

# A Little Respect for Rivers Please!

By Gordon E. Grant, Research Hydrologist USFS (1994)

There is a beguiling simplicity about rivers. Perhaps it is because we love to paddle, wade, bridge, divert, dam celebrate, fish, or just watch moving waters. Rivers are in our blood. We are drawn to them and it is easy to believe that we understand them. For the average citizen, this concept may go unchallenged. For the manager of a landscape dissected by rivers and responsible for maintaining or restoring an ecosystem dependant on them, a respect for the complexities of rivers is essential.

In one sense, rivers are fundamentally simple. There are only two forces at work: gravity and friction. Under gravity, water is inexorably pulled downstream. Friction of water against rock, soil, and itself resists that movement. Gravity transforms the potential energy of height into the kinetic energy of motion, providing power to accomplish the “work” of rivers: carving the landscape; carrying sediment, wood and nutrients; creating sound and heat; and turning waterwheels.

The interplay of these factors, however, also gives rise to the tremendous variety of forms and processes seen in alluvial channels. Here the simplicity begins to break down. Rivers have an almost infinite number of ways to adjust themselves in response to changes in their controlling variables.

Consider a flood. The increased water that the river must carry may be accommodated by an increase in channel width, depth, velocity, or a decrease in the resistance to flow. As the river rises, other changes may occur. The amount of sediment carried will likely increase, often by the erosion of the bed and bank. Also, the size of sediment and woody debris in transport increases, leading to different patterns of scour and fill. This, in turn, may lead to changes in the location or pattern of the channel; meandering channels may straighten, or bars may form or move downstream. Any change in one variable affects the others, creating new patterns, and there is no comprehensive way of predicting what direction changes may take. Equally complex interactions occur as the flood wanes. No wonder Heraclitus said “You cannot step into the same river twice.”

New adjustments operate when time scales are extended from individual storms to decades or centuries, or when different parts of the channel network are considered. Steep mountain channels adjust differently than low gradient pool and riffle channels. Human impacts, including logging, dam and road construction, grazing, urbanization, and channelization may induce slow or abrupt changes. The nature of these adjustments and their consequences are often difficult to predict.

So what should land managers do in the face of such uncertainty? While there are no simple solutions, there are ways to reduce risks associated with watershed management. The analysis required in Section 7 of the Wild and Scenic Rivers Act is a method for evaluating impacts on the free-flowing condition of rivers. Watershed analysis, already mandated in the Pacific Northwest, offers a systematic procedure for analyzing watershed and ecosystem processes to meet specific objectives. The adaptive method concept of viewing landscape manipulations as careful experiments requiring clear statements of purpose and monitoring and evaluating results over time is another.

Most importantly, it is worth cultivating a healthy humility and respect for rivers while proceeding cautiously with human interventions is.

First published in Wild and Scenic River News, 1994