



# STREAM NOTES

To Aid in Securing Favorable Conditions of Water Flows

January 1995

## A Research Strategy for Understanding Stream Processes

The demand for water from public lands, including National Forests, continues to increase. Human demand for water resources inevitably alters the character of streams, watersheds, ecosystems, and ultimately landscapes. The emerging emphasis on managing entire ecosystems demands sophisticated integration of diverse professional disciplines. Water is a connecting thread in the fabric of these disciplines. The anticipated widespread increase in the alteration of flow regimes and the implications this has for ecosystem management justifies a greatly expanded research emphasis.

The recent Rocky Mountain Forest and Range Experiment Station publication, *A Research Strategy for Understanding Stream Processes and the Effects of Altered Streamflow Regimes*, compiled by James Meiman and Larry Schmidt, proposes a strategy for addressing these needs.

The strategy recognizes the link between physical stream processes and the habitat and biology of the stream. Since most biological systems co-evolved with physical systems, understanding physical processes provides

essential knowledge for implementing ecosystem management.

The Stream Systems Technology Center (STREAM) was established, in part, to help acquire and assemble the knowledge needed to improve management of aquatic ecosystems.

Specific purposes of STREAM are:

- < To improve ecosystem knowledge about stream systems and physical processes,
- < Identify research needs,
- < Develop operational tools, and
- < Provide training and technical support so forest officers can manage National Forest System ecosystems to secure favorable conditions of water flows.

The mandate for the Stream Systems Technology Center requires it to focus on the physical characteristics of stream channels representative of those on USDA Forest Service administered lands fully recognizing that physical processes are but one component of ecosystem function.

STREAM NOTES is produced quarterly by the Stream Systems Technology Center, Fort Collins, Colorado.

The PRIMARY AIM is to exchange technical ideas and transfer technology among scientists working with wildland stream systems.

CONTRIBUTIONS are voluntary and will be accepted at any time. They should be typewritten, single-spaced, limited to two pages in length. Graphics and tables are encouraged.

Ideas and opinions expressed are not necessarily Forest Service Policy. Trade names do not constitute endorsement by the USDA Forest Service.

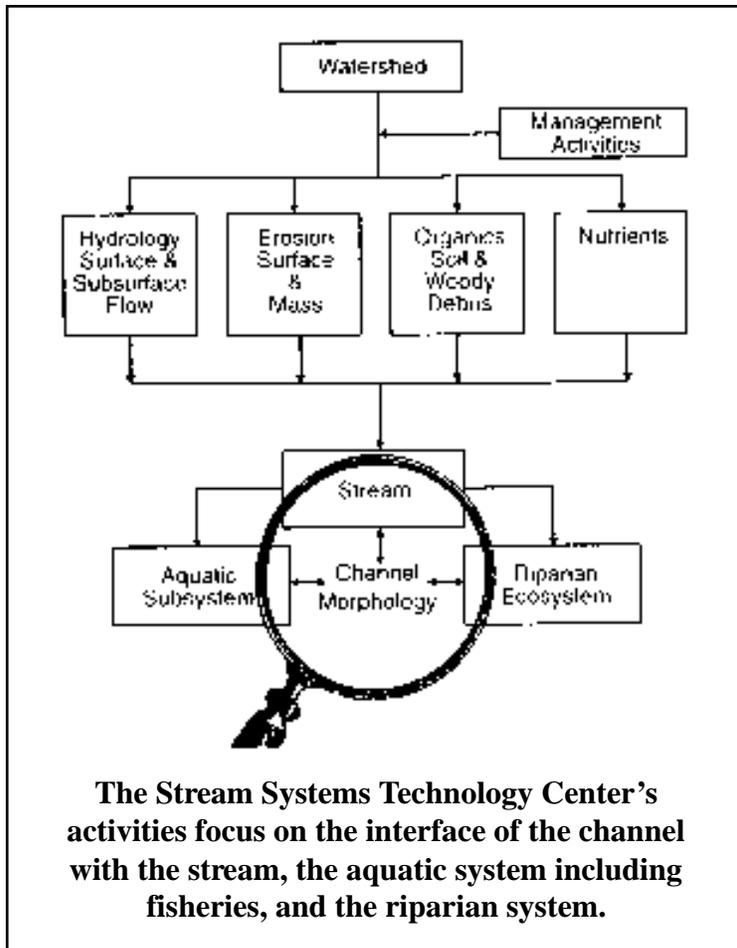
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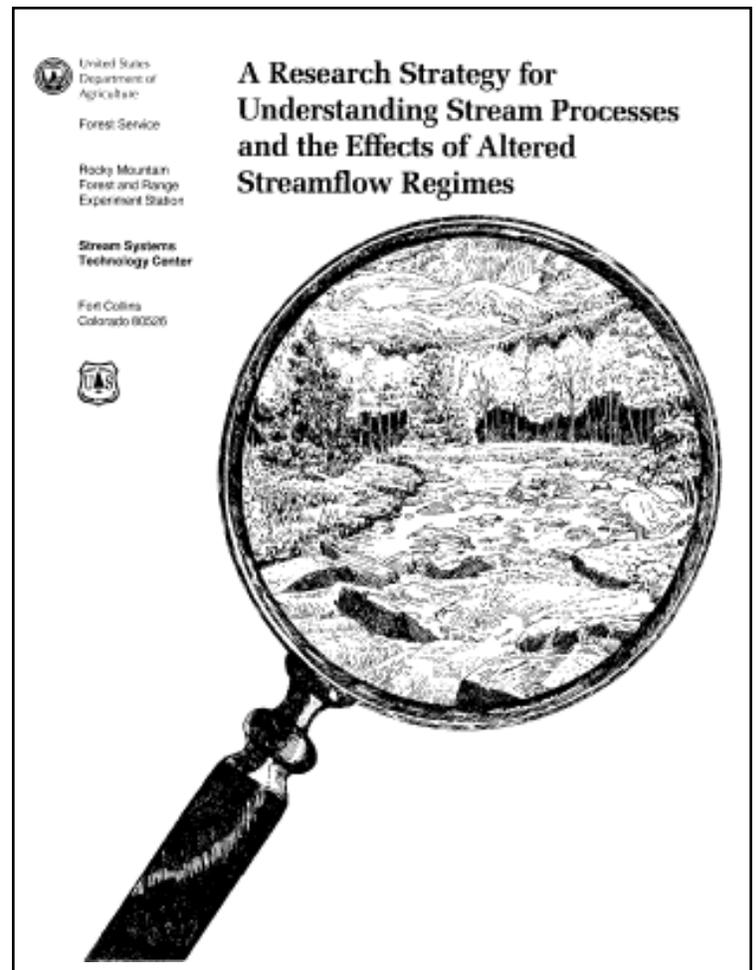
Some fundamental questions that underlie many specific issues to be addressed by this research strategy include:

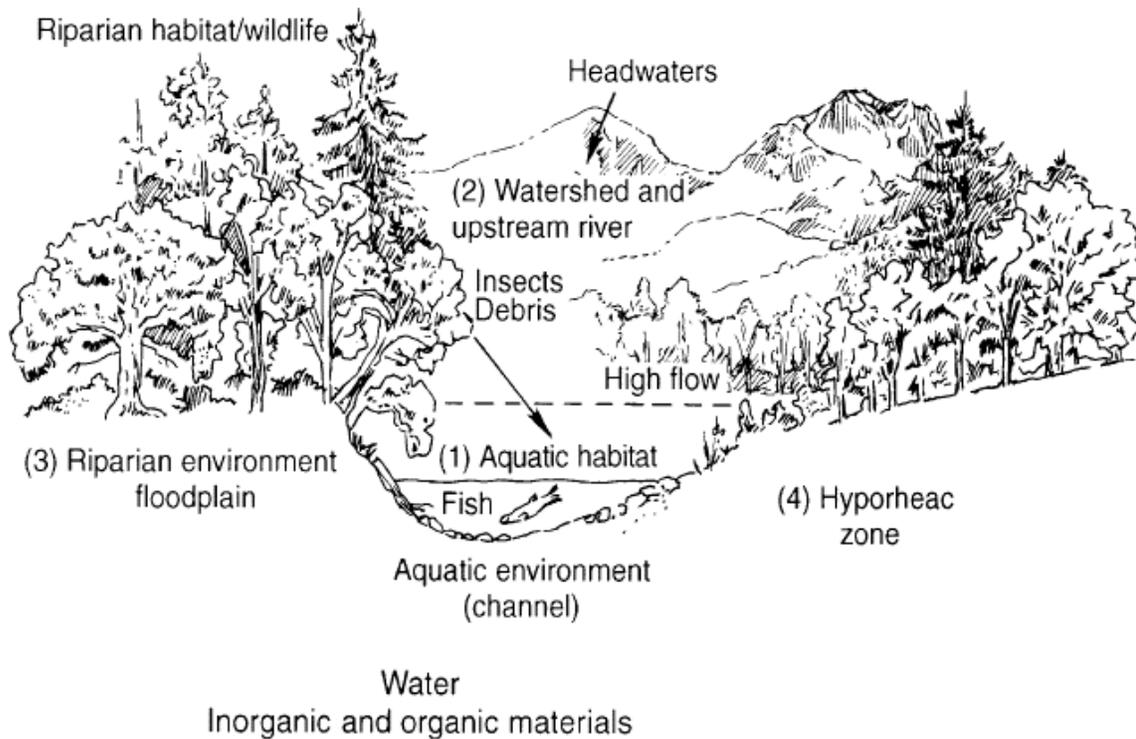
- < What type of streamflow regime is needed to maintain channel features plus instream and riparian values for different channel types?
- < What are the consequences of changed flow regimes to on-site and downstream channel functions and values?
- < How are instream flow needs affected by water diversions and land-use activities?

These kinds of questions require creativity from individual researchers, particularly with respect to formulating new paradigms for working with the steep-gradient, coarse-material streams often strongly influenced by woody debris, which are characteristic of the National Forests.

A comprehensive research program looking at channels from three different interactive approaches is recommended.

- < **Channel site and reach studies** to increase our understanding of basic processes of sedimentation and channel morphology. Emphasis is on determining the response of channels to changes in sediment load, sediment size, and streamflow including relationships between riparian vegetation and stream processes.
- < **Stream system studies** to increase understanding of systems in dynamic equilibrium and impacts of land and water use.
- < **Watershed studies** to provide a framework for analyzing channel management problems, integrating ecosystem knowledge, and identifying knowledge gaps for further research.





Streams are dynamic and vital components of several ecosystems. To be most effective, a research program must be cognizant of all of these complex systems and designed within the context of integrated system studies with interdisciplinary participation.

(1) At any given point in a channel, a stream represents the integrated effects of the water, sediment, woody debris, and dissolved materials from the contributory watershed above.

(2) Hillslopes contribute water and materials to stream sometimes directly and often through a myriad of surface and subsurface pathways.

(3) An integral connection exists between the adjacent riparian area and the stream and both surface and subsurface flows may travel in either direction. The riparian system connects both with the channel immediately adjacent and up and down valley via subsurface flow and sometimes (during floods) along the surface.

(4) Away from the direct influences of the stream at the groundwater/streamwater interface, is the hyporheic zone with its own unique ecology.

Initial priority of STREAM is on Channel Site and Reach studies. An integrated interdisciplinary program of collaborative research and joint funding with interested partners is suggested.

### Channel Site & Reach Study Priorities

Priority 1. Response of different channel types to changes in sediment and discharge.

Priority 2. Interrelationships between riparian vegetation and stream processes.

Priority 3. Flow frequency duration studies regionalized for application to stream channel management problems.

Priority 4. Regionalized studies of major channel types and the distinguishing features that separate significant differences in channel maintenance requirements.

Priority 5. Stream system studies of the continuity of streamflow-sediment dynamics and channel form change in space and time.



# Protecting and Restoring Aquatic Ecosystems

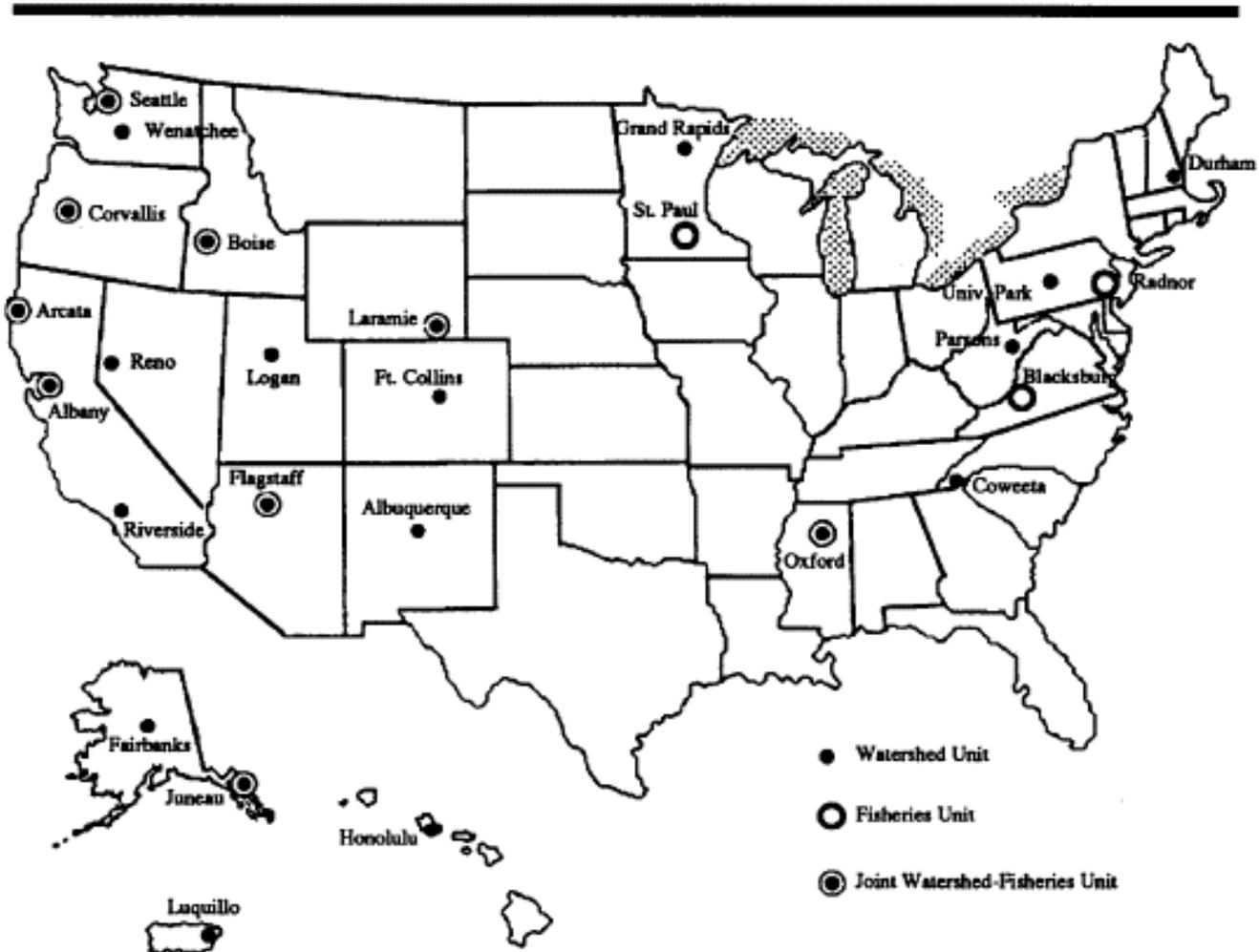
“New directions for watershed and fisheries research in the USDA Forest Service” is the subtitle of a publication called *Protecting and Restoring Aquatic Ecosystems* produced by the Washington Office, Forest Environment Research Staff. The document is a product of a workshop of research scientists held October 11-14, 1993 in St. Paul, Minnesota.

The document discusses current Forest Service watershed and fisheries research programs pointing out that watershed research began in 1909 while fisheries research did not begin until 1966. To address the information needs of the 1990's and beyond, a new more cooperative, interdisciplinary, coordinated way of working is proposed.

For the Forest Service to successfully turn ecosystem management theory into practice, a strong partnership between research scientists and forest managers is needed. In this new relationship, scientists will need to provide managers with more sophisticated predictions of the effects of management on the sustainability of ecosystems, and managers will challenge scientists to extend the limits of understanding to larger scales while considering a wider array of values and influences.

The document points out that throughout much of the United States, watershed and aquatic life are at risk. The role of watershed and fisheries research is to provide managers with

## Forest Service Watershed and Fisheries Research

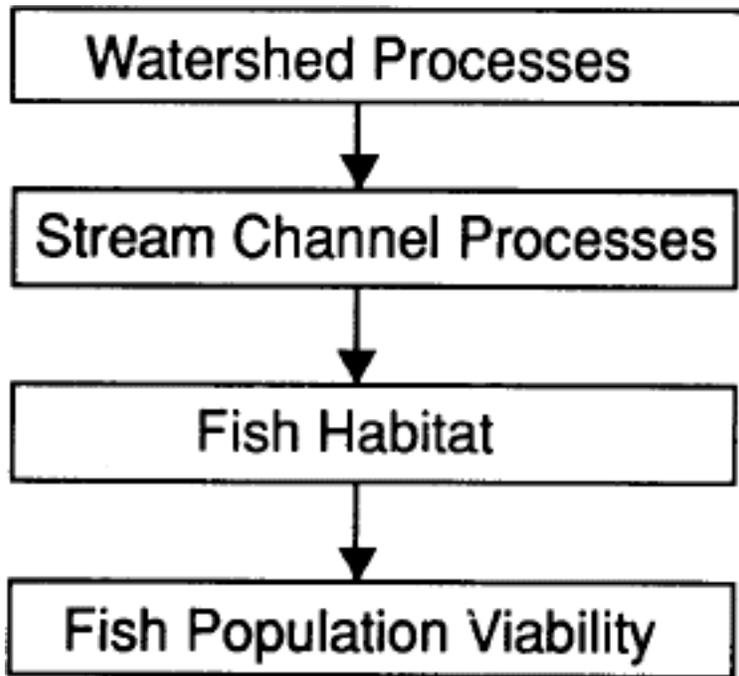


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the sound scientific information needed to develop conservation strategies that will protect and restore watershed condition and ensure the viability of aquatic species.

The document argues that if conservation strategies are to endure, they must be built upon the best available science. A research program which addresses the immediate information needs of land managers while improving our understanding of more basic scientific questions, is recommended as the soundest approach to developing this vitally needed information.

Watershed and fisheries scientists developed a conceptual model that illustrates this point.



In a simplified form, the model says that watershed processes strongly affect processes within stream channels. Processes in stream channels have a major influence on forming fish habitat. Habitat in turn controls fish population viability. This model connects the effects of management activities that occur primarily on the upland portion of the watershed with viability of fish populations in the streams.

## Group Recommendations

- < More resources must be directed to *joint watershed-fisheries research* to meet the information needs of managers.
- < *Better technology transfer* is needed to interpret scientific advances both to managers on the ground and to policy makers.
- < Provision must be made to *continue basic research* that gathers data to meet the long-term information needs of managers.
- < *Interagency cooperative research* needs to be initiated at all levels, especially in the field.
- < Research will be needed to develop means to *detect and reverse declines in aquatic species* before they reach crisis conditions.
- < Results of research need to be integrated at the *proper geographic scales* to be used by managers for protection and restoration of habitat for aquatic species.
- < Scientists of various disciplines needed to be encouraged to *work together and in partnership with managers and the public* to seek ecosystem approaches conducive to solving problems in aquatic and riparian systems.

*A Research Strategy for Understanding Stream Processes and the Effects of Altered Streamflow Regimes*, 1994, Rocky Mountain Forest & Range Experiment Station, Stream Systems Technology Center, 12 pages, and *Protecting and Restoring Aquatic Ecosystems, New Directions for Watershed and Fisheries Research in the USDA Forest Service*, 1994, USDA, Forest Service, Forest Environment Research Staff, Washington Office, 13 pages can be obtained from STREAM upon request. Send request via Data General to STREAM:S28A if possible. Alternatively, FAX requests to STREAM at (303) 498-2306, or phone Penny Williams at (303) 498-1731.





**Dear Doc Hydro: I haven't heard a recent update on STREAM TEAM activities. What projects does the STREAM TEAM have underway at present?**

The STREAM TEAM is working cooperatively on a large number of projects with a diverse group of research scientists, universities, consultants, and detailers.

**Current Projects:**

- Developing an improved approach for quantifying channel maintenance instream flows on National Forests.
- Developing a status of our knowledge paper on channel dynamics in forested mountain watersheds.
- Assessing channel maintenance instream flow concepts in spring-fed and bedrock-controlled streams.
- Improving the understanding of riparian vegetation-streamflow linkages.
- Assessing channel changes due to water diversion in Idaho and Utah.
- Evaluating channel morphology, streamflow, and effective discharge relationships in different hydrologic regions of the United States.
- Validating effective discharge concepts using long-term measured data.
- Working to continue work at the Squaw Creek magnetic pebble research site to improve our understanding of bedload transport processes.
- Producing a video on field identification of bankfull stage in Western U.S. streams.

- Evaluating techniques for objectively determining bankfull stage at cross-sections.
- Improving the XSPRO computer program for analyzing stream channel hydraulics.
- Developing procedures to characterize and regionalize streamflow data for a variety of instream flow analyses.
- Testing and developing prototype instrumentation for stream measurements (velocity head-rod, gravelometer, low cost water level recorder).
- Developing procedures for modeling bedload transport in gravel-bed and sand-bed streams.
- Developing improved methods for calculating flow and bed-material transport in rough mountain channels.
- Working to reprint Leopold, Wolman, and Miller's classic work, Fluvial Processes in Geomorphology.

**Collaborative Activities:**

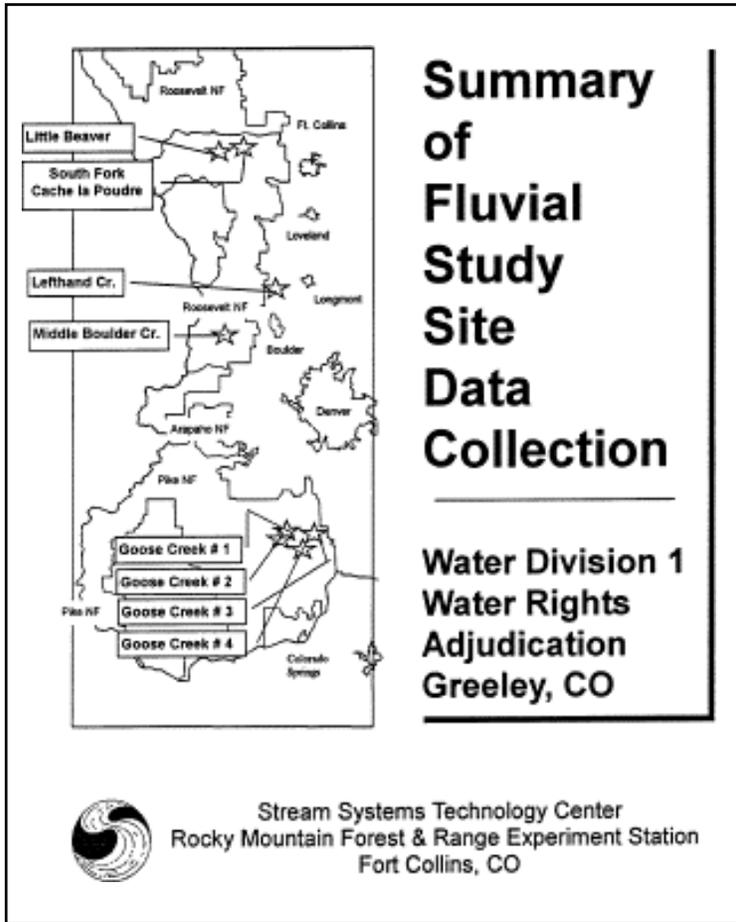
- Instructing at the Watershed Assessment and Restoration course at the National Advanced Resource Training Center in Marana.
- Working with the BLM to cosponsor water-related courses from the U.S. Geological Survey.
- Participated in the interagency steering committee that developed the Federal Instream Flow Needs Assessment Workshop.
- Working as a member of the Aquatic Ecomap Steering Committee.
- Co-chairing with BLM an effort to identify a consistent set of analysis approaches to guide Watershed Analysis and Ecosystem Management.
- Participating on an interagency steering committee to develop stream corridor restoration guidelines .

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## Summary of Fluvial Study Site Data

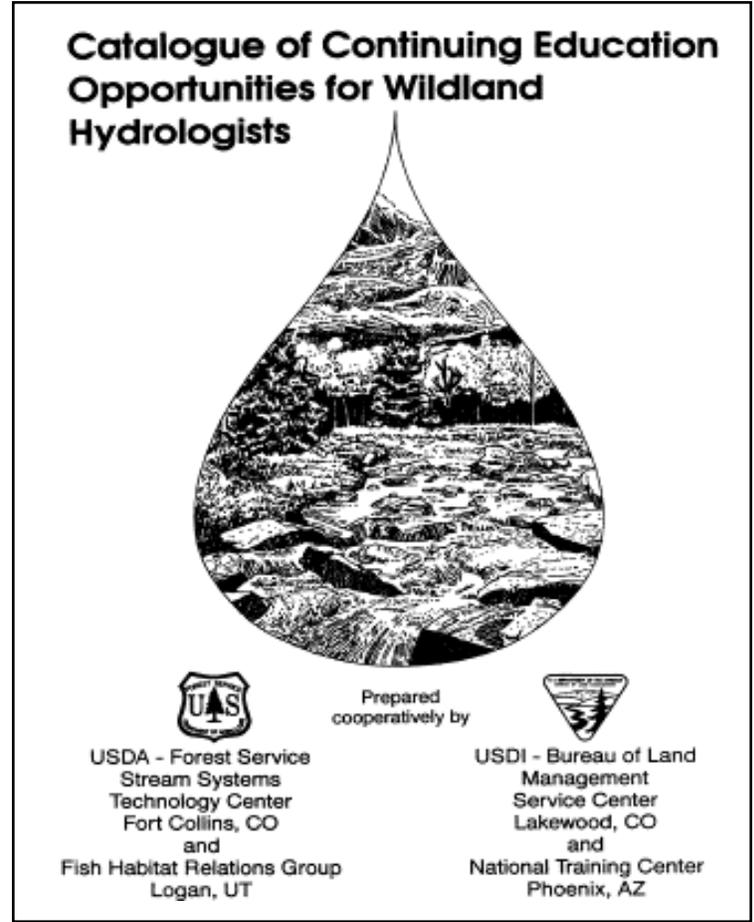


The *Summary of Fluvial Study Site Data Collection* publication provides information about data collected at nine fluvial study sites in Colorado to support the Forest Service's technical position in the Water Division 1 Water Rights Adjudication. Field data collected at these sites included water discharge, suspended and bedload sediment transport, surface and sub-surface particles size distributions, painted rock studies, and physical channel features such as cross-sections, slope, and other information. The publication does not summarize the data, but instead, is intended to provide enough information about the data to make it accessible to those not involved with collecting and analyzing the fluvial study site data, who may wish to use it for further study. Possible users of the data include universities and researchers. Copies of the publication are available from STREAM upon request.

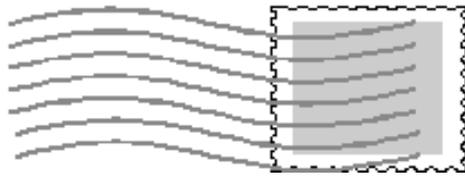


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## Watershed Training Opportunities Notebook



The *Catalogue of Continuing Education Opportunities for Wildland Hydrologists* is the result of a cooperative effort by the Stream Systems Technology Center, the Fish Habitat Relations Group, and the Bureau of Land Management to identify training opportunities in the area of water resources management. The notebook is primarily intended for Forest Service and BLM wildland hydrologists to help them develop training plans and assist them with acquiring the skills and knowledge needed to implement ecosystem management on federal lands. The notebook identifies numerous training opportunities available from federal agencies, universities, and consultants and will be updated periodically. Anyone working in water resources may find the information useful. Copies have been distributed to Forest Service and BLM hydrologists and aquatic biologists.



## Mailing List Update

We hope that you value receiving and reading STREAM NOTES. If you wish to receive future issues, **NO ACTION IS REQUIRED**. We are required to review and update our mailing list annually. If you would like to be removed from the mailing list for STREAM NOTES or if the information on your mailing label needs to be updated, please contact us via mail at the address below, DG Stream:S28A, phone Penny Williams at (303) 498-1731, or FAX (303) 498-2306.

## Editorial Policy

To make this newsletter a success, we need **voluntary contributions** of relevant articles or items of general interest. YOU can help by taking the time to share innovative approaches to problem solving that you may have developed.

Please submit typed, single-spaced contributions limited to two pages. Include graphics and photos that help explain ideas.

We reserve editorial judgments regarding appropriate relevance, style, and content to meet our objectives of improving scientific knowledge.

Send all contributions to:  
Stream Systems Technology Center,  
Attention: STREAM NOTES Editor.



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# STREAM NOTES

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