Section 11.0
Establishing Watershed and Riparian Restoration Goals

Summary

Successful watershed and riparian restoration projects require an understanding of the natural components and processes operating in the watershed as well as of the social context in which restoration projects are developed. Natural components of concern in the South Arkansas River watershed include reduced stream flows, limited in-stream habitat, degraded streamside habitat, and excessive sediment deposition. Components of the social context include water rights, management goals and practices on public and private land, limited project funding, and impacts arising from local zoning and development regulations. A variety of techniques are described to address both natural and social components in the watershed, as well as methods to establish project priorities.

This section discusses the natural and social components of watershed and riparian restoration, the process of establishing and prioritizing watershed and riparian restoration goals, and suggested restoration goals, projects, and techniques for the South Arkansas River watershed.

Introduction

Watershed and riparian restoration projects consist of natural components and processes, plus the social context in which restoration projects occur.

Natural Components in Watershed and Riparian Restoration

Fundamental to successful watershed and riparian restoration projects is an understanding of "the physical and ecological context of the project [and that] broader watershed processes must be considered when planning projects" (Roni et al. 2008). Specifically, successful restoration of watersheds and riparian systems requires understanding the following.

- Watersheds and riparian systems are dynamic and that dynamism is fundamental to their health and proper functioning.
- Disturbances such as flooding, erosion, and deposition are natural and necessary processes in watersheds and riparian systems.
- The variability resulting from disturbance is important for establishing and maintaining high quality in-stream and streamside habitats.
- The components of watershed and riparian systems interact in a variety of ways that may either reinforce or work against the change or restoration desired.

- "How ecosystems have changed from their natural potential and what kinds of restoration are possible" (Poff et al. 1997, Bohn and Kershner 2002, Beechie et al. 2008).

These recommendations reflect an approach to restoration that is based on the processes at work—or that are missing—in the watershed or stream system. In addition to improving the chances of project success, this process-based approach has the added benefit of increasing the likelihood that watershed and riparian system will respond to future changes, such as extended drought, through natural physical and biological adjustments without the need for additional intervention (Beechie et al. 2010).

That said, the reality of most situations is that *full restoration of all impacted watershed and riverine processes is rarely possible or practical*, particularly in areas heavily affected by development (Stanford et al. 1996). What remains short of full restoration are strategies and projects that range from restoring or improving selected ecosystem processes to treating specific symptoms by creating and enhancing habitat at select locations (Beechie et al. 2010).

Unfortunately, rather than examining underlying (or missing) processes, many restoration projects start by focusing on specific projects at individual locations and using techniques that seek to impose stability in order to fix conditions at a certain place and point in time. This is often achieved through the use of hardened structures. However, such efforts often: (1) aggravate existing problems or create new ones, (2) adversely impact other important ecosystem processes, (3) adversely impact non-target species, and (4) usually lead to project failure over time (Kauffman et al. 1997, Bohn and Kershner 2002). According to Booth and Jackson (1997), "most stream rehabilitation efforts that address only the in-stream symptoms of [development impacts on channel processes] are unlikely to succeed." Other factors that limit the success of various stream restoration techniques include the following.

- Poor existing water quality.
- In-stream structures that are inappropriate, whether because of design, type of structure chosen, or the number of structures installed.
- Imposition of inappropriate channel configurations when rebuilding streams.
- Inadequate efforts to reconnect habitats. For instance, restored riparian buffers that are too narrow or removal of a fish migration barrier addresses only a small section of stream (Roni et al. 2008, Beechie et al. 2010).
- Project proponents should not expect the same results from the same practice in different stream segments (Rinne 2004).

Restoration of Natural Components in the South Arkansas River Watershed

Based on the results of this assessment, the following natural components and processes in the South Arkansas River and watershed should be addressed.

- **Stream flows**—Loss of natural flow regime and diminished in-stream flows due to water storage, water diversions, and drought. Current flows are inadequate to support in-stream and streamside habitats and organisms.
- **In-stream habitat**—Degradation or lack of in-stream habitat diversity limit or eliminate the river's ability to support the various life stages of trout and aquatic invertebrates.
- **Streamside habitat**—Degradation or loss of streamside habitat limit or eliminate the river's ability to provide a variety of normal ecological functions, such as improving water quality, wildlife habitat, and corridor connectivity.
- **Excessive erosion and sediment deposition**—Excess erosion and deposition of fine sediments due to land use practices limit the suitability of various sections of the river for spawning and the river's ability to support aquatic invertebrates on which trout and other fish feed.

Recommendations to Address Restoration of Natural Components in the South Arkansas River Watershed

In the South Arkansas River watershed, restoration should be directed at the specific components and processes, as described below.

Stream Flows

Current flows in the South Arkansas River are inadequate to support in-stream and streamside habitats and organisms. Adverse impacts affect the entire project corridor, but increase downstream as the impact from water diversions accumulate. Given the social context, increasing the quantity of water in the channel does not seem likely. However, alternatives exist, some of which have been used locally. For instance, bypass flows of 2 cubic feet per second to improve fish habitat were approved as part of the re-licensing of hydroelectric dams on the South Arkansas River (FERC 1996, CDOW 2004). Also, the Voluntary Flow Management Program on the Arkansas River provides an example of cooperative changes in stream flows. This program is administered by the Bureau of Reclamation in cooperation with the Southeastern Colorado Water Conservancy District. Water management guidelines provide whitewater flows for summer recreation, while also protecting and enhancing the fishery by establishing minimum flow guidelines during the rest of the year (CPW 2013a). Many other, similar projects and water flow experiments exist elsewhere (e.g., Bednarek and Hart 2005, Richter et al. 2006, Richter and Thomas 2007).

An alternative to increasing flows is to decrease the footprint of the existing river channel so that the water that is available can sustain smaller, higher-quality in-stream and streamside habitat (Trush et al. 2000). One such project has been installed on the South Arkansas River and another is in the design phase.

In-Stream Habitat

In-stream habitat diversity that is needed to support the various life stages of trout and aquatic invertebrates is degraded or missing in the South Arkansas River. This is most common downstream of Chaffee County Road 210. Restoration efforts should address the conditions described below.

- Establish a new, more sinuous, low-flow channel in sections of the river that have been identified as too straight or too shallow. The intention should be to increase overall habitat diversity, and increase water depths to aid trout movement and overwintering habitat.
- Remove or reconfigure identified barriers to fish movement (e.g., grade control structures, water diversions, and road culverts).
- Increase the amount of large woody debris in the channel to increase in-stream habitat diversity.
- Replace diversion structures composed of stream substrate and other non-native materials with alternative structures and materials, such as log weirs, that allow fish passage but which do not require seasonal reconstruction and regular maintenance.

Streamside Habitat

Several sections of the South Arkansas River have no floodplain or streamside habitat, and where such areas do exist, they are often small, narrow, and of low quality because they are dominated by non-native, weedy, and non-riparian species. This is most common downstream of Chaffee County Road 210. Restoration efforts should focus on the following.

- Re-create streamside benches so that they are subject to frequent overbank flooding (every 2-3 years), particularly where stream banks are high and vertical. This is often done in conjunction with in-stream restoration.
- Re-establish overbank flooding, such as by creating new, lower streamside benches
- Encourage the presence of beaver and limit removal of existing beaver dams. The changes created by beaver have many of the desired features in riparian restoration and do not require maintenance.
- Identify and address restrictions and barriers to wildlife connectivity in the river corridor, such as road underpasses, culverts, and confined riparian habitat.
- Encourage appropriate riparian vegetation where it is limited or absent.
- Identify and address areas where riparian vegetation is adversely impacted by weedy species.

Allan (1995) observed that returning existing land uses to a less-developed state is "rarely practical," so stream improvement often depends on best management practices. As such, management of riparian areas is "particularly attractive" because changes to the riparian zone often have immediate and direct influence on stream conditions and the benefits are disproportionate to the land area required. However, Harding et al. (1998) warned that over-emphasis on restoration of riparian zones will not address stream conditions arising from larger, watershed-level conditions.

Excessive Erosion and Sediment Deposition

Excess erosion and deposition of fine sediments in several sections of the river limit the suitability of those areas for spawning and support of aquatic invertebrates at the base of the aquatic food chain. In the project corridor, these impacts are most common downstream of U.S. 285. Restoration efforts should focus on the following.

Streambank erosion. Identify and address areas of excessive streambank erosion. Depending on the cause and severity of erosion, techniques include redirecting erosive flows with rock and log vanes and weirs, re-establishing riparian vegetation (e.g., planting willow cuttings), and re-grading steep banks and stabilizing areas with inert fascines. A fascine is a bundle of live or dead branches tied together, wrapped in fabric, and assembled as a long, narrow tube that is anchored parallel to stream flow along an eroding bank. Properly installed, fascines address bank erosion, accelerate revegetation, and improve in-stream habitat. Other terms for fascines include revetment and brush mattress.

Stormwater runoff. Identify and address areas where stormwater runoff directly enters the river. Remediation can be accomplished by intermittently redirecting runoff to adjacent slopes to remove sediments, revegetating runoff channels to slow flows, and installing sediment basins to capture and hold runoff so that suspended sediments settle out. Which approach is most appropriate will be based on site-specific conditions.

Potential also exists for increased erosion and debris flows from upland areas caused by wildland fires and widespread insect infestations. Areas impacted by wildfire should be revegetated and excessive erosion addressed, and the location, progression, and severity of insect infestations should be monitored.

Last, suggested changes in stream flows and streamside habitat described above should also decrease the impact of fine sediments in the river. For instance, (1) reducing the size of the active channel to accommodate lower stream flows will concentrate flows and increase the movement of fine sediments; (2) improving the extent and health of streamside vegetation will help stabilize stream banks and thereby reduce stream bank erosion; and (3) re-establishing, creating, and expanding floodplains and overbank flooding will allow sediments to drop out in streamside areas rather than the river bottom.

Social Components of Watershed and Riparian Restoration

Watershed and riparian restoration efforts occur in a larger social context in which opinions of, and decisions about, restoration often influence whether restoration occurs, the type and location of projects selected, and the likelihood of project success. Thus, community involvement is critical to restoration success (Briggs and Osterkamp 2003). Components of this social context include:

- current conditions, such as water rights, existing facilities like roads and development, zoning and land use regulations, and plans for future growth;
- competing interests and values, such as how water is or should be used, and where (or if) development should occur;
- private land use decisions; and
- limited time and resources (Anderson et al. 2003, Beechie et al. 2008).

Social Components in the South Arkansas River Watershed

Social components that will influence restoration in the South Arkansas River watershed are described below.

- **Water rights**—Several reservoirs and dozens of water rights currently exist in the watershed. Changing water storage, diversion practices, and water uses are contentious, complicated, and costly. In addition, the creation of wetlands and riparian habitat often raises concerns regarding increased consumptive use of existing water rights.
- **Private lands**—Most of the land immediately adjacent to the South Arkansas River is privately owned. As such, the opinions and perspectives of those landowners and their willingness to participate in restoration activities will determine what is accomplished and how easily. Because watershed and stream processes are inter-related, restoration projects by one landowner may be compromised by failure to address conditions on land owned by another.
- **Public lands**—Most of the watershed above the South Arkansas River project corridor is managed by the U.S. Forest Service and the Bureau of Land Management. Decisions regarding logging, forest thinning, road building, and treatment of insect infestations and erosion will influence the health of the watershed and the river.
- **Funding**—Many public and private programs exist to finance watershed and stream restoration projects. However, how funds are used is normally restricted as to location (e.g., public vs. private lands) and project type (e.g., revegetation vs. in-stream work). Further, the amount of money is limited, and competition for available funds is often intense.
- **Zoning, regulations**—Local government planning, zoning, and development regulations direct the location and type of development that occurs near and adjacent to the river. State and local government regulations establish stormwater requirements and regulations such as construction best management practices.

Recommendations to Address the Impact of Social Components in the South Arkansas River Watershed

Water Rights

Changes in water storage, diversion practices, and water uses sufficient to demonstrably affect in-stream flows are not likely in the near term. However, the following efforts will benefit overall river ecosystem health and function.

- Where water rights are tied to land adjacent to the river, improve landowner awareness and understanding of current river conditions as well as the economic, social, and recreational value of a healthy river and river corridor.
- Increase outreach efforts to water right holders regarding impacts of and alternatives to existing diversion practices. Alternative water diversion practices improve in-stream habitat and fish passage while also reducing maintenance costs and time. Where appropriate, outreach should be coupled with site visits and habitat evaluations.

Private Lands

The opinions and perspectives of private landowners and their willingness to participate in restoration activities are critical to the success of those restoration efforts. Restoration efforts on private lands should involve the following.

- Improve landowner awareness and understanding of current conditions as well as the economic, social, and recreational value of a healthy river and river corridor.
- Increase outreach efforts to private landowners, coupled with site visits, habitat evaluations, and technical assistance regarding:
  - the benefits of maintaining an adequate buffer of streamside vegetation;
  - appropriate riparian plant species, as well as weed species detrimental to riparian habitats and appropriate control measures;
  - the benefits of large wood debris in the stream channel and the means to control undesired impacts; and
  - the benefits of beavers and the means to control undesired impacts.
- Coordinate the provision of technical assistance among local, state, and federal natural resource agencies.
- Increase landowner awareness of external funding sources available to assist with various restoration projects and land management activities.
- Provide technical assistance to agricultural landowners regarding alternative grazing strategies in riparian areas.
- Sponsor landowner workshops on such topics as riparian grazing, beaver management, and revegetation techniques.

Public Lands

Decisions regarding management of public lands influence the health of the watershed, but are largely outside the day-to-day review of average citizens. However, the following efforts will benefit overall river ecosystem health and function.

- Monitor forest conditions to insure that changes to areas subject to insect infestations and wildfires are known, particularly steep slopes adjacent to major tributaries.
- Insure that adequate resources exist to address potential post-fire impacts to watershed and river processes.
- Establish and maintain effective channels of communications with the U.S. Forest Service and Bureau of Land Management regarding potential impacts to the watershed and river from wildfires and insect infestations.

Funding

Watershed and river restoration funding is limited, and competition is often intense. The following can improve the chances of successfully funding projects.

- Increase consensus, coordination and participation among local governments, non-profit organizations, and local citizens to improve chances of restoration grant requests.
- Increase awareness of the requirements of agencies that fund restoration projects to ensure that funding requests are appropriately targeted.

Planning and Zoning

Local government planning and zoning regulations influence development in and near rivers. The following actions can limit subsequent adverse impacts on the river.

- Encourage the adoption of specific riparian setback provisions in local land use codes.
- Improve awareness of and requirements for construction best management practices related to stormwater runoff, and improve enforcement of existing provisions.
- Increase awareness of the impact of recreational trails placed in riparian areas. Where possible, relocate existing trails away from streamside areas, and encourage greater separation between new trails and riparian areas.
- Encourage local government efforts regarding source water protection.

Prioritizing Restoration Activities in the South Arkansas River Watershed

The criteria below are suggested for prioritizing projects for the South Arkansas River and watershed (Kaufman et al. 1997, Beechie et al. 2008, 2010).

- Identify those reaches that are relatively intact and worthy of protection or preservation strategies. Many of these reaches are located upstream of Chaffee County Road 210. However, several sections downstream are also fairly intact and, although smaller and isolated, attempts should be made to keep them in their current state.
- Identify those reaches where restoration is feasible with modifications to, or changes in, current land use activities. These reaches are scattered along the length of the project corridor and impacts generally involve agricultural operations. Land uses in developed areas are largely excluded from consideration because they are more difficult and expensive to address.
- Identify those reaches that could be restored, but only at high cost. In such cases, restoration benefits should be commensurate with costs. Most of these reaches are located downstream of U.S. 285 and involve developed areas immediately adjacent to the river. In these areas, streambanks are high and often nearly vertical, and so require removal of large amounts of soil and other materials and reconfiguration of the resulting banks.
- Identify those reaches that are in a condition where restoration is not technically feasible due to extreme conditions of alteration, degradation, or sociopolitical limitations. These reaches are located downstream of U.S. 285 and involve developed areas immediately adjacent to the river.

Scale of restoration. The scale of restoration efforts should match the scale of physical and biological processes involved (Bohn and Kerschner 2002). Scale refers to both the spatial extent of restoration efforts as well as the amount of time needed to realize a change. In addition, restoration efforts should be tailored to local potential (Bisson et al. 2006). For instance, the same issue at different locations may have different causes and, therefore, different solutions. Also, different locations may have constraints that alter or eliminate their suitability for restoration For instance, areas upstream from a proposed restoration site may produce excessive stream sediments, or a headcut downstream may be traveling upstream, destabilizing the channel.

Project type. In terms of project type, on-the-ground projects are more visible and often more galvanizing in terms of support and participation than activities such as preservation, education, and improved coordination. However, the latter may be more appropriate or effective. Last, projects and activities that produce tangible results in the short term, such as rapid habitat recovery and improved fishing, will usually garner more support more quickly than restoration projects with results measured in years.

Monitoring and Measurement of Outcomes

Explicit outcomes (objectives) regarding restoration projects are important for tracking project progress and performance as well as to set appropriate expectations. Examples of project objectives include changes in fish population, multi-species metrics for aquatic invertebrates (e.g., index of biotic integrity), specific water quality standards to be met, and vegetation transects that monitor percent cover and species composition. In each case, the objective should be measurable. With longer timeframes and larger projects, specifying a range of possible outcomes rather than a single target may be more realistic (Beechie et al. 2008, 2010).

> *There is always an easy solution to every human problem – neat, plausible, and wrong*.
>
> H. L. Mencken (1917)