Project Summary
Rocky Mountains Cooperative Ecosystem Studies Unit

Project Title: Hydrology and Geomorphology of the Snake River downstream from Jackson Lake Dam in Grand Teton National Park, including estimate of bed material budget
Type of Project: Research
Funding Agency: National Park Service
Other Partners/Cooperators: Utah State University
Effective Dates: 3/1/2005 – 6/30/2008
Funding Amount: $78,030
Investigators and Agency Representative:

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Project Abstract:

This project builds on an earlier project by J. Schmidt at Utah State, that produced a data base (Schmidt and White, 2003) to be used in an evaluation of changes in stream flow of the Snake River that are far more detailed than those undertaken by Marston (1993), who only evaluated changes in monthly discharge. It is essential that the NPS have a full understanding of the decadal, annual, seasonal, and daily characteristics of stream-flow that have been altered by Jackson Lake Dam. These data will be compared with the geomorphic characterization and rates of channel change to relate dam operations to downstream impacts.

Part A: Aerial photograph analysis of channel change: Aerial photographs (provided by GRTE)taken at different times during the last 60 years will be analyzed for channel change. The channel boundaries will be traced, digitized, and overlain on 2002 digital aerial photographs. By comparing the channels through the last 60 years, the extent of channel change and channel narrowing will be documented. Analysis of recent photographs will determine whether or not the high flows of 1997 were able to remove the large amounts of sediment deposited by tributaries. These analyses have already been completed from Jackson Lake Dam to Spread Creek. The areas further downstream to Moose will be analyzed in the coming months.

Part B: Surficial geologic mapping: The surficial geology of the Snake River from Jackson Lake Dam to Moose will be mapped. Both the stratigraphy and depositional environment will be described for all map units. Mapping will be completed at a scale of 1:12,000.

Part C: One-dimensional flow modeling: Parts A and B will provide evidence for changes in channel width and rate of channel change. In selected detailed study reaches, cross-sections will be established at regular intervals (e.g. one channel width in length) using surveying equipment and unobtrusive benchmarks in sufficient detail to fulfill requirements for one-dimensional HECRAS modeling. Using the survey-collected data and HECRAS flow modeling, inundation frequencies will be determined for the modern floodplain. These results will allow estimation of the discharge required to overtop the active channel and inundate the modern floodplain as well as the frequency of these occurrences. This, in turn, determines how often the vegetation on the modern floodplain becomes inundated with water, resulting in alteration/improvement of habitats for bird and mammal species.

Part D: Predictions of entrainment of bed material: Results from one-dimensional HECRAS modeling will allow estimation of the shear stress that the flow exerts on the bed material at various flows. Critical shear stress will be estimated by measuring the size of the bed material. These estimates will be compared with estimates based on tracking movement of marked rocks, of varying size, on the bed of the channel to determine the size of rocks that are entrained by current flows.

Part E: The principal investigator and graduate student will collaborate with the Grand Teton National Park and other researchers to accomplish the following: (1) develop a budget for bed material load in the Snake River, (2) identify discharges necessary to maintain equilibrium flux of tributary-derived bed material downstream through GRTE.

Outcomes with Completion Dates:

Final Report due September 2006. For Part E there will be a MS thesis by S.O. Erwin produced by December 31, 2007, and a non-technical article and presentation made on the project by the end of 2007.

Keywords: hydrology, geomorphology, stream flow, modeling, sediment budget, Snake River, Jackson Lake Dam, Grand Teton National Park, Utah State University

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Date Final Report Received:
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