* Post-wildfire Natural Hazards Risk Analysis

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Mitigating mass wasting and downstream impacts


*Introduction
*Post-wildfire Natural Hazards Risk Analysis
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*Conclusions

* Reconnaissance Review

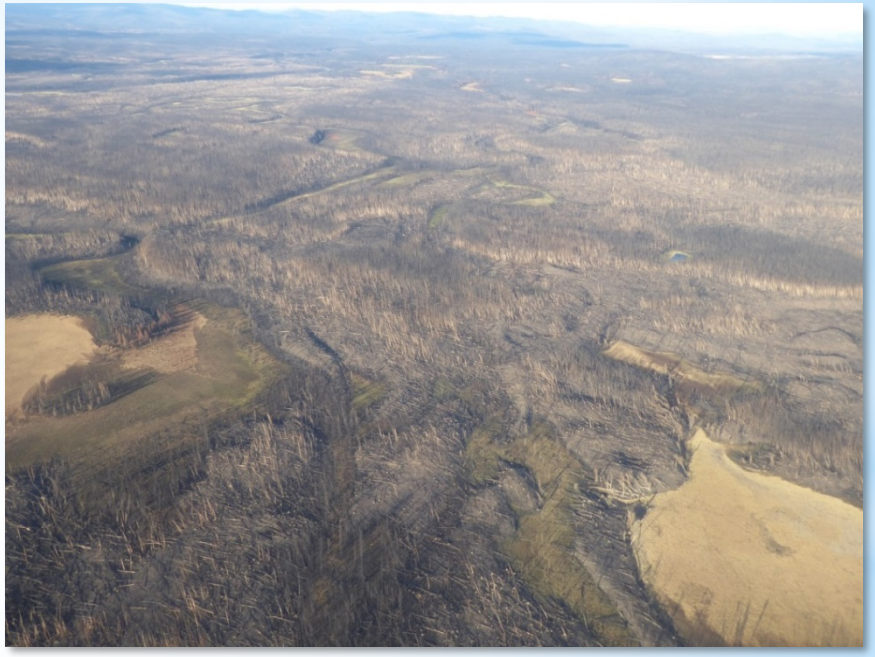
Collect information to complete a preliminary analysis of the post-wildfire conditions to quantify the downslope + downstream risks to life, property, and infrastructure, or "elements at risk."

Elements at risk are defined as:

- Residences or other occupied public or private buildings,
- Highways and other arterial roads and railways, or
- Linear infrastructure (pipelines, powerlines).

* Detailed PWNHRA Report

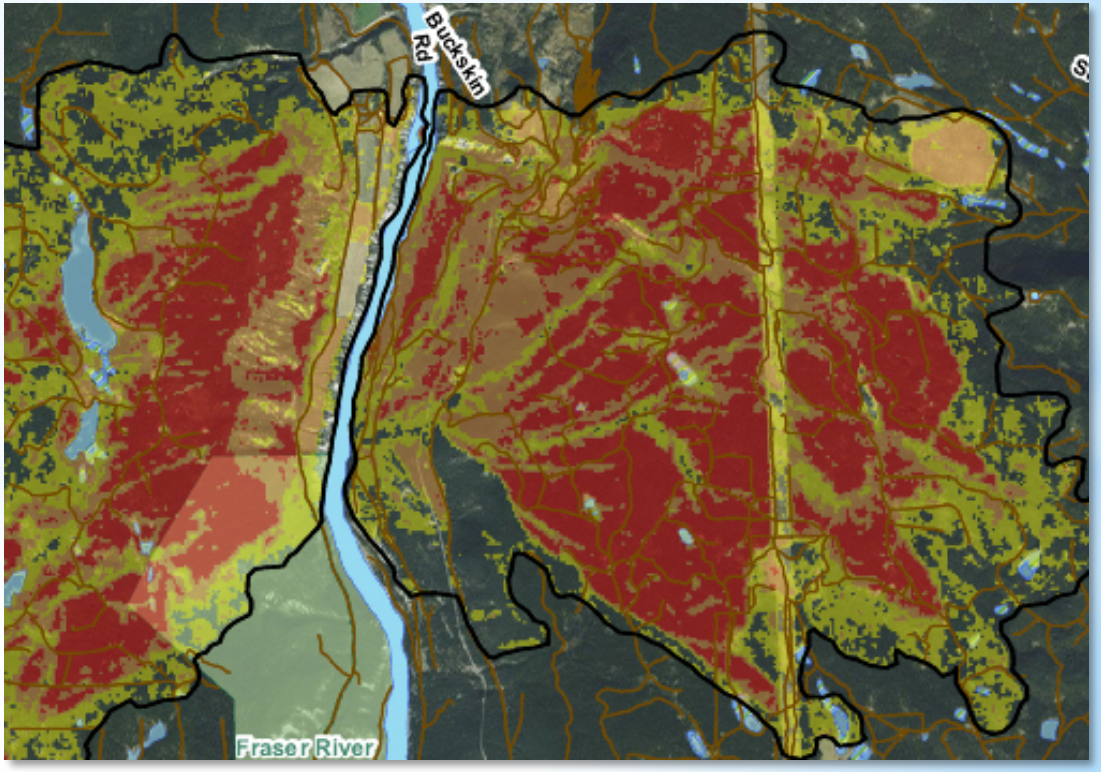
- Consideration of the burn severity and post-wildfire soil, hydrologic, and slope stability conditions



* Detailed PWNHRA Report

Fieldwork :

- *burn severity map* – a burn severity map is a satellite-derived map of post-wildfire vegetation condition.
- *topographic map* – stream channel morphometrics
- *streampower map* – merges steep slopes with sub-watershed areas to determine areas which will be prone to increased streamflows.



* Detailed PWNHRA Report

- Elaborates on hazards and risks identified in the reconnaissance review, identifies the need for risk mitigation, and may provide conceptual designs for the mitigation measures.

* Hydrologic Risk Assessment

Reconnaissance reviews
- limited steep slope natural hazards
- significant hazards from hydrologic response

Hanceville Fire affected 239,673 hectares:
323,268 ha (16%) of Chilcotin watershed
North - Anahim, Mackin, Zenzaco Withrow, Riske, Sword
South - Haines, Minton, Big, Gaspard, Kloh

Plateau Fire affected 512,021 ha:
435,765 ha (35%) of Blackwater watershed
30,260 ha (18%) of Narcosli watershed
54,987 ha (3%) of Chilcotin watershed

Bonaparte Fire affected 191,865 hectares:
140,400 ha (26%) of Bonaparte watershed
11,500 ha (8%) of Deadman watershed

* Hydrologic Risk Assessment

The assessments included review of:

- water repellent (hydrophobic) soils,
- pre-fire forest disturbance,
- fire-related forest disturbance,
- post-fire flood hazard,
- spring freshet,
- elements-at-risk,
- fire-related riparian disturbance,
- post-fire sediment yield potential,
- post-fire channel response potential, and
- overall post-fire hydrologic risk.

* Hydrologic Risk Assessment

- Recommendations include:
  - spring 2018 flood potential,
  - update burn severity mapping,
  - future ECA modelling,
  - review riparian disturbance,
  - review potential soil erodibility,
  - review channel stability,
  - floodplain mapping,
  - assess the presence of hydrophobic soils, and
  - refinement of the list of potential elements-at-risk, long-term flood and erosion mitigation, and hydrometric monitoring.

* Mitigating mass wasting and downstream impacts

In a natural forest environment the vegetation and forest floor (litter and duff) protect the surface soil.

After a wildfire, the forest canopy and the forest floor may partially or completely consumed and this:

- decreases the interception of precipitation,
- alters the soil structure,
- reduces the organic matter of the soil (increases erodibility), and
- vaporizes organic substances which may move downward into the soil and condense as they cool to form water repellent layers.

- Increased rain splash erosion makes sediment available for transport.
- The loss of the forest floor reduces the available water storage and increases the conversion of rain to overland or surface flow.

- On flatter plateau areas there are broad shallow watercourses in places you would never expect to pass water
- These are still mostly clear water flows with minimal sediment and flowing relatively slowly

- Once the water makes it onto steeper slopes, the velocity increases and so does the capacity to erode and transport material
- Numerous small flows coalesce into fewer larger streams which start be become confined

- Confinement focuses the flows, increasing streampower, velocity and carrying capacity
  - floods
  - debris floods
  - debris flows

* Mitigation and Recovery

Soil or forest floor

- Regenerate the forest floor to protect the soil layers – long term process to accumulate and decay grasses, mosses and shrubs; may appear healed but it is very thin for years.
- Re-establish plant cover – vegetation develops a surface mulch and root system that increases infiltration and stability.
- Natural regeneration is best and least expensive, our ecosystems are generally adapted to wildfire and contains the necessary seedbank to reproduce grasses, shrubs and trees.
- After 3 years the effects of water repellency is typically gone and the ground surface will have a mat of shallow rooted grasses, mosses and needle cast or leaf litter.
- Rocky slopes that were less vegetated will take longer to regenerate as they have less chance of ground cover developing.

* Mitigation and Recovery

Trees

- The typical tree species to naturally regenerate after a fire is pine.
- Planting preferred tree seedlings is common and could be useful to re-establish a productive forest.
- Salvage logging of the most severely burned stands is harsh on the ground at first but may have better long-term prospects.
- Timing of logging may help protect the ground from excessive disturbance but some disturbance is good to help break up any water repellent soils.
- Infill planting on stands would be recommended if salvage harvesting is not an option.
- Planting deciduous varieties along riparian zones is a good way to stabilize the channels.

* Mitigation and Recovery

Hydrologic recovery

- Hydrological recovery starts immediately with ground cover (grasses and shrubs) coming back within a year.
- Some ground seems to recover to "normal" within 2-3 years, some takes 3-5 and in some places 20+ years after the fire the ground still shows signs of the impact.

Other choices

- slash retention
- wood placement
- road deactivation,
- culvert removal,
- increase culvert sizing.

* Wildcard

Weather - precipitation is the key driver

- High intensity rainfall (thunderstorms)
- Long term rainfall causing groundwater accumulation
- Heavy snowpack leading to elevated freshet flows

* Thank you

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