The effects of fire on soil erosion risk

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Does wildland fire increase soil erosion risk?

• Short answer:
  – Yes, fire reduces canopy and ground cover and can alter soil characteristics that increase the risk of erosion after fire.

• A longer answer:
  – Yes, fire can increase the risk of erosion; however, the degree to which the risk is elevated and the duration of this elevated risk depend on several factors. Pre- and post-fire management may predispose a site to greater post-fire erosion risk.
This is not Oklahoma, Kansas, or even Texas.

Fire induced erosion may persist on this site for many years as the vegetation slowly returns to a pre-fire condition.
Steep mountain big sagebrush rangeland community in Idaho before fire...
... and after fire.
Post-fire runoff and erosion from a steep burned and unburned mountain big sagebrush community in Idaho
Erosion Risk Window

• Woodlands that have crowned out during fire have a much elevated erosion risk and for it’s elevated for a long duration.

• Health grasslands have lower erosion risk for shorter duration, but...
  – some grasslands are in transition to woodland or dense shrub land.
  – Timing of fire, such as during drought or early in the dormant season, may extend the duration of the elevated risk window.
Rangelands are most susceptible to erosion after fire.
But fire is a natural phenomenon for grasslands and canopy cover returns quickly when they are healthy.
Water Erosion Factors

- Precipitation
  - amount
  - duration, and
  - intensity
- Canopy cover (interception)
- Runoff
- Slope
- Soil characteristics
  - texture
  - roots content
  - porosity
  - repellency
- Ground cover

Fire effect

Management effects
Water Repellency
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Much bare soil several months after fire in areas with high profile juniper cover.
Ground Cover

• Slower to return than canopy cover
  – May require several years to recover
  – It’s importance is partially offset if canopy cover has returned and infiltration is good.

• Important for slowing flow of water along the surface.
  – Concentrated flow detachment and sediment transport rates may be elevated
  – Most important where slopes are long and steep
Wind Erosion Factors

- Wind speed
- Roughness height
  - Vegetation
- Fetch (protected distance)
- Soil texture
- Water repellent compounds
Conclusions

• The soil erosion response to fire is not the same in forests, chaparral, dense sagebrush, and grasslands.

• If your grasslands are healthy, soils are not too sandy, slopes are not very long or steep, and post-fire conditions are good, then the erosion risk is only slightly elevated for a short duration.

• Very sandy soils that burned in late autumn or during drought with poor post-fire regrowth conditions, may be susceptible to elevated risk of wind erosion.

• If your grasslands have transitioned to woodland (especially juniper) or dense shrub, post-fire recovery may be slowed and the risk elevated and extended.