



United States Department of Agriculture

# Climate Change Across the Mt. Baker-Snoqualmie NF



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Forest Service

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# The Forest Service Climate Journey

**The Trail to a Sustainable Future**

**Summit**  
*(Leading)*



**Camp 2**  
*(Gaining Momentum)*

**Camp 1**  
*(Taking Action)*

**Climate Challenge**  
**Trailhead**

**Trailhead**  
*(Organizing)*



# Progress along the trail



**Organizing** – This stage includes any preparatory work including brainstorming and convening initial discussions within the Forest and with potential partners.

**Taking Action** – This could include promoting the use of climate information to inform adaptation planning.

**Gaining Momentum** – This could include integrating climate change information into adaptation planning and decision-making.

**Leading** – This could include implementing projects that integrated climate change information in their planning.

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# Sustainability Scorecard



# Core Elements – Desired Outcome



**Vulnerability** – Developing peer-reviewed climate change vulnerability assessments for use in informing environmental decision-making processes and adaptive management.

**Adaptation** – Management actions and decision-making processes explicitly integrate climate change information to inform managing ecosystems and resources under changing conditions.

**Monitoring**– Monitoring climate change drivers and the impacts of stressors linked to climate change on key resources informs future assessment and adaptation planning needs.

**Carbon Stewardship** – Evaluations will support decisions regarding how national forests and grasslands store and remove carbon from the atmosphere and/or minimize its release.

**Watershed Stewardship** – Adaptively manage NFS watersheds by implementing practices designed to maintain or improve watershed resilience to current and projected climate impacts.



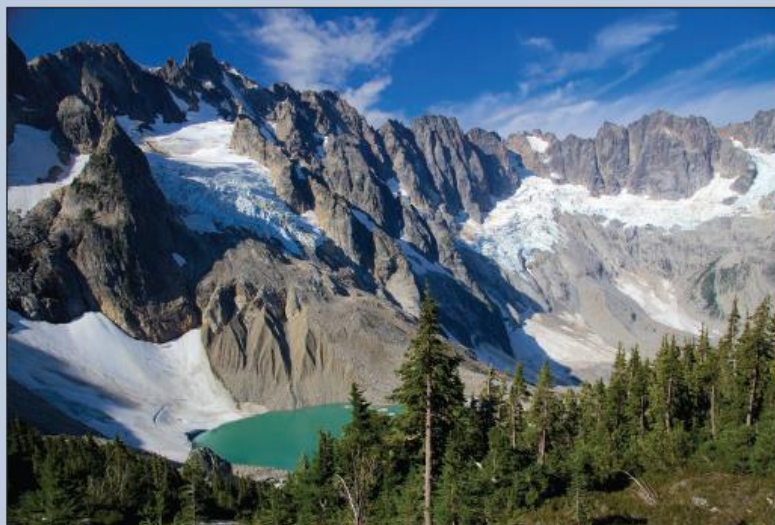
# Region 6 Sustainability Card Summary Ratings

Forest Name	Vulnerability	Adaptation	Monitoring	Carbon	Watershed Stewardship
Columbia River Gorge National Scenic Area	Gaining Momentum	Gaining Momentum	Taking Action	Gaining Momentum	Gaining Momentum
Colville National Forest	Leading	Gaining Momentum	Taking Action	Gaining Momentum	Leading
Deschutes National Forest	Leading	Gaining Momentum	Taking Action	Gaining Momentum	Gaining Momentum
Fremont-Winema National Forest	Leading	Gaining Momentum	Taking Action	Gaining Momentum	Taking Action
Gifford Pinchot National Forest	Leading	Taking Action	Taking Action	Gaining Momentum	Gaining Momentum
Malheur National Forest	Leading	Taking Action	Taking Action	Gaining Momentum	Taking Action
Mt. Baker-Snoqualmie National Forest	Leading	Leading	Taking Action	Gaining Momentum	Gaining Momentum
Mt. Hood National Forest	Gaining Momentum	Taking Action	Gaining Momentum	Gaining Momentum	Organizing
Ochoco National Forest	Leading	Gaining Momentum	Taking Action	Gaining Momentum	Leading
Okanogan-Wenatchee National Forest	Leading	Taking Action	Taking Action	Gaining Momentum	Taking Action
Olympic National Forest	Leading	Gaining Momentum	Taking Action	Gaining Momentum	Taking Action
Rogue River-Siskiyou National Forests	Leading	Gaining Momentum	Taking Action	Gaining Momentum	Gaining Momentum
Siuslaw National Forest	Gaining Momentum	Gaining Momentum	Gaining Momentum	Gaining Momentum	Gaining Momentum
Umatilla National Forest	Leading	Gaining Momentum	Taking Action	Gaining Momentum	Taking Action
Umpqua National Forest	Leading	Gaining Momentum	Taking Action	Gaining Momentum	Organizing
Wallowa-Whitman National Forest	Leading	Taking Action	Taking Action	Gaining Momentum	Organizing
Willamette National Forest	Gaining Momentum	Taking Action	Gaining Momentum	Gaining Momentum	Organizing
Regional Office	Leading	Leading	Gaining Momentum	Gaining Momentum	Gaining Momentum





## Climate Change Vulnerability and Adaptation in the North Cascades Region, Washington



Forest  
Service

Pacific Northwest  
Research Station

General Technical Report  
PNW-GTR-892

September  
2014



# Climate Change Vulnerability Assessment : Key Findings



- In response to warming, shifts from snowmelt-dominant to mixed-rain-and snow basins, and from mixed-rain-snow to rain-dominant basins are projected by the 2040s
- Climate models estimate little change in annual precipitation in the PNW when averaged over multiple models, but the seasonality of precipitation is projected to shift towards greater precipitation in autumn, winter, and spring, and less precipitation in summer



# Water Resource Impacts in the PNW Region

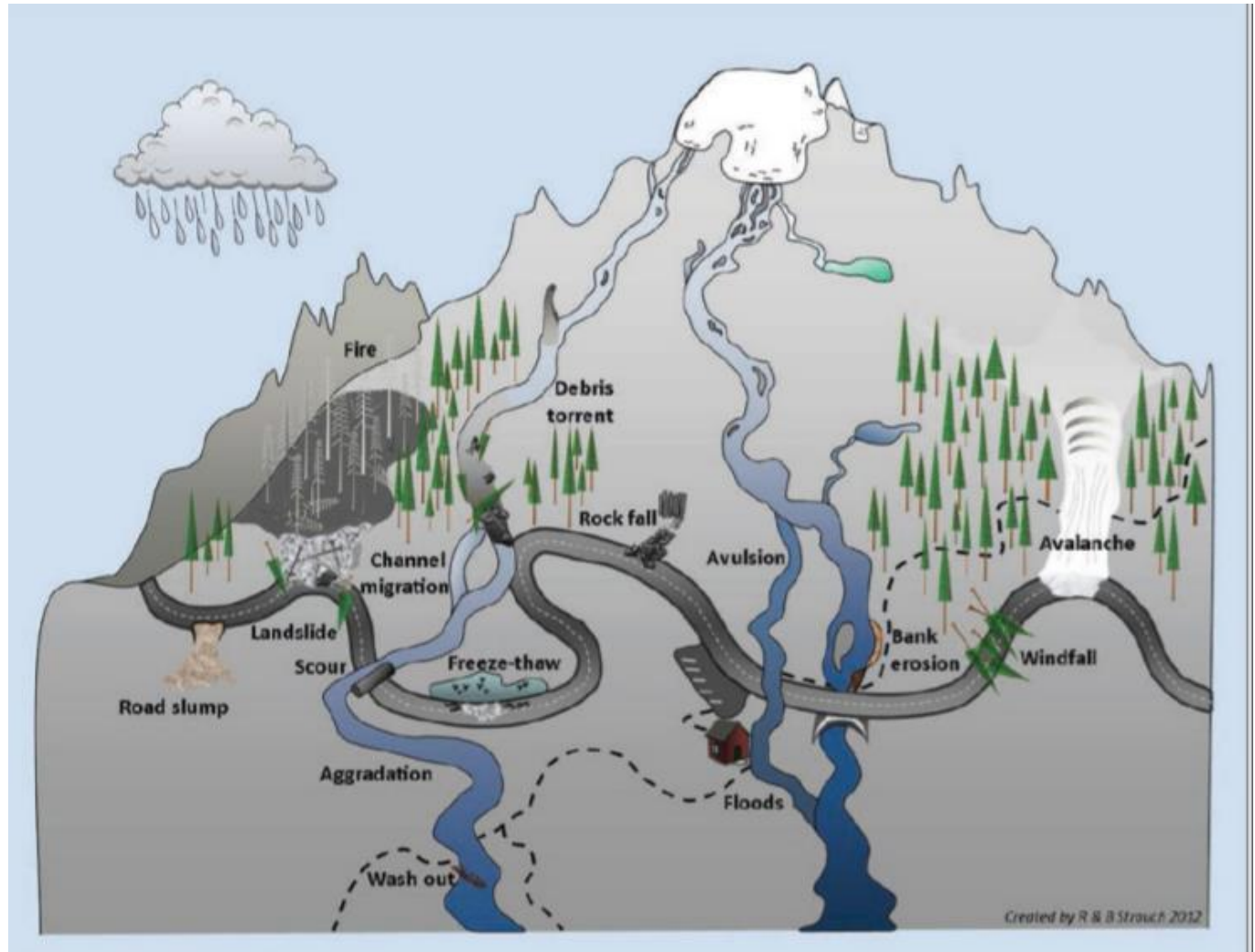


Figure 3: Hazards to transportation infrastructure with climate-related causes (Source: Strauch et al. In: Raymond et al., 2014).<sup>9</sup>

# Overview of Mt. Baker-Snoqualmie National Forest



- 2700+ miles of roads
- 10,000+ road culverts
- 170 road bridges
- 40-140+ inches of precipitation/year
- Steep elevation gradient
- Unstable soils
- 2+ million visitors/year
- No significant road maintenance budget

# Access and Travel Management : climate concerns



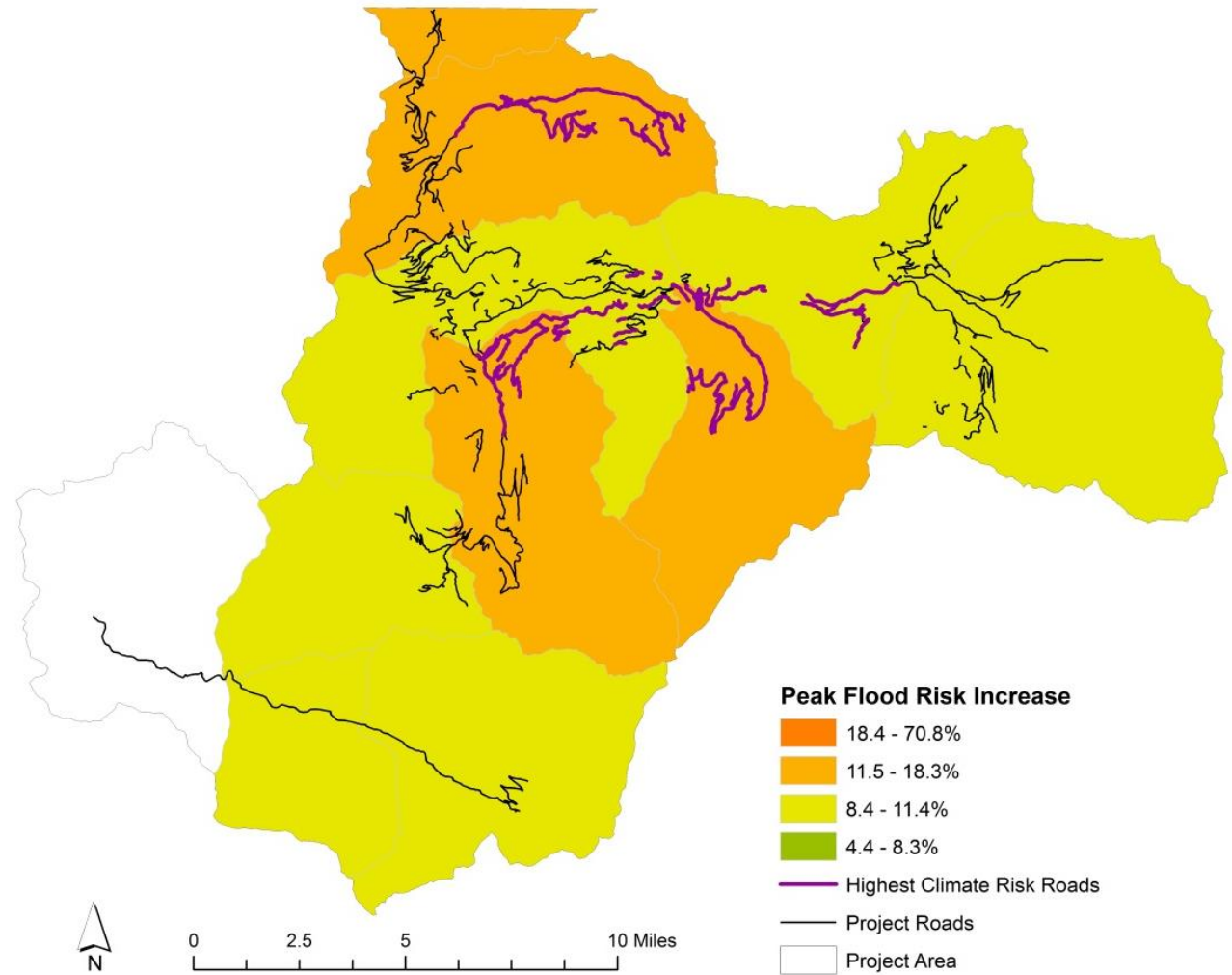
- Increased damage associated with higher peak flows and more frequent floods
- Increased damage associated with landslides, erosion, and saturated soils
- Decreased water availability with lower summer flows
- Changes in visitor use patterns that could lead to higher demand on facilities and public safety concerns

# Access and Travel Management : climate data

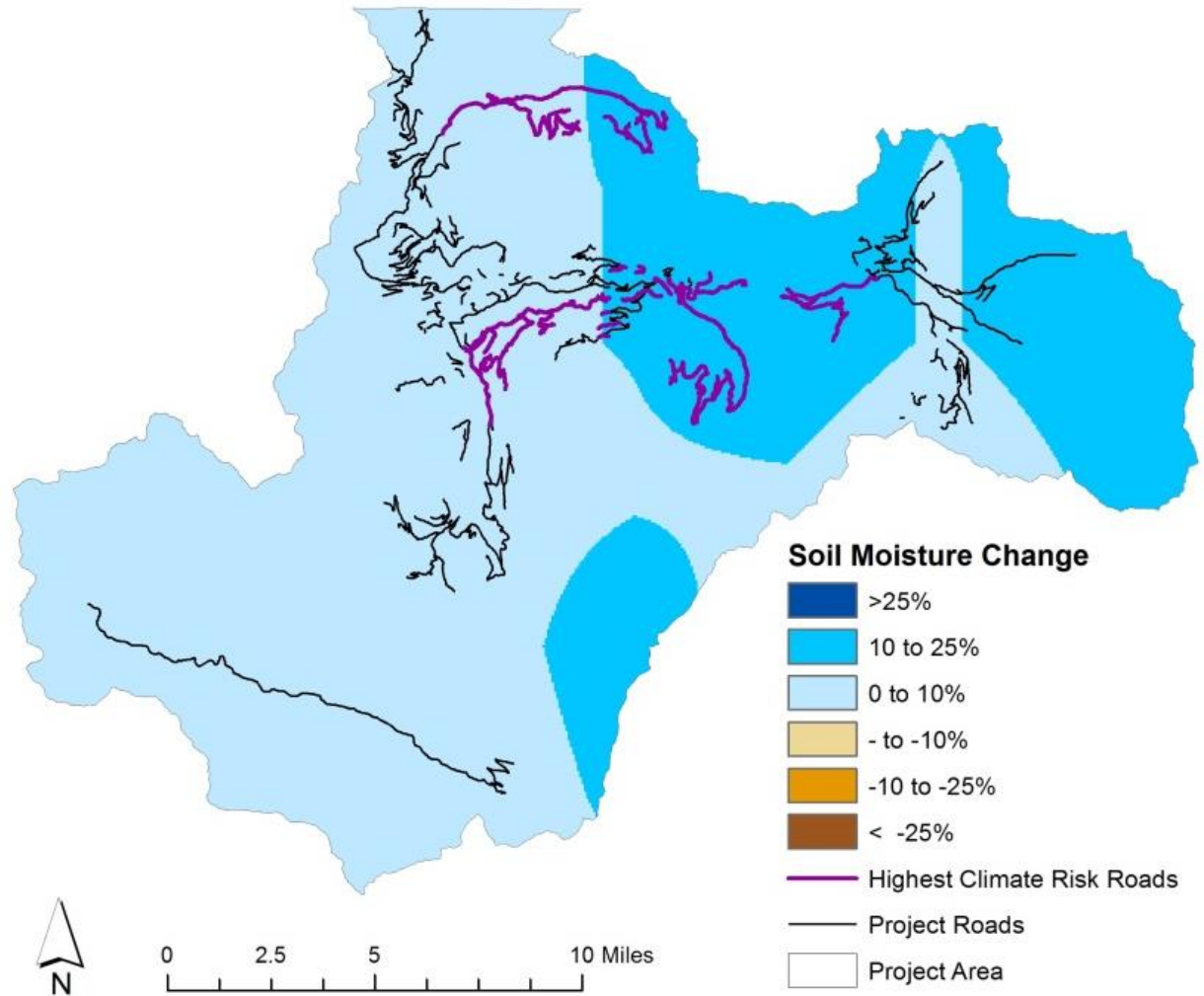


- **Watershed precipitation regime** - a classification of watersheds into categories of rain-dominant, snowmelt-dominant or mixed-rain-and-snow dominant, for each of four seasons for each of the climate scenarios.
- **The peak flood statistic** - the percent change of the 100-year flood level over historic (1916-2006) levels, for each of the future climate scenarios and aggregated by watershed. Values are based on 2080 climate scenario dataset.
- **Flood level** - the annual peak flow with an estimated 100-year return frequency (Q100), converted to a percentage of the present level.
- **Soil moisture percent change** - used as an indicator for potential landslides and slope failure. Values are based on the winter season 2080 climate scenario dataset.
- **Snowmelt date** - the number of days earlier that snowmelt is predicted to occur relative to the present, for each of the climate scenarios. Values are based on 2040 climate scenario dataset (2080 scenario data was not available).

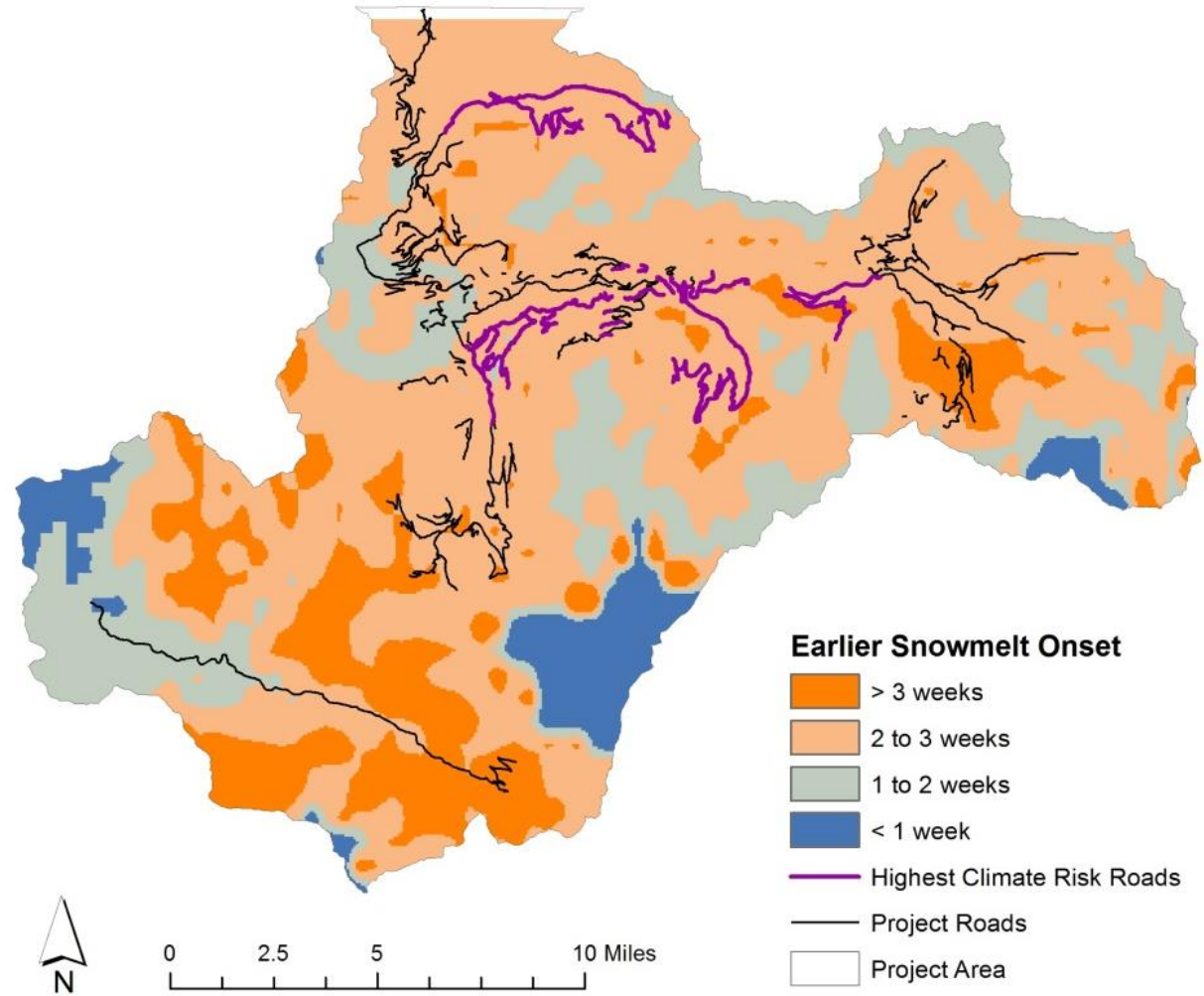
# Access and Travel Management : analysis



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# Access and Travel Management : analysis



# Access and Travel Management : analysis



**Miles of Roads within each Composite Climate Risk Score Group by Maintenance Level for Alternative 1  
Based on the 2080 Climate Projection Scenario.**

<b>Alternative 1 Maintenance Level</b>	<b>Risk Score: 40-47</b>	<b>Risk Score: 59-70</b>	<b>Risk Score: 71-88</b>	<b>Risk Score: 89-144</b>
3 to 5 – Suitable for Passenger Cars	4.7	13.4	56.8	53.6
2 – High Clearance Vehicles		3.2	43.6	60.8
2A – High Clearance, open only to administrative use				
1 – Basic Custodial Care (Closed)		1	6.2	
Decommission				
<b>Total Miles</b>	<b>4.7</b>	<b>17.6</b>	<b>106.6</b>	<b>114.4</b>



# Access and Travel Management : increasing resilience



- Installing hardened stream crossings
- Stabilizing streambanks
- Designing culverts for extreme flooding (100-year flood events)
- Upgrading bridges and increasing their height
- Reducing density of roads with high climate risk

# Implementation – signed NEPA decisions



- Nooksack Access and Travel Management EA (2017)
- Greenwater Access and Travel Management EA (2017)
- Mt. Baker Outfitter and Guide EA (2017)
- South Fork Stillaguamish Vegetation Management EA (2018)
- Snoquera Landscape Analysis EA (2020)

# Looking ahead



- Implement the decisions to date
- Continue to work with partners
- Sustainable Trails Strategy
- Shift to identifying vegetation refugia
- Forest Plan modernization

# Acknowledgements



- Ronda Strauch
  - Sustainable Roads Strategy climate change analysis
  - Climate Change, Hydrology, and Access in the North Cascade Range chapter\*
- George Wooten
  - Conservation Northwest
    - Travel management screens for the Mount Baker Snoqualmie National Forest (2013)
    - Analysis of climate change impacts to roads on the Mount-Baker Snoqualmie National Forest (2016)

\* Raymond, Crystal L., David L. Peterson, and Regina M. Rochefort. "Climate change vulnerability and adaptation in the North Cascades region, Washington." Gen. Tech. Rep. PNW-GTR-892. Portland, OR: US Department of Agriculture, Forest Service, Pacific Northwest Research Station. 279 p. 892 (2014).

