Regional Engagement Workshop Summary Report: Northwest Region

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U.S. Global Change Research Program
1800 G Street NW, Suite 9100 | Washington, DC 20006 | +1.202.223.6262
www.GlobalChange.gov

Introduction

The Fourth National Climate Assessment (NCA4), currently in development, will assess the science of climate change and its impacts across the United States. It will document climate change-related impacts and responses for various sectors and regions, with the goal of better informing public and private decision-making at all levels.

To ensure that the assessment is informed by and useful to stakeholders, engagement workshops were planned for each of the 10 NCA4 regions. These workshops provided stakeholders an opportunity to provide input to and exchange ideas with the chapter author team on key message formulation, share relevant resources, and give feedback on issues of importance to their region.

Workshop Structure

In an effort to maximize participation while easing travel burden, organizers employed a 'Hub and Satellite' model for most NCA4 Regional Engagement Workshops. A hub—or primary location—hosted stakeholders, the chapter author team, and NCA4 staff from the U.S. Global Change Research Program (USGCRP). Satellite locations throughout the region established remote connections to the hub for plenary presentations and discussion. Satellites were encouraged to hold break-out sessions on regional concerns and proposed topics for NCA4, reporting their discussions to the hub at a pre-determined time.

The Northwest Regional Engagement Workshop

The NCA4 Northwest chapter team held its Regional Engagement Workshops on March 21 & 23, 2017. The objective of the workshop was to gather input from a diverse array of stakeholders throughout the Northwest to help inform the writing and development of NCA4, and to raise awareness of the process and timeline for NCA4.

Rather than the hub-and-satellite model used by other regional engagement workshops, the Northwest chapter held two workshops, one in Portland, OR and one in Boise, ID. Participants were given the opportunity to join virtually for the Portland event.

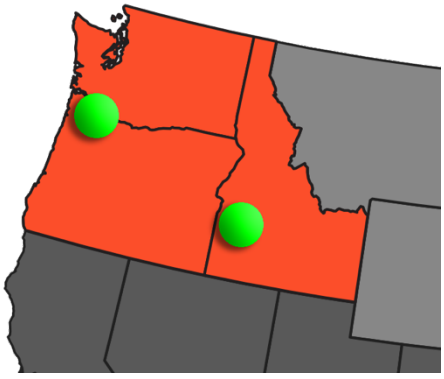

Figure 1. Map of the REW hub locations: Portland, OR and Boise, ID.

Authors, Locations, and Staff

Authors

- Charlie Luce, USDA – Forest Service (Coordinating Lead Author)
- Kris May, Silvestrum Climate Associates (Chapter Lead)
- Phil Mote, Oregon State University
- Gabrielle Roesch-McNally, US Forest Service
- Joe Casola, University of Washington
- Emily York, Oregon Health Authority
- Scott Lowe, Boise St University
- Gary Morishima, Quinault Nation
- Jennifer Cuhaciyan, US Bureau of Reclamation
- Mike Chang, Makah Tribe
- Meghan Dalton, Oregon State University
- Sascha Peterson, Adaptation International

Hub Hosts

- World Forestry Center (Portland, OR)
- Boise State University (Boise, ID)

USGCRP Staff

- David Reidmiller
- Chris Avery
- Susan Aragon-Long

Overview and Topics of Discussion

The two workshops (in Portland, OR and Boise, ID) followed similar agendas, with only minor differences based on the interests of the anticipated attendees. David Reidmiller, Director of the National Climate Assessment, opened the workshop with a welcome to all participants, and an introduction of all chapter authors and USGCRP staff who were present. Reidmiller went on give an overview of the NCA, providing context and explaining the goals of the workshop.

Philip Mote, author for the Northwest chapter, then led a discussion on the Northwest chapter itself. Additional detail on the Northwest chapter from NCA3 (2014) was presented, with specific detail provided on the key messages from that report.

Several Northwest Chapter authors then presented on the chapter's framing of issues through a geographical regional lens. These regions are broadly mapped in Figure 2.

- Kris May spoke about coastal issues, including increasing erosion and flooding, and warmer ocean waters, with all the pollution and acidification that entails.
- Gabrielle Roesch-McNally spoke about the inland Northwest, with an emphasis on challenges and threats to agriculture and ranching.
- Jennifer Cuhaciyan spoke about changes in snow and water supplies in the mountains, pointing out rising temperatures were resulting in less snow, which has acted as a natural water supply "reservoir," and all of

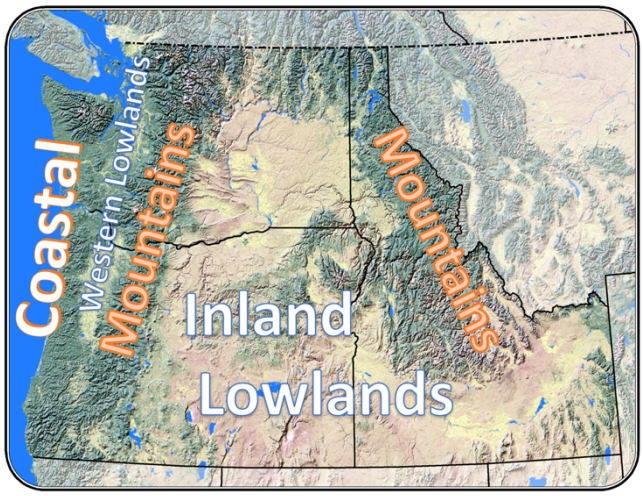

Figure 2. Map of the Northwest regional areas: coastal land, the densely populated western lowlands, mountains, and the inland lowlands.

the subsequent ecosystem impacts that were occurring as a result.
- Joe Casola spoke about the western lowlands, highlighting how warming and changes in water quality and quantity are becoming concerns for the urban centers and tribal communities in the area, emphasizing societal impacts.

In an open question and answer session to end the morning, stakeholders were invited to provide comment to the author team and USGCRP staff on the report development process, as well as the substance of the Northwest chapter.

During the afternoon, participants shared specific questions, issues, ideas, resources, and case studies for each of the aforementioned focal areas. For each focal area, stakeholders were asked a specific series of questions around which to structure their responses:

1. How is or how has climate change affected this topic (i.e. observed change)?
    a. Are there specific case studies you would suggest to illustrate that observed change?
2. How is climate change projected to affect this topic in the next 20-30 years and at the end of the century (i.e. projected change)?
    a. Are there specific case studies you would suggest to illustrate that projected change?
3. What challenges, opportunities, and success stories for addressing risk can be highlighted?
    a. Are there specific case studies you would suggest to illustrate those challenges, opportunities, and success stories?
4. What are the emerging issues and/or research gaps on this topic?
    a. Are there specific case studies you would suggest to illustrate those emerging challenges or research gaps?

Stakeholders were also given the opportunity to share thoughts on areas that were not covered by the previously-identified focal areas.

Key Takeaways

Stakeholders identified areas of opportunity and concern, case studies, and relevant regional information associated with each of the focal areas. This feedback was later distilled into key thematic takeaways for the chapter author team. These takeaways are summarized below.

Water Resources

- There is a great deal of uncertainty and variability in this topic.
- The idea of what is 'normal' is changing.
    - Focus on physical adaptation and upgrading facilities
    - Water quality is a priority, not just water quantity
- Related issues include tribal issues, northwest hydropower, the migration corridor, algal blooms, and freshwater concerns.
- Possible case study topics include: public health problems; marine topics; disease and pathogens; invasive species; sediment dynamics on salmon; intermediate zones in elevation; impacts of wildfire and dust on snow; reduced soil moisture impacts; consistency of snow; static collection sites unable to capture dynamics; glaciers and flooding; floodplain dynamics; and reservoir management.

Agriculture & Rural Issues

- Setting new baselines for water rights allocation, different probabilities of extreme water events and what that means for water planning.
- Water quality challenges, should be included, not just a water quantity issue
- Rangeland challenges tend to be ignored
    - Challenges with invasive species
    - Concerns about management and pea, productivity of forage
- Innovative solutions, such as for improvements to soil health and erosion prevention water conservation and retention, and community partnerships.
- Human health concerns, including social justice issues and specific challenges to farmworkers.
- Rural isolation, compounded by more extremes.
    - Upstream and downstream effects and access to services
- Authors need to be thinking in systems:
    - Economics and community well-being
    - Food-health-agriculture link
- Emphasis on the cultural heritage of the Northwest, including ranching, farming, and tribal ways of life.
- Invasive species are also a problem.

Forests & Natural Resources

- There is a web of issues that will be challenging to unknot for this piece of the chapter.
- A primary piece is changes in ecology. This will include species shifts and invasive species, movement of the timberline and shifts to ranges; and management of changing landscapes.
- Changes in forest ecology are impacting wildlife, migratory birds and other species especially. Forest disturbance, insects, and wildfire are also growing problems.
- There are connections to water resources here: forests are valuable to natural sourcewaters and their impacts on those hydrologies.

Human Dimensions

- Issues connected to human dimensions need to be embedded in each geographical region.
- Priorities include expanding ideas of what social science means; environmental justice and equity; training; identifying communities at high risk; public and human health especially for small communities; recreation; vector borne; tribal and indigenous vulnerabilities; and loss of livelihood and jobs.
- In NCA3, there were several videos that were relevant, but were not embedded in the final report. The author team should investigate whether that could be address in NCA4.
- We need to figure out how to better communicate and adapt our systems to work together. There are a number of interconnected systems that are going to change as the other move into a higher state of flux. Examples include: water, agriculture, and tourism; pressures on the housing market; and social safety net systems.

Built Environment

- As with many other topics, there are a lot of interconnected systems within the built environment. Some of these include: health, energy, water, transportation, and vulnerable populations.
- Groundwater quantity and quality is critical, both as drinking water and for broader use.

- Flooding, coastal flooding, and saltwater intrusion will also be important, and have effects on transportation.
- In emerging issues, some topics of focus include: heat preparedness, wildfire and other asthma triggers, and new pollens from new agriculture practices.
- Suggest focusing on promising solutions, such as: environmental justice with health impact assessments (Metro project discussed that created cost-benefit); co-benefits of actions; nature-based solutions in urban environments; Oregon Department of Transportation project where they combined moving levee that opened up space for fish and opened a new road; and conservation and efficiency could increase the offset of water demand.

Additional Topics

- It is critical to highlight traditional knowledge. Some experiences of traditional communities have robust solutions that need to be a part of the discussion. Examples include: clam gardens being used by the Swinomish, with stressors affecting food, health, and infrastructure.
- Think of habitats through connectivity lens; connections across the landscapes or watersheds and in doing so maintaining fidelity of functions, instead of doing well in one spot.
- Increasing integration of adaptation for climate and seismic risk.
- Consider focusing some on disrupting technological change and how that may affect our ability to adapt or play out. We have a smooth, linear expectation of how the future may unfold, which may be very wrong. Authors should be explicit when they make an assumption.
- Stories are critically important. Authors must include narratives so readers have something to relate to.

Western Lowlands

- What the authors refer to as the Western Lowlands are really never called that by anyone who lives there. Rather, residents of this region have specific names for the areas in which they live (Puget Sound, Portland metro, and Willamette Valley being relevant examples.)
- Summer of 2015 brought a huge number of events to the area: extreme heat, wildfire, smoke events, harmful algal blooms, and increased pressure on health systems, with cumulative effects that come from multiple hazards coming at the same time.
- What did the region look like before all the urban development?
- A wide array of projected changes for the area are documented; authors should mention them.

Mountains

- Glaciers are good examples and critical resources for the area. They have scenic value, are important water resources, and moderate impacts of heat on streams.
- There are research gaps on mountain snow. Most of the action is in the intermediate zone, which will move up as temperatures rise.
- Flora and fauna are being pinched out as species move with moving habitats.

Inland Northwest

- There are a lot of themes in this region that overlap with discussions from the Ag & Rural breakout group; “Rurality” was a term that brought together the unique nature and vulnerabilities of the area.
- Land use challenges will have to weight environmental needs vs rural livelihoods.
- Limited resources may force some opportunities to leverage partnerships.

- This area has unique vulnerabilities, such as changing economies, that make it quite distinct from its neighbors.

Oceans & Coasts

- Cross-jurisdictional issues (such as sea level rise and ocean acidification) are big issues. These will require coordination between Washington, Oregon, and British Columbia.
- Coastal issues are more than just sea level rise; it is critical to explain the science behind compounding storm surge, erosion, etc.
- Tourism and economies on the coast are critical, and it will be necessary to bring that up the food chain as it is explained.
- There are a ton of great case studies in this area. Authors should note how those examples in case studies are funded (federal, state, local).
- Authors should not talk about sea level rise without talking about seismic risk and tectonic lift. Significant seismic change could make all the issues of sea level rise go away.
- Coastal adaptation is not simple. Structures are not always solutions. The wrong adaptation solution could cause more damage than good in unintentional ways.

Results

The feedback provided during these workshops serves as valuable input to the development of not only the Northwest chapter of NCA4, but of all chapters. This summary report is being shared with all NCA4 authors to inform the development of their chapters, as well. It will also be made publicly available on the NCA4 website (www.globalchange.gov/nca4). Over 150 stakeholders throughout the Northwest region participated in the two distinct meetings, providing authors with a great deal of useful feedback – from concerns they face, to resources they use and specific case studies where communities are working to address the risks they face as a result of climate change. Responses from both authors and participants indicated that the workshop was not only positively received in and of itself, but it served to cultivate new relationships, research ideas and, hopefully, future collaborations across the Northwest.

About the NCA

The National Climate Assessment is the U.S. Government's premier resource for articulating the risks posed to the Nation by climate change, as well as what is being and can be done to minimize those risks. It is an inter-agency effort, bringing together experts from the 13 Federal agencies of USGCRP, the broader Federal government, as well as hundreds of experts in the academic, non-profit, and private sectors.

Appendix A: Workshop Agendas

4th National Climate Assessment

Northwest Regional Engagement Workshop

Tuesday, March 21 (Portland, OR)

Objective: To gather input from a diverse array of stakeholders throughout the Northwest to inform the Northwest (and related) chapters of NCA4, and to make the stakeholder community aware of the process and timeline for the development of NCA4.

8:30	**Registration opens**
9:00	**Introduction to workshop goals and brief introductions** *David Reidmiller – Director, National Climate Assessment, U.S. Global Change Research Program*
9:15	**What is the National Climate Assessment?** • Mandate, timeline, structure, etc. of NCA4 • Ways to get involved (ex. author, technical contributor, reviewer, etc.) • Areas of desired emphasis from public comments • Main findings from Northwest chapter of NCA3, focused on risk framing • Q&A *David Reidmiller – Director, National Climate Assessment, U.S. Global Change Research Program*
10:00	**BREAK**
10:15	**Preliminary Author Thoughts on Northwest Chapter** • Introduce chapter team of authors • Present notional chapter outline, sub-regional focus, & draft findings (*Kris May* – coastal; *Joe Casola* – lowlands; *Gabrielle Roesch-McNally* – inland NW; *Jen Cuhacayin* – mountains) *Philip Mote – Oregon State University and Regional Chapter Lead, Northwest chapter of NCA4* *Charlie Luce – USDA-USFS and Coordinating Lead Author of Northwest chapter of NCA4*
10:45	**Incorporating climate science in natural resources management and planning** *Kavita Heyn* *Climate Science Coordinator* *Portland Water Bureau*
11:00	**Stakeholder Perspectives**

Climate science and natural resource management challenges – *TBD*
Applying climate science to decisions - *TBD*

Open discussion for questions on process or content; suggestions on additional areas to address (or avoid); suggestions of resources to use or case studies to highlight; etc.

Potential guiding questions:

- What are the key attributes, assets and things of greatest value to the Northwest?
- And how are those things vulnerable to or at risk from climate change?
- Are there resources (reports, studies, etc.) or case studies we should be aware of?
- How have you used NCA3 in your own decisionmaking and how can NCA4 be useful? to you?

11:45 **Charge for Break-out Groups**

David Reidmiller – Director, National Climate Assessment, U.S. Global Change Research Program

Breakout sessions A and B will cover these topics for 40 minutes each. Participants may select any breakout group, and either stay during both sessions, or rotate to a different breakout group.

TOPIC	**FACILITATORS & NOTETAKERS**
1. Water Resources	Scott Lowe (Boise State University) & Jennifer Cuhaciyan (DOI-USBR)
2. Agriculture & Rural Issues	Gabrielle Roesch-McNally (USFS) & David Reidmiller (USGCRP)
3. Forests & Natural Resources	Charlie Luce (USDA-USFS) & Susan Aragon-Long (USGCRP)
4. Human Dimensions	Emily York (Oregon Health Authority) & Mike Chang (Makah Tribe)
5. Built Environment & Urban Issues	Sascha Petersen (Adaptation International) & Chris Avery (USGCRP)
6. Additional Topics, e.g., transboundary	Joe Casola (University Washington) & Meghan Dalton (Oregon State University)

- Introduce yourself (affiliation, area of expertise) and any role in previous NCAs
- For the given topic:
  - How is or has climate change affected this topic (i.e., observed change)?
  - How is climate change projected to affect this topic in the next 20-30 years and at the end of the century (i.e., projected change)?
  - What challenges, opportunities and success stories for addressing risk can be highlighted?
  - What are the emerging issues and/or research gaps on this topic?
  - Other issues / specific case studies to highlight?

For breakout session C, discussions will be organized by geographic interest. Participants may select any session.

Geographic interest	**FACILITATORS & NOTETAKERS**
1. Oceans & Coasts	Kris May & Gary Morishima

	2. Western lowlands	Joe Casola & Emily York
	3. Mountains	Jennifer Cuhaciyan and Charlie Luce
	4. Inland Northwest	Gabrielle Roesch-McNally
12:00	**Participants self-serve lunch**	
12:15	**WORKING LUNCH** **Break-out Session A (Topics)**	
12:50	**Break-out Session B (Topics)**	
1:30	**Break-out Session C (Geographies)**	
2:10	***BREAK***	
2:25	**Water Resources Read-out**	
2:35	**Agriculture & Rural Issues Read-out**	
2:45	**Forests & Natural Resources Read-out**	
2:55	**Human Dimensions Read-out**	
3:05	**Built Environment & Urban Issues Read-out**	
3:15	**Additional Ideas Read-out**	
3:25	**Oceans & Coasts Read-out**	
3:35	**Western lowlands Read-out**	
3:45	**Mountains read-out**	
3:55	**Inland NW Read-out**	
4:05	**Wrap-up & Next Steps**	
4:30	**ADJOURN**	

4th National Climate Assessment

Northwest Regional Engagement Workshop

Thursday, March 23 (Boise, ID)

Boise State University

Skaggs Hall (Room #1301), Micron Business and Economics Building

(at the corner of Capitol Ave. and University Avenue)

Parking is available on campus, in the Brady Street Garage, near Skaggs Hall

Objective: To gather input from a diverse array of stakeholders throughout the region to inform the Northwest (and related) chapter(s) of NCA4, and to inform the community of the process and timeline for the development of NCA4.

8:30	**Registration opens**
9:00	**Introduction to workshop goals and brief introductions** *David Reidmiller – Director, National Climate Assessment, U.S. Global Change Research Program (USGCRP)*
9:15	**What is the National Climate Assessment?** • Mandate, timeline, structure, etc. of NCA4 • Main findings from Northwest chapter of NCA3, focused on risk framing • Areas of desired emphasis from public comments • Ways to stay involved • Q&A *David Reidmiller – Director, National Climate Assessment, USGCRP*
9:45	**Preliminary Author Thoughts on Northwest Chapter** • Introduce chapter team of authors (photos for those not present) (*Charles Luce – USDA-USFS and Coordinating Lead Author of NCA4 Northwest chapter)* • Present notional chapter outline, sub-regional focus, & draft findings for Inland NW (*Scott Lowe* – Inland NW; *Jen Cuhacayin* – Mountains; *Charlie Luce* – Coasts & Oceans; Western Lowlands)
10:15	**BREAK**
10:30	**Stakeholder Perspectives**

<table>
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Potential guiding questions:
➢ What are the key attributes, assets and things of greatest value to the Northwest?
➢ And how are those things vulnerable to or at risk from climate change?
➢ Are there resources (reports, studies, etc.) or case studies we should be aware of?
➢ How have you used NCA3 in your own decision making and how can NCA4 be useful? to you?</td></tr>
<tr><td>11:00</td><td>Rotating Topical Sessions
David Reidmiller – Director, National Climate Assessment, USGCRP
The following topical issues will be addressed chronologically using the guiding questions below (which mirror the chapter template)
<table><tr><th><u>TOPIC</u></th><th><u>FACILITATORS & NOTETAKERS</u></th></tr><tr><td>1. Water Resources</td><td>Jennifer Cuhaciyan (DOI-USBR)</td></tr><tr><td>2. Agriculture & Rural Issues</td><td>Scott Lowe (Boise St Univ)</td></tr><tr><td>3. Forests & Natural Resources</td><td>Charlie Luce (USDA-USFS)</td></tr><tr><td>4. Human Dimensions</td><td>David Reidmiller (USGCRP)</td></tr><tr><td>5. Additional ideas</td><td>Susan Aragon-Long (USGCRP)</td></tr></table>
• Introduce yourself (affiliation, area of expertise) and any role in previous NCAs
• For the given topic:
o Are there new insights about observed changes that should be highlighted?
o Which projected changes are important for this topic in the next 20-30 years and at the end of the century (i.e., projected change)?
o What challenges, opportunities and success stories for addressing risk can be highlighted?
o What are the emerging issues and/or research gaps on this topic?
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<tr><td>3:15</td><td>ADJOURN</td></tr>
</table>

Appendix B: List of Northwest Regional Chapter Authors

Coordinating Lead Author: Charlie Luce, United States Department of Agriculture – Forest Service

Chapter Lead: Kris May, Silvestrum Climate Associates

Authors:

- Gabrielle Roesch-McNally, US Forest Service
    - Expertise: Inland Northwest, agriculture
- Joe Casola, Climate Impacts Group, University of Washington
    - Expertise: western lowlands; science; impacts assessment; adaptation planning
- Emily York, Oregon Health Authority
    - Expertise: health, air quality
- Scott Lowe, Boise St University
    - Expertise: agriculture, water, economics
- Phil Mote, Oregon State University
    - Expertise: climate impacts in the Northwest; science
- Gary Morishima, Quinault Nation
    - Expertise: tribal, coastal
- Jennifer Cuhaciyan, US Bureau of Reclamation
    - Expertise: water resources
- Mike Chang, Makah Tribe
    - Expertise: tribal; oceans; adaptation; social science
- Meghan Dalton, Oregon State University
    - Expertise: human health, tribal
- Sascha Peterson, Adaptation International
    - Expertise: adaptation, resilience

USGCRP staff:

- David Reidmiller, NCA Director
- Chris Avery, Senior NCA Manager
- Susan Aragon-Long, NCA Senior Scientist

Appendix C: Detailed Stakeholder Feedback on Focal Area Issues (Portland Workshop)

Agriculture & Rural Issues

$20M climate change research project (WSU, OSU and University Idaho)
Small acreage landowners – drought mitigation / land without waters rights

How is or has climate change affected this topic (i.e., observed change)?

- Qualitative and human dimensions of climate science – observed experience of change on the landscape is part of the broader picture that we need to focus on
- On the water rights side of things (Western water rights) in State of Oregon, the quantity of and timing of water available to permit for use is an issue. Determined by 30-year period (1958-1987) chosen because it was "representative" and sufficiently long where hydrology was. Not all streams were gauged, that pattern was taken and scaled to other rivers and streams that were not gauged. Water right permits were given determined on that.
- Another aspect of water issues to consider is irrigation systems. You can't put water on your crops until beginning of the season and can't put it on after the end of the season. But it's a lengthy process – need to know a year in advance.
- We're seeing this more and more – 2016 (more precipitation as snow, but it warmed up and melted quickly). Other states are recognizing this as a problem. Colorado RISA office put out a report in 2009 – are you seeing this issue, how are you dealing with it? Elect a water master to be lenient and hope it doesn't harm anyone?
- Nevada – a couple countries are testing a kind of moving from probabilistic to dealing with what you have. This is what Australia has been doing. Some are interested in updating that report and learning from other states. How do we get a better sense of what variability is now?
- Temperature changes; a better handle on precipitation changes (seasonal shifts) – precipitation shifting outside going seasons from spring to winter – would be useful.
- Investing resources into agritourism – i.e., "you-pick berry fields". People are wondering about that. A lot of them are homogenous crops – they make all their money in 2 months and are concerned about how climate changes may impact their livelihoods.
- Indoor products to protect themselves against unknowns. Cannabis – agriculture and security reasons – our concern is the power side of it; indoor ag is a lot more energy-intensive.
- Same thing for mint and other high-value products that people want to buy locally
- Irrigation district; amount of water loss that coincides with irrigation districts; there's a lot of room to improve our communication; Climate change and water conservation
- *In-region conflict?* Not so much of a problem because water right is water right, but people are starting to realize that it's become a more finite resource.
- We're needing to dig wells deeper and deeper; what makes it worse is that snowmelt is running into Pacific, so they're trying to capture the runoff and recharge the aquifers
- Aquifers are running dry in summer and needing to truck in water. This can have health effects in ag-centric industries. Affect not just physical, but also mental health – if you're relying on water to choose between giving water to livestock or irrigating crops. This can cause effects in the whole community

- There are opportunities with this, too. Capturing the run-off when it's available; building surface storage is expensive. Interface of urban and water.

How is climate change projected to affect this topic in the next 20-30 years and at the end of the century (i.e., projected change)?

- Can store water in soil; soil health and quality work – looking at strategies for **utilizing moisture from winter for summer use**. There's an opportunity (Andrew Millicin at OSU is making an online module about **drought-proofing your farm**)
- Stephen Machado (OSU) is working on environmental health module
- **Increasing organic material** - Mapping out where those soils are; conserve moisture for summer use.
- 1% increase in soil organic content → increase in 2000-5000 gallons. Wheat field on OR have lost soil organic matter. Building out some of that soil Organic Content – **cover crops, biochar** – instead of burning and releasing into atmosphere, char and put in ground
- Linking geographies together in NCA4 – **cross-regional issues and solutions** should be pulled into the chapter wherever possible
- Increase in **pesticides, herbicides and fertilizers** – how is that going to affect the health of farmworkers, farmowners and water quality
- Using goats (or other alternatives) instead of chemicals; First foods
- 8 tribes do rangeland mgmt. in NW; some concerns include old troughs that used to fill out and bone dry. How to bring water to livestock out there. Season of use is shortened; moving animals more or sending out water (e.g., drilling or use existing springs; using solar panels to drill down), but you start to have impacts on aquifers for the fish.
- **When you pull water from one resource, you impact another**
- **Viability of farming as a livelihood**
- How do you water your cows?

What challenges, opportunities and success stories for addressing risk can be highlighted?

- Don't get very much funds to implement a lot of these best practices – developing alternate watering points, water crossings; breaking pastures up w fences (no one likes fences)
- Working with communities – farmers and fishermen; how do you make everyone happy
- Many farmers are selling out because they can't afford it anymore.
- Spokane tribe not even issuing grazing permits the past two years
- Yakima have 10,000-15,000 horses running free on rangelands which impacts what is available. How do we properly manage horses out there (wild vs feral?)
- Horses are very valuable culturally, so **having communities take ownership is key**. They hold pride and value what they're doing on the ground a little more
- **Funds available for adapting farms** to more climate-friendly practices
- Utilizing vertical ag and greenhouses with pink lights – actions that are more resilient to climate change; trying to find a happy medium between traditional and modern agriculture
- Rural-wildland interface and increasing effects of wildfires and impacts on public health system. All parts of government need to mobilize to address the acute impacts

- Would be interesting if there are any case studies about an ecosystem and community affected by a wildfire 20, 10, 5, 1 year ago and how the ecosystem, community, government have all evolved, responded, adapted, built resilience, etc.
- We look at things in isolation; livestock running all over the place → land degradation
- Water quality – increasing intensity of water events; 25-yr, 24-hr event. Livestock growers are noticing that their systems are failing more often. Nutrient-laden water is being discharged
- Also, we need to be cognizant of the design standards not just for a given storm, but also atmospheric rivers; magnitude of any one event may not be in exceedance, but in such rapid sequence, can cause failure of systems
- Another farmer downstream can be impacted by the inability of upstream farmer to manage those impacts
- Clog up of drip systems from unicellular algae; in Malheur Basin - with all restrictions, they're not able to knock them out – issue of rainstorm intensity and what it carries and where it goes downstream from there (reservoirs on Columbia River system are accumulating this stuff and we're seeing toxic algal blooms – are they building up?)
- Forest fires – a lot of focus on municipal water supply; landslides
- Same can hold true for irrigation reservoirs; trying to stabilize soils and find alternative means to managing pests

What are the emerging issues and/or research gaps on this topic?

- **Impact on farmworkers** – what are consequences? (literature is hard to come by)
- Research study on migrant farmworkers

Water quality vs / and quantity

- How is a singular event affecting the whole community? At local level – especially at rural areas, work is so siloed. One reason for that is lack of resources. One thing that can be beneficial at local level – multi-disciplinary teams. One patient who has host of diseases or conditions. Different specialists come together to meet and develop comprehensive plan for individual. It's a big opportunity and challenge how to organize that and make it work in rural communities, in particular
- How can public health intersect with public food system → action plan; it'd just become part of health system
- We're beginning to talk about social determinants of health (e.g., equity), but also environmental determinants of health – bridging that gap
- **Food-health-agriculture connection** is missing to date
- **Systems thinking**?
- In final analysis (i.e., solutions), needs to be site-specific; is there more water for wheat, but less water for something else? Different parts of Pacific Northwest will be affected differently.
- If used as a planning document, a model we use in public health is a basic social-ecological model, where people can intervene.
- Willamette vs eastern Oregon – attributes and solutions will be different
- Willamette Valley – urban-ag interface is close, so water issues are more tightly-coupled

- Community-supported agriculture, farmers markets; (protect agricultural lands via zoning

Other issues / specific case studies to highlight?

- None were discussed

Human Dimensions

- Who reads the NCA4? Who do we hope reads it? What are the derivative products?
- There is utility for local governments – can consider NCA3 the backstop
- We need to include stories, narratives, tribal input. How do we want the NCA4 to evolve from the NCA3?
- NCA3 was web-based, more interactive – this was good. There were a lot of videos related to the NCA3, although they weren't as viewed because you had to go to a separate Vimeo channel to watch. Is there a way to embed the videos next time so that they are not separate from the report?
- Communications of the information is an important consideration when we're talking about human dimensions… are there visuals… not just of impacts observed, but looking 5 years out… what could our future be?
- Case studies should highlight best practices/success stories, not disasters
- Emerging human dimension issue is migration, how to address? There is not a lot of regional data on population projections related to climate factors, but it should still be discussed somehow
- How do we talk about the importance of stakeholder engagement within the NCA4? For example, the Local Environmental Observation (LEO) Network is a phone App that is engaging community members to increase 2-way/ participatory communication using modern technology to better track climate impacts. How can we highlight the importance of advancing "Citizen Science" approaches?
- Elders, low income people without air conditioning - heat waves can be deadly because we are not acclimated or prepared, as a region.
- Need more surge capacity in hospitals/medical clinics
- Heat waves create not just physical health risks, but also increase aggression/conflict/domestic violence, etc.
- Benton County is doing some cross-sector future scenario planning and beginning to assess financial impacts to various systems
- Future scenarios that include different socio-economic scenarios (not just different climate/policy scenarios); bringing together unlikely partners to discuss multiple stressors on systems.
- Displacement/migration, homelessness, climate refugees, etc.
- Air quality is a major concern – not just wildfire smoke, but ozone, other PM2.5 sources (diesel, etc.) considering non-climate stressors interaction with climate stressors; where can we move the needle/where do we have more control to change drivers?
- Public health has data/tools/expertise for surveillance/tracking/informing decision-making – but currently lacks the capacity/resources to really use them.
- Incredible mental health cost – suicide, etc. – need more surveillance
- Psychological First Aid – not just counselors, but community organizations need to be trained up on how to deal with the mental health implications of community-wide disaster/trauma, etc.
- There is an economic case (return on investment) for supporting these public health functions.

- There is a perception that government is purely regulative and not adaptive. In some places this is true, government programs are too rigid and not currently supported/directed to be more nimble and pro-active.
- Derivative products that may be developed off of this. Need to think of the audience. Narrative – people like stories.
- Tribal input is extremely important. Storytelling and narrative.
- Evolution of how NCA has evolved, the 3rd assessment has this interactive web interface – but lack of link to vimeo channels that is told by various reps from communities around the country. Also scientist videos and consequences of change. How can you build on this and re-imagine this? More stories to be incorporated into the assessment. How to be embedded into the report. Pictures of people!
- Same issues of developing climate action plan in Beaverton – the more visuals the better that are more relevant. Reframe on plan's outreach and communication. Help facilitate the future the people want to see (i.e. five years out rather than 50 years).
    - "at-a-glance" version of the plan.
- Emphasize the utility of the NCA for local governments, where a lot of adaptation and mitigation has to happen. NCA is a backstop – take it up with the feds, don't argue with me. Things like the traceable accounts can be useful. Something different – treating case studies as a method of best practices, and what local governments *should* be doing. (i.e. Chicago changing treatment strategies, Boston is moving hospitals). Case studies shouldn't just be about highlighting increased risk, but best practices at management.
- Migration as a research gap. (Human migration?).
    - Really hard to track this
    - Attributing moving somewhere to climate change is a huge problem
    - Challenge for which data to use? Climate impacts group; county level data.
- Engaging with stakeholders – point to the LEO network in Alaska, and expanding it the lower 48.
    - Local environmental observation network – started by Alaskan native health consortium.
    - Catalog changes people are saying, and how to get help to them.
    - Want to use tracking network and tie it to demographics (i.e. non-English speaking, elderly, etc…)
    - Expand and identify vulnerabilities
- In Portland this past winter, there were four deaths related to a more severe winter of homeless people.
    - Loss of livelihoods, disruption of local economy, already reduced housing, could influence homeless and low income housing areas
- Challenge and opportunity has to deal with community resilience in urban areas (or everywhere) – what am I/we going to in the future when climate change events happen
    - For example, lots around water conservation and less water is being used (but water price is going up).
    - How do we help people become more resilient? How to get in touch with family? (interconnected with the built environment). Urban communities need to be more involved since usually, rural communities already have these social connections.
- Air quality issue – we generally don't have ozone exceedances in the PNW, but with higher temperatures we may have higher ozone levels in the future which will be an issue.
- Community design, greenhouse gas emissions, and how do we address this within this assessment.

    - Cumulative effects of contributions to air pollution (i.e. ozone, transportation), and what happens when you add an increase to these pathways and are there levers that are easier to pull than others (i.e. if can decrease transportation, can buffer other pathways?).
- Changes in vector borne diseases, acute, and commutable diseases
    - Life cycle of insects/vectors. If not cold enough, they won't die off. Offspring born earlier, longer season
    - Opportunity to apply public health tools of surveillance and tracking to identify early the changes in these patterns and react earlier and prepare for disastrous events.
- Big issue is lack of resources to deal with all of these issues.
- Threat of internal migration due to climate change; can't exclude the influx of people from other parts of the world who are being displaced
- Climate change is a result of an increasing conflicts (i.e. in heat waves, crimes of aggression go up).
- Case study, Benton County Health - Climate change work can relate to local levels (county commissioners) and how they can shift financial resources within the county allocation.
    - i.e. recognizing how much resources are already allocated to addressing, understand the cost, and address this
        - Plowing roads five times, funding for flooding etc.
- Success story – how counties are developing climate plans to address these risks, and allocating a finite amount of resource/capacity to address climate change
    - Portland/Multnomah County adopted climate adaptation plans
- Gaps/data that we don't have that will make your job easier?
    - Building better collaboration with organizations or agencies that are in a position to be early warning sites
        - Hospital clinics, poison control centers, sharing info with local/state authorities
    - When a system fails– they don't want to contact DOH because it can be viewed as a regulatory agency.
        - Levels of trust between local communities and agencies

INLAND NORTHWEST

How is or has climate change affected this topic (i.e., observed change)?

- Lyme disease last year; and tick exposure and in SE WA and NE ID – West Nile virus; SE WA, Valley Fever from the soil
- Huge snow event – we attempted to declare an emergency and the isolation that can happen in our community; one of worst drought years to being snowed in
- Extreme heat events and prolonged events, something the PNW is not used to – isolated communities; vulnerable populations when they're shut off
- Declines in amphibian and pika, marmot population; upward migration of plants
- First Foods of tribes; less water in summer; higher water temperatures in summer – bad for fish.
- Extreme events and how to predict and deal with them; how to buffer the negative effects
- Fish and wildlife issues; water temp → less food; isolation of tribes
- Seeing a lot of changes (like NPS) – explosion in cheekgrass since 1980s; medusahead moving off clay soils; vintinata has emerged as new invasive plant affecting forest and rangelands – spread appears to be affected
- Juniper continuing to expand in conditions that in the past were dealt with

- No real observed change in water demand, but change in source water (temperature and seasonality/ availability)
- (Energy demand) System historically peaked in the winter, but peak is becoming more and more in summer. Variability is still there, which makes planning a challenge.

How is climate change projected to affect this topic in the next 20-30 years and at the end of the century (i.e., projected change)?

- None were discussed

What challenges, opportunities and success stories for addressing risk can be highlighted?

- Confluence of risk, stressors and impacts; how things are being compounded
- **Oregon Climate & Health Collaborative**, which helps to pool resources and ideas; being able to collaborate and pool resources and share ideas is an opportunity
- Conservation, distributed generation, microgrid is all good policy regardless of cause. Having more people involved in the power system (having an EV, battery and rooftop solar – more resiliency and buffer in times of a disaster – insurance policy of sorts)
- 6000 MW of conservation = 7 big dams over past several years, but that's a big change and impact
- Another opportunity – **bringing in more connectivity** between machine-to-machine to better understand the detail among machines and systems
- How you plan for habitat restoration in light of climate change; what species, how do invasives work?
- Salmon or steelhead access is no longer available to some; get fish up into those upland waters because of sensitivity to water temperature; access to tribal members.
- When we renew grazing permits, we're switching from rigid dates to "range readiness" approach. Time when cattle are grazing – and how long – will be much more variable
- They're re-doing some permits –Baker Priority Area for Conservation.
- Especially in Crook County, there are a lot more partnerships because of fewer resources – often times a much more "community" approach
- Big issue with inland NW is that it's semi-arid; with lack of water it really constrains your options. A lot of things are kind of on the edge anyways – expansion of salt desert scrub is expected, potentially. Types of invasive species may change. Maybe cheekgrass will die off, but we have red brome about to step in – trade one invasive species for another
- Could grow higher value crop than alfalfa, but water supply is becoming less reliable because Silvies River is becoming less reliable, so more farmers are putting in center pivots, and groundwater is over-allocated. Issues with domestic wells. And, in some cases, land subsidence.
- Economy of the NW; we used to be much more resource oriented (low value, high energy – paper, aluminum, timber), higher value lower energy-intensity products. **Changing economy of the NW** is both an opportunity and challenge for the NW.
- Monitor sprinklers more – don't just follow old habits, but check on status of plants.

What are the emerging issues and/or research gaps on this topic?

- Economics – how to integrate a little better

- Habitat restoration; how to allocate money in watershed where it's going to be too warm or too dry; where is the biggest bang for the buck
- I haven't heard environmental justice highlighted more; resource efficiency is important, but being sensitive to populations who need that focus
- Bull trout restoration efforts; due to climate change and looking at maps of where best to work in, many of those regions might be less of a priority. Streams they have access to may not have the fish.
- Farmworker / migrant worker issues

Other issues / specific case studies to highlight?

- None were discussed

Appendix D: Detailed Stakeholder Feedback on Focal Area Issues (Boise Workshop)

Preliminary Author thoughts on NCA4's NW chapter (Charlie Luce)

- Northwest is a very diverse region
- Author team is thinking about focusing on people perspective in regards to climate change in the Northwest

Open Discussion/Feedback

- Tribes not well represented in NCA3 – need better representation in NCA4
- Tribal Upper Snake River tribe did Climate Change Vulnerability Assessment in the Upper Snake River Watershed fact sheet (plus others)
- Fact sheet on Protecting Biodiversity in a Changing Climate
- With decommissioning of coal plants – what will be use on Water Use and Water Quality (and how will this affect water availability)
- Mitigation/adaptation are closely tied. The Nature Conservancy is feeling a more urgent press from its constituency to address greenhouse gases. Ways to couch sequestration issues without being policy-prescriptive. Renewable energy issues are also important.
- National chapter will discuss mitigation/adaptation nexus
- Need a strong focus on the economic impacts of climate change, which may be more relatable for the agricultural sector in Idaho (economics are what will get state politician's attention in ID)

- Any case studies on air quality standards near Sand Point? (Tribal reps will check to see what might be available).
- We are currently dealing with Agricultural/Businesses wanting to be able to increase pollutant loads in streams (issue for Tribes)
- Nutrient load issues in Oregon. There are some case studies we can point to in Idaho (ID didn't approve wastewater plant? Dixie drain project?).
- BioChar – are Tribes working on this? (not to their knowledge)
- Northwest Electric Loads are going to change. Right now peak for coasts is winter as compared to NW inland which peaks in summer. There will be impacts driven by the changes in when energy demand peaks.
- Ranching & Timber – lots of potatoes being lost due to increasing temperatures. It would be expensive to air condition storage buildings (haven't needed to do so previously)
- Monsanto is even looking at seeds and growing zones changing (they are very proactive in looking at these issues)
- Sage grouse/sagebrush loss in NW inland is an issue
- But a positive impact is that Idaho rangeland volunteer ranching firefighters are doing a much better job of fighting fires. Federal folks are providing training.
- Tribes – fish availability is an issue salmon/trout
- Assisted migration was brought up in Portland. Charlie – this may be a concern when you introduce new species.
- Contact Columbia River Treaty
- Contact Columbia Inter-tribal Commission
- Increased hypoxia is an issue

- Idaho utilities may be a useful group for authors to consult with
- **Agricultural & Rural**
    - feel pretty good about forecasting and modeling from research side. There is so much to be learned about SilvaCarbon, BioChar – the applied side needs more emphasis for "how will we solve the issues?"
- Idaho road closures due to avalanches impact communities
- **Forests**
    - Timber issue lower value trees displacing higher valued trees (becoming relevant issue to Idaho); check New Meadows region for species/places
    - Fire remains a big issue
    - Different set of demands and responses due to higher populations wanting to use forests for recreation
    - Salvage logging – value only first year or two after fire. There can be a glut of this type of wood (often just becomes firewood)
    - Insects and pest influences are a big issue with changing climate
    - Boise State University is doing big construction project on campus using salvaged wood., which is also being used for heating
- **Human Dimensions**
    - Tribal Cultural perspectives from Elders (what have they noticed) Fact Sheet (food/medicine/willow/etc.)
    - You may want to include some of the info from Yale study http://climatecommunication.yale.edu/visualizations-data/ycom-us-2016/ https://nyti.ms/2mL0o4J
    - Impacts of climate change on jobs is an important issue
    - Tribal Knowledge stories: contact Lee Juan Tyler (Shoshone-Bannok Tribe)
- Jen used NCA3 as a place to point people as a climate "primer"
- Potential changes in the future in energy costs (less snow may eventually equate to higher energy costs)
- **International/Transboundary Issues**
    - Agricultural exports – huge trade with other countries
    - Canada provides a lot of flood control
    - Grain barging –vs- trains –vs- shipping –vs- climate factors
- **2015 Issues**
    - Little brought up by Idaho participants (as compared to HUGE issues for Oregon)
    - Sockeye kill
- **Climate Change Positive Stories**
    - **Wine** – with a warmer season, the wine growing region has increased (Idaho, Walla Walla – change in grape varietals, and being able to grow grapes in regions you couldn't grow before – similar to Spain climate/regions)
    - **Hops** – land being acquired for hops (beer)
    - **Hay** – longer growing season, getting another cutting of hay (more profit)
    - **Idaho Power** has 10,000 acres in Oregon where they currently grow alfalfa, they are looking at moving to willow wood saplings and cottonwood saplings to line streams to help reduce stream temps
    - **Shipping lanes NW passage** and shipping for Oregon and Washington State