

# The complex future of parks: effects of climate change on invasive species in protected ecosystems

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Daniel E. Winkler<sup>1</sup>, Michael L. Goulden<sup>1</sup>, Gaku Kudo<sup>2</sup>,  
Lara M. Kueppers<sup>3</sup>, and Travis E. Huxman<sup>1</sup>

<sup>1</sup>University of California, Irvine

<sup>2</sup>Hokkaido University

<sup>3</sup>Lawrence Berkeley National Laboratory



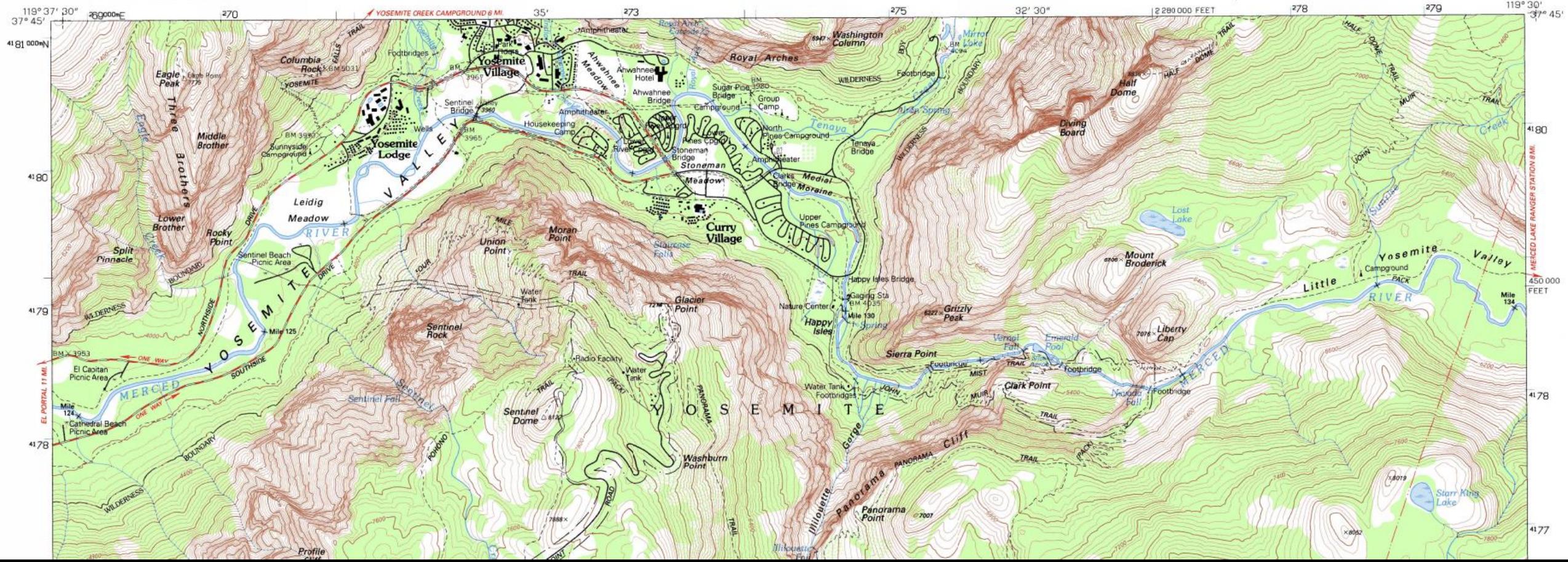




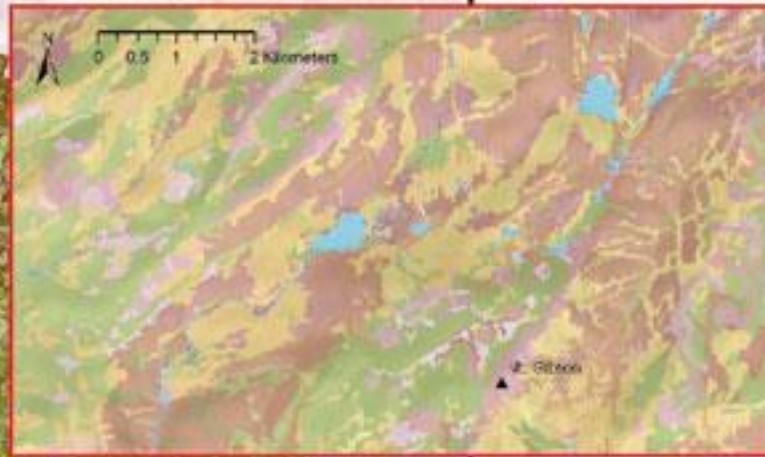
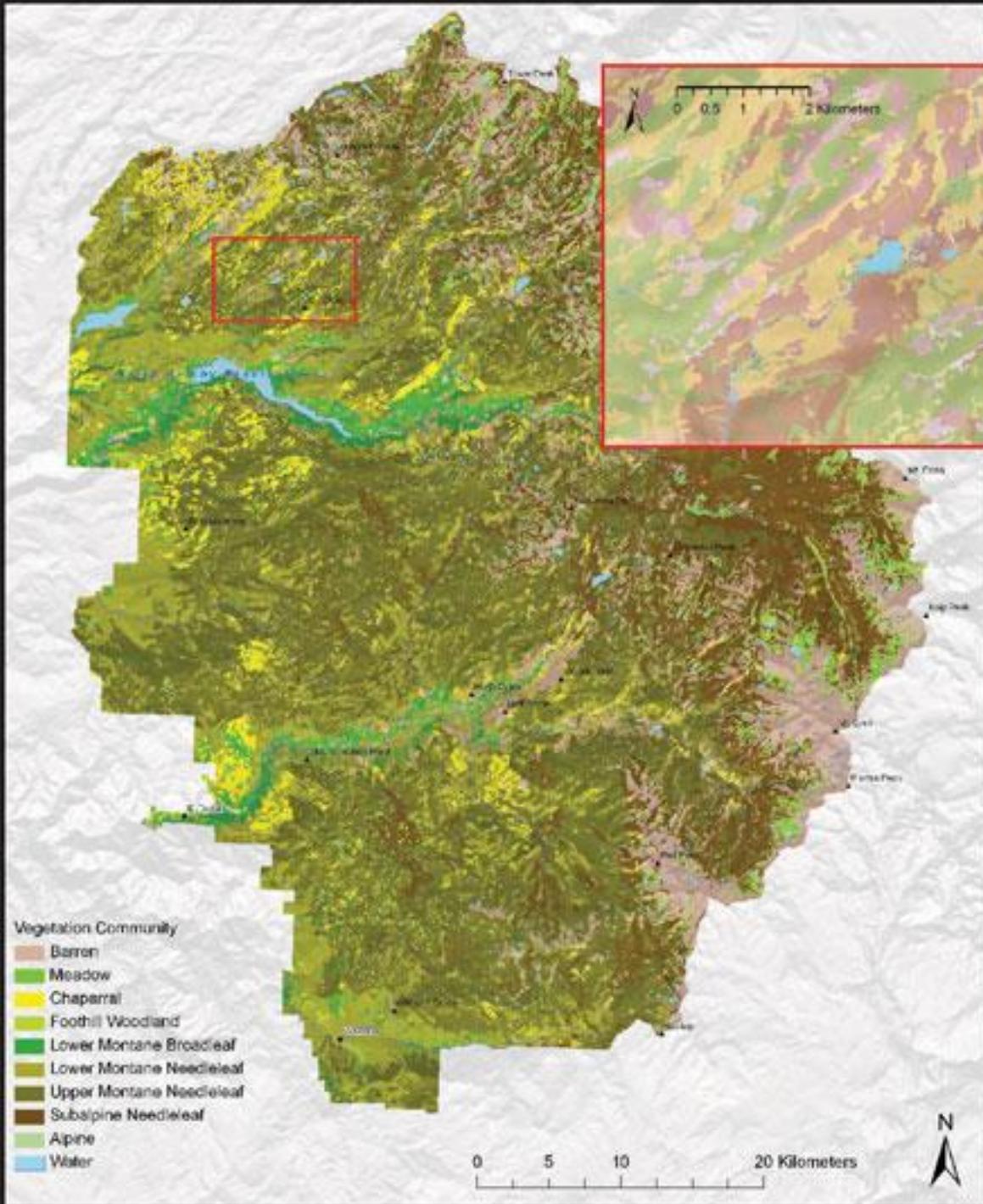


UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

HALF DOME QUADRANGLE  
CALIFORNIA  
7.5 MINUTE SERIES (TOPOGRAPHIC)



MERCED LAKE RANGER STATION B.M.  
450 000  
FEET  
Mile 134  
4178  
4177



# Ways of addressing these interacting elements

**What are the effects of climate change on biological invasions in National Parks and other protected lands?**

## **Traditional approach:**

- dispersal rates
- competition with native spp.
- recruitment abilities
- ability to acclimate or adapt

# Topography, boundaries, roads, communities

How do they interact?

Do they make each other more or less susceptible to invasion?

How might these interactions influence management?

**Are natives just as big of a problem as invasives?**

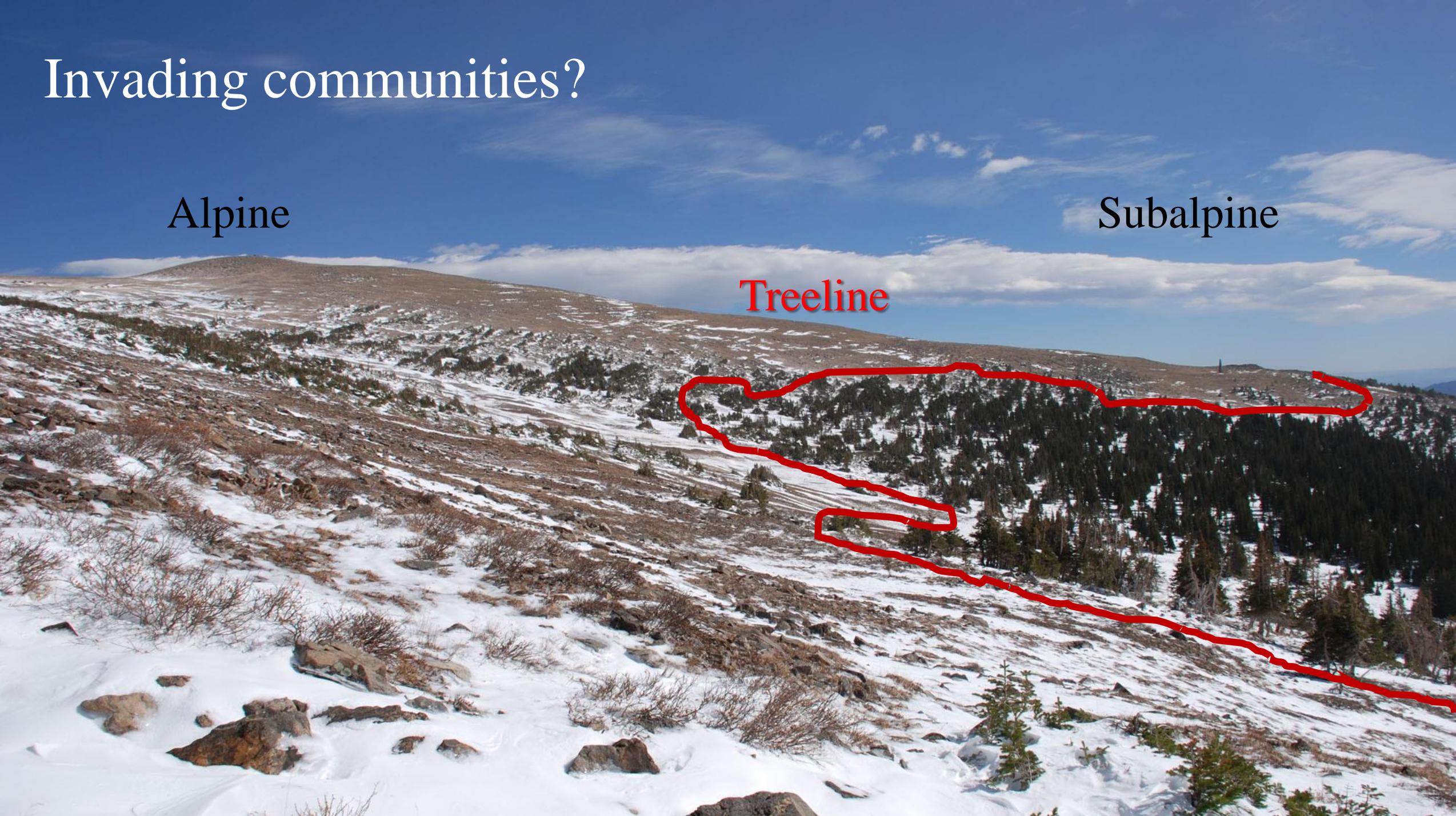


# Invading communities?

Alpine

Subalpine

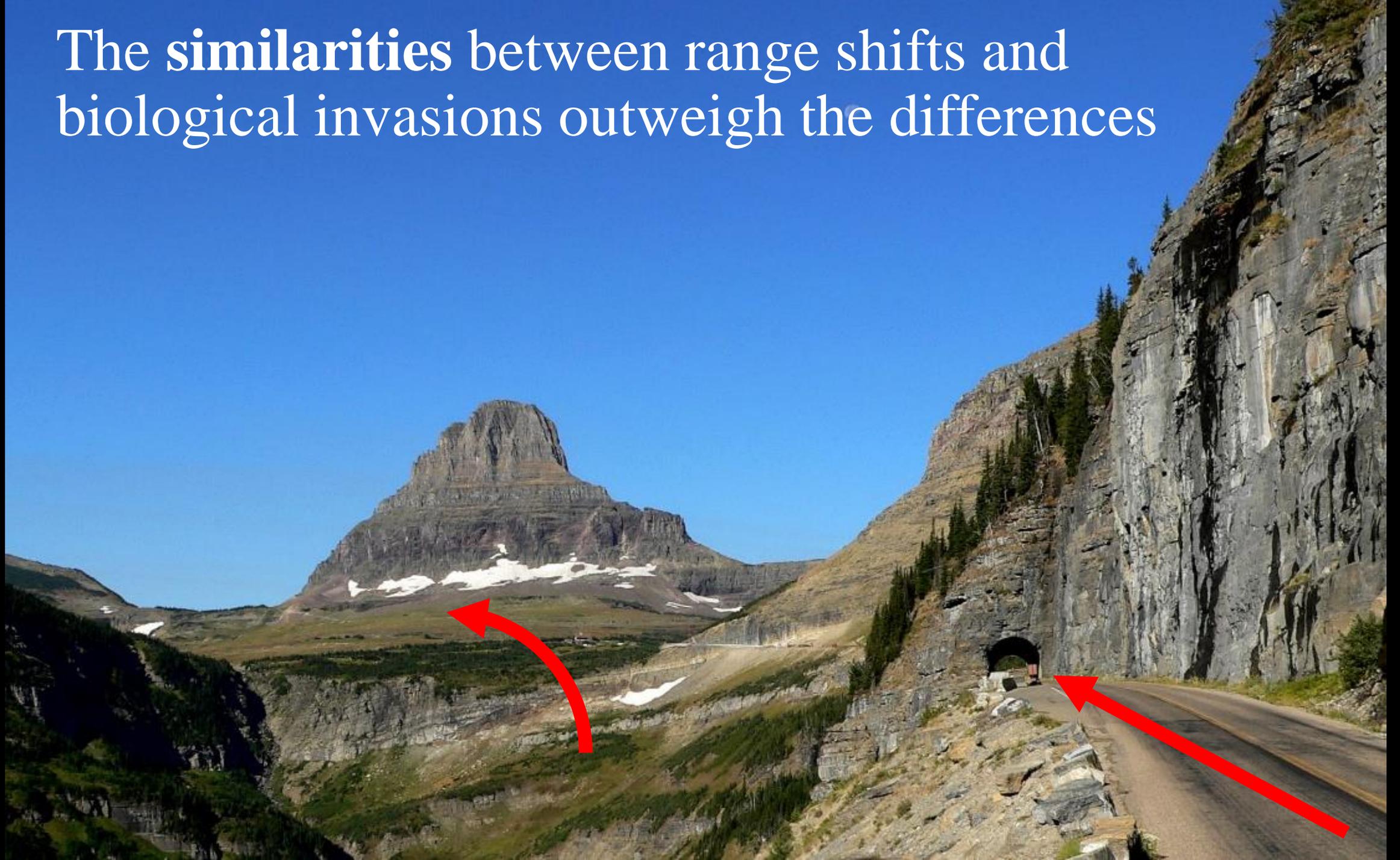
Treeline







The **similarities** between range shifts and biological invasions outweigh the differences



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# Alpine Treeline Warming Experiment Niwot Ridge LTER and Biosphere Preserve



Winkler, Chapin, and Kueppers *in review*

# Alpine Treeline Warming Experiment Niwot Ridge LTER and Biosphere Preserve

Species identity (dispersal, competition)

Moisture determines response to  
warming (acclimation)

Watch out for trees

...and graminoids!

Winkler, Chapin, and Kueppers *in review*

# Pinyon Flat, Santa Rosa Mountains, California

## San Bernardino National Forest

**What happens when a road runs through it?**

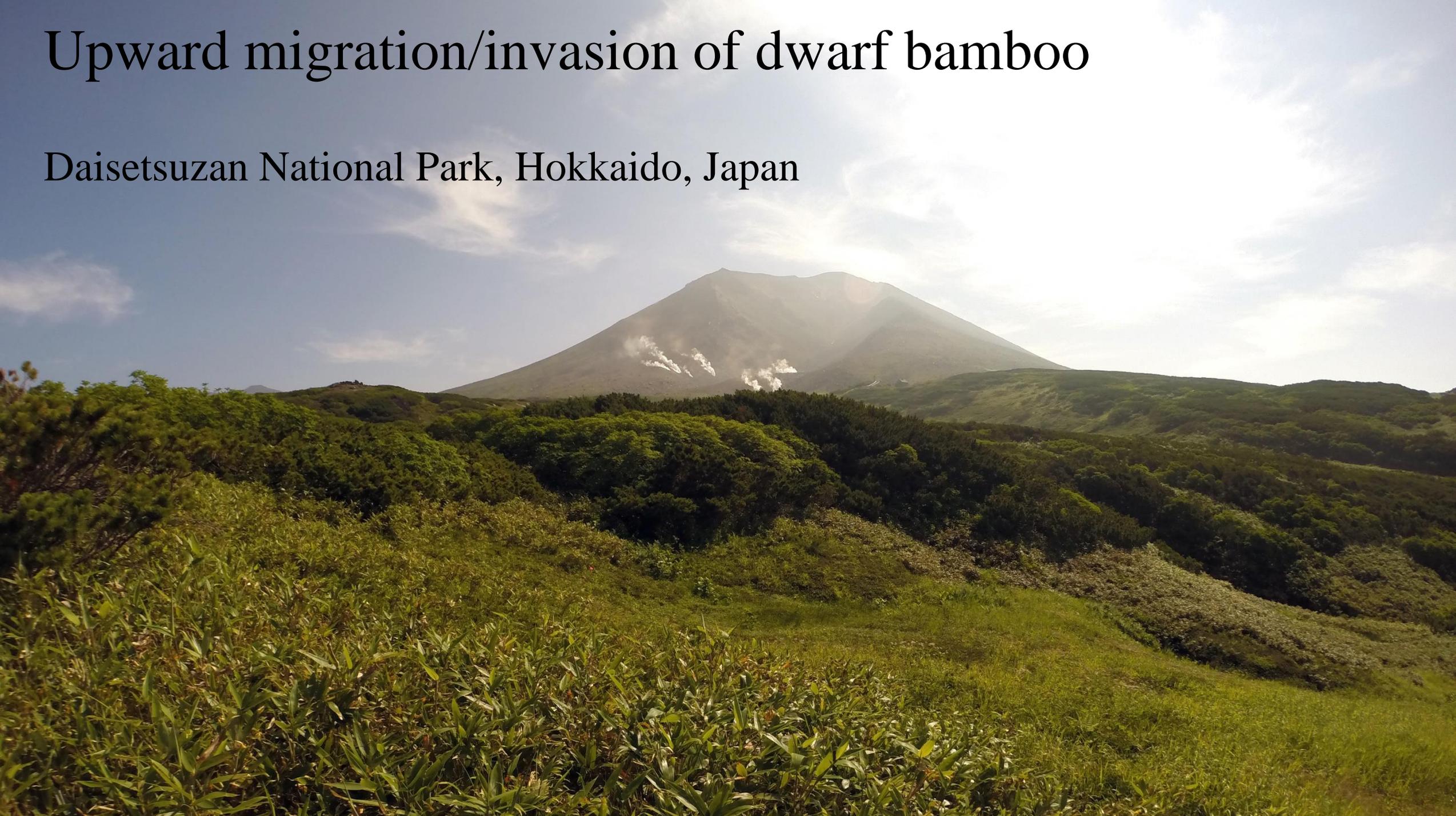
Community rearrangement in response to drought

Native vs. non-native invasives



# Upward migration/invasion of dwarf bamboo

Daisetsuzan National Park, Hokkaido, Japan



**Daisetsuzan  
National Park  
Hokkaido, Japan**



**Alpine  
1600 m**

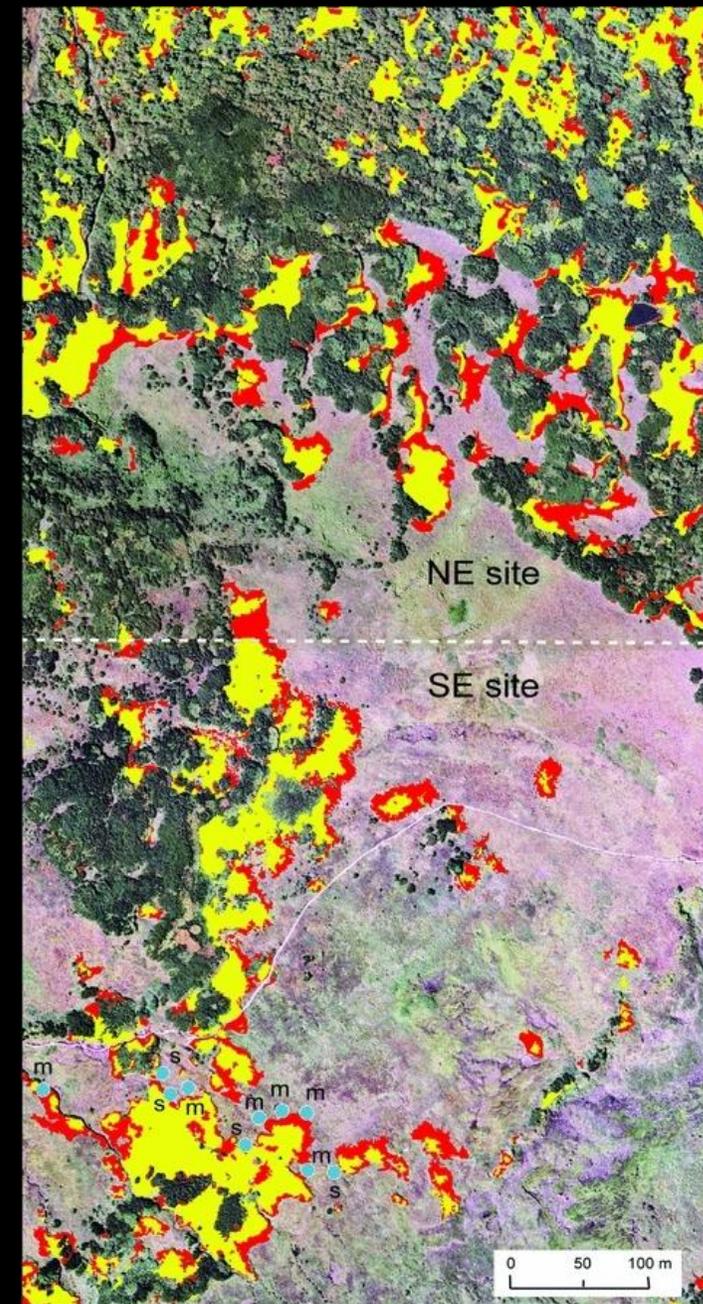
**Subalpine  
1310 m**

**Forest  
997 m**

**1 km**



# Dwarf bamboo upward invasion



# Roadways as drivers of Sahara mustard invasion

Anza-Borrego Desert State Park, CA

Joshua Tree National Park

Mojave National Park

Death Valley National Park

Lake Mead NRA

Glen Canyon NRA

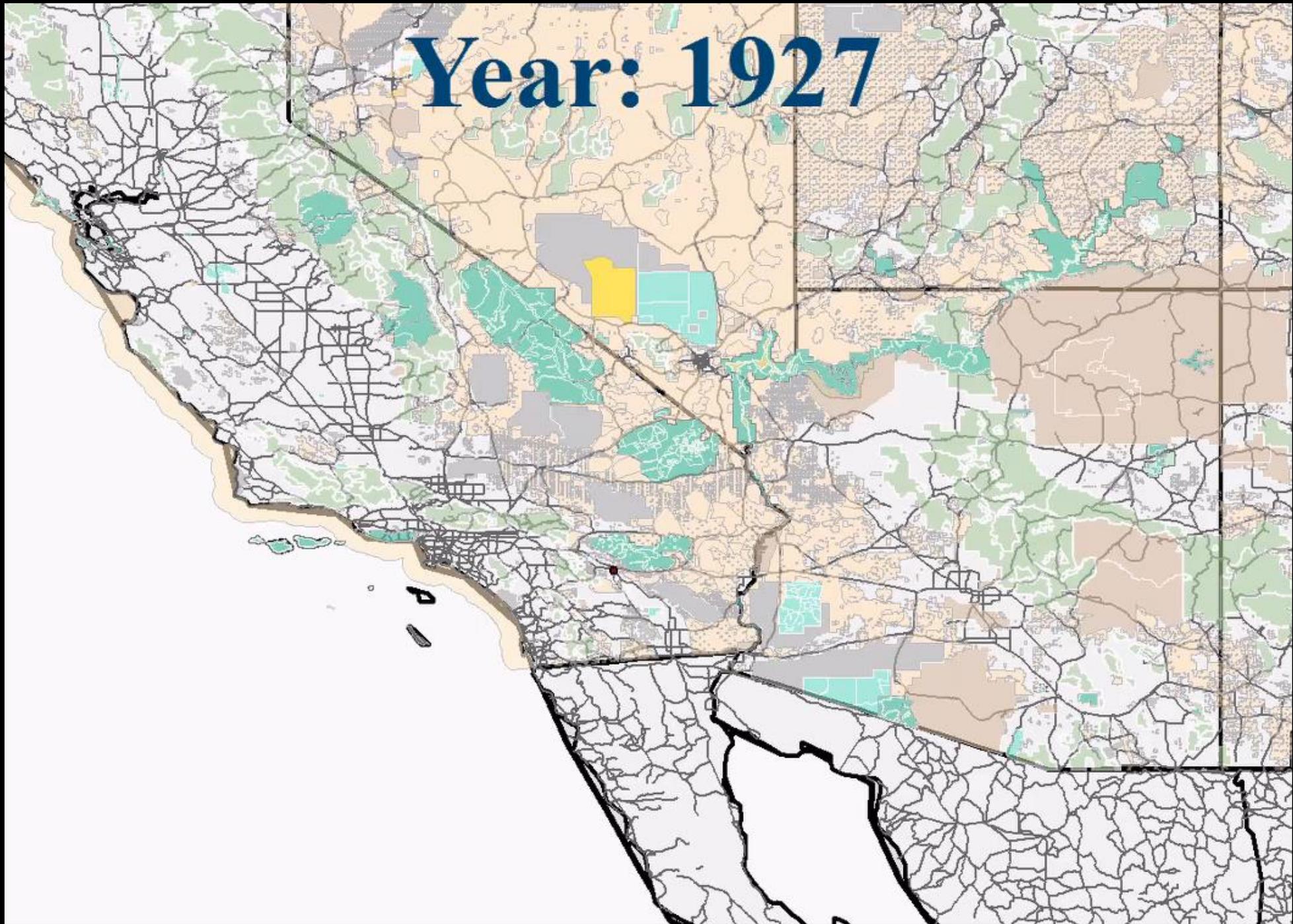
Organ Pipe Cactus NM

Casa Grande NM

Saguaro National Park



**Year: 1927**



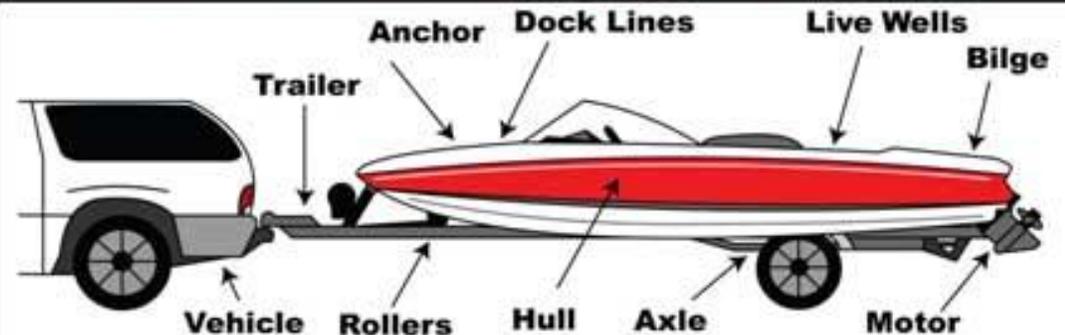
# BOATERS' ADVISORY

## ZEBRA MUSSELS HAVE BEEN FOUND IN THESE WATERS

To avoid illegal possession of Zebra Mussels you must inspect and clean your marine equipment. Zebra Mussels can survive out of water for several days during summer and up to 30 days in cool, wet weather.



### LOOK FOR MUSSELS HERE



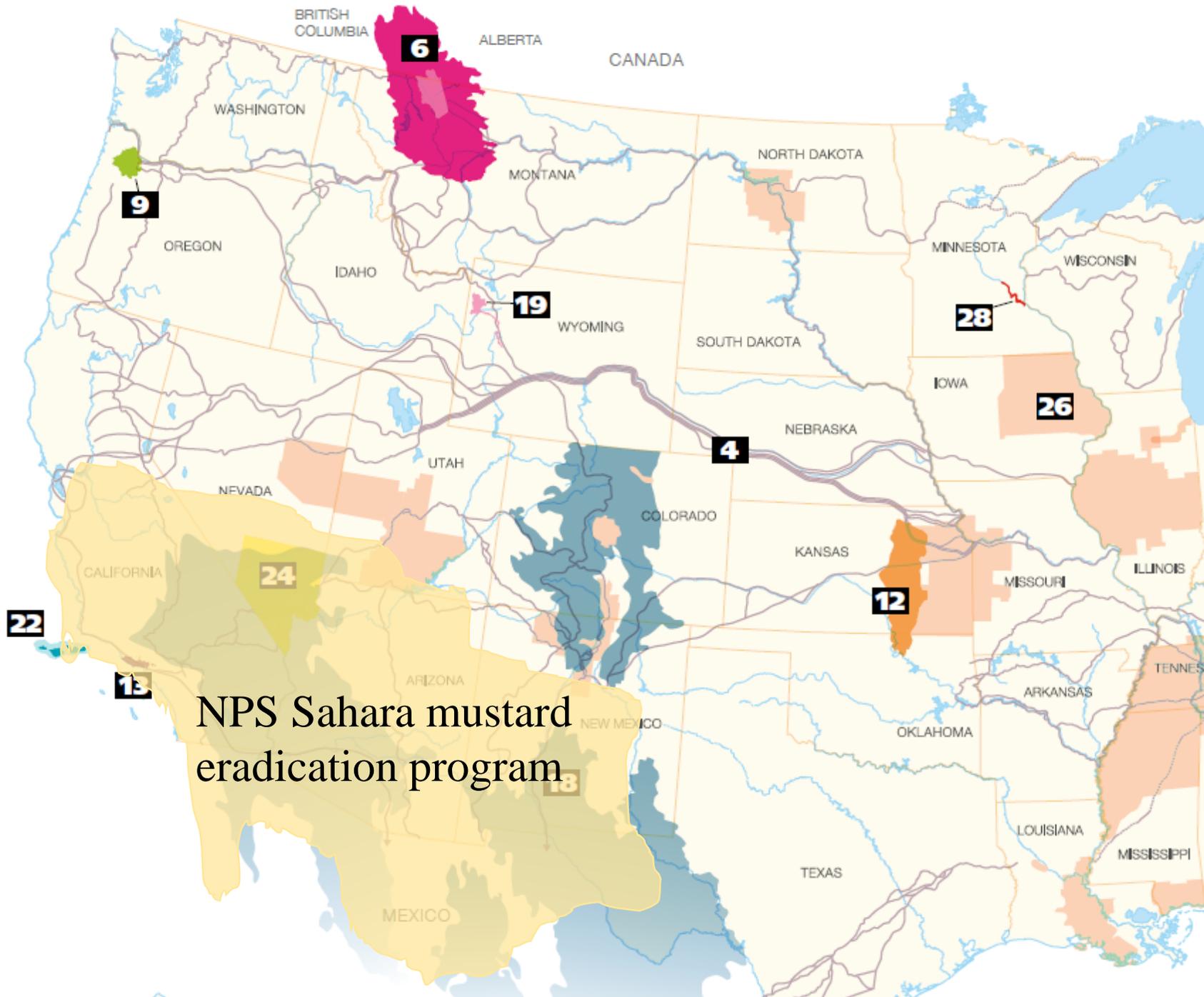
**CHECK YOUR BOAT, TRAILER AND VEHICLE**



# Scaling Up

Collaborative  
Approaches to  
Large Landscape  
Conservation





NPS Sahara mustard eradication program

# Topography, boundaries, roads, communities

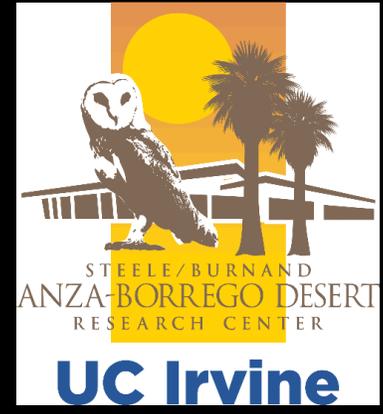
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Thank you



[winklerde@gmail.com](mailto:winklerde@gmail.com)