

THE FALLACY OF STRUCTURES AND THE FORTITUDE OF VEGETATION¹

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Abstract: Given time and proper management conditions, degraded rangeland streams can often produce by natural means the same results that we expect from streambank stabilization and fisheries enhancement structures. Advantages of using vegetation and natural recovery processes include: 1) costs are likely to be lower and 2) a wide range of benefits can accrue to a recovered stream. Structures tend to lock a stream channel in place whereas vegetation allows incremental changes in channel characteristics as flow and sediment loads vary. Healthy riparian vegetation can replace itself in perpetuity, providing a resiliency which keeps banks adjusted to channels — even shifting ones. Improved management of streamside vegetation, not structural additions to channels, offers the most promise for developing valuable and productive riparian systems.

State of the Art

A wealth of information on stream management is being presented in workshops and technical journals. Sometimes we call it habitat improvement, sometimes stream enhancement, and sometimes just stream structures. This information indicates that we have the capability to analyze, compute, design and construct projects on streams ranging in size from first to sixth order. These projects are accompanied by reporting procedures that allow us to document materials, cost per project, and "projected" benefits. Publications like "A Streambank Stabilization and Management Guide" (Commonwealth of Pennsylvania 1986) and the USDA Forest Service "Wildlife and Fisheries Habitat Improvement Handbook" (Payne and Copes 1986) take us through projects step by step. They identify project timing, size, materials and installation instructions in an attempt to ensure a successful effort. Some publications describe advantages, disadvantages, and apparent effectiveness of various structural modifications to stream channels. Diagrams and pictures provide additional information of what a structure will look like and how it is intended to operate within the stream system.

What Structures Do

There are various reasons for installing stream structures. In arid regions, the most common reason is probably for channel stability, followed by fisheries restoration and habitat enhancement. The main goal is usually to minimize channel changes or attempt to create specific habitat features. A "stable" structure is typically considered to be indicative of a successful project. Some structures are known to aid in the deposition of sediment, slow bedload transport, store water, and retard bank erosion. Their construction has also been reported to increase fish habitat for rearing and spawning, although rigorous evaluations and monitoring of increases in biological productivity are uncommon. Even so, it is often assumed by many biologists that we have an adequate understanding of how structures can be used to modify streams and fish habitat.

Telling the Stream vs the Stream Telling Us

The characteristics of naturally functioning stream systems can provide a basis for evaluating the relative success or failure of structural additions to streams. Figure IA provides a cross-sectional view of a degraded stream system. In this example the stream has cut down through previously deposited alluvium. As a result, the channel and associated vegetation have changed dramatically.

Species typical of wetland conditions have largely disappeared and the channel continues to erode laterally. There is little subsurface storage of water and the stream is characterized by intermittent flow.

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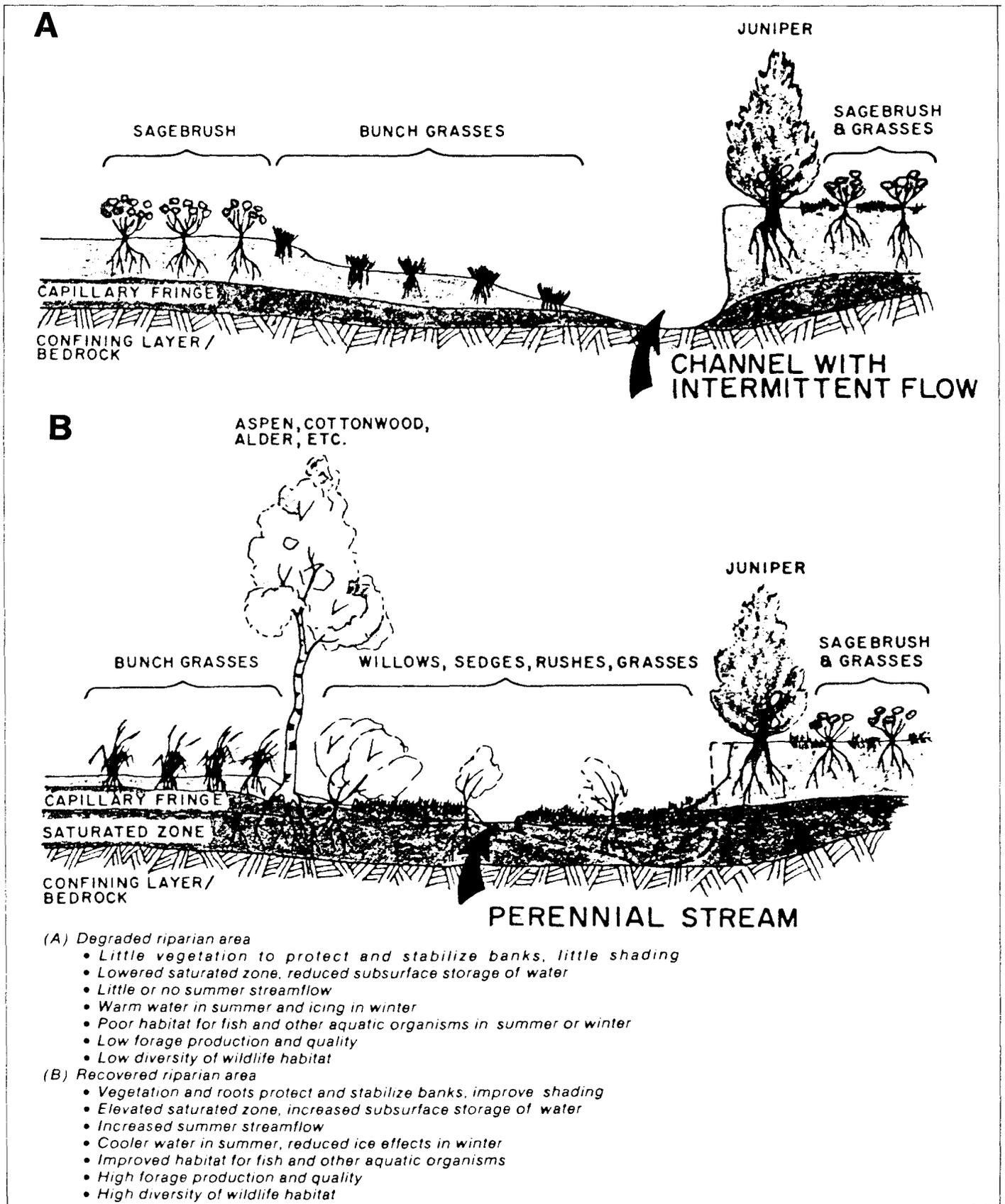


Figure 1 — General characteristics and functions of riparian areas associated with rangeland streams.

In contrast, Figure 1B illustrates a previously eroded channel that supports a diversity of riparian vegetation and has undergone recovery. The vegetation provides relative stability to streambanks and causes deposition of sediment; over time the channel has undergone aggradation. Such aggradation is often a natural consequence of allowing streamside vegetation (which may have been modified by historical grazing, logging, agriculture, or other management practices) the opportunity to again function and exert its influence on flow conditions and the characteristics of the channel. A consequence of this aggradation process is that the water table will similarly rise. In some cases, a formerly intermittent stream may flow perennially. For stream systems draining rangeland watersheds in the western United States, a change in grazing strategies is typically necessary to allow the recovery process to begin.

Often, we fail to address the real problem associated with a degraded stream system, i.e., the management of streamside vegetation. We forget about the role that such vegetation plays in influencing stream dynamics and channel morphology. If most streams are currently in a degraded state due to historical management practices that have heavily impacted riparian vegetation, doesn't it seem likely that a change in management and improvement in vegetation may represent an important solution?

Where improvement of a degraded channel is desired, the selection of a structural approach is seemingly driven by a desire for instantaneous gratification. We are currently using a "fast-food" approach to stream management. A certain sized pool or spawning riffle is desired and the apparent solution is to construct a structure that might immediately provide such a channel feature. Even where structural additions to a channel may help the recovery of riparian vegetation, we rarely allow several years of recovery before identifying where the structures might do the most good. Structures are almost always added to streams that are in poor ecological condition. As a result we are "telling a stream" where it needs help instead of letting the "stream tell us" where it needs help (Elmore 1987).

Structures and Streams

Many proponents of improved riparian management have reconciled themselves to spending large amounts of money to correct riparian problems. Additional funds are needed to assist in changing of streamside management, protecting sensitive stream reaches, and for additional research to better understand the complexities and management capabilities of riparian systems. Spending large amounts of money to build instream structures (e.g., gabions, dikes, check dams, rip-rap,

sills, etc.) or to structurally modify a channel with construction equipment (hydraulic excavators, backhoes, front-end loaders, etc.) will seldom provide a long-term solution to riparian problems and deficiencies. Furthermore, the construction of expensive structures allows managers to sidestep difficult management decisions (Elmore and Beschta 1987). Often, the structural "enhancement" of rangeland streams is viewed as the solution to inadequate riparian management. As a result, changes in management may not be forthcoming.

Alluvial streams undergo continual channel adjustments as flow and sediment loads vary. Incremental changes in channel morphology and streamside vegetation allow such streams to withstand the wide range of dynamic forces that occur as flows fluctuate rapidly during storm runoff and snowmelt flows. An important feature of alluvial streams is that their channels will continue to adjust, change, and sometimes shift location. However, by placing permanent structures in a channel, we are attempting to lock the stream into a relatively fixed location and condition. As a result, structures that are placed in a recovering stream system are often placed where they are not needed; many are ineffective.

In the rush to install expensive and often counter-productive fisheries enhancement structures, we have ignored what should be the primary management focus restoring streamside vegetation. Streamside vegetation can influence the character of a stream in a variety of ways: inputs of leaves and other plant parts as a source of energy for instream biota, shade from overstory plants, woody debris from tree species, streambank stability and cover from woody rooted species as well as sedge/grass/forb communities, and the biological processing and cycling of nutrients (Salo and Cundy 1987). Vegetation allows riparian areas to function in ways that structures cannot replicate.

The resiliency provided by riparian vegetation allows these ecosystems to withstand a variety of environmental conditions. Riparian vegetation, in contrast to structures, can maintain itself in perpetuity as new plants continually replace those that die. Whereas instream structures focus narrowly at attempting to improve fish habitat, diverse and healthy riparian plant communities provide a wide range of values related to water quality and quantity, wildlife, aesthetics, channel stability and fisheries. If we are truly after productive stream and riparian ecosystems, only vegetation provides hope of a long-term solution.

Structures and Economics

The alteration of stream channels by a wide variety of structural devices, in an attempt to enhance fish habitat or for other purposes, has gained increasing popularity in the last several years. And, based on the information presented at recent symposiums and workshops, we have become increasingly proficient at installing "stable" structures in many types of streams. However, are we judging the successes of our stream recovery enhancement program on the methods we use or on the results we achieve? Structures seemingly represent a quick fix and high-tech approach to degraded streams, but do they really work and are they cost effective? Bill Platts (Pers. Comm.) has indicated that structures in Big Creek (a stream with important fish habitat in northern Utah) have changed the stream into essentially a silty canal. Further, this condition now prevents the establishment of willows. He is recommending the removal of instream structures along Big Creek to allow the stream to function more naturally. Based on observations in Big Creek and throughout the intermountain west, Platts has further concluded that "A dollar in stewardship is worth \$10,000 in structures."

Experiences in eastern Oregon and elsewhere seem to echo Platt's concerns regarding the high economic costs associated with structural modifications of stream systems. In contrast, changes in management that will benefit streamside vegetation can often be incorporated within existing management planning and action programs at little additional cost. Not only may changes in management be less costly, such actions represent a real opportunity for long-term solutions to degraded channels and riparian areas throughout much of the western United States.

Vegetation recovery and responses to management, however, do require time. We cannot realistically expect all streams to recover immediately even with the most enlightened program of streamside management. However, if we want recovered riparian areas to become more prevalent in the future, we need to start today at changing our views of streamside management. We also need to reassess and reevaluate the role of structural modifications.

Conclusions

Our body requires healthy arteries and veins for nourishment. Similarly, our watersheds and streams need healthy riparian vegetation to function and provide a wide array of benefits. Now that we are able to diagnose and begin a healing process for many riparian maladies, there is little reason not to prescribe and implement treatments (Luscher Pers. Comm.). These treatments should focus on beginning the process of vegetation recovery through improved management of rangeland riparian areas; structural additions to streams are a much lower priority.

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