COOPERATIVE riparian RESTORATION

Full Stream Ahead

Fall 2011

News and Highlights of Creeks and Communities: A Continuing Strategy for Accelerating Cooperative Riparian Restoration

"Mr. Smith (& Mrs. Connolly) goes to Washington"
A message from
Steve Smith, NRST Team Leader

Welcome to another edition of Full Stream Ahead. As you are winding down from yet another challenging field season, I invite you to take a moment to look at this issue of our network newsletter.

In November, Carol and I made a trip back to Washington DC to share the work of the Creeks and Communities Network with a number of BLM, Forest Service, and Department of Interior folks at agency and department headquarters. It has been our experience that agency staffs in DC are very receptive and encouraged by the important, hands on work we do accelerating riparian restoration. During our visit, we had the opportunity to meet with many folks in Renewable Resources and Planning (BLM), the National Landscape Conservation System staff (BLM), the Forest Service Range and Watershed, Fish, and Wildlife staffs, and the DOI Policy Analysis and Collaborative Action-Dispute Resolution groups. We also had an opportunity to share the accomplishments of the Creeks and Communities Network with BLM Director Bob Abbey.

A message we consistently delivered was that riparian areas are ***still the right emphasis area*** because:

- Riparian areas are generally more sensitive than upland areas,
- Riparian areas connect agencies, landowners, and programs within agencies like no other resource/ program does,
- Riparian areas provide more concentrated, vital values than other areas; and
- Riparian areas are often the most limiting factor influencing management activities.

We also pointed out that fact that in an era of *limited* budgets, it makes tremendous sense to prioritize/ emphasize the most *limiting* resource (riparian areas) that serves as a barometer of overall land health. In addition, we noted that nearly all of the agency strategic planning documents place heavy emphasis on *science, monitoring, partnerships and collaboration* – all of which are directly aligned with the Creeks and Communities Strategy!

We enjoy visiting agency headquarters to coordinate with the folks that make it all work on that end to enable us to move forward on the ground. We are always met with hospitality and sincerely appreciate the warm welcome they always extend to us and the work they do on our behalf.

That's all for now; happy reading and thanks for all you do. Please keep in mind that if any of you ever need us to provide letters of support or telephone calls on your behalf for your work in Creeks and Communities, let us know. I can be reached at 541-416-6703 or sjsmith@blm.gov.

Sincerely,

Steve

Riparian Grazing Workshop – Enterprise, Oregon

A Riparian Grazing Workshop was conducted in Enterprise, Oregon, September 14-15, by members of both the National and Oregon Riparian Service Teams in cooperation with the Wallowa-Whitman and Umatilla National Forests, and local partners including Oregon State University Extension, Wallowa County Soil and Water Conservation District, Eagle Cap RC&D, Wallowa County Stock Growers, Wallowa Resources and others. A similar workshop was held in 2004; however, with a turnover in agency personnel and permittees, another session was warranted. This workshop was also a follow-up activity to the service provided by the NRST to the Wallowa-Whitman/Umatilla NF Range Program staff and Interdisciplinary team members who are involved with livestock grazing. The NRST conducted two video conference calls and three monitoring field reviews the past two years as part of the yearly range management training program on the forests led by Mitch Bulthius, Rangeland Management Specialist. As in many other locations around the West, the team was also asked to review monitoring, especially monitoring related to streambank alteration.

The September workshop was again designed for agency employees, private land owners, and others with an interest in riparian areas and provided an opportunity to re-visit Swamp Creek, which many of you may recognize from the case studies included in the Creeks and Communities Progress Report. The course included segments on riparian grazing techniques, riparian grazing management, and monitoring strategies. In addition, Jimmy Eisner, OR Riparian Team Leader and BLM fisheries biologist gave an informative presentation on the Endangered Species Act consultation process relative to the Pacfish/Infish Biological Opinions, followed by a long and lively discussion. Overall, the workshop resulted in developing a common understanding of the issues, processes, goals and outcomes of riparian grazing management.

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COOPERATIVE riparian RESTORATION

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"Healthy Streams Through Bringing People Together"

The aquatic equivalent of the canary in the coal mine: the use of aquatic invertebrates to assess freshwater ecological integrity

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Historically, canaries accompanied coal miners deep underground. Their small lung capacity made them more vulnerable to low concentrations of carbon monoxide and methane than their human companions. As late as 1986, the acute sensitivity of these birds served as biological indicators of unsafe conditions in underground coal mines. Although human health concerns continue to drive development and application of bioindicators, the loss of ecosystem services, such as clean air, drinking water and plant pollinators, has increasingly diverted our focus to the health of natural ecosystems.

Bioindicators are biological processes, species or communities used to assess the environment and how it changes through time. The concept builds upon the fact that all species (or species assemblages) tolerate a limited range of chemical, physical and biological conditions from which we can infer environmental quality. Changes in the environment are attributed to anthropogenic disturbances (e.g., pollution, land use changes) or natural stressors (e.g., drought, late spring freeze), though anthropogenic stressors are the primary focus of bioindicators. Nowhere are bioindicators more broadly used than in freshwater ecosystems, where in the United States all 50 states are currently developing or implementing biomonitoring programs using aquatic macroinvertebrates, periphyton (i.e., algae and diatoms) and/or freshwater fishes. Although many state and federal programs use multiple organisms to assess the status and trend of freshwater resources, aquatic macroinvertebrates are the most commonly used organisms.

Aquatic macroinvertebrates are animals that do not have a backbone, can be seen with the naked eye and spend at least part of their lives in water. In general, members of the taxonomic class Insecta comprise the overwhelming diversity of aquatic macroinvertebrates in North America, which is conservatively estimated at approximately 11,000 unique species. For perspective, the biodiversity of freshwater fishes is estimated to be around 800 unique species in North America! In addition to their tremendous biodiversity, macroinvertebrates play critical roles in stream and river ecosystems. While many folks are likely aware of their contribution to fish production, they also serve as important conduits of energy between basal stream resources (i.e., algae, aquatic macrophytes, leaf litter) and riparian song birds and bats among other organisms.

Aquatic macroinvertebrates are preferred over other freshwater organisms as bioindicators because they: (1) are relatively long-lived and thus integrate conditions through time and space; (2) are ubiquitously found in perennial stream systems; (3) exhibit a variety of life history strategies (e.g., mode of respiration, reproductive output, feeding strategies) which can be used to discriminate among causes of impairment; and (4) can be sampled and identified in an efficient and cost-effective manner. For example, an unimpaired Rocky Mountains stream or river segment can contain more than 60 unique taxa representing a range of habitat preferences and life history strategies. This taxonomic and functional diversity can capture the myriad of responses to different stressors and disturbances such as fine sediment, metals, nutrients and hydrologic alterations.

Whereas regulators traditionally conducted chemical assays and directly measured physical parameters of stream systems (e.g., thermal regime, salinity, nutrients), bioindication uses macroinvertebrates, periphyton or fishes to assess the cumulative impacts of both chemical pollutants and habitat alterations over time. Consequently, bioindication is fundamentally different than classic measures of environmental quality and offers numerous advantages. First, bioindicators add a temporal component corresponding to the life span or residence time of an organism in a particular system (~ 1 year for many macroinvertebrates), allowing the integration of current, past or future environmental conditions. In contrast, many chemical and physical measurements only characterize conditions at the time of sampling, increasing the probability of missing

sporadic pulses of pollutants. Furthermore, bioindicators are able to capture indirect biotic effects of pollutants, while many physical or chemical measurements cannot. Clearly, a pipe dumping phosphorus-rich sewage into a lake will adversely impact the ecosystem. Intuitively, we may guess that excess phosphorus directly increases growth and reproduction of some species. Chemical measurements, however, may not accurately reflect a reduction in species diversity or how growth and reproduction of other species may decline due to competitive interactions.

Charged with managing over 600,000 km of perennial streams, the Bureau of Land Management is embracing the use of aquatic macroinverterbates as a monitoring tool to ensure the maintenance of stream and riparian ecosystems under its multiple use mandate. One of the partnerships BLM uses to achieve this goal is the National Aquatic Monitoring Center (NAMC) aka the Buglab. NAMC is a cooperative agreement between the BLM and Utah State University which seeks to encourage and foster scientifically sound watershed monitoring programs on public lands. NAMC's primary focus is the use of aquatic macroinvertebrates as bioindicators of freshwater biological integrity. NAMC, housed at Utah State University in Logan, Utah, provides five fundamental services to BLM field offices and other state and federal agencies:

1. Processing aquatic macroinvertebrate samples
2. Database development and maintenance for over 50,000 macroinvertebrate samples
3. Freshwater bioassessment training to BLM field offices
4. Assistance with the design, implementation, and interpretation of aquatic biomonitoring programs
5. Research to address watershed management issues and advance the science and practice of aquatic biomonitoring

NAMC is currently working to increase the ease by which managers can use macroinvertebrate data to inform management decisions. This will be accomplished by adopting an analytical approach (RIVPACS or O/E modeling) that measures how closely sampled taxa match the expected taxa predicted to occur at regional reference conditions. This approach is being applied across the entire United States by multiple state and federal agencies and thus provides a common currency for assessing freshwater biological integrity. NAMC is working to provide this information for all samples submitted to the lab for processing. NAMC is also involved with several projects to design and implement aquatic monitoring programs to support field office scale to national initiatives relying upon aquatic macroinvertebrates. Example projects include the quantification of prey resource availability for migratory shorebirds in the Lara wetlands, CO; monitoring to detect impacts of gas development throughout the Roan Plateau, CO; the design and implementation of probabilistic surveys to determine the status and trend of BLM freshwater resources throughout ecoregions of the Intermountain West; and the development of biological condition scores for over 800 stations to be used in Rapid Ecoregional Assessments. Individuals seeking assistance with training and/or the application of bioindicators to freshwater management questions should feel free to contact NAMC.

The BLM is not alone in their use of macroinvertebrates, their numerous benefits as bioindicators of freshwater biological integrity have spurred legislative mandates for their use in numerous states and the US Environmental Protection Agency (USEPA) is working to develop numeric criteria by which macroinvertebrates could be used to place streams on the USEPA's 303(d) list of impaired waters. Yet, bioindicators are not without faults. Like the canaries in the coal mine, we rely upon the sensitivity of some bioindicators to function as early-warning signals. In some instances, we cannot discriminate natural variability from human impacts; thus, limiting bioindicators' applicability in heterogeneous environments. Accordingly, populations of indicator species may be influenced by factors other than the disturbance or stress (e.g., disease, parasitism, competition, predation), complicating our picture of the causal mechanisms for change. Finally, the overall objective of bioindicators is to use a single species or group of species to assess the environment and how it changes over time; yet, this can be a gross over-simplification of a complex system. Consequently, practitioners should not view chemical, physical and biological monitoring as mutually exclusive, but as complementary and necessary for accurate stressor identification.

Return to Canyons of the Ancients National Monument Results from a Field Visit -- May 9 - 12, 2011

Faithful and observant Full Stream Ahead readers will recall that NRST team members joined with members of the Colorado and Arizona Riparian Teams in October 2010, to assist the staff from BLM's Canyons of the Ancients National Monument (Monument) to assess intermittent/interrupted streams that are common in the steep, rugged canyon topography within the Monument. The Monument is located in southwest corner of Colorado, near the town of Cortez and Mesa Verde National Park. Established by Presidential proclamation in 2000, Canyons of the Ancients National Monument has the highest known density of archeological sites in the United States.

The initial visit in October 2010 included Monument staff as well as local stakeholders and consisted of a PFC assessment pre-work day, a one-day PFC workshop, and a one-day field session. At the conclusion of the October 2010 visit, there was agreement that many questions surrounding the function and potential of the canyon stream systems remained unanswered. The NRST agreed to return and spend additional field time with a small group of Monument specialists to hopefully answer those questions.

As promised, a team of four returned in May 2011 to work with the Monument interdisciplinary team and further explore the complex intermittent/interrupted stream systems found in the Monument. The team was comprised of Mark Gonzalez and Steve Leonard (NRST) and Liz Schnackenberg and Jay Thompson (Colorado Riparian Team). The Monument interdisciplinary team (this is a service first organization between BLM and Forest Service) included: Jonina Vanderbilt (USFS - Hydrologist), Shauna Jensen (USFS - Hydrologist), Eric Freels (BLM - Wildlife Biologist), Heather Musclow (BLM/CANM - Natural Resource Specialist), Jennifer Jardine (USFS - Rangeland Management Specialist), Cara MacMillan (USFS - Ecologist).

The main objective of the May 2011 return visit was to answer two key questions:

1. What is the potential of the riparian system in Squaw Canyon and similar intermittent/interrupted sites in southwestern Colorado and southeastern Utah?
2. How does tamarisk, an exotic invasive species, affect the function of Squaw Canyon and similar streams?

The group spent three days examining an intermittent creek known as Squaw Canyon. By studying a far greater length of Squaw Canyon than was done in October 2010, the group began to understand the processes that form and maintain the riparian area along Squaw Canyon. The group gathered enough observations to address the two principal questions.

Potential

The group identified an alternating pattern of perennial, intermittent, and interrupted (ephemeral) segments. The perennial segments were supported by groundwater discharge from springs. The springs are tied to bedrock lithologies. As the channel intersects different lithologies, one of two hydrologic processes occurs: either shallow ground water is forced to the surface by bedrock, or the channel intersects some lithologies that are bedrock aquifers. Water discharge into the channel creates perennial flow conditions that transition to intermittent conditions downstream and eventually to ephemeral conditions as water is lost by infiltration into the channel bed and evapotranspiration by riparian vegetation. Study of soils near the source of springs showed gleying features to the surface of the soils, which indicates a perennially high water table with little fluctuation in water-table elevation throughout the year.

The potential channel type near springs is a Rosgen E5b. The channel form in these spring-fed reaches is a large, slightly entrenched channel with a smaller, inset E channel underlain by a sandy substrate (Fig. 1). The potential vegetation along the inset E channel is a Baltic rush/coyote willow complex (Fig. 1).

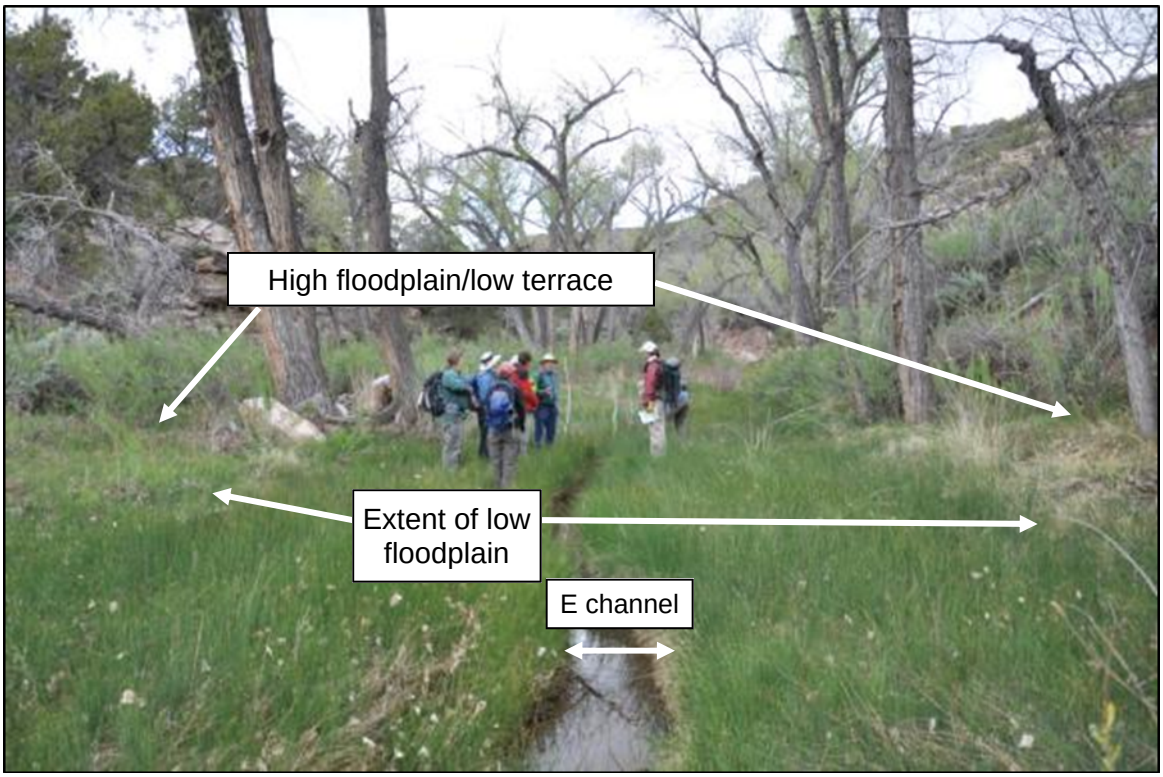


Figure 1. *Inset E channel form within a larger and slightly entrenched B channel form is distinct along the perennial, spring-fed segments of Squaw Canyon. Interdisciplinary team members are standing on a floodplain, which is vegetated by Baltic rush. Coyote willow is evident on the margins of the floodplain and on the riser to the high floodplain/low terrace. View is of segment of upper reach of Squaw Canyon.*

The inset E channel is stabilized by a robust mat of Baltic rush (*Juncus balticus*) and patches of coyote willow (*Salix exigua*), some of which are dense and large, others of which are small and sparse. Mature cottonwood trees occur sporadically along Squaw Canyon, generally on a surface that likely coincides with a multi-year floodplain or low terrace (i.e., likely not inundated by annual events, but by storm events with a 3-10 year recurrence interval; Fig. 1). There is little recent regeneration of cottonwood trees, and most can be attributed to sprouting of flood-broken trunks or flood-tipped and flood-trained trees.

Downstream of the springs, the channel hydrology transitions to an intermittent flow regime (Fig. 2). Baltic rush swards and stands of coyote willow are generally patchier and generally narrower than observed along perennial segments. Inland saltgrass (*Distichilis spicata*) is more abundant in the intermittent reaches and salt crusts appear on the soil surface in irregular patches. The channel becomes wider as stabilizing vegetation is less abundant. Upland species, such as sagebrush and rabbitbrush have invaded the floodplain and banks.

Downstream of intermittent segments evidence of any stored water is absent. The flow regime is ephemeral. The riparian system is interrupted. Obligate and facultative wetland species, with the exception of woody species such as cottonwood and tamarisk, are completely missing from these ephemeral segments.

Figure 2. *Lower reach of Squaw Canyon in a segment that is transitioning from intermittent to ephemeral flow conditions. Tamarisk dominates banks and creates a natural levee by trapping sediment.*

Impact of Tamarisk

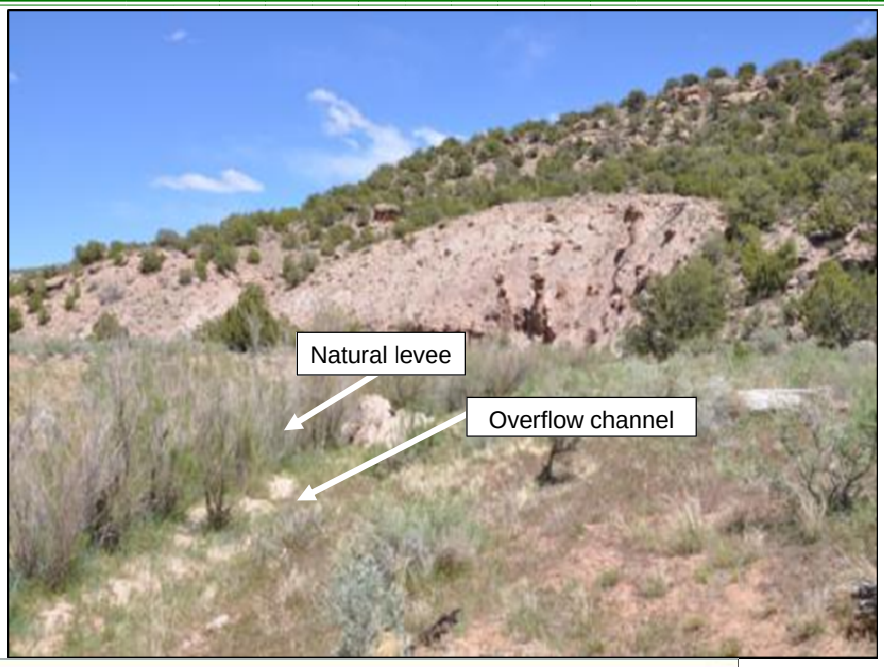
Tamarisk is most abundant in the lower reach and relatively absent (at present) in the upper reach of Squaw Canyon (Fig. 3). A few Russian olive plants were noted, but these are minor in comparison to tamarisk, which is the dominant riparian plant in the lower reach. During the October 2010 field visit, only a short segment of Squaw Canyon was observed. Members of the group thought that tamarisk invasion was transforming the channel from a single-thread to a braided condition. The 2011 investigation allowed inspection of a much greater length of channel, which led to more observations of tamarisk-channel relations.

The tamarisk typically forms a dense wall of vegetation along the top of the bank (Fig.3). The dense branching form of tamarisk at or near the ground surface exerts a strong hydrologic control on overbank flow by reducing stream velocity, trapping stream sediment and capturing organic debris. Consequently, the tamarisk is responsible for causing relatively rapid rates of vertical accretion along the stream banks and the formation of natural levees. The channel geometry in tamarisk invaded segments is Rosgen B- and F-like. In some places the width:depth ratio is so low that the channel has a Rosgen G-like form, although the process that forms this geometry is related to rapid vertical aggradation and not the channel incision that is typically associated with G channels.

Gaps in the wall of tamarisk allow high stream flows to breach the natural levees and deliver overbank discharge to overflow channels (Fig. 4). The well-developed nature of the overflow channels is what had mistakenly been interpreted as braided channels in October 2010. But notice that the bed elevation of braided channels is nearly the same in all channels; whereas, the bed elevation of overflow channels is much higher than the bed elevation of the main channel (Fig. 4), because overflow channels are floodplain features.

The long-term stability of tamarisk-lined channels is uncertain. Intuitively, the banks cannot aggrade vertically indefinitely without changing the hydrologic function of the channel. If the natural levees/banks aggrade too high, streamflow will not be able to access the overflow channels. Progressively larger streamflow events will be confined to a deep, narrow channel and the erosive forces will likely cause the channel to unravel by cutting a deep, G-like gully, or an entrenched and wide F channel (Fig. 5).

Figure 3. *Tamarisk line much of the lower reach of Squaw Canyon. Sand and fine gravel are trapped by the tamarisk to form a distinct levee adjacent to the channel. Overflow channels form behind the levees on the floodplain*



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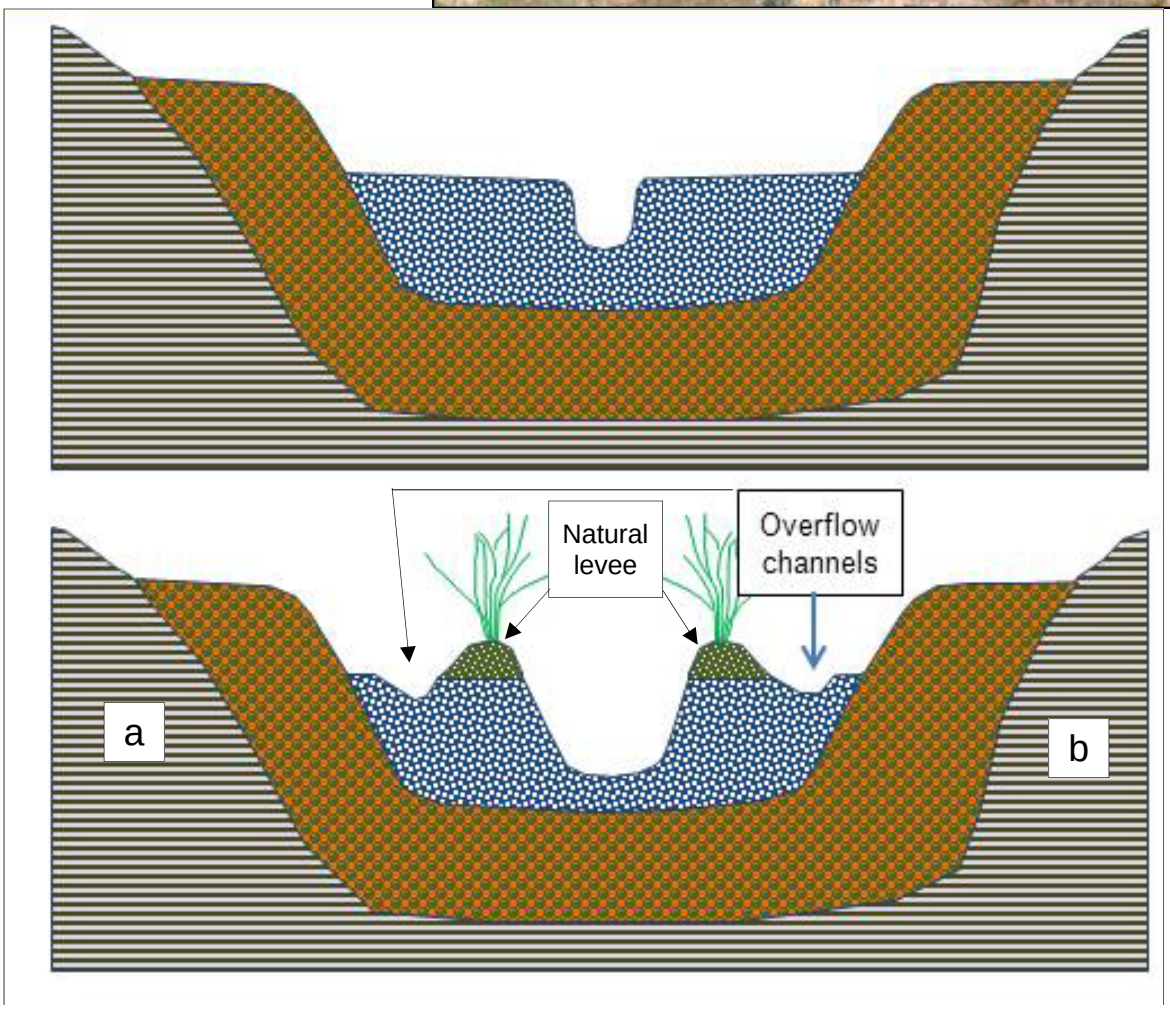

Figure 4. *(a) Illustration of inset E channel within B channel along a stream segment with perennial stream flow. (b) Tamarisk plants trap sediment to create natural levees at the top of channel banks. Overflow channels form on the floodplain behind the natural levees. The natural levees form by vertical aggradation. The deeper channels can hold more discharge so more streamflow energy is contained within the channel and less energy is dissipated by overflow onto the floodplain. Consequently, these tamarisk-lined channels may not be stable and are subject to channel erosion during low-frequency, high-magnitude events.*

Figure 5. *Ephemeral reaches are devoid of obligate and facultative wetland species. The channel geometry is developed by flashy discharges associated with storm events. G and F channel forms are typical in the ephemeral segments.*

Summary

In Squaw Canyon, interrupted segments with ephemeral hydrologic conditions will likely always be naturally unstable and prone to high rates of channel erosion, channel sedimentation, and channel migration. In contrast, spring-fed segments show resilience and are able to maintain a stable, inset E channel even through flashy runoff events that greatly overflow the channel and fill a much larger storm channel.

Tamarisk invasion has altered the shape of the channel by trapping sediment, generating high rates of vertical aggradation, and concentrating progressively larger discharges within a confined channel. It is uncertain how stable a vertically raised floodplain is, but channel instability with vertical and lateral incision is likely if storm discharge cannot access an elevated floodplain.

The riparian function of Squaw Canyon is impaired but not from the current grazing management. Tamarisk invasion has altered the sedimentation patterns and hydrologic conditions of the channel and overbank landforms. The current grazing management during dormant and early spring seasons provides deferment or nearly complete growing-season rest for most of the riparian vegetation. If questions persist concerning browsing and regeneration of woody riparian plants, then monitoring could be done twice per year (pre- and post-grazing) to determine the use by livestock and that of wildlife.

Figure 6. *Large, pristine pictograph panel located in the bottom of Squaw Canyon. Note that the top edge of the boulder has been "serrated" to give the boulder the appearance of an arrowhead.*

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