Adding climate change to the mix: using climate futures in conservation planning for Oregon's oak-dominated habitats

Eugene, Oregon
April 26-27, 2011

Workshop Summary

Introduction

In 2009, the Oregon Department of Fish and Wildlife initiated a process to incorporate information about climate change and its effects on fish, wildlife, and habitats into the Oregon Conservation Strategy. The agency acknowledged that climate change is already affecting Oregon's species and habitats and that future climate change represents one of the most serious long-term challenges to sustaining healthy populations of fish and wildlife.

This workshop brought together representatives of the research, land and resource management, and conservation communities to contribute to the update and implementation of the Oregon Conservation Strategy. Participants were asked to help ODFW identify climate change impacts and high-priority climate change adaptation strategies for Oregon's oak-dominated habitats. The meeting was also intended to build and strengthen partnerships in the research and management communities.

The objectives of the workshop were to:

- Hear about recent climate change research relevant to Oregon's oak-dominated habitats and discuss how to better link research with management efforts;
- Provide updates and hear feedback on on-going regional oak conservation efforts; and
- Identify and prioritize adaptation strategies that can help reduce climate change impacts on oak habitats.

Future workshops will address adaptation in other priority habitats outlined in the Oregon Conservation Strategy.

Workshop Structure

Day 1 of the workshop began with an overview of goals, objectives, and outcomes. Art Martin, of the Oregon Department of Fish and Wildlife, gave an overview of their process to revise the Oregon Conservation Strategy to include more climate change information. Contributing to that revision process is one of the primary goals of this workshop. The following three presentations addressed questions related to how oak-dominated habitats function today and how they will be affected climate change. Ed Alverson, of The Nature Conservancy, presented a draft conceptual model of oak-dominated habitats in Oregon. Darrin Sharp, from Oregon State University's Oregon Climate Change Research Institute, provided an overview of projections of climate change in the region. Finally, Bart Johnson, of the University of Oregon, gave us a more detailed look at how we might expect these changes to affect oak-dominated habitats and associated species.

On the afternoon of the first day, we began a series of facilitated small group discussions that developed the background information we needed to identify climate change adaptation strategies specific to the target ecosystem. The groups identified changes needed to the draft conceptual model, described existing and future ("climate-smart") conservation goals for Oregon's oak habitats, and looked for places in the conceptual model where they could identify intervention points for climate change adaptation strategies. In between

discussion sessions, we took a break from brainstorming to hear about a number of regional oak management initiatives.

On day 2, we met as a large group to discuss two questions:

- What changes will we make or what new resources will we need to meet our oak habitat management goals in a changing climate? In other words, what climate change adaptation strategies can we identify for this habitat type?; and
- What critical uncertainties need to be resolved before we can move forward with these adaptation strategies?

The group developed a conceptual model that showed the intervention points identified on day 1, the desired responses or goals we wish to reach through management, and the potential action – the climate change adaptation strategies – that could be used to link the two.

A number of key themes emerged in both the presentations and the large and small group discussions. One of these was the importance of cultural, social, and economic context in oak conservation. Because 90-95% of remaining oak habitat occurs on private lands, there is a critical need to create incentives for landowners to participate in conservation efforts. These incentives should include market-based opportunities for landowners to derive a profit from responsible management of oak habitat; there is a real need to research markets for products and services derived from functioning oak habitats.

Many of the adaptation strategies and research needs identified by the group were not the unique result of adding climate change information into the conservation planning process. Rather, we found that many of our existing goals, priorities, and management strategies for oak habitats will not necessarily change as a result of climate change, at least over the term of the next few decades. Instead, we found that climate change is sometimes an important new reason to do conservation work that has long been important for other reasons; sometimes a factor that leads us to change our priorities or the places we do work; and sometimes a shift that creates new threats to and opportunities for managing dynamic, resilient, oak ecosystems. For example, participants saw climate change as yet another important reason to create a representative, resilient, and interconnected network of oak habitats, but they also saw an increased importance being placed on fire management and supporting fire-resilient systems. Increased fire in lower elevation conifer forests might also create some opportunities for oak restoration in areas that are now marginal.

Workshop Outcomes

Please notes that the ideas described here were expressed by one or more workshop participants but do not necessarily represent the opinions of all participants.

Presentations and discussion groups were designed to answer four key questions:

1. How is climate change expected to affect Oregon's oak-dominated habitats?

All models and emissions scenarios predict temperatures to continue to warm throughout the 21st century and for the rate of warming to increase over the Pacific Northwest's twentieth century trend of about +1.5º F. Climate models used in the Intergovernmental Panel on Climate Change's Fourth Assessment Report project, on average, additional warming of 2.0º F by the 2020s, 3.2º F by the 2040s, and 5.3º F by the 2080s in our region. A somewhat greater increase in temperatures is expected in the summer months. This warming is projected to bring changes in some potentially significant thresholds for ecosystems, such as an increase in the number of days the temperature is above 90º F and a potentially quite large decrease in the number of days per year that the temperature drops below freezing.

Most models project summers to be drier and the rest of the year to be wetter, with little or no change in average annual precipitation, although precipitation projections are associated with higher levels of uncertainty. Perhaps more importantly from an ecological perspective, summer water supply is expected to decrease as a result of higher temperatures, reduced snowpack, and reduced summer precipitation. There is also some evidence that extreme precipitation events and periods of drought will increase in the future. As a result of warming temperatures and drier summers, fire activity is expected to increase in all Oregon forest types, a trend that has already been observed in some of Oregon's dry forests.

There is currently significantly less clarity about how these combined climatic changes will be reflected in changes to oak habitats. Climate envelope modeling of vegetation change suggests a complete loss of Oregon white oak in the Willamette Valley by 2070, with an increase in peripheral oak habitat in Washington, eastern Oregon, and in some models, southern Oregon. Even species like ponderosa pine, that would generally be expected to expand under warmer and drier conditions, are shown by these models to significantly decrease their range in Oregon over the same period. However, climate envelope models do not account for important non-climatic factors that help determine species distribution. Recently, dynamic general vegetation models have provided a more complete look at future vegetation shifts, but their results differ significantly based on different climate models. For example, in the Willamette Valley, some models show an increase in oak-dominated habitats, while others indicate a shift to temperate conifer or to warmer hardwood types, such as madrone or tan oak.

Adding to the uncertainty around vegetation responses to climate change, there may be abrupt thresholds beyond which ecosystem change becomes rapid, non-linear, and perhaps irreversible. In many western forests, for example, warmer temperatures, increased drought, and forest pest outbreaks have combined to create extreme fire conditions. This could results in rapid shifts in vegetation type if changing climate conditions prevent dominant vegetation species from re-colonizing an area after a major fire. It is possible that species and habitats may be affected more by competitive interactions and disturbances than by direct climate impacts, making predictions of future conditions even more difficult.

The discussion groups generally chose to focus on climate impacts with higher levels of certainty, such as increased summer and winter temperature, reduced snowpack, and the resulting changes in hydrology. They also highlighted a number of questions about climate change and climate-ecology interactions that are of particular interest to managers of oak habitats; these are outlined in section 4 below.

Participants also emphasized that in many of Oregon's oak woodlands and savannas, land conversion continues to be a more significant immediate risk than climate change. Especially in the Willamette Valley, there is concern that many of the remaining patches of oak habitat could be lost to agriculture or development within the next few decades, so that finding strategies to slow or stop conversion takes a much higher priority than planning for climate change adaptation. In other parts of the state, where conversion is less of a threat, climate change may be perceived as a higher-priority issue.

Results from conceptual models:

Ed Alverson (The Nature Conservancy) presented a draft conceptual model of oak-dominated habitats to get the group started in thinking about the important elements, processes, and relationships that make up these systems, including climate change impacts. In small group discussions, participants suggested specific changes to the draft model. The resulting "marked up" models will be posted on the Oregon Conservation Strategy website at: http://www.dfw.state.or.us/conservationstrategy/events.asp. Participants suggested bringing together a follow-up group to synthesize and refine the changes the groups suggested to the conceptual model.

2. What are our current conservation goals for Oregon's oak habitats, and how do we expect them to change? What values do we most want to protect in a changing climate?

Given the large past losses of oak-dominated habitats due to land conversion and conifer encroachment, manyparticipants felt that conservation efforts should not only limit future loss but also look for opportunities to restore currently degraded areas and re-establish former oak habitats. Priorities included conserving diverse portfolio of habitat types that ecosystem health, resiliency, and biodiversity, and are permeable to fire while resisting large, stand-replacing fires. Motivations for conserving oak-dominated habitats include cultural values (related both to Native American history and aesthetic and recreational benefits), support of oak-associated wildlife species, provision of ecosystem services, including wood products, and wildfire risk reduction.

The discussion groups generally concluded that climate change need not derail the goals they identified but would likely change the methods and information needed to meet the goals. They emphasized that climate change will increase the importance of engaging in strategic, landscape-scale planning to create connected and resilient network of oak habitats. Some of the groups also discussed the possibility that climate change may require an approach to conservation that is less focused on individual species and more attentive to maintaining processes and the provision of ecosystem services.

Climate change may also require making changes to conservation priorities. Some areas that support oak today may simply not continue to do so in the future. Current climate projections do not have sufficient scale and certainty to allow us to identify those areas. However, identifying a future climate envelope – a profile of areas where climate and other conditions may support oak habitats in the future – may even reveal opportunities to "restore" this habitat type in areas where it was not historically found. For example, warming temperatures and increased fire frequency may create opportunities for oaks and associated species to shift into higher-elevation areas that are now dominated by conifers. Connectivity between conservation lands will also be increasingly important as some species are expected to respond to climate change by moving to areas with more suitable conditions.

Management activities may also shift in importance. For example, if fire risk increases due to warmer temperatures, drier summers, or increased pest outbreaks, thinning oak habitats may increase in priority to prevent large oaks from being damaged by large fires. Efforts to limit non-native invasive plants may also increase in priority, as increased atmospheric carbon dioxide is expected to favor those species. Conversely, it is possible that warmer, wetter winters and warmer, drier summers could increase the occurrence of natural fires in some oak habitats and make thinning and prescribed fires less of a priority. Because of the many

uncertainties surrounding the responses of ecological systems to climate change, adaptive management and monitoring are also likely to become more important.

At the beginning of day 2, we agreed on a summarized list of "desired management responses" to reflect the groups' ideas of management goals in light of climate change:

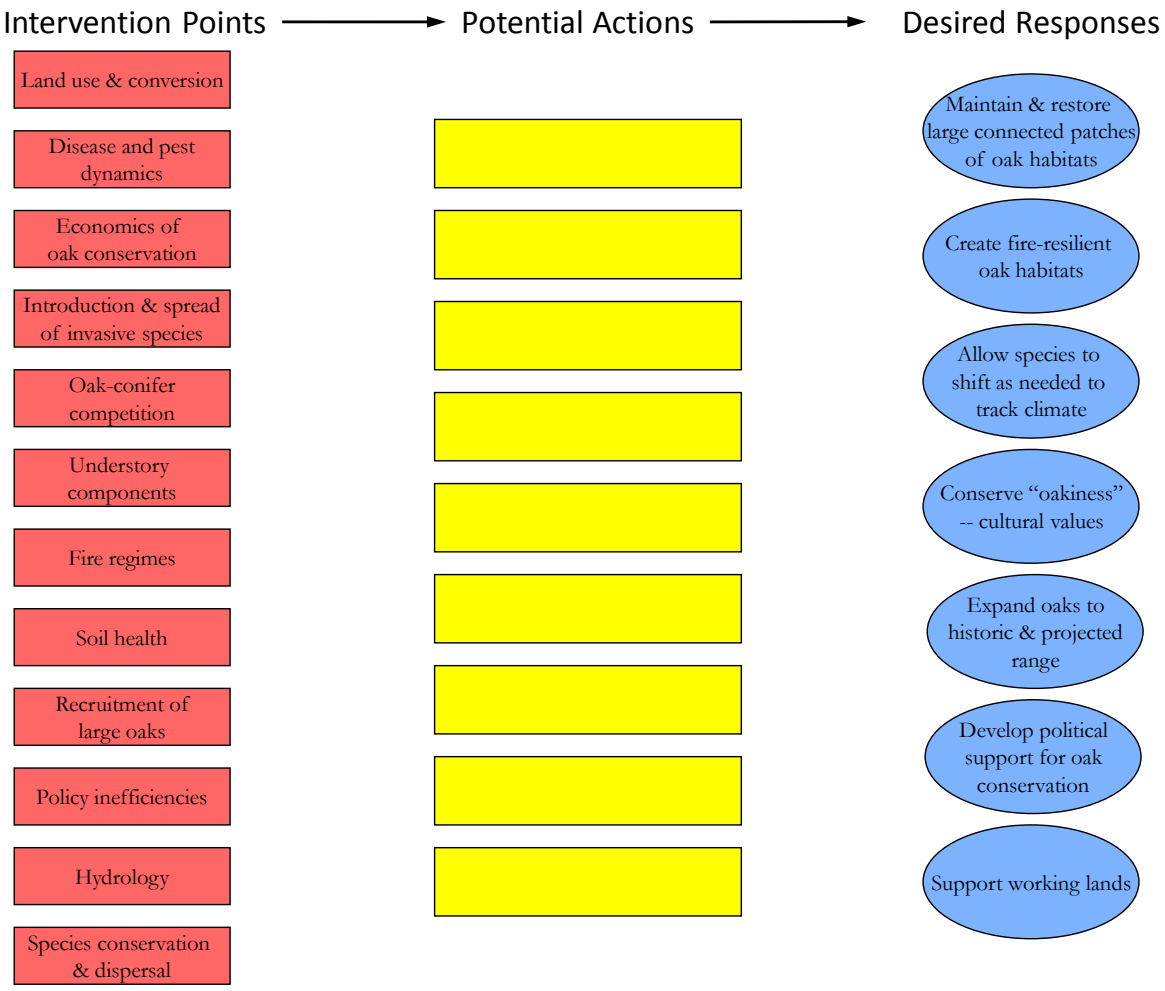
- Maintain and restore healthy, self-sustaining populations of native plant & wildlife species;
- Maintain and restore large, inter-connected patches of oak habitats;
- Create fire-resilient oak habitats;
- Allow species to shift as needed to track climate;
- Conserve "oakiness" – cultural values;
- Expand oaks to historic and projected range;
- Support working lands;
- Develop political support for oak conservation.

3. What management or policy interventions might improve our ability to reach conservation goals in a changing climate? What changes will we need to make or what new resources will we need?

We asked each of the discussion groups to look back at the conceptual models they developed at the beginning of the afternoon and to identify points or processes where management intervention can be directed to lessen the effects of climate change on oak habitats or to increase the chances that conservation efforts will be successful in a changing climate. The following morning, we met in a large group to synthesize the results of those conversations. Participants preferred to frame these categories as processes rather than points. The processes identified as key opportunities for intervention included:

- Land use and conversion;
- Disease and pest dynamics;
- Economics of oak conservation;
- Introduction and spread of non-native invasive species;
- Oak-conifer competition;
- Understory components;
- Fire regimes;
- Soil health;
- Recruitment of large oaks;
- Policy inefficiencies;
- Hydrology; and
- Species conservation and dispersal

We created a figure that outlined the lists of desired responses and intervention opportunities and set the stage for the group to identify actions or adaptation strategies that could be used to get from opportunity to response:



The group then brainstormed actions for each opportunity, noting which of the goals they were intended to promote. Below are the actions identified by the group, including several that were mentioned in earlier small group discussions or were communicated to the facilitators after the workshop ended.

Land use and conversion:

- Promote oak conservation and restoration as a strategy for protecting human communities from wildfire by keeping fires on the ground and preventing intense crown fires that may be carried in conifer-dominated forests;
- Protect and restore a diverse portfolio of oak habitats;
- Identify and consider protecting future habitat for oaks and associated species, including areas upslope of current range;
- Identify ways to make existing oak patches larger, because many may be too small for wildlife species of concern;
- Increase availability of landowner incentives, outreach, education, policies, and funding to prevent conversion;
- Identify ways to protect oak habitats through land use planning processes, including streamlining state and county processes so that patches that cross political boundaries can be protected more effectively;

- Look for new partners to engage on oak conservation, e.g., developers, cities, counties, National Turkey Foundation, local planning councils, city councils;
- Develop local and state policies to increase habitat protection;
- Develop regional working groups focused on protecting oak habitat blocks and connectivity, to build on existing work to map, identify, and prioritize key blocks and connections;
- Establish quantitative protection goals for core and connective areas;
- Create opportunities for land-use planning at larger scales.

Disease and pest dynamics:

- Research implications for control of Sudden Oak Death if black oak expands its range further into Oregon;
- Create or improve public education programs on pests and diseases, including photographs and descriptions for landowner detection and reporting;
- Promote resilience to pests and diseases by diversifying species;
- Promote resilience to pests and diseases through density reduction and thinning;
- Create or improve monitoring programs;
- Improve education and/or regulation of nurseries.

Economics of oak conservation:

- Integrate social science perspective into oak conservation planning;
- Work with county planners, landscape architects, and real estate developers to show benefits of having oak in communities;
- Integrate oak conservation with compatible recreation and promote oak habitat as recreation lands;
- Enhance urban forestry program; find ways to keep cities from removing oaks for liability reasons; identify policy and economic barriers to maintaining oaks in cities and developed areas;
- Promote understanding among private landowners of what opportunities they have for income off oak habitat – e.g., native species nursery, grazing, special wood products, mushrooms, specialty furniture, native wildflowers, ecotourism, medicinal plants (need for research and market development; promote an entrepreneurial "oak economy";
- Map and rank existing oak and prairie habitat, especially on private lands, with an eye toward establishing large areas and connectivity;
- Create oak mitigation plan as with wetlands (Willamette Partnership is already starting);
- Avoid creating new policy disincentives for private landowners by regulating and identifying oak habitat;
- Identify large-scale economic drivers of oak conversion (e.g., chip market) and research economic alternatives for landowners;
- Develop expertise at state level to track changes in economic markets, find ways to derive economic benefits while still maintaining ecological integrity;
- Build on model for small-diameter wood market to develop markets for thinning;
- Quantify the contribution of prairie and oak habitats to carbon storage and sequestration to see if carbon markets could be used to support restoration;
- Work with private logging contractors on thinning projects so that restoration brings local economic benefits;
- Increase grant funding for oak work and ability to leverage existing funding;
- Include funding for protection and restoration of oak habitats in existing programs, including the Oregon Watershed Enhancement Board grant programs and Oregon Forest Resource Trust;
- Promote oak- and prairie-associated pollinators as a benefit for agriculture;

- Tie restoration projects to Common School Fund, so that communities benefit economically from restoration efforts.

Introduction & spread of invasive species:

- Build consensus on how to define invasive species vs. "new natives" or climate refugees;
- Mow, graze, and spray to control weeds, especially where burning is impractical or may exacerbate the problem;
- Reseed any disturbed area with a diversity of native species (current programs mainly focused on wetlands, and areas that are thinned or have invasives removed are often recolonized by other invasives);
- Create broader plant materials program that increases availability of native seed;
- Promote compatible recreation use (minimize harm from OHVs);
- Create technical assistance to follow up restoration work with invasives prevention (especially important after large wildfires given climate change);
- Prevent future invasions by developing early detection and rapid response programs;
- Research what new species brought in by climate change might provide value and not cause problems ("new natives");
- Educate nursery industry about invasives and their impacts;
- Develop policies that help avoid introduction of non-native species;
- Research and consider promoting biological controls, but exercise caution.

Oak-conifer competition:

- Thin (remove or girdle) encroaching conifers;
- Conduct prescribed burns;
- Revise Forest Practices Act to make it easier to thin conifers;
- Find policies and incentives to encourage landowners to do thinning; look at disincentives, such as from carbon markets encouraging planting of Douglas fir;
- Develop local markets that promote conifer thinning;
- Education: make general public aware of value of oak habitats; help them understand why conifers are being removed; develop oak habitat extension program.
- Research ways of maximizing profit to landowners, not just maximizing net fiber production, through selective forestry that supports oak habitats.

Understory components:

- Improve native plant material programs;
- Identify and consider using "new natives," species that are new to the area due to climate change but may play a neutral or positive role in overall ecosystem function;
- Control non-native annual grasses and other species that compete with oaks and native understory plants;
- Develop management options that allow for a broader range of resilient and drought tolerant species.

Fire regimes:

- Reduce stand density;
- Reduce competition from conifers;
- Decrease fuel load;
- Remove annual grasses – avoid burning invasive species whose growth and propagation is stimulated by fire;
- Increase fire use in fall, when fires are ecologically appropriate;

- Restore native ground layer (canopy thinning might otherwise increase grass growth, fire risk);
- Increase fire frequency, as through prescribed burns, to decrease fire severity;
- Develop outreach program to increase social acceptance and political support of fire and smoke;
- Create financial incentives to reduce fuel around homes;
- Change land use rules to permit or encourage larger lot sizes and cluster development in ways that allow for more fire use;
- Provide technical and logistical support to conduct prescribed fire on private land; build fire expertise, body of practitioners that really understand fire and smoke management;
- Develop a technical pool of people that help landowners work together to do landscape-scale burns;
- Legislation to address liability issues that occur when public agencies burn on private lands;
- Outreach, education on oak-restoration for firefighters and other fire protection groups that are promoting fire-safe landscapes around communities;
- Research best practices for managing fire in oak habitats;
- Use landscape-scale planning to identify areas of greater risk;
- Prepare for conversion of ecosystems affected by stand-replacing fires.

Soil health:

- Inoculate soils with mycorrhizae as part of restoration efforts;
- Consider soil restoration, decomposition, and nutrient cycling in restoration efforts.

Recruitment of large oaks:

- Thin oaks as needed to reduce stand density (in areas where oak-on-oak competition prevents large oaks from developing;
- Protect existing large-canopy oaks from competition, and protect young full-canopy oaks that will someday be large;
- Develop a planting strategy for oaks;
- Provide for replacement for "wet" oaks;
- Create or maintain uneven-aged stands to provide for natural recruitment.

Policy inefficiencies:

- Look for new ways to use existing policies (Endangered Species Act, Forest Practices Act, land use planning laws, etc.) to benefit oak-associated species;
- Evaluate and remove disincentives or conflicting policies;
- Identify and promote social and economic incentives for private landowners in order to develop policies that effectively protect oak habitats.

Hydrology:

- Reintroduce beaver to improve natural water storage on the landscape;
- Ensure water allocations allow maintenance of hydrologic flows.

Species conservation and dispersal:

- Monitor populations of endangered and other special-status species;
- Research and consider using captive breeding, assisted migration for species in rapid decline;
- Restore savanna and other open-canopy oak habitats to benefit associated species;
- Increase or maintain overall habitat area and connectivity to maximize opportunities for species to disperse in response to changing climate conditions;
- Use banking to protect genetic diversity of flora, including local genotypes;
- Include wildlife-habitat relationships in oak planning (both vertebrate and invertebrate;

- Use reintroductions, nest boxes, snag creation, and other techniques to boost populations of native fauna.

4. What critical uncertainties need to be resolved before we can move forward with these adaptation strategies?

Our conversation about research needs focused on the most immediate priorities: What information is needed to inform current and near-term management decisions, and what existing information gaps could prevent implementation of climate change adaptation strategies? Participants emphasized that the results of this workshop actually represent a set of hypotheses about how oak ecosystems respond to management actions and changing climate conditions, and that each of the relationships outlined here includes assumptions that require further research. Above all, there is a strong need to build information on the on-the-ground ecological results of management actions, a gap that may be best filled by improved monitoring and adaptive management.

Many of the research needs identified revolved around the basic ecology of oaks and associated species:

- What conditions (including disturbance regimes) do oaks and other native plant species need for successful reproduction? How can they best be propagated to develop plant materials for restoration efforts?
- What are the physiological tolerances of oaks and other associated species?
- How do oak communities respond to common management actions, site conditions, and fire?
- What factors are currently limiting oak habitat?
- What are the disturbance and reseeding regimes that lead to healthy oak ecosystems?
- How will soils, mycorrhizae, and other non-climate factors limit species migration in response to climate change?
- What are the habitat needs of oak-associated wildlife? Which species are associated with different stand types (prairie, savanna, woodland)? What patch sizes do they require, and what are their dispersal abilities or limitations? How are wildlife responding to past and current restoration efforts?

Participants also identified several research questions specific to climate change and its impacts on oak habitats:

- Which climate variables are most important for determining the future distribution of oak-dominated habitats?
- How do climate extremes in temperatures and precipitation events affect plants and wildlife?
- How is June precipitation (a powerful driver of productivity in oak systems) expected to change in the future?
- Where will the future climate envelope occur for oaks and associated species? Where should we expect these species and associations to be most sustainable in the future?
- What soil biochemical changes will result from climate change and increased atmospheric carbon dioxide, and what impacts will these soil changes have on understory plant species?

Others focused on social, economic, and policy issues:

- What needs to be done to make oak conservation economically feasible and sustainable for landowners and communities?
- How can landowners be encouraged to conserve oak habitats and accept the need for thinning and fire use?
- Are there new voluntary policy tools that we will need or may have the opportunity to develop as a result of climate change?

- What are the net economic results of conservation and restoration? Can we quantify the economic benefits of active management of oaks and challenge the assumption that conservation lands are economically unproductive? If we were to fully implement a conservation vision for the Willamette Valley, what would be the net impact on the regional economy?

Finally, we discussed a number of needed changes in the way research is done in Oregon and elsewhere. There is a need to:

- do research across broader time scales to capture periodic reproduction events;
- integrate research across disciples and institutions;
- be strategic in addressing immediate and pressing research needs and avoiding duplication of efforts;
- collaborate with researchers around and outside the Pacific Northwest, including not only California, Washington, and British Columbia, but also oak systems in the Midwest and East;
- do more research that ties management actions to outcomes;
- create a "one-stop shopping" source for information about oak habitats and restoration, perhaps an annotated bibliography or clearinghouse;
- improve and update restoration guides to include information on climate change impacts and oak systems outside the Willamette Valley;
- create a repository of case studies of oak restoration, perhaps in the Conservation Registry, to help guide restoration planning;

Final Agenda

April 26: 10 am – 5 pm
April 27: 9 am – 12 pm
Obsidians Lodge
Eugene, Oregon

Goal: Contribute to update and implementation of the Oregon Conservation Strategy by developing priority climate change adaptation strategies for oak habitats and strengthening partnerships in the research and management communities.

Objectives:

- Provide updates and hear feedback on on-going Northwest conservation planning processes.
- Hear about recent climate change research relevant to Oregon's oak-dominated habitats and discuss how to better link research with management efforts.
- Identify and prioritize adaptation strategies that can help reduce climate change impacts on oak habitats.

Outcomes:
Based on results of the working groups, the organizers will develop and distribute a summary document describing:

- A basic conceptual model for Oregon's oak habitats, including potential climate change impacts; and
- An overview of management goals for oak-dominated systems;
- Priority climate change adaptation strategies for Oregon's oak habitats.

Agenda

Day 1: 10 am – 5 pm

10 – 10:30 am
Welcome and introductions
Goals, objectives, and outcomes
Overview of Oregon Conservation Strategy Revision
Art Martin, Oregon Department of Fish and Wildlife

10:30 am – noon
Conceptual model for oak-dominated habitats in Oregon
Ed Alverson, The Nature Conservancy

Climate change impacts on Oregon's oak ecosystems

Darrin Sharp, Oregon Climate Change Research Institute
Bart Johnson, University of Oregon

Working lunch provided

12:30 – 1:30 pm
Facilitated small group discussions:
What changes are needed to our conceptual model of oak habitats?

1:30 – 2:30 pm

Overview of regional oak management initiatives
Bonneville Power Administration Mitigation Agreement: *Laura Tesler, ODFW*
Southern Oregon Cooperative Conservation Partnership Initiatives: *Dave Ross, USFWS*
Central Umpqua Oak Habitat Assessment: *Jake Winn, BLM, and Ed Alverson, TNC*
USFWS Land Protection Plan: *Steve Smith, USFWS*

Break

3 – 4 pm

Facilitated small group discussions:
What are our conservation goals for Oregon's oak habitats?
What values do we most want to protect in these habitats in a changing climate?

4 – 5 pm
Exercise: Identifying intervention points for climate change adaptation actions

5 pm

Happy hour—McMenamins E 19th St. Café, 1485 E. 19th Ave.

Day 2: 9 am – 12 pm

Review of day 1 accomplishments

Small group discussions:

What changes will we need to change or what new resources will we need to meet our oak habitat management goals in a changing climate?:

- *Management strategies*
- *Policies*
- *Conservation tools*
- *Research or data*

What critical uncertainties need to be resolved before we can move forward with these adaptation strategies?

11:30 am – noon: Closing thoughts

How do participants think we should use and distribute the knowledge we've gathered here?

List of participants

Bob Altman, American Bird Conservancy
Ed Alverson, The Nature Conservancy
Steve Arquitt, University of Oregon
Susan Barnes, Oregon Department of Fish and Wildlife
Jock Beall, US Fish and Wildlife Service
Jason Blazar, Camas Education Network/Friends of Buford Park
Darren Borgias, The Nature Conservancy
Mary Bushman, City of Portland
Bill Cannaday, Oregon Department of Fish and Wildlife
David Chain, Natural Resources Conservation Service
CalLee Davenport, US Fish and Wildlife Service
Terry Fairbanks, Bureau of Land Management
Aryana Ferguson, Madrona Consulting
Lisa Gaines, Institute for Natural Resources, facilitator
Joan Hagar, US Geological Survey
Patricia Haggerty, Oregon Oaks Community Working Group
Andrea Hanson, Oregon Department of Fish and Wildlife
Ariel Hiller, Bureau of Land Management
Cheryl Hummon, volunteer facilitator
Jean Jancaitis, The Nature Conservancy
Bart Johnson, University of Oregon
Carole Jorgensen, Bureau of Land Management
Meg Kenagy, Oregon Department of Fish and Wildlife
Stan Cook, Walama Restoration Project
Rod Krahmer, Oregon Department of Fish and Wildlife
Ann Kreager, Oregon Department of Fish and Wildlife
Art Martin, Oregon Department of Fish and Wildlife
Holly Michael, Oregon Department of Fish and Wildlife, volunteer facilitator
Jim Morgan, Oregon Department of Parks and Recreation, volunteer facilitator
Bruce Newhouse, Salix Associates
Adam Novick, University of Oregon
Sara O'Brien, Defenders of Wildlife
Kevin O'Hara, US Fish and Wildlife Service
Pedro Pardo, Oregon Department of Parks and Recreation
Michael Pope, Greenbelt Land Trust
Claire Puchy, City of Portland
David Ross, US Fish and Wildlife Service
Elizabeth Ruther, Oregon Department of Fish and Wildlife
Julie Schneider, Oregon Department of Fish and Wildlife
Lawrence Schwabe, Confederated Tribes of Grand Ronde
Darrin Sharp, Oregon Climate Change Research Institute
Steve Smith, US Fish and Wildlife Service
Patty Snow, Oregon Department of Fish and Wildlife

Emily Steel, City of Eugene
Sean Stewart, Elijah Bristow State Park
Jack Tannehill, Oregon Department of Forestry
Trevor Taylor, City of Eugene
Laura Tesler, Oregon Department of Fish and Wildlife
Nate Uhlrich, University of Oregon
Jake Winn, Bureau of Land Management
Eric Wold, City of Eugene,
Gabriel Yospin, University of Oregon
Steve Zack, Wildlife Conservation Society
Curt Zonick, Metro
Bob Zybach, NWMaps Co.