Oregon Fish and Wildlife Commission Minutes

Climate Change Workshop:
October 9, 2008 9:00 a.m.
Oregon Department of Fish and Wildlife
Commission Room
3406 Cherry Avenue NE
Salem, OR 97303

Meeting:
October 10, 2008 8:00 a.m.
Oregon Department of Fish and Wildlife
Commission Room
3406 Cherry Avenue NE
Salem, OR 97303

Marla Rae, Chair	Roy Elicker, Director
Dan Edge, Vice-Chair	Curt Melcher, Deputy Director
Jon Englund, Commissioner	Holly Michael, Conservation Strategy Leader
Skip Klarquist, Commissioner	Ronald Anglin, Wildlife Division Administrator
Bobby Levy, Commissioner	Ed Bowles, Fish Division Administrator
Zane Smith, Commissioner	Roger Fuhrman, I&E Administrator
	Chris Wheaton, Northwest Region Manager
Bruce McIntosh, Fish Div. Deputy Administrator	Chip Dale, High Desert Region Manager
Mark Chilcote, Fish Conservation Project Leader	Craig Ely, Northeast Region Manager
Teri Kucera, Executive Assistant	Bruce Eddy, Grande Ronde Watershed Manager
Kristeen Volpa, Office Specialist 2	Larry Cooper, Wildlife Div. Deputy Administrator

WELCOME AND REMARKS

Commission Chair Marla Rae called to order the Climate Change Workshop on Thursday, October 9, 2008, at 9:00 a.m. She acknowledged all the guest speakers and thanked them for their participation.

INTRODUCTIONS, LOGISTICS AND FACILITATION

Holly Michael said the intent of today's workshop is to provide an informal dialogue and a broad overview of how climate change will affect Oregon's biodiversity, then provide a bit more detail on 4 major habitat systems of critical importance to ODFW and the Commission: oceans, freshwater, forests and sage. She introduced the first speaker Dr. Josh Lawler from the University of Washington.

OVERVIEW OF CLIMATE CHANGE IMPACTS TO OREGON'S BIODIVERSITY

Dr. Josh Lawler, University of Washington, gave a slide presentation on Climate Change Impacts to Oregon's Biodiversity. The warming we are seeing is being largely driven by greenhouse gases in the atmosphere. In the last 50-100 years (1979-2005) there has been an increased concentration of greenhouse gases (GHG). Over the years, as the temperatures fluctuate, so do the concentrations of GHG. Scientists have drilled down in glacial ice to analyze GHG concentrations over the last 600,000 years. He talked about trends. Most of the earth has been warming. The areas getting the warmest tend to be the northern parts of the world and the equatorial region, because the oceans have a cooling effect only on the southern hemisphere.

He talked about precipitation trends, which varies across the world. Oregon also has variable precipitation and is not consistent statewide.

Dr. Lawler talked about project projections used by global climate models that go several layers into the atmosphere and several layers down in the ocean. There are 14 models used that predict a range of results for temperature trends for 20-years and for the end of the century. North America will likely see a 1.5 degree increase. He talked about GHG gas emission scenarios. A fossil fuel intensive scenario was thought to be extreme, but now warming may be even greater than originally projected. Warming is greater towards the centers of the continent. Patterns coming out of these models do match the models seen from the past. Dr. Lawler also talked about the physical changes due to global warming.

- Measured trends in snowpack. Over the last 150 years, 110 glaciers have disappeared. Has an important ramification for hydrology and stream flows.
- Wildfires. Areas that have seen a decrease in moisture have seen more frequent large wildfires.
- Sea-Level Rise. The IPCC said the sea-level will rise .2 to .6 meters by 2100 This number is a result of the thermal expansion of the oceans and melting sea ice. We're likely, to see a .28 meter rise by the end of the century. There are coastal marshes (North Carolina) and beaches that will see significant changes. Some areas will go underwater.
- Climate Impacts on Biological Systems. These include changes in phenology, changes in species distributions, and physiological changes. For instance, scientists are seeing amphibians (frogs) breeding earlier, birds are returning and laying eggs earlier, and plants are flowering and fruiting earlier. Generally, spring events have moved forward 2.3 days earlier per decade.
- Physiological changes of plants. As the CO2 concentrations increase in the atmosphere, plants breathe less and conserve water. He talked about impacts and shifts, and used the change of shrubland to sage brush steppe as an example.

He said scientists have looked at 3,000 species, and used Badlands National Park as a model; which projected a range of 29-56% change in birds and amphibians moving in and out because their ranges are changing from climate changes. These are models that project but are uncertain. Dr. Lawler outlined recommendations for managing wildlife during climate change.

- As climate changes and species move, we need to provide more protected areas and refuges.
- Increase connectivity and make landscape more permeable, e.g., corridors allowing movement across the landscape. Climate change will happen very fast. Some species will adapt, some will move and some will not move. Those species may disappear.
- Minimize other threats which add to the stress of climate change.
- Restore habitat and remove exotic species.
- Remove barriers to dispersal.
- Translocation of species unable to move on their own (amphibians, reptiles, plants, some mammals).
- Active Adaptive Management. When we decide to manage in a certain way, we should monitor how that system is adapting to the management actions, and evaluate and adjust management as needed.

He also talked about research needs: develop vulnerability assessments, and test adaptive management approaches (how to manage in a fluid yet consistent and dynamic way. He asked whether the general recommendations will work, and suggested having more protected areas.

Steve Denney asked what kind of forests would be impacted. Lawler said the models were not good at predicting individual tree species. Dr. Lawler said his lab is building a database of species and looking at habitat and species most susceptible to climate changes. If a species has a quick reproduction rate (vs. low) it is less susceptible to climate change. A butterfly is dependent on certain flowers would be more susceptible to climate change. He is developing a list of 200-300 species to create a database that could be queried to see how sensitive that species might be.

Chair Rae talked about timing challenges; for instance, the need for additional easements. For the policy makers in this process, she asked how will they know what areas to go after and when before that land gets used for something else (e.g., another subdivision or destination resort), Dr. Lawler talked about areas that would see lots of changes and identifying and connecting corridors and refugia. There is work underway to look at where to place corridors but those ideas have not been tested. He suggested doubling the habitat reserves, providing linkages, and targeting refugia.

Chair Rae said there will be a tremendous amount of resistance to the government going in and getting those corridors and refugia. She asked the speakers and audience to give guidance on how to get other constituencies involved in this process.

Commissioner Bobby Levy talked about management plans and asked how plans can be part of what other groups are working on. Dr. Lawler said they will need to have organizations that pull everyone together (federal, national) in a collaborative manner.

IMPACTS OF FRESHWATER CLIMATE CHANGE ON THE POPULATION VIABILITY OF CHINOOK SALMON

Dr. Rich Zabel, NOAA Ecosystems & Climate Team, acknowledged the research work of NWFSC and the UW Climate Impacts Group. He said his report would cover four major topics.

1. Overview of Freshwater climate and climate change. Dr. Zabel talked about increase in temperatures. Terrestrial and marine ecosystems will have much different responses. Marine habitats will have a lower rate of warming and a very complex response. Terrestrial habitats have a faster rate of warming and are potentially more predictable. Dr. Zabel talked about the Salmon River Basin in Idaho, and similar Oregon populations in Northeast Oregon. He noted that decreased snowpack drives hydrology of these systems.

2. Case Study of Chinook salmon population viability.
   - Dr. Zabel examined the response of life stage-specific survival rates to current climate variability of last 15 years. He talked about population-scale: for 2 of the

cluster, the best predictor was fall flow. For two of the clusters, the predictor was summer temperature. He talked about survival response to temperatures in Cape Horn Creek, a higher elevation stream, and Lower Big Creek at a lower elevation. There is a differential response of populations to freshwater climate change and responses were moderated by habitat conditions. Dr. Zabel said we need to maintain habitat diversity as an important strategy.

- He talked about developing predictive models of how hydrology and systems will change. Global models must be downscaled for regional studies, e.g., level of resolution which is stream flows. They observed time series of flows and adjusted for how much climate will likely change in the future. He talked about development of a stochastic life-cycle model for Snake River Chinook Salmon.

- Population Viability Analysis. Dr. Zabel tracked mean population size and discussed the results of mean abundance drops of 20-46%.

- He talked about predictions of how life state specific survival will change with climate change, and incorporating predictions into the Population Viability Model to predict changes.

3. Climate and Growth. Based on this model, risks from climate change are substantial, and should be considered in management decisions. He said more research is necessary to understand populations, and maintain habitat diversity.

4. Conclusions. Dr. Zabel said future directions should include: 1) more study of ocean/freshwater climate interactions; 2) expansion of geographic scale for freshwater climate change impacts, and 3) develop freshwater climate indicators based on fish response. He said ongoing research should address growth and bioenergetics. Future considerations are life history variability and adaptability (in terms of habitats they occupy), and scientists need to consider changing landscape in terms of habitat suitability, which is going to shift. For instance, where will species move to?

The Workshop took a break at 10:45 a.m. and reconvened at 11:00 a.m.

IMPACTS TO OCEANS AND MARINE SYSTEMS

Dr. Bill Peterson, NOAA Fisheries in Newport, presented a slide show on four key issues: climate, ocean conditions, salmon, and global warming. He said there were low returns of Spring Chinook and Coho in the mid-1990s, but there was a dramatic "recovery" in the first years of this century. Dr. Peterson said there was an equally dramatic decline in returns of all life history types, especially Central Valley Fall Chinook. He said a holistic approach is being taken to develop indices and management advice.

Dr. Peterson said local conditions in the Pacific Northwest are affected by El Nino and PDO (Pacific Decadel Oscillation). Local physical conditions of salmon are affected by

bottom up processes (plankton) and top down processes like predatory fish and birds. He discussed data sets, including his own work where he sampled juvenile salmon in June and September since 1998, and talked about sampling methods (e.g., water sampling with CTD) and Juvenile Salmon Studies to determine their growth, prey, genetics, coded wire tags to look at stock orientation, diseases and parasites.

Dr. Peterson said several things affect the presence of plankton. He explained ocean currents from and to Japan, and water currents flowing north and south in mid-ocean. He discussed the circulation of the Pacific Northwest currents. This deep water is very rich in nutrients; an upwelling which feeds the food chain. Without this upwelling, the salmon will not survive long, which happened in Summer 2005 to the Fall Chinook from Sacramento Valley. He discussed winds and the current structure off coastal Oregon.

He said PDO has two phases resulting from the direction from which winds blow in the winter: 1) positive PDO means warm water; and 2) negative PDO means cold water. He discussed the different levels of PDO during El Nino. During cold phase, water comes down from the north and during a warm phase, warm comes from the gulf. Negative PDO gives you cold water species that live in the Bering Sea and Alaska. Cocopods are plankton and they drift in the currents. When currents change, the cocopods drift accordingly. Warm water taxa are small and have limited high energy. He said cold water taxa are lean and store wax esters as an overwintering strategy; these animals are an important part of the food chain that feeds salmon and other species.

Dr. Peterson talked about salmon habitat work and said in order to forecast returns of various salmon life history types; we must first establish where they live in the ocean. He said salmon are using particular places in the ocean which we don't fully understand yet and scientists are trying to forecast the returns of these fish. For salmon to do well, they need negative PDO, spring transition, upwelling season, zooplankton species, forage fish, and recruitment of juvenile salmon. He talked about climate change impacts and how management strategies will need to be modified. Dr. Peterson said there are about 9 models that try to predict ocean temperatures (EOFI of SST from 20C3M Simulations) through 2050. All the models determine what the PDO will do because PDO has an impact on precipitation, snowpack, and wild fires.

OPEN Q&A WITH COMMISSION

Chair Rae noted that Dr. Peterson had information on actions that management could take, which Holly Michael would get to the Commission.

Holly Michael asked what the future holds for monitoring aquatic systems. Dr. Peterson said the climate models need to be downscaled to the regional level. Dr. Zabel said long-term data is available but more monitoring will detect trends in populations. Dr. Lawler said it would get warmer and there will be more precipitation.

Discussion followed about how what to do about climate change, how to get started and involve more groups than governmental entities. General consensus was something needs to be done now.

Holly Michael recognized Russ Hoeflich, Executive Director of the Nature Conservancy in Oregon. Russ is also Co-chair of the Natural Resources Committee of the Oregon Global Warming Commission. He said a recent survey done by Nature Conservancy's showed that Oregonians are willing to pay for habitat and that 63% responded more positively to the phrase "global warming" versus "climate change" (4% of respondents). He said we need to invest in restoring and maintaining healthy conditions on lands owned by the federal government. He said to ask yourself where research should be housed, and who drives it? Is it at the federal level? - The state level? Who has capacity to drive the research year after year, and who has funding resources? What is the prioritization with limited research funding out there.

Ms. Michael adjourned the meeting at 12:10 p.m. and reconvened at 1:00 p.m. She gave an overview of the morning presentations and described the afternoon session.

IMPACTS TO RANGE, SAGE AND SOILS

Nicole DeCrappeo, Forest & Rangeland Ecosystem Science Center, USGS, gave a PowerPoint presentation of climate changes impacts on soil, range and sage habitats in the Great Basin area of Eastern Oregon. She said the ecosystem of the Great Basin possesses the following characteristics:

- Predominant precipitation in the form of snow
- High evapo transportation and saline soils
- Sagebrush dominant
- Bunch Grass and various wildflowers also present
- A variety of wildlife dependent on those habitats.

DeCrappeo said the impact of climate change is being felt by various stakeholders in land use who are experiencing decreasing range, loss of wildlife habitat and species. Because of the uncertainty of the magnitude of climate change in the future, various scenarios are being considered. She said climate change impacts include:

- Change in precipitation from snow to rain including flood risk due to warmer springs and earlier snow melt.
- Changes in plant growth from ground cover to woody tree species or decreased plant growth
- Shift from shrub to grassland and desert producing shift in species distribution. Sagebrush may shift north and be followed by desert species moving into sage habitats.
- Possible increase in water use for irrigation and development.
- Increase in fire frequency due to invasion of highly inflammable invasive species, such as Cheat Grass. She said frequency of fire could increase to a ten year cycle as opposed to the existing 100-year cycle. Sagebrush is not adaptable and the increased conifer population increases fuel loads.

DeCrappeo presented a flow chart showing both direct and in-direct effects of climate change on all the interwoven components of this ecosystem. This led to a discussion of

cheat grass, a major invasive species in the Great Basin. She said in the more than 64 million acres of public land, this grass has taken over in many areas and completely killed the sagebrush and drastically increased fire hazards; as well as, affected plant richness, structural diversity, root modification and soil moisture/temperature changes. DeCrappeo said it has also increased soil porosity and aeration, caused faster mineralization and loss of organic matter and carbon storage; which, in turn, affects soil nutrient availability and increases soil pH. She said effects on the soil community causes loss of below ground richness; however, healthy soil encourages: organic matter, soil moisture, productivity, plant growth/animal forage, provides nutrients and a decrease in erosion.

She talked about Biological Soil Crusts and their importance. Soil Crusts contain a variety of components including cynobacteria, bacteria, fungi, algae, mosses, lichens and liverworts, and hold the soil in place. They also allow water infiltration, an increase in nutrients, and occupy space that helps hold back invasive plant species. She described the contribution of each component and explained the difference between a native soil crust and one diminished and the affects it has on the local ecosystem. Restoration in these areas leads to a loss of diversity above ground and makes ecosystem management and restoration much more complex and difficult.

DeCrappeo discussed carbon sequestration and its importance to mitigating effects of climate change by increasing soil organic matter. She said its only problem is that it cannot be stored and used at the same time making it a questionable strategy.

IMPACTS TO FOREST SYSTEMS AND FIRE ECOLOGY

Sara O'Brien, Private Lands Coordinator with Defenders of Wildlife, said many of the discussions about how climate change challenges the soil, also applies to impacts found in forest systems. She said rising temperatures between two and ten degrees are causing many ecological changes in forests:

- Changes in precipitation. Less snow and more rain, due to earlier springs and increased temperatures in the summer, leads to: increased evaporation; less water in the summer causing a decrease in soil moisture; and more water in the winter leading to increased flood risk and other extreme events. O'Brien said these changes are more predictable on a global scale and less on a regional and local level. The issues are so complex it will be difficult to project climate change trends.

- Fire regimes and the resulting pest invasion and disease issues are considered to be the largest dominant driver of change in western forests over the next century. She said trees that appear to be resistant to fire damage will not survive when stressed by disease or pest invasion. She showed a map of different forest types in Western and Eastern Oregon and explained the differences in their fire intensity and frequency. Western forests are in low frequency, high severity zones due to dense forests and periods of drought. Eastern forests are in high frequency but lower severity zones because of lower tree density and drier climate conditions. O'Brien said western forest fire frequency and intensity has increased since 1960 and

projection models indicate that fires may double in the future. However, eastern projections are less conclusive and only suggest the possibility of doubling.

Sara displayed a slide with three different modeling maps each showing very different possible scenarios in various levels: higher temperatures, lower moisture, early snow melt, changes in forest structure and species, and increasing pests (e.g., the pine mountain beetle is the biggest forest invader) and diseases. She said other expectations include:

- Woody expansion shifting to the north and upward in elevation resulting in loss of other ecosystems.
- Timing mismatches for pollinators and wildlife breeding cycles.
- Loss of plant and animal species diversity.
- Loss of Alpine and Sub-Alpine ecosystems.
- Loss of wetlands.
- Migration, adaption or extinction of localized species.
- Increase in invasive, non-native species.

Discussion followed about challenges facing ODFW and other agencies to adopt strategies to accommodate fish and wildlife during rapid habitat changes: the speed in which change is taking place; habitat fragmentation; barriers to species migration and other non-climate stressors. A short term strategy is to increase the resistance of healthy habitats to disturbance and these stressors. The long term strategy is building resilience (the ability to recover after disturbance) into ecosystems. Biodiversity is the primary key to resilience and resistance. Guiding principles discussed for fish and wildlife adaption include:

- Maintain and restore key ecosystem processes (look back into history).
- Establish an interconnected network of lands and waters to support adaption of agricultural lands, public lands, and industrial and timberlands both working and non working lands regardless of ownership.
- Acknowledge, evaluate, weigh risks in context of climate change.
- Coordinate across political and jurisdictional boundaries regardless of ownership.
- "Might dos" in the past have become "must do's" now.

Discussion included what policy tools to use:

- Address key adaption funding needs (this is not optional).
- Review, revise and add to policy to prioritize adaption.
- Develop new institutions for collaboration and integration; working across states, ownership and agencies.
- Make use of the existing Oregon Conservation Strategy and the adaptive management guidelines developed under the Governor's Global Warming mandate.

FEDERAL RESEARCH OVERVIEW

Carol Schuler, Forest & Rangeland Ecosystem Science Center, USGS, reported on recent federal level activities to support state efforts to develop climate change programs. She said the U.S. Geological Survey (GSGS) recognizes that land

managers need to prepare for changes and are working to coordinate collaboration between state and federal agencies and resolve challenges, such as manager roles defined across agencies and state lines, predicting and understanding climate changes, and developing and evaluating adaptive strategies.

Schuler talked about other organizations involved in climate change. The World Meteorological Organization, managed through the U.N. Environmental Program, assesses and compiles information published in reports. The U.S. Climate Change Science Program synthesizes research on adaptability for ecosystems and human adaptability. Schuler listed agencies involved with climate change and emphasized that USGS is stepping up in a strong role because this is a natural extension of agencies existing role in science. Much of the work overlaps with ODFW work, e.g., sea-level rise and wildlife habitat.

She talked about studies. In 2008 about $7.3 million is available for new projects, such as the Global Warming and Wildlife Research Center that helps managers develop adaptive management strategies, and conducts studies on carbon sequestration. She said a new draft document, "Threshold of Change in the Ecosystem" is available that discusses "what happens when this happens", and habitats that are being set aside to sustain wildlife species. Also, a survey of federal climate change science was sent to federal agencies to identify the research they are conducting. She said the USGS Forest & Rangeland Science Ecosystem Science Center (FRESC) located in Corvallis is pursuing research in ecosystem landscape restoration, conservation and inventory. Schuler noted that the Pacific Northwest forests contain the highest carbon content in the world. In addition to these studies, freshwater clams are being studied to track climate change through the growth rings they possess comparable to those of trees.

Schuler discussed USGS's efforts to coordinate information, manage rapid advances in information and technology, and assist managers in developing strategies, to support workshops and support and coordinate new groups. She said a new group, the Pacific Northwest Climate Change Collaboration, encourages coordination between federal and state agencies and other non-federal groups.

Commissioner Smith asked about the progress of international collaboration. Schuler said a lot of progress is being made in this direction because everyone recognizes this as a global problem.

The Workshop took a break at 3:15 p.m. and reconvened at 4:00 p.m.

FRESHWATER ADAPTIVE MANAGEMENT STRATEGIES

Dr. Allison Aldous, from The Nature Conservancy, spoke on Adaptive Management Strategies and Building Climate Change into Freshwater Conservation. Her theme was "What Do We Need to Do Differently?" Dr. Aldous said that decades have been spent developing strategies to conserve plants and animals and are still good ways to maintain ecosystem resilience. She said we need to identify what further needs to be added to accommodate the climate change issues. She also talked about the

framework for fresh water conservation: hydrologic impacts; water quality, and adaptive management strategies.

Dr. Aldous discussed the difference between a snow melt dominated hydrology and a rain dominated hydrology, and illustrated it with a watershed map. In a rain dominated system there is very little variance in water timing, quality and quantity. In a snow melt dominated hydrology, there is increased water flow and it occurs earlier in the year. She said in a transitional zone with both rain and snow, there are many variations and sensitivities at a local scale.

She discussed the importance of groundwater, which often is ignored in climate change impacts. Ground water flow paths originate in higher elevations, percolate down and emerge as ground water. Dr. Aldous described how groundwater is recharged through various means (e.g., snow pack) and can be affected by warming trends which cause earlier snowmelt and high rates of evaporation. This can lead to less water recharge in the ecosystem. She said that groundwater hydrology needs to become more resilient because we increasingly tap into groundwater as other water becomes scarce. The two strategies available to encourage this are ecosystem based strategies and water management strategies. Dr. Aldous said that restoration methods would involve reconnecting streams and flood plains, restoring wetland hydrology and revegetating riparian areas. New environmental water allocation processes are needed to allocate water to ecosystems in addition to other uses.

Dr. Aldous said the Sycan Marsh project has been in place for 20 years in the Klamath Basin. Located in a higher elevation and a snow pack zone, Sycan Marsh houses a variety of groundwater recharged wetlands. She said it has been restored to its wetland state after historically being used as grazing land. Current strategies for managing the restoration of wetlands include filling ditches, riparian restoration, removing water controls and forest management.

She said the hypothesis for future climate change impact reflects the fact that a drop of even 20 centimeters can have a dramatic affect in plant life and the water available for wildlife. One of the most significant impacts is to species dependant on wetland food sources which are not available when conditions are too dry because the groundwater level has dropped. Dr. Aldous stated the need to:

- Identify key impacts to surface and groundwater systems.
- Examine current strategies under the lens of climate change.
- Consider new strategies for water allocation, use and management.
- Recognize that we do not need a complete new paradigm, we just need to be smarter about the one we already have.

PANEL DISCUSSION WITH FISH & WILDLIFE COMMISSION

Ms. Michael combined the **Panel Discussion with Fish & Wildlife Commission** and the **Commission Policy Discussion**.

Michael said most of the issues discussed today have been addressed in the Oregon

Conservation Strategy. These issues can be adapted into new management strategies and enlarged upon in partnership with other agencies and then networked to the public.

Ron Anglin, Administrator for Wildlife Division, said groundwater will be an increasingly important issue as populations grow and over allocation becomes an even greater danger. Wiser decisions for water allocation need to be understood and put into place.

Several panel members made other contributions discussing the prospect of wave energy for the future, wiser allocation of groundwater and the reversal of climate change. Chair Rae pointed out the need for "small bites" of information for the Commission to deal with and recognized the need for the Commission to rely on the advice of the experts in any decision making on their part.

Discussion followed about the need to connect with the public. It was noted that the Oregon Zoo has taken on an important role in helping to educate the public in matters of global warming, together with national and international efforts by various organizations in helping to educate the public on a variety of climate change impacts.

In summary, it was discussed that everyone needs to take on the responsibility of dealing with the effects of climate change on our planet and that every living thing is connected to one another.

WRAP-UP

Director Elicker closed the meeting with words of thanks for all the contributions that had been made to the workshop and reiterated ODFW's commitment to working hard for the solution that must be found to protect our resources.

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