

Consequences of Land Management and Natural Disturbance to Water Quality and Quantity across the Aquatic, Riparian, and Upland Continuum

**Research Work Unit 4352
Rocky Mountain Research Station
USDA Forest Service**

Mission: To quantify watershed processes and impacts on watershed resources of management activities, disturbance, and associated uncertainties across upland forests, riparian areas, and streams in the Central Rocky Mountains. Continued long-term research on hydrology, meteorology, and water quality interactions at Fraser Experimental Forest.

Problem 1: Determine interactions between channel morphology, flow/sediment dynamics, and native fish populations as influenced by land management and natural disturbance.

- Element 1. Define the range, duration, and amount of flow needed to support functional aquatic environments in the wide range of channel types in subalpine and montane environments in the Central and Southern Rocky Mountains. *(Sandra Ryan-Burkett, Mike Young)*
- Element 2. Evaluate the relationships between large wood characteristics and dynamics and channel structure, fish populations, and riparian vegetation. *(Kate Dwire, Sandra Ryan-Burkett, Mike Young)*
- Element 3. Improve methods for monitoring stream sedimentation, including the development and testing of new methods for measuring bedload. *(Sandra Ryan-Burkett)*
- Element 4. Determine the effect of nonnative fishes on the response of native fishes to land management and natural disturbance. *(Mike Young)*
- Element 5. Improve monitoring approaches for stream fish populations. *(Mike Young)*

Problem 2: Characterize the structural, hydrologic and biogeochemical linkages between terrestrial and aquatic environments and improve understanding of how fire, hydrologic manipulation and natural resource management influence ecosystem processes and species composition of riparian and stream environments.

- Element 1: Determine the role of hydrologic and geomorphic factors in determining plant species composition and in regulating the biogeochemical function of riparian ecosystems in subalpine and montane forests of the Central Rocky Mountains. *(Kate Dwire, Chuck Rhoades)*
- Element 2. Determine the influence of land management, particularly altered hydrologic regimes on characteristics of riparian ecosystems and plant communities, including the distribution of invasive non-native species along riparian corridors. *(Kate Dwire, Chuck Rhoades)*
- Element 3. Determine the influence of prescribed and natural fire on characteristics of upland, riparian, and aquatic ecosystems, including

nutrient cycling, organic matter dynamics, and the re-growth and distribution of native and non-native plant species. (*Kate Dwire, Sandra Ryan-Burkett*)

Problem 3. Effects of management and disturbance on terrestrial processes influencing water yield, water quality and carbon storage.

Element 1. Quantify the effects of forest type, structure, and disturbance on the water cycle from accumulation process to runoff, including interception, sublimation, evapotranspiration, infiltration, and other hydrological processes. (*Kelly Elder*)

Element 2. Determine how stand structure, particularly leaf area and its distribution, and carbon storage vary with disturbance (fire frequency, management regimes), stand age and species. (*Mike Ryan*)

Element 3: Evaluate how upland landscape patterns influence biogeochemical processes in stream and riparian ecosystems and assess the effect of upland disturbance and resource management on water quality. (*Chuck Rhoades*)

Element 4: Quantifying and integrating aquatic, riparian and terrestrial carbon storage processes from the plot scale to landscapes. (*Mike Ryan*)

Unit Personnel:

RWU4352 is co-located in Fort Collins, CO and Laramie, WY

Acting Project Leader: Kelly Elder – Research Hydrologist

Fort Collins Personnel

Research Scientists:

- Kelly Elder – Research Hydrologist
- Chuck Rhoades – Research Biogeochemist
- Michael Ryan – Research Forester
- Robert Stottlemeyer – Research Ecologist (NBS)

Professionals:

- Mark Dixon – Hydrologist/Fraser Experimental Forest Site Manager
- Gus Goodbody - Hydrologist
- Robert Hubbard – Ecologist
- Louise O’Deen – Chemist
- Laurie Porth – Statistician

Technicians:

- Banning Starr – Hydrological Technician

Administration:

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Laramie Personnel

Research Scientists:

- Sandra Ryan-Burkett – Research Hydrologist
- Michael Young – Research Fisheries Biologist
- Kate Dwire – Research Riparian Ecologist

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