Climate Change Response

Preparedness and Action Plan

Oregon Parks and Recreation Department

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Executive Summary

Background/Purpose
The consensus among the international scientific community and governmental organizations is that significant changes in global climate are occurring at rates accelerated by human activities now and are anticipated to increase in the future. Given OPRD’s mission and statutory responsibilities, the Director has identified that it is important to develop an understanding of the potential effects of climate change and create a plan to inform our actions. The past is no longer an appropriate guide to future conditions and immediate and long-term preparation and proactive adaptation to the consequences of climate change is necessary at all levels throughout OPRD. This plan identifies potential impacts and suggests actions to reduce risk and increase overall resiliency in the face of a changing climate.

Impacts
Climate change will have a variety of impacts on OPRD’s mission, facilities, operations, programs and various statutory responsibilities: Natural and Cultural Resources
- Saltwater intrusion into estuaries and freshwater aquifers, altered tidal ranges and changes in sedimentation patterns, leading to habitat modification.
- Change in species composition/range shifts.
- Localized extinctions and loss (or shifting) of biodiversity.
- Increased pressures on threatened and endangered species like salmon.
- More threat from pests, including insect outbreaks and invasive species.
- Increased risk of forest fires.
- Ocean acidification and higher temperatures may impact nearshore marine life.
- Built historic resources may be threatened by increased fires and flooding.
- Coastal cultural resources, such as shell middens, impacted by increasing erosion.
- Impacts to culturally important species

Facilities
- Increased flooding, including storm surge flooding on the coast along with increased erosion will threaten park infrastructure.
- Wildfire threats to our built systems.
- Reduced water availability in peak recreation season will impact OPRD operations.

Ocean Shore Management
- Increasing permit requests for hardened structures for eligible (and ineligible properties) properties.
- Hardening of large stretches of shoreline with the potential to lead to a narrowing of the beach over time.

Outdoor Recreation and Interpretation
- Water dependent recreation will compete with other uses as availability changes.
- Erosion may lead to loss of facilities and beaches.
- More intensive and longer allergen exposure, along with hotter temperatures and reduced water availability, could lead to reduced outdoor recreation participation.
• Recreation and interpretive priorities, capacity, and budget may change in response to adaptation and mitigation.
• Messages and stories that interpretive staff currently focus on may need to change and necessitate more training, education, and coordination as information changes.

Planning
• Planning, development and acquisition priorities, capacity, and budget may change in response to adaptation and mitigation.

Recommendations
This plan provides guidance about what we might do as an agency, and as individual employees to help reduce our footprint, respond and adapt given an uncertain future.

Guiding Principles
• Reduce our footprint by improving efficiencies and conservation strategies throughout every facet of agency operations and associated interpretive strategies.
• Re-frame the actions we are currently taking at all levels of the agency, in the context of climate change.
• Consider the potential impacts of climate change in all future major decision making, including long-term development planning, design and acquisition strategies. By embracing adaptive management and reducing vulnerability by increasing resiliency, OPRD will be better suited to manage the natural and human systems for which we are responsible.

General Actions
• Evaluate inefficiencies throughout OPRD operations and identify ways to improve.
• Incorporate sustainable practices, wherever feasible, into all facets of OPRD’s mission, particularly: facility and site planning, design, construction, operations/maintenance; grant programs; contracting and procurement, and visitor programs and services.
• Explore options for inventorizing greenhouse gas emissions and plan for reductions.
• Discuss benchmarks/goals for agency-specific greenhouse gas emission reductions, consistent with state guidelines.
• Explore the “Climate Friendly Parks” model set by the National Parks Service.
• Continue to look for opportunities to do carbon sequestration projects with partners.
• Work with partners and continue to acquire and restore properties with wetlands (and other ecosystems) that provide important ecosystem services that may help buffer against the impacts of climate change.

Additionally, a variety of recommended actions are provided to help reduce our footprint (from on-site energy use to planning and development) and increase OPRD’s adaptive capacity to respond to each of the categories of potential impacts outlined in the plan. Information and impacts to OPRD will continue to change, therefore, OPRD’s response to climate change will require flexibility and adaptive management.
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1. Introduction

1.1 Background/context

The mission of the Oregon Parks and Recreation Department (OPRD) is to provide and protect outstanding natural, scenic cultural, historic and recreation sites for the enjoyment and education of present and future generations. OPRD holds a public trust to manage, preserve and protect Oregon’s extensive park system, the Ocean Shore State Recreation Area, State Scenic Waterways, and Oregon’s heritage and historic resources. OPRD is a major advocate for outdoor recreation and has a responsibility to help meet the total recreational needs of the state by working cooperatively with partners (OPRD, 2008).

Given OPRD’s mission and statutory responsibilities, the Director has identified that it is important to develop an understanding of the potential effects of climate change and create a plan to inform our actions.

From the Director:

The effects to our agency will be broad based. They will be manifested in changing visitor patterns, susceptibility to fire, more rainfall but lower water levels in peak recreation seasons, accelerated coastal erosion caused by increased storm events, receding beaches, changing vegetation patterns, spread of invasive species, and more. It is important to develop a comprehensive understanding of the potential effects of climate change and create a plan to inform our actions [in order to] responsibly respond to these issues as land managers and regulators.

State, National and International Context

The Governor charged the Climate Change Integration Group (CCIG) to create a preparation and adaptation strategy for Oregon. The CCIG made a variety of recommendations, including that all government agencies implement a climate change preparation plan (CCIG, 2008). Although this recommendation has not been mandated at this time, OPRD is choosing to take a proactive role in preparing for climate change. The CCIG recommended that “agencies should meaningfully incorporate projected climate change impacts and preparation planning into all of their existing programs and policies. Several other recommendations contained within the CCIG framework are particularly pertinent to OPRD and are inserted here:

- Prioritize increasing resiliency within natural and human systems before major impacts occur.
- Assess existing capacity and develop governance systems appropriate for the rate and scale of change that will accompany
climate change.

• Develop and implement a coordinated education and outreach program that will help increase public awareness of climate change impacts, strategies and benefits, including long-term cost savings.

• Integrate climate change preparation into existing and future long-range plans. These plans should include contingencies due to the uncertainties about the intensity and timing of impacts.

• Use and continually improve adaptive management processes and contingency planning (CCIG, 2008).

The consensus among the international scientific community and governmental organizations is that significant changes in the earth’s atmosphere and oceans are occurring at rates accelerated by human activities now and are anticipated to increase throughout the next century (IPCC, 2007).

The International Panel on Climate Change (IPCC)

The most recent IPCC report on climate change notes that “adaptation will be necessary to address impacts resulting from the warming which is already unavoidable... [and] that a portfolio of adaptation and mitigation measures can diminish the risks associated with climate change (IPCC, 2007).” The IPCC notes that “warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level (IPCC, 2007).”
1.2 Purpose

The past is no longer an appropriate guide to future conditions and immediate and long-term preparation and proactive adaptation to the consequences of climate changes is necessary at all levels (Baron et. al., 2009). This climate change response plan identifies potential impacts and suggests actions to help reduce risks and increase OPRD’s overall resiliency in the face of a changing climate.

The purpose of preparing a climate change response plan is to:

- identify the assumptions regarding climate variability;
- define the potential range of impacts of projected climate changes and assess the risks to natural ecosystems, infrastructure, recreation, human communities, cultural resources, particularly as they related to OPRD property and functions;
- develop a strategy to prepare, mitigate and adapt to anticipated conditions influenced by climate change;
- allow coordination and consistency with climate response plans of other state agencies; and
- position the department to take advantage of potential funding sources for research, planning, and response (including land acquisition and habitat restoration funding);
- promote long-term sustainability, defined by OPRD as "using, developing and protecting resources in a manner that enables people to meet current needs and provides that future generations can also meet future needs, from the joint perspective of environmental, economic and community objectives (OPRD COM 20-0)."

This is a guidance document which may be used by OPRD to help adopt a climate change policy and inform future decisions. This document helps outline the issues relevant to OPRD’s mission, our facilities, operations, programs and various statutory responsibilities and identify potential ways to improve decision-making in a changing climate.

Responding to a changing climate, whether it be through adaptation or mitigation measures, will require a mixture of strategies at all levels from the visitor and staff level to agency-wide policies. Throughout this plan, relevant Centennial Horizon strategies are referenced and incorporated to ensure the agency vision is maintained, even as the landscape changes (OPRD, 2008). These response strategies will need to be periodically reviewed and revised, as necessary, based on ever evolving climate change science and knowledge about impacts.
1.3 Characteristics of Climate Change

Change is already occurring

Current climate model findings with emphasis on changes specific to the Pacific Northwest indicate there are likely to be a variety of changes in the coming century. The scientific literature also has documented change that is already occurring.

Global research indicates that rapid warming in the past 30 years is causing global temperatures to reach and exceed the warmest levels seen in the past 12,000 years (Hansen et. al, 2006). This research indicates that “Earth has been warming at the remarkably rapid rate of approximately 0.36° Fahrenheit (0.2° Celsius) per decade for the past 30 years.” As a result, global temperatures are only about 1.8°F off of the maximum estimated temperature during the past million years (Hansen et. al., 2006).

In the Pacific Northwest, average annual temperatures have already increased by 1.5°F over the last century, with higher minimum and maximum daily temperatures (Mote and Salathé, 2009). The snowpack in the Cascades has declined by approximately 25% along with a 2.5°F increase in the cool season (Karl et. al, 2009). The strongest observed declines have been at lower and mid-level elevations (Mote, 2003; Mote et. al, 2005). In the Pacific Northwest, the Oregon Cascades are some of the most sensitive to changes in temperature with projected regional warming combined with lack of any significant increases in precipitation potentially leading to large declines of spring snowpack (Mote et. al., 2005).

Coastal erosion is occurring, storms are already increasing in severity and frequency (Allan and Komar, 2006, Ruggiero et. al., 2010), global average sea level has risen 6.7 inches during the 20th century, and both sea surface temperatures and acidity have increased in the ocean (IPCC, 2007). For example, at Cape Lookout State Park coastal infrastructure is already under constant threat from the erosional forces of the Pacific Ocean.

Recent research by Oregon scientists indicates that once regional variations in tectonic activity, along with several other factors are considered, the “regional absolute” sea level rise is approximately 2.3 mm/year over the last 50 years (Burgette et. al., 2009).

Change is predicted to continue

Warming temperatures

Global projections made by the IPCC for the 21st Century suggest that there will very likely be “higher maximum temperatures, more hot days and heat waves...higher (increasing) minimum temperatures; fewer cold days, frost days, and cold waves over nearly all land...”
areas (IPCC, 2001)."

The IPCC predicts that over the next two decades, there will be an average global warming of approximately 0.36°F per decade, in line with observed warming trends over the recent past (IPCC, 2007). The most recent IPCC report gives “best estimates” and “likely ranges” for a variety of different scenarios for average temperature increases by the end of this century. For example, the best estimate for the low emissions scenario is 3.2°F (2°F to 5.2°F), and 7.2°F (4.3°F to 11.5°F) for the high scenario (IPCC, 2007).

In recent decades, scientists have noted that the Pacific Northwest is warming along with the rest of the planet with a “best estimate” for warming over the next fifty years to be 0.5°F (0.2-1.0°F) per decade (Mote et. al., 2008). This is a three times higher rate of warming than what was observed during the 20th century (CIG, 2008). Warming estimates are that the Pacific Northwest will warm an average of 2.0° F by 2030 and 5.3° F by 2080 (Table 1).

### Table 1. Average changes in Pacific Northwest Climate from a variety of climate models and greenhouse gas emission scenarios for the 2020s, 2040s, and 2080s (Modified from CIG, 2008).

<table>
<thead>
<tr>
<th>Year</th>
<th>Forecasted temperature change in °F</th>
<th>Forecasted precipitation change in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>+2.0 (+1.1 to +3.3)</td>
<td>+1.3 (-9 to +12)</td>
</tr>
<tr>
<td>2040</td>
<td>+3.2 (+1.5 to +5.2)</td>
<td>+2.3 (-11 to +12)</td>
</tr>
<tr>
<td>2080</td>
<td>+5.3 (+2.8 to +9.7)</td>
<td>+3.8 (-10 to +20)</td>
</tr>
</tbody>
</table>

### Changing precipitation
In general, the IPCC forecasts suggest a high likelihood of increased total precipitation at high latitudes (IPCC, 2007). The degree (or even direction) of this change in the Pacific Northwest is highly uncertain (Mote and Salathé, 2009). The Climate Impacts Group (CIG) at the University of Washington has done some work looking impacts to the Pacific Northwest (CIG, 2008). Estimates are that average annual precipitation will change only slightly, increasing only 1 to 3 percent over the next few decades, with a high degree of variability between the various models (Table 1). However, it is reasonable to expect that existing seasonal patterns will be emphasized with increased winter precipitation and decreases in the summer (CIG, 2008, Mote et. al., 2008; Mote and Salathé, 2009).

Predictions indicate that no matter how much precipitation actually changes, a larger percentage will fall as rain because of increased temperatures in the winter (CIG, 2008). The trend of continued reduction in snowpack, and earlier peak timing of snowmelt is expected, which may result in an earlier peak streamflow and lower summer flows (INR, 2004).

### Sea Level Rise (SLR)
Global average sea levels are projected to rise between 7 and 23 inches by 2100, a narrower range than prior estimates (IPCC, 2007). Increased storm activity, rising water levels may lead to increased requests for protective structures like those shown above (S. Williams, OPRD).
Climate Change Response Plan

Climate models suggest that more frequent fire is possible, which could further threaten park properties, like Succor Creek shown in this photo after a 2002 burn.

2007). However, these estimates exclude meltwater from the Greenland and Antarctic ice sheets due to an inability to model these impacts (IPCC, 2007). There is significant controversy about sea level rise projections, and some estimates are much higher, including consideration of ice sheet melting and past conditions, with estimates of around 3.3 feet by 2100 (Rahmstorf, 2007; CCSP, 2009). The precautionary approach would suggest accounting for the possibility that this upper level of rise is possible during planning efforts (CCSP, 2009).

Storminess
The gradual rise of sea level may not be as dramatic in Oregon as it may prove to be in low-lying coastal areas elsewhere around the globe. The nature of our coastline, combined with recent information that indicates that our local sea level rise may actually be slightly lower than global averages are some of the reasons for that (Burgette et. al., 2009). However, wave-induced processes are more influential here, and the extent to which erosional forces will respond to that gradual rise along with increased storminess, has the potential to greatly affect our coast (J. Allan, pers. comm, 2006).

Research indicates that there has been a decadal increase in wave heights and periods (Allan and Komar, 2006). Average winter wave heights have increased at a rate of approximately 0.1 feet/year or around 2 feet in 25 years (Ruggiero et. al., 2010). Heights of major storms waves have increased approximately 30 to 38 feet in the past 25 years off the Pacific Northwest (Allan and Komar, 2006). This increase in heights results in a 65% increase in wave energy density and power (Allan and Komar, 2006). Maximum wave heights approach around 50 feet off the Oregon coast and appear to be increasing (Allan and Komar, 2006; Ruggiero et. al., 2010). Scientists believe that it is likely these changes are linked to earth’s changing climate (Ruggiero et. al., 2010).

Sea Surface Temperature (SST) and Acidification
Projections show that summer SSTs for coastal waters off the Pacific Northwest will likely warm by about 2.7°F by the 2040s (Mote and Salathé, 2009). Although this is smaller than the variability projected for land, normal changes in the ocean are also smaller in the ocean, so these increases could be significant (Mote and Salathé, 2009).

The pH of the ocean, which has already dropped .1 unit, is expected to continue to acidify by an unprecedented 0.2-0.3 units by the end of the century as a result of increased atmospheric carbon dioxide (NRC, 2010).
2. Impacts of Climate Change

2.1 Projected consequences on natural and human systems

Climate change will have a variety of impacts on OPRD’s mission, our facilities, operations, programs and various statutory responsibilities. As discussed above, the types of changes likely to occur in Oregon range from increased temperatures, changing precipitation, increased storminess, and sea level rise. Ramifications of a changing climate with potential to have the biggest impacts on OPRD are briefly discussed here to help inform future action.

Natural and Cultural Resources

OPRD is committed to saving Oregon’s special places. To do that we strategize to “manage properties to ensure their health, to protect their beauty, and to restore rare, sensitive, threatened and endangered species (OPRD, 2008).” All of those aspects that make areas we manage special, ecologically healthy and biodiverse may be affected by climate change. Increases in regional temperatures over the next 10 to 50 years will likely result in “an increase in elevation of the upper tree line, longer growing seasons, increased length of [the] fire season, earlier breeding by animals and plants...and possible changes in vegetation zones (INR, 2004).” Decreased summer water availability may increase the potential for droughts and susceptibility of the ecosystems in our parks to insects, introduced species, disease and fire (INR, 2004).

- There is the potential for changes in species composition in habitats we manage, resulting mainly from warming temperatures (both air and water) and water availability.
- Warming appears to already be resulting in movement of species ranges to the north as well as higher in elevation, resulting in some localized extinctions (Parmesan, 2006).
- Negative impacts to threatened and endangered species like salmon are likely (e.g., from reduced streamflows and warming water temperatures). Localized extinctions are likely to increase, resulting in loss (or shifting) of biodiversity if species are unable to adapt (CIG, 2008). Species that do not have the ability to disperse easily and/or quickly are less likely to be able to adapt by changing their distributions (CIG, 2008).
- Increased temperatures in the spring and summer combined with melting snow occurring earlier in the year have already led to increased western forest fires and are likely to increase risk in the future (Westerling et. al., 2006).
- Increasing prevalence and severity of wildfires is likely due to increased woody shrub and grass growth, which when combined with reduced moisture in the summer, leads to increased risk of fire (USDA-FS, 2004; Karl et. al., 2009).
- Increased threat from pests, including existing and new invasive species that thrive...
in disturbed systems. Insect outbreaks (e.g., mountain pine beetle) are likely to increase and spread to new areas and habitats (Logan et. al. 2003; Kar et. al., 2009). New invasives may be more likely to become established (Logan et. al., 2003), making early detection and rapid response even more critical.

- Increased salinity in coastal estuaries, waterways and aquifers from sea level rise and salt-water intrusion, along with altered tidal ranges and changing sedimentation can threaten sensitive coastal ecosystems (IPCC, 2001; CCSP, 2009).
- Shoreline and tidally influenced estuarine habitat modifications are possible which could impact sensitive species habitat (e.g., snowy plovers, various estuarine species).
- Ocean acidification and temperature increases will likely have impacts on resources living within the ocean shore recreation area (e.g., rocky intertidal areas), and other nearshore marine life via both direct and indirect (e.g., food web) impacts.

The effects of climate change will likely impact cultural heritage sites throughout the world. Multinational groups such as the International National Trusts Organization (INTO) have highlighted the potential impacts of these changes (INTO, 2009). Sites of cultural significance including, but not limited to, buildings, structures, landscapes, sites, objects, and Traditional Cultural Places will likely be threatened by impacts of a changing climate (INTO, 2009).

- Cultural heritage sites may be threatened, damaged or destroyed by increased wildfires, storms and flooding.
- Archaeological sites and structures located on the coastline and within tidal zones may be threatened by increasingly erosive shorelines and inundation.
- Culturally important species, such as salmon, are expected to be impacted by reduced water quality from increasing stream temperatures, among other factors.
- Shifting species distributions may move them outside of the areas traditionally used by Oregon Tribes. This may effect the ability of the Tribes to maintain their traditions and way of life (NAST, 2000; Karl et. al., 2009).

**Facilities**

One Centennial Horizon Principle is that we will “Build the State Park System with Purpose and Vision (OPRD, 2008).” Some of that building, both planned and existing infrastructure, may be threatened by climate change.

- Increased erosion and storm related flooding can threaten OPRD’s infrastructure on the coast (IPCC, 2001; CIG, 2008; CCSP, 2009). Existing infrastructure damage and loss (e.g., many of our coastal campgrounds and day-use areas are in low lying areas), and even reduction in state lands (e.g. loss to actual land from erosion and possible submergence) are all possible ramifications.
of climate change.
• As temperatures increase and winter snowpacks decrease, reduced water availability in the summer (which coincides with peak recreation season) may impact OPRD operations. Along with increasing population, decreased water availability and increased demand due to climate change will require OPRD to be more conservative with water use in our facilities (CIG, 2008).
• A more intense and longer wildfire season not only threatens our natural but also our built systems.
• Given the proximity of state parks to rivers, streams and floodplains, if flooding events increase in frequency and/or severity, recreational facilities (e.g., campgrounds, roads, access points, trails) could be impacted.
• Additionally, many if not most inland state parks are located along rivers, streams or within floodplains, which makes them vulnerable to flood events.

**Ocean Shore Management**

OPRD’s statutory responsibility to manage the ocean shore as a recreation area includes permitting authority for shoreline protective structures, designed to slow-down erosion. Increased coastal erosion and flooding, loss of beaches, and vulnerability to periodic inundation are all possible ramifications of climate change, exacerbating current coastal hazards (CIG, 2008; Karl et. al., 2009). Coastal erosion is estimated to cause the coastline to retreat based on sea level rise and projected increases in storm activities (intensity and/or frequency) and natural episodic events such as El Nino.

The additive effects of changes such as increased storminess and periodic events like El Nino provide a better idea of the potential landward shift. Estimates for retreat of Pacific Northwest coastlines is on the order of 20-25 meters in the average winter shoreline in the next 25 years (Allan and Komar, 2006). The impacts are expected to vary a great deal both regionally but locally as well (Jonathan Allan, pers. comm., 2006).
• Applications for permits for hardened structures are closely tied to winter storm severity. Given the increasing susceptibility of shoreline properties, OPRD can expect to see increasing permit requests for hardened structures for eligible properties, especially along the north and central coast. Several coastal cities still have many properties that are eligible for hardening permits but do not currently have any in place. There will likely be more requests for permits.
• If permits are issued for all eligible oceanfront properties, some shorelines have the potential to be almost completely hardened within the next century. Hardened structures (e.g., rip-rap, sea walls) are believed to shut off sand supply and will likely lead to a gradual narrowing of the
beach over time (Griggs et. al., 1994).
• Sections of shoreline where there is practically no beach in the winter already, are likely to increase in number (Jonathan Allan, pers. comm., 2006). However, more study is needed in Oregon to be able to know with certainty the potential impacts of a hardened shoreline in the future.

Outdoor Recreation
OPRD is dedicated to providing quality recreational experiences statewide. We strive to do that by attracting and inspiring visitors and connecting people to meaningful outdoor experiences (OPRD, 2008). These recreational resources are threatened by climate change.
• Recreational activities that depend on water (e.g., rafting, kayaking, fishing) may be impacted as a result of changing snowpacks and reduced summer streamflows. There are likely to be more strains on water use, for which there are increasingly competing needs, which will likely impact recreation in some places (CIG, 2008; Karl et. al., 2009).
• A changing ocean and related erosion may lead to loss of recreational facilities and popular use areas such as beaches, especially low lying coastal parks on the north and central coast, and beaches with upland hardening.
• There is the potential that safe public beach access will be limited seasonally, or even, in some locations and as conditions worsen, beaches will be completely impassable.
• More intensive and longer exposure to allergens could lead to difficulties getting people outside (INR, 2004).
• Hotter weather and limited water availability may limit who wants to recreate outdoors in the hottest part of summer. However, a longer warm season may lead to an overall increase in recreation demand.
• Longer fire seasons may limit access to areas or activities (e.g., campfires, motorized recreation) and raise system-wide suppression costs.

Interpretation
As OPRD continues to engage visitors through education and outreach, it will be even more important to inform them about OPRD’s sustainability actions, things they can do to help reduce their footprint, and the impacts of climate change.
• Interpretive priorities, capacity, and budget may change in response to adaptation and mitigation.
• Interpretive facilities and structures may be threatened by fire, flooding, inundation.
• Messages and stories that interpretive staff currently focuses on may need to change and necessitate more training, education, and coordination as information changes.

Planning
• Planning priorities, capacity, and budget may change in response to adaptation and mitigation.
3. Recommendations

3.1 Guiding Principles

The park system we enjoy today is a result of the foresight of yesterday. Oregonians took bold actions that set aside priceless pieces of this state and OPRD’s job is to continue this legacy, even in the face of a changing climate (OPRD, 2008).

Although not a detailed guide to all the potential actions OPRD can take, this plan provides guidance about what we might do as an agency and as individual employees to help mitigate, respond and adapt given an uncertain future, including adopting the three following guiding principles:

- Reduce our footprint by improving efficiencies and conservation strategies throughout every facet of agency operations and associated interpretive strategies.
- Re-frame the actions we are currently taking at all levels of the agency, in the context of climate change.
- Consider the potential impacts of climate change in all future major decision making, including long-term development planning, design and acquisition strategies. By embracing adaptive management and reducing vulnerability by increasing resiliency, OPRD will be better suited to manage the natural and human systems for which we are responsible.

In addition to the recommendations in the “reducing our footprint” and “adapting to climate change” chapters that follow, the following items will help implement this framework plan over the long-term.
- Report to OPRD Commission at least annually on implementation of this plan and ongoing adaptive management.
- Prepare a set of case studies from different parts of the state (e.g., coast, valley, east side) to discuss, in more detail, the potential impacts of climate change on park properties.
- Develop an agency Climate Change and Sustainability Policy, to be reviewed and approved by the Commission.
- Develop a comprehensive Climate Change Interpretation Plan to effectively communicate climate change to our visitors, staff, volunteers and partners.
- Explore additional mitigation and adaptation options as new information becomes available.
- Continue to follow and examine state and other relevant policies and plans related to climate change including participation in state level climate change planning.
- Review, and participate in as appropriate, future state-specific climate vulnerability assessments.
3.2 Reducing our Footprint

It is already an OPRD policy to: “plan, design, and implement operations, business systems, and resource management practices consistent with the principles of conservation, energy efficiency, and sustainability (OPRD COM-20-0-Natural Resource and Environmental Management)”. Additionally, one of the guiding principles of the Centennial Horizon Plan is essentially related to long-term sustainability, or “Taking the Long View” (OPRD, 2008).

The objective of the following recommendations is for OPRD to continue, with a heightened awareness of the urgency to act, to explore ways to reduce activities that contribute to climate change (e.g., greenhouse gas production). Reducing greenhouse gas production (commonly referred to as “reducing our footprint”) may not be significant on a global scale but the agency can lead others by example.

Although not exhaustive, the following actions will help OPRD reduce our footprint, showcase sustainable energy sources and practices with our visitors, as well as help with long-term cost savings. These actions, both general and specific, will help guide OPRD in reducing our footprint more comprehensively and follow existing policy.

**General**
- Evaluate inefficiencies throughout every facet of OPRD operations and identify ways to improve.
- Incorporate sustainable practices, wherever feasible, into all facets of the department’s mission, particularly: facility and site planning, design, construction, operation and maintenance; grant programs; contracting and procurement, and visitor programs and services (COM-20-0);
- Continue to explore and implement emission mitigation actions, using the OPRD Sustainability Committee as a sounding-board for ideas. Encourage all employees to submit ideas to the committee, and develop mechanisms to make this easy to achieve.
- Explore ways to adopt the “Climate Friendly Parks” model set by the National Parks Service
  - Explore options for inventorying existing greenhouse gas emissions and use them to plan to reduce emissions (e.g., the HUB, CLIP model from NPS).
  - Discuss benchmarks/goals for agency-specific greenhouse gas emission reductions, consistent with state guidelines.
- Continue to explore opportunities for carbon sequestration projects.
- Work with partners and continue to acquire
and restore properties with wetlands (and other ecosystems) that provide important ecosystem services that may help buffer against the impacts of climate change.

- Train staff and volunteers to reinforce the agency’s commitment to resource stewardship and conservation and to gain compliance with adopted practices (OPRD COM-20-0);
- Use this plan to inform development of relevant Centennial Horizon action items.
- Develop strategies for short and long-term funding sources.

**On-site Energy Use**
- Reduce fossil fuel consumption by adopting more stringent energy conservation measures.
- Continue to explore and encourage on-site production and/or purchasing of renewable electricity. Expand on actions already identified, such as purchasing green power at north coast parks (Centennial Horizon strategy) and installing solar power at the Oregon Exhibition Center.
- Consider energy efficiency when replacing equipment, such as major (e.g., furnaces) and minor (e.g., office equipment, lighting) appliances and electronic equipment.
- Use biodiesel in generators and other stationary equipment as appropriate and practicable.
- Measure and record the “true-cost” of energy (i.e., “cradle to grave”) use at park facilities, and consider, over the long-term including those in fee structures.

**Transportation**
- Reduce fuel consumption by employing alternative means of transportation (e.g., carpooling), working (e.g., teleworking) and meeting techniques (e.g., conference calls, on-line webinars and conferences).
- Explore options to provide incentives to encourage alternative transportation means such as preferred carpool parking and bike storage.
- Encourage electric, hybrid and fuel efficient and alternative (e.g., biodiesel) fuel vehicular options when considering leasing DAS vehicles and other transportation related purchases (including electric vehicles for on-site transportation, electric mowers and bicycles).
- Include brief (e.g., iLearn) training for employees that drive for work to improve gas/mileage efficiencies (e.g., as part of the already required safe-driving training).

**Waste Elimination**
- Increase agency-wide recycling and re-use, including exploring composting options within state parks, the Oregon State Exposition Center, and OPRD Headquarters. Work with partners (e.g., vendors, concessionaires, Friends groups) to do the same.
- Encourage, as practicable, on-site composting of food-waste and other
• Make recycling as easy as possible for visitors, by centralizing it and making facilities a highly visible alternative to adding to the waste stream.
• Require employees to evaluate use of “surplus” items prior to purchasing new equipment (e.g., office supplies, desks, chairs etc.).
• Increase water conservation and wastewater reduction, through careful management at all OPRD managed facilities.
• During the design phase of construction projects (including restoration/renovation), assess options for reuse (either on-site or off) of materials, and if not possible recycle.
• Incorporate “green” materials (e.g., recycled content, compostable, low emissions paint, fertilizers, cleaning products) and concepts into all agency activities, all the way from staff meetings to large procurements, including at the State Fair and for concessionaire agreements across the state.
• Evaluate historic structures to determine suitability for re-use. In situations where re-purposing reduces impacts compared with new construction, consider this option.
• Upgrade historic buildings for energy efficiency to lower energy use and decrease overall resource consumption, wherever practical.

Outdoor Recreation

OPRD is committed to connecting people with meaningful outdoor experiences (OPRD, 2008). The very nature of doing that creates indirect footprints, those of the millions of park visitors that travel to visit OPRD’s natural, scenic, cultural, historic, and recreational sites.
• Develop opportunities (with partners) for non-motor-vehicular recreation and alternative modes of transportation (e.g., public transit, carpooling, shuttles) to access outdoor recreation statewide, particularly near urban centers.
• Work with partners to provide close-to-home recreational opportunities.
• Develop incentives to encourage visitors to use alternative and fuel efficient transportation to reach parks.
• Work with partners to create interconnected systems of bicycle, hiking and water trails, including those close to home.
• Examine existing recreation grant criteria for opportunities to incorporate sustainability.

Interpretation
• Showcase exemplary environmental practices and engage visitors through interpretive techniques to encourage them to reduce their own footprints.
• Recognize achievements of staff, partners, volunteers and visitors and share those through on-site and other educational means (e.g., improving the sustainability portion of the OPRD website).
• Provide education/training opportunities to
help OPRD staff and volunteers reduce their personal and work-related greenhouse gas emissions.

- Conduct educational and interpretive activities to inform and inspire visitors and local communities to reduce their impact on the environment for the benefit of present and future generations (OPRD COM-20-0).
- Develop visitor education on energy and water conservation in parks (e.g., campground programs, the OPRD website). Topics for programs could include, for example, turning off AC’s in RV’s when not in use and solar power options for RVs.

**Planning and Development**

“When we build and maintain parks, heritage areas and facilities, we must balance the needs of today’s recreation with tomorrow’s health. It is incumbent upon us to use environmentally sound and culturally sensitive methods of construction, [design] and maintenance” in the park system (OPRD, 2008). The following actions will help us do that.

- Prioritize energy and resource efficiencies into design of new and renovated facilities.
- Develop emergency response plans with contingencies for increased flooding, fire, and storms/storm surges.
- Support local entities and agencies in future emergency response and planning in coordination with partners.

- Take into account OPRD’s carbon footprint when conducting landscape design.
- Place native trees and shrubbery to offset carbon and enhance habitat.
- Design to preserve and enhance wetlands and other natural areas.
- Plan trails to minimize human impacts, especially in sensitive areas.
- Minimize carbon based maintenance (e.g., mowing, water intensive features) through design.
- Minimize the use of irrigated turf grass areas and emphasize native, drought tolerant plantings wherever feasible.
- Inventory and reduce hard surfaces that may exacerbate storm runoff and where feasible relocate facilities outside of floodplains.
- Some resource efficiency “best practices” identified by OPRD that should be employed in new facility design and significant modifications include (OPRD, 2002):
  - Day lighting, passive cooling, full insulation, efficient lighting and appliances, occupancy sensors, and high efficiency heating on an as-needed basis.
  - Consider durability and longest economically achievable design life in choosing building materials and features (e.g., water and waste water systems storage/conveyance).

Wetlands provide critical ecosystem services that may help buffer against the impacts of climate change. Beaver Creek State Natural Area, on the central Oregon coast is pictured below (J. Little, OPRD).
3.3 Adapting to Climate Change

We may not know what exactly will be happening 5, 10, or 50 years down the road, but by using this plan as a starting point, we can employ adaptive management to help us respond to Oregon’s changing climate. Climate change needs to be brought down to the operations level, and be ingrained in all employees that this is a consideration for all relevant major and even minor decisions. We need to do this collectively and set the stage so we are not as reactive as we are today. An organization that accepts change and adapts to it quickly will be better prepared in the future that is before us.

Natural and Cultural Resources

OPRD strives to manage properties to ensure their health, to protect their beauty, and to restore rare, sensitive, threatened and endangered species (OPRD, 2008). This needs to be done in the context of climate change as we adapt as an agency.

Sensitive Species

- Increase current efforts to manage park properties to reduce human-induced stressors, promote biodiversity (Baron et al., 2009) and ecosystem resilience.
- Work with partners to identify sensitive species, including those that are currently rare, culturally sensitive, and/or threatened and endangered and living within park properties and managed areas that are at high risk from projected changes in climate.
- Acknowledge that it won’t be possible to maintain many species in their existing range, much less within a given park and thus, prioritize restoration efforts and other management strategies to help protect species and habitat resilience.
- Consider ramifications of climate change when evaluating properties for acquisition, including potential habitat for sensitive and rare species, habitat, and communities.

Forestry Management

Forests have been touted as ways to store large amounts of carbon (i.e., carbon sequestration). This may conflict with forest policies of fuel reduction to reduce fire risk since fire, which is projected to increase with climate change, can release stored carbon (USDA-FS, 2004). The US Forest Service acknowledges that “balancing the carbon budget may become a consideration in forest management” and it should be a consideration in OPRD’s forest management practices as well (USDA-FS, 2004).

- Incorporate climate change into decisions related to OPRD’s forest management.
- Investigate fire prone areas to reduce risk to existing, planned, and future infrastructure as part of fire and forestry management planning (Baron et al., 2009).
- Include increasing droughts, the probability of longer hotter summers, and insect/
disease infestations into decision making, such as when choosing species to plant (USCRP, 2000; USDA-FS, 2004).

- Continue to manage forests to reduce susceptibility to catastrophic fire.

**Invasive Species**

- Explore opportunities to partner with the other state and federal agencies, and universities, to improve educational programming on invasive species in Oregon, and at Oregon State Parks (OPRD, 2008).
- Develop educational items/trainings for OPRD staff and volunteers to help improve early detection and rapid response (EDRR) in Oregon State Parks, and waterways we provide access to including but not limited to the Ocean Shore Recreation Area and State Scenic Waterways.
- Develop EDRR techniques, protocols and training by OPRD District.

**Cultural Resources**

- Continued inventory and documentation of cultural resources found in parks will provide a permanent record, and potentially highlight sites located in areas of high risk from coastal erosion, flooding, etc.
- Assess vulnerabilities of cultural resources within the park system to help inform future management actions. For example:
  - Excavation of archaeological sites might be appropriate if they are in danger of damage or destruction from coastal erosion, flooding, etc. Documenting and removing the archaeological materials could provide a means for mitigating damage, if a site is threatened. Moving historic buildings may be justified in some cases if they are at extreme risk.

**Ocean Shore Management**

- Revise ocean shore rules and policies in consideration of climactic change effects.
- Conduct an assessment of DLCD’s Goal 18 eligibility database to identify shoreline areas likely to become an issue in the future.
- Continue to promote more “natural” approaches to shoreline protection such as the cobble berm employed at Cape Lookout.
- Participate, as practicable, in planned regional littoral cell planning to help communities plan for more significant wave impacts and erosion.
- Evaluate new information that may be soon available regarding impacts of sea level rise in Oregon (NRC study to be conducted over the next 2 years).
- Review the products of the West Coast Governor’s Agreement on Ocean Health (WCGA) related to Coastal Climate Change Adaptation (e.g., adaptation planning resources), which are expected in the future. Expected products include, for example, a classification system for modified shorelines, and how those might be impacted by climate change.
- Participate in planned pilot vulnerability assessments and adaptation strategies for coastal communities as outlined in the
West Coast Governors Agreement.

Outdoor Recreation
- Incorporate climate change considerations into SCORP planning recommendations and other venues in which we participate in outdoor recreation discussions (e.g., the Oregon Outdoor Recreation Council).
- Consider future climate scenarios when assessing the supply and demand for recreation resources on a regional basis.
- Examine participation trend information to identify the effects of climate change on recreation behavior.

Interpretation
- Provide education/training opportunities to OPRD staff and volunteers on impacts of climate change, mitigation and adaptation strategies.
- Share information about what OPRD is doing to reduce its footprint and adapt to climate change with visitors, staff, and volunteers (e.g., interpretive programs, online, staff-meetings, training materials).
- Emphasize that efforts are intended to reduce long-term maintenance costs.
- Enhance current efforts to showcase sustainability at the Oregon State Fair. Encourage the addition of additional materials on climate change impacts, mitigation and adaptation techniques to inform the general public.

Planning and Development
OPRD plans to build a state park system with purpose and vision and take the long view (OPRD, 2008). Climate change needs to come into the purpose and vision not only during every-day actions but also in long-term planning for park development and acquisition.
- Incorporate climate change considerations into long-range planning for park development, natural and cultural resource management and acquisitions.
- Employ the precautionary principle in management planning given the high level of uncertainty moving forward in time (Baron et. al., 2009).
- Consider longer time intervals than perhaps we have in the past (e.g., 10-25 and even 50-75 year scales), especially involving major investments and infrastructure intended to survive longer than 10 years (CCIG, 2008).
- Plan interdisciplinarily and at larger scales to insure integration between different sectors to increase resiliency (CCIG, 2008; Baron et. al., 2009).
- Include multiple scenario planning exercises in major decision making (Baron et. al., 2009).
- Avoid development of new facilities within highly vulnerable floodplains, erosion hot-spots or fire prone areas.
- Discuss implications of climate change when looking at visitor capacity issues, including exploring new acquisitions.
• Inventory all parks for vulnerability (e.g., inland flooding, coastal storm surges and wildfires) and prioritize facilities for relocation as funding is available. Conduct a cost/benefit analysis when discussing potential relocation options.
• Incorporate measures to reduce vulnerabilities to threats exacerbated by climate change in emergency response and disaster planning.
• Consider ramifications of climate change on existing park properties and resources when evaluating properties for acquisition to protect significant landscapes, natural resources (e.g., sensitive species habitat such as coastal estuaries and waterways within parks), historical sites or cultural areas (OPRD, 2008).
• Acknowledge changing climate trends and recent scientific findings to inform future design and construction of facilities. For example, analysis that are used to build structures usually account for past trends (e.g., the “100-year storm”, floods etc.).
• Consider future changing shoreline scenarios when planning any significant infrastructure development (e.g., major financial investments, structures intended to last more than 10 years) in Oregon’s coastal parks, particularly those that are low-lying and already prone to flooding, slides and erosion (USCRP, 2000).
• Evaluate all strategies and actions articulated in the Centennial Horizon Plan in the context of climate change.
• Coordinate with local governments and relevant state and federal agencies to ensure the best available scientific information is being considered when coastal development like shoreline hardening is proposed.

**Partnerships**
Increasingly, partnerships with other local, state, and federal agencies will be important as the state works to adapt to a changing climate. Topics that may need increased coordination include sensitive species management, emergency response planning, invasive species, and fire management. Additionally, research needs will be beyond the scope of what OPRD staff can accomplish itself. Partnerships with other agencies and research bodies will be crucial to getting the information we need to improve adaptation planning and response.

• Explore partnership and funding opportunities to achieve the action items outlined in this plan and those that emerge in the future. For example, work closely with OWEB and local watershed councils to enhance watershed function and thus, ecosystem resilience.


4. Implementation

4.1 Adaptive Management

This framework plan and OPRD’s response to climate change will both need to evolve as the information becomes more certain and impacts to OPRD become clearer. Currently, this plan focuses on foreseeable and imaginable changes (Baron et. al., 2009). However, given the nature of climate change, this plan will be modified to incorporate important new information, particularly currently unknown or surprising changes (Baron et. al., 2009). Staff will review scientific and policy information, at a minimum every 10 years, and revise strategies to reduce impacts and meet any new demands and goals of the agency. If highly pertinent and significantly different information becomes available, this plan should be revised as soon as possible.

4.2 Recommended Actions

Establishing an integrated planning approach to Climate Change response will help ensure future planning and development will incorporate these concepts into decision making throughout the agency. The following are recommended near-term actions that can be accomplished using existing resources.

Near-term Actions

- Integrate the department’s efforts of environmental management, sustainability, energy and economic efficiencies, and reduction of Greenhouse gas (GHG) footprint into one initiative.
- Establish a simple governing structure to lead this initiative that expands on the existing Sustainability Committee and has direct linkages to executive management.
- Leverage existing resources to meet sustainability goals. For example, use the Operations Efficiency Incentive Program to support GHG footprint reducing actions.
- Prioritize energy and resource efficiencies into design of new and renovated facilities.
- Apply the “Climate Friendly Parks” model developed by the National Parks Service to three parks, one in each region, as a pilot test for applicability throughout our system. Use the Climate Leadership in Parks (CLIP) modules to conduct a park inventory, calculate GHG emissions, and develop a plan for the most efficient means...
for reduction of the parks’ GHG footprint.

- Reduce motorized vehicular dependency within and to-and-from parks.
- Encourage electric, hybrid, fuel efficient/no-fuel (e.g., bikes) and alternative-fuel options when leasing or buying vehicles and for other transportation related purchases (e.g., vehicles for on-site transportation).
- Apply sustainability criteria to OPRD grant programs.
- Explore opportunities for carbon sequestration projects with partners, while continuing to plant native trees and shrubs for sequestration and habitat enhancement.
- Reduce stresses from park use and development on sensitive species threatened by climate change.
- Prioritize restoration efforts and other management strategies to protect and enhance biodiversity and habitat resilience.
- Work with partners to acquire and restore properties with ecosystems (e.g., wetlands) that may help buffer against the impacts of climate change.
- Increase forest management practices (i.e. thinning for forest health and fuels management) that reduce vulnerability to climate change effects.
- Train staff to identify and detect aquatic invasive species (AIS), post signs at boat ramps, and distribute brochures at targeted parks susceptible to AIS.

- Incorporate ways to improve efficiencies into existing OPRD employee driver training.
- Incorporate anticipated climate change impacts in Ocean Shores rule-making.
- Prioritize scheduled inventories and documentation of cultural resources based on parks more susceptible to disturbance resulting from climate change.
- Showcase exemplary environmental practices and engage visitors through interpretive techniques to encourage them to reduce their own footprints.
- Recognize achievements of staff, partners, volunteers and visitors and share those through on and off-site educational means.
- Conduct educational and interpretive activities to inform and inspire visitors and local communities to reduce their impact on the environment for long-term sustainability.
- Consider anticipated effects of climate change in planning any significant development, especially on the coast. Avoid development in highly vulnerable areas.

A comprehensive approach will be established to carry this process forward and will require the further development of interpretive concepts, specific management actions, budget needs, and operational actions and planning. OPRD will rely on the Sustainability Committee for evaluation of early actions, incorporation of new emerging information, adaptive management, and development of a long-term climate change adaptation strategy.


