# Targeting Post-Wildfire Watershed Restoration at Source Water Protection

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**National Forest Foundation**
**Collaborative Restoration Workshop**
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## Fire & Water

High severity wildfires alter the physical and biological processes that determine how watersheds retain and release nutrients and influence stream water quality. Proximity of the 2002 Hayman Fire and the 2013 High Park Fire to Front Range populations brought the fundamental links between forest conditions, wildfire and water supply into sharp focus and highlighted the challenges of source water protection in watersheds vulnerable to severe wildfire. For example, water quality changes following the High Park Fire compromised water supply to >250,000 homes and agricultural producers.

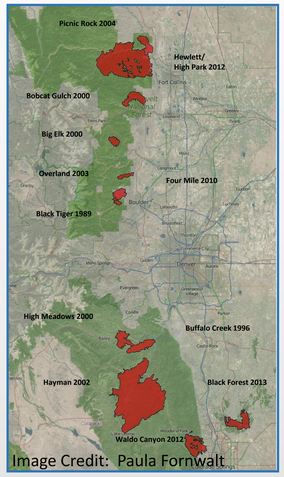
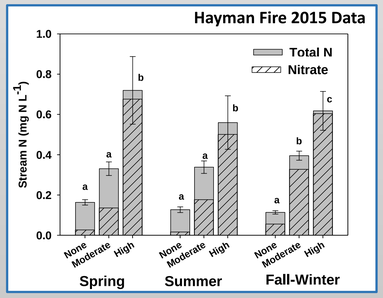


Image Credit: Paula Fornwalt

## Project Objective and Approach

This new project aims to advance understanding of upland, riparian and in-stream nutrient retention and post-fire restoration to enhance clean water supply from burned Colorado watersheds.

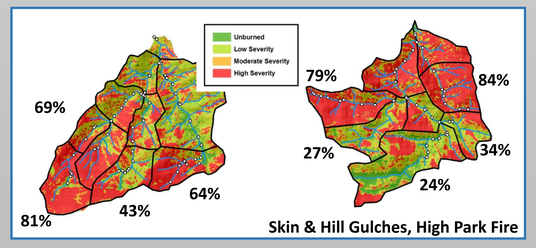
## Background

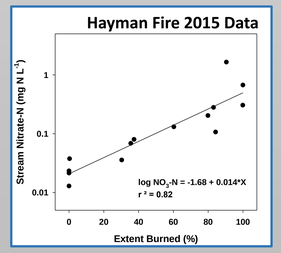



Stream nitrate increases after Front Range fires and can remain elevated for more than a decade.

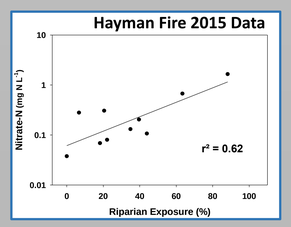
**Why worry about Stream Nutrients ?**

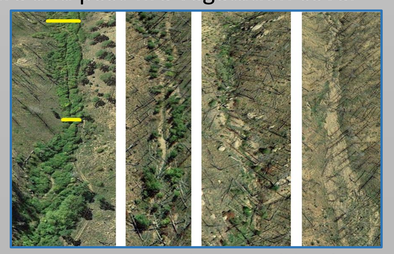
- Human & aquatic health
- Water treatment complications
- Clean water supply from forestland
- Ecosystem Productivity – Forest Growth
- Disturbance Indicator / Restoration Target



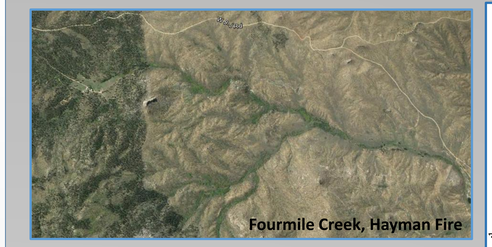




The extent and severity of the fire and post-fire vegetation cover influences stream nutrients



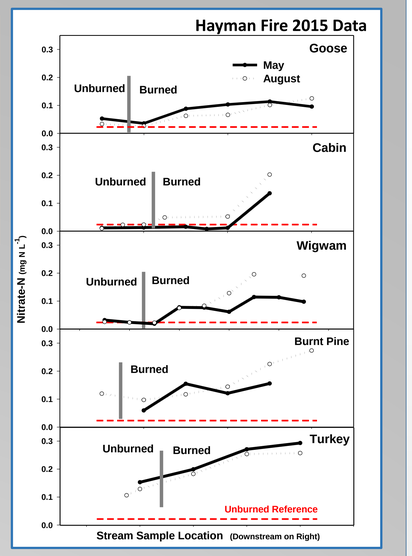




## Crossing the Line

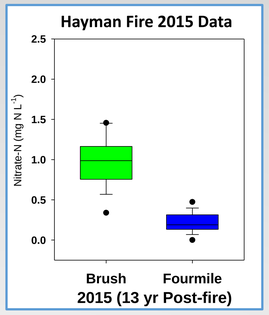


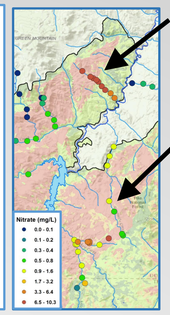

13 years after the Hayman Fire, nitrate concentrations are 2- 5 times higher inside the burn compared to portions of the streams outside the burn.

Nitrate levels are 5-12 times more than unburned local streams (0.02 mg $L^{-1}$) and well above EPA draft levels for least-disturbed streams in this ecoregion (0.01 mg nitrate-N $L^{-1}$).




## What Goes Up... May Stay Up




**Brush Crk: Little Recovery**
No decline in mean nitrate since 2002;~100X >unburned streams

**Fourmile Crk: The Road Back**
Still ~ 10X > unburned streams

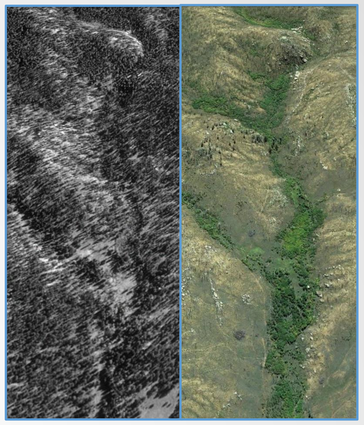
| | | Yrs 1-5 | 2015 |
|---|---|---|---|
| Brush | Median | 0.99 | 0.99 |
| | Max | 2.20 | 1.46 |
| Fourmile | Median | 0.49 | 0.19 |
| | Max | 2.35 | 0.47 |

Lasting nutrient impairment may relate to immediate post-fire changes and upland, riparian and channel locations and their rates of recovery.

**Brush Creek**

Pre Fire 2001 Post Fire 2015

**Fourmile Creek**



Pre Fire 2001 Post Fire 2015

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Coalition for the Poudre River Watershed

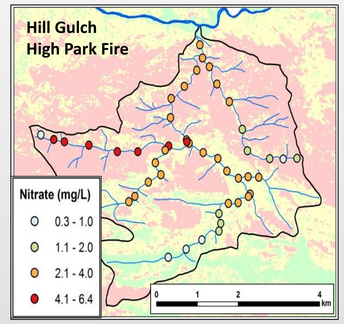
City of Fort Collins

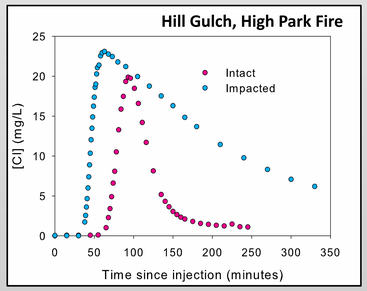
City of Greeley

The Coalition for the Poudre River Watershed (CPRW) is a non-profit organization formed in the immediate aftermath of the High Park Fire. CPRW connects municipal water utilities, land management agencies, watershed researchers and citizen groups to identify threats to water supply, prioritize watershed restoration activities and advance understanding of post-fire watershed processes.

## Targeting Source Water Protection, Advancing Watershed Restoration & Science

Forests and watersheds disturbed by severe wildfire represent a testbed to advance knowledge of ecosystem resilience. The "megafires" of the past decades underscore limitations of current understanding about recovery of water quality and nutrient retention to pre-fire conditions.




Curve shape characterizes reach hydrodynamics: velocity, residence time, transient storage.

**Impacted Reach:** fast & slow transport on rising & falling limbs, indicate that changes in channel morphology from post-fire erosion and deposition have altered reach hydrodynamics and in turn stream retention capacity and nutrient export.

## Restoration Targets

We will study small catchments to examine the effectiveness of restoring post-fire nutrient retention with upland or riparian plantings. This will help broaden thinking about source water protection and watershed restoration to include ecosystem resilience, forest recovery and nutrient retention.

## Citizen Science

Monitoring by trained citizen scientists will expand our project's capacity to survey water quality, aquatic biota, channel and watershed condition more extensively and will strengthen local involvement.