UNITED STATES DEPARTMENT OF AGRICULTURE

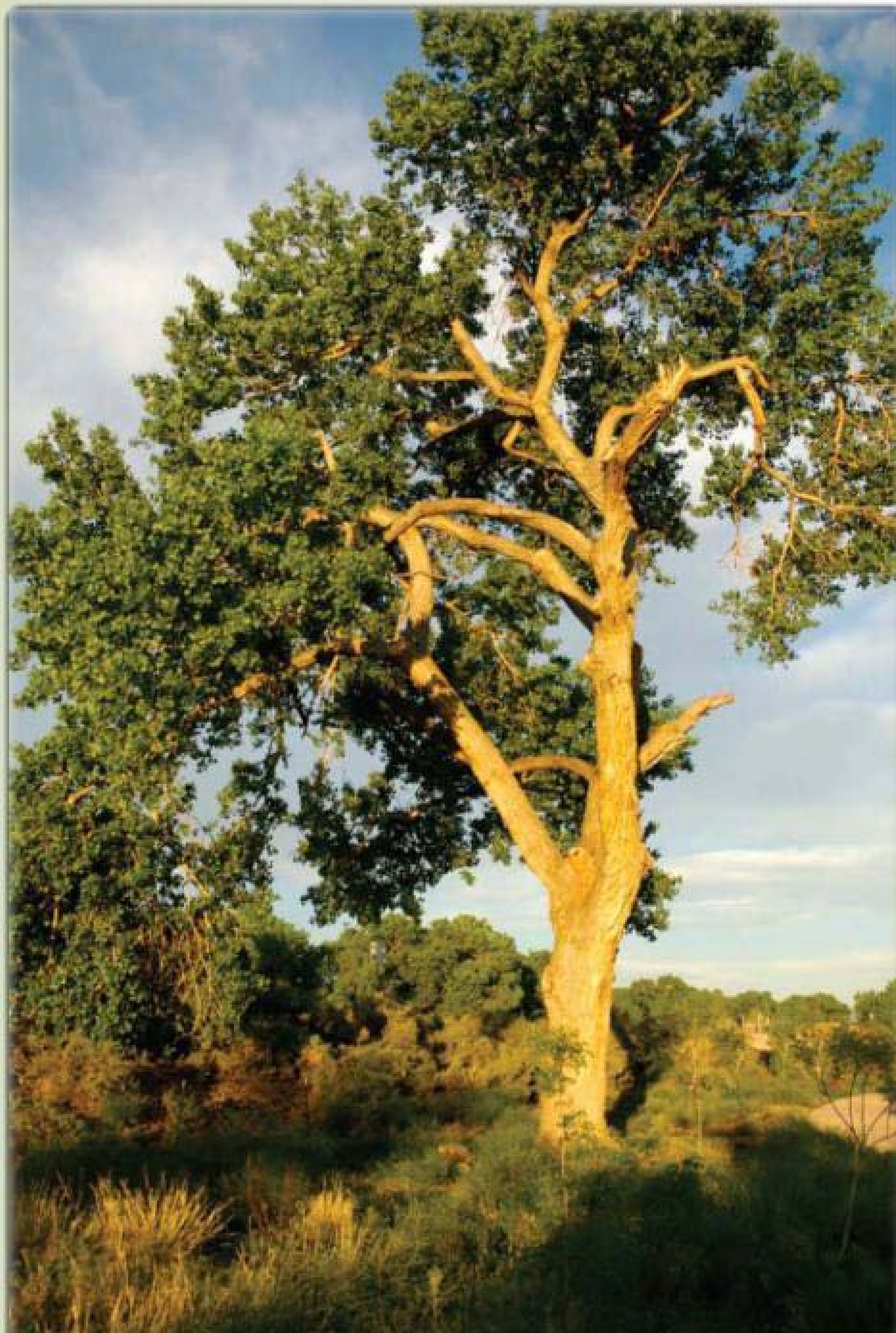
A Guide for Planning Riparian Treatments in New Mexico

United States Department of Agriculture

New Mexico Natural Resources Conservation Service

New Mexico Association of Conservation Districts

NRCS Los Lunas Plant Materials Center



September 2007

I. FOREWORD

This guide has been prepared by the USDA New Mexico Natural Resources Conservation Service and the New Mexico Association of Conservation Districts, through funding for the restoration of riparian and watershed areas in the Pecos and Rio Grande Watersheds. The experiences of NRCS staff and Soil and Water Conservation Districts staff are reflected in the guide.

UNITES STATE DEPARTMENT OF AGRICULTURE

II. TABLE OF CONTENTS

III. INTRODUCTION

A Guide for Planning Riparian Treatments in New Mexico has been developed as a guide for those conservationists who will be providing both planning, and design assistance in treating riparian areas. The guide recognizes that in New Mexico, some stream channels have incised to an extent where riparian areas are now upland sites.

IV. INVENTORY, ANALYSIS, AND DESIGN

STEP 1 – OBJECTIVE

This first step in the process of restoring riparian areas provides the basis for the planning and design effort. The objective of the land user is the key component for success. Some items to consider in developing the objective include:

- What is the landowner's vision for the site?
- What is the site's potential?
- Will access be limited?
- Will there be access for recreation?
- Will there be a grazing of the area and to what intensity?
- Will the area be returned to its natural condition?

STEP 2 – OBTAINING THE RESOURCE DATA ON THE SITE

a. **LOCATE THE SITE** – Use of aerial photography and USGS quad sheets aid in location of the site and serve as a planning tool. These tools aid in determining the acreage, as well as the shape of the riparian area. Using these tools, the distance to water, other wildlife cover, and sources of wildlife food, can be determined. The quad sheets show elevation and aid in locating various plantings that depend on groundwater. The elevation information can aid in locating the spacing between structures in a stream. References 4 and 6, in Section VI, provide Web locations for obtaining information. Some of the key features to consider in locating the site are:

   a. **Land ownership** – Land ownership consists of Federal, state, local, tribal government and Private. Access and permission to carry out the restoration work with the landowner and the land manager is important. The landowner and operator is the key to success of any restoration. Their involvement at all levels, including site selection, planning of species, installation of the project, and maintenance and monitoring helps them to understand their role in the restoration process. They generally will be able to observe the site on a regular basis and may have the equipment or other resources available to do some of the restoration and maintenance required.

   b. **Utility corridor** – Look for evidence of overhead and buried power lines, oil and gas lines, telephone lines, canals, acequias, and drainage ditches. These features can restrict access for heavy equipment used in invasive vegetation clearing and revegetation. For example, avoid planting large trees immediately below overhead power lines. These trees may need to be trimmed or removed at a later date to avoid interfering with the power lines.

   c. **Streams and flood control structures** – Major flood control structures, such as dikes, or dams, are hydrologic modifiers which affect the natural flow regime and will influence the project design. These types of large structures generally cannot be altered or removed to have less impact on the riparian area. It is important to know how operation of these structures affects the riparian area. An irrigation diversion dam may remove or change the timing, volume, and/or duration of water available to the area. In such cases, different plants may need to be used or supplemental water provided. It may be possible to work with the operator of the dam to release some temporary flows to provide the needed water for the riparian plants.

   d. **Site Modifications** Look for channel modifications or relocations. There may be areas of human disturbance or alteration including waste disposal, concrete or car bodies. These inappropriate treatments do not stabilize streambanks in an environmentally sensitive way. The channel treatments may cause a channel to be unstable, with active channel erosion or bank erosion. These areas could destroy a riparian treatment if not avoided or stabilized as part of the restoration. Dumping of waste products can make restoration more difficult by being unable to plant trees to the appropriate depth or having negative effect on the water quality that the plants may not tolerate.

e. **Public access** – The landowner/operator has the final say on public access. When the public is allowed access, it may be wise to plan for trails and trash containers to reduce the impact on the site. An educational experience can be provided by use of signs to identify plants and other features in the riparian area. More monitoring of the area and maintenance of the plants and structures may be needed compared to no access areas. The landowner/operator should consider increased liability exposure and work with their insurance advisor.

f. **Rules and Regulations** – Compliance with environmental laws including National Environmental Policy Act (NEPA), Endangered Species Act (ESA), and the Clean Water Act particularly Sections 404 and 401, may be necessary. Cultural Resource review will be needed, depending on the type of ground disturbance that will be involved. Water rights may be required for some restoration activities. For information on these aspects, see (Reference # 20) http://www.nm.nrcs.usda.gov/technical/fotg/section-1/references.html.

2. **SOILS MAP AND INTERPRETATIONS** – Soils information of the area is critical to the success of the restoration project. Soil maps and interpretations can be found on the USDA Web Soil Survey site (Reference #33) http:// websoilsurvey.nrcs.usda.gov/app/. An on-site review by a soil scientist may be helpful in obtaining more specific soils information. Soil tests may also be needed. Some of the soils factors to consider are as follows:

a. **Texture** – Soil texture will significantly affect the type of plant community and species which are appropriate for a site. Extremes of soil texture can drastically influence the planting of containerized and pole stock as well as direct seeding. Rocky and cobbly soils can make auguring holes to the groundwater difficult or impossible. Dry sand and/or gravel layers can collapse into augered holes preventing pole placement into groundwater. Soils with high clay or silt content may not be favorable for the growth of many riparian trees and shrubs. If shallow groundwater is present on such sites, they are probably wet meadow environments. If grasses and forbs are direct seeded, soil texture can have a considerable effect on the selection of appropriate species.

b. **Salinity** – Soil salinity has a profound influence on what plant species are adapted to a site. The interactions among soil salt content, texture, groundwater depth and fluctuation, drainage potential, and flooding will determine the salinity types and values affecting the site. Soluble salts measured as electro-conductivity only reflect the total salts and not which ions are contributing to salinity. Some ions (sodium, chloride) are more toxic than others (calcium, sulfate); their relative composition can be determined by soil testing. In addition to the toxic effects, high levels of soluble salts result in high osmotic potentials. This increases the soil water potential and results in less water available to plants. Common New Mexico native riparian grasses that can tolerate high salts include; inland salt grass, alkali muhly, galleta, and alkali sacaton; common shrubs include screwbean mesquite, wolfberry, and willow baccharis. More salt-tolerant plants can be found at: (Reference # 18) http://plants.usda. gov/.

3. **CLIMATE**– Climate information can be found at the USDA National Water and Climate Center web site (Reference #31) http://www.wcc.nrcs. usda.gov/cgibin/state.pl?state=nm. Information on temperature, precipitation, frost-free days, and length of growing season are available for selecting adapted plant species. This information also helps to determine the appropriate time of planting for best survival. Site specific climate information should be researched with local governmental offices and the local community.

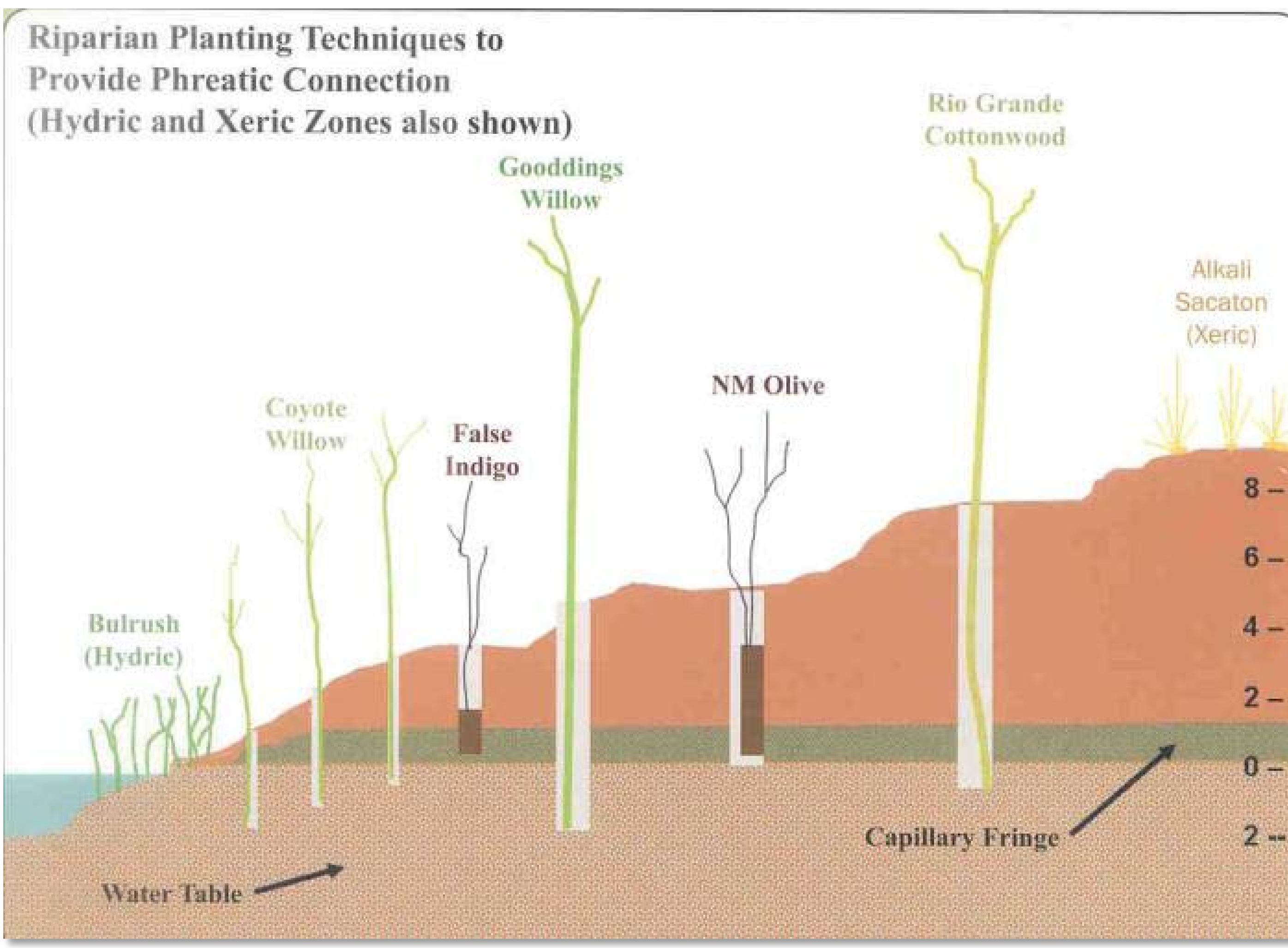
4. **HYDROLOGY** – Southwest stream hydrology is complex with highly variable localized conditions. High intensity, short duration storms are common. Planning for these types of storms is critical. Monitoring of the sites after a storm will identify maintenance needs so that repairs can be completed as required.

a. **Flooding** – Flooding is a critical component to the natural hydrology and is essential for the natural recruitment of native riparian vegetation in the desert regions of the Southwest. Flooding may occur from off-site drainage or from localized storms. Flooding provides the supplemental moisture and sediments required to establish new riparian phreatophytic plants.

b. **Depth to Groundwater** – Depth to groundwater is a critical element for the success of riparian plant species. Seepage from the bank of a river, stream, pond or lake provides a localized shallow groundwater table. Riparian plants depend on this water in the desert regions to sustain survival. When planting riparian plant species, including cuttings or rooted containerized plant materials, they must be planted in the capillary fringe (where there is both oxygen and water) or in the water table proper. Generally, this requires that the groundwater depth is less than 8 feet with standard auguring equipment. Guidelines for *Planting Longstem Transplants for Riparian Restoration in the Southwest* can be found at the following site: (Reference #15) http://www.nm.nrcs.usda.gov/news/publications/ deep-planting.pdf . (See Figure 1 for proper riparian planting depths).

c. **Drought** – Drought can adversely and significantly affect the volume and duration of stream flow. Extended drought can kill riparian vegetation including any recent plantings which seem to be more sensitive because of the less extensive root systems. Current moisture conditions at the site need to be considered, including recent rainfall and soil moisture levels. Information on drought conditions can be obtained from the US Drought Monitor. (Reference #38) http://drought.unl.edu/dm/monitor.html

Figure 1 – Proper Riparian Planting Depths



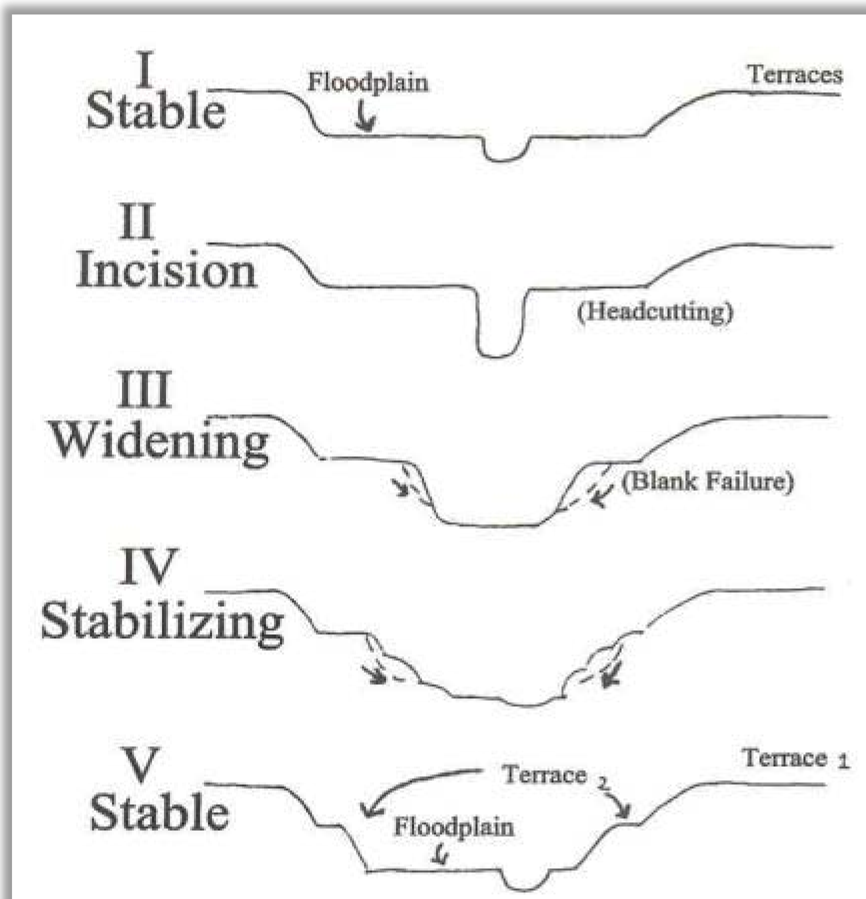
5. CHANNEL CONDITION – Each reach of the proposed treatment site must be carefully and properly evaluated to determine the current conditions found at the site and any discernible limitations that exist. Dave Rosgen developed a classification scheme to describe channel morphology in his publication, *Applied River Morphology*, 1986. Another classification scheme for assessment is *Incised Channels*, *Morphology, Dynamics and Control*, 1984, by S.A. Schumm, M.D. Harvey, and C.C. Watson. (Reference #10) http://www.nm.nrcs.usda.gov/technical/tech-notes/bio.html (See Figure 2).
This scheme stresses that vegetative treatment will not be successful in areas where the streambank has not reached a stable alignment.

6. **PLANTS PRESENT AND POTENTIAL** – Ecological Site Descriptions based on region, soils, and topography can prove useful in determining the plant community that is typically present on sites. Other sources which describe typical riparian plant communities include the *NM Natural Heritage Program's Handbook of Wetland Vegetation Communities* (Reference #2) http://nhnm.unm.edu/vlibrary/pubs_archive/nhnm/nonsensitive/U00MUL01NMUS.pdf and "*New Mexico Vegetation: Past, Present, and Future*" by Dick-Peddie, 1993, (Chapter 9, especially Tables 9.1 and 9.2). Relic plant communities can provide insight into species composition, canopy closure, plant density, and spatial relationships.

   a. **Existing plant community** – An on-site assessment of the existing plant community before revegetation proceeds is essential to determine if noxious weeds are present that require control. Such weeds can range from New Mexico noxious woody species such as saltcedar and Russian olive to invasive annuals such as kochia which can severely inhibit planting success. The age structure and species diversity of the native plant community will help to determine whether natural regeneration is occurring and if revegetation is required.

   b. **Potential plant community** – After the soils, climatic, and hydrologic data as outline above have been compiled and after the existing plant community has been defined, it may be possible to identify the potential plant community based on site potential and capability. The resources described above will help in the selection of appropriate grass, forb, shrub and tree species. Additional information regarding specific species may be required. Two comprehensive sources are the USDA Plants Database (Reference #18) http://plants.usda.gov/ and the Fire Effects Information System (Reference #7) http://www.fs.fed.us/database/feis.

Figure 2: Channel Evolution (Harvey, 1978)



7. **WILDLIFE HABITAT** – Habitat structure is at least as important as the plant species composition. An example would be that the Southwestern willow flycatcher has been known to nest in saltcedar, Russian olive, Baccharis spp., willow spp., and other species. These species provide similar habitat structure which conceals nest sites from nest parasites such as brown headed cowbirds. Habitat restoration requires more than the establishment of the suite of species known to occur at a given site. Spatial relationships, patchiness, canopy closure, understory, and plant density are all important factors when restoring wildlife habitat.

   The United States Fish and Wildlife Service need to be consulted when restoration activities may affect threatened and endangered species and their habitats. Information on the distribution of wildlife and their habitats is available online at the following sites

a. **Native wildlife** – (Reference #1) http://nmnhp.unm.edu/bisonm-m.org

b. **Threatened and Endangered (T & E) Species Present** – (Reference #5) http://www.fws.gov/southwest/es/EndangeredSpecies/lists/

c. **Analyzing** – Additional tools for analyzing riparian wildlife habitat can be found in Section II of the NM NRCS Field Office Technical Guide (FOTG): (Reference #34) http://www.nm.nrcs.usda.gov/technical/fotg/section-w/whegs.html

8. **WILDLIFE DEPREDATION** – The potential impacts of browsing and grazing wildlife should be considered during planning.

   Tree guards may be required to prevent rodent damage. Mesh wire may be needed to stop beaver gnawing. Browsing by wintering elk can cause plantings to fail. Contact the New Mexico Game and Fish Department to explore options for reducing elk damage. (Reference #3) http://www.wildlife.state.nm.us/

STEP 3 – ANALYZE THE CONDITION OF THE RIPARIAN AREA

Determining the condition, potential, and sources of impairment of the riparian area is a vital step in planning an appropriate restoration project. In this step, the needs of the site are determined. This guide uses the New Mexico Visual Riparian Assessment Tool. Other available tools are listed in the Appendix.

The factors considered in the Visual Riparian Assessment Tool are described below. Use the complete Technical Note to score the site, which assesses the current condition at the site. A scoring sheet is included in the Appendix. Many assessment methods are available. See USDA NRCS Watershed Science Institute Technical Report Stream Corridor Inventory and Assessment Techniques as a guide to which techniques to use in various settings. (Reference #32) ftp://ftp-fc.sc.egov.usda.gov/WSI/pdffiles/ Stream_Corridor_Inventory_Techniques.pdf

1. HYDROLOGICAL FACTORS

Hydrologic Alteration – Streams function to move sediment and water down gradient. Alterations to the hydrologic regime, channel morphology, and watershed condition all affect the ability of the stream to perform its intended functions. Hydrologic alterations such as dams, levees, berms, channel straightening, and rip-rap adversely affect the ability of the stream to distribute energy and material. Functioning streams must have access to their natural floodplains in order to distribute excess sediment and energy in support of sustainable riparian ecosystems.

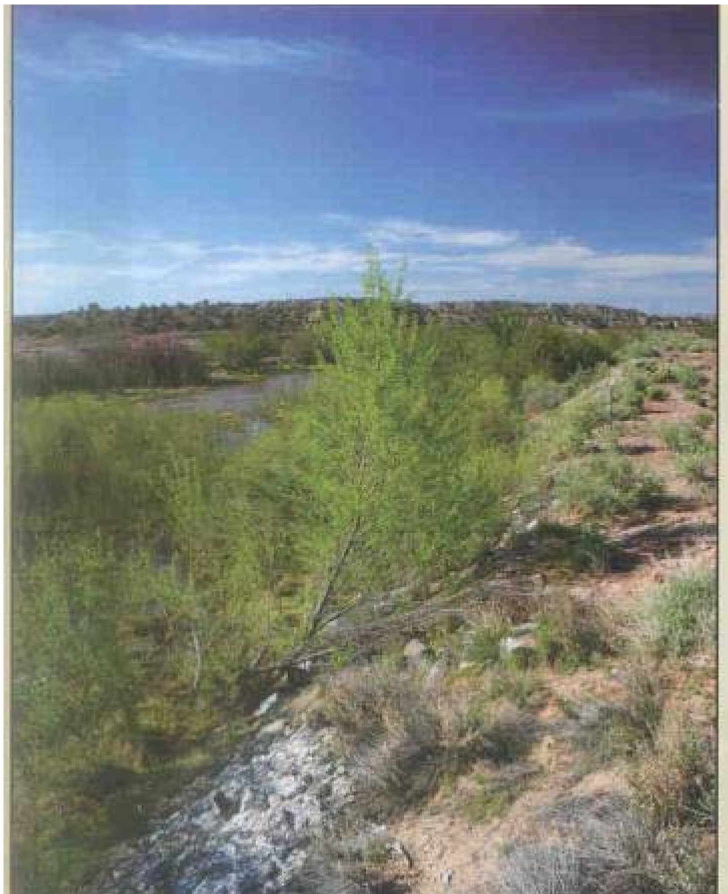


Photo 1 – Levee restricting the flood plain width, Jemez River, Sandoval County

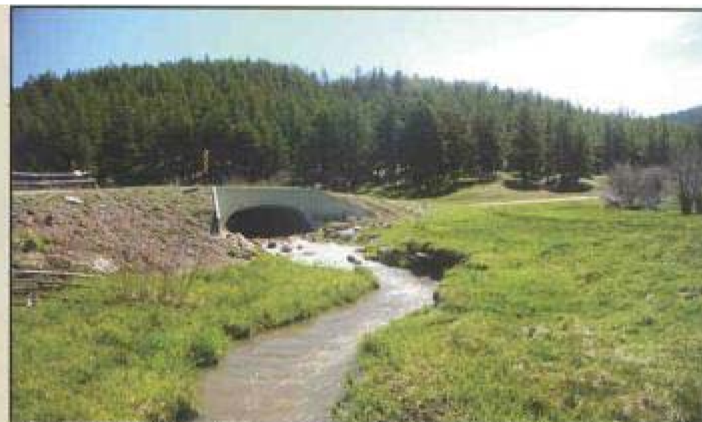


Photo 2 – Rio Guadalupe Bridge Crossing with associated armoring which reduces meandering and increases bank erosion, Sandoval County

Photo 3 – No hydrologic alternations, Rio Chama, Rio Arriba County

Channel Condition – Channels that are stable are in balance with their landscape position. Channel form is dependent on gradient, substrate size, and watershed discharge. Depending on stream type, a healthy channel has a characteristic width depth ratio, access to its floodplain, and incisement ratio.

Photo 4 – Incised channel with unstable banks, Cottonwood Creek, McKinley County

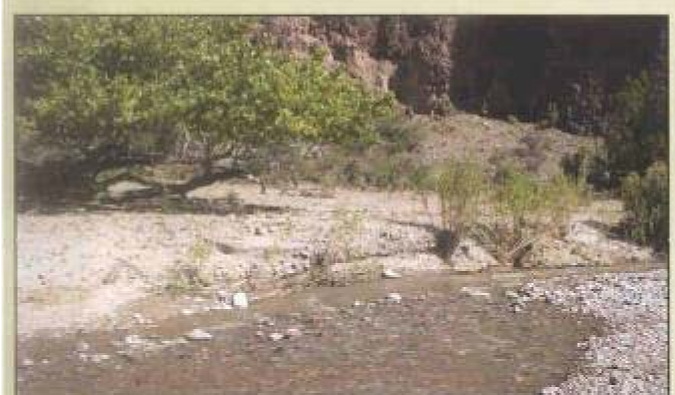


Photo 5 – Poor width to depth ratio, wide and shallow channel resulting in poor sediment transport capacity, Alamosa Creek, Sierra County

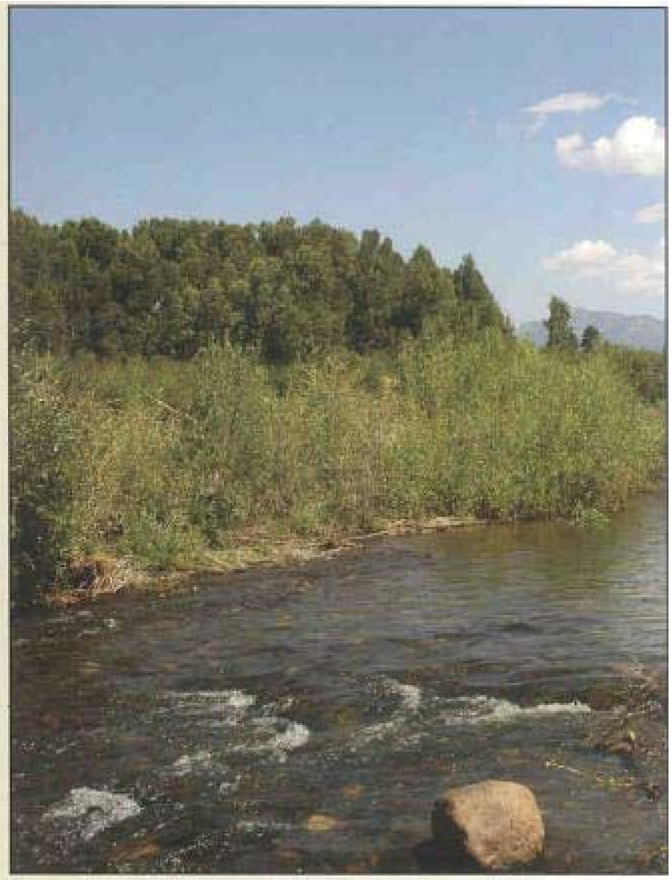


Photo 6 – Healthy channel, Rio Chama, Rio Arriba County

Bank Stability – Stable banks assist in maintaining stream form and function in appropriate channel types and geomorphic settings.

Photo 7 – Unstable bank, Rio de las Vacas, Sandoval County

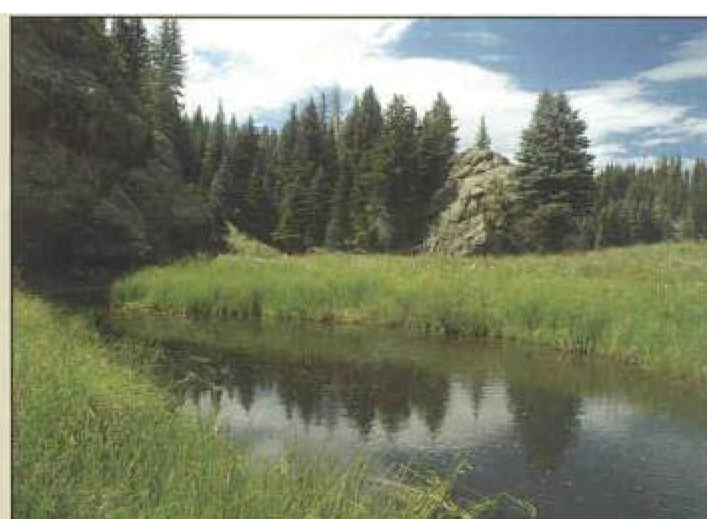


Photo 8 – Stable bank, East Fork of Jemez River, Sandoval County

Riparian Zone Width – A healthy riparian zone will widen until it reaches the maximum extent possible. The widening can be inward (as the stream channel narrows), outward (towards the adjacent uplands), or both. The maximum extent is limited by topography, geology, soil type, and hydro factors.

Photo 9 – Inadequate riparian zone width, Taylor Creek, Catron County

Photo 10 – Riparian area widening inward, channel narrowing, Taylor Creek, Catron County

Active or Stable Beaver Dams – Presence of active beaver dams modifies stream velocity, gradient, and sediment load. Abandoned beaver dams can adversely affect the stream condition. Some detrimental factors include sediment flush and headcutting. A pair of beavers required 16 acres of riparian vegetation to survive.

Photo 11 – Mora River, Mora County

Photo 12 – Rio Guadalupe, Sandoval County

2. SOILS – EROSION AND DEPOSITION FACTORS

Soil Characteristics/Rooting Medium – Soil type and water holding potential are critical factors in determining the sites potential.

Photo 13 – Poor rooting medium due to erosion of channel and flood plain materials, Harding County

Photo 14 – Adequate rooting medium, Ute Creek, Harding County

Exposed or Bare Ground – Riparian vegetation acts as a ground cover to reduce erosion, insulate the soil, provide cover and habitat, and it provides a sediment filter during flow events.

Photo 15 – Greater than 50% bare ground, Union County

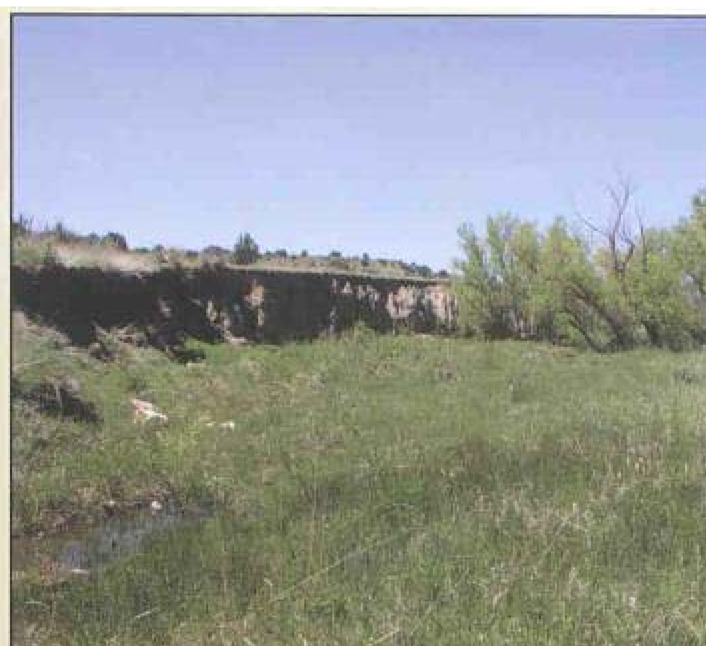


Photo 16 – 10% to 20% bare ground, Harding County

Topographic Variance or Surface Expression on Floodplain – Micro-topography increases surface roughness to dissipate energy and collect new sediment.

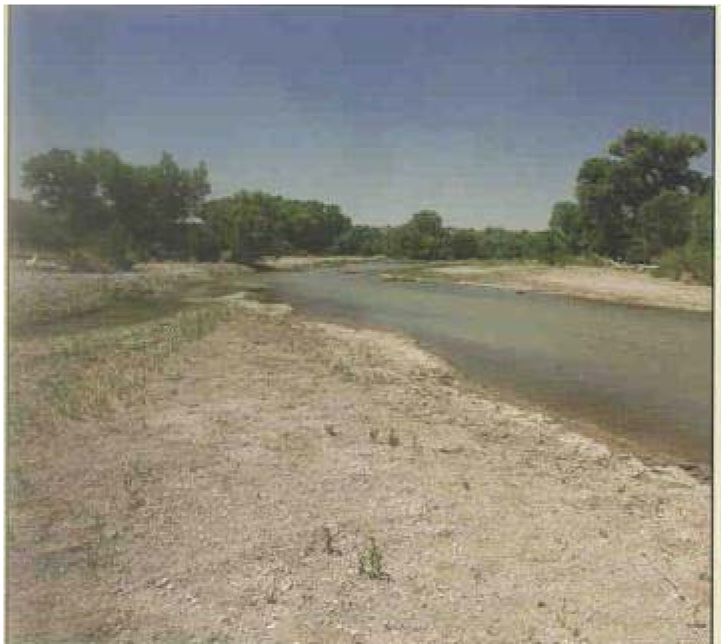


Photo 17 – Little micro-topographic variation, Gila River, Grant County

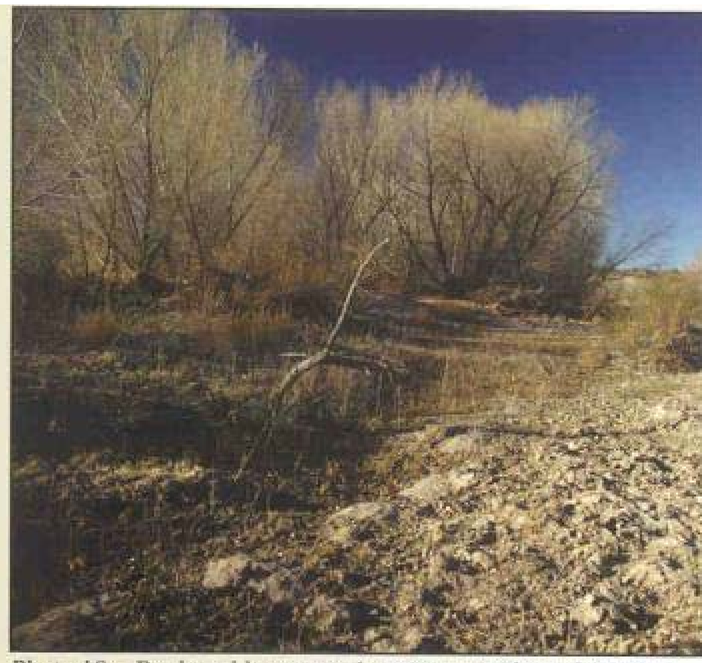


Photo 18 – Rock and large wood present, creating micro-topographic variation, Gila River, Grant County

Streambank Rock Armoring – Natural rock armor can lessen streambank erosion. Not all stream types and settings have rock armor. In some stream types, bank stability is provided exclusively by vegetation.

Photo 19 – No rock armor increases the opportunity for channel and bank erosion, Cottonwood Creek, McKinley County

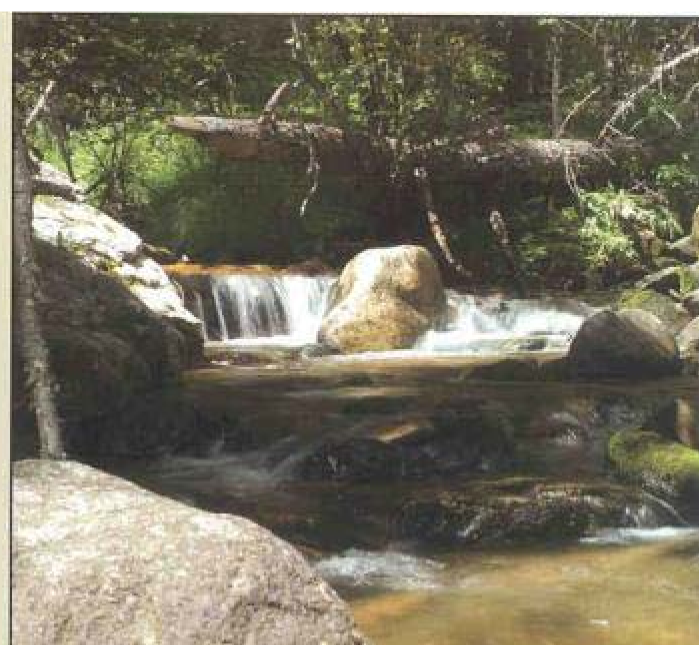


Photo 20 – Well armored, stable channel and banks, Holy Ghost Creek, San Miguel County

3. VEGETATION FACTORS

Point Bar Revegetation – Point bars are indicative of a stream with a balanced channel width. New vegetation should begin to grow on newly deposited substrate.

Photo 21 - Unstable point bars lead to unstable channels, Cottonwood Creek, McKinley County

Photo 22 - Stable point bars are indicative of healthy channel width and function, Rio Guadalupe, Sandoval County

Diverse Age Class Distribution of Trees – On stream types where trees are part of the natural community, age diversity is indicative of riparian health and stability.

Photo 23 - Even aged riparian trees lacking saplings and seedlings indicating a lack of reproduction, Penasco River, Otero County

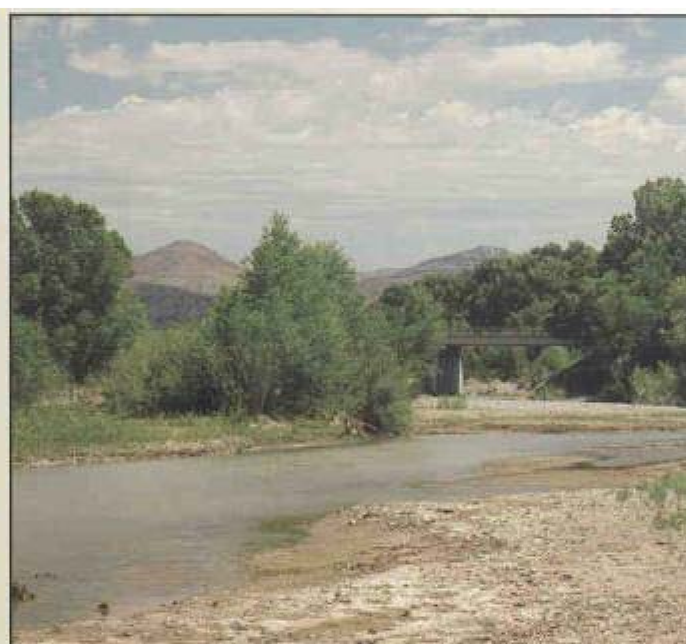


Photo 24 - Multi-aged, diverse species occupy healthy riparian corridors, Gila River, Grant County

<u>Diverse Age Class Distribution of Shrubs</u> – On stream types where shrubs are part of the natural community, age diversity is indicative of riparian health and stability.

Photo 25 – Decadent willows, no seedlings or saplings, Rio Guadalupe, Sandoval County

Photo 26 – Diverse age class and species composition, Sawyer Creek, McKinley County

<u>Total Ground Cover of Grasses and Forbs</u> – Vegetation reduces the affects of erosion and captures sediments during overbank events**.**

Photo 27 – Less than 50% groundcover, Cottonwood Creek, McKinley County

Photo 28 – 75% to 95% groundcover Bluewater Creek, Cibola County

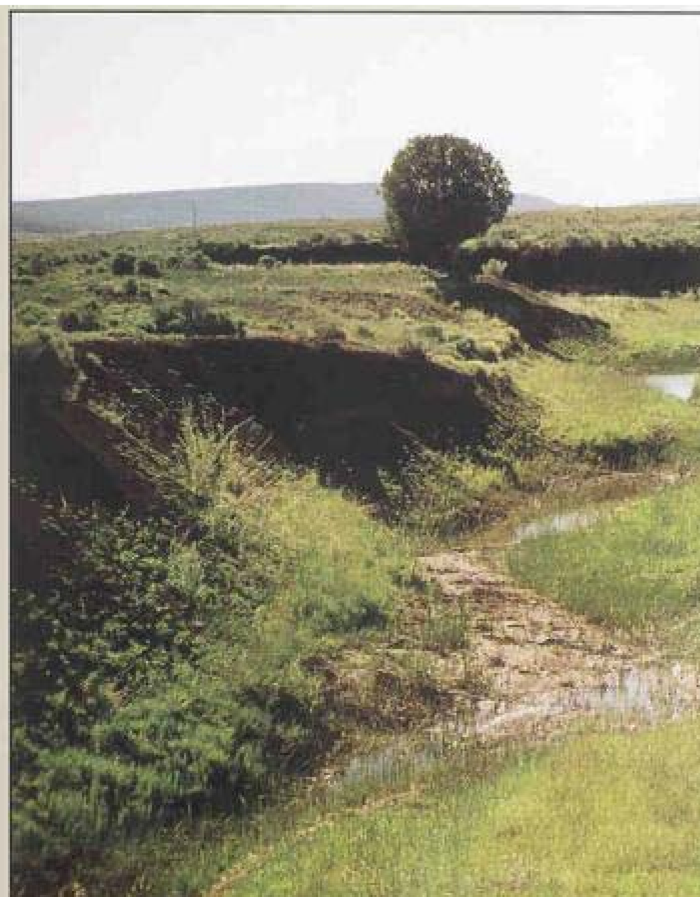


Photo 29 – 50% to 75% groundcover, Cottonwood Creek, McKinley County

Bank Stability – Stable banks result in less sedimentation and can be better protected with vegetation.

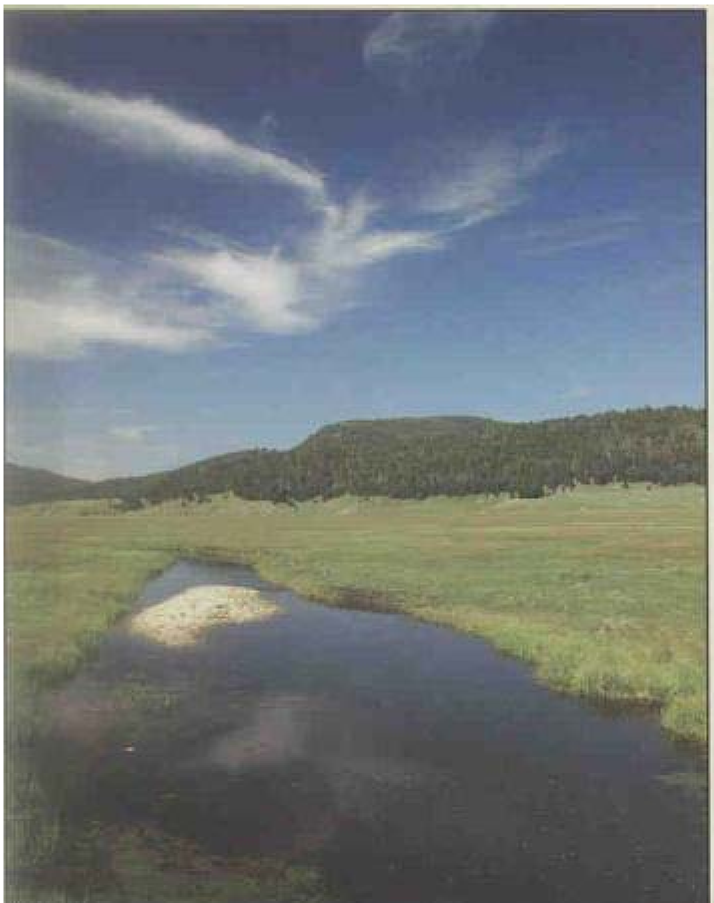


Photo 30 – Greater than 95% coverage, East Fork Jemez River, Sandoval County

Photo 31 - 50% to 75% coverage, Burro Cienega, Grant County

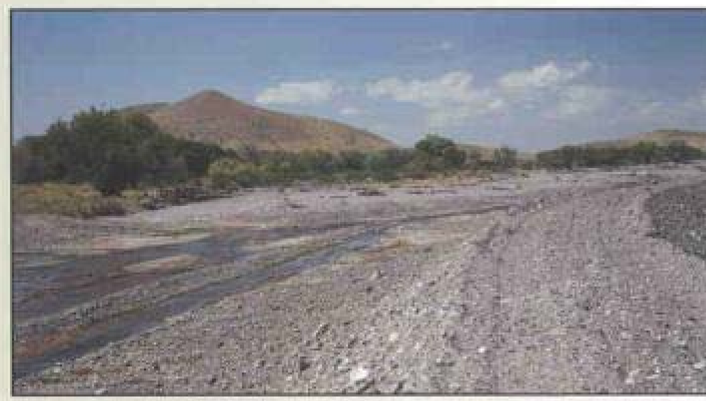


Photo 32 – Less than 50% coverage, Mimbres River, Grant County

Percent of the Streambank with a Deep, Binding Root Mass – Riparian species with high root densities lead to greater bank stability**.**

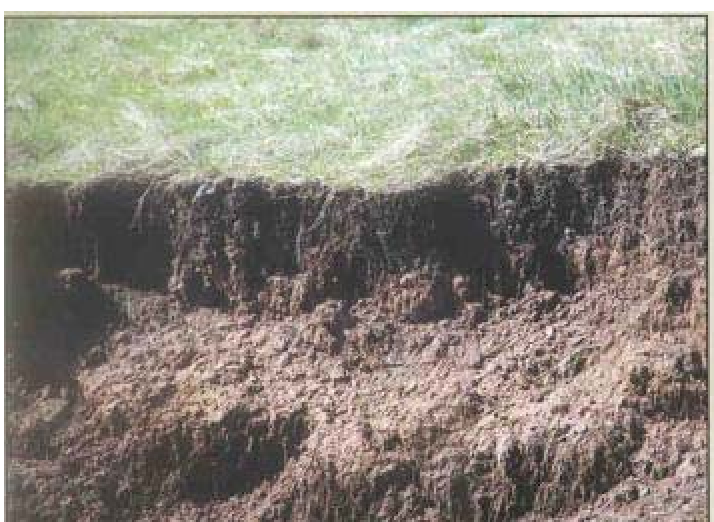


Photo 33 – Less than 25% of the bank with deep binding root mass (pasture grasses), Rio Guadalupe, Sandoval County

Photo 34 – Greater than 75% of the bank with a deep binding root mass (sedges), Cottonwood Creek, McKinley County

Total Area Occupied by Undesirable Herbaceous and Woody Species – Non-native invasive species degrade the condition of the riparian corridor.


Photo 35 - Russian knapweed, Sawyer Creek, McKinley County


Photo 36 - Saltcedar, Jemez River, Sandoval County

STEP 4. DESIGN CONSIDERATIONS

Bioengineering is the practice of restoring stream channels using natural materials to aid in the stabilization process. This includes both vegetative and structural treatments. *Stream Corridor Restoration, Principles, Processes and Practices, Federal Interagency Working Group*, 1998, is an excellent reference. This Publication may be ordered at: (Reference 35) http://www.ntis.gov/products/bestsellers/stream-corridor.asp?loc=4-2-0. Additional assistance is provided by specialists at the Natural Resources Conservation Service.

1. **CONTROL OF INVASIVE WOODY SPECIES AND SUBSEQUENT HERBACEOUS WEEDS** – Detailed information on invasive woody species control can be found at (Reference #9) http://www.invasivespeciesinfo.gov/docs/toolkit/ltmgmtofexotictrees.pdf and (Reference #20) http://www.nm.nrcs.usda.gov/technical/fotg/section-1/references.html

   a. **Treatment options** for woody invasives include: aerial herbicide spraying, foliar herbicide spraying, cut stump herbicide spraying, and crown fire, pulverize with a grinder, cut and chip, leave standing, and biological control. A follow-up control treatment for woody invasives is often critical for a minimum of five years after the initial control treatment. A foliar herbicide spraying is often used.

   b. **Before planting** or direct seeding it is necessary to control dense stands of herbaceous weeds (i.e., kochia or Russian thistle) because of the competition for soil moisture and sunlight. Control needs to occur before these weeds are able to set seed which will contribute to the soil seed bank. Treatment options include herbicide application, mowing, burning, and grazing. Disturbance of the soil surface during control treatments and planting should be minimized to limit germination of weed seed already in soil.

2. **STREAMBANK STABILIZATION** – On some projects stabilizing of the streambanks is important. This might be accomplished through vegetation plantings or mechanical means using rocks and wire, etc. The right design is critical to ensure success. In many cases, a specialist is needed who has had experience in similar projects. Note the design information in the following references: USDA NRCS New Mexico Streambank and Shoreline Stabilization Practice Standard and Specification

   a. (Reference #27) http://efotg.nrcs.usda.gov/references/public/NM/580.pdf

   b. (Reference #26) http://efotg.nrcs.usda.gov/references/public/NM/580fspec.doc

   c. (Reference #25) http://efotg.nrcs.usda.gov/references/public/NM/580rspec.doc

   d. (Reference #28) http://efotg.nrcs.usda.gov/references/public/NM/580wspec.doc

e. *Stream Corridor Restoration Principles, Processes, and Practices*, The Federal Interagency Stream Restoration Working Group, 1998. (Reference #35) ***http://www.ntis.gov/products/ bestsellers/stream-corridor.asp?loc=4-2-0***

3. **CHANNEL STABILIZATION** – Similar to streambank stabilization, a stable channel is important. There are numerous methods to accomplish this, from increasing sinuosity, to drop structures. Channel dynamics are very complex and take someone with training and experience to be successful. (Reference #23) http://efotg.nrcs.usda.gov/references/public/NM/584.pdf

4. **FUTURE LAND USE** – The restored plant community may include fire breaks designed around structures, open areas to allow equipment access, low plant density to reduced fuel load in areas prone to fire, enhancement of wildlife habitat, or improved grazing and browsing for livestock.

5. **MANAGEMENT OF LIVESTOCK AND WILDLIFE USE** – Grazing and browsing should be deferred particularly during the first three years of initial establishment when the plants are most vulnerable. Afterwards grazing must be managed so the restored ecosystem will be sustainable. Riparian Area Management (TR 1737-20), *Grazing Management Processes and Strategies for Riparian - Wetland Areas*, 2006 (Reference #37) http://www.blm.gov/nstc/library/ techref.htm and Prescribed Grazing Standard (Reference #39) http://efotg.nrcs.usda.gov/references/public/NM/528.pdf

6. **PLANTING RIPARIAN AREAS WITH SHALLOW WATER TABLES** –

   a. **Planting** – Planting of riparian species is not always required. Natural regeneration is possible where floodplain inundation occurs on a regular basis during high flow events. Native plant materials must be located in the area to provide a sufficient seed source. In some instances, invasive weeds need to be controlled in a fashion that does not damage the new native plants. Grazing strategies must be included to provide protection to seedlings and young woody vegetation.

   b. **Species selection** – The sources listed in the section on the existing and potential plant community can be used to determine appropriate species. The commercial availability of riparian species is limited. If species other than those commonly available are required, these species will have to be contract grown. If undisturbed riparian sites with similar soil and hydrologic conditions are present in the vicinity of the project, they can provide considerable information regarding appropriate species.

   c. **Connecting to ground water** – Most riparian species are phreatophytes denoting their use of groundwater as a water source. For phreatophytic plants to become established their roots need to extend to and proliferate in the capillary fringe above the water table. With natural regeneration capillary fringe. This can take years depending on the soil texture, depth to ground water, and the root growth rate. If the riparian area is located in an arid region and not flood prone, then a long-term commitment to irrigation will be required to establish seedlings with shallow rootballs.

   d. **Deep planting cutting and containerized stock –** A number of stock types can be deep planted to connect the plant roots to the capillary fringe. Dormant pole and whip cuttings of cottonwoods and willows installed with their stump ends into ground water produce adventitious roots in the capillary fringe; poles are typically planted where ground water is 3-to 8-feet in depth and whips where ground water is 1-to 3-feet in depth. Other tree and shrub species will require a different deep-planting approach. Pots with long root systems (e.g., 30 inches tallpots) can be planted with their roots in the capillary fringe if the water table is in the three to four foot range. Deeper water table depths (4-to 6-feet) may require planting longstem planting stock (stem lengths of 4-to 6-feet) which entails burying the root crown well below the ground surface and making sure the bottom of the root ball contacts capillary moisture. In situations where the capillary moisture could recede below the rootball or under drought conditions, a watering tube can be embedded alongside the root ball in the planting hole to allow water to be added that will provide a zone of moist soil from the root ball to the capillary fringe. Planting considerations have been summarized for poles (Reference #29) http://www.nm.nrcs.usda.gov/news/publications/ polecutting.pdf, whips (Reference #16) http:// www.nm.nrcs.usda.gov/news/publications/ dormant-willow-planting.pdf and long-stem stock (Reference #11) http://www.nm.nrcs.usda.gov/news/publications/deep-planting.pdf.

   e. **Direct seeding –** Direct seeding is generally appropriate for grasses and forbs as well as a few shrubs easily established from seed (e.g., four-wing saltbush). Riparian grasses and forbs which depend on capillary moisture can be established by direct seeding if sufficient precipitation has occurred pre- and post-seeding to allow root growth to the capillary fringe. In montane situations this may occur fairly often during summer monsoon or spring snow melt. In arid situations this precipitation pattern would be a rare event. On arid sites, upland species of grasses and forbs which can subsist on precipitation and not capillary moisture would be more likely to become established. Important factors influencing the success of direct seeding other than species selection include seedbed preparation, accurate depth control of seed placement, and application of mulch. Additional information about direct seeding can be found in (Reference #22) http://www.nm.nrcs.usda.gov/programs/pmc/symposium/riparianseeding-ws.pdf

7. **PLANTING OF FORMER RIPARIAN AREAS WITH DEEP WATER TABLES** – Former riparian areas that have experienced significant declining of the water table may no longer be suitable for planting of riparian species. These sites now experience no river flooding (they may still be subjected to over land flooding) and coupled with extreme water table depths cannot support most phreatophytic species. Plant communities established on these sites must subsist on precipitation and over land flooding similar to surrounding upland sites; however, their alluvial soils may retain characteristics resulting from its past status as a riparian area. Thus in lower elevation river valleys, silt and clay soils with appreciable salinity in the former river floodplain may be coupled with arid conditions making them extremely difficult to revegetate.

   a. **Species selection** – Species selection for these sites should generally be based on the surrounding upland or non-riparian bottomland plant communities having similar soil characteristics. If sites contain a variety of soil textures, seed mixes can be custom-made for different soil types if these areas can be delineated or a mix with greater diversity can be formulated with some species adapted for each distinct soil. Future land use will also help determine the appropriate species (e.g. grazing versus wildlife habitat).

   b. **Stock Planting** – Containerized stock planting in arid regions will require prolonged irrigation to allow for the growth of an extensive root system capable of sustaining the plant through droughts. Stock grown in deep containers has an advantage because roots can exploit deep soil moisture much sooner than a shallow containerized plant. Methods to ensure deep penetration of irrigation water are required to allow deep root growth. This moisture penetration can be accomplished by prolonged periods of drip irrigation, water basins capable of holding sufficient water to infiltrate below the rootball, or by applying water to the root zone using embedded watering tubes installed alongside the rootball in the planting hole. Surface water application can promote weed growth and will result in considerable water loss to evaporation; these limitations can often make watering tubes a more efficient means of irrigation. The application of starch-based hydrogels into watering tubes can reduce the frequency of irrigation. (Reference #30) http://efotg.nrcs.usda.gov/references/public/NM/612spec.pdf. In montane situations, some water application may be required if normal precipitation is lacking. With adequate precipitation, concern about excessive weed competition with small containerized stock is warranted.

   c. **Alternative approach to revegetation in arid environments** – Because of the meager and erratic nature of precipitation in desert environments, the success rates of direct seeding are low. The cost of installing and maintaining planted stock are so high that only small areas are feasible for revegetation. One alternative approach is to establish small seed-source islands of vegetation distributed throughout the disturbed area using intensive cultural practices. These vegetation islands will provide a long-term seed source to the surrounding soil seed bank allowing for establishment when the rare optimum precipitation pattern occurs.

8. **CRITERIA FOR WILDLIFE HABITAT** – Restoration of wildlife habitat should emulate the species composition, spatial relationships, and the structure of the natural plant community. Riparian plant communities express a patchiness that is a result of recruitment events. (See Figure 3) These recruitment events occur when the right flood event deposits fresh sediments on the floodplain and flood waters retreat at a rate that allows for plant establishment. This results in patches of habitat. Plants within a patch tend to be even-aged while the patches themselves are uneven-aged. This structure and patchiness should be emulated in the restoration plan. Use relic sites, wildlife species accounts, and the Wildlife Habitat Evaluation Guide (WHEG) (Reference #34) http://www.nm.nrcs.usda.gov/technical/fotg/section-2/whegs.html to determine the structure and spatial relationships of habitats.

9. **MAINTENANCE AND MONITORING** – Restoration projects need to be monitored closely for the first three years to identify maintenance needs of the plants and any structural practices. Items that need to be considered are:

   a. **Reprout of invasive species** – Invasive species are generally treated ahead of implementing restoration practices. This treatment needs to be monitored every 2-to3-months for the first few years and spot treated to ensure a complete treatment.

   b. **Occurrence of annual weeds** – Annual weeds generally flourish in areas disturbed while carrying out restoration. These weeds need to be treated either mechanically or with chemicals before becoming so large to over shadow the restoration project, and take valuable moisture. Monitoring should occur every 1-to 2-months, especially after rain shower.

c. **Water supply** – New plantings need to be monitored closely for the first 1-to 3-months for adequate moisture. There may be a need to provide water on a temporary basis for the roots to grow to the water table.

d. **Grazing by wildlife and domesticated animals** – The plans made for grazing need to be monitored closely in the first two years to determine impact on the restoration.

e. **Damage to structure from rainfall and runoff events** – Streams that have been restored with vegetation and/or structural practices need to be monitored after each significant rainfall and runoff event. Any damage needs to be repaired. Usually after 3-to 4-years the restoration practices become more entrenched and can withstand more significant runoff events.

f. **Replacement of vegetation** – Through the first two years, significant vegetation loss needs to be replaced to ensure a longterm effective. Some loss is normal and replacement of trees and other materials will need to be considered in the establishment year.

Figure 3 – Aerial photograph of the San Juan River illustrating riparian habitat occurring on the floodplain. Note the patchiness and spatial relationships of different habitat types resulting in a diversity of riparian wildlife.

V. PLANTING SCENARIOS

The planting methodologies utilized for all proceeding Planting Scenarios are described in (References 10, 13, 14, 16, 18, 19 and 26).

1. POND VEGETATION TREATMENT

Photo 37 – A Saltcedar/salt grass meadow in Hernandez, NM before a pond is excavated where the annual precipitation is about 11 inches.

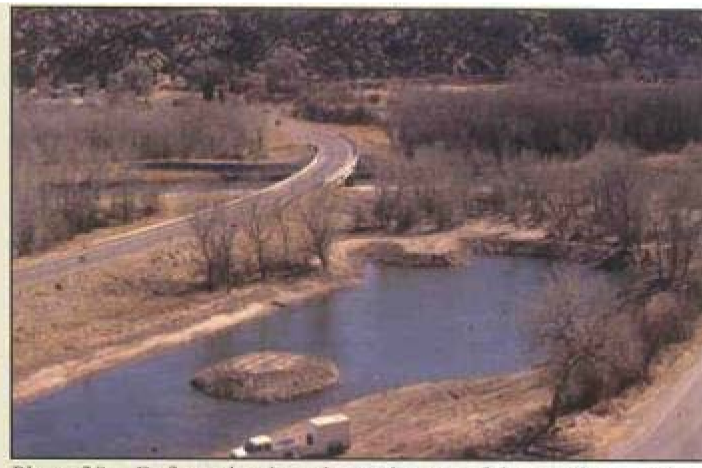


Photo 38 – Before planting, the perimeter of the pond was only vegetated on the south bank with mature cottonwood trees which where left untouched.

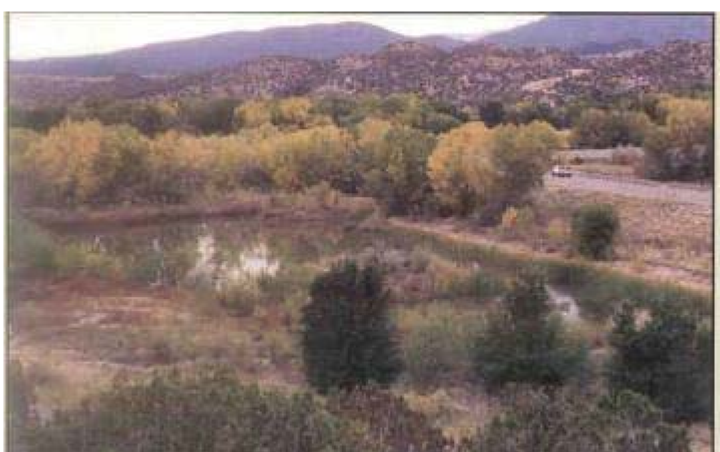


Photo 39 – The planting included: 2,000 wetland plants (bulrush, sedge, spike rush and rushes), 4,000 coyote willow, 500 cottonwood and black willow pole cuttings, and 200 longstem shrubs. Survival of the plant materials averaged about 70% after ten years. No supplemental water has been provided

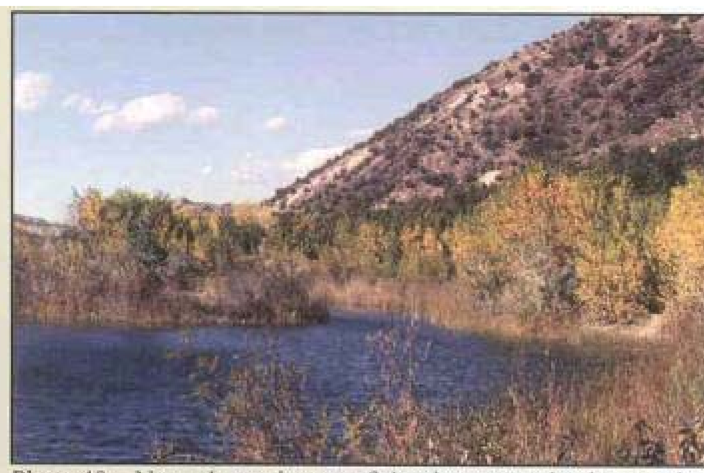


Photo 40 – Natural recruitment of riparian vegetation has continued to occur around the perimeter, in the capillary fringe of the pond.

Considerations: Survival of coyote willow and the wetland plants was initially reduced by the unexpected high water level of the pond during the first growing season. During May and June, for more than 50 days, these plants were inundated.

2. POND VEGETATION TREATMENT WITH GRASS SEEDING

Saltcedar, Russian olive, Siberian elm were mechanically removed from a pond bank in Belen, New Mexico, where the annual precipitation is less than 10 inches. The slope of the pond was reduced to control erosion.

Photo 41 – 125 long-stem transplants, and 50 cottonwood and black willow poles cuttings were planted in February.

Photo 42 – In July, the site was seeded by hand broadcasting and raking. A wood fiber hydro-mulch was sprayed over the planting after seeding. Plants were temporarily covered during the hydro-mulching activity to prevent them from being coated with the sticky mulch.

Photo 43 – By the end of the second growing season, transplants, pole cuttings, and grasses seem to be well established. The shrub and pole cuttings had a better than 80% survival with only one initial irrigation.

Photo 44 – By the fourth growing season, the vegetation seemed to be at a maturity stage where surface erosion may be controlled.

Considerations:

Successful grass seedings in the Southwest deserts require at least three to four consecutive rainstorms separated by four to seven days. Afterwards, monthly precipitation events will maintain the stand. Seedings should be scheduled to take advantage of the typical Southwest monsoon season, usually beginning in July. This will increase the germination and survival rates of the emerging grass.

3. RIVERBANK WILLOW TREATMENT ON SANDY SOILS

Photo 45 – Saltcedar and Russian olive were treated using the cut stump method with the chemical Triclopyr to control resprouting of the stumps on the San Juan River near Farmington, New Mexico. The annual precipitation averages less than 10 inches at this location.

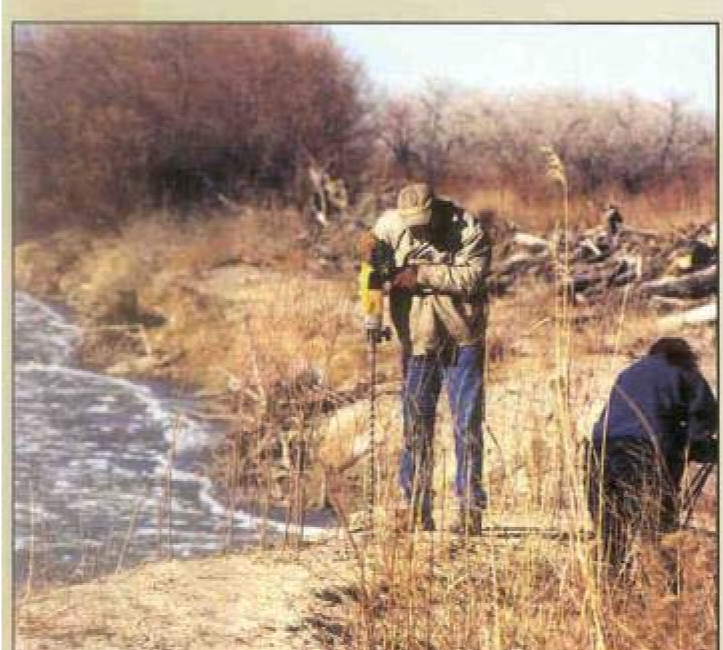


Photo 46 – The cut trees were piled in a windrow on the second terrace from the river to reduce the bank erosion if extreme spring overbank flooding occurs. In its place, 5,000 coyote willow cuttings were planted to groundwater depth on this one-fourth mile reach of river bank.

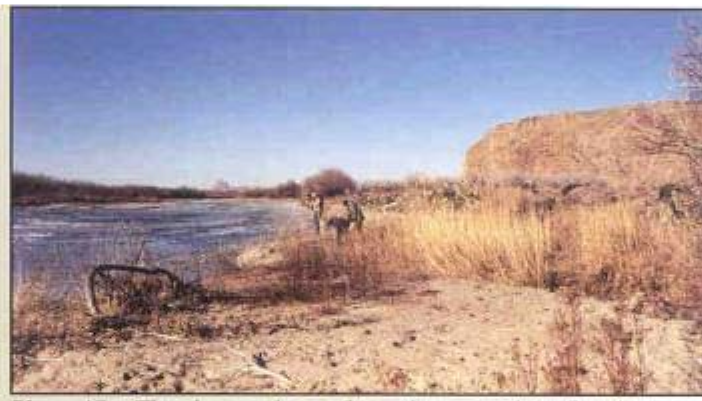


Photo 47 – The site was bare of woody vegetation after the treatment of the exotic tree species.

Photo 48 – The willows seem to be well rooted, and subsequently established by the conclusion of the first growing season. No supplemental water has been provided to the willows.

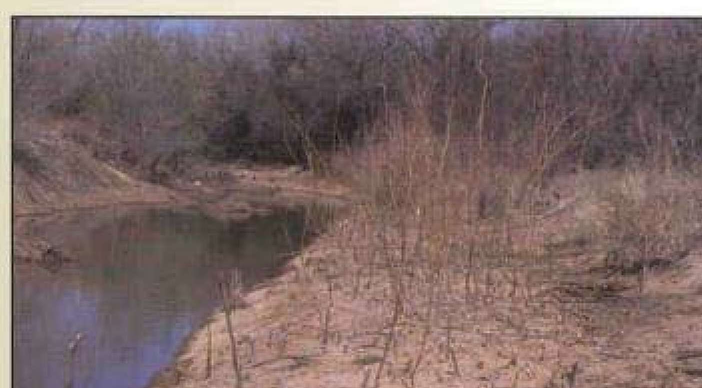


Photo 49 – Beaver predation of planted willow is common. However, because a 30 inches stem is planted, there is plenty of stem carbohydrate reserves available for re-sprouting.

4. PERENNIAL STREAMBANK VEGETTION TREAMTENT

Photo 50 – A fence was built around this 7 acre planting site to protect it from cattle grazing on the Rio Santa Fe near Pena Blanca, New Mexico, where the annual precipitation is less than 12 inches.

Photo 51 – A total of 350 cottonwood and black willow pole cuttings, 1,000 coyote willow whips, and 200 transplants were planted.

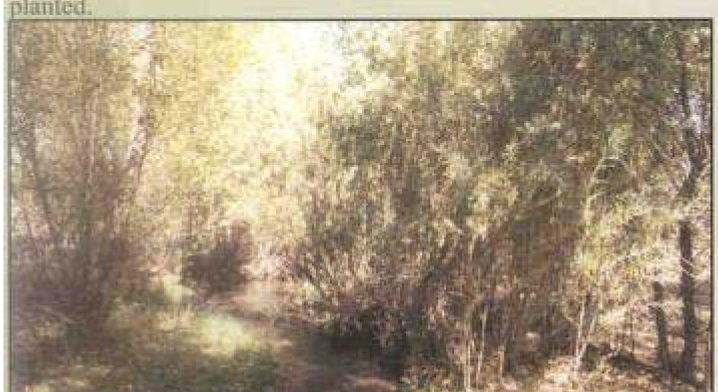


Photo 52 – By the tenth year, survival of all plants averaged about 75% and provided a closed canopy, shading the stream and enhancing fish habitat. Three supplemental irrigated treatments were provided only to the transplants: two treatments the first year and a third treatment the second year.

Photo 53 – Woody debris from the planting often falls in the river and may form log jams causing step pooling.

Photo 54 – Step-pooling resulted in some overbank flooding, providing the environment for natural recruitment of cottonwood seedlings.

5. **UNDERSTORY VEGETATION TREATMENT WITH EXISTING MATURE BOSQUE**

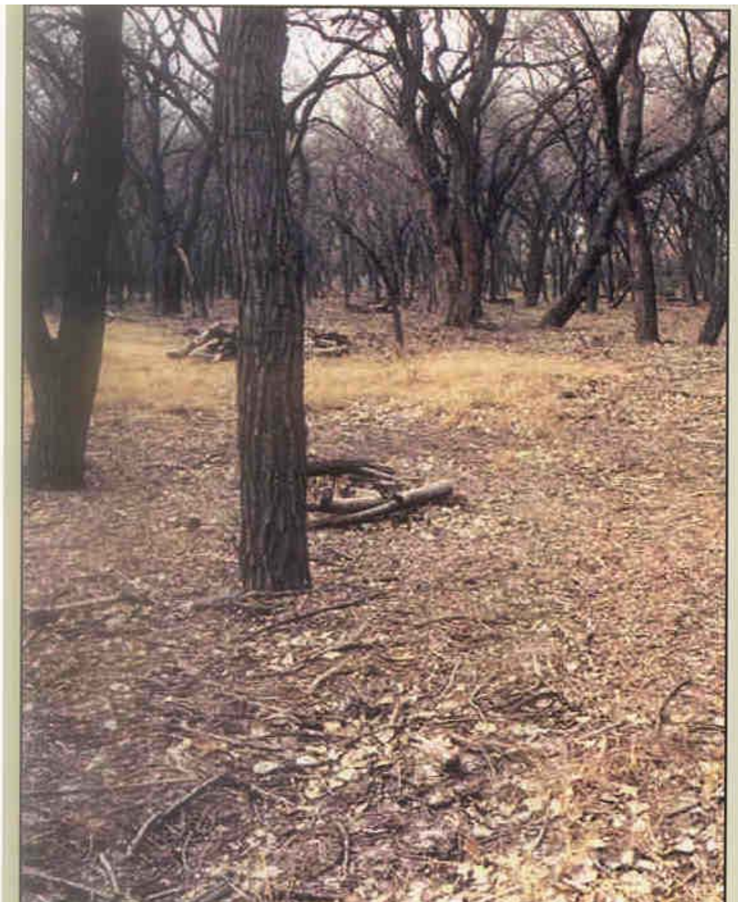


Photo 55 – 3,000 long-stem transplants were planted on this forty acre site. Plants were grouped by species and planted in mosaic patterns over the area. Plant species included screwbean mesquite, golden current, skunkbush sumac, false indigo, netleaf hackberry, New Mexico olive, and false willow. After three years, survival is averaging 85%, no supplemental water has been provided to the plants.

Photo 56 – New Mexico olive was planted in areas of dense shade.

Photo 57 – False willow was planted in open areas.

6. <u>RIO DE LAS VACAS TREATMENT SITE</u>

This project is located in the Jemez Mountains. The stream begins in the San Pedro Mountains around 10,000 foot elevation. The headwaters are on forested lands with minimal disturbances. The rock-lined channel flows onto private land around 8,200 foot elevation. The stream course is lined with forest and riparian vegetation while on Forest Service administered lands. The land use changes from forest to recreational homes and cattle grazing, when the stream enters private lands. Most riparian vegetation has been removed throughout the private lands. The project site elevation is around 7,950 feet.

Assistance was requested by the landowner to address an eroding streambank that was undermining a property line fence. The initial site investigation was conducted in August, 1997. The stream exhibited some incision which was limited by cobble to boulder armoring in the streambed. Excessive lateral erosion had occurred and was aided by the removal of riparian woody vegetation on the privately owned lands. Cutbanks can be observed throughout the valley, removing valuable topsoil from some of the pastures. The stream flow, while perennial, can fluctuate greatly depending on the amount of winter snowpack and the number and intensity of summer thunderstorm events.

Remediation efforts began in August 1997. A supply of cobbles to small boulders had been placed on site at an earlier date and was available to use on the project. Other boulders used to build structures were collected from the nearby hillsides. A local Youth Conservation Corps group numbering around 12 people provided the labor to move and place the needed rocks.

In order to meet the needs of the landowner and protect the boundary fence, it was decided that the most effective treatment required a series of stream barbs to stabilize the eroding banks and limit the rate of lateral recession of the streambank.

The project was installed using hand labor and a tractor with a front loader to move the rock to the needed location. The project took three days to install a total of six barbs and a small stretch of rip-rap. The rocks were all placed by hand and built up to the edge of the cutbank, but not keyed into the bank.

The project has been in place for over ten years. It has performed during spring runoff events with minimal damage. The only repairs have consisted of restacking some of the rocks from the nose of several of the barbs. These rocks had been rolled off of the barbs during high and extended flows, but overall the damage has been minimal. Woody riparian vegetation has not recovered due to continued grazing. The herbaceous species, including sedges and rushes, have increased in frequency and density. Some trampling and trails behind the barbs have continued to have detrimental effects on the treated streambanks.

This project has functioned as designed for ten years. The treated streambank has remained relatively stable although there has been minor recession as the bank reaches a stable angle of repose. The fence remains in place and has not been moved as was required before the treatment. The bank has more vegetation and more desirable riparian species than before the treatment. The stream barbs have been effective in keeping the lateral movement of the stream in check and also capturing new coarse sediment behind the barbs. The project continues to be monitored and photographed yearly.

Before treatment in 1999, Rio de las Vacas, Sandoval County

Treated site in 2006, Rio de las Vacas, Sandoval County

VI. REFERENCES

1. Biota Information System of New Mexico http://www.bison-m.org/
2. Handbook of Wetland Vegetation Communities of New Mexico http://nhnm.unm.edu/vlibrary/pubs_archive/nhnm/nonsensitive/U00MUL01NMUS.pdf
3. New Mexico Game and Fish http://www.wildlife.state.nm.us/department_info/Directory.htm
4. NM Resource Geographic Information System Program Reference Maps http://rgis.unm.edu/loader_div.cfm?new=true&theme=Digital%20Orthophotography
5. US FWS Endangered Species Lists http://www.fws.gov/southwest/es/EndangeredSpecies/lists/
6. US Geological Survey Webstore (location for the 7.5 minute USGS Quad sheets) http://store.usgs.gov/
7. USDA/Forest Service's Fire Effects Information System http://www.fs.fed.us/database/feis
8. USDA/Forest Service (web site for over 800 publications by the USFS Rocky Mountain Research Station) http://www.fs.fed.us/rm/publications/titles.shtml
9. USDA/National Invasive Species Information Center (NISIC) http://www.invasivespeciesinfo.gov/docs/toolkit/ltmgmtofexotictrees.pdf
10. USDA/NRCS Biology Technical Notes http://www.nm.nrcs.usda.gov/technical/tech-notes/bio.html
11. USDA/NRCS Deep Planting Publication http://www.nm.nrcs.usda.gov/news/publications/deep-planting.pdf
12. USDA/NRCS Ecological Site Descriptions http://www.nm.nrcs.usda.gov/technical/fotg/section-2/ESD.html
13. USDA/NRCS Ecological Site Descriptions System for Rangeland & Forestland Data http://esis.sc.egov.usda.gov/Welcome/pgReportLocation.aspx?type=ESD
14. USDA/NRCS Guidelines for Planting Dormant Pole Cuttings in Riparian Areas of the Southwest http://www.nm.nrcs.usda.gov/technical/tech-notes/pmc/pmc68.pdf
15. USDA/NRCS Guidelines for Planting Longstem Transplants for Riparian Restoration in the Southwest http://www.nm.nrcs.usda.gov/news/publications/deep-planting.pdf
16. USDA/NRCS Guidelines for Planting Dormant Whip Cuttings to Revegetate and Stabilize Streambanks http://www.nm.nrcs.usda.gov/news/publications/dormant-willow-planting.pdf
17. USDA/NRCS National Environmental Compliance Handbook http://policy.nrcs.usda.gov/media/pdf/H_190_ 610.pdf
18. USDA/NRCS Plants Database (provides a single source of standardized information about plants: standardized plant names, symbols, and other plant attribute information) http://plants.usda.gov/
19. USDA/NRCS Publications by Plant Materials Center (provides a subject and location listing of publications by PMC throughout the United States) http://plant-materials.nrcs.usda.gov/technical/publications/
20. USDA/NRCS References to the Field Office Technical Guide (FOTG) http://www.nm.nrcs.usda.gov/technical/fotg/section-1/references.html
21. USDA/NRCS Riparian Restoration in the Southwest. (Focusing Your Planning on Crucial Factors Concerning Site Preparation, Landscape Goals, and Revegetation, Los Lunas Plant Materials Center) http://www.nm.nrcs.usda.gov/technical/tech-notes/pmc/pmc67.pdf
22. USDA/NRCS Seeding Xeric Riparian Sites Following Removal of Invasive Phreatophytes http://www.nm.nrcs.usda.gov/programs/pmc/symposium/riparian-seeding-ws.pdf
23. USDA/NRCS Stream Channel Stabilization Standard http://efotg.nrcs.usda.gov/references/public/NM/584.pdf
24. USDA/NRCS Stream Visual Assessment Protocol Technical Note http://www.nm.nrcs.usda.gov/technical/tech-notes/bio/bio47.pdf
25. USDA/NRCS Streambank & Shoreline Protection Loose Rock Riprap Specification http://efotg.nrcs.usda.gov/references/public/NM/580rspec.doc
26. USDA/NRCS Streambank & Shoreline Protection Post and Wire Revetment Specification http://efotg.nrcs.usda.gov/references/public/NM/580fspec.doc
27. USDA/NRCS Streambank & Shoreline Protection Standard http://efotg.nrcs.usda.gov/references/public/NM/580.pdf

28. USDA/NRCS Streambank & Shoreline Protection Wire Bound Riprap Specification **http://efotg.nrcs.usda.gov/references/public/NM/580wspec.doc**
29. USDA/NRCS The Pole Cutting Solution **http://www.nm.nrcs.usda.gov/news/publications/polecutting.pdf**
    USDA/NRCS Tree & Shrub Establishment Specification ***http://efotg.nrcs.usda.gov/references/public/NM/612spec.pdf***
30. USDA/NRCS Water Climate Information ***http://www.wcc.nrcs.usda.gov/cgibin/state.pl?state=nm***
31. USDA/NRCS Watershed Science Institute Technical Report Stream Corridor Inventory & Assessment Techniques ***ftp://ftp-fc.sc.egov.usda.gov/WSI/pdffiles/Stream_Corridor_Inventory_Techniques.pdf***
32. USDA/NRCS Web Soil Survey ***http://websoilsurvey.nrcs.usda.gov/app/***
33. USDA/NRCS Wildlife Habitat Evaluation Guide Sheets (WHEGS) ***http://www.nm.nrcs.usda.gov/technical/fotg/section-2/whegs.html***
34. USDC/National Technical Information Services ***http://www.ntis.gov/products/bestsellers/stream-corridor.*** asp?loc=4-2-***0***
35. USDI/BLM Process for Assessing Proper Functioning Condition for Riparian Area Management ***http://www.blm.gov/nstc/library/pdf/Final%20TR%201737-9.pdf***
36. US Department of Commerce/BLM Riparian Area Management (TR 1737-20) *Grazing Management Processes and Strategies for Riparian - Wetland Areas* ***http://www.blm.gov/nstc/library/techref.htm***
37. US Drought Monitor ***http://drought.unl.edu/dm/monitor.html***
38. USDA/NRCS Prescribed Grazing Standard ***http://efotg.nrcs.usda.gov/references/public/NM/528.pdf***
39. USDA/NRCS Stream Restoration Design ***http://directives.sc.egov.usda.gov/H_210_NEH_654.htm***

Riparian Assessment Tools:

- Biology Technical Note 50 - Visual Riparian Assessment Tool (Appendix)
- Proper Functioning and Condition (Reference #31)

The above listed references are links using the Internet. Access can also be obtained by contacting the local offices listed below.

New Mexico Game and Fish Department, PO Box 25112, Santa Fe, NM 87504

USDA Natural Resources Conservation Service, 6200 Jefferson NE, Albuquerque, New Mexico 87109, Phone: 505-761-4400

USDI Bureau of Land Management, 1474 Rodeo Road, P.O. Box 27115, Santa Fe, New Mexico 87505, Phone: 505-438-7400

USDA Forest Service, 333 Broadway SE, Albuquerque, NM 87102 Phone: 505-842-3292

USDI Fish and Wildlife Service, 2105 Osuna Blvd. NE, Albuquerque, 87113, Phone: 505-346-2525

APPENDIX

TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE NEW MEXICO October 2006

BIOLOGY TECHNICAL NOTE NO. 50

VISUAL RIPARIAN ASSESSMENT TOOL

A visual riparian assessment tool has been developed for the use of Natural Resources Conservation Service field office staff in assessing riparian areas found on private lands. The tool should be used by a team consisting of 3 to 5 appraisers who represent varied natural resources backgrounds. The document has been written to provide a description and scoring template for hydrologic, soil and vegetative elements observed at the site. Each team member should examine the area and then discuss their observations with the other team members before a value is assigned for each scoring element. Upon completion of the assessment, the values should be totaled and a determination for the condition of the riparian area can be calculated. The tool was developed using three publications: 1) US Department of the Interior, Bureau of Land Management, TR 1737-9 Process for Assessing Proper Functioning Condition, 2) US Department of Agriculture, Natural Resources Conservation Service, Stream Visual Assessment Protocol, Fourth Draft, and 3) University of Montana, School of Forestry, Riparian and Wetland Research Program, Assessing Riparian Health, RWRP's Short Form. The score sheet varies from PFC in that instead of being a subjective rating system, numerical values are assigned giving the NRCS a defensible management tool. This is critical considering our work with private landowners, and the land management strategies of our agency. The final result of the score sheet will allow the field staff to assess whether or not the riparian area is functioning, in what capacity, and will also direct the assessor to the elements of concern. The rating will not necessarily provide the causes of the deficiencies, but should identify the areas which need to be addressed.

It is recommended that the field staff attend Proper Functioning Condition training, provided by the New Mexico Riparian Cadre. Information for the next training sessions can be obtained from Steve Lacy, Geomorphologist or Marcus Miller, Wildlife Biologist, in the state office.

RIPARIAN ASSESSMENT
STANDARD SCORE SHEET

Date: ______ | ______ | ______

County: ______________________ Geographic coordinates or UTM's ______________

Land Ownership Status: (Federal) (State) (Private) check the appropriate status

Name of Land Owner: ______________________________

Identify the Tract or Field Where the Scoring Occurred ______________________________

Name of the Stream or River ______________________________

Names of Field Scoring Members ______________________________

Attach Map of Site and Identify the Different Reaches

Available Points	Points Scored	HYDROLOGIC FACTORS
10		Hydrologic Alteration
10		Channel Condition
10		Bank Stability
5		Riparian Zone Width
5		Active or Stable Beaver Dams

Available Points	Points Scored	SOILS -EROSION AND DEPOSITION FACTORS
10		Soil Characteristics / Rooting Medium
10		Exposed or Bare Ground
10		Topographic Variance or Surface Expression on Floodplain
5		Streambank Rock Armoring
5		Point Bar Revegetation

Available Points	Points Scored	VEGETATION FACTORS
10		Diverse Age Class Distribution of Trees
10		Shrub Regeneration
10		Total Ground Cover of Grasses and Forbs
10		Percent of the Streambank with a Deep, Binding Root Mass
10		Total Area Occupied by Undesirable Herbaceous and Woody Species

Total Available Points	Total Points Scored

REMARKS: ______________________________

SUMMARY DETERMINATION

FUNCTIONAL RATING:

A riparian assessment examines various elements to determine the condition of the riparian area. Various characteristics have been rated to establish whether the site has a minimal capacity to function in a natural state. The ratings established through the scoring process should provide direction for the land owner or land manager in the identification of individual elements of concern. By using a percentage of the total points scored, we have tried to eliminate any negative bias, which may arise from an element which may not be appropriate for a site. An example would be an Active or Stable Beaver Dams, which may not be an appropriate category for some sites. In this case, the 5 points would be deducted from the total available points, and would therefore not affect the final percentage scored.

To determine the percentage scored, divide the total points scored by the total available points and multiply by 100. This value, expressed in percent will provide the rating to be used in the assessment tool.

For a riparian area to be considered for possible effective treatment, a percentage of 40% and above must be reached. Some riparian areas are damaged to the point where effective treatment is not practical. Funds would be better spent on areas where positive benefits can be more readily achieved. When riparian areas are found in entrenched systems, especially in the southwest, the rating party should consider the effect of the steep gully walls as part of the riparian area. These unstable walls may contribute large amounts of sediment and areas lacking vegetation.

Place a check mark in the appropriate box for the assessed riparian area. Your assessment is based on the assessment percentage. 70% and above is considered as a functioning riparian area, 40-70% is functioning at some capacity, while <40% is non-functional.

Proper Functioning Riparian Area ☐

Functional – At Risk ☐

Nonfunctional ☐

Are Factors Contributing to Unacceptable Conditions Outside of the Land Owners Control?

☐ Yes ☐ No

If yes, What are Those Factors?

☐ Flow regulations	☐ Mining Activities	☐ Upstream channel conditions
☐ Channelization	☐ Road Encroachment	☐ Oil field water discharge
☐ Augmented flows	☐ Other (specify) ______________________	

SCORING DESCRIPTIONS

Examine the entire reach of the riparian area to be evaluated. Separate the riparian area into reaches with distinct characteristics. Complete a score sheet for each reach. Prepare a site map and identify each reach on the map.

Each assessment element is rated with a value rating of either 1 to 10 or 1 to 5. Rate only those elements appropriate to the stream. Record the score that best fits the observations you make based on the narrative descriptions provided. For each assessment element, some background information is provided as well as a description of what to look for.

I. HYDROLOGIC FACTORS

HYDROLOGIC ALTERATION

Regular flooding every 1.5 – 2 years. Natural channel, no water withdrawals, no dikes or other structures limiting access to the floodplain. Channel is not incised.	Flooding occurs only once every 3 - 5 years; limited channel incision. Withdrawals do not affect available habitat for biota or transport capacity	Flooding only once every 6-10 years channel deeply incised, OR Withdrawals significantly affect available low flow habitat for biota or transport capacity	No flooding; channel deeply incised or structures prevent access to floodplain or dam operations prevent flood flow, OR Withdrawals have caused severe loss of low flow habitat or transport capacity, OR Flooding occurs on a one-year rain event.
10	7	3	1

Explanation:

Flooding is important to maintaining the structure of the channel and maintaining the physical habitat for animals and plants. Flooding moves sediments, scouring fine sediments and moving gravels and boulders to create pools and riffles. The river channel and floodplain exist in dynamic equilibrium having evolved in the present climatic regime and geomorphic setting. The relationship of water and sediment are the basis for the dynamic equilibrium that maintains the form and function of the river channel. The energy of the river (water volume discharge and slope) should be in balance with the bedload (volume and particle size of the sediment). Any change in flow regime alters this balance. Decreases in flood flows decrease the river's ability to transport sediment and can result in excess sediment deposition, channel widening and shallowing, and ultimately, in braiding of the channel. Conversely, an increase in flood flows or the confinement of the river away from its floodplain increases the energy available to transport sediment and can result in bank and channel erosion.

The low flow or "base flow" during the dry periods of summer or fall usually comes from groundwater flowing into the stream through the streambanks and bottom. A decrease in the low flow rate may result in a smaller portion of the channel suitable for aquatic organisms. The withdrawal of water from streams for irrigation or industry and the placement of dams often change the normal low flow patterns. Base flow can be affected by management and land use within the watershed – less infiltration of precipitation reduces base flow and increases the severity of high flow events. For example, urbanization increases runoff and can increase the frequency of flooding to every year or more and also reduce low flows. Overgrazing and clear cutting can have similar, although typically less severe, effects.

What to look for: Ask the landowner about the frequency of flooding and about summer low flow conditions. An active floodplain should be inundated every 1.5-2 years except during drought. Evidence of flooding includes high water marks, such as water lines, sediment deposits or stream debris. Look for these on the banks, on the bankside trees or rocks or on other structures such as road pilings or culverts. Low flow conditions can be noted by exposed stream beds; aquatic vegetation attached to the rocks or other structures may be exposed and the sides of the stream channel will often be exposed and lack rooted vegetation.

Excess sediment deposits and wide, shallow channels could indicate a loss of sediment transport capacity. The loss of transport capacity can result in a stream with three or more channels known as braiding. A channel bottom devoid of sediment could indicate increased flows and current or potential downcutting.

CHANNEL CONDITION

Natural channel; no structures, dikes. No evi-dence of downcutting or excessive lateral cutting of the stream.	Evidence of past channel degradation but with significant recovery of channel and banks. Any dikes or levies are set back to provide access to an adequate floodplain.	Degraded channel; <50% of the reach with rip-rap and/ or channelization. Excess aggradation; braided channel. Dikes or levees restrict floodplain width.	
10	7	3	1

Explanation:

Streams naturally meander through a valley bottom or topographic low area. Often, land usages in the area results in changes in a meandering pattern and the flow of a stream. These changes in turn may affect the way a stream naturally does its work, such as the transport of sediment, development and maintenance of habitat for fish, aquatic insects and aquatic plants, and the transfer of oxygen into the water. Some of the modifications may not be noticeable because they are located upstream and may not be accessible or visible from where the assessment is made. Some modifications to stream channels have more impact on stream health than others. For example, channelization and dams affect a stream more than the presence of pilings or other supports for road crossings.

Active downcutting and excess lateral cutting are both serious impairments to stream function. Both conditions are indicative of an unstable stream channel. To address other problems with stream function prior to the stabilization of the channel is premature. For instance, restoration of riparian vegetation along an actively downcutting channel is doomed to failure. As the channel continues to down cut, the vegetation may be left high and dry.

What to look for: Indicators of downcutting in the stream channel including knick points or head cuts in the stream bottom, exposure of cultural features such as pipelines that were initially buried under the stream. A lack of sediment deposits in the stream bottom is normally an indicator of incision. A low vertical scarp at the toe of the streambank may indicate downcutting, especially if the scarp occurs on the inside of a meander. Another visual indicator of current or past downcutting is high streambanks. Excessive bank erosion is indicated by raw banks in areas of the stream where they are not normally found such as straight sections between meanders or on the inside of curves. Bank failures in cohesive soils are generally rotational slumps. In less cohesive soils, slab failures are more typical.

Signs of channelization or straightening of the stream; this may include an unnaturally straight section of the stream, unnaturally high berms or embankments on either side of the stream, or a lack of flow diversity (all the same depth).

Drop structures (such as check dams), irrigation diversions, culverts, bridge abutments, and rip-rap are also indicators of changes to the stream channel.

BANK STABILITY

Banks stable; erosion or bank failure absent or minimal; little potential for future problems; <5% of bank affected.	Moderately stable; in-frequent, small areas of erosion mostly healed over; 5-25% of banks in reach have areas of erosion.	Moderately unstable; 25-50% of banks in reach have areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; “raw” areas frequent along straight sections and bends; obvious bank sloughing; 50-100% of banks have erosion scars.
10	7	3	1

Explanation:

This element is the existence of or the potential for detachment of soil from the upper and lower streambanks and its movement into the stream. Steep banks are more susceptible to erosion or collapse. Complete vegetative cover helps stabilize the banks; roots from trees, shrubs and even deep rooted grasses are important in providing support to the bank. Soil types found at the surface and at depth also determine bank stability. For example, banks with a thin soil cover over gravel or sand are more prone to collapse than are banks in which there is a deep, cohesive soil layer.

What to look for: Signs of erosion including unvegetated stretches, exposed tree roots, or scalloped edges along the banks. Also see if there are overhanging areas along the banks, or leaning trees. Observe the stream bed from the top of the bank to the waterline to see what type of soil or subsurface material is visible. Evidence of disturbance, animal paths, or grazing areas which lead directly to the water’s edge suggest conditions that may increase the chance of bank collapse. Estimate the size or area of the bank affected relative to the total bank area; this can be expressed as a percentage and compared to the descriptions.

RIPARIAN ZONE WIDTH

Extends at least one active channel width on each side or covers entire floodplain.	Extends ¾ of the ac-tive channel width on each side or slightly less than the floodplain.	Extends ½ of the active channel width on each side or covers ½ of the floodplain.	Extends ⅓ of the active channel width or ⅓ of the floodplain.	Less than ⅓ of the active channel width or less than ⅓ of the floodplain.
5	4	3	2	1

Explanation:

This element is the width of the natural vegetation zone from the edge of the upper streambank out into the floodplain (or effective riparian area). The riparian vegetation zone: 1) serves as a buffer zone for pollutants entering a stream from runoff; 2) controls erosion; 3) dissipates energy during flood events; 4) enhances the physical habitat of the stream; and 5) is a source of organic material for the stream. The type, timing, intensity and extent of activity in riparian zones are critical in determining the impact on these areas. Narrow riparian zones and/or riparian zones with roads, agricultural activities, residential or commercial structures, or significant areas of bare soils have reduced protection value for the stream.

What to look for: Compare the width of the riparian zone to the active channel width. In steep V-shaped valleys there may not be enough room for a floodplain riparian zone to extend as far as one active channel width. In these cases, observe how much of the floodplain is covered by the riparian zone. Most riparian areas have some disturbance; however unless the disturbance is permanent or is intensive, the riparian area will usually recover. Look to see if there is only mature vegetation and few seedlings which would indicate a lack of regeneration. Healthy riparian zones on both sides of the stream are important for the health of the entire system. If one side is lacking the protective vegetative cover, the entire reach of the stream will be affected. In doing the assessment, be certain that you examine both sides of the stream and note which side of the stream has problems.

ACTIVE OR STABLE BEAVER DAMS

Beaver are present in the stream and actively building or maintaining dams.	Beaver may be present in the stream by evidence of old, non-maintained dams.	There is no evidence of beaver found in the stream or along the riparian area.
5	3	0

Explanation:

This element recognizes the importance of beaver in a riparian community. Beaver dams reduce water velocity and the streams power to erode. This leads to sediment deposition, elevated water tables, and increased herbaceous and woody vegetation. Beaver dams decrease or retard rapid spring runoff through water storage and improve water quality. Beaver are a desirable species for improved fish habitat and brood rearing areas for waterfowl. Beaver can only live along streams with a gradient of 3% or less.

What to look for: Beaver are primarily nocturnal. They eat a variety of vegetation and prefer herbaceous and succulent plants. Woody plants are necessary for over winter survival. Preferred trees and shrubs include aspen, willow, alder, and cottonwood.

Beavers will build dams from mud and available woody material. Dam building takes place from August to October. Maintenance is continual and generally occurs at night. Beaver dams block streams creating wet and marshy areas behind the dams. Beaver will cut trees in order to keep their ever-growing teeth worn down. Some damage to riparian vegetation will occur initially, however over time, the increased moisture will allow for regeneration and increased survival of woody species.

II. SOILS – EROSION AND DEPOSITION FACTORS

SOIL CHARACTERISTICS / ROOTING MEDIUM

>75% of the site has sufficient soil to hold water and act as a rooting medium.	>50% to 75% of the site has sufficient soil to hold water and act as a rooting medium	>25% to 50% of the site has sufficient soil to hold water and act as a rooting medium.	25% or less of the site has sufficient soil to hold water and act as a rooting medium.
10	7	3	1

Explanation:

This element is to describe the two basic functions of soil (or substrate materials) in riparian areas. These are to act as a sponge to store water, and to support riparian vegetation by acting as a rooting medium. The kind and amount of soil materials present are among the most important factors in determining a site's potential. For example, soils comprised of clays, silts, and to some degree sands will be able to hold moisture, while other substrates, such as gravels, cobbles, and boulders will not. Likewise, an adequate rooting medium for plant growth also depends on substrate particle size. Substrates dominated by unfractured or unweathered bedrock, exposed boulders or large cobbles do not provide an adequate rooting medium for plant growth. Gravels and small cobbles up to 5 inches in diameter can provide adequate rooting medium when inter-mixed with soil materials.

What to look for: It is important that the assessor can identify various types of soil. The three basic materials, clay, silt and sand will form differing soil types based on the percentages of each material present. A shovel or soil auger should be used to examine the soil at the site. Observations can be made in the stream channel to look for soil or material changes. A soil survey, if available, should also be consulted.

EXPOSED OR BARE GROUND

10% or less of the site with exposed soil surface.	10% to 20% of the site has exposed soil surface.	20% to 50% of the site has exposed soil surface.	>50% of the site has exposed soil surface.
10	7	3	1

Explanation:

Exposed soil surfaces are those surfaces not protected from erosive forces by plants, litter or duff, downed woody materials or rock material larger than 2.5 inches. Exposed soil can be caused by soil conditions, human caused activities, livestock, wildlife, or dense canopy cover. Exposed soil is an important factor in evaluating the health of riparian sites for several reasons: 1) exposed soil is vulnerable to erosion; 2) it may contribute to streambank deterioration; 3) it reflects reduced vegetation cover available for sediment entrapment; and 4) exposed soil provides sites for potential invasion by noxious weeds and other undesirable species. Generally, if the causes are human related or are accelerated by human land uses, this more strongly suggests a deteriorating situation.

What to look for: Walk through the riparian area and observe areas of bare or exposed ground. If these areas are present, make an assessment of the cause if possible. Look to the area adjacent to the riparian area and observe any possible activities which may cause or contribute to exposed soil surfaces.

TOPOGRAPHIC VARIANCE OR SURFACE EXPRESSION ON FLOODPLAIN

Excellent topographic variability with thick vegetation in the overstory, shrub layer and grasses. Large woody debris or large rocks are present. No signs of concentrated flow of water are present.	Good topographic variability with good vegetative cover. Some rocks or woody debris is present, with little evidence of concentrated flow erosion.	Some topographic variability is present and there is some vegetative cover. Woody debris or rocks may be present. There may be some evidence of concentrated flow erosion.	Very little to no topographic variability is visible. Very little to no evidence of woody debris or rocks are present. Evidence or water erosion is clearly evident.
10	7	3	1

Explanation:

Once water leaves the stream channel and begins overland flow, the factors which determine whether sediment will be trapped include, 1) the overbank topography, 2) the amount and types of herbaceous and woody vegetation, 3) the amount of dead and down woody vegetation, and 4) any bedrock outcrops or boulders present. The greater the amount of surface variability and additional roughness factors will lead to an increased ability for sediment to be filtered and trapped from the overland flow. Trapped sediment helps to enrich the soil and add nutrients to the ecosystem. Topographic variance also allows for energy dissipation of the flood waters. This prevents scouring and erosion from damaging the overbank areas.

What to look for: For this element, observe the landform of the floodplain. The topography should be rough enough to prevent concentrated flow erosion, and have enough vegetation to absorb energy from overland flow. Look for logs, rocks, or other obstructions which can block the waters' progress and encourage ponding or backwater formation.

STREAMBANK ROCK ARMORING

Large cobbles at least 5” in diameter make up over 50% of the streambank.	Cobbles at least 2.5” in diameter are found over 40% of the streambank.	Large gravels at least 1.25” in diameter are found over 25% of the streambank.	Very little gravel or cobbles are found along the streambanks.
5	3	1	0

Explanation:

The composition of streambank materials influences streambank susceptibility to erosion from water flow, trampling and other disturbances. In general, larger rocks provide better protection against disturbance than smaller rocks. Streambanks composed primarily of fine sands, silts and clays are more susceptible to degradation and require adequate vegetative protection to compensate for their smaller particle size.

What to look for: Make visual estimations on the percentage of rock found along the streambank reach. Check the diameter of the cobbles or gravels with a tape, if necessary, or calibrate with your eye.

POINT BAR REVEGETATION

The point bars are well formed and maintained and have excellent growth and regeneration of the preferred species.	The point bars are stable and have good amounts of vegetation and some regeneration of preferred species.	The point bars are not stable and have little evidence of growth or regeneration of preferred species.
5	3	1

Explanation:

Point bar revegetation is a visual indicator of a stream channel which is maintaining a balanced channel width. Lateral movement of a stream is a natural function and over time will increase the width of the floodplain. During lateral movement, streams remove bank material from the outside bend and deposit material on the point bar formed on the inside bends of the meander. As vegetation is established on the point bar, new roots help to stabilize the bar and the emergent vegetation acts as a sediment filter and a velocity drag on flood waters. Preferred woody species such as cottonwood and willow need moist, bare, mineral soil in order to have successful seed establishment. Their period of viability for the seeds is very short and conditions for germination must be met in order have successful colonization of these species.

What to look for: See if the channel has a meander system with point bars present. Are the point bars formed so that they gently slope down into the stream without steps, nicks or channels formed across them? Observe the amount and type of emerging vegetation from the water line back to where the bar joins the bank.

VEGETATION FACTORS

DIVERSE AGE CLASS DISTRIBUTION OF TREES

>10% of the total canopy cover of trees is represented by seedlings and saplings.	>1% to 10% of the total canopy cover of trees is represented by seedlings and saplings.	1% or less of the total canopy cover of trees is represented by seedlings and saplings.	No tree seedlings or saplings are present.
10	7	3	1

Explanation:

One of the clearest indicators of a riparian tree habitats ecological stability and subsequent health is the presence of trees of all age classes (seedling, sapling, pole, mature, decadent, and dead) of the species. The presence of all age classes gives promise of the self-perpetuating stability inherent to all potential natural communities.

What to look for: The ecological stability and health of a seral community type may be indicated by one of the following conditions: 1) in late seral communities, the presence of seedlings, saplings, and pole ages of climax tree species, and mature and older individuals of later seral species; and 2) for early seral communities, the presence of seedlings, saplings, and pole ages of seral species, and the absence of any climax tree species.

SHRUB REGENERATION

>10% of the total canopy cover of the shrub layer is represented by seedlings or saplings.	>1% to 10% of the total canopy cover of the shrub layer is represented by seedlings or saplings.	1% or less of the total canopy cover of the shrub layer is represented by seedlings or saplings.	There are no shrub seedlings or saplings are present.
10	7	3	1

Explanation:

Another clear indicator of a riparian habitat's health is the presence of shrubs representing all age classes. The presence of all age classes of shrubs ensures the self-perpetuating stability inherent to all potential natural communities. Ecological stability and health of later seral community types is indicated by the presence of seedlings and saplings of climax shrub species and mature and older individuals of later seral species. Early seral communities are naturally dynamic in character. The presence of seedlings and saplings of seral species and the absence of any age classes of climax shrub species is their normal healthy status.

What to look for: The ecological stability and health of a seral community type may be indicated by one of the following conditions: 1) in late seral communities the presence of seedlings, saplings, and mature shrubs of climax species, and mature and older individuals of later seral species; and 2) for early seral communities, the presence of seedlings, saplings, and mature shrubs of the seral species which should be represented.

TOTAL GROUND COVER OF GRASSES AND FORBS

> 95% of the soil surface is covered by plant growth.	> 75% to 95% of the soil surface is covered by plant growth.	> 50% to 75% of the soil surface is covered by plant growth.	< 50% of the soil surface is covered by plant growth.
10	7	3	1

Explanation:

Vegetative groundcover is instrumental in the ability of the system to trap sediments and to reduce the velocity of water moving over the floodplain or along the streambanks during flooding or overbank flow events. The vegetative canopy cover mitigates raindrop impact, other erosive forces, and the rate of evaporation.

What to look for: Make a visual assessment of the percent of the ground which is covered by forbs, sedges, or grasses, or any other ground vegetation. Assign the appropriate rating for the rated area.

PERCENT OF THE STREAMBANK WITH A DEEP, BINDING ROOT MASS

>75% of the streambank has evidence of a deep, binding rootmass.	>50% to 75% of the streambank has evidence of a deep, binding rootmass.	>25% to 50% of the streambank has evidence of a deep, binding rootmass.	25% or less of streambank has evidence of a deep, binding rootmass.
10	7	3	1

Explanation:

The vegetation along streams stabilizes the soil with a deep, binding root mass and filters sediments from overland flow. All tree and shrub species, and some sod forming grasses are considered to have deep, binding root masses. Among riparian wetland herbaceous species, the first rule is that annual plants lack deep, binding root masses. Perennial species, offer a wide range of root mass qualities. Some rhizomatous species such as the deep rooted sedges (Carex spp.) are excellent streambank stabilizers. In all situations, a greater density of woody species or vigorously rhizomatous herbaceous species indicates greater streambank stability.

What to look For: Walk along the streambank and observe what types of species are present. Use a shovel or soil auger to penetrate the soil to see the root structure which has developed. Slumped areas on the streambanks can be looked at to see the degree and depth of root development.

TOTAL AREA OCCUPIED By UNDESIRABLE HERBACEOUS AND WOODY SPECIES

5% or less of the area is covered by undesirable herbaceous species	> 5% to 25% of the area is covered by undesirable herbaceous species.	> 25% to 50% of the area is covered by undesirable herbaceous species.	> 50% of the area is covered by undesirable herbaceous species.
10	7	3	1

Explanation:

Disturbance-induced herbaceous and woody plants (either native or introduced) may indicate a trend away from the preferred native plant communities, or a reduction in a site's ability to function as a healthy riparian wetland ecosystem. Most of these weedy, herbaceous and woody species provide less soil holding and sediment trapping capability and less desirable forage and wildlife values than native, later successional species.

What to look for: Areas of disturbances are likely sites where undesirable herbaceous and woody species can become established. Be aware that some species, such as Russian thistle, saltcedar, and Russian olive are not native, even though they are widely distributed across the west.

Notes:

Notes: