



**Pedestrian and Bicycle
Information Center**

Advancing Trails to Support Multimodal Networks and Resilient Infrastructure



Webinar Series, February 28, 2024

pedbikeinfo.org

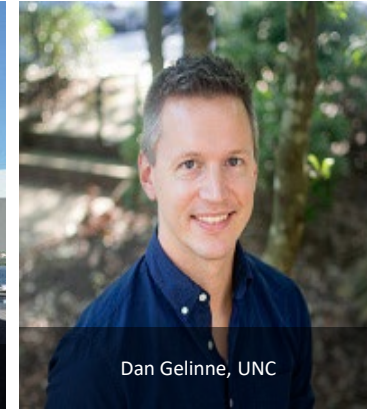
   @pedbikeinfo



Presenters



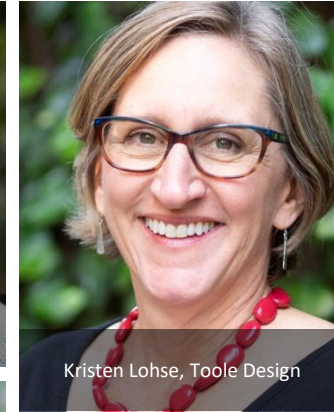
Christopher Douwes,
FHWA



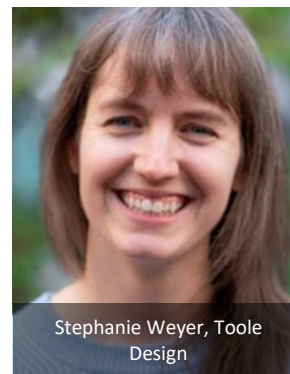
Dan Gelinne, UNC



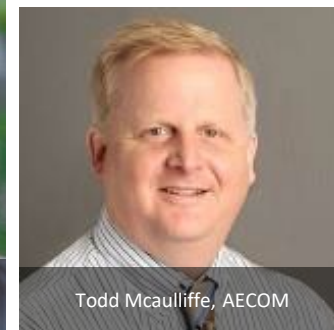
Jeff Ciabotti, Toole Design



Kristen Lohse, Toole Design



Stephanie Weyer, Toole
Design



Todd Mcaulliffe, AECOM

Housekeeping

- ⇒ **Submit your questions**
- ⇒ **Webinar archive: www.pedbikeinfo.org/webinars**
- ⇒ **Certificates and professional development hours**
- ⇒ **Follow-up email with more details**
- ⇒ **Review previous episodes and sign up for upcoming sessions**



Recreational Trails Program

- Currently a set-aside of funds from the Transportation Alternatives Set-Aside.
- Up to \$84.1 million/year, apportioned at 2009 levels.
- Part of \$281 million in Federal motor fuel excise tax paid annually by OHV users.
- \$1.5 billion for 27,000 projects since 1993.
- Provides funds to the States to develop and maintain recreational trails for all trail uses.
- Usually administered through a State resource agency (a few DOTs).
- 80% Federal share, with flexibility.
 - RTP funds may match or be matched by other Federal funds.
 - Some in-kind may be donated prior to project approval.
- Project sponsors are encouraged to use [Youth Corps](#). Sole source provisions apply.
- Change in BIL: New provision to treat any recreational trail project as an RTP project.
- **FHWA Administrative funds support trail research.**



Trails are Essential Transportation Infrastructure

- RTP [Publications](#) Page
- Links to many USDA Forest Service trail reports
- [Rails-with-Trails: Best Practices and Lessons Learned](#)
- [The Future of E-Bikes on Public Lands Research Study](#)
- [Electric Bicycles: Literature Review and Case Studies](#)
- [Tribal Development of Trails and Other Dedicated Pedestrian and Bicycle Infrastructure](#)
- [Trails and Resilience: Review of the Role of Trails in Climate Resilience and Emergency Response](#)
- [Trails as Resilient Infrastructure](#)
- Ongoing research: Rails-with-Trails Design and Engineering
- Trails are an integral part of a safe, accessible, equitable, and comfortable multimodal transportation network.



TRAILS AS RESILIENT INFRASTRUCTURE

GUIDEBOOK | December 2023



Gambles Mill Eco-Corridor (Photo: RES (Resource Environmental Solutions))

INFO BRIEF

Advancing Trails to Support Multimodal Networks

Overview: Trails Info Brief

www.pedbikeinfo.org/pdf/AdvancingTrailsToSupportMultimodalNetworks_PBICInfoBrief.pdf

INFO BRIEF

Advancing Trails to Support Multimodal Networks



Overview: Trails Info Brief

Sections that apply to your community

Communities that ...

are pursuing some of their first trails	have a built a beginning network	have an established trail network
<ul style="list-style-type: none">• Benefits of trails to build the case• Building support through partnerships and community engagement• Planning timeline	<p>Guidance on expanding the network:</p> <ul style="list-style-type: none">• Equity considerations• Route selection• Requiring developers to build or pay for AT infrastructure	<p>Design guidance to create a world-class network with amenities</p>

Sections that apply to your community

Communities that ...

are pursuing some of their first trails

have a built a beginning network

have an established trail network

Can all use...

- Equity considerations
- Regulatory strategies to coordinate land use
- Funding opportunities
- Evaluation and management
- Ideas to promote trail use

Research on the Benefits of Trails

- Network Connectivity
- Social, Historic and Cultural Preservation
- Economic Vitality
- Community and Individual Health
- Equity
- Climate Resiliency



What's new and useful?

EQUITABLE
TRAIL
DEVELOPMENT

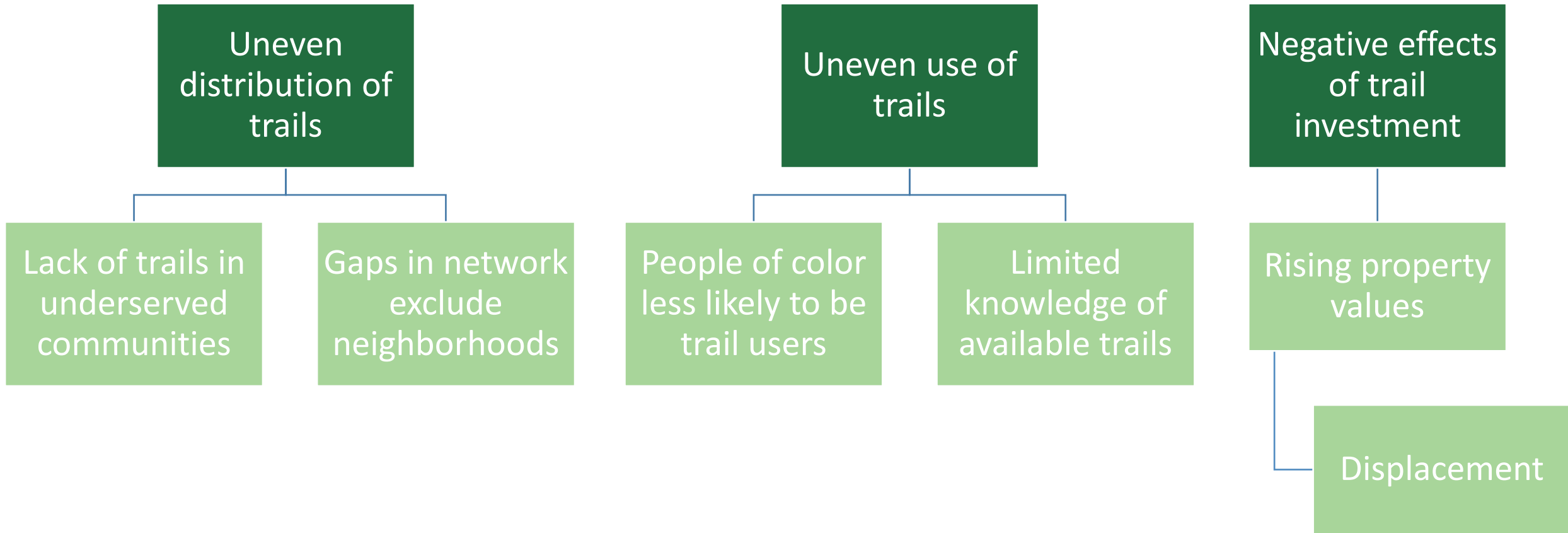
MULTIMODAL
NETWORKS

CLIMATE
RESILIENT
TRAILS

Equity and Inclusion



Recognizing Equity Issues



Tips and strategies for inclusion

For Partnerships

- Demonstrate a community-specific need or benefit
- Establish a formal structure to define roles and responsibilities.
- Understand the landscape of existing plans and policies

For social inclusion

- Centering local knowledge
- Creating structures of long-term co-governance



Joe Louis Greenway



Resisting “green gentrification” and displacement

Tools for resisting displacement

- community land trusts
- public land disposition
- business tax incentives
- inclusionary zoning
- affordable housing
- rent control
- home loan and improvement programs
- owner-occupied tax relief
- business tax incentives

Multimodal Networks





For **recreation** and **transportation**

Trails are being used for a variety of reasons

By walkers, bikers, skaters, scooters, joggers, and people using assistive mobility devices

How we plan and build trails is changing



Multimodal Trail Considerations

- Trail material and width
- Managing speeds, especially if e-bike and e-scooters allowed
- Local connectors to access trail networks or previously inaccessible destinations
- Supplement existing transportation options



Climate Resiliency



Trails & Climate Change

resilience, adaptation, and mitigation



Gambles Mill Eco-Corridor, Richmond, VA
Image: Waterstreet Studio

Guidebook: Trails as Resilient Infrastructure



Guidebook topics/chapters

1. Introduction and Context
2. Planning and Implementation
3. Evaluating Vulnerability
4. Design and Engineering for Resilience
5. Emergency Response Planning
6. Maintenance and Management
7. Conclusion
8. Case Studies

Presentation Topics

Guidebook

1. Climate Impacts to Trails
2. Adapting Trails to Climate Impacts
3. Trails for Climate Mitigation
4. Trails for Emergency Response
5. Taking Action!



Climate Impacts to Trails

01



Evaluating vulnerability

The Climate Explorer interface is divided into several sections:

- Header:** "The Climate Explorer" with an "About" link.
- Location:** "Washoe County, NV".
- Map:** A map of Washoe County with a location pin. Below it, a "Climate Maps" section with the text "past and projected future conditions in your county." and a "Climate Graphs" section with the text "Check past and projected values for climate variables."
- Graphs:** A "Climate Graphs" section with the text "Check past and projected values for climate variables." and a "Ready to plan for resilience?" section with the text "Resources from our partners can help you identify what matters and evaluate how climate change could affect it:" and a list of bullet points:
 - Check your exposure to extreme events such as wildfires and
 - Identify social vulnerabilities across urban areas
 - Get step-by-step guidance for completing a vulnerability assessment and an action plan.
- Events:** A "Climate Graphs" section with the text "Check past and projected values for climate variables." and a "Ready to plan for resilience?" section with the text "Resources from our partners can help you identify what matters and evaluate how climate change could affect it:" and a list of bullet points:
 - Check your exposure to extreme events such as wildfires and
 - Identify social vulnerabilities across urban areas
 - Get step-by-step guidance for completing a vulnerability assessment and an action plan.
- Extreme Events:** A "Climate Graphs" section with the text "Check past and projected values for climate variables." and a "Ready to plan for resilience?" section with the text "Resources from our partners can help you identify what matters and evaluate how climate change could affect it:" and a list of bullet points:
 - Check your exposure to extreme events such as wildfires and
 - Identify social vulnerabilities across urban areas
 - Get step-by-step guidance for completing a vulnerability assessment and an action plan.
- Map View:** A large map of California and Nevada showing temperature projections. The map is color-coded from blue (cooler) to red (warmer). A location pin is placed over Reno, NV. Below the map, there are controls for "Higher Emissions" and "2020s".
- Navigation:** A bottom navigation bar with icons for "Climate Maps", "Climate Graphs", "Extreme Events", "High-Tide Flooding", and "Take Action".

River and Stream Flooding

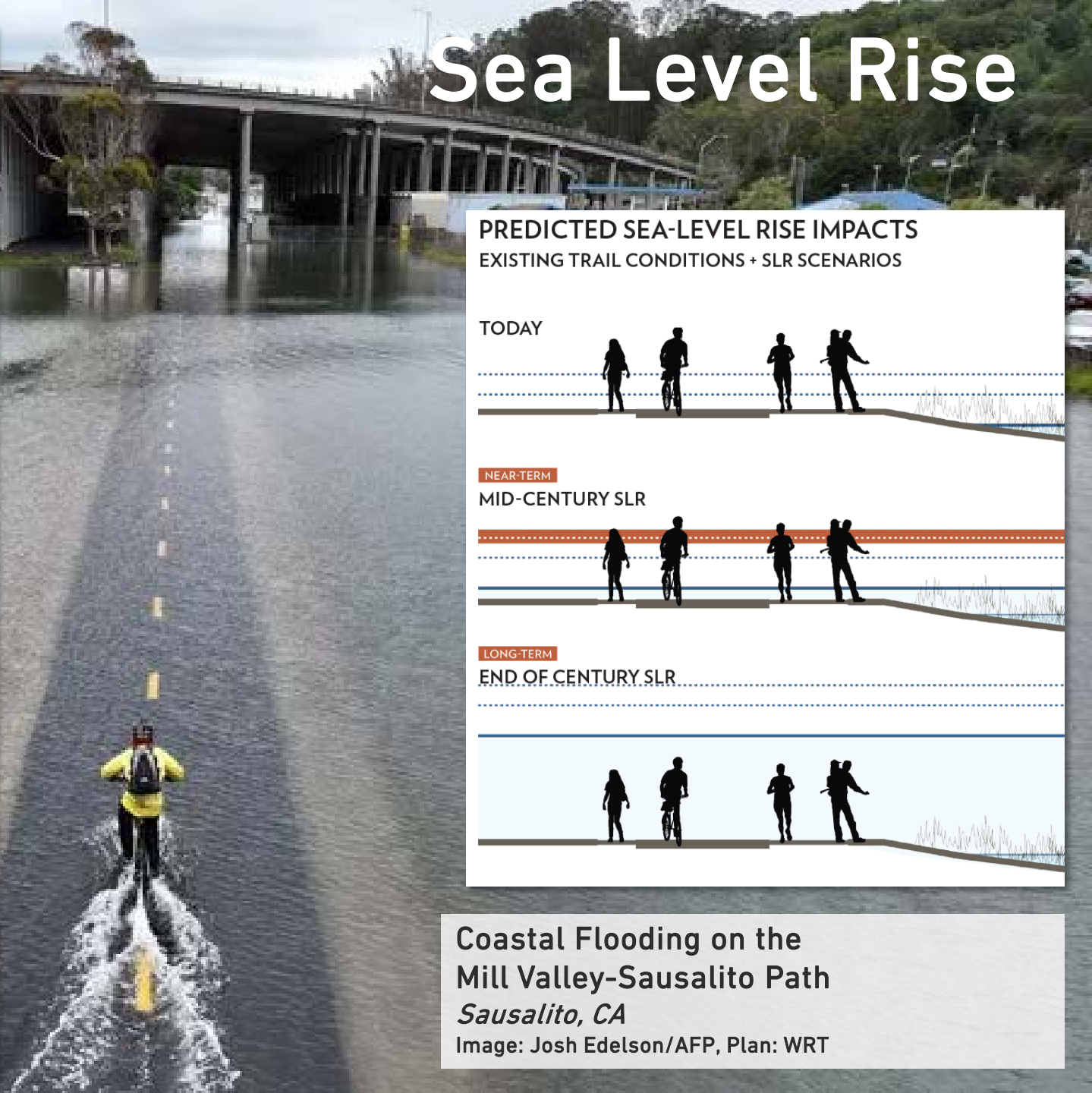


Flooding on the Waterfront Renaissance Trail, Vancouver, WA
Image: Mark Bowder/The Columbian



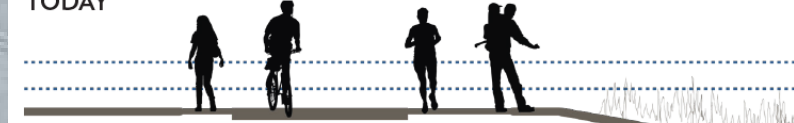
Flood Damage on the Cowboy Trail, Nebraska
Image: Outdoor Nebraska Magazine

Sea Level Rise



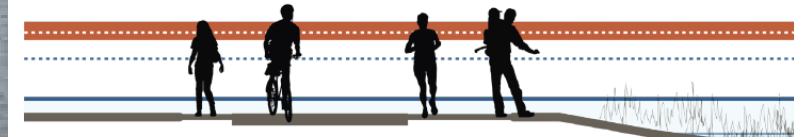
PREDICTED SEA-LEVEL RISE IMPACTS EXISTING TRAIL CONDITIONS + SLR SCENARIOS

TODAY



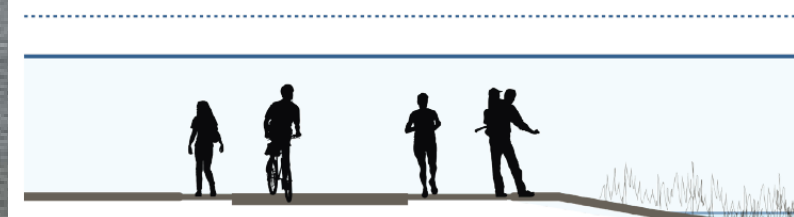
NEAR-TERM

MID-CENTURY SLR



LONG-TERM

END OF CENTURY SLR



**Coastal Flooding on the
Mill Valley-Sausalito Path
Sausalito, CA**

Image: Josh Edelson/AFP, Plan: WRT

Extreme Heat

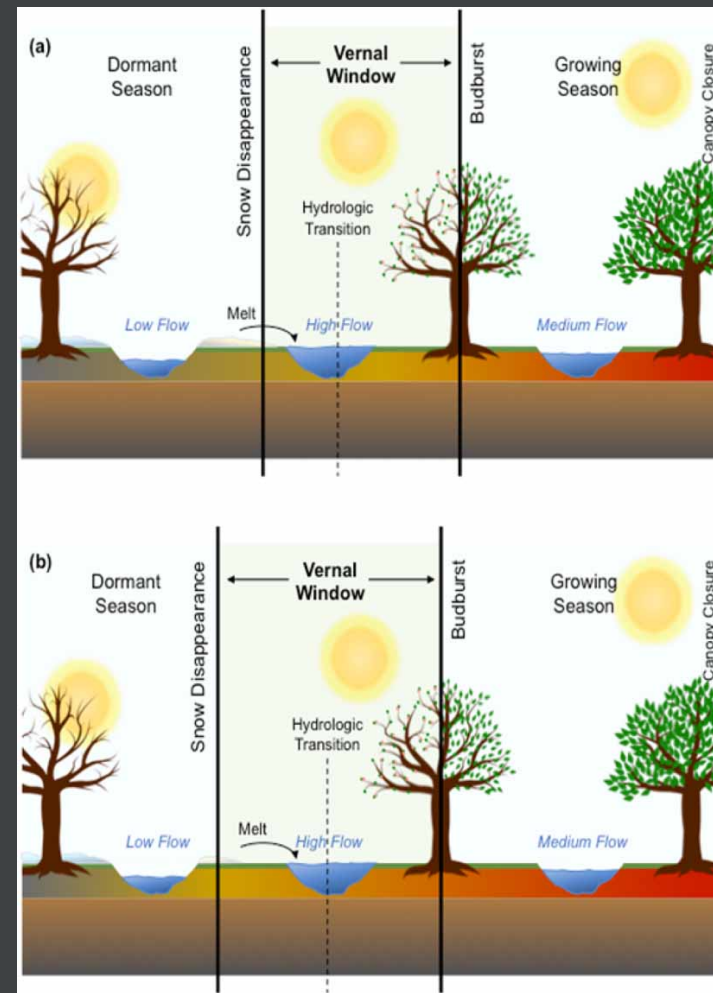
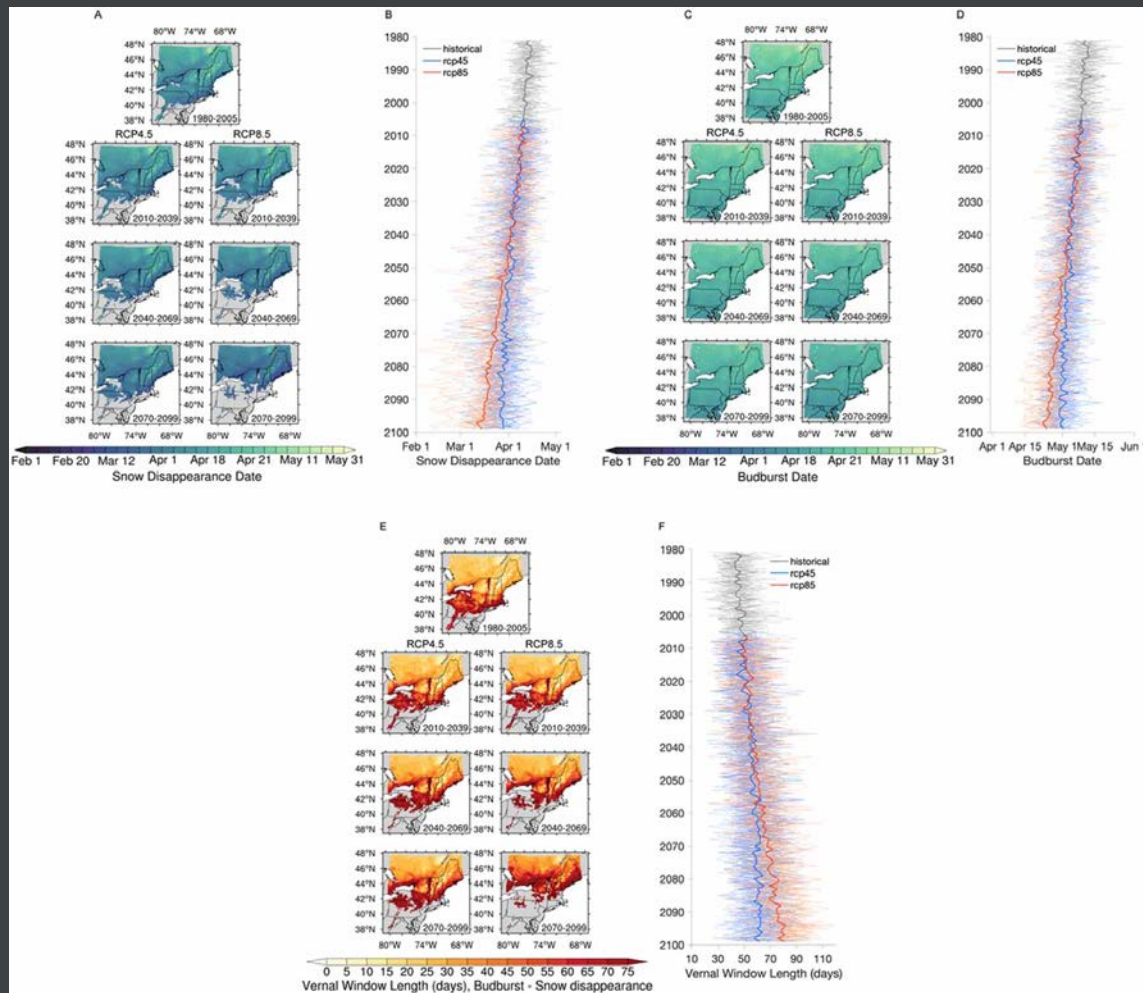


Extreme Heat

SR 544 near Everson, WA

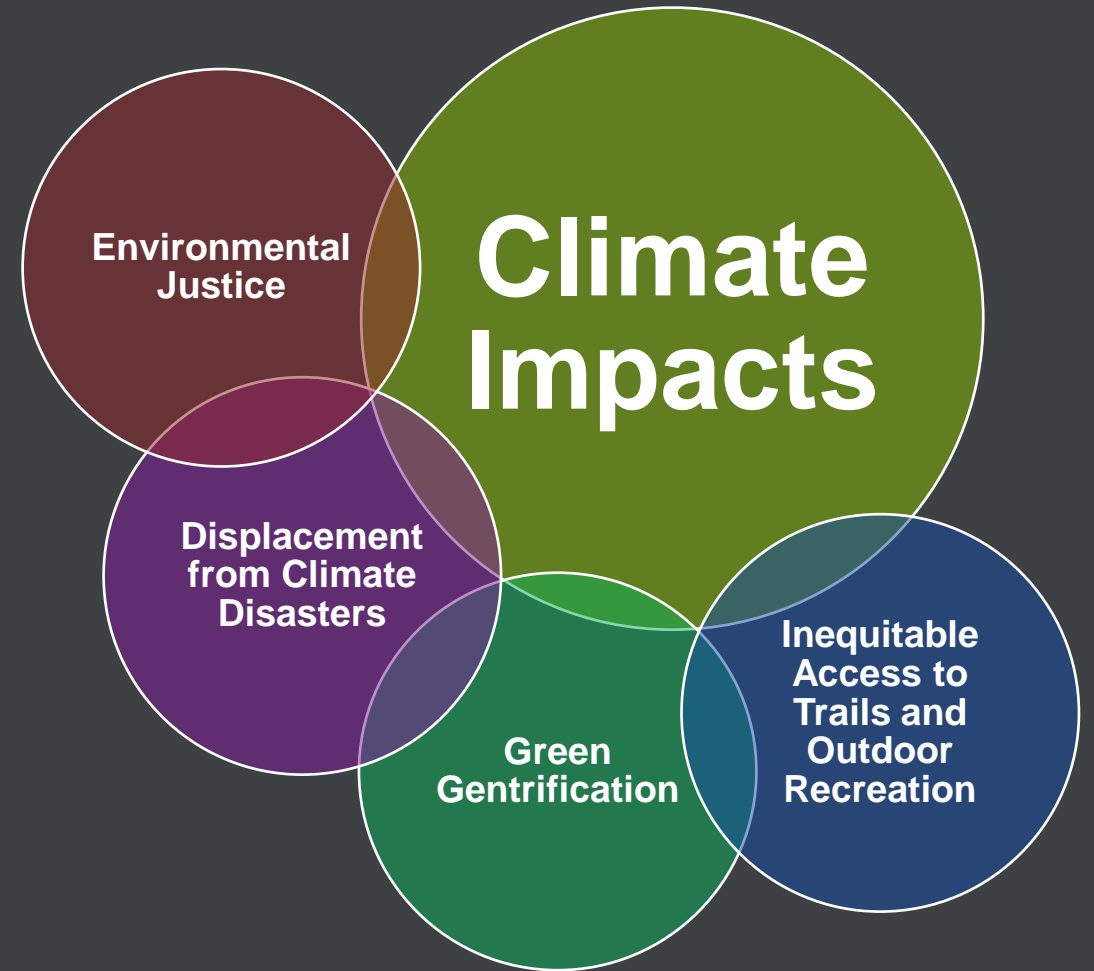
Image: WSDOT

The Expanding Vernal Window



Source: D S Grogan et al. (2020). Snowmelt control on spring hydrology declines as the vernal window lengthens. *Environmental Research Letters*, 15 114040.

Equity, Access, Displacement, and Environmental Justice



What is the top climate impact affecting trails in your community?

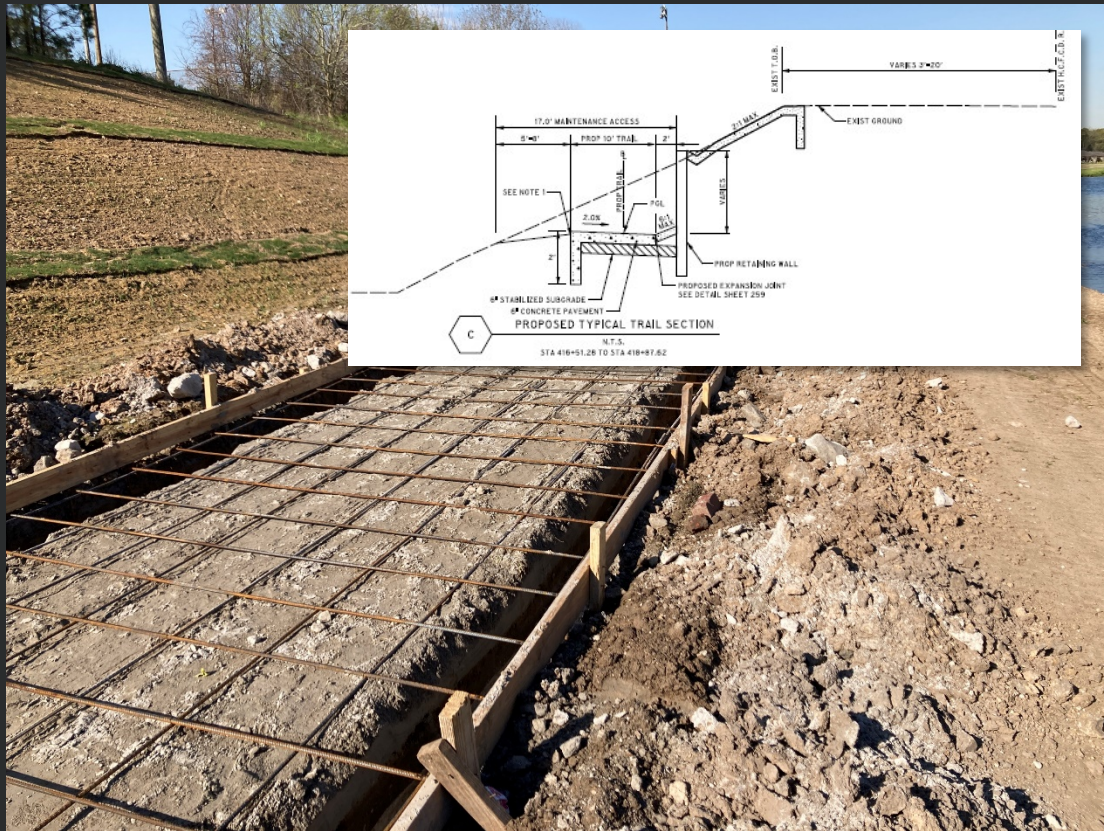
- More days when heat, smoke, or poor air quality impacts trail users
- More days when high temps impact trail use or extend the use season
- Heavy rain events, flooding, king tides
- Longer mud season
- Increased pressure on from insects and diseases, causing vegetation or human health hazards

Adapting Trails to Climate Impacts

02



Design for Drainage

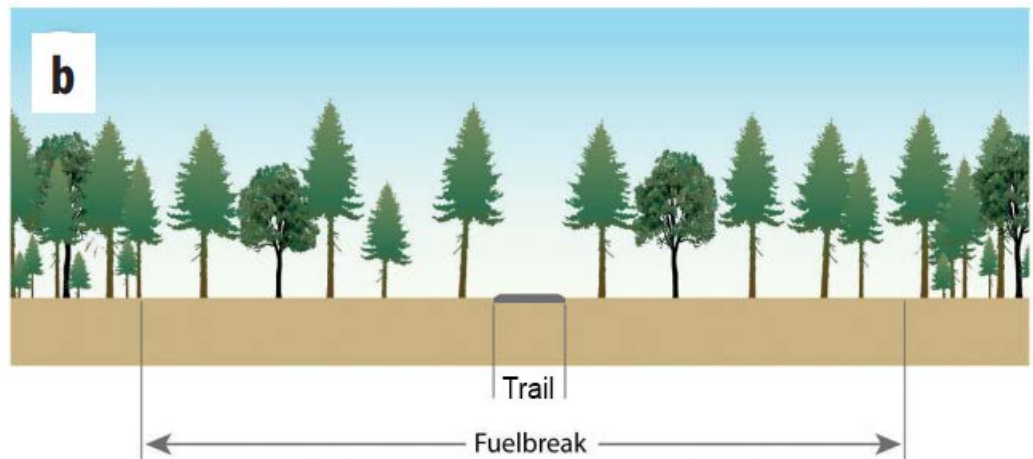
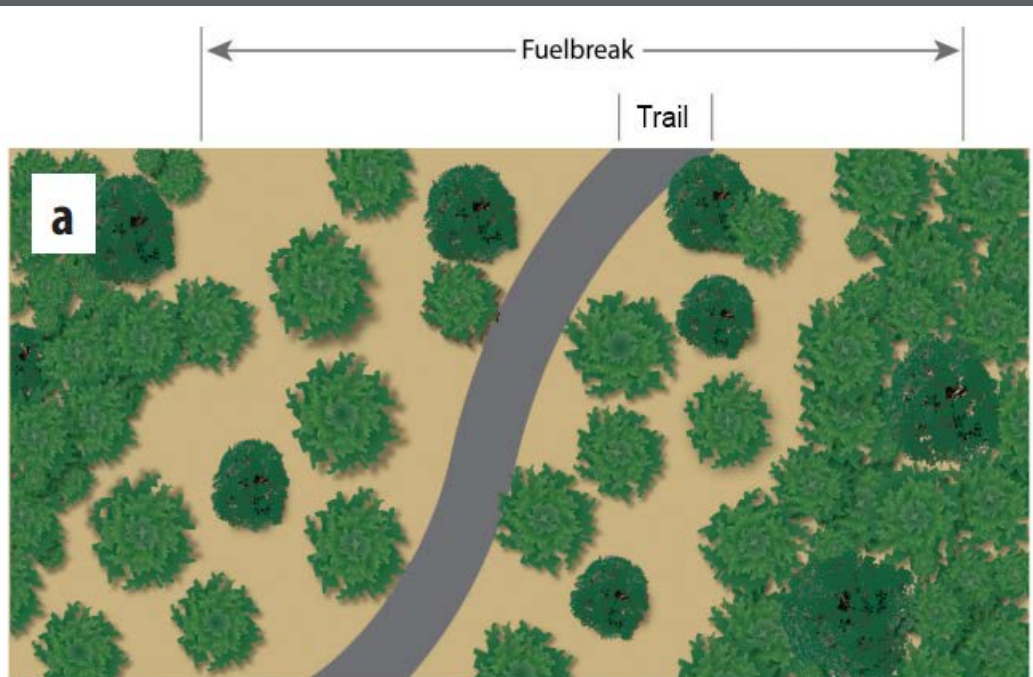


Constructing Turndowns on the Houston Bayous Greenway
Image: Houston Parks Board



Green Infrastructure on the Indianapolis Cultural Trail
Image: Toole Design

Planning and Managing Trail Corridors for Fire



**Vegetation Control
Bear Creek Greenway**

Jackson County, OR

Image: Jackson County Emergency Management,
Jackson County Parks

Design for Heat



Shade and Water on the CV Link
Coachella Valley, CA
Image: CVAG

Management & Communications



Trail Closure Sign

Image: John Meyer, Denver Post



Image: Reddit



Mud Season Signage

Image: Mountain Trails Foundation

Maintenance



What steps has your community/organization taken to address climate impact to trails?

- Gathered data on current issues and /or future risks
- Conducted studies or research on current issues and /or future risks
- Adapted the design of a trail or trail features
- Increased or changed trail management (closures, reroutes, limited use, etc.)
- Increased or changed maintenance practices (higher frequency, more staff, additional tasks and equipment)

Trails as a Climate Solution

03



Emissions Reduction



Trail Corridors as Green Infrastructure

An aerial photograph of a park area. A paved trail runs diagonally from the bottom left towards the top left. A winding stream flows through a grassy area in the center and right. The landscape is filled with various trees, some with bright green foliage and others with more mature, darker green leaves. In the top right corner, a playground structure is visible. The overall scene is a lush, green environment.

**Trails as Green
Infrastructure**
Gambles Mill Eco-Corridor
Richmond, VA
Image: Resource Environmental Solutions

Equity in Trail Work



Regional Trails
Prioritization Tool
Report

Regional trails prioritization results
oregonmetro.gov/trails

May 2022



Map showing regional trails prioritization results across the Willamette Valley, including areas like Hillsboro, Beaverton, and Portland. The map uses color-coded lines to represent different local demographics scores: Very high (dark purple), High (purple), Medium (magenta), Low (pink), and Very low (light pink). Existing regional trails are shown as grey lines. The map also shows major roads, rivers, and cities.

Note: The trails scored with the prioritization tool does not encompass all planned regional trails. Only those eligible for funding through the 2019 Parks & Nature Bond are scored and displayed here.

Local Demographics Score

- Very high
- High
- Medium
- Low
- Very low

Existing Regional Trails



East Boston Greenway

What would help you better plan for the impacts of climate change in the context of trails (aside from funding)?

- Understanding your community/region's vulnerabilities
- Data on trail usage and user needs
- Improved management/maintenance plan
- Specific design guidance
- A better understanding of impacts to vulnerable communities

Trails for Emergency Response

04



Trails for Emergency Management

Emergency Management Context

- Evacuation route redundancy
- Access to community lifelines

Trails for Emergency Management

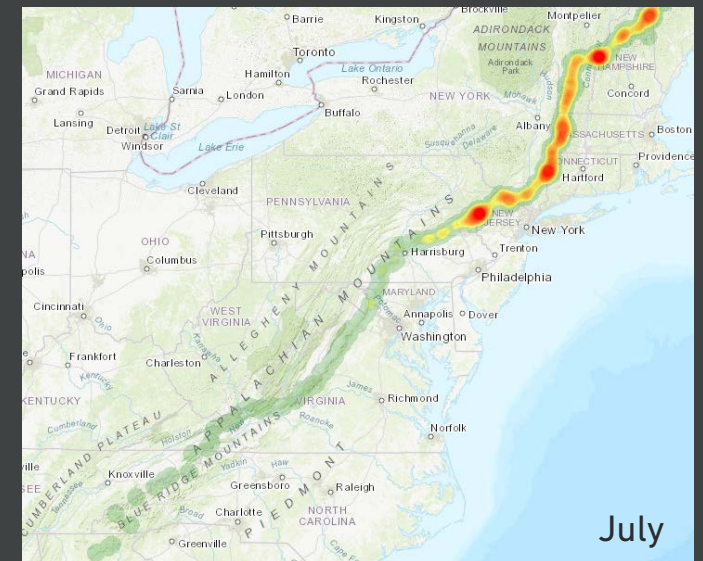
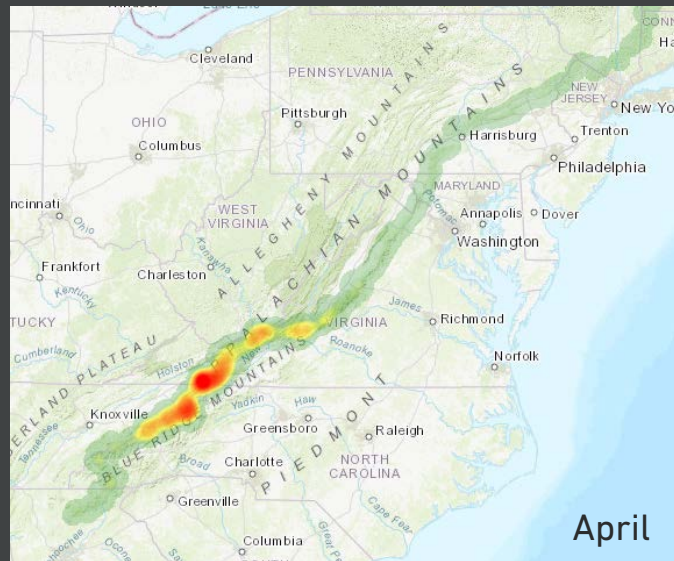
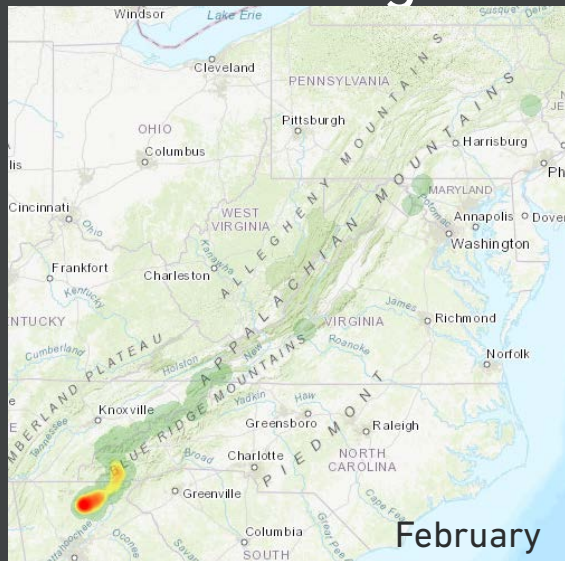
Trails in emergency response planning

- Trail networks should be integrated into emergency response plans
 - Consider new trail development, trends in trail use, and emerging threats
 - Plan trail access points with emergency response team
 - Trail designs should accommodate emergency vehicle traffic
- Evacuation planning examples:
 - New York, NY - Hurricane Sandy; Berkeley, CA - FEMA Fire Prevention and Safety grant

Trails for Emergency Management

Emergency operations and management

- Communications & location ID
- Monitoring & data





PARADISE RIDGE
ELEMENTARY SCHOOL

← **ONE WAY**

NO LEFT
TURN

Trails as Emergency Access
Paradise Multi-use Paths

Paradise, CA

Image: Town of Paradise, CA

Trails for Emergency Management

Equity in Emergency Response

- Vulnerable populations
- Universal design standards
- Trail access
- Funding allocation

Does your community consider trails as part of emergency response or evacuation planning?

- Yes
- No
- Not sure

Taking Action!

05

Incorporating Resilience at Every Stage of Trail Development



Trail Development Stages

Planning

- ❖ Long range project prioritization
- ❖ Project goals
- ❖ Equity and Environmental Justice

Design + Construction

- ❖ Design for water, heat, drought and fire
- ❖ Equitable design process
- ❖ Construction methods

Management + Maintenance

- ❖ Communications
- ❖ Planning for extreme weather
- ❖ Visitor use management
- ❖ Maintenance methods
- ❖ Community stewardship

Tips for Resilient Trails

- Use durable materials and/or techniques
- Consider vulnerability to climate impacts
- Leverage trails for resilience planning
- Improve drainage and stormwater management
- Improve trail access and location identification for emergency responders
- Improve vegetation management along trails
- Add shade, water, or other amenities for the safety of vulnerable users

What do you think is the most urgent need for additional research?

1. How different types of trails are impacted by climate change?
2. How technological advancements can better monitor and understand these impacts?
3. How can we better plan for emergency management during catastrophic events?
4. What funding sources can be leveraged to advance climate resiliency goals for trails?
5. A wider scan of case studies and the long-term effectiveness of the strategies implemented.



Thank you for joining us today. Please share your questions.