LIFEBLOOD OF THE WEST

Riparian Zones, Biodiversity, and Degradation by Livestock

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Riparian, or streamside, areas are critical habitat for many plants and animals in the arid West. Livestock grazing is the leading cause of riparian degradation. Impacts to vegetation, stream hydrology, and geomorphology can separately or synergistically affect stream functioning and many wildlife species. Thus, riparian restoration, including the removal of livestock, must be a high priority for the conservation of biodiversity.

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Riparian zones are a unique wetland environment adjacent to rivers or streams. People have long recognized that riparian zones and rivers are the lifeblood of the western landscape, being more productive and home to more plants and animals than any other type of habitat. Scientists refer to riparian zones as hotspots of biodiversity, a characterization that is particularly apparent in arid and semiarid environments, where such zones may be the only tree-dominated ecosystems in the landscape. The presence of water, increased productivity, favorable microclimate, and periodic flood events combine to create a disproportionately higher biological diversity than that of the surrounding uplands.

In the Intermountain West and Great Basin, about 85 percent of native animal species are dependent on riparian zones for all or part of their life cycles. In these same riparian zones, more than 100 plant species commonly can be found on a single gravel bar of about 150 feet in length. In Oregon and Washington, about 71 percent of the native animal species utilize riparian zones.[1] Given that riparian areas make up only 0.5 to 2 percent of the landscape, their value in terms of biological diversity is incomparable.

Healthy riparian zones are of special importance to native fish, aquatic insects, and other stream-dwelling organisms. Particularly in headwater areas, most of the nutrients and energy used by aquatic organisms come from riparian zones—either plant materials that fall into the stream or nutrients dissolved in groundwater flows. Riparian zones are also the source of large pieces of wood that provide important in-stream habitat. Riparian vegetation gives shade over creeks, strongly influencing water temperature and thereby the distribution of coldwater species such as bull trout and other salmonids. Roots bind soil together and create resistance to stream erosion, resulting in complex habitat features such as overhanging banks, deep pools, and clean gravels. Finally, riparian zones are important in influencing water quality through nutrient uptake, chemical transformation (such as the conversion of nitrogen compounds into forms more useful for a variety of plant and animal species), and the mechanical filtering of sediments when flood waters flow high over stream banks.

Cattle graze in a wet meadow along Blacktail Creek, Beaverhead National Forest, Montana. Streamside vegetation is cropped low, parts of the stream bank are bare, and other parts are sloughing into the creek.

Many of the same attributes of riparian zones that result in high productivity and high biodiversity are of great economic value to human society. Unfortunately, many current uses of riparian corridors and wetlands by society do not correspond with preservation of these places as wildlife habitats or as providers of important natural services, such as the reduction of flood velocity and intensity. Broad floodplains formed along streams through the millennia have been productive not only because of their complex wildlife habitats and linkages to the aquatic biota but also because of their nutrient-rich soils. In fact, although the best lands for tilled agriculture, livestock forage, and timber growth are riparian zones and wetlands, these same activities, along with a variety of others, have been conducted in such an abusive fashion as to diminish greatly the value of riparian and stream ecosystems, from both utilitarian and ecological viewpoints.

A multitude of land uses show a lack of respect for, or ignorance of, the value of healthy and vigorous riparian zones and have resulted in the deterioration of not only riparian areas, but the entire landscape. In general, land abuses that have degraded riparian zones include logging, water diversion for irrigation or municipal uses, mining, roads, channelization, urbanization, industry, and agriculture. In the western United States, it is likely that livestock grazing has been the most widespread cause of ecological degradation of riparian/stream ecosystems.[2] More riparian areas and stream miles are affected by livestock grazing than by any other type of land use.

Livestock, especially cattle, prefer riparian zones for many of the same reasons that so many species of wildlife use them: high plant productivity, proximity to water, favorable microclimate, and level ground. As much as 81 percent of the forage removed by livestock within a grazing allotment can come from the 2 percent of land area occupied by the riparian zone.[3] Without controls on animal numbers, timing, and duration of use, cattle can rapidly and severely degrade riparian areas through forage removal, soil compaction, stream bank trampling, and the introduction of exotics. These factors have been defined as the direct effects of domestic livestock grazing on ecosystems.[4]

Through time, the direct effects of livestock can have many additive or even synergistic impacts that dramatically change the structure, function, and composition of the riparian zone. Of particular importance are the effects of livestock on streamside forests of cottonwood, aspen, and willow. The highest densities of breeding songbirds in the West are found in these habitats. Long-term overgrazing can eliminate these stands, which are of inestimable value as centers of biological diversity. In the short term, herbivory can depress both plant growth and reproductive output. Depressing the vigor of native plant species, along with increased soil disturbance due to livestock trampling, facilitates the spread of exotic weeds. Herbivory also causes a corresponding decline in the root biomass of riparian vegetation.

At stream edges, the combination of root loss and trampling weakens and collapses banks. Bank loss and the resulting sediment loads contribute to downcutting, channel widening, and degradation of water quality and fish habitats. As the channel downcuts, overbank flows cease, and subsurface water exchange between stream and floodplain is lost. Floodplain forests evolved to grow and develop in the environment created by large floods. By altering or eliminating the natural flood regime, channel downcutting impedes or halts the development of multi-layered, multi-aged—or "gallery"—forests, such as those composed of cottonwood trees and willows, along with other riparian plants. Loss of the riparian forests negatively affects not only the terrestrial wildlife, but the aquatic biota as well. Loss of shade and organic inputs from riparian vegetation results in increased stream temperature, altered water quality, and a change in composition and abundance of the aquatic biota.[5]

Although occupying a small portion of the landscape, riparian zones are keystone ecosystems because of their high level of biodiversity and provision of other ecosystem services. The restoration of riparian zones would yield many positive benefits, including the return of flood events to something resembling their natural patterns. Because riparian plants have adapted to survive frequent floods and other natural disturbances, they often show great resilience after the cessation of human activities that are causing degradation. Such removal of harmful activities is termed passive restoration, and in the arid West, the most significant act of passive restoration would be the removal of grazing livestock.[6] Logically, passive restoration should be implemented first, and its effectiveness assessed, before the initiation of more active measures, such as structural modifications and reintroductions of species.

Among the greatest barriers to effective riparian recovery are political and social factors. Land and river managers have often been limited to, or limited themselves to, band-aid approaches that do not address the real causes of degradation. For example, salmon have continued to decline in the Columbia Basin of the Pacific Northwest, despite the input of billions of dollars for restoration projects and mitigating measures, because, among other reasons, livestock continue to degrade riparian zones. A prominent and popular project on public lands in the Columbia Basin has been the installation of artificial structures in smaller streams, in an attempt to re-create aquatic habitat that has been lost to decades of poor resource management. However, artificial stream structures can be expensive and often are sited and constructed poorly.

In many cases, the most effective, cheapest, and simplest approach to restoring these river courses would be to halt grazing damage and allow the streams to recover their own natural vegetative and morphological characteristics over time. But it can be extremely difficult politically for managers to make such decisions. And restoration results can take a long time to appear, whereas political demands arise much more rapidly. Yet, given the inestimable natural values that arise from healthy riparian zones, a long-term commitment to riparian restoration, preservation, and sustainable management should receive high priority. The reduction or removal of livestock from vital riparian and wetland habitats throughout the West needs to be given serious consideration by all those concerned about ecosystem health.

This stream in northern New Mexico has become "entrenched." Over time, grazing and trampling of the soils and banks by livestock have caused the stream to widen and cut downward. Typical results of this stream degradation process include lowered water table, drier soil in the zone adjoining the waterway, and riparian-type plants (such as willows) gradually replaced by more drought-resistant plants (such as sagebrush).