Riparian restoration of Seiiorito Canyon, a tributary of the Rio Puerco

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Abstract.—Señorito Canyon, a non-functional, degraded tributary stream of the Rio Puerco in New Mexico, has begun to respond to management strategies by the Bureau of Land Management. Restoration of the riparian ecosystem has been accomplished principally through livestock grazing management and planting and reestablishment of the native cottonwood/willow communities. The use of riparian pastures constructed along the stream was necessary to "jump-start" the system and allow total grazing deferment from 3 to 5 years.

INTRODUCTION

Señorito Canyon is one of the few, perennial flow, tributaries of the Rio Puerco in New Mexico. The Rio Puerco produces large quantities of sediment and flows into the Rio Grande, which is one of the most polluted rivers in the southwest.

The confluence of the Rio Puerco and Seiiorito Canyon is located approximately five miles south of Cuba, N.M., and has 34,087 acres of watershed above this point. The headwaters located on the Santa Fe National Forest are 11 miles upstream at over 9,000 feet in elevation in the Fir-Aspen zone.

The BLM manages the lower elevation or the furthest downstream reach of this stream (approximately 3 miles). This reach ranges from 6,680 to 6,800 feet in elevation. The channel sinuosity ratio is 1.19. The stream width ranges from 36 to 47 inches and depth is 4-12 inches at low flow. The width of the riparian area ranges from 119 feet in the upper portions to 171 feet further downstream.

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ENVIRONMENTAL SETTING

The watershed drains a portion of the Nacimiento Uplift, which are Precambrium, plutonic, igneous rocks overlain by Permian and Triassic sedimentary rocks. Low lying hills along the margins of the valley further downstream are composed of Createous Lewis shale, a marine shale that forms the "bedrock" in the stream channel area.

The soils along the streambank are Navajo clay. This is an Entisol, Typic Torriorthent, fine, mixed, calcareous, mesic. The A horizon (O-16 inches) is reddish brown sandy clay loam to clay loam with granular to angular blocky structure. The C horizon (16-31 inches) is very heavy dense clay with a weak, fine, blocky structure. This soil contains much salt with vertical cracks or "piping" common. It has a high shrink-swell potential and a reaction of 8.5 to 9.0 PH. The permeability is slow and water holding capacity is high. The hydrologic soil group is D.

The BLM managed segment has a mean annual precipitation of 13.45 inches, with a frost free period precipitation of 7 inches. The mean number of frost free days is 140 (approximately May 10 to September 25).

A monthly hydrograph of Senorito Canyon shows a peak runoff in May with a mean of 119 cfs. This represents the snowmelt period. A second smaller peak in August of 18 cfs, represents the mean from summer thunderstorms. Summer flash floods have ranged from 130 to 2,360 cfs.

The lower, BLM managed areas adjacent to the riparian zone have a dominant vegetative cover of black greasewood *Sarcobatus vermiculatus,* shadscale *Atriplex confertifolia* and basin big sagebrush *Artemisia tridentata* tridentata. The herbaceous understory is dominated by alkali sacaton *Sporobolus airoides.*

At the present time, the BLM managed segment of the riparian stream habitat is 22% non-functional and 78% functional at risk. The trend has been upward for the last four years (1990-1994).

Elliott (1979) devised a hypothetical sequence of arroyo evolution for the Rio Puerco and its tributaries. Senorito Canyon ranges from stage B to C in the BLM reach (refer to figure 1).

HISTORICAL RECORD

It is estimated that the last downcutting of the Rio Puerco and its tributaries began between 1885 and 1890. The Senorito Canyon stream channel has been downcut 10-20 feet through the alluvium and the water table has subsequently dropped. This has allowed upland species to invade the riparian zone such as rabbitbrush and sagebrush, During the 1920's and 1930's, salt cedar *Tamarix spp.* was planted by the Soil Conservation Service for the purpose of streambank stabilization. Since that time it has spread the entire length of the lower Senorito Canyon. Another non-native, Russian olive *Elaegnus angustifolium* has also begun to invade the riparian zone.

Historically, the Rio Puerco and its tributaries, such as Senorito Canyon, supported a native riparian plant community of a gallery overstory of Fremont cottonwood *Populus fremontii.* Associated species included coyote willow *Salix exigua,* fendler rose Rosa *woodsii,* New Mexico locust *Robinia neomexicana,* Desert olive *Forestiera* neomexicana, and other woody species. The understory was a mixture of sedges, rushes and aquatics such as horsetail *Equisetum* spp. and cattail *Typha* spp.. The coyote willow still occur, but have been replaced to a large degree by salt cedar.

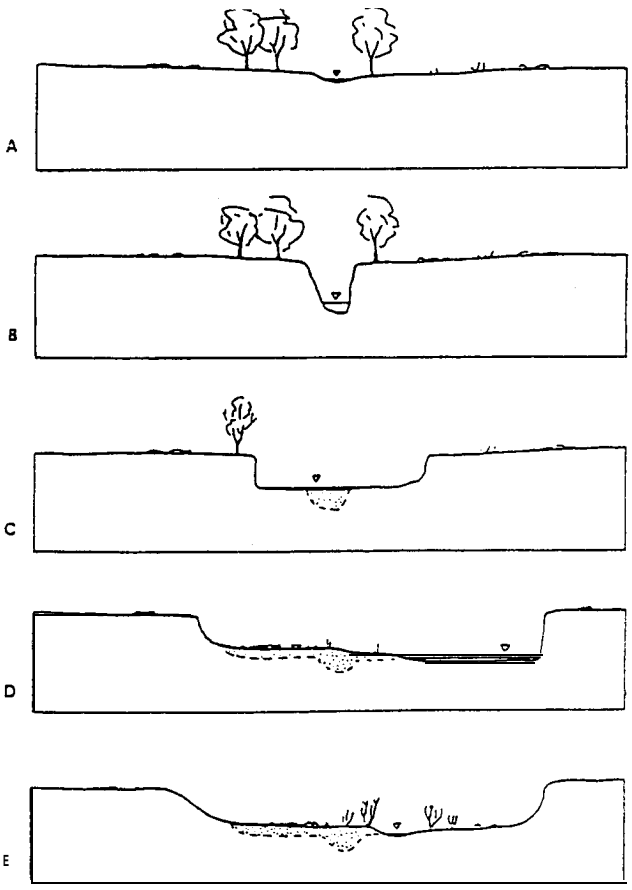

Figure 1. Hypothetical sequence of arroyo evolution. (Elliott, 1979).

The gallery forests of Fremont cottonwood which once covered the Rio Puerco floodplains and its tributaries, were often close to early settlements. Trees were cut for fuel, ceiling beams "Vegas" for adobe buildings and to clear land for agriculture and urbanization. Beaver Castor *canadensis* have also cut down cottonwoods. The benches and terraces of the Rio Puerco and its tributaries such as Senorito Canyon, when flooded, cause cottonwoods to sprout. The seedlings are highly relished by cattle and are browsed along with the willows. During the 1990 inventory of Senorito Canyon, only one cottonwood was found on the reach managed by BLM, State, and private land owners (approximately 6 miles).

Historically the riparian area has been grazed heavily and continuously yearlong. The BLM segment of the stream flows through three grazing allotments. Cattle concentrated along the stream because of the obvious shade, succulent feed and

perennial water supply. This has severely restricted cottonwood and willow regeneration.

The native cottonwood/willow communities, once common along the Rio Puerco and its tributaries are now threatened. As the few old trees (80-100 years) die they are not being replaced and reproduction is low.

Cottonwoods are considered a "keystone" species because so many other plants and animals depend upon them. Their large size provides a canopy habitat that serve raptors, cavity nesters, and neo-tropical migrants.

WILDLIFE HABITAT

Managing riparian habitat for wildlife has drawn a great deal of interest in the past few years. Riparian habitat is especially important to neotropical migrant birds, which are declining over much of their ranges. The Partners in Flight/Aves de las Americas Neotropical Migratory Bird Conservation Program is a commitment to conserve these species and their habitats.

The Rio Grande Basin, which includes the Rio Puerco and its tributaries has been identified as part of the historical range of several neotropical birds on the decline. The southwestern willow flycatcher *Epidonax traillii extimus* is one of these. It winters in southern Mexico south to Panama and occurs in the western side of New Mexico during the spring and autumn migration and are known to breed in the Rio Grande Basin. These birds are confined to riparian woodlands. They need a cottonwood overstory with a willow understory with nearby areas of surface water (preferably slow flowing).

The southwest willow flycatcher has suffered from loss of riparian habitat or a degradation of the habitat and has further declined due to the brown-headed cowbird *Molothrus ater*. This bird, the original buffalo bird of the plains, is a parasitic breeder. It lays its eggs in the nest of songbirds including the SW willow flycatcher ends up raising cowbirds.

MANAGEMENT PLAN

In 1990, a cooperative resource management plan was developed with the private land owners, U.S. Forest Service, Soil Conservation Service, New Mexico State Land Office and Bureau of Land Management. This plan was intended to better manage the entire watershed with emphasis on the riparian zone.

The reach of Seriorito Canyon managed by BLM have the following general objectives:

- Improve diversity and productivity of the riparian plant communities.
- Improve water storage and restore ground water table.
- Improve water quality.
- Reduce peak flow velocities and the impacts of flooding.
- Reduce upland tap rooted shrubs that have invaded riparian area.
- Increase available water to native hydrophytes by controlling salt cedar.
- Improve wildlife habitat for migrant ave-fauna, aquatic macroinvertebrates, fish, obligate and facultative amphibians, reptiles and mammals.
- Provide a dependable and nutritional source of livestock forage for wintering cattle.
- Improve watershed conditions on the adjacent uplands by reducing sheet erosion caused by overland flow.

After the initial inventory and establishment of monitoring studies specific objectives were proposed:

- Increase the dominance of preferred plant communities by 20% five years after plan implementation. Preferred communities were:
  - *Salix exigua/Melilotus alba* or *M. officinalis*
  - *Populus fremontii/Salix exigua/Carex spp.*
- Reduce the dominance accordingly of *Tamarix/Chrysothamnus/Artemisia*. Maintain the width/depth ratio of 9.29 on the Forty Four allotment segment and 13.3 on the Señorito Allotment segment.

RECOMMENDATIONS

- Leave an adequate carryover vegetation for bank protection and sediment filtering during spring snowmelt and summer floods.

- Provide a structural layering of cottonwoods and willows with several age classes to provide shading, nest building, perching, ready access to water and escape cover for wildlife.
- Plant cottonwoods, willows and other native, woody species to act as buffers of peak run-offs on stream banks and flood energy dissipators.
- Develop a grazing scheme to allow for increased germination, sprouting and seedling survival for riparian vegetation.
- Slow runoff velocities and catch sediment from sheet erosion from adjacent uplands.

PROPOSED ACTIONS

- Construct five riparian pastures approximately 10 to 20 acres in size.
- Plant cottonwood poles, sprig willows, and plant root stalk riparian species in all five riparian pastures.
- Spray salt cedar with Isopropylamine salt of imozapyr (Arsenal or Chopper), Spray approximately 5-10 acres per year for 5 years.
- Defer livestock grazing from 3-5 years (no grazing) until desired riparian vegetation is established and stream banks are stabilized and the riparian area is functioning properly. Grazing will then be allowed only during the dormant season (October 15 to March 31).

MONITORING

The BLM is using false color infrared photos 1:4800 scale, that were flown in July of 1991. This will be the baseline and will be flown every 5 years to help monitor the riparian vegetation and stream channel. The more subtle changes will be detected using the green line vegetative monitoring. The green line is a .1 acre area 363 feet on each side of the stream (726 feet) and 6 feet wide. There are three cross sections in each 0.1 acre area that measure channel width and depth plus width of each vegetative community across the entire riparian area. The number and age class of woody species are also counted and the amount of bank overhang. Nine photo points are also established at the three cross sections. The BLM also began macroinvertebrate sampling in 1993. This baseline data will be another indicator of water quality.

RESULTS

Water gap fencing was constructed between each of the five riparian pastures. Cattle have a 300-600 ft. wide access to the stream between each pasture. Panels of (PE) polyethylene pipe were hung on a cable stretched across the channel.

Cottonwood poles (12-14 feet) and willows were planted along with some root stalk of other riparian species. Holes were augured down to the water table 3 to 4.5 feet, depending on the distance away from the channel. More than 100 cottonwoods and over 300 willows were planted. Planting occurred during the last week in March. By June they had begun to leaf out. By August they began to look like a tree with branching and leaves. By September, sprouting willows were showing up that we didn't plant. Planting was done with the aid of volunteers from the Southwestern Indian Polytechnic Institute.

The channel of Señorito Canyon shows initial stages of meandering in the upper reaches and advanced sections further downstream. By midsummer of 1993, nine months after the first four riparian pastures were constructed, we had a great deal of channel narrowing by vegetation. This was principally an increase in sedges, white and yellow sweet clovers and coyote willows.

After two large flash flows during the summer of 1993, the velocity of the stream flow was noticeably slowed as evidence of bent over vegetation and litter accumulation. There were also several inches of sediment deposited along the channel. Channel aggradation has begun to occur.

CONCLUSIONS

The Rio Puerco and its tributaries have lost much of their ecosystem integrity. This is evident in the low diversity, present riparian vegetative communities and the wildlife they support. Native species of cottonwoods, willows and sedges have

been replaced by exotic invaders such as salt cedar, Russian olive and sweet clovers. This loss of native species has caused a reduction in biological diversity of plant and animal species. Only fragmented stands of cottonwood/willow stands are now found along stream banks. We hope to change Señorito Canyon from poor riparian condition rating to high and bring the riparian areas rated as non-functional and functional at risk to proper functioning condition.

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