Wildfire risk to municipal water supplies sourced from National Forest System lands in Montana: Planning status overview, future approaches, and key takeaways for informed decision making

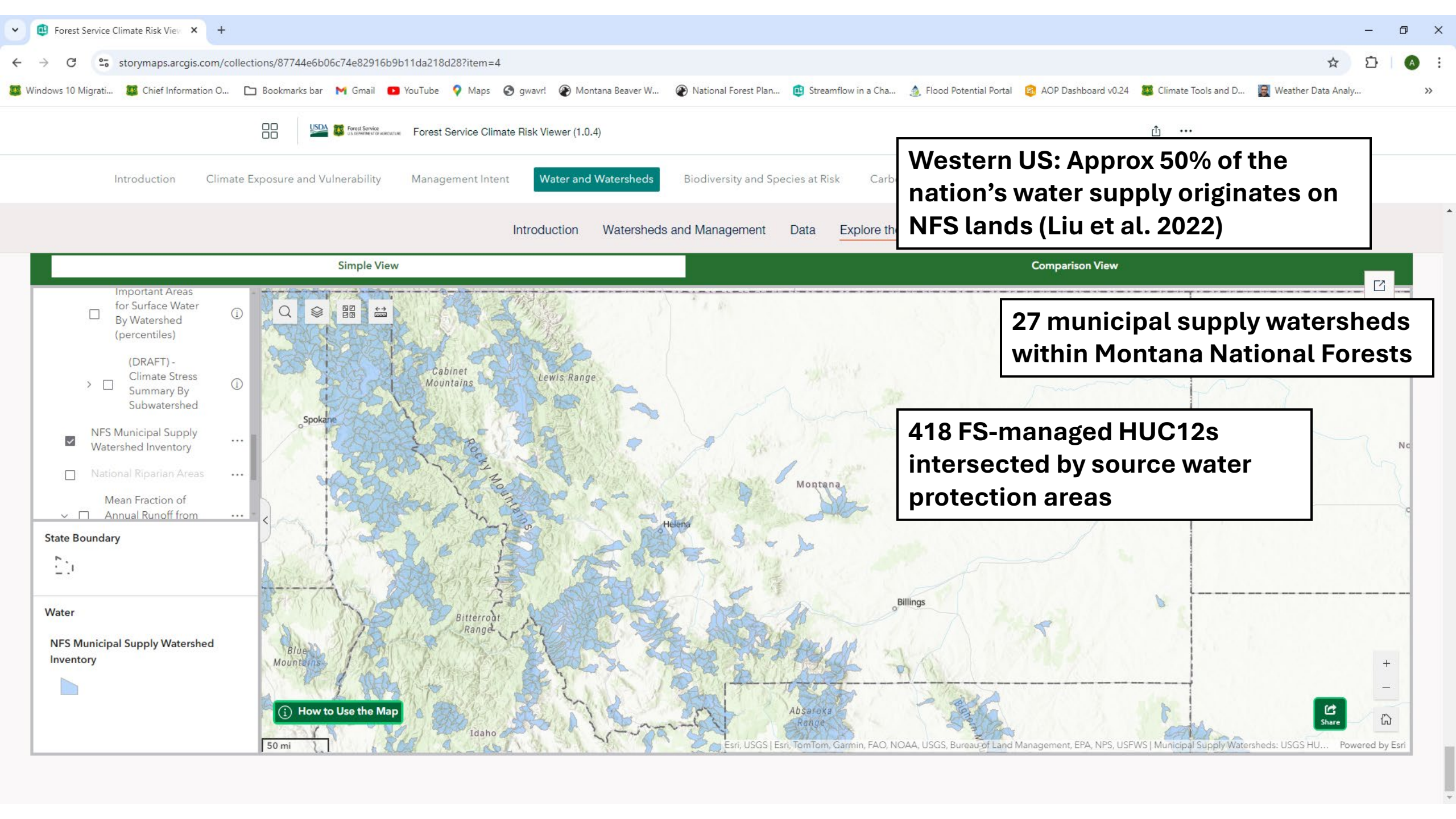
Andy Efta and Vince Archer

U.S. Forest Service- Northern Region

Outline

- General overview of agency direction and regional planning to date
- Discuss relationship between natural process and risk assessment; shaping the threat
- Ideas for continued advances in strategic planning

- Same formula for analysis within and outside municipal supply watersheds→ **Opportunity for channeling best science**



Western US: Approx 50% of the nation's water supply originates on NFS lands (Liu et al. 2022)

27 municipal supply watersheds within Montana National Forests

418 FS-managed HUC12s intersected by source water protection areas

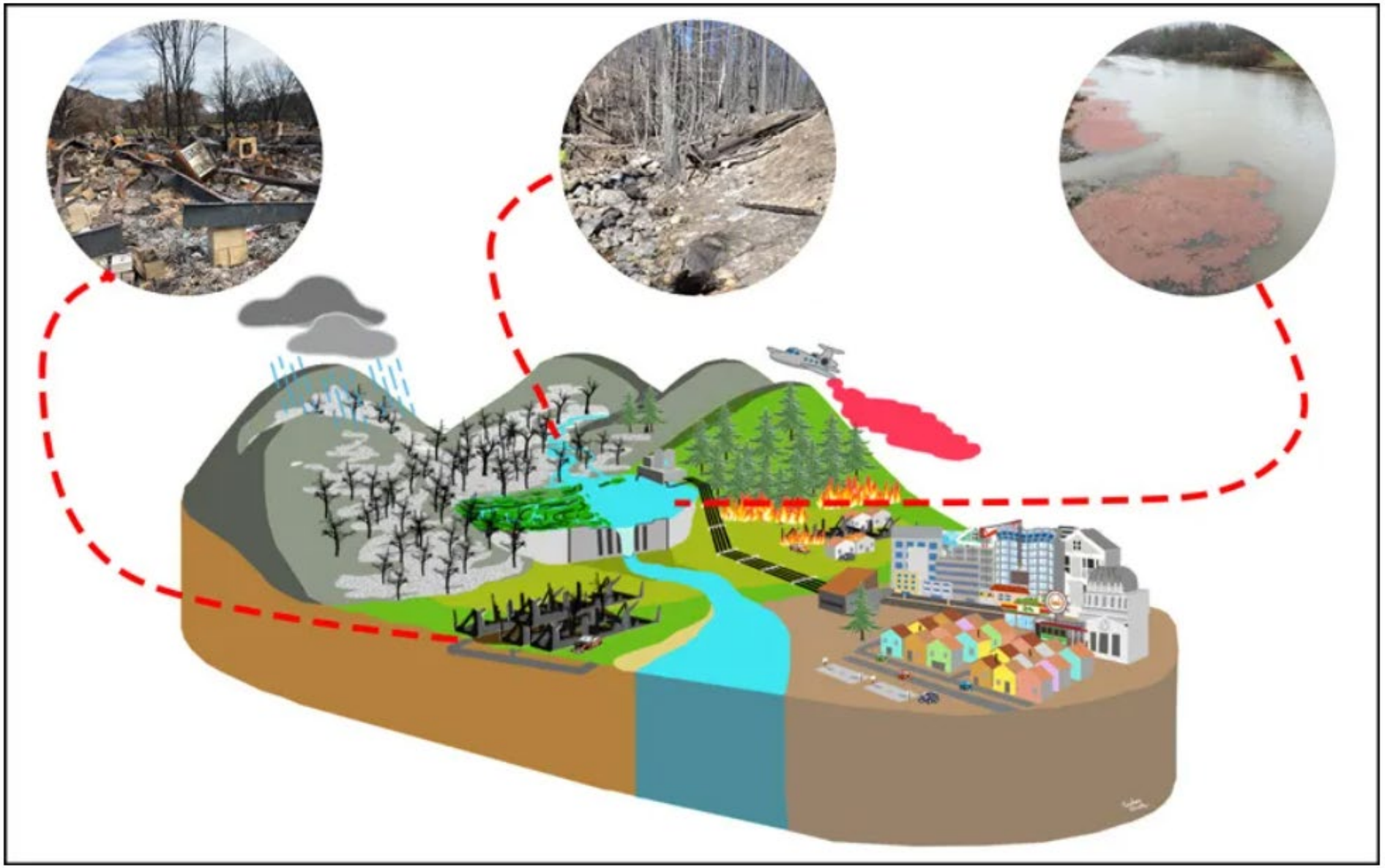
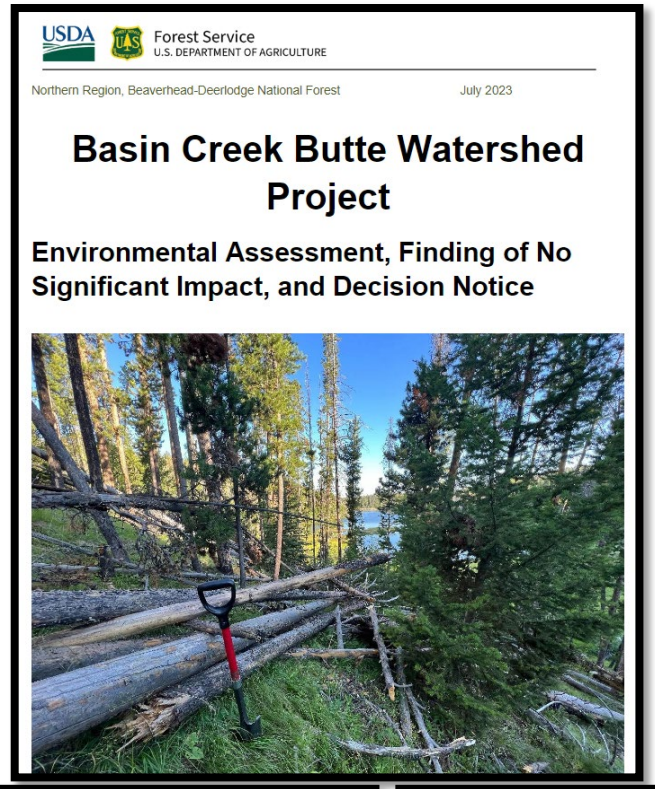


Fig. 1. Threats to drinking water supplies from wildfires include releases of toxic chemicals from burned infrastructure, electronics, plastics, cars, and other artificial materials (left); releases of pyrogenic dissolved organic matter and toxic chemicals from ash deposits into source water supplies (middle); and postfire eutrophication and algal blooms in water supplies because of increased nutrient availability (right). Credit: Illustration, Wing-Yee Kelly Cheah; inset photos, Alex Tat-Shing Chow

Chow et al. 2021

Montana NFS project areas



USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

Northern Region, Beaverhead-Deerlodge National Forest July 2023

Basin Creek Butte Watershed Project

Environmental Assessment, Finding of No Significant Impact, and Decision Notice

USDA

Tenmile – South Helena Project
Record of Decision
Forest Plan Site-Specific Amendment #34

USDA Forest Service
Helena Ranger District, Helena-Lewis and Clark National Forest
Lewis and Clark County and Jefferson County, Montana

Lead Agency: USDA Forest Service
Helena–Lewis and Clark National Forest
Helena Ranger District

Responsible Official: LISA M. STOEFFLER, ACTING FOREST SUPERVISOR
Helena-Lewis and Clark National Forest
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For Information Contact: HEATHER DEGEEST, DISTRICT RANGER
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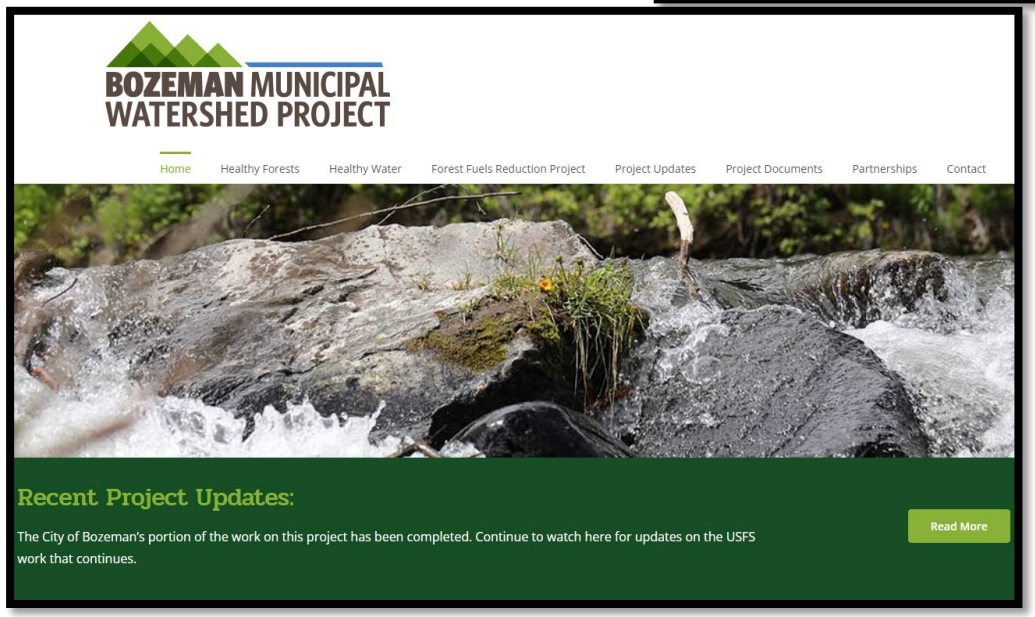
LISA M. STOEFFLER, Acting Forest Supervisor
Helena-Lewis & Clark National Forest
USDA-Forest Service

12/19/16
Date



BOZEMAN MUNICIPAL WATERSHED PROJECT

Home | Healthy Forests | Healthy Water | Forest Fuels Reduction Project | Project Updates | Project Documents | Partnerships | Contact

Recent Project Updates:

The City of Bozeman's portion of the work on this project has been completed. Continue to watch here for updates on the USFS work that continues.

Read More

USDA

Flathead National Forest
650 Wolfpack Way
Kalispell, MT 59901
Web: http://www.fs.usda.gov/flathead
Twitter: https://twitter.com/FlatheadNF
Facebook: https://www.facebook.com/discovertheflathead

News Release

Media Contact: Janette Turk
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Environmental Assessment and Draft Decision Notice completed for the Whitefish Municipal Watershed Fuel Reduction Project

KALISPELL, MT –December 7, 2016 –The Tally Lake Ranger District has released the Environmental Assessment and Draft Decision Notice for the Whitefish Municipal Watershed Fuel Reduction (WMWFR) project.

USDA Firesheds

Introduction | Fireshed Framework | Data | Explore the Data

Simple View | Comparison Vi

- State Boundary
- Landscape Priorities
  - Wildfire Crisis Strategy Landscapes
  - High Risk Firesheds Within FS Lands
  - High Risk Firesheds Outside FS Lands
- Firesheds
  - Firesheds with NFS Lands in the West

High Risk Firesheds Within FS Lands

Firesheds

Firesheds with NFS Lands in the West

Does the risk differ?

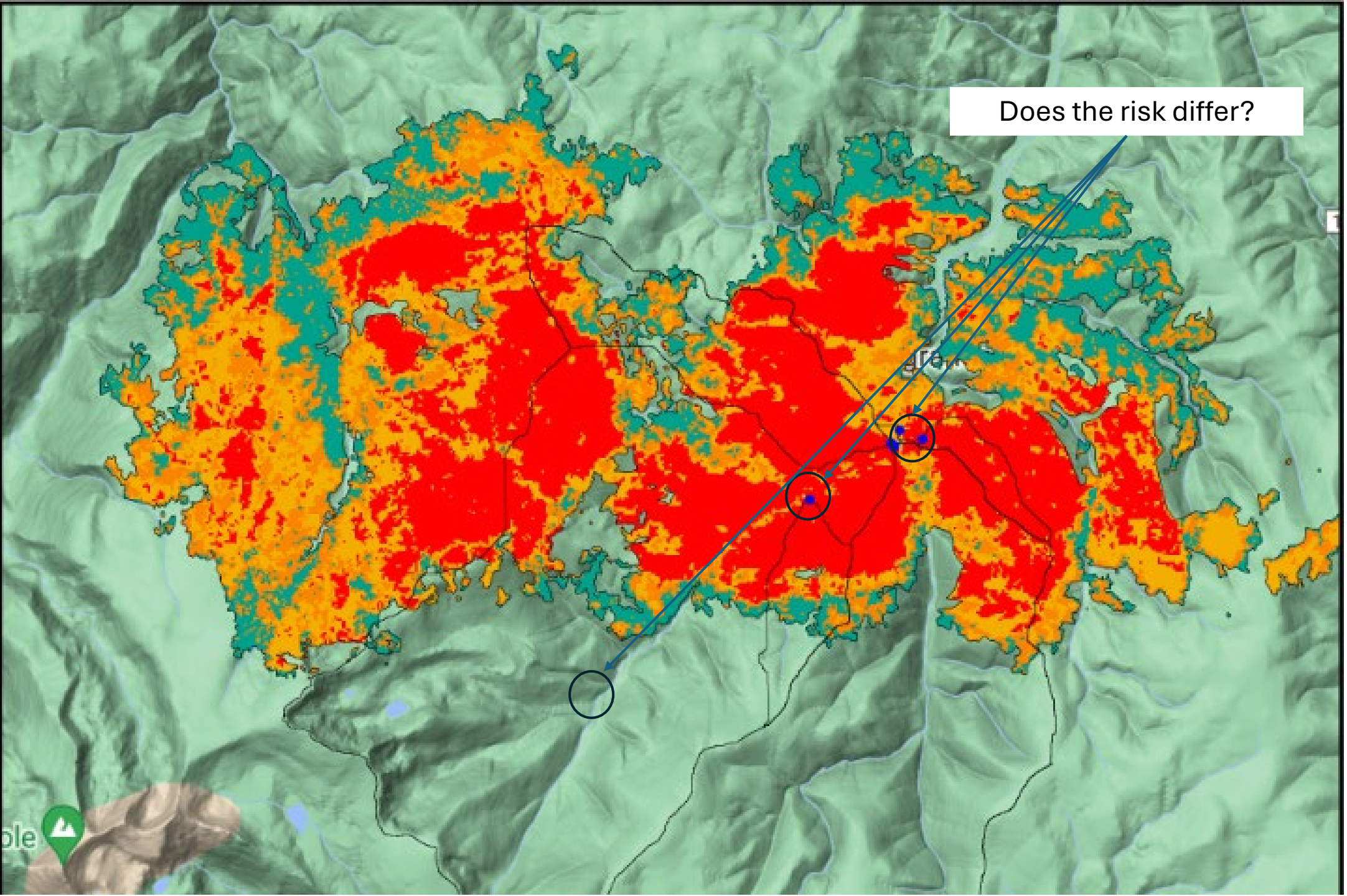
How to Use the Map

Share

50 mi

Esri, USGS | Esri, TomTom, Garmin, FAO, NOAA, USGS, Bureau of Land Management, EPA, NPS, USFWS | This project was funded by the USDA For... Powered by Esri

https://storymaps.arcgis.com/stories/44744f9b4f0447938660a06a3c06a7e5


Does the risk differ?
Pour Points
SBS
Unburned
Low
Moderate
High

What is the dependent variable?

- Mitigate debris delivery?
- Sediment?
- DOC?
- Nutrients?
- All of the above??

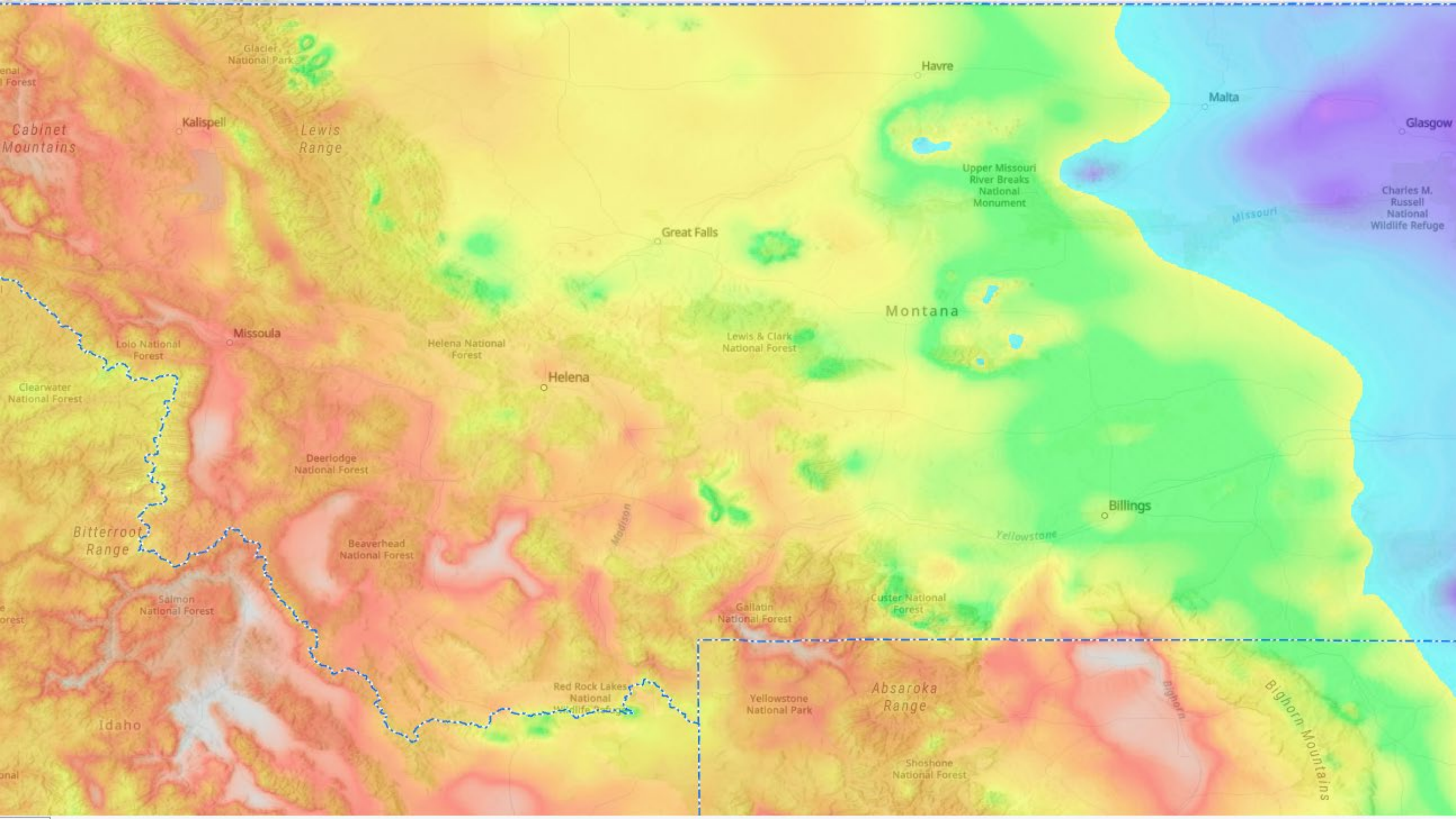
- …How to address these concerns?

Photo credit: Erin Grinde

Determinants of post-fire hydrologic response

$$Q = P\ A^{x}$$

- Hydroclimatic controls
  - Rainfall intensity
  - Total annual precipitation
  - Timing of precipitation
  - Type (snow v. rain)
- Biophysical controls
  - Upland vegetation characteristics
  - Riparian vegetation condition and extent
  - Basin physiography
  - Network drainage pattern
  - Soil characteristics


Glacier National Park
Havre
Malta
Glasgow
Cabinet Mountains
Kalispell
Lewis Range
Upper Missouri River Breaks National Monument
Charles M. Russell National Wildlife Refuge
Missouri
Great Falls
Montana
Missoula
Lolo National Forest
Helena National Forest
Lewis & Clark National Forest
Helena
Clearwater National Forest
Deerlodge National Forest
Billings
Bitterroot Range
Madison
Yellowstone
Beaverhead National Forest
Salmon National Forest
Gallatin National Forest
Custer National Forest
Red Rock Lakes National
Yellowstone National Park
Absaroka Range
Bighorn
Bighorn Mountains
Idaho
Shoshone National Forest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680 4868285
338° N22W 6009mils (True)
27.1°
4.9°
slope- mod

Photo Credit: Matt Enger, Bighorn NF

Post-fire erosion context and processes- what does delivery look like?

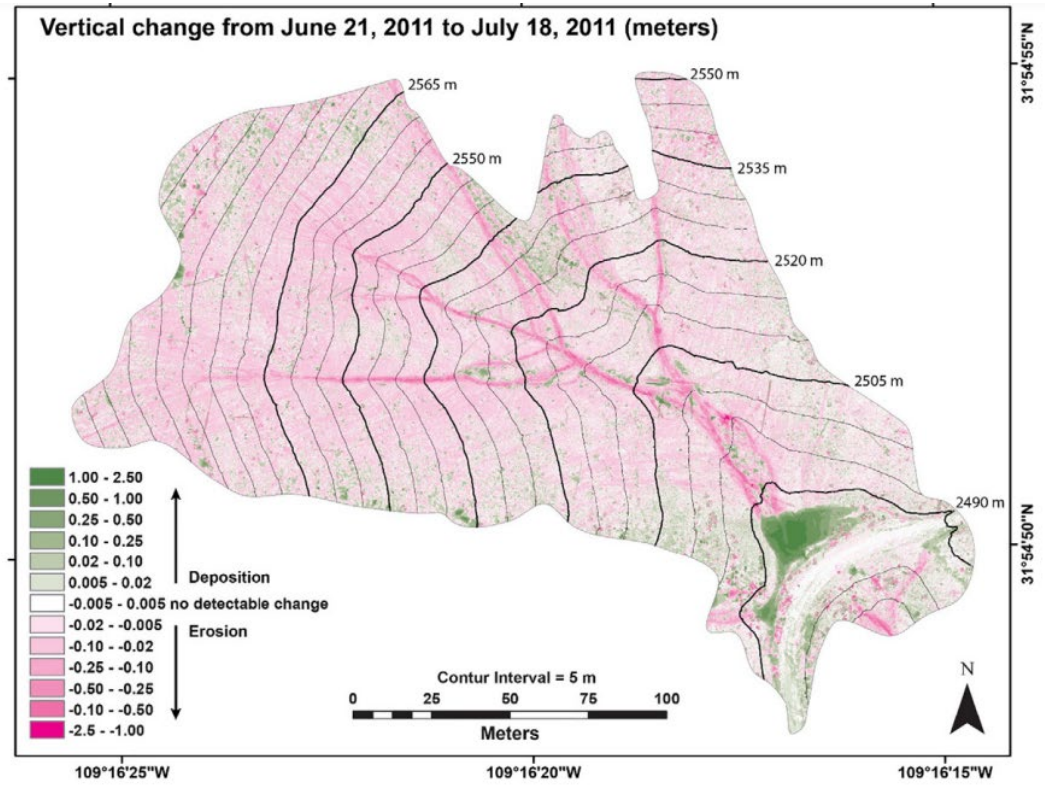

Fig. 6. Landscape change from June 21 to July 18, 2011. Magenta tones indicate erosion. Green tones indicate deposition. White areas represent change <0.005 m (up or down) f previous elevation, and areas of no data.

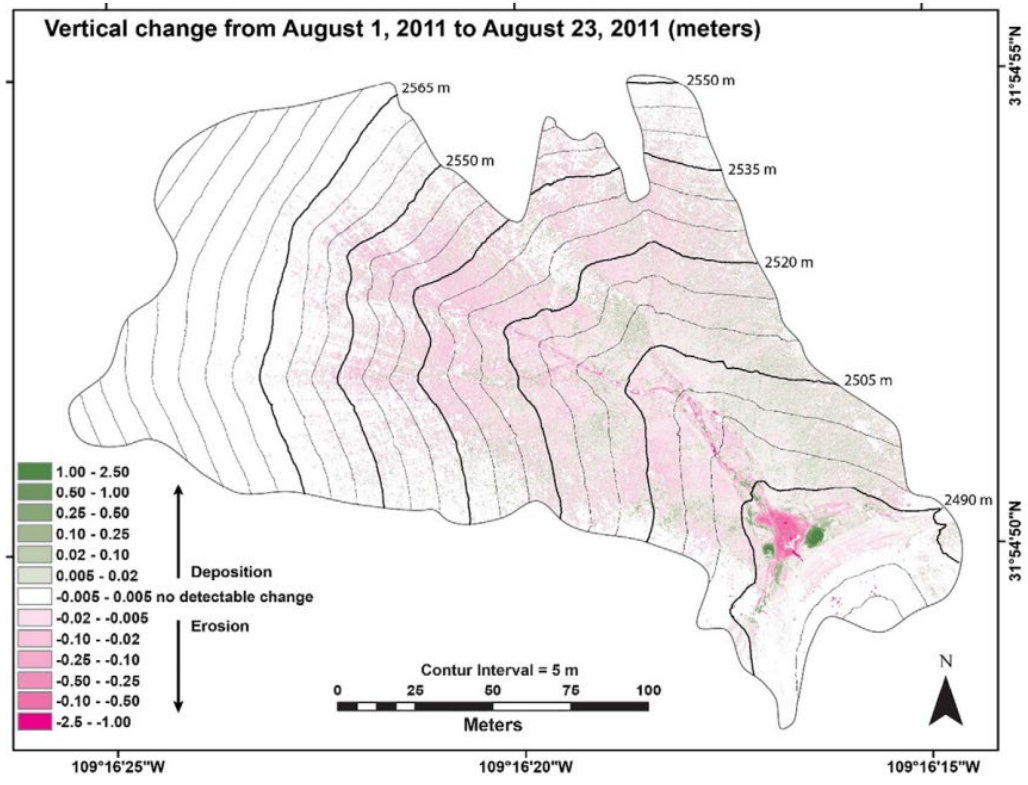

Fig. 12. Map showing landscape change from August 1 through August 23, 2011. Magenta tones indicate erosion. Green tones indicate deposition. White is change <0.005 m (up or down) from previous elevation, and areas of no data. Changes in depositional area were a result of U.S. Forest Service excavating culvert and piling coarse deposits.

DeLong et al. 2018

Fuels management vs. infrastructure upgrades?

https://www.fs.usda.gov/sites/default/files/fs_media/fs_document/WCS-Historic-Year.pdf

https://www.bozeman.net/home/showpublishedimage/16305/638429078590400000

Takeaways

- Lots of agency investment in municipal water supply management
- Pretty good at fuels planning, working on water quality planning
- Multi-scale planning considerations
- Need to consider spatial variability within watersheds
- Multiple process drivers to consider when determining treatment approach
- Infrastructure upgrades versus fuels management?

Questions?

- References:

  - Chow, A. T.-S., T. Karanfil, and R. A. Dahlgren (2021), Wildfires are threatening municipal water supplies, Eos, 102, https://doi.org/10.1029/2021EO161894. Published on 12 August 2021.
  - DeLong, S.B., Youberg, A.M., DeLong, W.M., and Murphy, B.P. 2018. Post-wildfire landscape change and erosional processes from repeat terrestrial lidar in a steep headwater catchment, Chiricahua Mountains, Arizona, USA. Geomorphology 300: 13-30.
  - Gannon, B.M., Wei, Y., Thompson, M.P., Scott, J.H., and Short, K.C. 2022. System Analysis of Wildfire-Water Supply Risk in Colorado, USA with Monte Carlo Wildfire and Rainfall Simulation. Risk Analysis 42(2): 406-424.
  - Liu, N., Dobbs, G.R., Caldwell, P.V., Miniat, C.F., Sun, G., Duan, K., Nelson, S., Bolstad, P.V., and Carlson, C. 2022. Quantifying the Role of National Forest System and Other Forested Lands in Providing Surface Drinking Water Supply for the Conterminous United States. USDA Forest Service General Technical Report WO-100: 48 p.

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