Preparing for Climate Change in the

Upper Willamette River Basin of Western Oregon

Co-Beneficial Planning for Communities and Ecosystems

EXECUTIVE SUMMARY

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Full Report Available at:

http://climlead.uoregon.edu/programs/scenariosplanning.html

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Executive Summary

The Intergovernmental Panel on Climate Change (IPCC) reached a consensus in 2007 that the evidence is now "unequivocal" that the earth's atmosphere and oceans are warming and concluded that these changes primarily are due to human activities (IPCC, 2007). While reducing carbon and other greenhouse gas emissions is vital to stabilize the climate in the long term, excess emissions already concentrated in the atmosphere will produce significant changes in the global climate now and throughout the next century. These changes are expected to transform natural systems and pose new stresses on native species in the Upper Willamette River Basin. Changes in the Basin's natural systems will, in turn, modify the way the local economy functions and produce new stresses on infrastructure and buildings, human health, and the quality of life of the people who live in and enjoy the Upper Willamette River Basin.

Numerous initiatives already underway will have benefits that help prepare the Basin's communities, economy, and landscapes for these effects. However, few initiatives focus on the actions needed to prepare explicitly for climate change. Expanding existing activities, launching the additional climate preparation efforts described in this report, and continuing to develop new strategies in an integrated and co-beneficial manner can help build resistance and resilience to climate change across multiple scales in the Upper Willamette River Basin and enable the region to thrive over the coming century.

In the fall of 2008, the University of Oregon's Climate Leadership Initiative (CLI) and the National Center for Conservation Science & Policy (NCCSP), in partnership with the Mapped Atmosphere-Plant-Soil-System (MAPSS) Team at the U.S. Forest Service Pacific Northwest Research Station, initiated a project to assess the likely consequences of climate change for the Upper Willamette River Basin. The Basin is defined as the region from the confluence of the McKenzie and Willamette rivers south and east to the headwaters of the South Fork Willamette, Middle Fork Willamette, and McKenzie rivers. This report outlines a framework for climate preparation activities in the Basin, but specific details, locations and issues will need to be addressed by other groups, community leaders, and scientists.

This project began by considering projected changes in temperature, precipitation, fire patterns, and distribution of native vegetation for the Basin, based on the downscaling of three global climate models reviewed by the International Panel on Climate Change (IPCC) and a vegetation model developed by the MAPSS Team. The three global climate models applied in this study are considered to have high scientific credibility, although recent evidence suggests that the current suite of climate models reviewed by the IPCC underestimate the potential severity of climate change over the next 100 years (MWC, 2009; Schwartz, 2009). Regardless, basin-scale projections of future temperature and snowpack are considered to be more reliable than projections of precipitation and fire.

CLI and NCCSP convened a panel of scientists and land managers to determine the likely stressors to natural systems posed by projected changes in climate. This panel also was asked to make recommendations for increasing the capacity of ecosystems and species to withstand and adapt to climate induced stressors. Using these findings, a panel of policy experts then assessed the risks for built, human, and economic systems within the Upper Willamette River Basin. The policy panel also made recommendations for preparing these sectors for the adverse effects of climate change. This report summarizes the key findings and recommendations made by these panels.

Findings: Future Climate Conditions

Conditions in the Upper Willamette River Basin are projected to change substantially during the coming century due to changing global climate conditions.

Temperature

- Annual average temperatures are likely to increase from 2 to 4º F (1 to 2º C) by around 2040 and an additional 6 to 8º F (3 to 4º C) by around 2080.
- Average summer temperatures are likely to increase 4 to 6º F (2 to 3º C) by 2040 and an additional 4 to 8º F (2 to 4.5º C) by 2080, while average winter temperatures may increase 1 to 2º F (0.5 to 1º C) by 2040 and an additional 2 to 4º F (1 to 2º C) by 2080.

Precipitation and Snowpack

- One model shows a slight increase in mean annual precipitation while the other two models show no real change.
- By 2040, all three models predict slightly less precipitation during spring, summer and fall and two models predict slightly more precipitation in winter.
- By 2080, precipitation patterns could range from a slight year-round decline to larger shifts that include monsoon patterns in the spring coupled with increased seasonal drought in the summer.
- Snowpack across the Pacific Northwest is likely to decline by 60% by 2040 and 80-90% by 2095 from current levels.
- As snow melts earlier in the spring, stream flows will peak earlier but at lower levels than typical flows in recent years, depending on the geology of the particular stream reach.

Storms and Flooding

- With warmer oceans and more available moisture in the atmosphere, storm events could increase in intensity, resulting in more flooding in all rivers in the Basin.

Wildfire

- One model projects conditions that may lead to more wildfire and a much greater proportion of area burned in the Basin, while the other two models anticipate little change from historic conditions.

Vegetation Change

- Although current conditions in much of the Basin are suitable for coastal spruce and fir, future conditions in the western portion may become more suitable for mixed pine, hardwoods, and oaks. Growing conditions in the eastern portion may best support ponderosa pine and Douglas-fir.
- Despite changes in growing conditions, plant and wildlife communities may take decades or centuries to adjust, making the timing of changes to dominant vegetation difficult to project. Fire is expected to be a major agent of vegetation change, even if fire incidence and size remain at approximately current levels.

Findings: Consequences of Projected Climate Change on Natural Systems

Based on the projected changes in climate conditions, the science panel identified the following likely consequences for aquatic and terrestrial systems and species in the Basin:

Aquatic Systems and Species

- Increased winter storm intensity, changes in seasonal precipitation patterns, and increased temperatures are likely to be detrimental to the reproduction and survival of many native fish and amphibians.
- Increasing temperature is likely to benefit warm water native species and non-native fishes and amphibians while harming native species that rely on cooler water. This will likely result in the decline of Chinook salmon, steelhead, and Oregon chub. Spring Chinook are likely to have particular problems in the lower Middle Fork due to higher temperatures.
- Spring-fed streams and riparian areas will be buffered somewhat from climate change due to mediated shifts in flow and temperature. The McKenzie is likely to remain the best stronghold for fish in the Upper Willamette. The Middle Fork also may see more moderate changes in flow.
- Because the McKenzie watershed is vital to Eugene municipal water supply in the summer months, increased summer drought and evapotranspiration could lead to seasonal water shortage.

Terrestrial Systems and Species

- The greatest risk to terrestrial systems and species is the potential for climate change to exacerbate existing stressors, such as fragmentation (e.g. loss of connectivity due to roads or land clearing), invasive species, and habitat loss. Warmer temperatures and drought stressed vegetation are likely to provide more favorable conditions for disease, insect pests, and invasive species that will negatively impact wildlife and wildlife habitat.
- The goods and services that humans gain from natural ecosystems, such as clean water and recreational opportunities, are likely to be negatively impacted and degraded as a result of climatic changes to the natural system. Some species will be especially at risk, including those at high elevations (alpine and subalpine species), species that depend on old-growth forests (e.g. northern spotted owl), moisture dependent species (e.g. waterbirds, some salamanders and land snails), species that already are rare and declining, and maritime evergreen associated species (e.g. marbled murrelet).
- Areas especially at risk include lower elevations of the Basin, notably including the Coast Fork, where stressors such as erosion, development, and logging already are higher. Areas at the interface between public and private lands, where management issues such as fire and invasive species control become problematic due to differing objectives, also will be particularly vulnerable.
- Invasive and exotic species that have evolved to colonize quickly following disturbance (such as fire) and those that are habitat generalists will gain a competitive advantage. For example, non-native blackberry and bullfrogs could become more common across the landscape. Some species that are not considered to be invasive under current conditions could become invasive as conditions change.

Recommendations: Prepare Natural Systems for Climate Change

The panels made the following recommendations to prepare aquatic and terrestrial systems for climate change:

- Prioritize the following areas for protection from development and degradation: areas that provide ecosystem services, such as recreation, flood control, water storage, and carbon sequestration; areas that provide "climate refuges" in the form of cooler local climate and less change to vegetation; and areas typified by intact or slightly modified ecosystems that currently have few external stressors.
- Increase early detection and rapid response efforts to identify, manage, and control invasive species. Standards should be developed for determining when species are considered invasive and when they are successfully shifting their ranges due to climate change.
- Base resource management decisions on a thorough understanding of the entire ecological system, climate change projections for the

area, and careful consideration of the outcome of alternative management actions. Goals for all management decisions should include maintaining resiliency and flexibility.
- Adopt new conservation priorities based on a sound understanding of future climatic and ecological conditions in specific locations. Rather than continuing to manage to retain historical conditions and species, future goals will need to shift towards protecting and restoring key parts of the landscape that will be able to withstand the additional stress of climate change.
- Update methods for resource monitoring and evaluation continually in order to detect climate change impacts and trajectories while testing the efficacy of management action. Because ecological communities are expected to unravel, monitoring of individual species as well as ecological relationships within ecosystems will become increasingly important.
- Direct planners and managers to work across jurisdictions to develop interdisciplinary, co-beneficial strategies and policies that build resistance and resilience to climate change impacts.
- Replace the 'multiple use approach' to federal lands policy with a 'whole systems' approach that strives to maintain and enhance the processes and components of the landscape that are vital to sustaining water quality and availability, soil health, nutrient cycling, and other critical ecosystem services. This will facilitate decisions that allow forests, wetlands, and other natural systems to withstand and adapt to climate change.

Findings: Consequences of Projected Climate Change on Built, Human, and Economic Systems

Based on the projections of likely changes to the climate system and assessments by the science panel of the impact of such changes on natural systems, the policy panel identified the following risks to built, human, and economic systems in the Upper Willamette River Basin:

Infrastructure, Transportation and Buildings
- Increased flooding and wildfire is likely to produce greater risks for buildings, transportation systems, and other public infrastructure, especially in floodplains and areas within the wildland-urban interface.

Energy Systems
- Reduced snowpack and summer water storage in reservoirs behind generation facilities is likely to diminish hydroelectric generation.
- A possible increase in the number of acres burned by wildfire may threaten power lines in some locations.
- Wildfire and persistent summer drought may reduce the supply of biomass for new large-scale biomass energy power plants.

Public Health and Emergency Services
- Increases in ground level ozone, increased allergens, degraded air quality, and potentially increased wildfire will likely cause higher rates of asthma and other respiratory diseases.
- Warmer waters and more mosquitoes and ticks are expected to lead to an increase in vector-borne diseases (those transmitted through another organism, such as a mosquito) such as West Nile Virus, as well as water-borne disease such as cryptosporidiosis, a parasitic disease of the intestinal tract.
- Higher temperatures will likely lead to increased heat stroke and cardiovascular disease, particularly for those without air conditioning.
- Warmer temperatures may lead to more food contamination.
- Higher concentrations of people due to population growth and climate refugees (i.e., people coming to Oregon to escape greater climate stress in other areas) may create conditions for communicable disease outbreaks.

Agriculture and Forestry
- Reduction in snowpack will diminish water supplies from streams, reservoirs, and groundwater available for irrigation.
- Crops sensitive to higher day and nighttime temperatures, such as some varieties of wine grapes, will lose viability. Other crops may benefit from a longer growing season.
- The possibility of increased acres burned by wildfire, increased disease, and persistent drought may reduce levels of sustainable green tree timber harvest due to lower productivity.

Manufacturing, Retail and Service Sectors
- Energy prices may rise as hydroelectric production declines and energy sources shift to new technologies rather than carbon-based fuels.
- Reduced snowpack and warmer winter temperatures will impair winter recreation, but spring and summer recreational opportunities may expand due to warmer temperatures.
- Increased flooding and acres burned by wildfire may isolate certain smaller communities and homeowners as well as disrupt transportation systems.
- Increased stream runoff rates may increase costs of treating public water supplies.
- Because the food system currently is heavily reliant on imported foods, disturbances to transportation systems due to increased storm activity could threaten local food security.

Recommendations: Prepare Built, Human, and Economic Systems for Climate Change

The policy panel made the following recommendations to prepare human, built, and economic systems for climate change:

Local Government Planning, Public Infrastructure, and Building Agencies

- Prevent expansion of residential development into forested areas and floodplains to reduce risks of property damage and loss of life from increased flooding and wildfire, and retain the capacity of the land to moderate flooding and fire.
- Account for projected climate change impacts in land use planning, regulation, and zoning. Reduce development that increases vulnerability to flood and fire and increases demand for emergency services.
- Incorporate energy efficiency and waste reduction in all new and existing buildings.

Emergency Management Agencies

- Implement educational outreach to private landowners to provide information on risks and methods for protection so they can take protection of homes and selves from extreme weather events and fires into their own hands.

Public Health Agencies

- Initiate programs to monitor and develop appropriate responses to the likely increase in heat related illnesses.
- Build cooling centers for public use during extreme heat events and develop means for transporting vulnerable populations to the centers.
- Develop an expanded approach to the likely increase in asthma and other respiratory diseases.
- Expand vector-borne disease control programs to develop strengthen monitoring, early warning and management of outbreaks.

Agriculture and Forestry

- Research and develop new crop varieties suitable for a warmer climate that may be wetter in the winter and drier in the summer.
- Encourage local food production to build resistance to transportation disruptions.
- Embrace local, state, and federal policies that protect land from urban sprawl and encourage water use efficiency.
- Reexamine the existing water rights system, assess groundwater resources and well capacity, and reevaluate existing permits in light of future potential water limitations to avoid over-appropriation.
- Research how transitions in growing conditions will affect reforestation decisions and how resilience to climate-induced impacts can be enhanced with revised management strategies on private, state, and federal lands.
- Link preparation strategies to economic development opportunities. For example, integrate efforts to reduce wildfire fuels near homes with biomass energy production (i.e. use brush near homes to create electricity).

Manufacturing, Retail, and the Service Sectors

- Implement energy and water use efficiency strategies to encourage a reduction in demand so that systems are not stressed during extreme weather events.
- Install on-site renewable energy systems like solar photovoltaics to provide energy security and insulate businesses from power outages due to storms or wildfire as well as price fluctuations of traditional fuels.
- Institute widespread outreach and education to businesses on climate associated health risks for employers to help protect workers.

Recommendations: Adopt Governance Systems Appropriate for Rapidly Changing Climatic Conditions

A consistent theme heard from the panels was the need for new types of information, resource allocations, and decision-making mechanisms. In short, because future conditions will be very different from the historic conditions that our current systems were based on, the panels called for new and expanded forms of governance. Specific recommendations include:

- Adopt governance models that cross traditional boundaries. For instance, governance based on counties and cities should expand to encompass structures based on watersheds or climatic regions. In addition, preparation strategies should seek to provide benefits for all regions and sectors.
- Focus planning and decision-making teams on inclusive participation and diverse stakeholder representation. Climate change expands the realm of the issues and people that may be affected by projects and policies.
- Use scenario planning to consider management options across the full range of possible future conditions. Analyze current data gathering and monitoring systems and adopt mechanisms that are better suited for rapidly changing conditions.