Access to National Parks and National Forest
Climate Change Impacts on Access to Forest Service and Park Service Lands in the North Cascades, Washington

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National Park Service
U.S. Forest Service
Why is climate a concern for access?

- Impacts already occurring
- Extensive infrastructure damage
- Expensive to repair and maintain

Photo – Sam Martinson
Study Location

Washington Access Network

North Cascadia Adaptation Partnership
Mountainous Region

Photo – Andy Porter

Photo – TheGirlsNY
Study Approach

- **Key drivers of impacts to access**
  - Snow, flooding, landslides (soil moisture)

- **Data source (Climate Impacts Group)**
  - Hydrologic model simulations (VIC) forced by statistically downscaled GCMs forced by A1B emissions scenario to local grid scales

- **Analysis**
  - GIS spatial analysis with roads and trails
Snow Impacts
Snow - Peak

April 1 Snow Water Equivalent (SWE)

1916-2006 Historical

1916-2006 Change

> 5 m
10 mm
+20% Increase
-100% No snow

2040s

Drier & Least Warming

Moderate Warming

Wetter & Most Warming

Figures by Rob Norheim (CIG)
Snow - Melt

90% Melt Date

2040s

PCM1
Drier & Least Warming

Ensemble
Moderate Warming

MIROC 3.2
Wetter & Most Warming
Snow & Access

- Which roads and trails may melt out sooner?

Snow melt ≥3 weeks earlier

Legend
- Roads
- Trails
Flooding Impacts
Stream Flows - Peak

Shift in 100-year Flood Statistic

2020s

2040s

2080s

Decrease 0.5 2.8 Increase

50 km
Flood & Access

- Where are flows likely to increase most?

100-yr flood double by 2080s
Landslide Impacts
Soil Moisture

December 1
Total Column
Soil Moisture

Historical

500 mm
100 mm

Change
Increase +35%
Decrease -10%

2040s

Drier & Least
Warming

PCM1

Moderate
Warming

Ensemble

Wetter & Most
Warming

MIROC 3.2
Where is soil moisture expected to increase?

> 10% increase by 2040s
Applications

- Recreation & transportation planning
- Restoration planning
- Minimum roads analysis
- Boundary adjustments
- Emergency response & safety management
- Maintenance prioritization
- Design culvert/bridge & roads/trails
- Resource staffing
- Monitoring and research
- Collaborations & partnerships
- Education & funding
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US Department of the Interior, USGS

Climate Impacts Group – Climate data & GIS
- Guillaume Mauger (snow data)
- Ingrid Tohver (flood data)
- Robert Norheim (GIS figures)

National Park Service & National Forest Service – project initiation & guidance