



Cascading Hazards

WILDFIRES, POST-FIRE FLOODING AND THE ROLE OF CLIMATE CHANGE

THE NEED

While wildfires create instantaneous damage as they burn, the charred vegetation, ash, and burnt soil left behind after a fire enhance flood risk for years that follow. The increased potential for flash flood impacts lasts until vegetation is restored, which can take up to a decade or longer. In these areas, flash flooding poses a threat not only from the massive force and amount of water, but also from debris and ash forming mudslides and debris flows. Flash flood-triggered debris flows further endanger human lives, property, and water infrastructure (dams, culverts, bridges). In a changing climate where extremes – both floods *and* wildfire-enhancing heatwaves and droughts – are projected to become more extreme, it is critical to understand the processes influencing the multitude of risk factors across both short- and long-term timescales.

THE SCIENCE

- NOAA Physical Sciences Laboratory (PSL) research spans weather-climate timescales to address wildfire, post-wildfire impacts: causes, explanations, and risks.
- We develop, evaluate, and apply state-of-the-science weather, water, and climate models and physical understanding to improve flood risk assessment based on land-surface changes.
- Wildfires and extreme rainfall are both controlled by processes occurring on multiple scales: Understanding

skill and uncertainties in climate projections is critical to identifying climate change imprint on events.

- Estimating the most extreme flood potential: Accurate *probable maximum precipitation* (PMP) estimates are critical to Colorado Dam Safety. NOAA recently implemented state-of-the-science models, technology, climate change expertise to update decades-old dam, flood safety requirements.

APPLICATION

- NOAA coordinating agency-wide efforts to more fully integrate wildfire science and societal needs.
- Scenario planning, examining wide envelopes of extreme risk potential often recommended for stakeholder's extreme event risk assessment and planning: especially key for "cascading hazards" such as post-wildfire flooding and other downstream societal impacts.
- Dam safety: The Colorado-New Mexico Regional Extreme Precipitation Study (CO-NM REPS) improved PMP estimation, plus ongoing necessary update PMP for safe infrastructure operations and planning.
- Improved flood forecasts by combining meteorological and hydrologic models, expertise.
- Improved climate projections via improved understanding of land-surface interactions, feedbacks, vulnerabilities.

TRANSITIONS

- Agency scientists serve as “honest brokers” to many stakeholders (local, state, and national) producing and communicating state-of-the-science to meet decision-making needs.
- Dam safety: NOAA’s role in CO-NM REPS improved PMP estimation in Colorado and New Mexico. PSL and NOAA key partners in creating a 21st century PMP for safer national dam safety and infrastructure operations and planning.
- NOAA’s Hydrometeorology Testbed allows researchers and operational forecasters to co-develop, test-drive new science, technologies. NOAA Boulder research (PSL and NOAA Global Systems Laboratory), operations being co-located enhances collaboration, research transition potential.

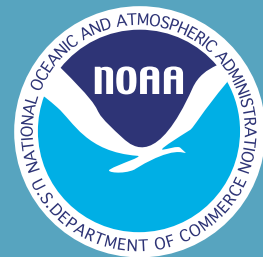
FUTURE WORK

- Dam safety (state and national), Probable Maximum Precipitation: scientific upgrades needed at national scale.
- Growing NOAA’s Hydrometeorology Testbed to address cascading hazards that lead to flood risk (e.g., post wildfire flooding, debris flows).

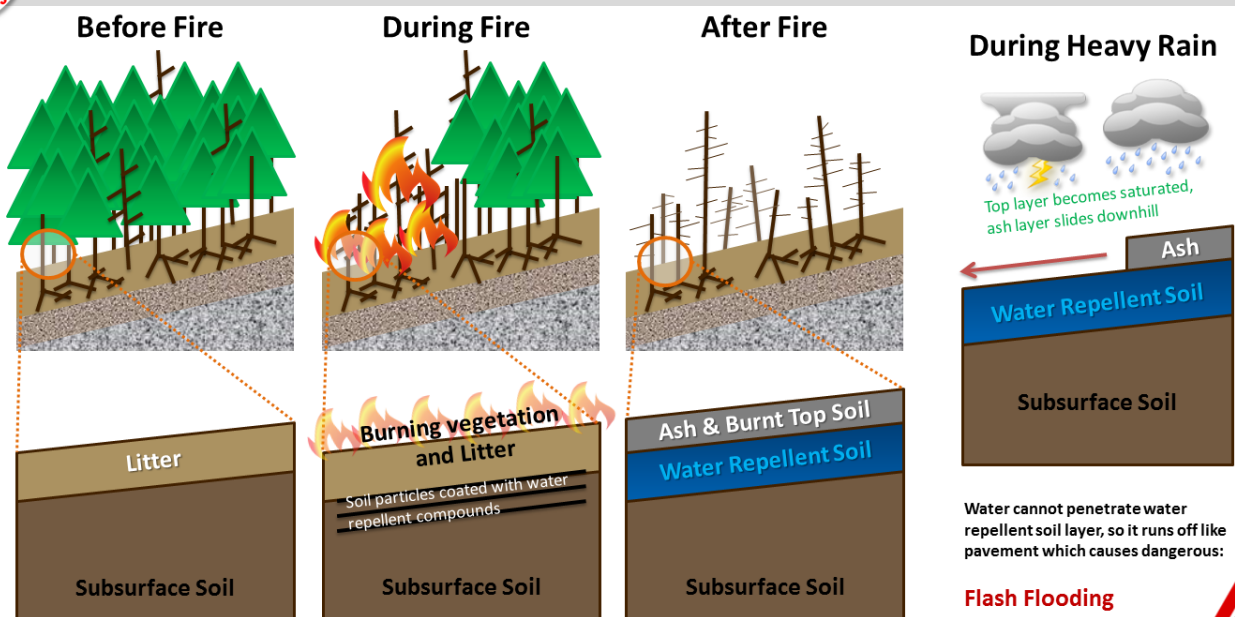
CONTACT

Robert Webb, Director
 NOAA Physical Sciences Laboratory
 Boulder, Colorado
 Email: Robert.S.Webb@noaa.gov

Visit us online at: <https://psl.noaa.gov>



Wildfire Burn Scars are a Flood Risk



Water cannot penetrate water repellent soil layer, so it runs off like pavement which causes dangerous:

**Flash Flooding
 Mud & Debris Flows
 Mudslides**



Litter: organic material such as needles, leaves, grass, brush, bark.

Water Repellent Soils: formed when organic material such as trees, scrubs, plants and litter burn at high intensity, water repellent compounds are vaporized, and condense on cooler soil layers below, which prevents soil from absorbing water.