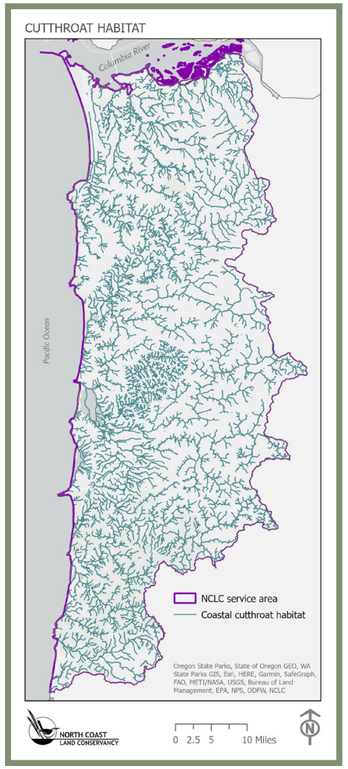
The waterways of our service area provide habitat for Oregon Coast coho salmon (Oncorhynchus kisutch), an evolutionarily significant unit which is federally listed as threatened. Fall Chinook (Oncorhynchus tshawytscha), chum salmon (Oncorhynchus keta), Coastal Cutthroat Trout (Oncorhynchus clarkii clarkii), and winter steelhead (Oncorhynchus mykiss), and Pacific Lamprey (Entosphenus tridentatus) are also vital to the ecosystems of the north Oregon coast. These anadromous species are critical to the nutrient cycles of stream systems throughout their ranges, bringing ocean-derived nutrients into watersheds and supporting aquatic and terrestrial species.
Data on historical stream usage by salmonid species was obtained from the Oregon Department of Fish and Wildlife. These data were used to identify priority stream corridors by giving weight to reaches used by salmonids as rearing and spawning habitat. Using these data, we were also able to identify platted parcels of land that provide, or have the potential to provide, vital upland buffers to salmonid streams. Parcels featuring habitat for one salmonid species were assigned a score of one. Parcels that contain habitat for all six of the salmonid species found in our service area are considered a high priority, with a cumulative score of six.

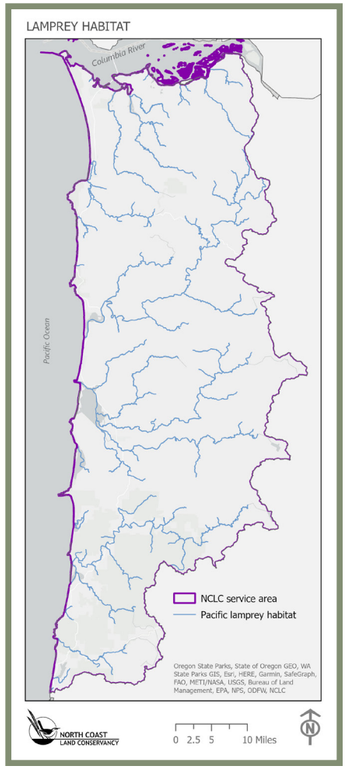












APPENDIX 4: NCLC PREVIOUS CONSERVATION INITATIVES

Changes in NCLC's initiatives happen from time-to-time as our priorities and understanding of the landscape change. However, this does not mean we abandon the work that was already completed, but rather the habitat reserves in past initiatives remain an important part of NCLC's land conservation and stewardship work and history. The decision to focus on different habitats in our service area is done for a variety of reasons. We may have accomplished the lion's share of work in an area, our priorities may shift over the years or they may become part of newer, broader initiatives. Regardless of the reason, NCLC will continue to build connectivity between the habitat reserves protected during past conservation initiatives, something that is outlined as a key priority in this Plan.
NCLC's Past Initiatives:

NCLC'S PAST INITIATIVES: COLUMBIA QUIET WATERS

"The wetlands of the lower Columbia River are a high priority for NCLC conservation work. We are particularly focused on the lower Skipanon River and upper Neacoxie Creek near Warrenton and the extensive wetlands and fens among the dunes here. The Sitka spruce wetland forest and swamp community found here is considered globally rare. It contains an intact and ecologically high-functioning forested wetland habitat network of a kind that may be unique in the world. Our goal in this pristine, minimally fragmented landscape is to maintain and promote wildlife corridors and other types of ecological connectivity."

NCLC'S PAST INITIATIVES: NEACOXIE WILDLIFE CORRIDOR

"The unique coastal habitat that has developed south of the mouth of the Columbia River over the past 5,000 years began as a series of parallel sand dunes. Groundwater trapped in dune swales created wetlands, lakes and streams, and the landscape evolved to include native prairie, treed shelterbelts, and other habitats associated with Neacoxie Creek and Neacoxie Lake. The lands here serve as a corridor for migrating birds and other species and are essential habitat for the threatened Oregon silverspot butterfly. Thanks in large part to NCLC, much of the Clatsop Plains prairie and its connecting forests and wetlands have been conserved, and our focus here is now on stewardship. Our partners in this endeavor currently include the U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife, The Nature Conservancy, The Institute of Applied Ecology, Oregon Air National Guard, and the National Park Service."

APPENDIX 5: WORKS CITED

1 Oregon Department of Land Conservation and Development (2019) Oregon Statewide Land Use Planning Goals. http://www.oregon.gov/LCD/Pages/goals.aspx

2 Dalton, M., Fleishman, E., editors (2021) Fifth Oregon Climate Assessment. Oregon Climate Change Research Institute, Oregon State University, Corvallis, Oregon.

3 Dalton and Fleishman (2021)

4 Dalton and Fleishman (2021)

5 Buotte, P. C., Law, B. E., Ripple, W. J., and Berner, L. T. (2020) Carbon sequestration and biodiversity co-benefits of preserving forests in the western United States. Ecological Applications 30(2):e02039. https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/eap.2039

6 Buotte et al. (2020)

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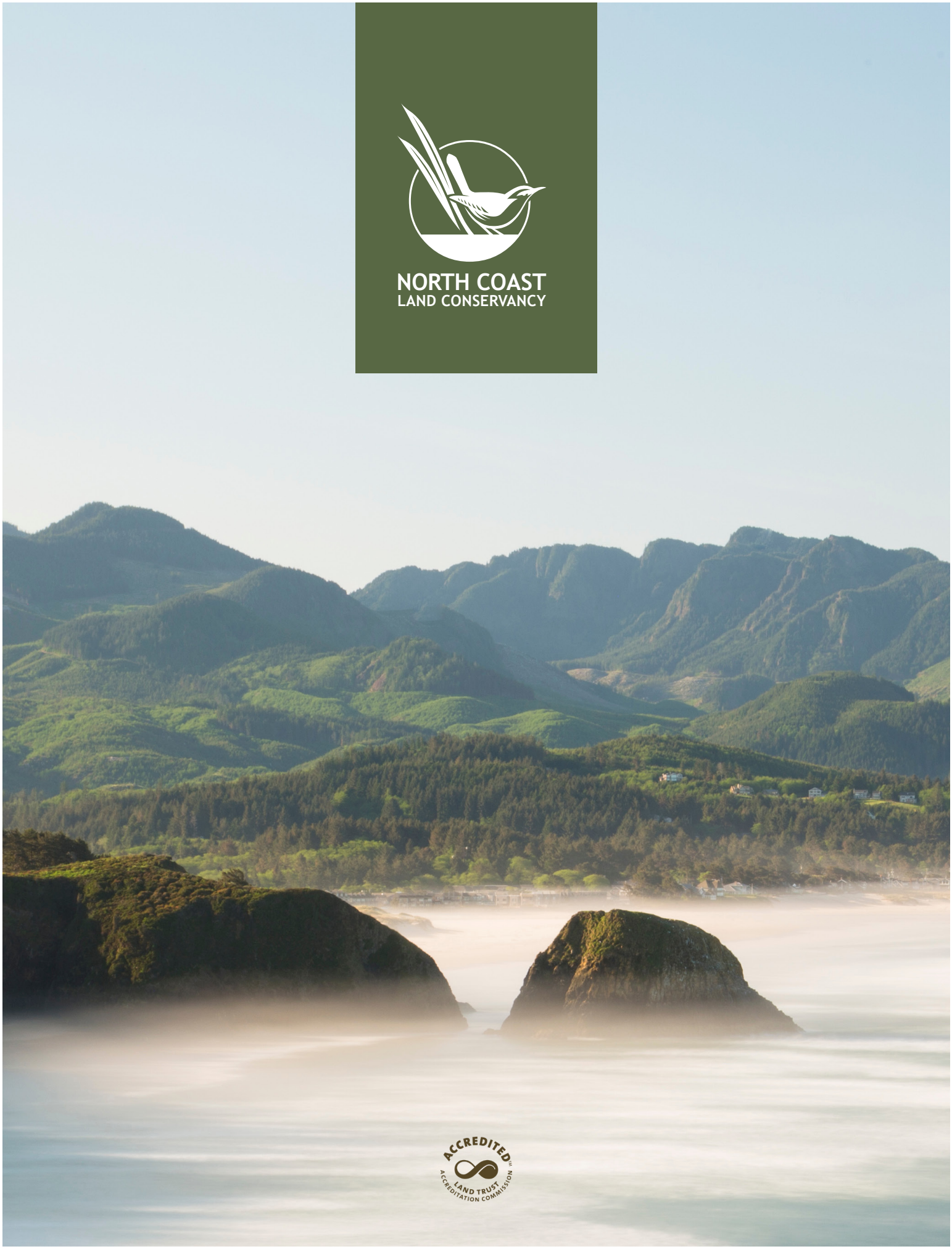

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