

Northwest Basin and Range Ecosystem Symposium Proceedings

February 15–16, 2017

Lakeview, Oregon

Hosted by:

Northwest Basin and Range Synthesis



Report photos courtesy of Basin and Range, Sarah Sanborn, and Levi Old

Questions Contact:

Levi Old

lold@thegreatbasininstitute.org

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

CONFERENCE HIGHLIGHTS..... 2

 Panel Discussion: Wildlife Habitat Connectivity in the Northwest Basin and Range 2

 Panel Discussion: Changing Patterns of Water Availability on the Landscape: State of the Knowledge . 4

 Panel Discussion: Juniper, Weeds, and Seeds: Terrestrial Habitat Restoration in the Northwest Basin
 and Range 6

 Panel Discussion: Sage-Steppe Habitat Management in the Northwest Basin and Range 8

 Ignite Sessions..... 10

 Posters 11

 Activities..... 11

APPENDICES 12

 Appendix A: Example of Synthesis document for Riverine-Riparian Conservation Target 12

 Appendix B: Registration List 14

 Appendix C: Sponsors 19



"...great symposium, well worth my time."

Greg Cianella, Oregon Watershed Enhancement Board

"It was fantastic, I learned a lot."

Leah Knighton, Brigham Young University

"I made some really great connections down in Lakeview last month. It turns out there is a woman doing vegetation modeling in SE Oregon who literally sits downstairs in my building. I was connected with her through someone in my springs, seeps, and wetlands breakout group."

Hank Johnson, U.S. Geological Survey

EXECUTIVE SUMMARY

The Northwest Basin and Range Ecosystem Symposium attracted a dynamic and diverse group of people from the Northwest Basin and Range ecoregion and beyond to Lakeview, Oregon on February 15–16, 2017. They shared current research, field practices and tools to address the challenges and opportunities of natural resource management across this landscape. 115 people gathered for presentations, discussions, a facilitated work session, a sage-steppe tools workshop, locally catered food, and a wonderful keynote presentation. Key features of the Symposium included:

Panel Presentations and Discussions: Panel discussions included 18 regional experts representing universities, agricultural research stations, state fish and wildlife agencies, state water resources agencies, federal land management agencies, research institutions, soil and water conservation districts, non-profit organizations, and private lands. The panels covered a variety of aquatic and terrestrial natural resource and conservation topics at the landscape scale. Panel topics included habitat connectivity, water resources, and sage-steppe habitat restoration and management.

Conservation Target Breakout Session: Symposium participants self-selected into breakout session groups based on a conservation target of their choice. Target topical areas included: Wetlands, Seeps and Springs; Riverine and Riparian Systems; Sage-steppe Habitats; Aspen Woodlands; and Habitat Connectivity. Participants began by reviewing summary reports on their conservation target. The Northwest Basin and Range Synthesis project created these reports (example in Appendix A) by summarizing and synthesizing over 60 regional natural resource plans and assessments, plus scientific literature. The session included a participatory mapping exercise, a mock-up funding proposal based on an identified research or management need, networking with regional partners, and a report out to the larger Symposium audience.

Ignite Session: This series of short “lightning” talks included:

- *A vegetation assessment of the Burns BLM District*, Eric Sant, Open Range Consulting
- *Bird community within riparian areas of the Black Rock and Pine Forest Ranges, northwest Nevada*, Jennifer Ballard, Great Basin Bird Observatory
- *North Warner Multi-Ownership Forest Health Partnership*, Marci Schreder, Lake County Watershed Council
- *Science communication*, Dominique Bachelet, Conservation Biology Institute

Poster Session: The poster session included eleven presenters from conservation research, stewardship, management, and the arts. Please see separate [Link to View](#) poster abstracts.

Keynote Speaker: Professor Michael Branch, University of Nevada - Reno, delivered an inspiring and hilarious keynote address. Michael brings humor and insightful thinking into his works about Great Basin landscapes, family, and everyday experiences. He is well known for his High Country News series, *Rants from the Hill*, recently published book *Raising Wild*, and over 200 published essays.

Sage Steppe Tools Workshop: The [Conservation Biology Institute \(CBI\)](#) and the Bureau of Land Management (BLM) hosted a decision-support tool workshop on the afternoon of February 16th. 27 attendees learned about and provided feedback to CBI and the BLM about their sage-steppe and climate focused decision support tools.

CONFERENCE HIGHLIGHTS

Panel Discussion: Wildlife Habitat Connectivity in the Northwest Basin and Range

Panelist Presentations

Jim Strittholt, Executive Director, Conservation Biology Institute

- Jim provided background information on the evolving field of landscape connectivity science. Although there are a variety of modeling methods and tools that have been developed, the foundations of landscape connectivity science are rooted in reserve or protected lands design and the techniques are intended to describe the flow or movement of species and ecological processes.
- The issues of connectivity are scale-specific and species-specific. Barriers to wildlife movement or fragmenting agents could include natural barriers or anthropogenic barriers such as roads, energy development (power lines; wind, oil, and gas energy), and fence lines. Some solutions are easier to mitigate than others.
- The Oregon Connectivity Project is an ongoing, currently State-funded project with a working group consisting of the Oregon Department of Fish and Wildlife, Oregon Department of Transportation, Conservation Biology Institute, U.S. Fish and Wildlife Service, Defenders of Wildlife, and the Samara Group. The goal is to work at inter- and intra-ecoregional scales to, initially, integrate and leverage existing connectivity datasets and visualization tools using Data Basin to support decision making. The plan is to start with terrestrial and aquatic habitats at the same time, then focus on species such as greater sage-grouse, pronghorn, and migratory birds. There will be products within 9 months including synthetic datasets; the focus is on display/visualization and discoverability.

Mark Freese, Western Region Supervisory Habitat Biologist, Nevada Department of Wildlife (NDOW)

- Mark provided a state wildlife agency's perspective on connectivity. Maintaining landscape connectivity is a goal and NDOW has the capacity to affect decision-making on site development through technical review (e.g., National Environmental Protection Act [NEPA] document review). Threats to connectivity include fire, weeds, pinyon pine/juniper, habitat degradation (e.g., improper livestock grazing, wild horses), fencing, and human disturbance/fragmentation. Reactive modes for addressing threats are through avoiding, minimizing, or mitigating adverse impacts; the resource management planning process is more proactive.
- NDOW has connectivity-related data for hunted species such as mule deer and greater sage-grouse, but limited data for other species.
- The Nevada State Wildlife Action Plan provides a framework for statewide work and identifies focal areas (which are not yet formally cross-walked with BLM Resource Management Plan amendments). Ongoing or upcoming work includes mule deer movement models and Great Basin Landscape Conservation Cooperative (LCC) supported habitat division strategic planning.
- Resources are currently limited for bridging local scale considerations (e.g., connections between projects) with statewide scale (e.g., connection between groups of projects) with the ecoregional scale, but NDOW is working on a database and geospatial tool.

Gail Collins, Supervisory Wildlife Biologist, U. S. Fish and Wildlife Service

- Gail described a study she led examining the seasonal distribution, timing, and migration routes of pronghorn within the greater Sheldon-Hart Mountain area. The study was conducted in 2011/2012 and 2012/2013. Methods included use of VHF/GPS collars for location, elevation, and temperature and SNOTEL and other station data for weather and snow.
- Key findings included:
 - Peak travel was during fall migration; least travel occurred during fawning season. Maximum distance travelled was 40 km.
 - Pronghorn movement direction was variable but commonly between the two wildlife refuges (Sheldon National Wildlife Refuge [NWR] and Hart Mountain National Antelope Refuge).
 - Sampled pronghorn exhibited winter range in 2012/2013 twice the size and with lower site fidelity compared to 2011/2012 because 2012/2013 was a harsher winter (i.e., colder and with deeper snow) than in 2011/2012.
 - Conditional migration: there was more migration in 2012/2013 and generally, longer migration.
 - Exploratory migration occurred during fall before pronghorn settled on winter range; similar movements were not observed in spring migration.
 - There were no significant barriers to pronghorn migration for this population.

Philip Street, PhD candidate, University of Nevada - Reno

- Philip presented on his research looking at the influence of late summer habitat quality on the connectivity and fitness of greater sage-grouse. To develop resource selection functions, he used logistic regression models, with individual random effects. The model was trained using data from Sheldon and Hart Mountain NWRs with adjacent BLM land as a control. Validation data was from Eureka County, Nevada. The best model, selected based on AICc weight, included additive effects of slope and distance to road and interaction effects of dispersal distance, location type, and elevation; and normalized difference vegetation index (NDVI), distance to riparian, and elevation. The result effectively identifies low elevation meadows and high elevation sites used by greater sage-grouse.
- Implications of Philip's research include:
 - Fitness:
 - Movement to higher quality habitat is related to lower survival of adult females.
 - Use of higher quality habitat leads to higher probability of chick survival.
 - Management implications:
 - Stressors include feral horses, which are relatively unmanaged, and livestock grazing.
 - Mesic habitat is limiting.
 - Buffers around leks are not sufficient; they will not encompass the source of mortality for all populations.

Summary of Panel Discussion

- Connectivity modeling needs to be scale- and species-specific. While looking at the general permeability of the landscape may work for some species in some areas (e.g., pronghorn in the Sheldon-Hart Mountain area), other species such as pygmy rabbit or pika may need more species-specific and finer resolution of analysis.
- Key species to consider for protecting, as opposed to restoring, connectivity include pygmy rabbit, mule deer, elk, bighorn sheep, pika, and greater sage-grouse.
- Riparian corridors provide linkages between aquatic and terrestrial connectivity.
- Regarding the incorporation of climate into connectivity science, capturing extremes (e.g., in Gail's pronghorn example) is important. However, funding cycles may hamper the ability to do research that captures extremes because you cannot necessarily plan for them; therefore, long-term data sets are important.
- Partnerships are key for managing towards protecting or restoring connectivity, especially when dealing with management issues across jurisdictions. One key to success is being on the ground with landowners and stakeholders, building trust.

Panel Discussion: Changing Patterns of Water Availability on the Landscape: State of the Knowledge

Panelist Presentations

Jason Dunham, Supervisory Aquatic Ecologist, U.S. Geological Survey

- Jason discussed flow permanence and thermal regimes in upland streams in the Great Basin. Overall, the conservation community knows very little about water in upland streams of the Great Basin because of the lack of data. Jason's team analyzed 125 sites across the Oregon's Great Basin. See webinar [link](#) for more.
- Over the course of research, most sites in 2015 were drier than normal, but a few were cooler. Jason noted that when streams dry out, it typically lasts for less than five years.
- Upland streams saw high frequency, but short durations (<5 years) of dryness, with a rising variance. Rising variance is a regionally coherent phenomenon, likely driven by marine conditions (e.g., sea surface temperature).

Jonathan La Marche, Hydrologist, Oregon Water Resources

- Jonathan presented about understanding the changing patterns of water availability in the Oregon area. He focused on these changes in relation to Pacific Decadal Oscillation (PDO) and ENSO (El Niño-Southern Oscillation; La Niña and El Niño) events that influence Pacific Northwest weather and climate variability. PDO and ENSO are not as predictive as we would like for hydrology because southern Oregon and northern Nevada/California are in a transition area.
- Overall, changes include:
 - A decrease in precipitation, at least since 1980, but this may be static if you go farther back in time
 - Declining annual streamflow and groundwater
 - Cyclic wet and dry cycles of 10–15 years
 - Overall increased temperatures, reducing the snow/water equivalent and impacting water sources
 - Earlier snowmelt and runoff

- Stream systems that are more runoff-dominated, rather than spring-dominated, are exhibiting more variance.
- Jonathan stressed the need to understand groundwater and surface water interactions.

Hank Johnson, Hydrologist, U.S. Geological Survey

- Hank presented on the fundamental hydrological concepts in the Northern Basin and Range. He showed the traditional geology of the Basin and Range. It includes relatively short flow paths, streams decreasing in lower elevations, and that the streams that do not make it to the basin floor help feed groundwater supplies.
- The hydrological budget includes water going into the system (such as precipitation and interbasin groundwater flow) equals water going out of the system (such as evapotranspiration and interbasin groundwater flow) plus or minus a change in storage.
- The new quasi-equilibrium is a reduction or loss of streamflow, a reduction or loss of spring flow, and lower lake levels.
- Overall, managing water means managing trade-offs of water use.
- In Harney County, there is a project underway to develop a hydrologic model.

Nicole Sullivan, Owyhee Coordinator, Trout Unlimited (TU)

- Nicole presented on the High Desert Drought Resilient Ranching, a Regional Conservation Partnership Program. The program targets restoration efforts on private and state lands to improve wildlife habitat for three key species: Columbia spotted frog, sage-grouse, and redband trout.
- On these properties, the team sought to improve hydrologic function, improve cold water springs and stream reach, improve and increase wet meadow abundance, prioritize project selection based on multiple species benefits and livestock health, and provide education and outreach.
- The project united 14 partners and addresses 15 million acres in the Owyhee, Salmon Falls, and Malheur watersheds. The Natural Resources Conservation Service (NRCS) and TU are using GIS to prioritize Hydrologic Unit Code 12 (HUC 12) level watersheds for their work.

Justin Ferrell, District Manager, Lake County Soil and Water Conservation District; John Taylor, private landowner

- Justin worked with John, a private landowner, to establish a Candidate Conservation Agreement with Assurances (CCAA). CCAs encourage conservation actions for species that are candidates for listing as threatened or endangered, or are likely to become candidates.
- Justin and John have done several water-related projects on John's land.
- John stressed the importance of water, and recognized the need for private landowners to help with conservation efforts. Justin noted that a pre-existing relationship with John

on other efforts helped them set up the CCAA. Both agreed that relationship building is important in these partnerships.

Summary of Panel Discussion

- Research looking at groundwater using observation wells will reflect climate trends and water use; however, depending upon the level of neighboring water use, it may be difficult to see a climate signal. Soil and water conservation districts are engaged in irrigation efficiency improvements.
- Strong and resilient partnerships are built on trust and relationship building. It is important to work on both public and private lands when addressing issues with water availability. Managing water means trade-offs.
- Much is unknown about groundwater and its relationship with surface water in the NW Basin and Range. Further studies need to be conducted to better understand these relationships.

Panel Discussion: Juniper, Weeds, and Seeds: Terrestrial Habitat Restoration in the Northwest Basin and Range

Panelist Presentations

John Bates, Rangeland Ecologist, USDA - Agricultural Research Service

- John gave an overview of juniper woodland phases ([1] early-successional, [2] co-dominated, and [3] tree-dominated), available treatment options (prescribed fire, mechanical treatments, and herbicide), and vegetation responses following treatment.
- A low mortality rate of perennial grasses is key for keeping invasive annual grasses (cheatgrass) out. The recommended minimum monitoring for rangeland restoration in juniper-encroached areas is of perennial grasses.
- A study was conducted looking at old cuts and old burns (the oldest treatments were >20 years ago) in phase 2/3 areas. The chance of cheatgrass invasion was 50% following burning versus 20% following cutting treatments. The difference was due to perennial bunchgrass mortality.
- Other lessons learned included:
 - If phase 3 areas are burned, they should be reseeded. If in lower elevations, these areas may need reseeded with a non-native bunchgrass mix and using a seed drill.
 - Phase 3 areas may be treated for watershed values (e.g., erosion) or to recover shrub components (e.g., mountain mahogany).
 - Cutting and winter burns are recommended for removing flashy fuels, maintaining the herbaceous layer, and not burning trees hot. Pile burns are useful because of their smaller footprint and ease of reseeded following burning.

Kirk Davies, Rangeland Ecologist, USDA - Agricultural Research Service

- Kirk presented results from four studies looking at the restoration of mountain big sagebrush after fire in juniper-encroached rangelands. Study sites were in phase 2 and 3 juniper woodlands, 5000–6000 feet in elevation, and within Steens Mountain, the Northern Great Basin Experimental Range, or Duck Buttes. The first study looked at prescribed burning and broadcast seeding of native and introduced species in phase 3

juniper woodlands. The second study looked at the differences in prescribed burning and sagebrush seeding treatments between north and south aspects of a phase 2 juniper woodland. The third study looked at delaying seeding of sagebrush until four years post-fire, in phase 3 juniper woodlands. The fourth study looked at seeding phase 2 and 3 juniper woodlands after wildfires.

- Summary conclusions from the studies included:
 - Seeding sagebrush increased sagebrush in all cases, except when delayed.
 - Variability among sites and within sites was due to whether an area was phase 2 or 3 and due to aspect. South facing slopes were more difficult to recover.
 - Seeding herbs limited exotic annual grass expression; therefore, seeding herbs in addition to sagebrush is recommended. The seeding rate used was 13 lbs/acre for grasses and .5 lbs/acre for sagebrush.
 - The success of broadcast seeding depends on elevation; higher elevations equal better success (>5000 feet). If <5000 feet or on a south or west aspect, drill seeding may be needed. There are experiments with scattering cut juniper parallel to slope to keep snow/moisture on south slopes (i.e., snow redistribution)

Lindsay Davies, Three Rivers Fish Biologist, Bureau of Land Management - Burns District

- Lindsay presented on a cooperative effort to restore juniper-encroached habitat on a mix of private and public lands in the ~73,000 acre Five Creeks rangeland near Steens Mountain. NEPA was completed in 2006 and implementation began in 2007. Broad-scale treatments included cutting to carry fire and prescribed burning and specialized treatments included buffers along creeks and mountain mahogany and hand piling, and hand or machine piling around sage-grouse leks to retain sagebrush cover. Results were positive: juniper was reduced, seeding was successful, native bunchgrass response was strong, riparian habitat improved, and mountain big sagebrush recruitment increased.
- Lessons learned included:
 - Canada thistle biological control using the Canada thistle stem mining weevil worked well.
 - Elk caused issues with plantings. Wild horses pulled out seedlings; cheatgrass invaded. There is a need to do a seedling-pull test to determine root strength and when to bring grazers back to the site.
 - Because of the juniper removal there was a lost opportunity for large woody debris placement to improve riverine habitat.

Grace Haskins, Natural Resource Specialist, Bureau of Land Management - Lakeview District

- Grace provided a summary of invasive annual grass management in the Lakeview Resource Area. Partners include private landowners, Lake County Cooperative Weed Management District, U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife, Oregon State University extension, U.S. Forest Service (USFS), Natural Resources Conservation Service, and Soil and Water Conservation Districts.
- Aerial and ground surveys were performed for invasive annual grasses. The aerial surveys missed infestations; ground surveys were needed to find isolated infestations in areas where there was little information.

- Timing of annual grass treatments is in the fall but BLM is still testing and trying to coordinate with juniper treatments, grazing, follow-up herbicide application, and seeding. BLM is also working on a native seed production program.

Summary of Panel Discussion

- The success of restoration efforts depends upon many variables, including successional stage, elevation, aspect, and the use and timing of different techniques and technologies.
- Research needs include reseeding technologies (e.g., carbon pillows, the availability of native seeds), timing of seeding, and long-term monitoring of restoration sites.



Panel Discussion: Sage-Steppe Habitat Management in the Northwest Basin and Range

Panelist Presentations

Chad Boyd, Rangeland Scientist, USDA - Agricultural Research Service

- Chad discussed resilient management systems. He noted that historical point-source ecological management problems were important, but often simple to solve. Modern conservation problems are far more complex and persistent.
- In order to address persistent problems, management systems must be adaptive and last long enough to matter. This can be accomplished through collaborative decision making, having the appropriate scale (big enough to matter, small enough to work) and by having a science-based vision of how the ecological system works and what success looks like.
- Chad described fast thinking (reactionary) versus slow thinking (deliberate and considered). Often the policy and funding world lends itself to fast thinking, while the management world lends itself to slow thinking.
- Chad presented an example of different landscape types, threats to those communities, and what types of conservation measures can make landscapes more resilient.

Angela Sitz, Wildlife Biologist, U.S. Fish and Wildlife Service

- Angela presented on the multiple scale habitat needs of greater sage-grouse. She stressed that sage-grouse hens need four specific attributes for successful nesting: obstruction from the top and front, diverse stages of sagebrush, good sagebrush cover, and nearby food to nesting sites.
- Angela described multiple management scales, the landscape scale and site scale. She showed examples of successful versus unsuccessful nests based on varying scales.
- She also noted that sage-grouse do best when there is more than 70% sagebrush cover and less than 3% development, but in many cases there is over 30% development in areas, which results in lek abandonment.

Travis Miller, Wildlife Biologist, Bureau of Land Management - Burns District

- Travis presented an example of a sage-steppe habitat management project. His team conducted long-term monitoring where they used a permanent photo point to take photos over time and measure changes in ground cover, plant life, and more.
- Through this monitoring, his team mapped out sagebrush in the allotment. He stressed the importance of seeing patterns in sagebrush in order to understand trends.

Jeremy Austin, Hart-Sheldon Coordinator, Oregon Natural Desert Association

- Jeremy presented on a site-scale monitoring effort he did in the Beatys Butte region to help inform larger monitoring efforts. His team used line-point intercept protocols and looked at plant groups rather than species.
- Through a pilot effort in 2016, the team collected data to help inform management decisions, using methods described in Assessment Inventory and Monitoring (AIM) to standardize efforts with the surrounding landscape.
- Jeremy hopes to gather a more robust dataset in the second year

John Owens, Data Manager, U.S. Fish and Wildlife Service, former Wildlife Biologist, Bureau of Land Management - Lakeview District

- John described his work with the AIM protocol, an intensive one-size-fits-most database.
- John answered a series of questions from the audience. He described a telemetry study that captured sage-grouse and examined where they travelled to help determine areas of sagebrush cover. They learned that the BLM needs to be more “surgical” in addressing their sagebrush cover analysis.

Summary of Panel Discussion

- Today’s ecosystem challenges are more complex and persistent than past problems. In order to address these problems management systems must be adaptive and last long enough to matter.
- There is no one size fits all when it comes to habitat assessment.
- Scale can be a big challenge to effective habitat assessment in the Northwest Basin and Range.

Ignite Sessions

- **Black Rock & Pine Forest Bird Surveys, Jen Ballard Great Basin Bird Observatory (GBBO)**
 - Jen Ballard reported out on the bird surveys GBBO has been conducting in the Black Rock and Pine Forest regions of the Northwest Basin and Range.
 - There were a large number of conservation priority species including a high diversity of raptors.

- **Communication of Science, Dominique Bachelet, Conservation Biology Institute (CBI)**
 - Dominique talked about CBI's work to communicate science through a variety of decision-support tools designed for natural resource practitioners. CBI created Data Basin as a place to store and visualize spatial data.
 - CBI's tools include the Sage-Brush Climate Console, an interactive State and Transition Model platform (landscapesim.org), Environmental Evaluation Modeling System (EEMS) - an interactive tool decision support tool where users can create their own models, the USFS-funded climate adaptation and Seedlot Selection Tool where users can find out where to get seeds to maximize restoration potential.

- **N. Warner Multi-ownership Forest Health Project, Marci Schreder, Lake County Watershed Council**
 - This collaborative effort will facilitate restoration projects across federal/private to improve forest health (150,000 acres of land total; 50,000 USFS; 30,000 private); 17 private landowners are included in the effort.
 - The goal is to see ridgetop to ridgetop restoration: uplands, meadows, streams and other waterbodies.

- **Open Range Consulting, Eric Sant, Vegetation Assessment of the Burns BLM District**
 - Eric used Earth Sense Technology, a technique which combines high-resolution photo plots with nested satellite or aerial imagery, to evaluate rangeland condition at multiple scales for the Burns BLM District (4 million acres).
 - Scales evaluated include use of Chad Boyd's USDA ARS assessment method to qualitatively describe community state at 30 meters resolution, 1 meter resolution medusahead assessment, and 1 foot resolution sagebrush assessment.

Posters

Please follow this [link](#) to read through the poster abstracts.



Activities

On the afternoon of the first day Symposium participants self-selected into groups based on four conservation targets: Sage-Steppe; Aspen Woodlands; Riverine-Riparian; and Wetlands, Seeps and Springs. The participants were led through a series of questions to identify actions to mitigate target stressors, and to spend some time sharing knowledge via a participatory mapping exercise. Finally, each group mocked up a funding proposal to move forward on one of their action steps. The goal of the activity was primarily to network and discuss issues regarding Northwest Basin and Range conservation and natural resource issues. The compiled notes that include the action steps to alleviate systems can be found at this [link](#).



APPENDICES

Appendix A: Example of Synthesis document for Riverine-Riparian Conservation Target



Overview of Riverine and Riparian Systems

Rivers, perennial streams, and their associated riparian habitat make up only a fraction of a percent of landcover in the Northwest Basin and Range (NWBR), but they are vitally important to supporting life in the high desert. The NWBR is nested within the larger Great Basin watershed, one of the driest regions in the U.S. (Chambers, 2008). Riparian and riverine systems in arid and semi-arid regions are particularly sensitive to changes in climate (Chambers and Miller, 2004). Snowfall and spring runoff supply most of the water in the NWBR, and “water supply can vary dramatically from year to year” (Chambers, 2008).

NWBR rivers and perennial streams are characterized by highly variable flows. These surface waters sustain rural livelihoods, livestock, fish, wildlife, and moisture-loving plant communities. They add to regional biodiversity by harboring many species, such as the endemic Warner sucker (found only in the Warner basin), the federally threatened Lahontan cutthroat trout, and the recreationally important redband trout.

Riparian vegetation along the banks of perennial streams and rivers provides numerous ecosystem services. Riparian trees and shrubs supply wildlife habitat, nutrients that aquatic organisms depend on, and shade, which keeps water temperatures low. Riparian vegetation also stabilizes banks, filters surface water run-off and reduces sedimentation.

Riverine and riparian systems in the NWBR compete with agriculture, and to a lesser extent, residential development, for water. Diversions are widespread on rivers and perennial streams. Agriculture accounts for 90% of groundwater use in the larger Northern Great Basin ecoregion, and on average, groundwater levels are declining by about 6 inches per year, which will likely impact stream flows (BLM and SAIC, 2013).

Key Ecological Attributes

The Northwest Basin and Range Synthesis (NWBRs) identified the following Key Ecological Attributes that can be assessed and monitored to better understand the health of riverine and riparian systems in the NWBR.

- **Biological community structure** – How are the populations of focal fish species (e.g., redband trout), native aquatic invertebrates, and endemics (e.g., Warner sucker) faring compared to nonnative aquatic species?
- **Watershed and stream connectivity** – Roads, dams, culverts and natural barriers impede the movement of aquatic organisms through riverine systems.
- **Stream temperature and flow** – are vital for sustaining biological communities in and around streams. The percent of streams that are listed as Impaired by the EPA under Section 303(d) can be used an indicator of poor conditions.
- **Floodplain function** – Stream sinuosity, or the degree to which streams meander across their floodplains, can be assessed to determine whether they are within their natural range of variability.
- **Riparian cover** – The percent of riparian corridors that have intact native vegetation, compared to areas that have been degraded or developed.

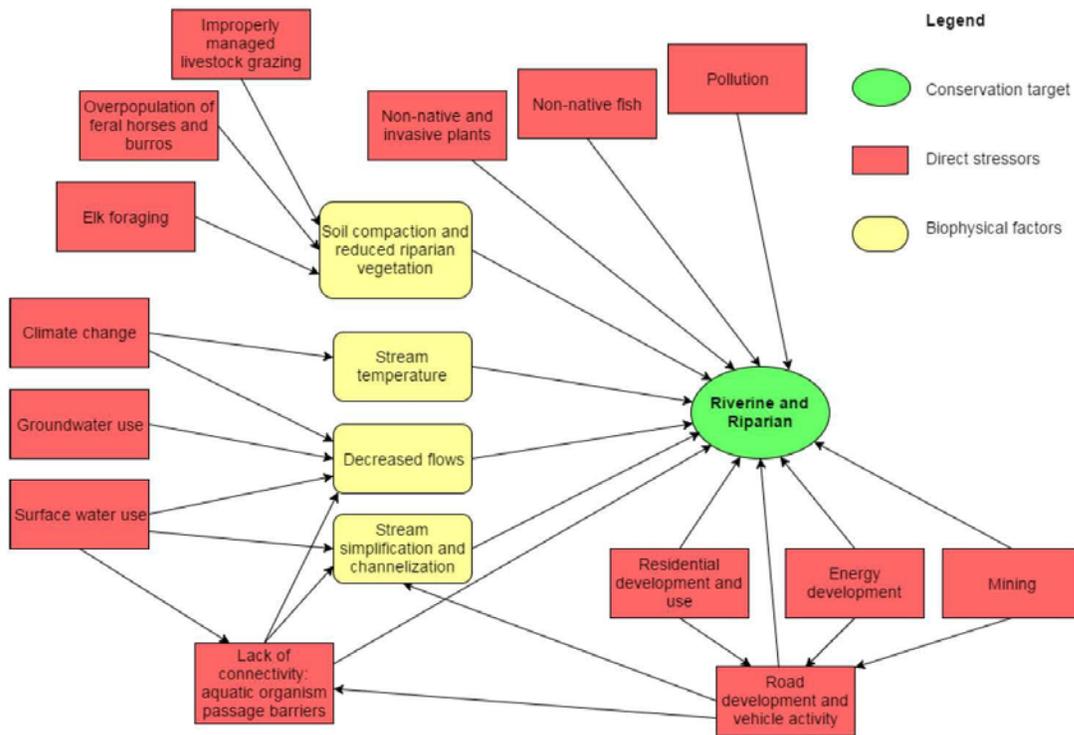
Key Stressors

The NWBRs synthesized scientific literature, management plans and expert opinion to identify the following key stressors to riparian and riverine systems:

- **Climate change** may alter the timing and amount of precipitation in the NWBR, resulting in different seasonal flow patterns and water availability.
- **Surface water use** reduces in-stream flow, which can increase water temperature and reduce dissolved oxygen content—degrading water quality and fish habitat.
- **Loss of connectivity:** Barriers, such as dams, diversions, culverts, and roads, plus fluctuations in flow, can block the passage of aquatic organisms, cut off lakes from streams, and isolate populations.
- **Improperly managed livestock grazing** can degrade riparian vegetation, reduce regeneration of hardwood trees and shrubs, and destabilize banks. Impacts of historic overgrazing may be difficult to differentiate from those of current practices.
- **Groundwater use** for drinking and irrigation may increasingly affect water levels in rivers, streams and their associated riparian areas.

Conceptual Model of Riverine and Riparian Systems

The NWBRS team created the following conceptual model of riverine and riparian systems using CMP's *Open Standards for the Practice of Conservation*. The model depicts the relationships between direct stressors (red) and important biophysical factors (pale yellow), all of which ultimately impact the health of riverine and riparian systems.



Selected References

Bauer S. and Salminen E. 2009. [Lake County Watershed Council Area Watershed Health Indicators](#). Oregon Watershed Enhancement Board.

Beever, E. 2003. Management implications of the ecology of free-roaming horses in semi-arid ecosystems of the western United States. *Wildlife Society Bulletin* 31 (3): 887-895.

BLM and Science Applications International Corporation (SAIC). June 2013. *Ecoregional Assessment Report: Northern Great Basin Rapid Ecoregional Assessment*. Contract L10PC00483.

Chambers, J.C. 2008. [Water resources in the Great Basin](#). In: Chambers, J.C.; Devoe, N.; Evenden, A., eds. *Collaborative management and research in the Great Basin*. Gen. Tech. Rep. RMRS-GTR-204. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. p. 20-23

Chambers, J.C. and Miller, J.R. 2004. *Great Basin riparian areas: ecology, management, and restoration*. Society for Ecological Restoration International. Island Press.

Clarke, S. et al. 2004. Oregon riparian assessment framework. Oregon Plan for Salmon and Watersheds. https://www.oregon.gov/OWEB/docs/pubs/or_riparianassessframework.pdf

Kauffmann, J.B. and Krueger, W.C. 1984. Livestock impacts on riparian ecosystems and streamside management implications, a review. *Journal of Range Management* 37:430-438.

Oregon Department of Fish and Wildlife (ODFW). 2005. Oregon Native Fish Status Report. <http://www.dfw.state.or.us/fish/ONFSR/docs/volume-1-final.pdf>

ODFW. May 12, 2015. [Malheur Lakes and Catlow Valley Redband Trout Conservation Plan: Public Review Draft](#).

ODFW. 2016. Oregon Conservation Strategy. Salem, Oregon. <http://www.oregonconservationstrategy.org/>

Sada, D. 2008. [Great Basin riparian and aquatic ecosystems](#). In: Chambers, J. C.; Devoe, N.; Evenden, A. eds. *Collaborative management and research in the Great Basin*. Gen. Tech. Rep. RMRS-GTR-204. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. p. 49-52.

U.S. Fish and Wildlife Service (USFWS). 2012. [Sheldon National Wildlife Refuge Comprehensive Conservation Plan](#).

Wildlife Action Plan Team. 2012. Nevada Wildlife Action Plan. Nevada Department of Wildlife, Reno, NV.

Appendix B: Registration List

This is a list of individuals who registered for the Symposium, or who the Project Coordinator connected with about attending.

First Name	Last Name	Email
Aaron	Collins	Aaron_Collins@fws.gov
Aaron	Switalski	aaron.switalski@idfg.idaho.gov
Adam	Schutz	adam.schutz@simplot.com
Amber	Ross	amber.ross@dsl.state.or.us
Angela	Sitz	angela_sitz@fws.gov
Anna	Kerr	anna.kerr@iwjv.org
Benjamin	Cate	Benjamin.Cate@burnspaiute-nsn.gov
Brandon	Haslick	Brandon.haslick@burnspaiute-nsn.gov
Brian	Day	brian_day@fws.gov
Calla	Hagle	calla.hagle@burnspaiute-nsn.gov
Cecilia	Marella	cmarella@blm.gov
Chad	Boyd	chad.boyd@oregonstate.edu
Chris	Colson	ccolson@ducks.org
Cidney	Bowman	cidney.n.bowman@odot.state.or.us
Cindy	Spiry	cindy@snoqualmietribe.us
Clint	Albertson	calbertson@fs.fed.us
Craig	Miller	gis@onda.org
Mary	Foster	craig.l.foster@state.or.us
Dan	Craver	dan_craver@fws.gov
Daniel	Montero	dannvdan@gmail.com
David	Bobzien	david@bobzien.com
Dawn	Hulton	fws.gov

Northwest Basin and Range Ecosystem Symposium Proceedings
February 15–16, 2017

First Name	Last Name	Email
Deborah	Ford	deborahford@playasummerlake.org
Denise	Joines	denise@wilburforce.org
Dominique	Bachelet	dominique@consbio.org
E.Lynn	Burkett	eburkett@blm.gov
Elizabeth	Johnson	elizabethjohnson@fs.fed.us
Eric	Sant	eric@openrangeconsulting.com
Eric	Jensen	ejensen@thegreatbasininstitute.org
Everard	Baker	elbaker@blm.gov
Gail	Collins	Gail_Collins@fws.gov
Garrett	Swisher	gswisher@blm.gov
Gina	Rone	grone@fs.fed.us
Grace	Haskins	ghaskins@blm.gov
Greg	Ciannella	greg.s.ciannella@oweb.state.or.us
Hank	Johnson	hjohnson@usgs.gov
Heidi	Albertson	heidiandcrew@yahoo.com
Jackie	Cupples	jacqueline_cupples@fws.gov
James	Strittlholt	stritt@consbio.org
Jami	Ludwig	jludwig@blm.gov
Jason	Dunham	jdunham@usgs.gov
Jason	Kesling	jason.kesling@burnspaiute-nsn.gov
Jaycee	Decker	leonard.jca@gmail.com
Jeff	Mackay	jeff_mackay@fws.gov
Jenny	Jayo	jjayo@fs.fed.us
Jeremy	Austin	jeremy@onda.org

Northwest Basin and Range Ecosystem Symposium Proceedings
February 15–16, 2017

First Name	Last Name	Email
Jerry	Keir	jkeir@thegreatbasininstitute.org
Jessica	Griffen	jessie.griffen@gmail.com
Jimmy	Leal	jleal@blm.gov
John	Tull	jctull@ndow.org
John	Kasbohm	john_kasbohm@fws.gov
John	Owens	jowens@fws.gov
John	Morris	jdmorris@blm.gov
John	Severson	john.p.severson@gmail.com
John	Stevenson	jstevenson@coas.oregonstate.edu
John	Taylor	taylorranch@centurytel.net
Jonathan	La Marche	jon.l.lamarche@oregon.gov
Justin	Ferrell	lakecountyswcd@hotmail.com
JUSTIN	Miles	justin.p.miles@state.or.us
Justin	Gibson	justingibson@fs.fed.us
Kai	Foster	kai.foster@consbio.org
Kaitlin	Hasler	kaitlin.hasler@or.usda.gov
Kate	Yates	khyates@blm.gov
Katie	O'Connor	katie.oconnor@consbio.org
Ken	Kestner	kkestner@co.lake.or.us
kevin	Halesworth	kevin.halesworth@odot.state.or.us
Kevin	Goldie	kevin_goldie@fws.gov
Kevin	Kunkel	kkunkel@blm.gov
Khem	So	khem_so@fws.gov
Kirk	Davies	kirk.davies@oregonstate.edu

Northwest Basin and Range Ecosystem Symposium Proceedings
February 15–16, 2017

First Name	Last Name	Email
Kyle	Gorman	Kyle.G.Gorman@oregon.gov
Les	Boothe	lboothe@blm.gov
Levi	Old	lold@thegreatbasininstitute.org
Levi	Bateman	lbateman@blm.gov
Lindsay	Davies	ldavies@blm.gov
Louisa	Evers	levers@blm.gov
Lucinda	Stobart	lstobart@blm.gov
Marci	Schreder	schreder@centurytel.net
Marilyn	Miller	goosemiller@msn.com
Mark	Freese	markfreese@ndow.org
Megan	Walz	mwalz@blm.gov
Melanie	Brown	Melanie.Brown@consbio.org
Melissa	Nelson	mjnelson@blm.gov
Michael	O'Casey	michael@onda.org
Michael	Dolan	heremusgramen@gmail.com
Michael	Branch	mbranch@unr.edu
Mike	Gough	mike.gough@consbio.org
Miranda	Crowell	mirandamaurine@gmail.com
Morgan	Weigand	mmweigand@blm.gov
Nicole	Sullivan	nsullivan@tu.org
Pete	Talbott	ptcows@gmail.com
Peter	Schreder	peter.schreder@oregonstate.edu
Randy	Wiest	randy.wiest@state.or.us
Rebecca	Carter	rjcarter@blm.gov

Northwest Basin and Range Ecosystem Symposium Proceedings
February 15–16, 2017

First Name	Last Name	Email
Renee	Aldrich	renee@basinandrange.org
Richard	Kearney	rkearney@blm.gov
Sarah	Sanborn	ssanborn@enviroissues.com
Shannon	Ludwig	shannon_ludwig@fws.gov
Shaun	Clements	Shaun.Clements@oregonstate.edu
Shawn	Zumwalt	shawn.zumwalt@state.or.us
Sheena	Miltenberger	sheena.miltenberger@state.or.us
Steven	Yates	w7egl@mysteelnet.net
Susan	Abele	susan_abele@fws.gov
Tara	Vogel	tara_vogel@fws.gov
Tim	Bowden	tbowden@blm.gov
Todd	Forbes	tforbes@blm.gov
Tosha	Comendant	tosha@consbio.org
Travis	Miller	tmiller@blm.gov
Valda	Lockie	vlockie@blm.gov
Vanessa	Schroeder	vanessa.schroeder@oregonstate.edu
Virginia	Mike	mikemercado@hotmail.com
Yolanda	Morris	yolanda@wilburforce.org
Zarela	Guerrero	zguerrero@fs.fed.us

Appendix C: Sponsors

