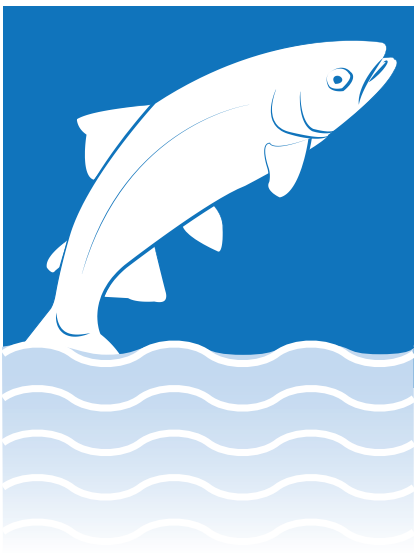


Chapter 4
Six Key Projects

The restoration projects described in this chapter were carefully chosen to represent a broad range of methods of restoring habitats and managing water quality. They are applicable to most of California, proven to be effective, and critical to restoring habitat and water quality in the state. This is not meant to be an exhaustive list; there are many more projects and practices available to restoration practitioners. Additional projects may be added to this evolving manual as their effectiveness and importance are evaluated.

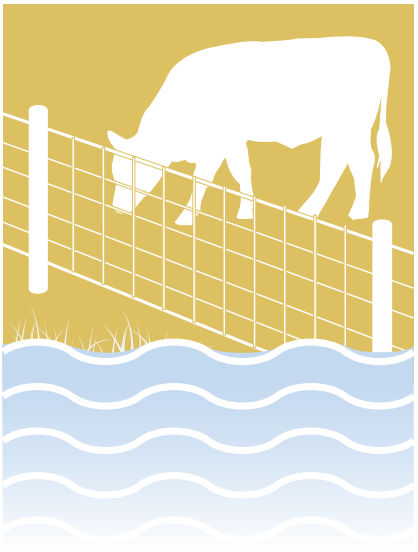
Each project write-up is meant to provide general guidelines for planning and implementing that particular project, either alone or as part of a larger restoration effort. The practitioner is advised to seek out additional resources and experts for help determining if a particular project is appropriate and for assistance in subsequent planning, preparation, and implementation.

Each project offers a wide range of benefits to wildlife, stream health, and water quality. The table below identifies some of the specific benefits associated with each one.

	Removing an In-stream Barrier	Emplacing Large Woody Material	Fencing a Riparian Area	Trapping Stormwater	Buffering a Wetland	Managing Wetland Water Level
Allow fish migration	●					
Restore hydrologic processes	●	●				●
Increase habitat complexity		●			●	●
Control erosion & sedimentation		●	●	●	●	
Restore habitat	●	●	●			
Improve water quality			●	●	●	●
Recharge groundwater				●	●	
Control non-native species			●			●
Support wildlife populations	●	●	●		●	●

This Project description is part of the full publication "Habitat Restoration and Water Quality Management"

For more information email info@elkhornsloughctp.org



Project 3
Fencing a Riparian Area to Manage Livestock Impact

Fencing around a riparian area allows a manager to exclude livestock when such exclusion is seen as a way of reaching habitat or species goals within the riparian ecosystem.

Background

Improper livestock use of riparian areas, particularly in the arid western United States, has been broadly implicated in a variety of water quality, habitat, and species-related threats (e.g., Belsky et al. 1999; Freilich et al. 2003). The impacts of improper livestock management include altered plant community composition and structure, soil compaction, and reduced bird species diversity and abundance. Fencing can help managers more easily control livestock use of riparian areas. Completely excluding livestock from riparian areas may not be necessary or warranted, and may even have negative consequences (Nelson et al. 2010).

Benefits

Livestock can have both positive and negative impacts in riparian areas. When a riparian area is surrounded with fencing, the livestock manager or landowner can control the timing and frequency of grazing to minimize the negative impacts and maximize the positive, thereby furthering goals for habitat restoration, species conservation, and water quality improvement.

Improves water quality. Livestock can trample streambanks and remove vegetation, leading to erosion and sedimentation. During the summer, the tendency for livestock to congregate in cooler riparian areas can cause fecal contamination of the stream and increased nutrient loading. If downstream areas are used for recreation or drinking water, this can be a serious problem. Excluding livestock can help limit nutrient loading and fecal contamination (Belsky et al. 1999; Davies-Colley et al. 2004). Excluding livestock with fencing can also increase vegetation cover, reduce the area of bare soil, reduce soil compaction, and reduce streambank erosion, resulting in decreased sediment delivery into the stream or river (Platts and Waggstaff 1984; Kaufmann and Kreuger 1984).

Protects and restores riparian habitat. Riparian habitats can benefit from the management flexibility provided by installation of livestock fencing. Riparian fencing controls the potentially destructive movement of livestock into and around riparian habitats. Fencing riparian pastures can help some managers to manage more effectively for riparian vegetation-related goals (Kauffman and Krueger 1984)

Aids wildlife populations. If fencing is used successfully to recover riparian vegetation and stem erosion and sedimentation, there can be resulting benefits for terrestrial and aquatic wildlife species. Restored riparian forests provide habitat for bird species to forage, nest, feed, and elude predators, resulting in increased diversity and abundance. Additionally, aquatic species, including listed fish species, benefit from the shading and resulting decreased water temperature provided by restored riparian vegetation (Armour et al. 1991; Blann and Nerbonn 2002) and the reduced sedimentation benefits benthic invertebrate species and the eggs and larvae of fish (Bjornn and Reiser 1991).

Planning

When considering the installation of riparian-area fencing, is important to note that full livestock exclusion is not being recommended. Livestock use of riparian areas has proven beneficial consequences. For example, California tiger salamanders and California red-legged frogs are known to prefer habitats with trampled banks and to benefit from nutrient-rich water (Ford et al. 2013). Exclusion of livestock is appropriate when the goals of the project are explicitly habitat restoration and/or water quality improvement for sensitive aquatic species. Even then, managers may find it beneficial to allow livestock to graze within the fenced area for periods of time as long as there is particular attention paid to critical movement periods for certain amphibians.

Planning for this project should occur within the context of an existing livestock management plan, preferably one that includes clearly defined restoration objectives.

Advance Analysis

Site Assessment

A baseline understanding of the biological and soil resources present at the project site helps to determine many aspects of fencing design; it also provides a basis for determining how the new fencing will function within the grazing management program. It is important to know where sensitive resources or target habitats are located in relation to the riparian fencing, so that appropriate plans can be made for grazing inside the fenced area vs. outside.

Hydrological analysis may be important as well. Containing livestock grazing within the fenced riparian area in the wet season may be a concern if there is the possibility of flash flooding.

Seasonality

Installation of riparian fencing is normally seasonally constrained. In many parts of Northern California, fences are built from spring through fall, as digging may be a problem when the ground is frozen or wet. In other areas installation takes place after August 1 to avoid disturbance to native birds or migrating amphibians. Stream crossings and new livestock water access areas are built during the summer, when work is least likely to disturb fish (Bush 2006).

Expertise Needed

Livestock manager. A livestock manager provides important input on fencing design and directs long-term management of the fencing once it is installed.

Biologist. A biologist helps determine where the fence should be placed and what materials it should be constructed from to maximize benefit and avoid undue impact to biological resources. If fencing traverses a stream or river, a fish biologist needs to identify presence of native fish and other aquatic species. A biologist's expertise also assists in choosing the best timing for construction.

Soils expert. Potential soil erosion from cattle movement up and down slopes as well as along stream banks is addressed and mitigated by this expert. A soils expert may also help predict interactions between fence post material types and different soil types, so that materials that last the longest can be employed.

Implementation

Design

A key design issue is the scale of the fencing project. This will depend on basic project goals (protecting a relatively small area with a spring vs. a long reach of a stream), the size of the riparian zone, long-term management goals, and budget.

The design of the fencing should facilitate long-term management. Adding gates into the fenced riparian area, for example, allows a rancher to give livestock access to the area inside, to free trapped livestock, and to easily enter the area to perform regular maintenance activities such as weed control. An unplanted strip along fences allows vehicle access and prevents livestock from pushing against the fence and potentially weakening it (Prunuske 2006). If the fencing will cross a stream, special designs and materials are needed to ensure stability in high-flow situations and security during low flows.

Since excluding livestock from a riparian area may also mean cutting them off from a water supply, the project should be designed to account for alternative water sources. When

linking to an alternative water source, consult the experts. Any piping crossing streams must be buried, and trenching associated with this must be a minimum of three feet deep to ensure that scour does not eventually reach the surface of the pipeline (NRCS 2007). In general, increasing the number of places livestock have access to water reduces overgrazing near one water source (Bush 2006).

Photo P3.1 Mowing fence lines allows for easy access for repairs and maintenance. Photo: ESNERR

Particularly when installing fencing is part of a larger riparian restoration project, fence installation may involve planting of native species (see Chapter 1). Generally, revegetation occurs after the fencing is installed to avoid damaging new plants with fence construction activities. Practitioners might consider waiting to replant for one to two years after installing fencing, because plants native to California's riparian areas often return naturally. If revegetation occurs immediately after fence installation, it is recommended that livestock be excluded for 3 to 5 years to allow for plant establishment.

Materials

There are numerous materials available for constructing riparian fencing for livestock. The choice of materials depends on the conservation objectives established during the planning stage. For instance, if improving water quality is a goal and the fencing crosses water or wetlands, then it may be best to use non-treated wood or metal posts. Wildlife-friendly fences are available for use where wildlife movement is a concern. Choosing between barbed or non-barbed wire and placing fence posts at a distance that insures wildlife movement are important installation considerations. As mentioned above, including gates in the construction allows access into and out of the fenced area for both livestock and manager. In public use areas, signage may be required to properly inform passers-by of the purpose of the fencing.

Adaptive Management

Livestock managers who utilize fencing to manage livestock movement in riparian areas should be prepared to monitor these areas during the life of the installation and make adaptive management decisions when necessary. Although livestock management itself is integral to any riparian fencing project, methods for managing livestock once the fence is

in place are beyond the scope of this document (the Related Resources section below lists livestock management resources that pertain to riparian fencing).

Monitoring

Monitoring of water quality (and, if appropriate, of the populations of sensitive species and their habitats) should begin during the planning stage and inform the adaptive management plan for the life of the project. As the site is monitored over the years, land managers are able to make repairs to the fencing and adjustments to the grazing regime to insure that the project is achieving its goals and objectives.

The Marin RCD handbook for erosion control suggests photographing the site before, during, and after implementation as part of the monitoring efforts (Prunuske 2006). This information will prove valuable as the project ages. Photographic monitoring helps to inform grazing regimes and identifies when modifications must be made.

Maintenance

The success of livestock exclusion depends on fencing working properly. Periodic maintenance to insure that poles are stable and that cables and/or wire are still attached is required. In riparian areas the fencing should be inspected after all rains for potential bank destabilization. If alternative water sources have been provided as part of the project, the manager must maintain these water sources regularly to insure the safety of the livestock.

Management of invasive plants is often necessary, particularly when restoration of native vegetation or habitat for sensitive species is a project goal. Even if livestock are excluded for only part of the year, their absence in the exclusion area may lead to undesirable growth of non-native vegetation. Electric fence lines risk high grasses shorting out the current, so areas near such fences must be mowed seasonally.

Managers should be aware that fencing may need to be redesigned over time if use of the area by humans, livestock, or wildlife changes.

Potential Concerns

Disrupted grazing regime. Riparian fencing can change the grazing regime, either by design or as an unintended effect of the exclusion, and these changes may not work well for the rancher/landowner. Negative consequences can be avoided by emphasizing a collaborative approach to project design. Potential negative impacts to wildlife and livestock are addressed during the design phase as well as through vigilant monitoring.

Risk to wildlife and livestock. Placing fencing in a riparian zone and across a riverine system can place native wildlife and livestock at risk. Animal entanglement and habitat

Photo P3.2 Vehicle access along livestock fencing. Photo: Nils Christoffersen

destruction can occur during installation. Livestock also risk entanglement and injury on fencing as they move to get closer to water sources and desirable vegetation. All of these issues should be anticipated during the planning and advance analysis phases, but ongoing monitoring of the fencing is also necessary to detect any damage to the fence that could lead to these negative outcomes. Wildlife-friendly fencing is available to protect wildlife movement patterns. These fences are designed with smooth bottom wires and are placed an adequate distance from the ground to allow small animals to move under the fence freely (Bush 2006). Fencing with wire strands closer together prevents cattle and larger animals from pushing their heads through to reach vegetation, avoiding potential entanglement.

Debris accumulation. Regularly scheduled inspections and inspections after flood events can address debris accumulation in fencing, which can inhibit fish passage and result in fence damage.

Weed and fuel load management. Certain fencing designs may limit landowners' ability to use livestock to manage weeds and fire fuel loads (George et al 2004). A well-designed livestock management plan, developed in a collaborative manner, can usually mitigate this concern by allowing livestock access to the fenced area during certain times of the year.

Costs

The costs for installing riparian fencing vary from region to region and are influenced by the physical characteristics of the site as well as by the people and organizations involved in the project. Developing a plan that addresses site constraints and project objectives is a first step to controlling the cost of installation. Stakeholders should work together to create a detailed plan that allows contractors and laborers to understand the scope of the project in advance and allows all costs to be figured into the project estimate.

The type, design, and length of fencing ultimately affect the final cost of the project. Numerous styles of fencing exist; the choice depends on the goals of the project and the location and placement of the fencing. The type of fencing used (electric, woven wire,

barbed, etc.) determines cost as well as the terrain. Rotational grazing and the installation of alternative water sources may decrease the number of miles of stream fencing required. Vegetative buffers can be used in conjunction with fencing to further minimize the length of fencing required. Once fencing is installed, maintenance costs are minimized with a carefully designed maintenance plan that involves scheduled inspections and post-flood-event inspections.

In a recent project, fencing two 100-foot corridors cost about $6,000 per stream mile (Platts and Wagstaff 2011). Federal cost-share programs can defray fencing costs from $1.60 to $5.00 per linear foot depending on the type of fencing, but the associated engineering and materials requirements may increase the base cost (Natural Resource Conservation Services 2012). The cost can increase considerably if a fence is to be constructed on certified organic ground (fence posts that meet certification standards do not have chemical additives or preservatives). Likewise, projects that must comply with American Made and prevailing wage requirements can increase costs.

Maintenance costs per stream mile per year can run between $60 and $200. Maintenance in flood zones is intensive because ranchers must clear fence lines of debris following storms.

Related Resources

- *The Grazing Handbook: A Guide for Resource Managers in Coastal California* is a handbook for public agency personnel and private landowners along California's Central and Northern Coasts. It develops guidance on utilizing livestock grazing as a management tool. The handbook includes excellent information on incorporating fencing into a management plan (Bush 2006).

- The New South Wales Government Fishing and Aquaculture website offers descriptions and diagrams for fence placement along streams and in riparian habitats. The site answers questions about where to put the fence, how to identify flood-prone areas, what type of fencing should be used, and what are the various fencing options (NSW 2012).

- The Marin RCD has published an erosion control handbook that addresses erosion control and livestock management issues related to riparian fencing (Prunuske 2006).

- *Fencing to Control Livestock Grazing on Riparian Habitats Along Streams: Is It a Viable Alternative?* (Platts and Wagstaff 2011)

Case Study

Riparian Fencing at Lynch Canyon

Lynch Canyon, Solano County CA
Solano Land Trust

Lynch Canyon is a 1040-acre working cattle ranch owned by Solano Land Trust (SLT) since mid-1990s. A 1998 Management Plan recommended excluding cattle from the riparian areas for vegetation improvement, ground and riparian nesting birds, and native grass improvement. Riparian fencing was installed to buffer the two forks and main channel of Lynch Creek, the main drainage on the property. Prior to fence installation, cattle had year-round free access to the creeks and large impacts to bed and bank, riparian trees and shrubs, and native grasses were evident. Tree recruitment (particularly with oaks) was negligible with the former grazing scheme.

Implementation

Five-strand barbed wire fences with periodic gates were placed in segments along the creek as funding was gathered for this project. As of 2013, both forks and the main section have continuous fencing that exclude cattle from the riparian area. The distance from the creek to the fence varies throughout the valley, from 30 to 300 feet from top of bank. Cattle grazing is now limited to a four- to six-week season in late summer to allow ground and other nesting birds to fledge and reduce cattle impacts during wet seasons. Along the valley, SLT-installed cattle troughs fed by springs and wells provide off-creek water for cattle. Vegetation planting was performed with volunteers and staff; it ranged from simple (placement of non-irrigated willow sticks and acorns) to more intensive (irrigation and use of Dri-Water and individual plant protections).

Results

Native vegetation along the creeks has increased dramatically, particularly where willows and other riparian plantings to add diversity were installed. Where shrubs were essentially absent in the past, mid-story vegetation made up of willows, elderberry, and coffee berry has done well. Oak and bay trees dominate the upper story vegetation at the site and these species have rebounded with less impact to their trunks and lower branches and more seedling recruitment. The native grass *Elymus triticoides* has rebounded such that after 4–5 years it dominates the upland grasslands within the exclosed areas. Noticeable increase in bird nesting has occurred with ground-nesting birds, raptors in tall trees, and mid-canopy nesters.

Task Checklist

Design the project

- ☐ Contact land owner to discuss restoration work
- ☐ Create a team of experts that include but are not limited to; land owner, livestock manager, environmental consultant, local RCD and/or NRCS staff, contractor……
- ☐ Describe objectives and purpose of restoration work
- ☐ Define grazing regime for restoration
- ☐ Define adaptive management strategy
- ☐ Design fencing to accommodate soil type and wildlife interaction
- ☐ Identify potential alternative water source
- ☐ Identify locations for stream crossings
- ☐ Identify locations for needed gates
- ☐ Account for machine access
- ☐ Create work plan
- ☐ Contact regulatory agency to understand regulations associated with practice
- ☐ Contract with sub-contractors

Analyze the site

- ☐ Conduct soil assessment
- ☐ Conduct biological survey
- ☐ Conduct hydrology study
- ☐

Prepare site for the installation of fencing

- ☐ Clear site of brush
- ☐ Dig holes
- ☐ Install fencing and gates
- ☐ Install or connect to alternative water source
- ☐ Plant native plants in riparian areas
- ☐

Maintenance the first year

- ☐ Remove debris
- ☐ Replant where necessary
- ☐ Mow around fence line if needed

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