

**Climatic Change
Supplemental Material**

Adapting transportation to climate change on federal lands in Washington State, U.S.A.

R.L. Strauch, C. L. Raymond, R.M. Rochefort, A.F. Hamlet, and C. Lauver
Corresponding author: Ronda Strauch, rstrauch@uw.edu

Climate Change, Hydrology, and Access in the North Cascadia Ecosystem November 30 – December 1, 2011

Location:

Woodland Park Zoo Education Center, 750 N 50th St., Seattle, WA

Background:

This workshop is one in a series of workshops on climate change vulnerability and adaptation as part of the North Cascadia Adaptation Partnership (NCAP). These resource-specific workshops follow a series of four general climate change education workshops that were held at each of the four Forests and Parks participating in NCAP.

NCAP is developing climate change vulnerability assessments and adaptation strategies for four resource areas: (1) fish and fish habitat, (2) vegetation and ecological disturbance, (3) hydrology and access, and (4) wildlife and wildlife habitat.

This is a two-day workshop on climate change effects on hydrology and human access to the national parks and forests. The first day will focus on assessing the vulnerability of roads, trails, and other infrastructure to projected changes in climate and related hydrologic changes. The second day will focus on developing adaptation strategies and examples of tactics to help reduce the vulnerability of these resources to climate change. Results from this workshop will be incorporated into a final report on climate change effects, vulnerabilities, and adaptation plans for the North Cascadia ecosystem, which will be published as a Forest Service General Technical Report in summer 2012.

Workshop objectives:

- 1) Identify key sensitivities of roads, trails, and infrastructure to climate and related hydrologic changes in the North Cascadia ecosystem.
- 2) Review current access management priorities and share management approaches that have already considered climate or climate change.
- 3) Use the latest scientific information on climate change and projected effects on hydrologic regimes to identify adaptation strategies and tactics that can be implemented by the Forests and Parks.
- 4) Identify opportunities to work with other partners to develop adaptation strategies and tactics that cross jurisdictional boundaries in the North Cascadia ecosystem.

Agenda:

Day 1 – Vulnerability Assessment

- 9:00 – 9:15 **Welcome and statement of objectives**
Crystal Raymond, Research Scientist, USFS PNW Station
- 9:15 – 9:45 **Climate Change and Hydrology Projections for the North Cascadia Region**
Alan Hamlet, Research Assistant Professor, University of Washington
- 9:45 – 10:05 **Spatial Variability in Climate Change Effects on Snowpack in the North Cascadia Region**
Guilluame Mauger, Climate Impacts Group, University of Washington
- 10:05 – 10:20 Break
- 10:20 – 11:15 **Panel: Climate Change Effects on Roads, Trails, and Infrastructure. Glaciers and Aggradation – Sensitive Locations**
Jon Reidel, North Cascades National Park
Scott Beason, Mount Rainier National Park
- Flooding and Storm Water**
Ingrid Tohver, Climate Impacts Group, University of Washington
- Impacts of changes in snowpack, flood risk, and landslides**
Ronda Strauch, University of Washington
- Overview of current road, trail, and infrastructure management goals and objectives**
It is important to put climate change sensitivities in the context of current management goals and priorities for access associated with trails, roads, infrastructure, and cultural resources.
- 11:15 – 11:30 Overview of road, trail, and access management – Jim Ziolkowski (trails), Eric Walkinshaw (roads), Mt. Rainier NP
- 11:30 – 11:45 Overview of trail, road, and access management – Jack Oelfke, North Cascades, NP
- 11:45 – 12:00 Overview of trail, road, and access management – Mt. Baker-Snoqualmie NF team
- 12:00 – 12:15 Overview of trail, road, and access management – Marge Hutchinson, Okanogan-Wenatchee NF
- 12:15 – 1:30 **Lunch**
- 1:30 – 1:50 **FHWA Vulnerability Model – WSDOT Pilot Project**
Mark Maurer, WA Dept. Of Transportation
- Working Session – Vulnerability Assessment for Hydrology and Access**
- 1:50 – 1:55 Introduction to small group working sessions
Crystal Raymond, Research Scientist, USFS PNW Station
- 1:55 – 3:00 Small group discussion: climate sensitivities of hydrology and access (roads and infrastructure, recreation and trails, and cultural resources).
- 3:00 – 3:15 Break
- 3:15 – 4:00 Small group discussion continued.
- 4:00 – 4:25 Large group discussion of climate sensitivities identified in small groups (5 minutes per group).
- 4:25 – 4:30 Next steps and wrap up
Crystal Raymond, Research Scientist, USFS PNW Station

Day 2 – Adaptation Planning

9:00 – 9:10 **Opening comments and statement of objectives**
Crystal Raymond, Research Scientist, USFS PNW Station

9:10 – 9:20 **Summary of key points from the vulnerability assessment (Day 1)**
Crystal Raymond, Research Scientist, USFS PNW Station

Climate Change Adaptation for Roads, Trails, and Infrastructure

9:20 – 9:40 **Overview of Adaptation Principles for Hydrology and Road Management**
Alan Hamlet, Research Assistant Professor, University of Washington

9:40 – 10:10 **Adaptation Planning for Road Management on Olympic National Forest**
Bill Shelmerdine, Forest Engineer, Olympic National Forest

10:10 – 10:30 Break

10:30 – 10:50 **Climate Change Adaptation in Roadway and Bridge Design**
Amit Armstrong, PE, WFLHD, Federal Highway Administration

10:50 – 11:10 **Stehekin Valley Road Case Study**
Jon Reidel, North Cascades NP

11:10 – 11:30 **Road and Bridge Project Case Studies from the Mt Baker-Snoqualmie NF**
Felix Nishida, Assistant Forest Engineer, Mt Baker-Snoqualmie National Forest
Claribel Orellana, Civil Engineer, Mt Baker-Snoqualmie National Forest

11:30 – 1200 **Panel discussion and Q&A with morning speakers.**

12:00 – 1:30 Lunch

Working Session – Climate Change Adaptation Planning for Human Access

1:30 – 1:35 Introduce small group working session objectives
Crystal Raymond, Research Scientist, USFS PNW Station

1:35 – 2:45 Small group brainstorming session to identify: (1) adaptation strategies and tactics and (2) opportunities and barriers to implementation.

2:45 – 3:00 Break

3:00 – 3:30 Small group discussion continued.

3:30 – 4:00 Large group discussion on adaptation strategies identified in small groups (5 minutes per group).

4:00 – 4:15 Wrap up and next steps.
Dave Peterson, Research Scientist, USFS PNW Station

Climate Impacts, Sensitivities, and Expected Outcomes

What are the important climate change impacts and sensitivities of processes, functions, and projects in a changing climate?

Broad-Scale Climate Impacts (see list of 10 below)	Specific process, function, or project	Specific Sensitivity	Expected Outcomes

Broad Scale Climate Impacts: the overarching change in climate that is expected to affect roads, trails, infrastructure, and cultural resources

Specific Sensitivity: describe how the specific process, function, or project is sensitive to climate

Expected Outcomes: the ways in which the specific process, function, or project is expected to respond to the broad-scale climate impact because of its sensitivity to climate (draw from model projections or what can be inferred from responses to climatic variability).

Broad Scale Climate Impacts:

1. Increased winter air temperatures/fluctuation above and below freezing
2. More precipitation falling as rain rather than snow
3. Decreased snowpack
4. Earlier snowmelt
5. Increased winter and spring streamflows in some types of watersheds
6. Decreases summer streamflows in some types of watershed
7. Increased winter precipitation and runoff
8. Increased storm intensity
9. Increased flood frequency and magnitude in some types of watersheds
10. Elevation shifts in transition (rain-on-snow) zones.

Worksheet: Adaptation Strategies and Tactics

Identify adaptation strategies and tactics for implementation.

Expected Outcome	Adaptation Strategy	Adaptation Tactic	Time Frame

Sensitivity: from the list of climate change impacts and sensitivities identified in the vulnerability assessment (Day 1)

Adaptation Strategy: broad goals for adaptation responses that consider regional impacts and conditions

Adaptation Tactic: specific adaptation actions that can be applied to a single resource or specific site ("you could put them on a map")

Time Frame(s): approximate time frame for implementing strategies: Immediate, Short-term, Long-term, Conditional (e.g. triggered by event)

Worksheet: Adaptation Strategies and Tactics

Identify adaptation strategies and tactics for implementation.

Opportunities for Implementation	Barriers to Implementation	Information Needs

Opportunities for implementing adaptation strategies and tactics (regulatory, planning, ecological)

Barriers to implementing adaptation strategies and tactics (regulatory, legal, fiscal, trade offs)

Information Needs is an optional category to be completed if the group identifies some gaps in the information necessary to implement the adaptation strategy.

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