Wildfire & Water

Mighty Peace Watershed Alliance - Fire and Water Forum

Michael Wagner, Forest Hydrologist
Alberta Forestry and Parks, Forestry Division
February 28, 2024

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Agenda

- Forests, water and natural disturbance
- Wildfire and watershed level response
- Impacts of wildfire to watershed values

Topic one

Forests, water and natural disturbance

Forests and Watersheds

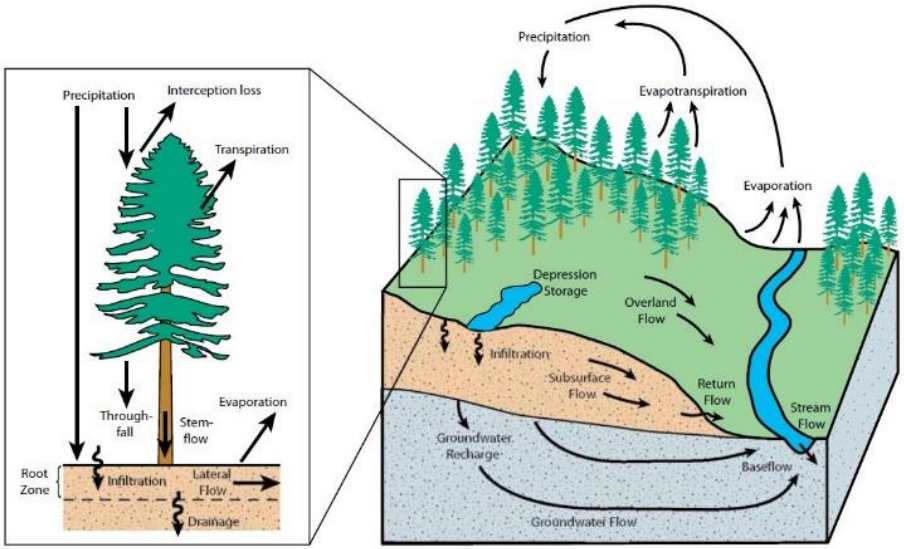
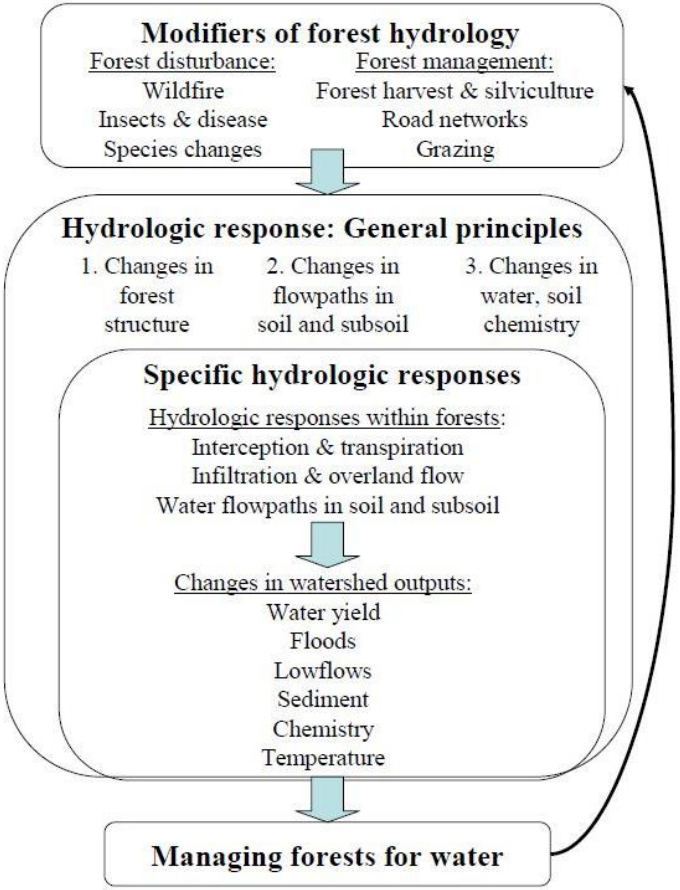


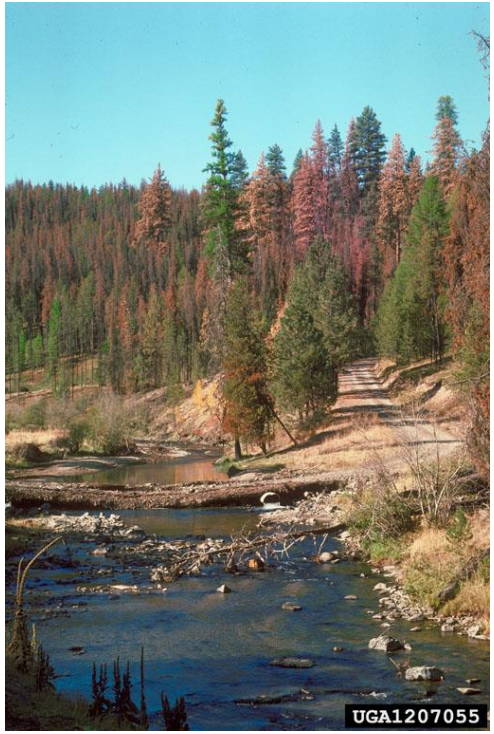
FIGURE 6.1 *The hillslope hydrologic cycle and stand water balance.*

Winkler et al. 2008



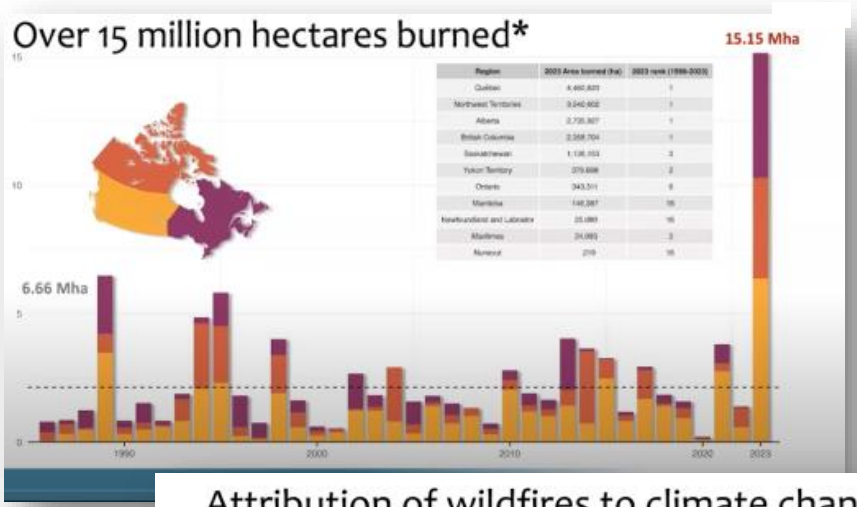
National Academy of Science, 2008

Natural Disturbance




SRWP 2018, Kenow Fire Waterton

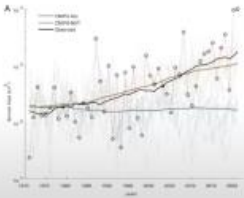

McLoud River, June 2023



Attribution of wildfires to climate change

PNAS study, June 2023:

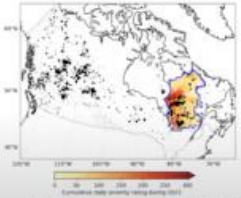
Nearly all *increases in area burned in California since 1971 can be attributed to anthropogenic climate change*



Turco, M., Abatzoglou, J.T., Herrera, S., Zhuang, Y., Jerez, S., Lucas, D.D., AghaKouchak, A. and Cvijanovic, I., 2023. Anthropogenic climate change impacts exacerbate summer forest fires in California. *Proceedings of the National Academy of Sciences*, *120*(25), p.e2213815120. https://www.pnas.org/doi/full/10.1073/pnas.2213815120

World Weather Attribution Study, August 2023:

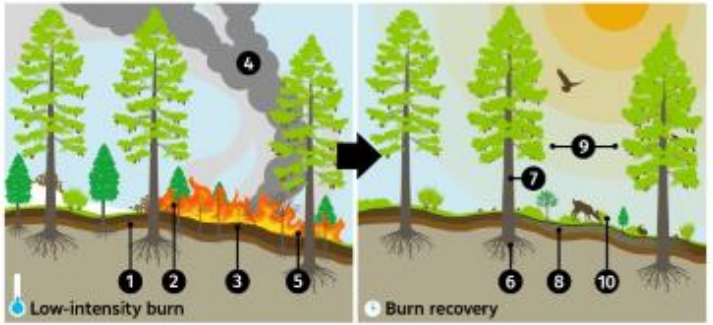
Seasons of same severity as 2023 are ***7*** *times more likely under climate change; and with same fire weather extremes are* ***twice*** *as likely under climate change*



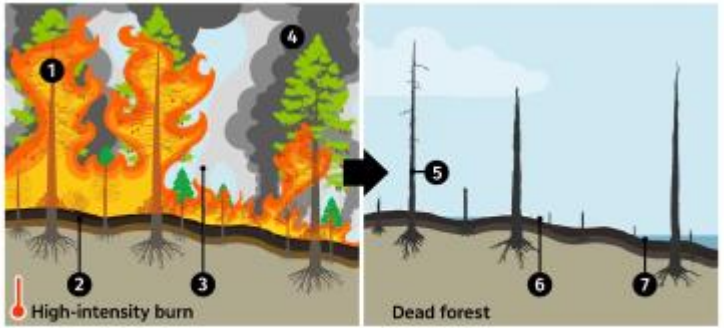
Barnes, C., Boulanger, Y., Keeping, T., Gachon, P., Gillett, N., Boucher, J., Roberge, F., Kew, S., Haas, O., Heinrich, D. and Vahlberg, M., 2023. Climate change more than doubled the likelihood of extreme fire weather conditions in eastern Canada. https://www.worldweatherattribution.org/climate-change-more-than-doubled-the-likelihood-of-extreme-fire-weather-conditions-in-eastern-canada/

Natural Resources Canada | Ressources naturelles Canada

https://www.youtube.com/watch?v=4iW9v9ef6Uk



Low-intensity fire



High-intensity fire

https://www.cbc.ca/news/science/what-on-earth-indigenous-fire-forests-1.6194999

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Topic two

Wildfire and watershed level response

Post Wildfire Watershed Response

Likelihood of greater runoff and sediment/nutrient transport to streams is increased due to the physical changes resulting from wildfire.

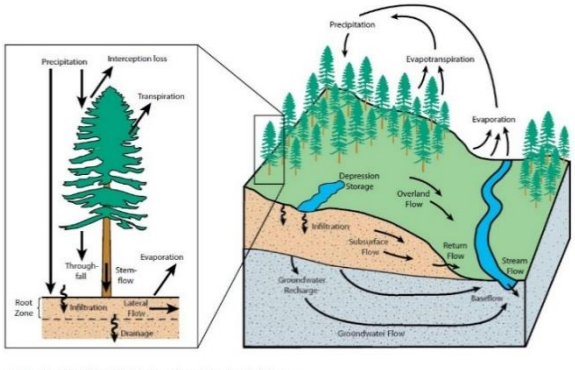

FIGURE 6.1 *The hillslope hydrologic cycle and stand water balance.*

Winkler et al. 2008

SRWP, Lost Creek - 2004

↓ Interception (snow and rain), transpiration, infiltration, surface roughness

↑ Hydrophobic soils and runoff pathways

↑ Connectivity of flow paths and transport downslope/ downstream

↑ Water, nutrient and sediment yields

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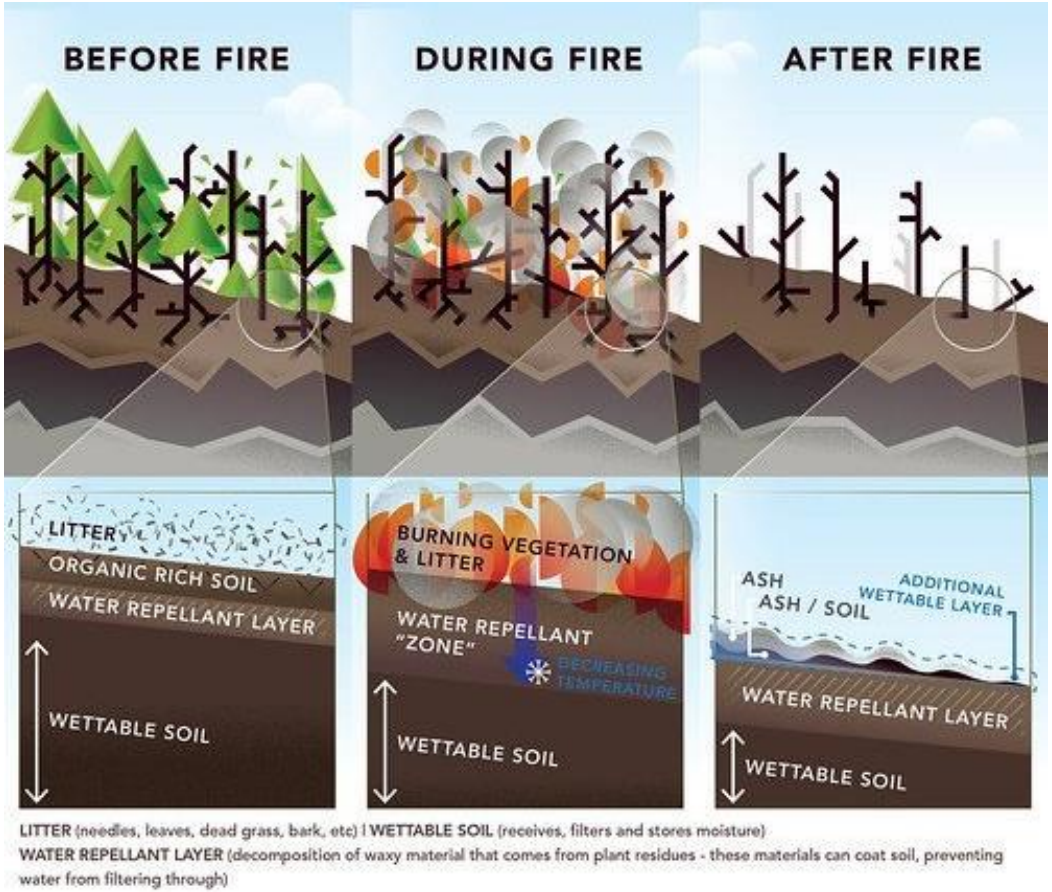

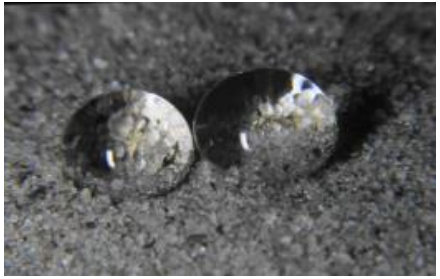

https://www.usda.gov/media/blog/2016/02/08/western-water-threatened-wildfire

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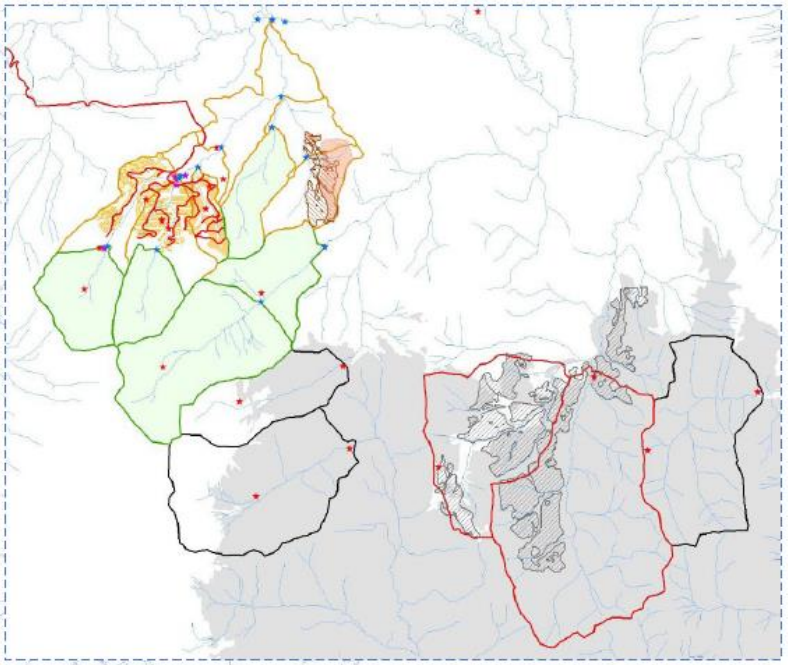
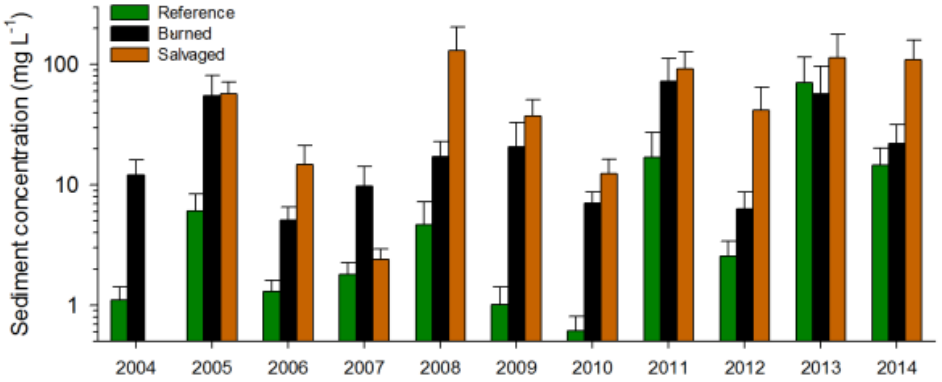
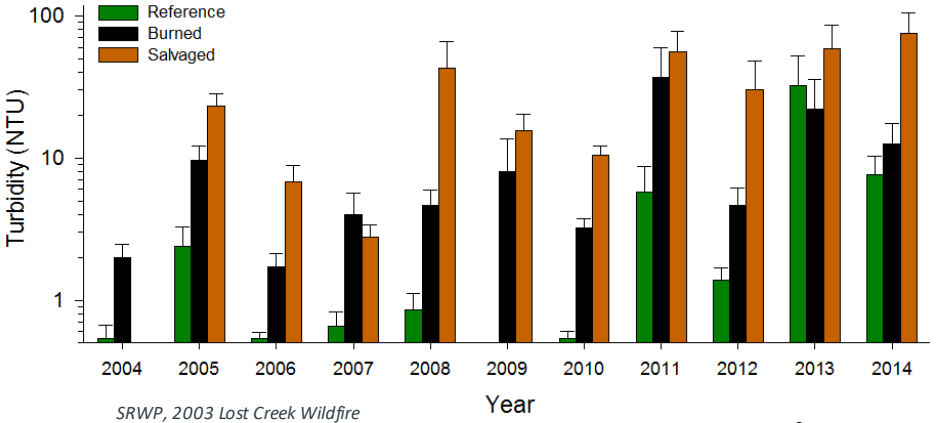
Lost Creek - Sediment production

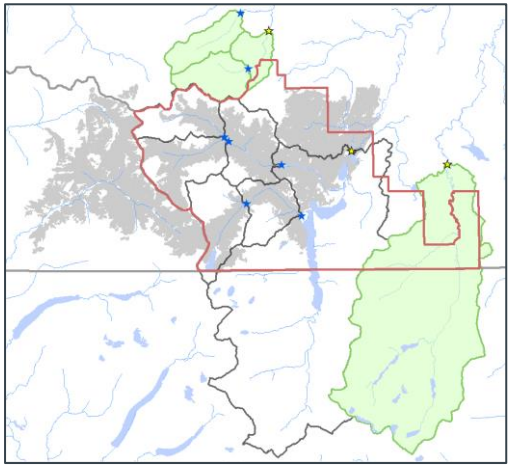






SRWP, 2003 Lost Creek Wildfire

Kenow - Sediment production



Sediment production similar to lost creek
Larger watersheds then SRWP
Lost creek sediment x9 over reference
kenow x12 times over reference

Silins et. al 2022

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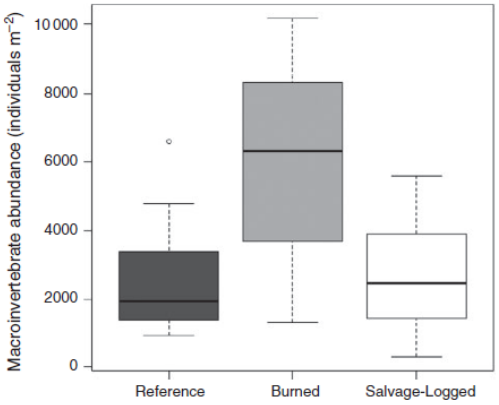
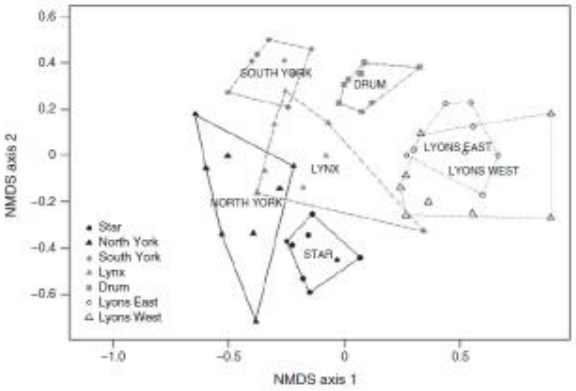
Streamflow

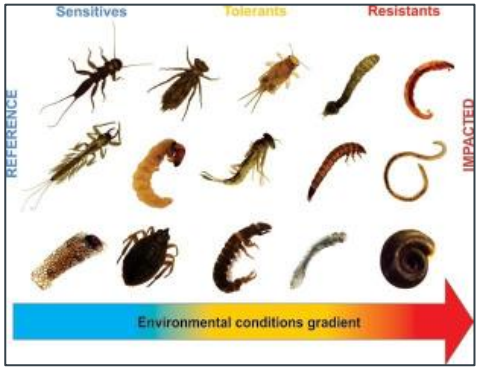
- Recent analysis on Lost Creek and Kenow Wildfires by Southern Rockies Watershed Project suggests that wildfire can have significant impacts across the entire streamflow regime
  - Annual yields (6 to 24% increase)
  - Earlier onset of spring melt (1 to 2 weeks)
  - Higher low summer flows (July/Aug)

Aquatic Ecosystems





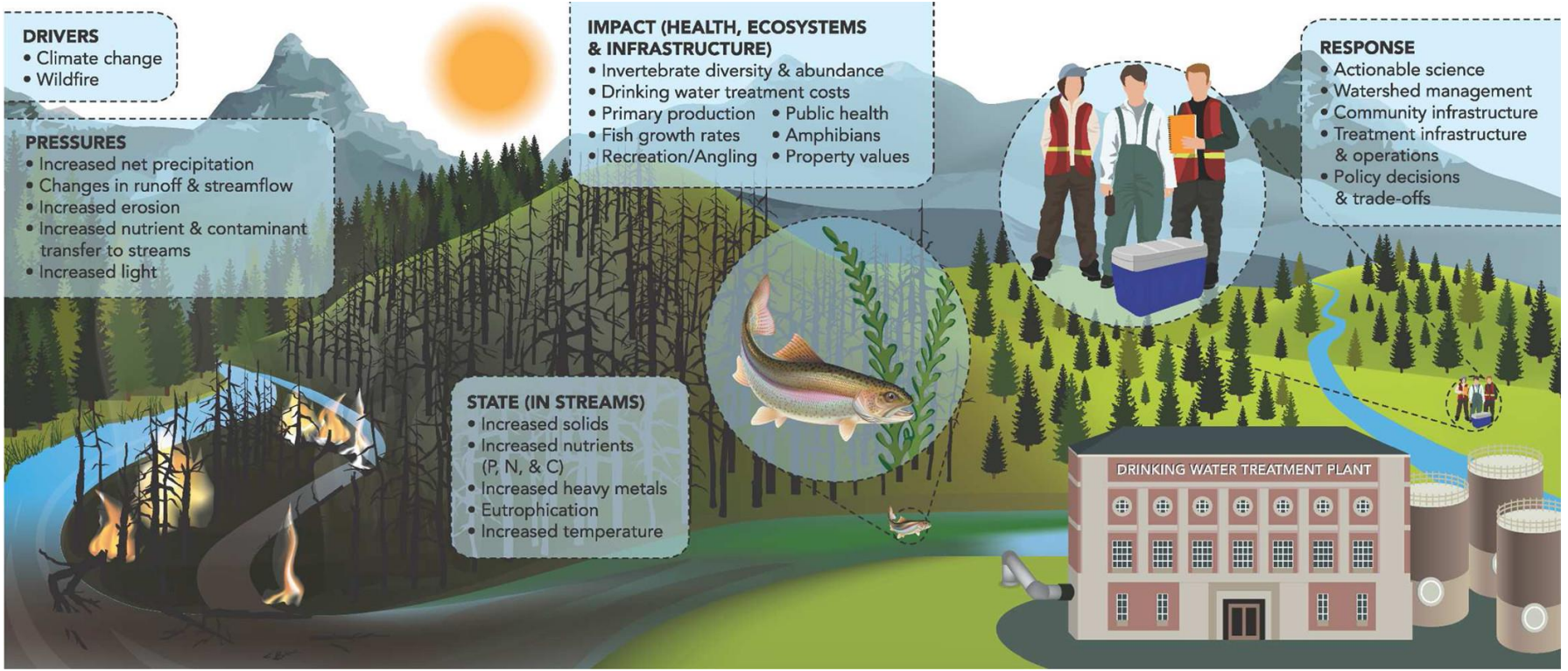
Martens et. al (IJWF, 2019)



Macroinvertebrates as biotic indicators of environmental quality. Methods in stream ecology. Academic Press, 2017

Topic three

Impacts of wildfire to watershed values



Wildfire and the Future of Water Supply. Bladon et al., 2014. https://pubs.acs.org/doi/10.1021/es500130g

Drinking Water

Globe and Mail, June 17, 2016

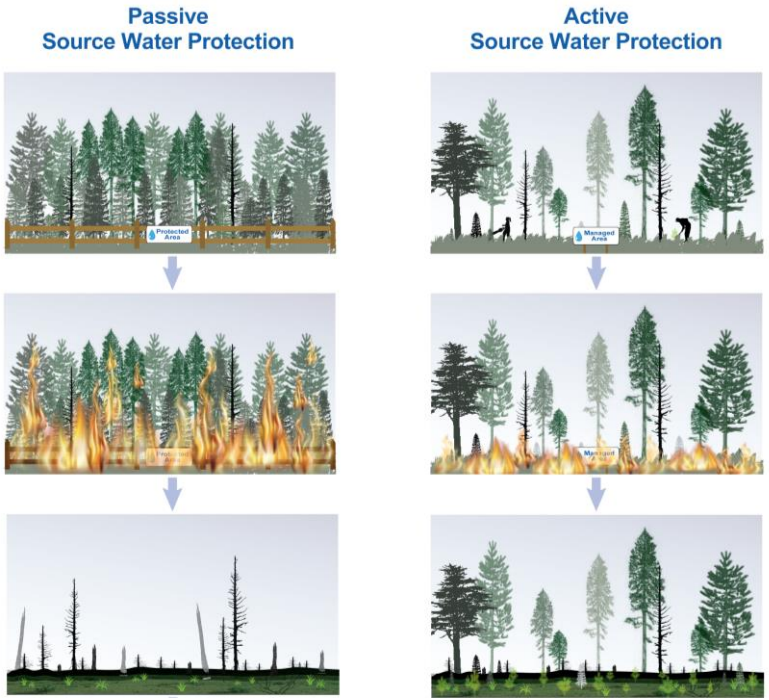
CBC News, February 09, 2017

Emelko & Silins, 2016 AI project #2385

Emmerton et al. (2020)

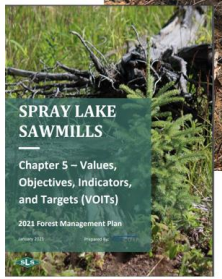
Source Water Protection Solutions

Resilient Forests = Resilient Water



Calgary, Spray Lake Sawmills & *forWater*: Key First Steps for DW Security

- Collaborative development and inclusion of two voluntary goals within SLS's FMP:
  - water quality
  - harvesting to reduce wildfire risk
- Water quantity and quality values were currently addressed in the FMP but not particular to municipal drinking water



Calgary

Spray Lake Sawmills

forWater
NSERC Network for Forested Drinking Water Source Protection Technologies

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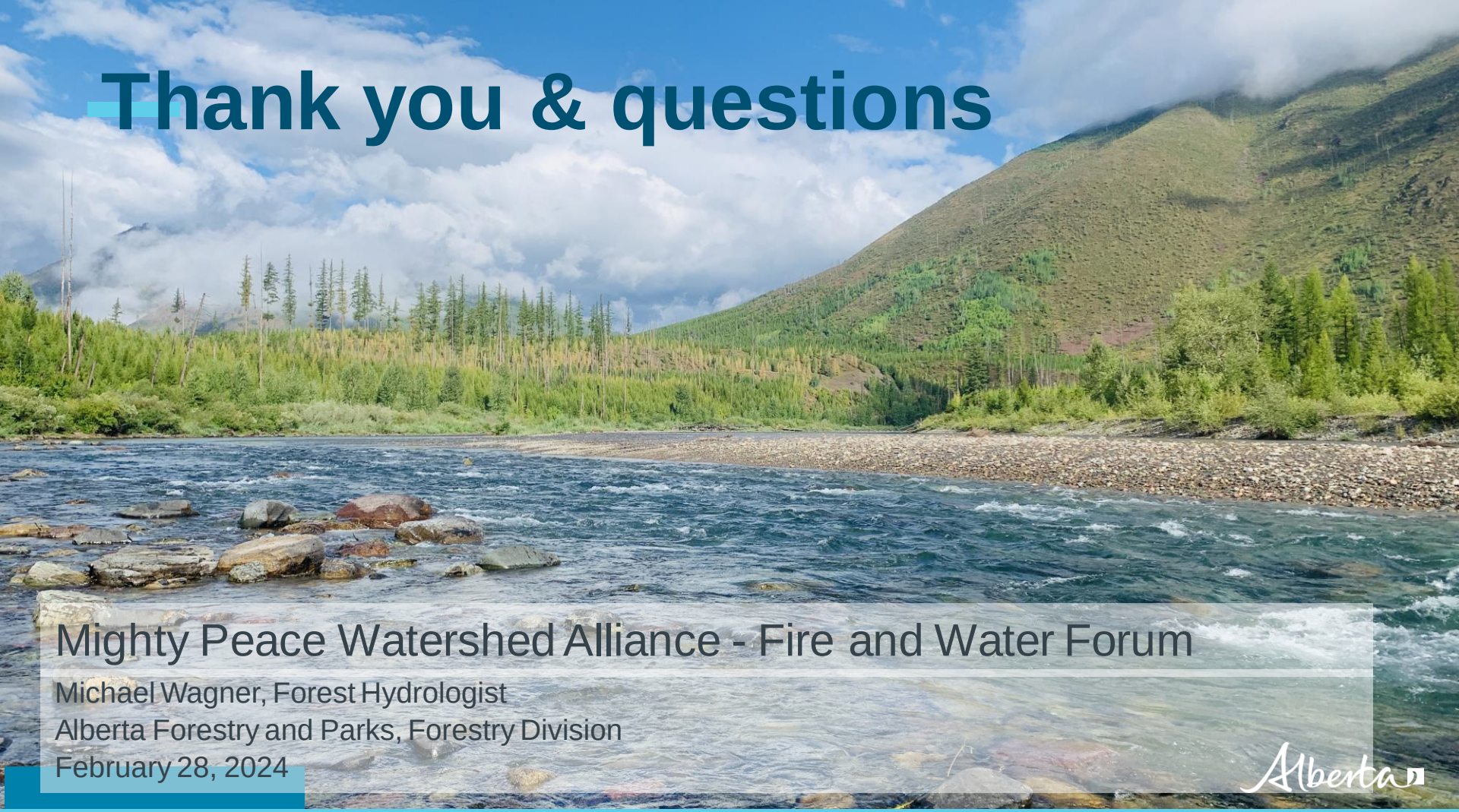
Emelko, Water STP 2022

Thank you & questions



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Questions?