



## WATER RESOURCES RESEARCH GRANT PROPOSAL

**Title:** FOREST MANAGEMENT, WATER YIELD, AND WATER QUALITY: A STATE-OF-THE-ART ASSESSMENT

**Focus Categories:** WQL, WQN, ECL, FL

**Keywords:** Water quality, Water quantity, Land-water interactions, Watershed management

**Duration:** 3/00 - 2/01

### Funds Requested:

**Federal funds:**        \$ 4,500

Direct

**Nonfederal funds:**   \$ 4,810

Direct

\$ 4,190

Indirect

\$ 9,000

TOTAL

### Principal investigators name(s) and university:

*Principal Investigators:*

Lee MacDonald, Colorado State University

*Co-Principal Investigator:*

John Stednick, Colorado State University

**Congressional district:** 4<sup>th</sup>

### Statement of critical regional or state water problems:

Over the past decades there has been a continuing evolution in forest management practices on both public and private lands. On many public lands there is now less emphasis on timber production, and more emphasis on recreation, preservation, and ecosystem management. The long history of fire suppression, combined with reductions in logging and grazing, has resulted in increased forest density and fuel loadings. These changes are now being recognized as detrimental to forest health and increasing the risk for catastrophic forest fires. Such wildfires in the Front Range and elsewhere pose a severe threat to water quality, aquatic resources, air quality, and human health. The Buffalo Creek and Storm King fires are but two examples of the current hazard. Although there is increasing recognition of the role of fire in sustaining healthy forest ecosystems,

there is not yet a clearly defined desired future condition, much less a consensus on how, and how rapidly, we might get to that condition.

Since most of the water supply for Colorado originates on forest lands, the management of Colorado's forest lands cannot be separated from issues of water quality, water quantity, and downstream aquatic ecosystems. A growing series of water-related issues are leading to a renewed focus on the management of Colorado's forests. Increased logging, for example, is being suggested as one means to increase downstream water supplies for endangered species, and others point to increased logging as a means to sustain rural communities. Source water protection studies are being required in order to minimize threats to drinking water quality, and this poses an additional burden on water providers. However, one cannot assess risks without some understanding of the different processes that affect water quality and quantity, and the extent to which these processes might be altered by either natural events or anthropogenic activities. There is also an increasing concern with respect to the quality of the raw water flowing from forest lands, and this is leading to more intensive and comprehensive monitoring (e.g., dissolved organic carbon).

### **Statement of results or benefits**

Recent lawsuits are forcing a more rapid development of TMDLs (Total Maximum Daily Loads) for impaired water bodies, and many of these will require an assessment of the effects of forested areas on the constituent(s) of concern. None of these issues can be effectively addressed unless there is an accurate understanding of the likely effects of management activities, or maintaining the status quo, on water quality and quantity.

Colorado is particularly fortunate in that it sits astride the headwaters of at least five major rivers. There is also a long history of research on forest-water interactions, as the first paired-basin experiment was conducted in Wagon Wheel Gap from 1909-1928, and the Fraser Experimental Forest has been operating for over 50 years. This work provides a strong background on some issues, while others have not been subject to extensive study. The overall goal of this project is to summarize the information that is available to help answer current and expected management questions, and to identify critical data gaps that must be addressed in order to guide future decisions.

### **Nature, Scope and Objectives**

The purpose of the proposed project is to identify the key questions with respect to the interactions between forest management, water quantity, and water quality; provide a state-of-the-art summary with respect to these questions; and identify the gaps in our knowledge that can then guide future CWRI research priorities. Although the precise objectives will have to be approved by the panel that will oversee this project, we propose that the following objectives should be addressed:

- Identify the forest management issues that are of primary concern for water managers in Colorado.

- Summarize the state of the art with respect to how past and present forest management is affecting annual water yields, low flows, and peak flows.
- Determine the potential for altering current flow regimes through changes in forest management.
- Summarize the state of the art with respect to the effects of forest management on water quality.
- Assess the different risks to water quality posed by both current forest condition and possible changes in forest management.
- Recommend areas where additional research is needed, with particular emphasis on topics that might be addressed through CWRRI.

### **Approach and Products**

The basic approach will be to prepare a white paper under the guidance of a Forest Water Panel comprised of water managers, forest managers, and scientists. The first task of the panel will be review and modify the objectives of the project. Key faculty members with expertise in forest-water interactions will then prepare a draft white paper for review by the panel. The resulting paper will be similar in scope and magnitude to earlier CWRRI papers addressing emerging water management issues (Smith et al., 1996; Wohl, 1998).

The panel will be chaired by Dr. Lee MacDonald of the Watershed Science Program at Colorado State University (CSU). The first set of meetings will be convened within six weeks after the project is funded, and these meetings will serve to finalize the objectives, the approach, and the time frame for completing the first draft and initial review of the white paper. The group will then meet somewhat less frequently (e.g., every 1-2 months) to review progress and ensure that the objectives are still valid. Dr. MacDonald will take the lead in writing the paper, although other faculty will contribute sections in their area of expertise. If the project is funded in a timely manner, a draft document should be ready by mid-2000, and a revised version should be ready for panel approval by early fall 2000. The proposed panel membership is as follows:

Dr. Lee MacDonald (forest/hydrology relationships) - Chair of the Panel

Dr. John Stednick (forest/water quality relationships)

Dr. Chuck Troendle (forest/water relationships, with special emphasis on U.S. Forest Service lands)

Representative from the National Forest System

Ron Gosnell (forest/water relationships from a State Forest Service perspective)

Representative from Denver Water

Representative from the Northern Colorado Water Conservancy District

Representative from the Colorado River Water Conservation District

Representatives from other Water Districts as appropriate

Graduate Research Assistant (Watershed Science)

## **References**

Smith, D.H., K. Klein, R. Bartholomay, I. Broner, G.E. Cardon and W.M. Frasier with contributions from D.F. Champion, R. Curtis, R. Kuharich, D.C. Lile, M. Gross, D. Parker, H. Simpson, and E. Wilkinson. 1996. Irrigation Water Conservation: Opportunities and Limitations in Colorado. Completion Report No. 190, Colorado Water Resources Research Institute, Colorado State University, Fort Collins, Colorado, October, 58 pages.

Wohl, E. with contributions from R. McConnell, J. Skinner, and R. Stenzel. 1998. Inheriting Our Past: River Sediment Sources and Sediment Hazards in Colorado. Water in the Balance Report No. 7, Colorado Water Resources Research Institute, Colorado State University, Fort Collins, Colorado, June, 28 pages.