Riparian/Wetland Vegetation Communities

of New Mexico:

Gila, San Francisco, and Mimbres Watersheds

Final Report

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INTRODUCTION

In New Mexico, as well as in the rest of the country, wetlands and riparian areas along our streams and rivers are very important biological and economic resources. These areas support highly productive ecosystems and a wide variety of plants and animals. Riparian/wetland ecosystems are in turn very important for maintaining water quality and quantity, stabilizing streambanks, providing flood protection, as well as enhancing habitat for fish and wildlife (EPA 1988). Additionally, the native plant communities along our rivers can diminish the magnitude of peak flood flows and increase groundwater recharge within a watershed, thereby having a greater impact on the health of the watershed than their acreage alone might suggest (Elmore and Beschta 1987).

Because of the exceptional resource value of riparian and wetland areas, the New Mexico Environment Department (NMED) in cooperation with the Environmental Protection Agency (EPA), has initiated the development of a Wetlands Protection Plan for the state following the guidelines of the National Wetlands Policy Forum. The primary goals of this plan are (1) inventory and assessment of wetland resources; (2) the identification of wetlands protection mechanisms, and (3) the development of strategies for implementation of the plan.

To meet the first goal of the planning effort - inventory and assessment - the New Mexico Natural Heritage Program (NMNHP) at the University of New Mexico has joined with NMED and EPA in a multi-year cooperative venture to describe and classify riparian vegetation communities of New Mexico, and to initially develop an inventory of high-quality riparian/wetland sites that are fully functional or restorable. In 1993 the venture focused on the Pecos River Basin (Durkin et al. 1994), and in 1994 on the Upper and Middle Rio Grande Basin from the Colorado border to Elephant Butte Reservoir (Durkin et al. 1995a). In 1995 our efforts concentrated on the Gila, San Francisco and Mimbres Rivers, the results of which are reported here.

Below we present an overview of our knowledge of the riparian ecosystems of New Mexico, and in particular the riparian ecosystems of the Gila–San Francisco–Mimbres watersheds, as well as a literature review of recent ecological studies. We then present our methods followed by the results from 1995 investigations. The results are divided into two parts: Part I details the preliminary classification of riparian/wetland communities of the Gila–San Francisco–Mimbres watersheds with sections on the hydrological regimes and soils, along with the vegetation community composition. The temporal and spatial ecological relationships among the different vegetation communities in the riparian landscape are also presented. We additionally look at plant species diversity in terms of exotics versus natives, and in terms of wetland indicator values.

Overview of Riparian/Wetland Ecosystems

The riparian ecosystem encompasses the river and the adjacent floodplain, linking the aquatic ecosystem to the terrestrial ecosystem (Gregory et al. 1991, Crawford et al. 1993). It is a flood-driven environment where the effects of floods can be destructive or constructive to riparian plant communities (Szaro 1989). Riparian ecosystem composition and structure is dependent not only on surface flows, but also on subsurface streamflows that play an integral role in the ecology and evolutionary dynamics (Reichenbacher 1984) of seed dispersal, plant establishment, species replacement patterns, maintenance of species and "patch" diversity, as well as nutrient cycling and productivity (Leonard et al. 1992, Stromberg et al. 1993 and 1996). The expression and spatial patterns of riparian vegetation and species distribution is naturally a result of the dynamics and configuration of channels, periodic flooding, the presence or absence of large woody debris, as well as geomorphology and soil moisture (Heede 1985, Hupp and Osterkamp 1985, Minkley and Rinne 1985, Hupp 1992, Malanson 1993, Muldavin 1993a). Vegetation patterns in the riparian ecosystem are also magnified by the effects of human induced impacts, such as grazing, timber harvest and recreation (Szaro 1989, Sewards and Valett 1996). Moreover, riparian plant communities are naturally resilient to flood flows (Szaro 1989, Stromberg et al. 1993) and require appropriate seasonal flows of water for plant recruitment, growth and development, maintenance, and restoration (Bock and Bock 1985, Brady et al. 1985, Asplund and Gooch 1988, Szaro 1989, Siegel and Brock 1990, Leonard et al. 1992, Muldavin et al. 1993b, Stromberg et al. 1993, Crawford et al. 1993, Durkin et al. 1994 and 1995a).

In the Southwest, riparian forests and shrublands are considered wetlands along with the inundated marshes that we typically think of as wetlands (Johnson and Lowe 1985, Lowe et al. 1986, Krueper 1996). Following Cowardin et al. (1979) and the National Wetlands Inventory (1984) our riparian areas would be classified into forested, scrub-shrub or herbaceous persistent-emergent wetlands. The riparian/wetland vegetation communities are uniquely distinct from those found in the adjacent uplands. While the uplands commonly support desert, grassland or woodland vegetation, riparian zone communities are reminiscent of the winter-deciduous hardwood bottomland and upland forests of the eastern United States (Johnson and Lowe 1985). But unlike their eastern counterparts, the riparian vegetation of the West occurs as narrow, linear strips of vegetation along ephemeral, intermittent, or perennial streams, and large floodplain rivers, such as the Rio Grande or Gila rivers in New Mexico.

Although riparian zones occupy only a small portion of a watershed, they are an extremely important ecological component of the landscape (Elmore and Beschta 1987). In the arid and semiarid landscape such that occurs in New Mexico, riparian vegetation on a whole is estimated to occupy only less than one percent of the landscape (Knopf et al. 1988). Riparian/wetland ecosystems are considered to be among the rarest habitat types in the Western Hemisphere (Krueper 1996). Yet, despite their rarity, the greatest diversity of native vegetation communities, along with birds, fish, and terrestrial vertebrates occurs in riparian zones of the Southwest (Hink and Ohmart 1984, Siegel and Brock 1990, Howe and Knopf 1991, Durkin et al. 1995b).

In New Mexico, native riparian/wetland communities are considered highly threatened. The geographic extent of riparian/wetland ecosystems, as in other southwestern states, has been dramatically reduced (Fenner et al. 1985). The rapid decline of these critical ecosystems is generally attributed to long-term human impacts resulting from agricultural conversion and urbanization of the floodplain (Campbell and Dick-Peddie 1964, Hink and Ohmart 1984, Brady et al. 1985, Siegel and Brock 1990, Howe and Knopf 1991), and for most major floodplain rivers, the degradation of riparian ecosystems is also due to the development of water storage projects (Crawford et al. 1993). Moreover, the deterioration and decadence of riparian ecosystems has been attributed to groundwater depletion and stream dewatering (Stromberg et al. 1996).

For southwestern New Mexico, the most immediate and obvious threat to riparian vegetation is from domestic livestock grazing. This is considered to be the most important land management issue impacting Southwestern riparian ecosystems (Noss 1994). Livestock grazing of the upper watersheds (Medina 1986) accompanied by excessive grazing and trampling within the generalized floodplain itself (Marlow and Pogacnik 1985, Chaney et al. 1991, Shaw and Clary 1996) for the past 100+ years has been shown to negatively affect riparian vegetative composition, ecosystem function and ecosystem structure (Krueper 1996, Ohmart 1996). Major ecological effects from grazing impacts have included a significant invasion by exotics (Sivinski et al. 1990, Busch and Scott 1995, Medina 1996), an increase in soil compaction, reduced vegetative cover, and changes in species composition (Kauffman and Krueger 1984, Szaro 1989), as well as streambank erosion, changes in channel morphologies, increased sediment transport, and the lowering of the surrounding water tables (Clary and Webster 1990, Krueper 1996). Other serious impacts contributing to the degradation of overall watershed conditions have come from excessive logging (Boles and Dick-Peddie 1983). Additionally, historical management of upland areas has included fire suppression coupled with grazing. Consequently, it is speculated that reduced herbaceous cover from grazing, together with conversion of upland savannahs to shrublands and forests, may have altered infiltration and runoff patterns in upland areas, which ultimately alters river flow regimes by increasing the frequency and intensity of floods (Wallace 1992). Collectively, all of these impacts compromise the biological quality and ecological integrity of riparian/wetlands in New Mexico (Deardorff and Wadsworth 1996).

Review of Other Studies

Despite their ecological significance, the riparian/wetland communities of southwestern New Mexico have been little studied particularly within the Gila, San Francisco, and Mimbres watersheds. Only those sources, published and unpublished, that specifically focus on riparian/wetland communities are briefly reviewed here. In general, the interrelationships between the plant communities and soils in combination with hydrologic analyses have not been studied. No serious attempts have been made to classify the riparian/wetland communities to accommodate the full range of natural variation that occurs within the floodplain over a full range of environmental conditions. The available information is primarily limited to certain elements, or is restricted to a small geographical extent, and no investigations have attempted to document all native and introduced plant species, or their wetland indicator status.

The only major attempt to classify riparian/wetland plant associations and their soils, and examine the impacts of grazing was by Medina (1986), but was limited to the smaller Fort Bayard watershed of the Mimbres. Freeman and Dick-Peddie (1970) conducted a comparative study of woody riparian vegetation along an environmental gradient, which also described soil characteristics. This was also limited geographically to the Black and Sacramento mountain ranges and made no attempt to classify or describe the plant communities. A quantitative study of woody riparian vegetation patterns along an environmental gradient was published by Boles and Dick-Peddie (1983). The authors also discussed grazing impacts, but excluded herbaceous plant associations and was limited to the Mimbres River. For parts of the Gila and San Francisco rivers, the first study to document the relationship between soils and riparian vegetation, and identify and describe riparian/wetland plant communities was by Dick-Peddie et al. (1987). This study also recognized herbaceous riparian plant associations.

A biological survey of portions of the San Francisco valley by Hubbard and Hayward (1973) described five general vegetation/habitat types and physiognomy as part of an investigation to quantify the birds, mammals, reptiles, and fishes of the area. They also made management recommendations to facilitate preservation of the canyon. The first recommendation would ban off-road vehicles from the canyon to prevent further erosion of the soils and damage to vegetation, and second to ban grazing. A final recommendation allowed for inclusion of the valley as part of the Wild and Scenic River System.

Several significant phenological studies of the major southwestern woody riparian plant species are well known. Regeneration ecological studies have been published for Fremont's cottonwood (*Populus fremontii*) by Fenner et al. (1984 and 1985), for Arizona sycamore (*Platanus wrightii*) by Bock and Bock (1985), and for other major woody species by Pope et al. (1990), Siegel and Brock (1990), and by Brock (1994). Asplund and Gooch (1988) examined the geomorphology and distributional ecology of Fremont's cottonwood (*P. fremontii*), while Reichenbacher (1984) focused on the evolutionary ecology of key southwestern riparian plant communities.

The ecological condition of riparian habitats in parts of the Gila watershed was recently addressed by Ohmart (1996) who identified grazing as the major cause of degradation of streambanks and plant communities. The only approach to providing ecological descriptions of riparian plant communities for parts of the Gila River and Mogollon Creek (Muldavin 1987), and a segment of the Mimbres River (The Nature Conservancy 1994) are treated in unpublished reports.

STUDY AREA

The study area (figure 1) encompasses the three major watersheds of southwestern New Mexico, the Gila, San Francisco and Mimbres rivers. The Gila and San Francisco rivers drain the southeasternmost portion of the Lower Colorado River Basin while the Mimbres river drains the Southwestern Closed Basin. With headwaters high in the Mogollon Mountains at approximately 3050 meters (10,000 ft) within the Gila Wilderness of New Mexico, the Gila River flows in a westerly direction to Arizona, through the Cliff/Gila valley, through Redrock valley, and exiting the state near Virden at 1221 m (4004 ft). The Gila then flows westerly through southern Arizona and is part of the larger Colorado River Basin. The San Francisco River enters New Mexico from the White Mountains of Arizona near Luna, New Mexico at an elevation of approximately 2530 m (8300 ft) and loops south through Reserve and Glenwood, NM. It then flows back out of New Mexico at approximately 1524 m (5000 ft) to Arizona where it converges with the Gila. The Mimbres River, however, remains entirely in New Mexico as a surface entity, eventually reaching into Mexico to an inland basin close to the Sierra Madres Mountains of Mexico (Boles and Dick-Peddie 1983). It originates in the Mogollon Mountains of New Mexico at 2450 m (8036 ft.) and ends as a surface stream, near the Florida Mountains east of Deming, New Mexico at an elevation of 1300 m (4264 ft.).

Climate

The climate of the survey area is semiarid and lies in two different climatic zones, one of mountainous regions, and the second of the semiarid desert. In general, as elevation increases, precipitation increases and temperatures decrease. In mountainous regions, or in the northern part of the survey area, mean annual temperatures range from 0° C to 7° C (32° F to 45° F) and mean annual precipitation ranges from 50 cm to 80 cm (20 in. to 32 in.). Almost half of the precipitation stems from moist air over the Gulf of Mexico, and falls from July to September as brief but occasionally heavy monsoonal thunderstorms. While spring and fall are relatively dry, a small increase in precipitation occurs in the winter from moist air over the Pacific Ocean. Occasional heavy rainfall from tropical Pacific storms over the Gulf of California during winter tends to cause local flooding. In the semiarid desert portions of the southern part of the survey area, mean annual temperatures range from 13° C to 20° C (55 ° F to 70° F) and mean annual precipitation ranges from 20 cm to 32 cm (8 in. to 13 in.). More than half of the precipitation stems from moist air over the Gulf of Mexico, and like the northern portion, falls from July to September as brief but occasionally heavy monsoonal thunderstorms. Winter precipitation falls as snow from December through February and usually melts fairly rapidly (Parham et al. 1979, McNab and Avers 1994).

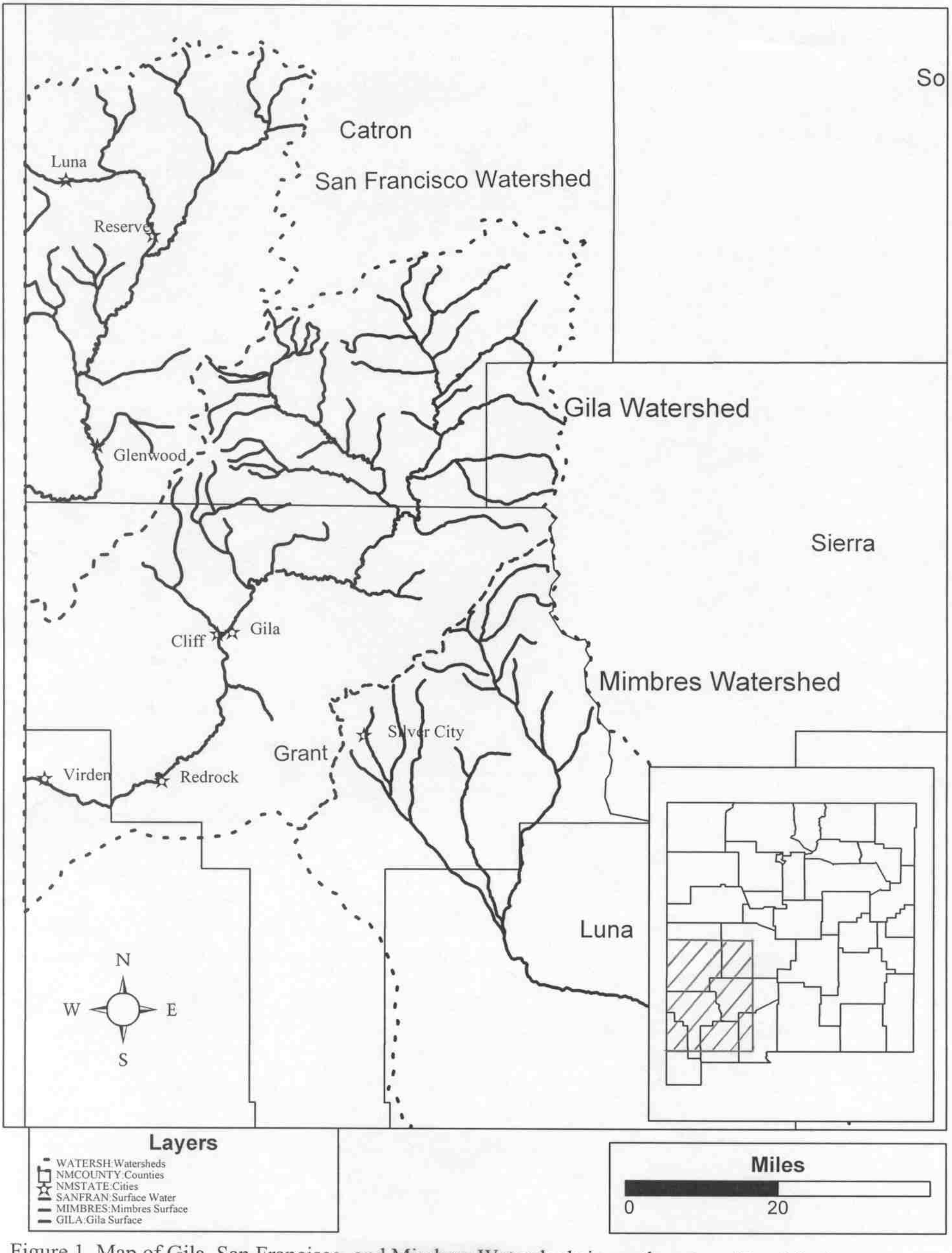

Figure 1. Map of Gila, San Francisco, and Mimbres Watersheds in southwestern New Mexico.

Geology

Mean elevations of the northern portion of the study area range from 1830 m to 3840 m (6000 ft. to 12,600 ft.). Parent materials of the surrounding mountains are derived from Cenozoic volcanics and Mesozoic sedimentary rocks. The surrounding upland vegetation is predominantly ponderosa pine (*Pinus ponderosa*) forests and Gambel's oak (*Quercus gambelii*) woodlands at lower elevations, while white fir (*Abies concolor*) and Douglas fir (*Pseudotsuga menziesii*) are common at the upper elevations. For the southern region, mean elevations range from 800 m to 1676 m (2,600 ft. to 5,500 ft.) and parent materials are derived from Paleozoic–Cenozoic complexes and alluvium. Surrounding upland vegetation principally consists of oak – juniper (*Quercus – Juniperus*) woodlands, mesquite – tarbush (*Prosopis – Flourensia*) desert scrub, and grama grass – tobosa grass (*Bouteloua – Hilaria*) desert grasslands (McNab and Avers 1994).

Ecoregions

The study area includes three ecoregions following Omernik and Gallant (1987). The major ecoregion is known as the Arizona/New Mexico Mountains, but there are small amounts of the Arizona/New Mexico Plateau to the north, and Southern Deserts to the South. With respect to the ecoregional hierarchy of Bailey and others (1994), the study area also includes: (1) the White Mountains–San Francisco Peaks Section of the Arizona–New Mexico Mountains Semi-Desert – Open Woodland – Coniferous Forest – Alpine Meadow Province (M313A) which the majority of the Gila and San Francisco flow through, and (2) the Basin and Range Section of the Chihuahuan Semi-Desert–Basin and Range Province (321A) in which the Mimbres River flows (see Bailey 1994; McNab and Avers 1994).

METHODS

Vegetation sampling was designed to characterize the riparian/wetland vegetation communities throughout the study area and to evaluate their relationship to the hydrological regimes and soils. Vegetation and environmental data along with information on disturbances and impacts were collected at each sampling site.

Sampling Design

Due to the size and remoteness of the study area, aerial photographs and videography obtained from the U.S. Forest Service and the Bureau of Land Management were used to initially evaluate potential sampling sites in terms of structure, composition and extent of the riparian vegetation. Additionally, aerial reconnaissance flights by our own ecologists aided in the evaluation, particularly in areas lacking aerial photography. Areas thought to be of outstanding, satisfactory, or poor quality were transcribed on USGS 7.5 minute topographic maps and National Wetlands Inventory (NWI) maps were consulted to confirm the broad vegetation type (i.e., forested wetlands, shrublands, herbaceous wetlands, saltcedar woodlands, wet barren flats or other land-use types (e.g., farmlands). Topographic maps provided elevations from which stream gradients could be determined. These maps also provided other important features that facilitated determination of site selection, such as landform type, relief, streamflow regimen, as well as forested and marshy vegetation. Survey reaches were delineated and classified according to stream gradient, elevation and the hydrologic regime. Within each survey reach potential sites for field sampling were identified and categorized by structure, gross composition, size and condition.

A preliminary sampling pool two to three times larger than the targeted final sample size was developed to account for possible access problems on private and public lands, as well as on-the-ground unsatisfactory conditions not previously detected by aerial assessments. Prior to collecting the data in the field, landownership information was determined from county tax rolls, BLM land status maps, and interviews with knowledgeable individuals (i.e., agency personnel). Landowners, both public and private, were contacted for permission to access their property.

Final sampling site selection was based on on-the-ground reconnaissance and was structured to maximize geographic distribution and floristic variation. Sites that were drastically altered by human activity such as cultivation, dumping of refuse, livestock holding sites, as well as logging and mining were not included in the sampling. Site selection was also dependent on finding a relatively homogeneous stand of vegetation 0.1 hectare in size (1,000 meters^2). Sites dominated by or contaminated by exotic vegetation were not necessarily excluded (e.g., saltcedar woodlands).

Data Collection and Analysis

Hydrology

One of the most important environmental influences on a riparian/wetland community is the flooding environment. To evaluate potential flows at a site a cross-sectional profile of the channel and the adjacent floodplain was surveyed. A transit level and stadia rod was used to measure elevations relative to the transit level to the nearest inch. Each cross-section extended across the active channel and floodplain and measurements were made at every topographic break. Channel substrate character and significant topographical features or landforms, such as island bars, side bars, and terraces along the cross-section were described. The elevations of current water surface heights, high water marks, location of flood debris, root crown heights for significant riparian species, and bank heights were measured. Stream gradients were also measured with the transit level and stadia rod. The elevations at varying points along the water's edge from upstream to downstream positions were measured and the angle of the slope determined.

Discharge measurements of stream flows were taken on the day of site sampling using a Marsh-McBirney Model 2000 Flow Meter. Velocity was measured in feet/second at one- to two-foot intervals depending on channel width and depth. Streamflows or cfs (cubic feet/second) were then estimated using a combination of these measurements.

The channel morphology at each site was classified following Rosgen's (1992) stream classification system. Parameters used included: channel gradient (measured as energy slope of the water surface); sinuosity (ratio of channel length to valley length); width/depth ratio (width of bankfull stage divided bankfull depth); dominant particle size of bed and bank materials; entrenchment of channel and confinement of valley; and landform features including their stability or erodibility and soil texture. Additionally, Rosgen (1992) defines a list of physical characteristics of channels for delineation to stream sub-types. These criteria were used to further define the channel morphologies and included: (1) riparian vegetation; (2) organic debris and/or channel blockages; (3) stream size (width); (4) flow regimen (perennial, ephemeral, subterranean, intermittent channels, streamflow variations and sources (i.e., stormflow or snowmelt); (5) depositional features; and (6) meander patterns.

For all surveyed cross-sections, each point measured (distance and elevation) was entered into the cross-sectional profile analyzer computer program XSPRO (Grant et al. 1992). The program produces a profile of the channel and associated landforms then models the flows through the cross-section at designated stage heights. Modeling parameters include stream cross-sectional areas, stream gradients, and a user-assigned Manning's "n" channel roughness coefficient for each cross-section. Manning's "n" was initially estimated using Barnes (1967). Stream gradients were calculated from field measurements and from 7.5 minute topographic maps.

Modeled flows were calibrated from discharge measurements for the date of sampling or from flows measured on that day from the nearest USGS stream gauge. Manning's "n" and the stream gradient were adjusted until the modeled flows matched discharges from the stream gauge. For the cross-sections where flows were not directly measured or, where cross-sections were not located near stream gauges, linear extrapolations were made between flow levels of adjacent USGS stream gauges to the point of the cross-section.

Once the flows to flood the site for the cross-sections were calculated, the estimated return intervals for these flows was determined using the recurrence probabilities calculated at New Mexico stream gauges by Waltemeyer (1986). As with the daily flows, recurrence intervals were only calculated for the sites near gauging stations and then extrapolated to cross-sections not located near stream gauging stations. For the cross-sections located on smaller tributary basins without stream gauging stations recurrence intervals were calculated by determining the drainage basin area and the average elevation of the stream. These two variables were then input into Waltemeyer's (1986) linear regression equations which estimate a recurrence interval for the specific basin in New Mexico. As a corollary to recurrence interval, the ratio of the cross-sectional area of the floodplain where sample plots are located to the cross-sectional area of the channel at bankfull height was calculated. Thus, each vegetation plot located on a cross-section has a recurrence interval associated with it along with cross-sectional ratios and actual discharges in cfs necessary to flood the site.

Vegetation

Vegetation data was collected so as to be closely compatible with the standards of the U.S. Forest Service's Terrestrial Ecosystem Survey (Edwards et al. 1987) and Habitat Type classification databases (Muldavin et al. 1990), as well as other ongoing community classification projects of the New Mexico Natural Heritage Program (Muldavin and Mehlhop 1992, Muldavin et al. 1993a and 1993b, Durkin et al. 1994, Muldavin et al. 1994a and 1994b).

At, or along a stream cross-section, homogeneous stands of vegetation were identified that were representative of the community type(s) of the site. Within each stand, a 400 m^2 square or rectangular plot was established and the species present in both the plot and in the surrounding riparian and upland stands were recorded. Percent canopy cover for each species present within the plot was estimated. Where trees were present, stems were tallied in two-inch size classes and one or more dominant tree was cored to determine age.

Other variables estimated or measured at each site included: elevation; aspect (stream bearing); valley floor width (from topographic maps); ground cover of bare soil, litter, wood, gravel, rock, bryophyte, and non-vascular plants; height of the center of the community above bankfull stage of the channel; distance of the center of the community from bankfull stage of channel; landscape position (point bar, floodplain, old channel, terrace, etc.); signs of wildlife or domestic livestock utilization; signs of disturbances (flooding, fire, windthrow, logging, etc.); successional relationships where trends are observed; adjacent upland communities; hydrologic and geomorphic features (beaver dams, point bars, etc.); evidence of landuse history (from landowner or manager); and plot photographs of the stream reach environment featuring representative species of the community type(s) and associated landforms, as well as unique attributes of the stream and floodplain.

All plants not identifiable in the field, particularly of difficult genera such as *Salix*, *Carex*, and *Juncus* were collected and pressed for later identification. All voucher specimens are archived at the University of New Mexico Herbarium of the Museum of Southwestern Biology.

All plants were evaluated for their wetland indicator status (WIS) in this region (Region 7, which encompasses the southwestern states of Arizona and New Mexico). Five wetland groups as defined by Reed (1988) include:

<u>obligate wetland plants (OBL)</u> - occur almost always (estimated probability of >99%) in wetlands, but occasionally are found in nonwetlands (estimated probability of <1%);
<u>facultative wetland plants (FACW)</u> - usually occur in wetlands (estimated probability of 67 to 99%), but occasionally are found in nonwetlands (estimated probability 1 to 33%);
<u>facultative plants (FAC)</u> - share an equal likelihood (estimated probability 33 to 67% of occurring in either wetlands or nonwetlands;
<u>facultative upland plants (FACU)</u> - usually occur in nonwetlands (estimated probability 67 to 99%), but occasionally are found in wetlands (estimated probability 67 to 99%), but occasionally are found in wetlands (estimated probability 1 to 33%);
<u>obligate upland plants (UPL)</u> - occur almost always (estimated probability >99%) in nonwetlands.

Species in the facultative category were further assigned a plus (+) or minus (-) sign to indicate those species with a higher or lower affinity to be associated with wetlands, or not. Those species that were not assigned an indicator status (no indicator; NI), due to insufficient information, were assigned an indicator status based on knowledge of the taxa. If there was strong disagreement with the designated indicator status other than the NI designation, then an alternate assignment was parenthetically given, which we feel more appropriately classifies the taxon (see Table 1 of Appendix A).

The preliminary vegetation community classification was developed by applying agglomerative cluster analysis using Euclidean distance and Ward's Method as an initial organizational tool to define riparian/wetland community types. The program SYNTAX IV (Podani 1990) was used to generate a dendrogram of hierarchical groupings of plots with similar vegetation associates. Plots were then sorted using synthesis stand tables into final vegetation community type groups following procedures outlined in Mueller-Dombois and Ellenberg (1974). Hydrological, soil and other site characteristics were then correlated to the community types. Summary tables were produced to average the species values and environmental variables among all plots within a community type. These summary values provide the quantitative basis for the development of community type descriptions. Full descriptions for each community type (Community Characterization Abstracts or CCA's) were developed. Each CCA includes sections on distribution, vegetation, environmental setting, adjacent vegetation, a discussion of ecological dynamics, and relevant documentation. With this data, plant communities can then be constructed and organized into a vegetation classification scheme.

Essential to a riparian classification is the consideration of natural fluvial disturbances. This classification, as in others (Padgett et al. 1989, Hansen et al. 1990, Kittel 1993, Kittel and Lederer 1993; Muldavin et al. 1993b, Durkin et al. 1994, Durkin et al. 1995a), considers riparian vegetation communities to be either relatively stable, or at least to be predictable assemblages that are dependent on the fluvial dynamics of a river system for long-term maintenance and regeneration. This complex process of riparian ecosystem development has been referred to as "site progression" by Leonard et al. (1992) and is a critical process in the maintenance and growth of these communities. Where possible, we have made a preliminary evaluation of the dynamic status of each community type in terms of successional or stage of site progression, and have developed general concepts and models of riparian/wetland community dynamics along each major reach.

Soils

Soil sampling and soil profile descriptions followed guidelines established by the Soil Conservation Service's <u>National Soils Handbook</u> (SCS 1991). At each vegetation plot a 1 m^3 soil pit was excavated and soil horizons were determined along with horizon depth. For each horizon, soil structure, color, texture, consistency, percent rock fragments, size and abundance of pores and roots, calcium carbonate reaction ($CACO_3$), and any hydric soil redox features (i.e., mottling and gleying following Vepraskas 1992) were described. Soil samples from each horizon were collected for laboratory analysis and later archiving. For each horizon, pH and salinity levels were determined. Salinity was measured by electrical conductivity (EC) in each horizon (in milliSeimens) within 20 centimeters (8 inches) of the surface. A soil paste (at the water saturation point of the sample) was used to make soil EC measurements.

All soils were then keyed and classified to the family level (Soil Survey Staff 1992). Soils were also ranked in terms of wetness based on Subgroup and Great Group characteristics (Table 1). Plant available water percentages as calculated by Donahue, Miller and Shickluna (1983), based on soil texture, were estimated for the moisture control section of the soil profile. Depth to gleying and redox features were also determined.

Databases

All field data was entered into computer databases for storage and retrieval, and is accessible to all participating agencies. Selected information collected during this project will be entered into The Nature Conservancy's Biological and Conservation Data System (BCD) maintained by the New Mexico Natural Heritage Program at the University of New Mexico's Biology Department, Albuquerque. The New Mexico Natural Heritage Program seeks to continually update and inventory biological and ecological features, and biodiversity preservations of New Mexico utilizing the BCD. This system houses descriptions of plant associations and rare plant species, information on their locations in the state, information on high quality examples of plant communities, and literature relevant to the management and protection of the biodiversity of plant communities and rare species. Information stored in the BCD is available to biologists, land managers, consultants, and any other interested party. However, the New Mexico Natural Heritage Program reserves the right to respect the confidentiality of certain data.

Table 1. Soil wetness ranks based on the soil classification. Wetness ranks were assigned to soil types based on their degree of aquic conditions as defined in the Soil Taxonomy (1992). Values increase from 1.0 (ponded) to 13.0 (Typic Torrifluvent) as wetness decreases.

Great Group	Subgroup	Wetness Rank
Ponded		1
Fluvaquentic	Endoaquoll	2
Mollic	Endoaquent	2
Mollic	Fluvaquent	2
Riverwash		2
	Fluvaquent	2
	Endoaquent	2
	Fluvaquent	2
	Psammaquent	2.5
Aeric	Fluvaquent	3
Aquic	Ustipsamment	5.5
Oxyaquic	Udifluvent	6
Aquic	Torrifluvent	7
Oxyaquic	Ustifluvent	
Oxyaquic	Ustipsamment	7.5
Oxyaquic	Torrifluvent	9
Oxyaquic	Torripsamment	9.5
Aquic	Camborthid	10
Mollic	Udifluvent	11
Fluventic	Haplustoll	12
Fluventic	Ustochrept	12
	Ustifluvent	12
	Ustipsamment	12
	Ustochrept	12
Lithic	Ustipsamment	13
Aridic	Ustochrept	13
	Torrifluvent	13

RESULTS

The results from our 1995 investigations are divided into two parts. Part I details a preliminary classification of riparian/wetland communities of the Gila–San Francisco–Mimbres watersheds with sections on hydrological regimes, soils, vegetation community composition, and ecological relationships among communities in riparian landscapes, both in time and space. We also look at plant species diversity in terms of exotics versus natives, and in terms of species specific wetland indicator values.

In Part II, we present an initial inventory of riparian/wetland sites in the Gila–San Francisco–Mimbres watersheds based on our 1995 sampling. This initial inventory was not intended to be comprehensive. It represents only a first step in the inventory effort for these watersheds. The inventory was limited geographically by the specific sampling criteria set for collecting data to meet the needs of community classification and descriptions presented in Part I. But since the classification effort was oriented towards sampling the highest quality sites available for describing riparian/wetland communities, the initial inventory contains some of the highest quality sites remaining in these watersheds. Sites are described in terms of river segments within particular reaches of each of the three river basins. We also provide a quality assessment abstract for each site along with maps and photographs.

This preliminary classification of riparian/wetland communities developed for the Gila–San Francisco–Mimbres watersheds (figure 1) is based on data from 39 cross-sections, and 72 vegetation and soil plots distributed throughout the basins.

Part I

Riparian/Wetland Communities

of New Mexico:

Gila, San Francisco and Mimbres Rivers

Photo: Mike Bradley

Upstream portion of a Fremont's Cottonwood (*Populus fremontii*)–Goodding's Willow (*Salix gooddingii*) Community Type along the Gila River at Glenwood.

Hydrologic Regimes

Gila River Watershed.— In New Mexico, the Gila drains an area of approximately 3549 mi^2 (Wallace 1992), which corresponds to the hydrologic units, 15040001 and 15040002, of the Hydrologic Unit Map for New Mexico (USGS 1974). Major tributaries include the West, Middle, and East Forks, along with Diamond Creek, Beaver Creek, Turkey Creek, Black Canyon and Mogollon Creek. Only a few small reservoirs are contained within the watershed. These include the 72-acre Lake Roberts on Sapillo Creek, the 62-acre Bill Evans Lake, which draws water from the main stem, 50-acre Snow Lake on the Middle Fork, and 20-acre Wall Lake on Taylor Creek (Forest Service 1990).

The upper reaches of the Gila watershed are confined in deep and remote canyons. River flows here remain unimpeded and there are few, if any, channel diversions or impacts. Only two gauging stations are maintained by the U.S. Geological Survey (USGS) with flow records dating back to 1928. One gauging station is located at Gila, while the second is located at Redrock. For the period of record at Gila, average monthly peak flows occur in March, with maximum flows peaking in December. Flows peak again in March, are lowest in June, and peak a third time in September (figure 2). In September 1941, a peak flow of 25,400 cfs (cubic feet/second) was recorded at the gauging station just above the confluence of the Gila and Mogollon Creek (BOR 1971). Forty-three years later, another major flood with a peak flow of 23,400 cfs was recorded in December 1984 (USGS 1992). The most recent flood occurred in November 1994 with a peak flow of 9,960 cfs. A flood of this magnitude is estimated to occur every ten years (Waltemeyer 1986). Below the Mogollon confluence the floodplain widens dramatically into the irrigated Cliff/Gila valley. The 1994 flood was strong enough to cause severe structural damage to bridges, and scoured river banks and bars. As a result, flood control measures, such as dredging and levee construction are in place throughout much of the valley. As the Gila flows toward Arizona, the drainage area increases, and the river again becomes constricted and confined by what are known as the Middle and Lower Boxes. Correspondingly, the magnitude of flood flows increases dramatically. Like the upper Gila, average monthly peak flows for the period of record at Redrock occur in March, with maximum flows peaking in December (figure 3). Flows peak again in March, are lowest in June, and peak a third time in September. The September 1941 flood with a 50-year return interval reached 40,000 cfs in Redrock, while the December 1994 flood had a peak flow of 16,700 cfs in Redrock. This flood according to Waltemeyer (1986) is estimated to occur every 10 years.

San Francisco Watershed.— The San Francisco river in New Mexico also remains free-flowing and is only moderately impacted by human intervention (Wallace 1992). Draining an area of approximately 1836 mi^2 (Wallace 1992), the San Francisco watershed corresponds to the USGS (1974) hydrologic unit 15040004 of the Hydrologic Unit Map for New Mexico (USGS 1974). Major tributaries include the Tularosa River, Apache Creek, Centerfire Creek, Pueblo Creek, Saliz Canyon, Whitewater Creek, and Mule Creek.

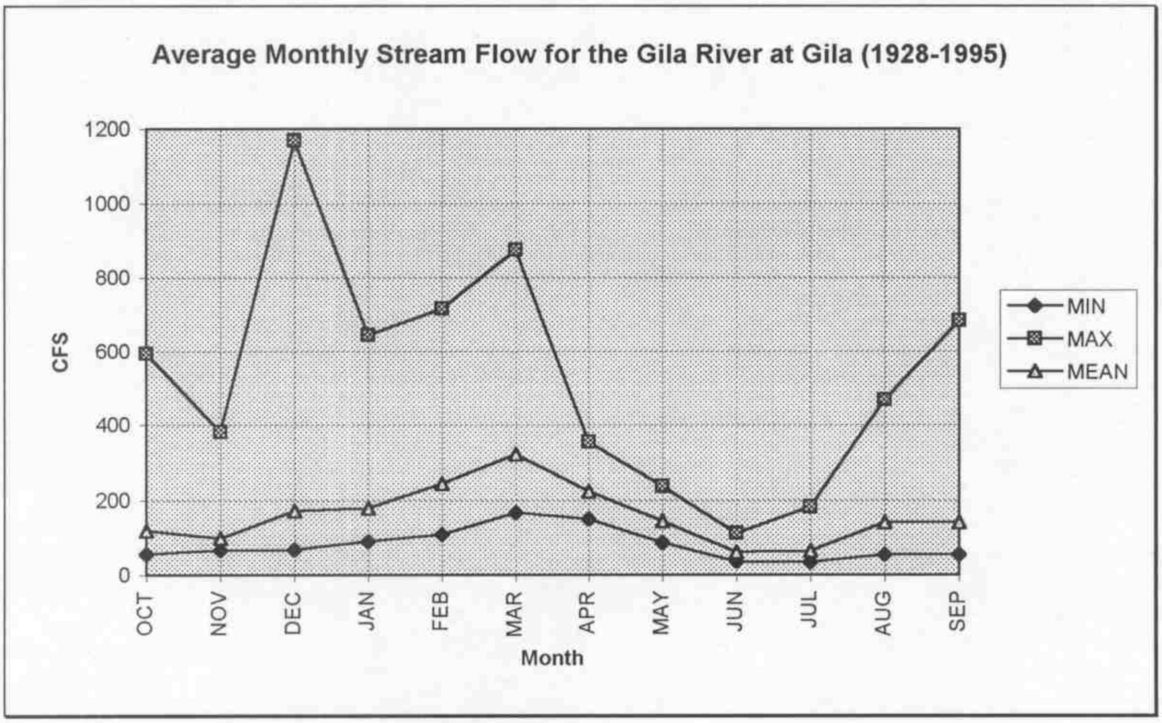

Figure 2. Average monthly stream flows with minimum and maximum flows for the Gila River at the Gila gauging station. Flows, in cubic feet per second (cfs), are for the period of record (1928-1995). Average monthly peak flows occur in March, with maximum flows of nearly 1200 cfs occurring in December. Data provided by the U.S. Geological Survey, Albuquerque, NM.

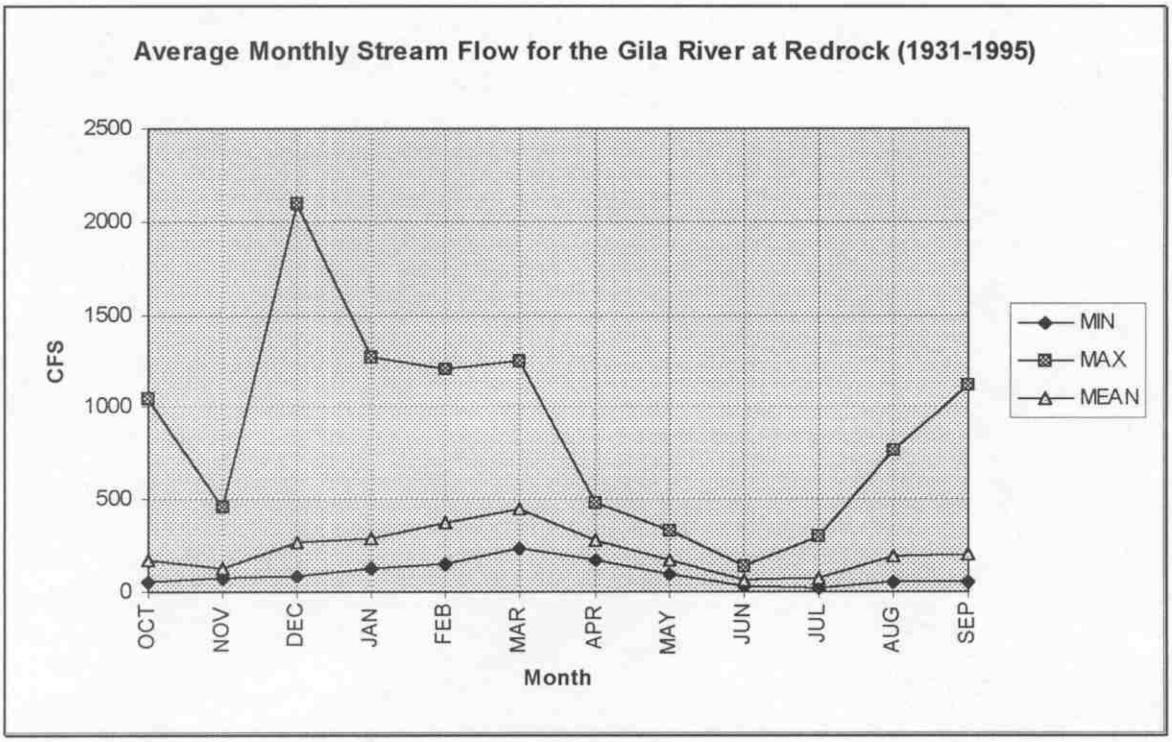

Figure 3. Average monthly stream flows with minimum and maximum flows for the Gila River at the Redrock gauging station. Flows, in cubic feet per second (cfs), are for the period of record (1931-1995). Average monthly peak flows occur in March, with maximum flows of roughly 2000 cfs peaking in December. Flows peak again in March, are lowest in June, and peak a third time in September. Data provided by the U.S. Geological Survey, Albuquerque, NM.

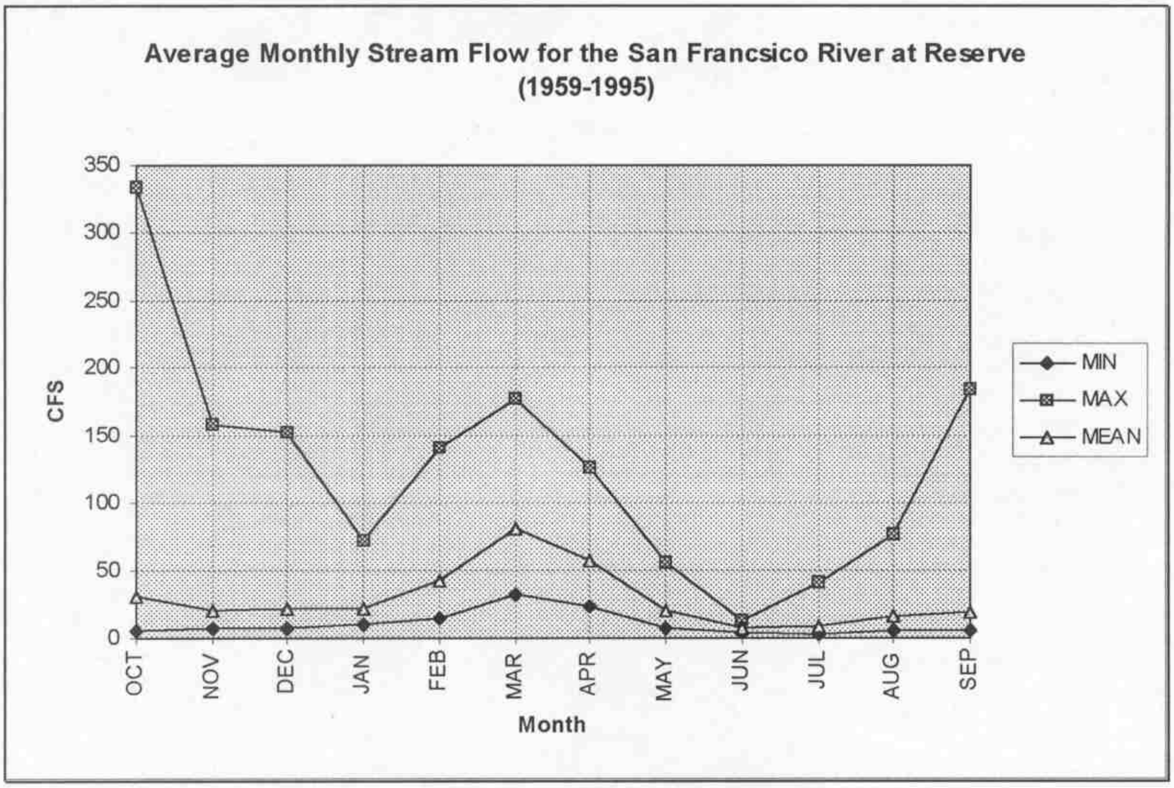

Figure 4. Average monthly stream flows with minimum and maximum flows for the San Francisco River at the Reserve gauging station. Flows, in cubic feet per second (cfs), are for the period of record (1959-1995). Average monthly peak flows occur in March with maximum flows of nearly 350 cfs occurring in October. Data provided by the U.S. Geological Survey, Albuquerque, NM.

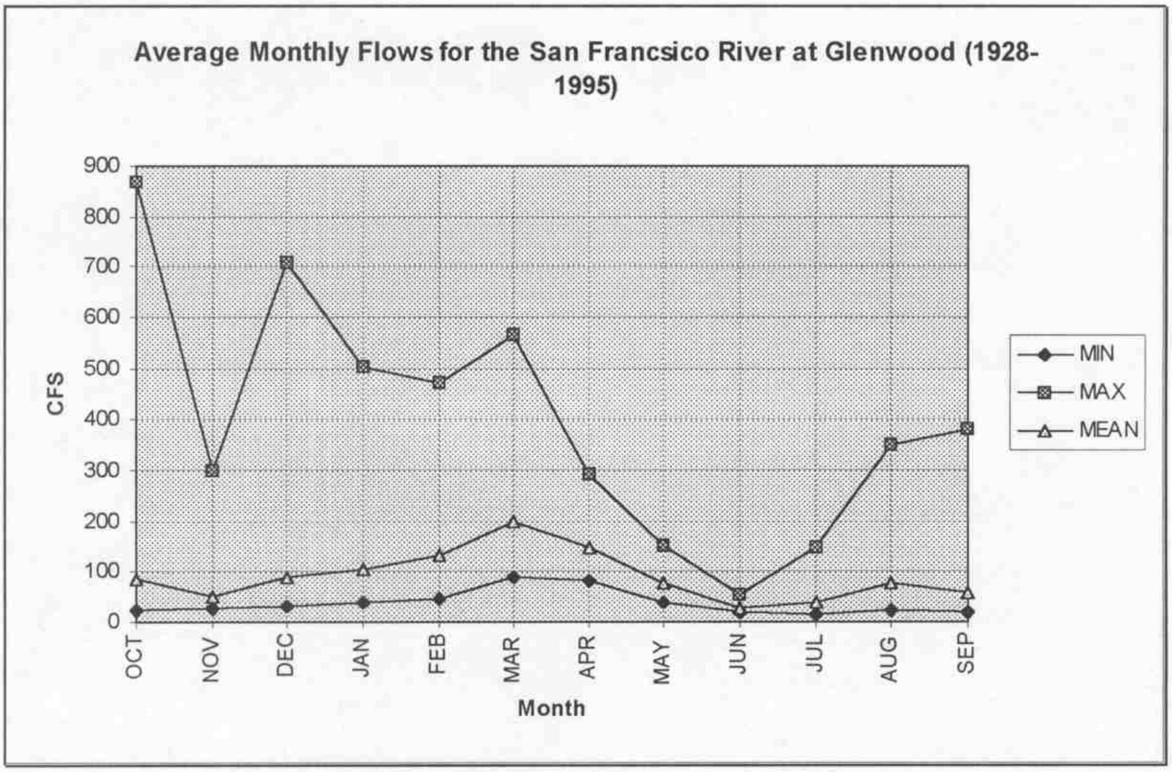

Figure 5. Average monthly stream flows with minimum and maximum flows for the San Francisco River at the Glenwood gauging station. Flows, in cubic feet per second (cfs), are for the period of record (1928-1995). Average monthly peak flows occur in March with maximum flows of nearly 900 cfs occurring in October. Data provided by the U.S. Geological Survey, Albuquerque, NM.

Like the Gila, only two gauging stations are maintained by the USGS on the San Francisco River. One gauging station is located at Reserve, while the second is at Glenwood. Gauging station records at Reserve have been maintained only since 1952. For the period of record, average monthly peak flows occur in March with maximum flows occurring in October, declining in January, and peaking again in March. Flows are their lowest in June and begin to peak again in September (figure 4). In 1952, the largest peak flow was recorded. Flows volumes were 5000 cfs which correspond to a 10-year return interval (Waltemeyer 1986). The next largest flood recorded was 1510 cfs, which according to Waltemeyer (1986) occurs every five years. Downstream near Glenwood, gauging station records have been maintained since 1927. For the period of record, average monthly peak flows occur similarly in March. Maximum flows occur in October, but decline rapidly by November, peak in December, and peak again in March with the lowest flows occurring in June (figure 5). A peak flow of 27,500 cfs was recorded in October 1983. A flood of this magnitude has a return interval of 100 years (Waltemeyer 1986). The most recent major flood occurred in November 1994 with flows of 8130 cfs and a return interval of 10 years (Waltemeyer 1986). This flood was large enough to scour bars and carry large flood debris (trees and limbs). Water depths for this flood were estimated to be between 15 to 20 feet deep based on observed heights of flood debris.

Mimbres River Watershed.— At its head, the Mimbres River is divided into three small forks that merge into one stream within three miles. The Mimbres drains an area of approximately 4,387 mi^2 (Wallace 1992). This corresponds to the USGS (1974) hydrologic unit 13030202. The Mimbres remains free of large reservoirs, but has been extensively altered by channelization, as well as by river bed disturbance associated with industrial and agricultural activity (Wallace 1992). Major tributaries include Gallinas Canyon, Sapillo Creek, Bear Canyon, McKnight Canyon, Skate Canyon and Cameron Creek. Only one small reservoir, the 70-acre Bear Canyon Reservoir is contained within the Mimbres watershed.

Only one gauging station has been maintained by the USGS near the town of Mimbres since 1978. For the period of record, average monthly peak flows (less than 50 cfs) are fairly steady through the winter months. Maximum flows of roughly 350 cfs occur in December with the lowest flows (near 25 cfs) occurring in June, and peaking again in August (figure 6). Since 1978 two large floods have been recorded. The first major flood occurred in December 1984. This flood was measured at 2500 cfs, which is estimated to occur once every 50 years (Waltemeyer 1986). More recently, in December 1994, a flood of 1460 cfs having a 10-year return interval was recorded. Debris from this flood was observed on side bars that were measured at heights of six- to seven feet above the river bed.

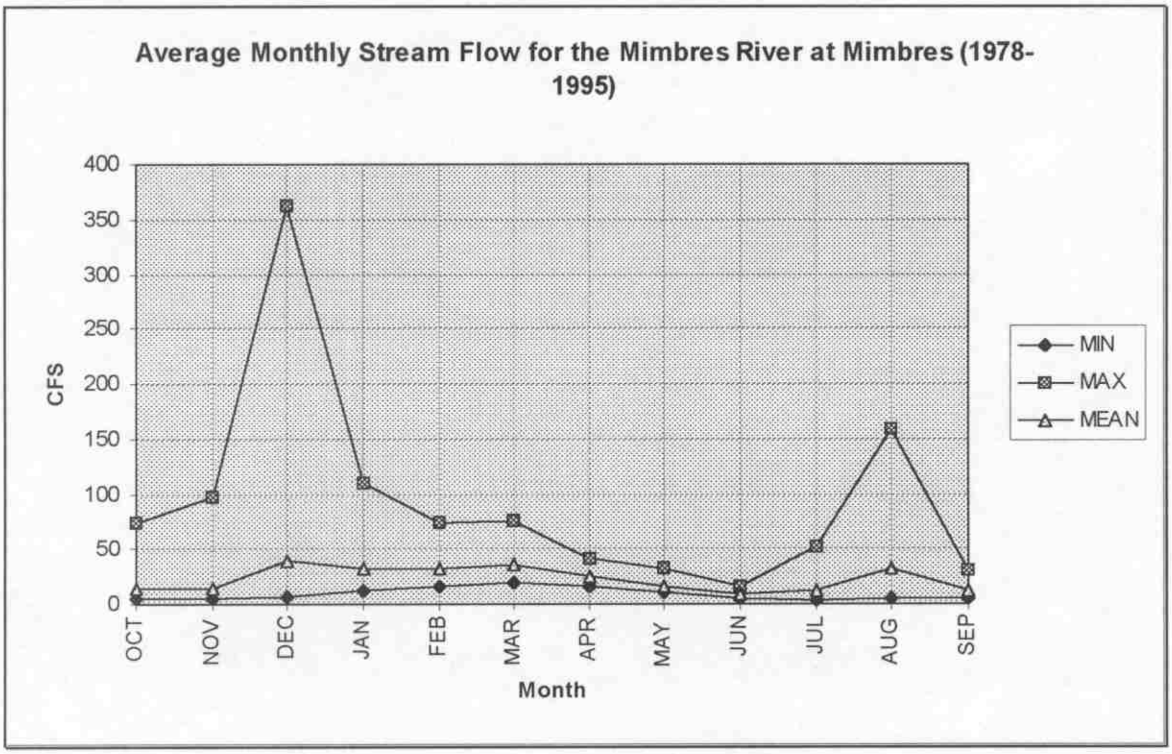

Figure 6. Average monthly stream flows with minimum and maximum flows for the Mimbres River at the Mimbres gauging station. Flows, in cubic feet per second (cfs), are for the period of record (1978-1995). Average monthly peak flows are fairly steady (less than 50 cfs) through the winter months. Maximum flows of roughly 350 cfs occur in December with the lowest flows occurring in June, and peaking again in August. Data provided by the U.S. Geological Survey, Albuquerque, NM.

Riparian/Wetland Soils and Community Characterization

Riparian soils are flood-deposited alluvial sediments that can be classified according to their position in the floodplain and by the amount of pedogenesis or development they have undergone. Soils were ultimately classified to family levels. Taxonomical soil orders most commonly encountered for the study were Entisols, Inceptisols, and Mollisols. Entisols are relatively young soils that display little or no development, usually have a sandy-skeletal texture, and are typically found on the lowest bars that are most frequently flooded. Inceptisols display some development of peds and leaching of clays to subsurface horizons, are finer textured, and are found on higher bars or young terraces that are less frequently flooded. Mollisols have a thick, organically rich surface horizon, show further development, and are found on the oldest terraces that are rarely flooded.

Soil wetness and plant-available water based on soil texture are important factors in determining riparian vegetation expression. The most frequently flooded soils have saturated or gleyed horizons, as well as certain redoximorphic features, including the presence and depth of manganese or iron oxidation mottles. These features can readily be seen in the soil pit (figure 7). All soils were ranked according to their wetness level. Wetness ranks ranged from 1 (i.e., soils that are frequently ponded and have low recurrence intervals) to 12 or 13, which are the driest soils, such as Aridic Ustochrepts, that are infrequently flooded. Table 2 relates the soil classification to wetness ranks and mean depths of the soil profile, redox mottles, gleying or reduction characteristics, as well as mean percent plant available water. The table is ordered by wetness ranks with the wettest soils presented first and the driest last. Table 3 relates the soil classification to plant community types (ordered alphabetically by community type), while Table 4 details vital soil and hydrological characteristics by the community type, important in determining community expression. Like Table 2, this table is ordered according to wetness ranks with the wettest community type listed first.

Soils that were ponded could not be classified, but supported the American Bulrush–Common Spikerush, Coyote Willow/Common Spikerush, Knotgrass/Common Spikerush, and Softstem Bulrush/Common Cattail Community Types (Table 3). Ponding of the communities may be permanent or lasts only a few weeks out of the year.

Soils classified as Typic Fluvaquents, Fluvaquentic Endoaquolls and Aeric Fluvaquents (wetness rank 2 and 3) displayed strong evidence of aquic conditions and had water tables within 50 cm. The soils found were moderately textured and their plant-available water percentages are greater than 1%. They are found within the lowest elevations in the floodplain and their discharge ratios are generally less than one. These riverbank or bar communities are flooded every 1- to 2-years and support mesic communities where obligate riparian/wetland species are commonly found. Typic Fluvaquent soils supported the American Bulrush–Common Spikerush, American Bulrush/Smooth Horsetail, and Seepwillow/American Bulrush Community Types. Fluvaquentic Endoaquolls supported the Narrowleaf Cottonwood–Boxelder/Kentucky Bluegrass Community Type, while Aeric Fluvaquents were found with Fremont's cottonwood/Seepwillow Community Types (Table 3 and 4).

Photo: Mike Bradley

Figure 7. Example of soil pit and hydric soils from Taylor Creek of the Gila watershed. The soil type is a Typic Fluvaquent. The water level is within 40 centimeters, well within the rooting zone of most obligate riparian/wetland species. Community Type is classified as Common Spikerush (*Eleocharis palustris*)/Yerba Mansa (*Anemopsis californica*).

Table 2. Average soil wetness characteristics for soil types identified in the Gila, San Francisco, and Mimbres floodplains. Wetness characteristics include depth to aquic indicators (reduction/oxidation mottles and gleyed horizons), flooding freqency, the position in the floodplain (discharge ratio), and plant available water percentage.

Soil Classification		Wetness rank	(n)	Profile depth (cm)		Depth of redox mottles (cm)		Depth of gleyed horizons (cm)		Flood recurrence interval (yrs)		Discharge ratio		Plant available water %	
				Ave	SD	Ave	SD	Ave	SD	Ave	SD	Ave	SD	Ave	SD
			0	0	0					16.3	22.5	5.69	3.95		
Ponded		1	6	0	0					0.75	0.5	0.49	0.39		
Typic	Fluvaquent	2	8	40.9	20	0.71	1.89	4	7.62	1.13	0.35	0.7	0.85	4.49	3.43
Riverwash		2	9	5	15					3.89	7.93	1.13	0.94	0.57	0.17
Fluvaquentic	Endoaquoll	2	1	92		17		44		10		4.2		7.34	
Aeric	Fluvaquent	3	1	65						2		2.1		1.53	
Aquic	Ustipsamment	5.5	4	97.5	5	12.7	21.9	61		2.5	1.73	2.39	2.45	5.04	0.13
Oxyaquic	Ustifluvent	7	10	88.8	20	5	14.1	85		10	10.5	1.84	0.96	3.6	2.56
Oxyaquic	Torrifluvent	9	2	100	0	0				37.5	17.7	4.36	2.88	7.13	0.32
Oxyaquic	Torripsamment	9.5	1	149		12				100		7		5.33	
Mollic	Udifluvent	11	1	64						25		9		1.87	
Fluventic	Haplustoll	12	1	90						50		48.5		1.38	
Fluventic	Ustochrept	12	1	113						100		16.1		8.2	
Typic	Ustochrept	12	8	102	10	0				60.6	35.5	9.26	4.85	6.55	2.73
Typic	Ustifluvent	12	12	100	40	15.5	3.54			46.3	35.7	12.2	15.5	4.14	2.47
Typic	Ustipsamment	12	1	116						100		28.8		3.83	
Lithic	Ustipsamment	12.5	1	10						50		10.9		0.51	
Aridic	Ustochrept	13	1	68						100		6.45		3.16	

Soils classified as riverwash are unconsolidated and non-stratified. Like the above soils these are also flooded every 1- to 2-years, have a wetness rank of 2, and are found along riverbanks or in dry channels where the discharge ratio is often less than one (Table 4). Riverwash differs in that they are coarser textured (typically gravelly to stony). Consequently, their plant-available water percentages are less than 1, often averaging 0.51%. These soils supported the Arizona Alder/Bluestem Willow, Arizona Alder/Rice Cutgrass, Arizona Sycamore–Arizona Alder, Bluestem Willow/Beaked Sedge, Fremont's Cottonwood–Arizona Sycamore, Fremont's Cottonwood/Seepwillow, Fremont's Cottonwood–Goodding's Willow/Seepwillow, and Seepwillow/Arizona Sycamore Community Types (Table 3).

Aquic Ustipsamments with a wetness rank of 5.5 are also found on low-lying sand bars that are flooded every 1- to 5-years. Average discharge ratios are greater than one. Regenerating cottonwoods, willows, and seepwillow flourish on these bars. These soils supported the Fremont's Cottonwood–Goodding's Willow/Coyote Willow, Fremont's Cottonwood/Seepwillow, and Fremont's Cottonwood/Sparse Community Types (Table 3).

Oxyaquic Ustifluvents, Oxyaquic Torrifluvents, and Oxyaquic Torripsamments have wetness ranks of 7, 9, and 9.5 respectively. These are commonly found on side bars and low terraces, or in positions in the floodplain that are flooded every 5- to 25-years. These soils generally have water tables at, or deeper than, one meter. Aquic indicators can be present at lower depths. They are usually newly deposited sediments and pedogenesis has not occurred. These soils support moderate-aged cottonwood-willow communities, as well as the more fully developed shrub communities, such as seepwillow or coyote willow dominated communities. Oxyaquic Ustifluvents were very common and supported the Arizona Alder–Narrowleaf Cottonwood/California Brickellbush, Arizona Sycamore–Arizona Alder, Fremont's Cottonwood/Sparse, Fremont's Cottonwood–Goodding's Willow/Coyote Willow, Fremont's Cottonwood–Goodding's Willow/Seepwillow, Narrowleaf Cottonwood–Boxelder/Kentucky Bluegrass, and Narrowleaf Cottonwood/Bluestem Willow Communities. Oxyaquic Torrifluvents supported the Fremont's Cottonwood–Arizona Sycamore/Seepwillow and Fremont's Cottonwood–Goodding's Willow/Seepwillow Community Types, while Oxyaquic Torripsamments supported the Fremont's Cottonwood–Goodding's Willow Community Type (Table 3).

Mollic Udifluvents, Typic Ustifluvents, Typic Ustipsamments, Typic Ustochrepts, Fluventic Ustochrepts, Fluventic Haplustolls, Lithic Ustipsamments, and Aridic Ustochrepts are among the driest groups of soils described in the study area with wetness ranks ranging between 11 to 13. These soils are found on high terraces and on the fringes of the floodplain. They are rarely subjected to flooding. Floods usually occur on the order of 100 year intervals. These are some of the oldest soils found within the floodplain and some pedogenesis has occurred. On finer textured high terraces, plant available water percentages are greater than 5%. The riparian communities are dominated by mature and aging forests, such as those dominated by Fremont's cottonwood, narrowleaf cottonwood, and Arizona sycamore. Mollic Udifluvents were not commonly encountered, but supported the Narrowleaf Cottonwood–Rocky Mountain Juniper/Sand Dropseed Community Type. Typic Ustifluvents were common and supported a wide variety of Community Types, such as Arizona Alder–Narrowleaf Cottonwood/California Brickellbush, Arizona Sycamore/Sand Dropseed, Arizona Sycamore–Arizona Alder, Arizona

Sycamore/California Brickellbush, Arizona Walnut–Boxelder, Arizona Walnut/New Mexico Olive, Fremont's Cottonwood–Arizona Sycamore/Seepwillow, Fremont's Cottonwood–Goodding's Willow, Narrowleaf Cottonwood–Boxelder/Kentucky Bluegrass, and Rubber Rabbitbrush/Sand Dropseed. Typic Ustipsamments supported the Arizona Walnut–Netleaf Hackberry/California Brickellbush Community Type. Typic Ustochrepts were also common and supported Arizona Sycamore–Emory's Oak, Arizona Walnut–Netleaf Hackberry/California Brickellbush, Arizona Walnut–Boxelder, Fremont's Cottonwood–Arizona Sycamore, Fremont's Cottonwood–Arizona Sycamore/Seepwillow, Fremont's Cottonwood–Arizona Sycamore/Cheatgrass, Narrowleaf Cottonwood/ Kentucky Bluegrass, and Narrowleaf Cottonwood–Boxelder/Kentucky Bluegrass Community Types. Fluventic Ustochrepts supported the Arizona Walnut/New Mexico Olive Community Type. Lithic Ustipsamments supported the Netleaf Hackberry/California Brickellbush Community Type, Fluventic Haplustolls supported the Arizona Walnut–Boxelder Community Type, while Aridic Ustochrepts supported the Arizona Walnut–Netleaf Hackberry/California Brickellbush Community Type (Table 3).

Table 3. Soil classification of all communities sampled. Some soils for the rubber rabbitbrush and desert willow series remain unclassified.

Community Type	Phase	Soil Classification(s)	
American bulrush common spikerush		Ponded	
			Fluvaquent
American bulrush smooth horsetail		Typic	Fluvaquent
Arizona alder bluestem willow		Riverwash	
Arizona alder narrowleaf cottonwood	California brickellbush	Oxyaquic	Ustifluvent
			Ustifluvent
Arizona alder rice cutgrass		Riverwash	
Arizona sycamore Arizona alder	California brickellbush	Riverwash	
			Ustifluvent
Arizona sycamore Arizona alder	seepwillow	Typic	Ustifluvent
Arizona sycamore Arizona alder	sparse undergrowth	Oxyaquic	Ustifluvent
Arizona sycamore California brickellbush		Typic	Ustifluvent
Arizona sycamore Emory's oak		Typic	Ustochrept
Arizona sycamore sand dropseed		Typic	Ustifluvent
Arizona walnut box elder		Fluventic	Haplustoll
			Ustifluvent
			Ustochrept
Arizona walnut netleaf hackberry	California brickellbush	Aridic	Ustochrept
			Ustipsamment
			Ustochrept
Arizona walnut New Mexico olive		Fluventic	Ustochrept
		Typic	Ustifluvent

Table 3. (continued)

Community Type	Phase	Soil Classification(s)	
bluestem willow beaked sedge		Riverwash	
bluestem willow common spikerush		Typic	Fluvaquent
common spikerush yerba mansa		Typic	Fluvaquent
coyote willow common spikerush			
			Fluvaquent
desert willow rubber rabbitbrush			
Fremont's cottonwood alligator juniper cheatgrass		Typic	Ustochrept
Fremont's cottonwood Arizona sycamore seepwillow		Typic	Ustifluvent
		Oxyaquic	Torrifluvent
		Typic	Ustochrept
Fremont's cottonwood Arizona sycamore	velvet ash	Riverwash	
			Ustochrept
Fremont's cottonwood Goodding's willow		Oxyaquic	Torripsamment
			Ustifluvent
Fremont's cottonwood Goodding's willow coyote willow		Oxyaquic	Ustifluvent
			Ustipsamment
Fremont's cottonwood Goodding's willow coyote willow	Arizona alder	Oxyaquic	Ustifluvent
Fremont's cottonwood Goodding's willow seepwillow		Oxyaquic	Torrifluvent
		Riverwash	
		Oxyaquic	Ustifluvent
Fremont's cottonwood seepwillow		Aeric	Fluvaquent
		Riverwash	
			Ustipsamment

Table 3. (continued)

Community Type	Phase	Soil Classification(s)	
Fremont's cottonwood sparse undergrowth		Aquic	Ustipsamment
		Oxyaquic	Ustifluvent
knotgrass common spikerush		Ponded	
narrowleaf cottonwood bluestem willow		Oxyaquic	Ustifluvent
narrowleaf cottonwood box elder Kentucky bluegrass		Typic	Ustochrept
		Fluvaquentic	Endoaquoll
		Oxyaquic	Ustifluvent
			Ustifluvent
narrowleaf cottonwood Kentucky bluegrass		Typic	Ustochrept
narrowleaf cottonwood Rocky Mountain juniper sand dropseed		Mollic	Udifluvent
netleaf hackberry California brickellbush		Lithic	Ustipsamment
rubber rabbitbrush sand dropseed			
			Ustifluvent
seepwillow American bulrush		Typic	Fluvaquent
seepwillow Arizona sycamore		Riverwash	
softstem bulrush broadleaf cattail		Ponded	

Table 4. Average soil wetness rank, water availabe %, discharge ratio, and recurrence interval of all communities sampled. Some soils for desert willow and rubber rabbitbrush series remain unclassified.

Community Type			Phase	(N)	Soil classification wetness rank		Water available %		Discharge ratio		Recurrence interval (yrs)	
					Ave	SD	Ave	SD	Ave	SD	Ave	SD
American bulrush	common spikerush			3	1.3	0.6	10		0.8	0.3	0.7	0.6
American bulrush	smooth horsetail			3	2	0	2	2	0.4	0.2	1	0
Arizona alder	bluestem willow			1	2		0.5		2.1		2	
Arizona alder	narrowleaf cottonwood	California brickellbush		2	9.5	4	4	0.04	7.3	8	20	10
Arizona alder	rice cutgrass			2	2	0	0.5	0	1	0	1	0
Arizona sycamore	Arizona alder		California brickellbush	2	7	7	0.9	0.5	4.6	2	40	20
Arizona sycamore	Arizona alder		seepwillow	1	12		6		6.8		10	
Arizona sycamore	Arizona alder		sparse undergrowth	1	7		2		2.6		5	
Arizona sycamore	California brickellbush			1	12		1		5.2		10	
Arizona sycamore	Emory's oak			1	12		4		8.2		10	
Arizona sycamore	sand dropseed			1	12		1		3.9		50	
Arizona walnut	box elder			3	12	0	4	4	43	20	80	30
Arizona walnut	netleaf hackberry	California brickellbush		3	12	0.6	3	0.8	14	10	+02	0
Arizona walnut	New Mexico olive			2	12	0	7	1	17	1	75	40
bluestem willow	beaked sedge			1	2		0.5		.09		1	

Table 4. (continued)

Community Type			Phase	(N)	Soil classification wetness rank Ave	SD	Water available % Ave	SD	Discharge ratio Ave	SD	Recurrence interval (yrs) Ave	SD
bluestem willow	common spikerush			1	2		5		0.3		1	
common spikerush	yerba mansa			1	2		6		2.7		2	
coyote willow	common spikerush			2	1.5	0.7	4		0.2	0.2	1	0
desert willow	rubber rabbitbrush			1					11		50	
Fremont's cottonwood	alligator juniper	cheatgrass		1	12		9		9.1		50	
Fremont's cottonwood	Arizona sycamore		velvet ash	2	7	7	4	4	4.9	6	50	70
Fremont's cottonwood	Arizona sycamore	seepwillow		3	11	2	7	0.7	5.5	1	40	10
Fremont's cottonwood	Goodding's willow			3	11	1	6	0.8	8.4	2	+02	0
Fremont's cottonwood	Goodding's willow	coyote willow		4	6.3	0.9	4	2	2.6	2	4	2
Fremont's cottonwood	Goodding's willow	coyote willow	Arizona alder	1	7		2		0.4		1	
Fremont's cottonwood	Goodding's willow	seepwillow		4	6.3	3	4	3	1.5	1	8	10
Fremont's cottonwood	seepwillow			3	3.5	2	2	2	1.5	0.5	2	0
Fremont's cottonwood	sparse undergrowth			2	6.3	1	4	2	2.2	2	13	20
knotgrass	common spikerush			1	1				.09		1	
narrowleaf cottonwood	bluestem willow			1	7		2		2.5		5	

Table 4. (continued)

Community Type			Phase	(N)	Soil classification wetness rank		Water available %		Discharge ratio		Recurrence interval (yrs)	
					Ave	SD	Ave	SD	Ave	SD	Ave	SD
narrowleaf cottonwood	box elder	Kentucky bluegrass		4	8.3	5	9	2	5.3	4	30	20
narrowleaf cottonwood	Kentucky bluegrass			1	12		6		4.9		25	
narrowleaf cottonwood	Rocky Mountain juniper	sand dropseed		1	11		2		9		25	
netleaf hackberry	California brickellbush			1	13		0.5		11		50	
rubber rabbitbrush	sand dropseed			4	12		2		4.1	1	10	10
seepwillow	American bulrush			1	2		3		0.8		1	
seepwillow	Arizona sycamore			1	2		0.5		1.2		1	
softstem bulrush	broadleaf cattail			2	1	0			0.5			

The Riparian/Wetland Classification System

The classification is organized in a multi-level hierarchical and open-ended system that allows for expansion, contraction, or transference of community types as additional data is accumulated. The system is based primarily on the existing natural vegetation. The classification draws upon Cowardin et al.'s (1979) Classification of Wetlands and Deepwater Habitats of the United States, Brown, Lowe and Pase's (1979) classification of biotic communities of the Southwest, UNESCO's Physiognomic-Ecological Classification of Plant Formations of the Earth (Mueller-Dombois and Ellenberg 1974, Driscoll et al. 1984) and its modification by The Nature Conservancy (Bourgeron and Engelking 1994). The UNESCO system is currently used by Natural Heritage Programs throughout the United States as a basis for regional, national and international comparisons. The Cowardin et al. (1979) Classification was adopted by the U.S. Fish and Wildlife Service for use in its National Wetland Inventory.

Initially, all riparian/wetland communities are considered part of the Palustrine System as defined by Cowardin et al. (1979). There are seven hierarchical levels to the classification structure:

I. Class — major physiognomic type. Class of Cowardin et al. (1979) and UNESCO (Driscoll et al. 1984);

II Zone — moisture and temperature defined sub-classes. Similar to Brown, Lowe and Pase's (1979) Climatic Zone, SubClass and Group; in part, of UNESCO;

III. Regional Biome — biogeographically related Series Groups. Similar to Brown, Lowe and Pase's (1979) Biome;

IV Series Group — the dominant plant communities within the same biome, zone, and class related by equivalent sets of morphological, environmental or floristically related series; commonly equivalent to the Cowardin et al. (1979) Sub-class and UNESCO Formation (Driscoll et al. 1984);

V Series — sets of Community Types related by at least a single common dominant. Equivalent to the primary Dominance Types of Cowardin et al. (1979) and patterned after the Series of Daubenmire (1968), and the Alliance of Braun-Blanquet (1965) and Bourgeron and Engelking (1994).

VI Community Type — fundamental repeated assemblages of species. Synonymous with plant association of Braun-Blanquet (1965) and Bourgeron and Engelking (1994). Somewhat equivalent to secondary Dominance Types of Cowardin et al. (1979)

VII Phase — floristic variants of Community Types. Synonymous with sub-association of Braun-Blanquet (1965). The term Typic refers to the modal species composition of the Community Type.

Riparian/Wetland Plant Community Classification

The preliminary, hierarchical classification of riparian/vegetation communities for the Gila, San Francisco and Mimbres watersheds is summarized in Table 5. At Level VI of this classification we have identified 35 fundamental riparian/wetland Community Types based on 72 vegetation plots on 39 stream cross-sections. A detailed description of the classification presented below follows the hierarchy of Table 5. Along with summary information on each hierarchical level of the classification, there are complete descriptions of each community type in abstract form that includes distribution, species composition, environmental setting, adjacent vegetation in the landscape, discussions of ecological factors for each type. It also includes documentation of similar or synonymous community types from the literature in New Mexico and elsewhere in the Rocky Mountain and Southwest regions of the United States. Some community types have previously been described in New Mexico or the surrounding regions, while most are apparently new dominance types for New Mexico. As additional data is accumulated throughout other major basins of the state some new types may ultimately be expanded or rejected. The distribution of some dominants may also cross several regional biomes.

The series level of the hierarchy represents the dominant species of the community type. It is the climax species that shows the strongest evidence of reproducing, and thus self-perpetuation. In some cases, community types may have two major dominants of the same stratum which are then separated by a dash. To characterize the underlayer a slash indicates the dominant shrub, or herbaceous forb or graminoid of that layer. Thus, trinomials or binomials are used to represent the community type (CT). Phases (PH) of the community type represent floristic variants of the typical community type for which there is either not yet enough data available to recognize a distinct community type, or the phase may be a potential community type. The following descriptors are used to characterize vegetative cover values in the community characterization abstracts:

<u>absent</u> – cannot be found in stand (opposite = present);
<u>accidental</u> – individuals occur either very infrequently, occasionally, or are limited to special microsites;
<u>abundant</u> – canopy coverage >25%;
<u>common</u> – canopy coverage >1% (opposite = scarce);
<u>dominant</u> – density or cover is as great as, or greater than, any other species of the same life form (two or more species can be dominant, i.e. co-dominant);
luxuriant – canopy coverage >50%;
<u>poorly represented</u> – canopy coverage <5% (opposite = well represented);
<u>present</u> – individuals can be found in the stand (opposite = absent);
<u>re-generation</u> – understory trees occur as established seedlings, saplings (dbh 2.5-5 cm or 1-2 in), or small poles (dbh 5-25 cm or 2-10 in.);
<u>scarce</u> – canopy coverage <1% (opposite = common);
<u>well-represented</u> – canopy coverage >5% (opposite = poorly represented).

Table 5. A preliminary riparian/wetland vegetation community classification of New Mexico for the Gila, San Francisco and Mimbres watersheds. The classification is hierarchically arranged within the Palustrine System into Class, Zone, Regional Biome, Series Group, Series, Community Type, and Phase. Organization of the classification system follows Cowardin's (1979) system with modifications based on the New Mexico Natural Heritage Program's statewide classification of terrestrial systems. Community types are identified by their common and scientific name following Kartesz (1994), and their six- or seven-letter acronym.

PALUSTRINE SYSTEM – RIPARIAN/WETLAND VEGETATION

I. FOREST/WOODLAND CLASS – FORESTS AND WOODLANDS

II. Cold Temperate Riparian/Wetlands

III. Rocky Mountain Montane Forested Wetlands

IV. Broad–Leaved Deciduous Series Group

V. Narrowleaf Cottonwood (*Populus angustifolia*) Series

1. Narrowleaf Cottonwood–Boxelder/Kentucky Bluegrass Community Type
   (*Populus angustifolia–Acer negundo/Poa pratensis*)
   (POPANG–ACENEG/POAPRA)
2. Narrowleaf Cottonwood/Bluestem Willow Community Type
   (*Populus angustifolia/Salix irrorata*)
   (POPANG/SALIRR)
3. Narrowleaf Cottonwood/Kentucky Bluegrass Community Type
   (*Populus angustifolia/Poa pratensis*)
   (POPANG/POAPRA)
4. Narrowleaf Cottonwood–Rocky Mountain Juniper/Sand Dropseed Community Type
   (*Populus angustifolia–Juniperus scopulorum/Sporobolus cryptandrus*)
   (POPANG–JUNSCO/SPOCRY)

III. Southwest Montane Forested Wetlands

IV. Broad–Leaved Deciduous Series Group

V. Arizona Alder (*Alnus oblongifolia*) Series

1. Arizona Alder/Bluestem Willow Community Type
   (*Alnus oblongifolia/Salix irrorata*)
   (ALNOBL/SALIRR)
2. Arizona Alder–Narrowleaf Cottonwood/California Brickellbush Community Type
   (*Alnus oblongifolia–Populus angustifolia/Brickellia californica*)
   (ALNOBL–POPANG/BRICAL)
3. Arizona Alder/Rice Cutgrass Community Type
   (*Alnus oblongifolia/Leersia oryzoides*)
   (ALNOBL/LEEORY)

II. Warm Temperate Riparian/Wetlands

III. Southwest Lowland Forested Wetlands

IV. Broad–Leaved Deciduous Series Group

V. Arizona Sycamore (*Platanus wrightii*) Series

1. Arizona Sycamore–Arizona Alder Community Type
   (*Platanus wrightii–Alnus oblongifolia*)
   (PLAWRI–ALNOBL)
   Comment: California Brickellbush (*Brickellia californica*; BRICAL) Phase
   Seepwillow (*Baccharis salicifolia*; BACSAL) Phase
   Sparse Phase
2. Arizona Sycamore/California Brickellbush Community Type
   (*Platanus wrightii/Brickellia californica*)
   (PLAWRI/BRICAL)
3. Arizona Sycamore–Emory's Oak Community Type
   (*Platanus wrightii–Quercus emoryi*)
   (PLAWRI–QUEEMO)
4. Arizona Sycamore/Sand Dropseed Community Type
   (*Platanus wrightii/Sporobolus cryptandrus*)
   (PLAWRI/SPOCRY)

Arizona Walnut (*Juglans major*) Series

1. Arizona Walnut–Boxelder/Skunkbush Sumac Community Type
   (*Juglans major–Acer negundo/Rhus trilobata*)
   (JUGMAJ–ACENEG/RHUTRI)
2. Arizona Walnut–Netleaf Hackberry/California Brickellbush Community Type
   (*Juglans major–Celtis laevigata* var. *reticulata/Brickellia californica*)
   (JUGMAJ–CELLAER/BRICAL)
3. Arizona Walnut/New Mexico Olive Community Type
   (*Juglans* major/Forestiera *pubescens* var. *pubescens*)
   (JUGMAJ/FORPUBP)

V. Fremont's Cottonwood (*Populus fremontii*) Series

1. Fremont's Cottonwood–Alligator Juniper/Cheatgrass Community Type
   (*Populus fremontii–Juniperus deppeana/Bromus tectorum*)
   (POPFRE–JUNDEP/BROTEC)
2. Fremont's Cottonwood–Arizona Sycamore Community Type
   (*Populus fremontii–Platanus wrightii*)
   (POPFRE–PLAWRI)
   Comment: Velvet Ash (*Fraxinus velutina*; FRAVEL) Phase
3. Fremont's Cottonwood–Arizona Sycamore/Seepwillow Community Type
   (*Populus fremontii–Platanus wrightii/Baccharis salicifolia*)
   (POPFRE–PLAWRI/BACSAL)
4. Fremont's Cottonwood–Goodding's Willow Community Type
   (*Populus fremontii–Salix gooddingii*)
   (POPFRE–SALGOO)
5. Fremont's Cottonwood–Goodding's Willow/Coyote Willow Community Type
   (*Populus fremontii–Salix gooddingii/Salix exigua*)
   (POPFRE–SALGOO/SALEXI)
6. Fremont's Cottonwood–Goodding's Willow/Seepwillow Community Type
   (*Populus fremontii–Salix gooddingii/Baccharis salicifolia*)
   (POPFRE–SALGOO/BACSAL)
7. Fremont's Cottonwood/Seepwillow Community Type
   (*Populus fremontii/Baccharis salicifolia*)
   (POPFRE/BACSAL)

8. Fremont's Cottonwood/Sparse Community Type
   (*Populus fremontii*/Sparse Ground Cover)
   (POPFRE/SPARSE)

III. Southwest Arroyo Forested Wetlands

IV. Broad–Leaved Deciduous Series Group

V. Desert Willow (*Chilopsis linearis*) Series

Desert Willow/Rubber Rabbitbrush Community Type
(*Chilopsis linearis/Chrysothamnus nauseosus*)
(CHILIN/CHRNAU)

V. Netleaf Hackberry (*Celtis laevigata* var. *reticulata*) Series

Netleaf Hackberry/California Brickellbush Community Type
(*Celtis laevigata* var. *reticulata/Brickellia californica*)
(CELLAER/BRICAL)

I. SCRUB/SHRUB CLASS – SHRUBLANDS

II. Cold Temperate Riparian/Wetlands

III. Rocky Mountain Montane Scrub/Shrub Wetlands

IV. Broad–Leaved Deciduous Series Group

V. Bluestem Willow (*Salix irrorata*) Series

1. Bluestem Willow/Beaked Sedge Community Type
   (*Salix irrorata/Carex rostrata*)
   (SALIRR/CARROS)
2. Bluestem Willow/Common Spikerush Community Type
   (*Salix irrorata/Eleocharis palustris*)
   (SALIRR/ELEPAL)

II. Warm Temperate Riparian/Wetlands

III. Southwest Lowland Scrub/Shrub Wetlands

IV. Broad–Leaved Deciduous Series Group

V. Coyote Willow (*Salix exigua*) Series

Coyote Willow/Common Spikerush Community Type
(*Salix exigua/Eleocharis palustris*)
(SALEXI/ELEPAL)

V. Seepwillow (*Baccharis salicifolia*) Series

1. Seepwillow/American Bulrush Community Type
   (*Baccharis salicifolia/Scirpus americanus*)
   (BACSAL/SCIAME)
2. Seepwillow/Arizona Sycamore Community Type
   (*Baccharis salicifolia/Platanus wrightii*)
   (BACSAL/PLAWRI)

III. Southwest Arroyo Scrub/Shrub Wetlands

IV. Broad–Leaved Deciduous Series Group

V. Rubber Rabbitbrush (*Chrysothamnus nauseosus*) Series

Rubber Rabbitbrush/Sand Dropseed Community Type
(*Chrysothamnus nauseosus/Sporobolus cryptandrus*)
(CHRNAU/SPOCRY)

I. PERSISTENT–EMERGENT WETLANDS CLASS – HERBACEOUS WETLANDS

II. Cold Temperate Persistent–Emergent Riparian/Wetlands

III. Rocky Mountain Montane Persistent–Emergent Wetlands

IV. Persistent–Emergent Series Group

V. American Bulrush (*Scirpus americanus*) Series

1. American Bulrush–Common Spikerush Community Type
(*Scirpus americanus–Eleocharis palustris*)
(SCIAME–ELEPAL)
2. American Bulrush/Smooth Horsetail Community Type
(*Scirpus americanus/Equisetum laevigatum*)
(SCIAME/EQULAE)

V. Common Spikerush (*Eleocharis palustris*) Series

Common Spikerush/Yerba Mansa Community Type
(*Eleocharis palustris/Anemopsis californica*)
(ELEPAL/ANECAL)

V. Softstem Bulrush (*Scirpus tabernaemontani*) Series

1. Softstem Bulrush/Broadleaf Cattail Community Type
(*Scirpus tabernaemontani/Typha latifolia*)
(SCITAB/TYPLAT)

II. Warm Temperate Persistent–Emergent Riparian/Wetlands

III. Southwest Lowland Persistent–Emergent Wetlands

IV. Persistent–Emergent Series Group

V. Knotgrass (*Paspalum distichum*) Series

Knotgrass–Common Spikerush Community Type
(*Paspalum distichum–Eleocharis palustris*)
(PASDIS–ELEPAL)

I. FOREST/WOODLAND CLASS – FORESTS AND WOODLANDS

Forested wetlands are communities dominated by single- or multi-boled obligate or facultative riparian tree species that are five meters (15 ft.) in height or greater. Overstory dominants are usually obligate riparian species, such as cottonwoods (*Populus* spp.) or willows (*Salix* spp.) that are adapted to and dependent on flooding and/or the close proximity of the water table for growth, maintenance, and reproduction. Tree canopies range from open "woodlands" (10-50%) to closed "forests" (greater than 50% cover). The degree of canopy closure is dependent to some extent on stand age, where older stands tend to be more open as trees die and are not replaced. In functioning riparian ecosystems, forested wetlands are commonly found intermixed among a mosaic of shrub and herbaceous wetlands (figure 8). Occasionally, on smaller tributaries they may completely dominate the site.

II. Cold Temperate Riparian/Wetlands

Forests restricted to cold temperate climates with cold to very cold winters and generally cool to mildly warm summers; includes forests commonly referred to as "boreal" or "montane".

III. Rocky Mountain Montane Forested Wetlands

These cold temperate forests of mountainous regions occur at mid-elevations and are dominated by cold tolerant species associated with the Rocky Mountain biogeographic province. In the study area, these forests are represented by communities of the Narrowleaf Cottonwood (*Populus angustifolia*) Series. They are common along low gradient streams on alluvial side bars and terraces.

IV. Broad–Leaved Deciduous Series Group

Forests that are dominated by rounded crown deciduous species. Needle-leaved species from the adjacent uplands, such as blue spruce (*Picea pungens*), ponderosa pine (*Pinus ponderosa*), and junipers (*Juniperus* spp.) may be present, but do not dominate.

V. Narrowleaf Cottonwood (*Populus angustifolia*) Series

Riparian forests of southwestern Rocky Mountain montane regions of New Mexico occur in upper elevations. In the study area, these forests occur at altitudes ranging between 1841 and 2122 m (6040 to 6960 ft). The dominant series is narrowleaf cottonwood (*Populus angustifolia*). Narrowleaf cottonwood forests can be found along low gradient streams that may be moderately incised or confined, but movement still occurs within the floodplain allowing for development of bars and terraces. Soils of the lower bars are commonly Typic Ustifluvents or Oxyaquic Ustifluvents. They have sandy or coarse-loamy surface horizons that overlay a cobbly matrix of the original channel bottom. On the higher terraces, soils have finer surface horizons and are either Typic Ustochrepts, Mollic Udifluvents, Oxyaquic Ustifluvents, Typic Ustifluvents, or Fluventic Endoaquolls.

Photo: Mike Bradley

Figure 8. Aerial view of the riparian forest communities along the Gila River in the upper portion of the Cliff/Gila valley, not far from the Mogollon confluence. Note the multiple channels that helped form a mosaic of different aged stands, diversifying the floodplain.

1 Narrowleaf Cottonwood–Boxelder/Kentucky Bluegrass
Populus angustifolia–Acer negundo/Poa pratensis
POPANG–ACENEG/POAPRA CT

Distribution.– The Narrowleaf Cottonwood–Boxelder/Kentucky Bluegrass riparian community type is known from the Mimbres River at Allie Canyon, Bear Canyon and near San Lorenzo. It is also known from Apache Creek of the San Francisco watershed.

Vegetation.– Narrowleaf cottonwood (*Populus angustifolia*) and boxelder (*Acer negundo*) together co-dominate the overstory canopy providing 75% to 85% cover. The understory canopy is distinctively grassy with scattered shrubs. Kentucky bluegrass (*Poa pratensis*) is the sub-canopy dominant providing up to 33% cover. Other grasses include meadow fescue (*Festuca pratensis*), cheatgrass (*Bromus tectorum*), and Canada wildrye (*Elymus canadensis*). Shrubs include the woody vines canyon grape (*Vitis arizonica*), Virginia creeper (*Parthenocissus quinquefolia* var. *quinquefolia*) and western white clematis (*Clematis ligusticifolia*), as well as recently established sapling-sized Arizona walnut (*Juglans major*), netleaf hackberry (*Celtis laevigata* var. *reticulata*) and boxelder (*Acer negundo*). Common forbs include lesser burdock (*Arctium minus*), Fremont's goosefoot (*Chenopodium fremontii*), Richardson's geranium (*Geranium richardsonii*), Fendler's meadowrue (*Thalictrum fendleri*), and stinging nettle (*Urtica doica*).

Environmental Setting.– The Narrowleaf Cottonwood–Boxelder/Kentucky bluegrass community occurs at elevations ranging between 1768 and 2000 meters (5800 and 6560 ft.). Flooding occurs at 10 to 50 year intervals. Discharge ratios range from 1.84 to 10.6. Stream gradients range from .61% to 1%. Soils are represented by fine loamy over sandy skeletal Oxyaquic Ustifluvents, fine loamy over sandy skeletal Fluvaquentic Endoaquoll, sandy over coarse loamy Typic Ustochrepts, and coarse loamy Typic Ustifluvents. Oxyaquic Ustifluvents have a wetness rank of 8. Plant available water is 9.94%. Fluvaquentic Endoaquolls have a wetness rank of 2. Plant available water is 7.34%. Typic Ustochrepts have a wetness rank of 12 and plant available water is 10.7%. Typic Ustifluvents have a wetness rank of 12. Plant available water is 6.92%.

Adjacent Vegetation.– Outer floodplains or high terraces are dominated by the Arizona Walnut–Boxelder/Skunkbush Sumac (*Juglans major–Acer negundo/Rhus trilobata*) community type or Arizona Walnut–Netleaf Hackberry/California Brickellbush (*J. major–Celtis laevigata* var. *reticulata/Brickellia californica*). Uplands are either dominated by pinyon pine/juniper woodlands or are converted to farmland and pasture.

Discussion.– The Narrowleaf Cottonwood–Boxelder/Kentucky Bluegrass community represents a major plant association of the series. These riparian forests develop on large, undisturbed terraces. They are often adjacent to the river or creek, but are situated well above base flows. They have closed canopies and are well-shaded. Unless the stands are reset by floods, this community will likely progress toward an even drier site and either one of the adjoining communities dominating the outer floodplains.

Documentation.– This description is based on plots 95PD001, 95PD004, 95PD005, and 95PD042.

2. Narrowleaf Cottonwood/Bluestem Willow
Populus angustifolia/Salix irrorata
POPANG/SALIRR CT

Distribution.- The Narrowleaf Cottonwood/Bluestem Willow riparian community is known from the main stem of the San Francisco River near Higgins Mountain near Reserve.

Vegetation.- Narrowleaf cottonwood (*Populus angustifolia*) dominates the overstory canopy (85% total cover) above a shrubby sub-canopy (30% total cover) where bluestem willow (*Salix irrorata*) is the dominant shrub. Fremont's cottonwood (*P. fremontii*) is well-represented and also extends into the upper canopy. Other shrubs include coyote willow (*Salix exigua*). The herbaceous understory contains few grasses and grass-like species (1% total cover). However, forbs collectively provide up to 25% total cover, though no one species is dominant. Most are exotic species including curly dock (*Rumex crispus*), Russian thistle (*Salsola kali*), common ragweed (*Ambrosia artemisiifolia*), or are tacitly weedy, such as rough cocklebur (*Xanthium strumarium*). A few are obligate or facultative wetland species. These include curlytop knotweed (*Polygonum lapathifolium*), cinquefoil (*Potentilla pulcherima*) and field horsetail (*Equisetum arvense*).

Environmental Setting.- The Narrowleaf Cottonwood/Bluestem Willow community occurs at approximately 1793 meters (5880 ft.). Flooding occurs at 5 year intervals. The discharge ratio is 2.5. The stream gradient is .24%. Depth to the water table is 95 cm. Soils are represented by sandy skeletal Oxyaquic Ustifluvents. They have a wetness rank of 8. Plant available water is 1.95%.

Adjacent Vegetation.- Adjoining the Narrowleaf Cottonwood/Bluestem Willow community on lower, more mesic sites is the American Bulrush-Common Spikerush (*Scirpus americanus-Eleocharis palustris*) herbaceous community. Uplands are dominated by pinyon pine/juniper woodlands and ponderosa pine.

Discussion.- The Narrowleaf Cottonwood/Bluestem Willow riparian community is generally found in intermediate positions within the riparian landscape. It occurs along banks that are generally well-armored by bedrock or stones. At this stage, the community appears to be stable. Floods carrying heavy bedloads and debris could disturb or destroy the existing community. Past signs of beaver herbivory is evident.

Documentation.- This description is based on plot 95PD043 It has previously been documented by Durkin et al. (1995a) for the Rio Grande.

3. Narrowleaf Cottonwood/Kentucky Bluegrass
Populus angustifolia/Poa pratensis
POPANG/POAPRA CT

Distribution.- The Narrowleaf Cottonwood/Kentucky Bluegrass riparian community is known from the West Fork of the Gila watershed.

Vegetation.- Narrowleaf cottonwood (*Populus angustifolia*) dominates the tree canopy, though other trees such as boxelder (*Acer negundo*), ponderosa pine (*Pinus ponderosa*) and Rocky Mountain juniper (*Juniperus scopulorum*) sometimes extend up into the canopy. Total cover is 70%. The stand is well-shaded and species diversity is relatively low. Shrubs are widely scattered and the understory is distinctively grassy. Kentucky bluegrass (*Poa pratensis*) is the dominant. Total graminoidal cover is 33% and forbs are scarce. Other common grasses include the exotics smooth brome (*Bromus inermis*), meadow fescue (*Festuca pratensis*), and creeping bentgrass (*Agrostis stolonifera*). The predominant forbs include sweet four o'clock (*Mirabilis longiflora*), pineywoods geranium (*Geranium caespitosum*), Fendler's meadowrue (*Thalictrum fendleri*), and sweetclover (*Melilotus officinalis*). Shrubs present include skunkbush sumac (*Rhus trilobata*), American black currant (*Ribes americanum*), New Mexico alder (*Forestiera pubescens*), and sapling-sized boxelder (*A. negundo*) and narrowleaf cottonwood (*P. angustifolia*).

Environmental Setting.- The Narrowleaf Cottonwood/Kentucky Bluegrass community occurs at approximately 1734 meters (5689 ft.). Flooding occurs at 25 year intervals. The discharge ratio is 4.9. The stream gradient is .27%. Depth to the water table is greater than the depth of the soil pit. Soils are represented by coarse loamy Typic Ustochrepts. They have a wetness rank of 12. Plant available water is 5.78%.

Adjacent Vegetation.- Open areas adjoining this community are typically small cobble bars dominated by the Rubber Rabbitbrush/Sand Dropseed (*Chrysothamnus nauseosus/Sporobolus cryptandrus*) community type. Uplands are dominated by ponderosa pine (*Pinus ponderosa*) forests.

Discussion.- Aggradation during flooding in association with vegetation has aided the development of this community to levels several feet above the active channel. It occurs along perennial stream reaches of relatively level stream gradients. Vegetative cover is very good and there are no signs of outside disturbances such as grazing or human induced.

Documentation.- This description is based on plot 95PD056. The community type is well documented in New Mexico (Dick-Peddie 1993 and Durkin et al. 1995a), as well as from Utah and Southeastern Idaho (Padgett 1989), and Montana (Hansen et al. 1990).

4. Narrowleaf Cottonwood-Rocky Mountain Juniper/Sand Dropseed
Populus angustifolia-Juniperus scopulorum/Sporobolus cryptandrus
POPANG-JUNSCO/SPOCRY CT

Distribution.- The Narrowleaf Cottonwood-Rocky Mountain Juniper/Sand Dropseed riparian community is known from Saliz Canyon of the San Francisco watershed.

Vegetation.- Narrowleaf cottonwood (*Populus angustifolia*) dominates this riparian forest with Rocky Mountain juniper (*Juniperus scopulorum*) as a sub-canopy dominant. Sand dropseed (*Sporobolus cryptandrus*) is a significant understory component. California brickellbush (*Brickellia californica*), skunkbush sumac (*Rhus trilobata*), and the woody vines Virginia creeper (*Parthenocissus quinquefolia* var. *quinquefolia*), canyon grape (*Vitis arizonica*), and Drummond's clematis (*Clematis drummondii*) make up a fairly well-represented shrub layer. Grasses are more common than forbs and include sideoats grama (*Bouteloua curtipendula*) and alkali sacaton (*S. airoides*) along with little barley (*Hordeum pusillum*), spidergrass (*Aristida ternipes*) and Kentucky bluegrass (*Poa pratensis*). Forbs are represented by desert penstemon and beardlip penstemon (*Penstemon pseudospectabilis* and *P. barbatus*), as well as Fendler's meadowrue (*Thalictrum fendleri*), common ragweed (*Ambrosia artemisiifolia*), common mullein (*Verbascum thapsus*), and sweetclover (*Melilotus officinalis*).

Environmental Setting.- The Narrowleaf Cottonwood-Rocky Mountain Juniper/Sand Dropseed community occurs at approximately 1744 meters (5720 ft.). Flooding occurs at 25 year intervals. The stream discharge ratio is 9 and the stream gradient is .21%. Depth to the water table is greater than the depth of the soil pit. Soils are represented by sandy skeletal Mollic Udifluvents. They have a wetness rank of 11. Plant available water is 1.87%.

Adjacent Vegetation.- Adjoining this community on the streambanks are Arizona Alder/Bluestem Willow (*Alnus oblongifolia/Salix irrorata*) while pinyon pine/juniper woodlands mixed with ponderosa pine dominate the upland sideslopes.

Discussion.- The community occurs in a narrow canyon (ca. 100 meters wide or less). It is situated on a dry, sandy terrace approximately 25 meters from the active channel, as well as from the upland sideslopes. The presence of juniper in floodplain communities is often considered invasive. It is at least an indicator that flooding occurs infrequently.

Documentation.- This description is based on one sampled plot 95PD030. A similar community type has previously been documented by Durkin et al.1995a for the Rio Grande.

III. Southwest Montane Forested Wetlands

Forests of low to mid-elevations dominated by cold tolerant species with floristic ties to the Sierra Madrean biogeographic province of Mexico. These native, cold temperate forests, typically bordering higher order tributary streams, are represented by communities of the Arizona Alder (*Alnus oblongifolia*) Series.

IV. Broad-Leaved Deciduous Series Group

Forests dominated by rounded crown deciduous species. Needle-leaved species as in ponderosa pine (*Pinus ponderosa*) or junipers (*Juniperus* spp.) may be present, but do not dominate.

V. Arizona Alder (*Alnus oblongifolia*) Series

Arizona alder dominated forests replace thinleaf alder (*A. incana* ssp. *tenuifolia*) in the central and southwestern mountains of New Mexico. In the study area, these native forests occur along perennial stream segments with low- to mid-gradients, low discharge ratios (1 to 2.1), and in the one- to two-year floodplain at elevations ranging between 1683 m. to 1744 m. (5520 ft. to 5720 ft.). Streams are commonly shallowly cut with cobbly and rocky banks. The floodplain is typically very narrow with the upland slope directly adjacent to, or nearby the stream. These forests are typically dense with closed canopies (60% to >75%) and border the stream in long narrow bands. Soils are commonly deep and loose, unconsolidated and non-stratified riverwash. More developed soils are either coarse cobbly Oxyaquic Ustifluvents or sandy Typic Ustifluvents. Forests of this series are extremely effective in stabilizing streambanks.

1. Arizona Alder/Bluestem Willow
Alnus oblongifolia/Salix irrorata
ALNOBL/SALIRR CT

Distribution.- The Arizona Alder/Bluestem Willow riparian forest community is known from Saliz Canyon of the San Francisco watershed. It is expected to occur in the Gila watershed, but it is not yet known. It is not expected to occur in the Mimbres basin.

Vegetation.- This riparian forest community has a moderately dense canopy. Total overstory cover provided by Arizona alder (*A. oblongifolia*) is 60%. Saplings of boxelder (*Acer negundo*) and narrowleaf cottonwood (*Populus angustifolia*) are well-represented, yet the understory dominant is bluestem willow (*S. irrorata*) providing 25 to 33% cover. Graminoids and forbs are fairly numerous and collectively contribute 20% cover to the herbaceous layer, but no one species dominates. Common graminoidal species include common spikerush (*Eleocharis palustris*), American bulrush (*Scirpus americanus*), Baltic rush (*Juncus balticus*), Kentucky bluegrass (*Poa pratensis*), creeping bentgrass (*Agrostis stolonifera*) and redtop (*A. gigantea*), and Japanese brome (*Bromus japonicus*). Common forbs include black medic (*Medicago lupulina*), field horsetail (*Equisetum arvense*), common dandelion (*Taraxacum officinale*), meadow salsify (*Tragopogon pratensis*), common mullein (*Verbascum thapsis*), Fendler's meadowrue (*Thalictrum fendleri*), and Canadian horseweed (*Conyza canadensis*).

Environmental Setting.- This community occurs at approximately 1744 meters (5720 ft.). It occurs along locally flat, low gradient (<.5%) reaches. It dominates low and narrow sidebars where it is flooded every other year (discharge ratio = 2.1). Soils are sandy and cobbly unconsolidated riverwash that lack structure and stratification.

Adjacent Vegetation.- Narrowleaf cottonwood/Kentucky bluegrass (*Populus angustifolia/Poa pratensis*) forests occupy nearby terraces one to two feet higher. Uplands are dominated by ponderosa pine (*Pinus ponderosa*), pinyon pine (*P. edulis*), and alligator juniper (*Juniperus deppeana*).

Discussion.- These riparian forest communities are found bordering low side bars of smaller tributary streams. Under the present hydrological regime, the lack of alder re-generation coupled with good recruitment of boxelder in the understory may indicate a successional trend towards a more drier site and subsequent new community type similar to the Narrowleaf cottonwood-Boxelder/Kentucky bluegrass community type.

Documentation.- This description is based on one sampled plot 95PD031. This is a newly described riparian forest community for New Mexico and the Southwest and more data is needed to confirm composition and distribution.

2. Arizona Alder-Narrowleaf Cottonwood/California Brickellbush
Alnus oblongifolia-Populus angustifolia/Brickellia californica
ALNOBL-POPANG/BRICAL CT

Distribution.- The Arizona Alder-Narrowleaf Cottonwood/California Brickellbush is known from the main stem of the Mimbres River near Bear Canyon and Cooney Canyon.

Vegetation.- Arizona alder (*Alnus oblongifolia*) and narrowleaf cottonwood (*Populus angustifolia*) together co-dominate the overstory canopy providing 45% to 70% cover. The shrub and herbaceous understory is fairly diverse, however, California brickellbush (*Brickellia *californica*) is the sub-canopy dominant. Other trees present are recently established sapling-sized Arizona walnut (*Juglans major*) and boxelder (*Acer negundo*), as well as ponderosa pine (*Pinus ponderosa*) and Gambel's oak (*Quercus gambelii*). Graminoids and forbs are nearly equally represented, though forbs are more numerous. The dominant grasses include the exotic species meadow fescue (*Festuca pratensis*), little barley (*Hordeum pusillum*), cheatgrass (*Bromus tectorum*), and smooth brome (*Bromus inermis*). Kentucky bluegrass (*Poa pratensis*) and sixweeks fescue (*Festuca octoflora*). The pervasive forb is the exotic mint horehound (*Marrubium vulgare*). Native species include cutleaf coneflower (*Rudbeckia laciniata*), stinging nettle and mountain nettle (*Urtica doica* and *U. gracilenta*), Fremont's goosefoot (*Chenopodium fremontii*), and Missouri gourd (*Cucurbita foetidissima*).

Environmental Setting.- The Arizona Alder-Narrowleaf Cottonwood/California Brickellbush community occurs at elevations ranging between 1841 and 2122 meters (6040 and 6960 ft.). Flooding occurs at 10 to 25 year intervals. Discharge ratios range from 1.32 to 13.33. Stream gradients range from .9% to 1.8%. Soils are represented by sandy skeletal over coarse loamy Oxyaquic Ustifluvents and sandy skeletal Typic Ustifluvents. Oxyaquic Ustifluvents have a wetness rank of 8. Plant available water is 3.8%. Typic Ustifluvents have a wetness rank of 12. Plant available water is also 3.8%.

Adjacent Vegetation.- Outer floodplains or high terraces are dominated by the Arizona Walnut-Boxelder/Skunkbush Sumac (*Juglans major-Acer negundo/Rhus trilobata*) community type. Uplands are either dominated by pinyon pine/juniper woodlands or are converted to farmland and pasture.

Discussion.- These riparian forests are typically positioned adjacent to the active channel and one to two meters above base flows. The closely spaced alders border the channel and tend to slightly overhang the banks, while the taller cottonwoods are set several feet further back away from the channel and are widely spaced. Seedling reproduction of the obligate riparian species typically occurs outside the community on low gravelly bars in the riverbed.

Documentation.- This description is based on plots 95PD003 and 95PD007. An ecologically similar community type has previously been described by Durkin et al. (1995a) for the Rio Grande basin.

3. Arizona Alder/Rice Cutgrass
Alnus oblongifolia/Leersia oryzoides
ALNOBL/LEEORY CT

Distribution.- The Arizona Alder/Rice Cutgrass riparian forest community has a widely scattered distribution in the Gila watershed. It is known from the Middle Fork and from the main stem near Alum Hot Springs.

Vegetation.- This riparian forest community is characterized by a tall and dense (>75%) tree canopy dominated by Arizona alder (*A. oblongifolia*) which overtops a rich and luxuriant herbaceous underlayer dominated by rice cutgrass (*L. oryzoides*) that provides 33-50% cover. A mixed variety of broadleaf trees/shrubs such as boxelder (*Acer negundo*), leadplant (*Amorpha fruticosa*), California brickellbush (*Brickellia californica*), New Mexico olive (*Forestiera pubescens* ssp. *pubescens*), and the woody vine Virginia creeper (*Parthenocissus quinquefolia* var. *quinquefolia*) can provide (10-15% cover), however, the thick and lush band of herbaceous species collectively contribute 60% or more cover. Among the graminoids several sedges (*Carex nebrascensis, C. aquatilis, C. stipata, Cyperus esculentus*) and rushes

(*Scirpus americanus, S. tabernaemontani, Eleocharis palustris*) are common. Grasses are commonly represented by creeping bentgrass (*Agrostis stolonifera*), as well as meadow fescue (*Festuca pratensis*) and Canada wildrye (*Elymus canadensis*). Numerous herbs diversify the community. These include: field horsetail (*Equisetum arvense*), cutleaf coneflower (*Rudbeckia laciniata*), seep monkeyflower (*Mimulus guttatus*), water hemlock (*Cicuta douglasii*), wild mint (*Mentha arvensis*), watercress (*Rorippa nasturtium-aquaticum*), and curlytop knotweed (*Polygonum lapathifolium*).

Environmental Setting.- Elevations of the Arizona Alder/Rice Cutgrass community range from 1683 to 1744 meters (5520 to 5720 ft.). It occurs along low gradient runs (<1%) on low sidebars where it is flooded annually (discharge ratio = 1). Soils are sandy and cobbly unconsolidated riverwash that lack structure and stratification.

Adjacent Vegetation.- The highest terraces are dominated by upland Ponderosa pine-Rocky Mountain juniper (*Pinus ponderosa-Juniperus scopulorum*) forests. Narrowleaf cottonwood-boxelder (*Populus angustifolia-Acer negundo*) riparian forest communities are common on mid-elevation terraces. Interspersed among these forests in more open areas are Rubber rabbitbrush/sand dropseed shrublands.

Discussion.- These riparian forest communities are found bordering the river in narrow and isolated canyons. Diversity of species is typically high (50+ species) in these communities and encroachment by exotics is low. Many of the species are facultative wetland species and a few are obligate. Flooding occurs annually allowing for re-generation of the alders. Flooding can occasionally occur at great magnitudes such that large logs and flood debris accumulate to build the bars higher, eventually terracing the community and changing the species composition.

Documentation.- This description is based on plots 95PD051 and 95PD054. This is a newly described riparian forest community for New Mexico and the Southwest and more data is needed to confirm composition and distribution.

II. Warm Temperate Riparian/Wetlands

These forests are found in warm temperate climates with cold to mild winters, and cool to warm summers.

III. Southwest Lowland Forested Wetlands

These warm temperate native forests are restricted to lower elevations of southwestern New Mexico. They occur in entrenched canyons or across broad floodplains. Major species have floristic ties to the Sierra Madrean biogeographic province. These forests are common along perennial and intermittent streams that have not been stabilized by storage reservoirs. In the study area, these native forests are represented by communities from the Arizona Sycamore (*Platanus wrightii*), Arizona Walnut (*Juglans major*), and Fremont's Cottonwood (*Populus fremontii*) Series. They are common in functioning riparian systems in hilly regions of southwestern New Mexico.

IV. Broad-Leaved Deciduous Series Group

Forests dominated by rounded crown deciduous species. Needle-leaved species as in ponderosa pine (*Pinus ponderosa*) or junipers (*Juniperus* spp.) may be present, but do not dominate.

V. Arizona Sycamore (*Platanus wrightii*) Series

Arizona sycamore dominated forests have been classified into four community types co-dominated by either Arizona alder, California brickellbush, Emory's oak, and sand dropseed. Canopies are generally somewhat open. This is a major series common to the Gila and San Francisco watersheds that typically occur on high and dry terraces at elevations ranging between 1378 m to 1756 m (4520 ft. to 5760 ft.). Communities are flooded at 5- to 50-year intervals and discharge ratios vary from 2.62 to 8.22. Average discharge ratio is 5.14. Soils are represented by Typic Ustifluvents, Oxyaquic Ustifluvents, Typic Ustochrepts, and unconsolidated, non-stratified riverwash. Sycamore reproduction typically occurs along the channel on fresh gravelly or cobbly moist alluvium. Understories are variably diverse and commonly dominated by perennial grasses, such as sand dropseed and spidergrass. Reproduction of other trees, such as Arizona walnut, boxelder, or velvet ash may be common.

1 Arizona Sycamore-Arizona Alder
Platanus wrightii-Alnus oblongifolia
PLAWRI—ALNOBL CT

This major community type is common in the Gila and San Francisco watersheds along narrow and largely cobble-dominated or stony reaches. The community type is not known to occur in the Mimbres watershed. Arizona sycamore and Arizona alder typically co-dominate the overstory. Depending upon the position of the community in the floodplain, the understory may be diverse in numbers of species (averaging 30 species in the stand) or sparse with fewer species and scarce ground cover. Three phases are recognized: (1) the California brickellbush phase, (2) the Seepwillow phase, and (3) a Sparse phase.

California Brickellbush Phase
Brickellia californica
PLAWRI-ALNOBL, BRICAL PH

Distribution.- The California Brickellbush phase of the Arizona Sycamore-Arizona Alder community type is the most common community type of the Arizona sycamore series. It is known from the Turkey Creek and the West Fork of the Gila watershed. It is not yet known from the San Francisco watershed and is not expected to occur in the Mimbres basin.

Vegetation.- The community is co-dominated by a dense canopy of Arizona sycamore and Arizona alder (60% cover). Subcanopy species are diverse and luxuriant. Woody species are abundant overall, although California brickellbush is typically more well-represented than other species. Common trees include boxelder (*Acer negundo*), black cherry (*Prunus serotina*), velvet ash (*Fraxinus velutina*), Arizona walnut (*Juglans major*), common hoptree (*Ptelea trifoliata*), Rocky Mountain juniper (*Juniperus scopulorum*), ponderosa pine (*Pinus ponderosa*), gambel oak (*Quercus gambelii*), and gray oak (*Q. grisea*), but their covers seldom exceed 4%. The woody lianas, Virginia creeper (*Parthenocissus quinquefolia* var. *quinquefolia*) and Arizona grape (*Vitis arizonica*) are also common. Collectively, the herbaceous layer is not a strong component of the community, but tends to be grass dominated. Herbaceous species include the grasses, Kentucky bluegrass (*Poa pratensis*) and Arizona fescue (*Festuca arizonica*), while the forbs are represented by Canada goldenrod (*Solidago canadensis*), Fendler's meadowrue (*Thalictrum fendleri*), and scarlet hedgenettle (*Stachys coccinea*).

Environmental Setting.- Elevations of the California brickellbush phase range from 1512 to 1756 meters (4960 to 5760 ft.). It occurs on low side bars or mid-elevation terraces where stream gradients range from 0.7 (discharge ratio = 6.2) to 1.04 % (discharge ratio = 3). Flooding is infrequent and occurs on the order of every 25 to 50 years. Soils are somewhat variable depending on the position of the community in the floodplain. They are represented by sandy and cobbly unconsolidated riverwash that lack structure and stratification, or by sandy skeletal Typic Ustifluvents. Availability of water for plant growth is low (.51) for soils classified as riverwash, and only slightly higher (1.28) for Typic Ustifluventic soils.

Adjacent Vegetation.- When flood regimes become increasingly intermittent this community type adjoins the drier Arizona sycamore-Emory oak-Alligator juniper (*P. wrightii-Q. emoryi-J. deppeana*). Uplands are dominated by mesquite (*Prosopis glandulosa/P. velutina*), manzanita (*Arctostaphylos pungens*), viscid acacia (*Acacia neovernicosa*), and turpentine bush (*Ericameria laricifolia*).

Discussion.- These riparian forests are mature communities found on drier terraces. Canopies are dense resulting in an open shrub and herbaceous understory. Disturbance is low and exotic species are few. Reproduction of the obligate riparian dominant species within the community is poor, but remains active closest to the streambank and channel on surfaces much lower than the terrace. Sapling-sized facultative riparian species, such as boxelder (*Acer negundo*) and Arizona walnut (*Juglans major*) are common in the understory suggesting a successional trend towards a different community under the present hydrological regime.

Documentation.- This description is based on plots 95PD050 and 95PD057. It is a phase of the Arizona sycamore-Arizona alder riparian community type. In the same watersheds, Dick-Peddie et al. (1987) describe a similar Arizona sycamore association.

Seepwillow Phase
Baccharis salicifolia
PLAWRI-ALNOBL, BACSAL PH

Distribution.- The Seepwillow (*Baccharis salicifolia*) phase of the Arizona Sycamore-Arizona Alder community type is known from the lower San Francisco watershed near Gorilla Spring.

Vegetation.- The community is co-dominated by a dense canopy of Arizona sycamore (*Platanus wrightii*) and Arizona alder (*Alnus oblongifolia*) (70% cover). Subcanopy species are diverse and numerous. The herbaceous layer collectively contributes 20% cover, yet no one species is dominant, and although the shrub layer provides 10% cover, seepwillow (*Baccharis salicifolia*) is the understory dominant. Reproduction of other riparian trees is common in the shrub layer. These include velvet ash (*Fraxinus velutina*), boxelder (*Acer negundo*), netleaf hackberry (*Celtis laevigata* var. *reticulata*), Arizona walnut (*Juglans major*), and Fremont's cottonwood (*Populus fremontii*). Other components of the shrub layer include the woody liana Virginia creeper (*Parthenocissus quinquefolia* var. *quinquefolia*), skunkbush sumac (*Rhus trilobata* var. *trilobata*), and oneseeded juniper (*Juniperus monosperma*). The principal herbaceous species are the introduced species bermudagrass (*Cynodon dactylon*) and sweetclover (*Melilotus officinalis*). The majority of the remaining herbaceous species are also introduced. These include meadow fescue (*Festuca pratensis*), cheatgrass (*Bromus tectorum*), Canadian horseweed (*Conyza canadensis*), common sunflower (*Helianthus annuus*), common mullein (*Verbascum thapsus*) and spiny cocklebur (*Xanthium strumarium*), as well as common ragweed (*Ambrosia artemisiifolia*) and watercress (*Rorippa nasturtium-aquaticum*). Only seep monkeyflower (*Mimulus guttatus*), golden columbine (*Aquilegia chrysantha*), and common maidenhair fern (*Adiantum capillus-veneris*) are native species.

Environmental Setting.- The Seepwillow (*Baccharis salicifolia*) phase occurs at approximately 1378 meters (4520 ft.). It occurs along very low stream gradients (<1%) on terraces that are flooded at approximately ten year intervals (discharge ratio = 6.8). Soils are sandy Typic Ustifluvents (wetness rank = 12) that have a moderate water holding capacity (available water = 5.75).

Adjacent Vegetation.- On the lowest bars bordering the channel is the Fremont's cottonwood-Goodding's willow/Seepwillow (*Populus fremontii-Salix gooddingii/Baccharis salicifolia*) riparian forest. Uplands are dominated by oneseeded juniper (*Juniperus monosperma*), honey mesquite (*Prosopis glandulosa*), and grama grasses (*Bouteloua* spp.).

Discussion.- The abundance of seepwillow may indicate a successional change in the community from a streambank community towards a mature forest. High recruitment of many facultative and obligate riparian species, as well as the dominant overstory trees may reflect this transitional phase from a wetter to a drier site. The presence of some obligate upland associates such as oneseeded juniper (*J. monosperma*) may also be indicative of this change.

Documentation.- This description is based on one sampled plot 95PD013. It is a phase of the Arizona sycamore-Arizona alder community that may be similar to the Arizona sycamore association of lower terraces described by Dick-Peddie et al. (1987) for the Gila watershed.

Sparse Phase
PLAWRI-ALNOBL, SPARSE PH

Distribution.- The Sparse phase of the Arizona Sycamore-Arizona Alder Community Type. It is known from Pueblo Creek of the San Francisco watershed.

Vegetation.- Arizona sycamore (*Platanus wrightii*) and Arizona alder (*Alnus oblongifolia*) collectively contribute to 90% of the total canopy cover. There is little development in either the shrub or herbaceous layer. The shrub layer consists of sapling-sized elements of the dominants (total canopy cover = 1%), and of Arizona walnut (*Juglans major*). The herbaceous layer contributes scarcely more. Still, species that are present include only two natives, Fremont's goosefoot (*Chenopodium fremontii*) and mock vervain (*Glandularia wrightii*) while the remaining species have been introduced. These include the ubiquitous species redtop (*Agrostis gigantea*), Canadian horseweed (*Conyza canadensis*), sweetclover (*Melilotus officinalis*), and curlytop knotweed (*Polygonum lapathifolium*).

Environmental Setting.- The Sparse phase of the community type occurs at approximately 1622 meters (5320 ft.). It occurs directly adjacent to the channel where stream gradients are moderate (1.6%). Inundation of the community by floods occurs at 5 year intervals (discharge ratio = 2.62). Soils are represented by Oxyaquic Ustifluvents with a sandy skeletal texture (plant available water = 1.75) and a wetness rank of 8. Channel materials consist of a mixture of cobbles, small to medium sized gravels, and sand with alternating riffles and small pools that seldom exceed 25 to 30 centimeters (10 to 12 in.) in depth and to 2 meters (3 to 6 ft) long or wide.

Adjacent Vegetation.- Other riparian trees, such as the hybrid lanceleaf cottonwood (*Populus* x *acuminata*) and velvet ash (*Fraxinus velutina*) are widely scattered through the site, however this abstract largely describes the dominant community type for the sampled reach. The upland vegetation is dominated by pinyon pine (*Pinus edulis*) and oneseeded juniper (*Juniperus monosperma*) woodlands mixed with various suffrutescent shrubs.

Discussion.- This phase of the community type is distinguished by having the highest density of tree canopy cover of the Arizona sycamore series, thereby restricting the growth of a well-developed understory. These forests are extremely effective in stabilizing the banks and withstanding the force of large floods. Channel migration and meander patterns result in the community being situated typically within 1 to 1.5 meters (3 to 4 ft.) above the active channel and up to 5 meters (15 ft.) distant.

Documentation.- This description is based on one sampled plot 95PD021. It is closely related to the Arizona Sycamore-Arizona Alder community type described by Durkin et al. (1995b) from Las Animas Creek that drains the east side of the Black Range to the Rio Grande basin.

2. Arizona Sycamore/California Brickellbush
Platanus wrightii/Brickellia californica
PLAWRI/BRICAL CT

Distribution.- The Arizona Sycamore/California Brickellbush riparian forest community is known from the main stem of the Gila watershed near Canyon Hill. It is expected to occur in the San Francisco watershed, but it is not expected to occur in the Mimbres basin.

Vegetation.- A dense canopy (70%) of Arizona sycamore (*Platanus wrightii*) overtops a mixed shrub and grassy understory. California brickellbush (*Brickellia californica*) represents the dominant shrub providing up to 25% cover. Other shrubs include several facultative species yerba de pasmo (*Baccharis pteronoides*), Emory's oak (*Quercus emoryi*), rubber rabbitbrush (*Chrysothamnus nauseosus*), manzanita (*Arctostaphylos pungens*), oneseed juniper (*Juniperus monosperma*), as well as a few facultative wetland species such as flameleaf sumac (*Rhus copallinum*) and sapling-sized Arizona sycamore (*P. wrightii*). Common grasses include spidergrass (*Aristida ternipes*), sand dropseed (*Sporobolus cryptandrus*), alkali sacaton (*S. airoides*), sideoats grama (*Bouteloua gracilis*), and silver beardgrass (*Bothriochloa laguroides* ssp. *torreyana*). Forbs comprise a very minor component. Present are Rocky Mountain beeplant (*Cleome serrulata*), lacy tansyaster (*Machaeranthera pinnatifida* ssp. *pinnatifida*), as well as common mullein (*Verbascum thapsus*) and sweetclover (*Melilotus officinalis*) - both introduced species.

Environmental Setting.- The Arizona Sycamore/California Brickellbush community occurs at approximately 1463 meters (4800 ft.). It occurs on low gradient reaches (<1%) on moderate height terraces where it is flooded approximately every 10 years (discharge ratio = 5.24). Soils are represented by Typic Ustifluvents with a sandy skeletal texture (plant available water = 1.02) and a wetness rank of 12.

Adjacent Vegetation.- Bordering the river on cobble bars are the Seepwillow/Arizona Sycamore community with a considerable amount of sapling-sized sycamore reproduction. High terraces are dominated by silverleaf oak (*Quercus hypolucoides*), gray oak (*Q. grisea*), Gambel's oak (*Q. gambelii*), black cherry (*Prunus serotina*), and ponderosa pine (*Pinus ponderosa*). Uplands are dominated by catclaw acacia (*Acacia neovernicosa*) and various suffrutescent shrubs.

Discussion.- These riparian forests occur on dry terraces where the channel has cut down and away from meander bends leaving them a considerable distance above and away from the active channel. The species composition of the stand reflects the dryness of the site. Species diversity is moderate and the presence of exotic species is low.

Documentation.- This description is based on plot 95PD061. It is similar to types described by Durkin et al. (1995b) for Las Animas Creek of the Rio Grande basin. As more data is accumulated and analyzed for a final classification these previously described types may require re-classification.

3. Arizona Sycamore-Emory's Oak
Platanus wrightii-Quercus emoryi
PLAWRI-QUEEMO CT

Distribution.- The Arizona Sycamore-Emory's Oak riparian forest community is known from Mogollon Creek of the Gila watershed. It is also known to occur in similar environs of the San Francisco watershed, but was not sampled.

Vegetation.- Arizona Sycamore (*Platanus wrightii*), Emory's oak (*Quercus emoryi*), oneseed juniper (*Juniperus monosperma*), alligator juniper (*Juniperus deppeana*), velvet ash (*Fraxinus velutina*), and desert willow (*Chilopsis linearis*) collectively contribute to 60% of the total tree cover, though Arizona sycamore and Emory's oak are the dominant trees. The understory consists of a mixture of facultative and upland grasses and shrubs. Forbs are scarce. Shrubs include Mexican white sagebrush (*Artemisia ludoviciana* ssp. *mexicana*), rubber rabbitbrush (*Chrysothamnus nauseosus*), honey mesquite (*Prosopis glandulosa*), catclaw acacia (*Acacia neovernicosa*), gumhead (*Gymnospermum glutinosum*), and sapling-sized netleaf hackberry (*Celtis laevigata* var. *reticulata*). Grasses include spidergrass (*Aristida ternipes*), as well as cheatgrass (*Bromus tectorum*) and little barley (*Hordeum pusillum*) - both introduced. Forbs include willowleaf aster (*Aster praealtus*) and horehound mint (*Marrubium vulgare*), a ubiquitous exotic.

Environmental Setting.- The Arizona Sycamore-Emory's oak community occurs at approximately 1427 meters (4680 ft.). It occurs in broad floodplains on island bars dissected by numerous intermittent channels where flooding occurs at approximately ten year intervals. Channel materials are sandy and cobbly. The discharge ratio equals 8.22. Soils are represented by Typic Ustochrepts. They are stratified soils with a coarse loamy layer over a sandy skeletal layer. Plant available water equals 3.8 and the wetness rank equals 12.

Adjacent Vegetation.- The Desert Willow/Rubber Rabbitbrush (*Chilopsis linearis/Chrysothamnus nauseosus*) riparian community type borders these communities on more open and drier sites. Uplands are dominated by mesquite (*Prosopis glandulosa/velutina*), turpentine bush (*Ericameria laricifolia*) and various grasses.

Discussion.- These riparian forest communities dominate broad floodplains that typically have intermittent flows. These are mature communities with broad, sprawling canopies. Reproduction of the obligate riparian species is locally absent, but occurs downstream on the main stem of the Gila on recently exposed alluvium. Typically, these bars are dominated by seedlings of Arizona sycamore (*P. wrightii*), Fremont's cottonwood (*Populus fremontii*), and seepwillow (*Baccharis salicifolia*). The maintenance of these communities is likely then by episodic floods that accompany monsoonal thunderstorms.

Documentation.- This description is based on one sampled plot 95PD058. This community type was similarly described by Dick-Peddie et al. (1987) as an Emory oak association from upper terraces of the Gila river, by Muldavin 1987, and by Wallace 1992.

4. Arizona Sycamore/Sand Dropseed
Platanus wrightii/Sporobolus cryptandrus
PLAWRI/SPOCRY CT

Distribution. -The Arizona Sycamore/Sand Dropseed riparian community is known from the San Francisco watershed at the Springs near Glenwood. It is expected to occur in elsewhere in the San Francisco watershed as well as in the Gila watershed.

Vegetation.- Arizona sycamore (*P. wrightii*) forms an open canopy (25 to 33%). Individual trees have sprawling canopies that overtop a grassy understory (30% total cover) dominated by sand dropseed (*Sporobolus cryptandrus*). Shrubs are scattered and collectively comprise only 10% total cover. Common or present are California brickellbush (*Brickellia californica*), rubber rabbitbrush (*Chrysothamnus nauseosus*), Mexican white sagebrush (*Artemisia ludoviciana* ssp. *mexicana*), the woody liana canyon grape (*Vitis arizonica*), and sapling-sized saltcedar (*Tamarix chinensis*), an introduced and problematic weed to many southwestern riparian ecosystems. Other grasses and forbs present include one native species - spidergrass (*Aristida ternipes*) - and several introduced species bermudagrass (*Cynodon dactylon*), cheatgrass (*Bromus tectorum*), and common ragweed (*Ambrosia artemisiifolia*).

Environmental Setting.- The Arizona Sycamore/Sand dropseed community occurs at approximately 1440 meters (4720 ft.). It occurs on high terraces where flooding occurs very rarely at approximately 50 year intervals. Channel materials are typically cobbly and bouldery. The discharge ratio equals 3.9. Soils are represented by Typic Ustifluvents. They are non-stratified cobbly and sandy soils. Plant available water equals 1.275 and the wetness rank equals 12.

Adjacent Vegetation.- The Fremont's Cottonwood-Goodding's Willow/Coyote Willow riparian community type directly adjoins this community and the active channel, while the Arizona Walnut-Netleaf Hackberry/California Brickellbush (*Juglans major-Celtis laevigata* var. *reticulata/Brickellia californica*) borders the upland toeslopes and canyon walls. Uplands are dominated by oneseed juniper (*Juniperus monosperma*) and mesquite (*Prosopis glandulosa/velutina*).

Discussion.- These riparian forests occupy some of the driest sites within the floodplains of the San Francisco watershed. They are typically found in remote and deeply cut canyons. They are also rarely flooded, which is reflected by the composition of primarily upland species in the understory. They are also mature forests that will ultimately senesce and die, eventually succeeding to an upland community unless reset by floods.

Documentation.- This description is based on one sampled plot 95PD016. It is apparently a newly described riparian forest community for New Mexico and the southwest that may require more data.

V. Arizona Walnut (*Juglans major*) Series

Arizona walnut dominated forests are co-dominated by either boxelder with a skunkbush sumac dominated understory, netleaf hackberry with an understory dominated by California brickellbush, or by New Mexico olive. This is the dominant series that typically occurs along the outer fringe of the floodplain, at the toe of the upland sideslopes. It occurs in all of the three major watersheds at elevations ranging from 1329 m to 2000 m (4360 ft. to 6560 ft.). Discharge ratios are high ranging between 6.45 and 59.6. Average discharge ratio is 39.2. Flooding occurs at 50 to 100 year intervals. Soils are represented by Typic Ustifluvents, Fluventic Ustochrepts, Fluventic Haplustolls, Typic Ustipsamments, Aridic Ustochrepts, and Typic Ustochrepts.

Arizona Walnut-Boxelder/Skunkbush Sumac
Juglans major-Acer negundo/Rhus trilobata
JUGMAJ-ACENEG/RHUTRI CT

Distribution.- The Arizona Walnut-Boxelder/Skunkbush Sumac riparian forest community is known from Beaver Creek of the Gila watershed, Apache Creek of the San Francisco watershed, and from the main stem of the Mimbres River.

Vegetation.- Arizona walnut (*Juglans major*) and boxelder (*Acer negundo*) form closed canopies (50 to 75% cover) typically over a shrubby understory interspersed with mixed grasses and forbs. Several shrubs such as California brickellbush (*Brickellia californica*), poison ivy (*Toxicodendron radicans* ssp. *radicans*), Wood's rose (*Rosa woodsii*), oneseed juniper (*Juniperus monosperma*), Rocky Mountain juniper (*J. scopulorum*), as well as the vines canyon grape (*Vitis arizonica*) and Virginia creeper (*Parthenocissus quinquefolia* var. *quinquefolia*) are usually present and well represented, but skunkbush sumac (*Rhus trilobata* var. *trilobata*) is always present. Cover provided by the herbaceous layer ranges from sparse to well-represented (1 to 20%). Many of the species are introduced, probably escaping from the old fields, and include cheatgrass (*Bromus tectorum*), rescuegrass (*B. catharticus*) and meadow fescue (*Festuca pratensis*), as well as horehound mint (*Marrubium vulgare*), common mullein (*Verbascum thapsus*), common ragweed (*Ambrosia artemisiifolia*), and silverleaf nightshade (*Solanum elaeagnifolium*). Still, some forbs present, such as sweet four o'clock (*Mirabilis longiflora*) and smooth horsetail (*Equisetum laevigatum*) are facultative wetland species.

Environmental Setting.- The Arizona Walnut-Boxelder/Skunkbush Sumac community occurs at elevations ranging from 1841 to 2000 meters (6040 to 6560 ft.). It occurs on high terraces or towards the outer edge of the floodplain where flooding is rare, occurring at approximately 50 to 100 year intervals. Discharge ratios range from 20 to 59.6. Stream gradients are commonly 1%. Soils are represented by Typic Ustifluvents, Fluventic Haplustolls, and Typic Ustochrepts. They are either sandy skeletal or loamy over skeletal soils that are somewhat alkaline and have a wetness ranking of 12.

Adjacent Vegetation.- Typically, these communities are not situated directly adjacent to other riparian communities, but are usually somewhat disconnected to them by an old field that was grazed by cattle or horses in the past. However, the riparian vegetation that commonly borders the active channel is represented by the Narrowleaf Cottonwood-Boxelder/Kentucky Bluegrass community type. Uplands are dominated by pinyon pine (*Pinus edulis*), oneseed juniper (*Juniperus monosperma*), and Gambel's oak (*Quercus gambelii*).

Discussion.- These riparian forests occupy the outermost edge of the floodplain along the toe of canyon side slopes, yet still within the flood zone. These sites are drier alluvial terraces far from the active channel. Many stands are dense, well-developed and self-sustaining. Some stands have sparse understories, which is usually caused by some disturbance, such as grazing.

Documentation.- This description is based on plots 95PD041, 95PD045, and 95PD069. It is apparently a newly described riparian forest community for New Mexico and the southwest that may require more data.

2. Arizona Walnut-Netleaf Hackberry/California Brickellbush
Juglans major-Celtis laevigata* var. *reticulata/Brickellia californica
JUGMAJ-CELLAER/BRICAL CT

Distribution.- The Arizona Walnut-Netleaf Hackberry/California Brickellbush riparian community is known from the main stem of the Gila river at Alum Hot Springs, at Canteen Canyon, and from Moonhull Canyon. It is expected to occur in similar environs of the San Francisco watershed.

Vegetation.- Co-dominating the community are Arizona walnut (*Juglans major*) and netleaf hackberry (*Celtis laevigata* var. *reticulata*) which typically form closed canopies (60-80% cover). The understory is frequently represented by a assortment of sapling-sized trees and shrubs, as well as a mixture of grasses and forbs. California brickellbush (*Brickellia californica*) is the dominant understory shrub. Other significant species include Emory's oak (*Quercus emoryi*), gray oak (*Q. grisea*), boxelder (*Acer negundo*), skunkbush sumac (*Rhus trilobata* var. *trilobata*), turpentine bush (*Ericameria laricifolia*), velvet ash (*Fraxinus velutina*), and Mexican white sagebrush (*Artemisia ludoviciana* ssp. *mexicana*). Common grasses include sideoats grama (*Bouteloua curtipendula*), bottlebrush squirreltail (*Elymus elymoides*), little barley (*Hordeum pusillum*), cheatgrass (*Bromus tectorum*), foxtail brome (*B. rubens*), and Japanese brome (*B. japonicus*). Common forbs include sweet four o'clock (*Mirabilis longiflora*), Dillen's oxalis (*Oxalis dillenii*), beardlip penstemon (*Penstemon barbatus*), Canadian horseweed (*Conyza canadensis*), camphorweed (*Heterotheca subaxillaris*), Wooton's sandpuffs (*Tripterocalyx carnea* var. *wootonii*), and sweetclover (*Melilotus officinalis*).

Environmental Setting.- The Arizona Walnut-Netleaf Hackberry/California Brickellbush community occurs at elevations ranging from 1329 to 1683 meters (4360 to 5520 ft.). It typically occurs towards the outer edge of the floodplain at the toe of the side slope, or on high and dry terraces. Flooding is extremely rare, occurring at 100 year intervals. Discharge ratios range from 6.45 to 28.8. Stream gradients are generally <.5%. Soils are represented by Typic Ustipsamments, Aridic Ustochrepts, and Typic Ustochrepts. They are either sandy or sandy skeletal soils that have low water availability a wetness ranking of 12 and 13.

Adjacent Vegetation.- These communities typically border cobbly alluvial terraces dominated by the Rubber Rabbitbrush/Sand Dropseed (*Chrysothamnus nauseosus/Sporobolus cryptandrus*) shrub community and/or the Fremont's cottonwood-Arizona Sycamore (*Populus fremontii-Platanus wrightii*). Bordering the river on lower bars may be the Arizona Alder/Rice Cutgrass (*Alnus oblongifolia/Leersia oryzoides*) riparian community, while in the channel on recently exposed bars Fremont's cottonwood (*P. fremontii*), Arizona walnut (*P. wrightii*), Arizona alder (*A. oblongifolia*), and seepwillow (*Baccharis salicifolia*) are rapidly reproducing.

Discussion.- This community is a common vegetation type that borders the outer floodplains of the Gila watershed. Undisturbed stands tend to be fairly diverse and well-developed in all layers. Sparse understories are usually a function of grazing and browsing that could eventually fragment the community with succession leading towards an upland community type.

Documentation.- This description is based on plots 95PD052, 95PD065, and 95PD072. It has previously been described by Muldavin (1987) for the confluence of Mogollon Creek and the Gila main stem and for Guadalupe Canyon of the lower Gila.

3. Arizona Walnut/New Mexico Olive
Juglans major/Forestiera pubescens* var. *pubescens
JUGMAJ/FORPUBP CT

Distribution.- The Arizona Walnut/New Mexico Olive riparian community type is known from the main stem of the San Francisco watershed near the Kelly Mountains and Harve Gulch. It is expected to occur in similar environs of the San Francisco watershed.

Vegetation.- Arizona walnut (*Juglans major*) forms a moderately open canopy (30 to 50% cover) over an understory dominated by the tall shrub, New Mexico olive (*Forestiera pubescens* var. *pubescens*) and a grassy understory significantly invaded by cheatgrass (*Bromus tectorum*). Other trees present include netleaf hackberry (*Celtis laevigata* var. *reticulata*), boxelder (*Acer negundo*), alligator juniper (*Juniperus deppeana*), desert willow (*Chilopsis linearis*), oneseed juniper (*J. monosperma*), and Texas mulberry (*Morus microphylla*), but no one species is a significant component to the overstory. Common shrubs include pale wolfberry (*Lycium pallidum*), skunkbush sumac (*Rhus trilobata* var. *trilobata*), California brickellbush (*Brickellia californica*), tree cholla (*Opuntia imbricata*), and honey mesquite (*Prosopis glutinosa*). Other grasses include little barley (*Hordeum pusillum*), foxtail brome (*B. rubens*), sand dropseed (*Sporobolus cryptandrus*), and blue wildrye (*Elymus glaucus*), while forbs are represented by sacred thornapple (*Datura wrightii*), Missouri gourd (*Cucurbita foetidisimma*), horehound mint (*Marrubium vulgare*), and Fendler's globemallow (*Sphaeralcea fendleri*).

Environmental Setting.- The Arizona Walnut/New Mexico Olive community occurs at elevations ranging from 1470 to 1637 meters (4820 to 5370 ft.). It typically occurs on high and dry terraces where channel meandering has cut down and into terrace. Flooding is rare occurring at 50 to 100 year intervals. Discharge ratios range from 16.1 to 17.7. Stream gradients are generally .5% or less. Soils are represented by Typic Ustifluvents or Fluventic Ustochrepts. They are coarse loamy soils that are somewhat alkaline (pH = 8) and have a wetness ranking of 12. Plant available water ranges from 6.1 to 8.2.

Adjacent Vegetation.- Narrow strands of the Coyote Willow/Common Spikerush (*Salix exigua/Eleocharis palustris*) riparian community border the active channel along low bars, while young stands of the Fremont's Cottonwood-Arizona Sycamore (*Populus fremontii-Platanus wrightii*) community type with a Velvet Ash (*Fraxinus velutina*) Phase occupies slightly higher bars. Uplands are dominated by oneseed juniper (*Juniperus monosperma*) and mesquite (*Prosopis glandulosa*).

Discussion.- These communities may exist as a function of grazing. The terraces are generally flat and cattle trails are common. Cattle likely use these flats to bed down in as well as to browse on the woody trees, such as netleaf hackberry after the cheatgrass has died back in the spring. According to Muldavin (1987), such browsing prevents the trees from making it into the canopy and hence, succession to another community type.

Documentation.- This description is based on plots 95PD022 and 95PD037. This is a newly described riparian forest community for New Mexico and the Southwest and more data is needed to confirm composition and distribution.

V. Fremont's Cottonwood (*Populus fremontii*) Series

This is a major series occurring in all three watersheds. Fremont's cottonwood dominated forests have been classified into eight community types. The major co-dominating tree is Goodding's willow with either a coyote willow (known from the San Francisco river at elevations ranging between 1378 to 1439 m.; 4520 to 4720 ft.) or a seepwillow dominated understory (known from the Gila River at 1220 to 1408 m.; 4000 to 4620 ft.). They generally occur in dense stands on low bars with discharge ratios ranging between .10 to 6.0 and within the 1- to 5-year floodplain. Soils are either Aquic Ustipsamments, Oxyaquic Ustifluvents, or unconsolidated and non-stratified riverwash. Some communities have recognizable phases, such as Arizona alder. Two other major co-dominating trees in this series are Arizona sycamore with a seepwillow understory and a velvet ash phase, alligator juniper with a cheatgrass dominated understory. Fremont's cottonwood-Arizona sycamore communities are known only from the Gila and San Francisco watersheds at elevations from 1183 to 1573 m (3880 to 5160 ft.). These native forests generally occur in moderately open to closed stands on terraces, or are somewhat distant from the active channel. Discharge ratios typically range from 4.32 to 9.30 and flooding generally occurs at 25 to 100 year intervals. Soils are Oxyaquic Torrifluvents, Typic Ustochrepts, Typic Ustifluvents, or unconsolidated and non-stratified riverwash. The Fremont's cottonwoods-Alligator juniper community is known from the Mimbres River where channel meandering has cut down and into the adjacent terrace leaving the stand high and dry. It occurs at approximately 1768 m (5800 ft.). Discharge ratio is 9.15 and the stream gradient is moderate. Flooding occurs at 50 year intervals and soils are represented by Typic Ustochrepts. A Fremont's cottonwood community with a sparse understory has also been classified. Known from the San Francisco River at 1524 to 1637 meters (5000 to 5370 ft.) on high terraces. Mature forests have dense canopies that effectively prevent the development of an understory, or these forests develop on low bars and are younger stands where the underlayers are consistently scoured by floods.

1. Fremont's Cottonwood-Alligator Juniper/Cheatgrass
Populus fremontii-Juniperus deppeana/Bromus tectorum
POPFRE-JUNDEP/BROTEC CT

Distribution.- The Fremont's Cottonwood-Alligator Juniper/Cheatgrass community is known from the main stem of the Mimbres River.

Vegetation.- Fremont's cottonwood (*Populus fremontii*) is the dominant overstory tree. Forming a moderately open canopy (40% cover). Alligator juniper (*Juniperus deppeana*), a significant sub-canopy tree with 25-33% cover co-dominates. Other trees present are sapling-sized representatives of boxelder (*Acer negundo*), Arizona walnut (*Juglans major*), netleaf hackberry (*Celtis laevigata* var. *reticulata*), pinyon pine (*Pinus edulis*), and Siberian elm (*Ulmus pumila*), an introduced species. While there are numerous herbaceous species present, none are as abundant as cheatgrass (*Bromus tectorum*), which is also introduced. Many are facultative upland species and the majority are introduced. Present are rescuegrass and Japanese (*B. catharticus* and *B. japonicus*), little barley (*Hordeum pusillum*), meadow fescue

(*Festuca pratensis*), Kentucky bluegrass (*Poa pratensis*), western wheatgrass (*Pascopyrum smithii*), meadow salsify (*Tragopogon pratensis*), sweetclover (*Melilotus officinalis*), common sunflower (*Helianthus annuus*), Canadian horseweed (*Conyza canadensis*), blue lettuce (*Lactuca tartarica* var. *pulchella*), and Missouri gourd (*Cucurbita foetidissima*).

Environmental Setting.- The community occurs at approximately 1768 meters (5800 ft.) elevation. It typically occurs on high terraces. Flooding occurs rarely at 50 year intervals. The discharge ratio equals 9.15 and the stream gradient is .61%. Soils are represented by Typic Ustochrepts. They have a wetness rank of 12, are coarse loamy over sandy skeletal, dry and calcareous soils. Plant available water is 8.86%.

Adjacent Vegetation.- Lower elevation terraces are dominated by the Narrowleaf Cottonwood-Boxelder/Kentucky Bluegrass (*Populus angustifolia-Acer negundo/Poa pratensis*) community type. Adjoining riparian shrub and herbaceous communities are absent. Uplands are dominated by pinyon pine/juniper (*Pinus edulis/Juniperus* spp.) woodlands or converted to pasture and farmland.

Discussion.- Channel meandering has cut down and into these terraces leaving the community high and dry. The community appears to be shifting towards a drought tolerant community such as Arizona Walnut-Netleaf Hackberry (*Juglans major-Celtis laevigata* var. *reticulata*) community type. This is reflected by the composition of species, the lack of reproduction by obligate riparian species, and dry soils.

Documentation.- This description is based on one sampled plot 95PD006. This community is ecologically similar to the cottonwood-juniper community documented by Durkin et al. (1995a) for the Rio Grande, except Fremont's cottonwood (*P. fremontii*) is replaced by Rio Grande cottonwood (*P. deltoides* ssp. *wislizenii*) and alligator juniper (*J. deppeana*) is replaced by oneseed juniper (*J. monosperma*) and the dominant grass, saltgrass (*Distichlis spicata*) is replaced by cheatgrass (*B. tectorum*).

2. Fremont's Cottonwood-Arizona Sycamore
Populus fremontii-Platanus wrightii
POPFRE-PLAWRI CT

This community type is fairly common in both the San Francisco and Gila watersheds. It typically occurs on cobble dominated alluvium, along perennial reaches and through narrow canyons. Fremont's cottonwood (*P. fremontii*) and Arizona sycamore (*P. wrightii*) co-dominate the overstory canopy. The understory may have a sparse shrub and herbaceous layer, or the understory may be well-developed. One phase is recognized, the Velvet Ash (*Fraxinus velutina*) phase, while a second community type Fremont's Cottonwood-Arizona Sycamore/Seepwillow (*P. fremontii-P. wrightii/Baccharis salicifolia*) has been formed into a trinomial to reflect the characteristic understory dominant.

Velvet Ash Phase
Fraxinus velutina
POPFRE-PLAWRI, FRAVEL PH

Distribution.- This phase is known from the main stem of the San Francisco River near Harve Gulch and Devil's Creek.

Vegetation.- The community is co-dominated by Fremont's cottonwood (*Populus fremontii*) and Arizona sycamore (*Platanus wrightii*). Velvet ash (*Fraxinus velutina*) is characteristically well-represented. Shrubs and herbs are scarce, but other trees may be present. These include boxelder (*Acer negundo*), Goodding's willow (*Salix gooddingii*), ponderosa pine (*Pinus ponderosa*), Emory's oak (*Quercus emoryi*), and oneseed juniper (*Juniperus monosperma*).

Environmental Setting.- The community occurs at elevations ranging from 1470 to 1573 meters (4820 to 5160 ft.). Flooding occurs nearly every year for stands occurring on low side bars where the discharge ratio is .46, and very rarely, at 100 year intervals for high terrace communities where the discharge ratio is 9.3. Stream gradients are .5% or less. Soils are represented by riverwash or fine loamy over sandy skeletal Typic Ustochrepts. Typic Ustochrepts have a wetness rank of 12, and are dry and calcareous soils. Plant available water is 7.08%. Soils classified as riverwash are unconsolidated and non-stratified sandy skeletal alluvium.

Adjacent Vegetation.- The Coyote Willow/Common Spikerush (*Salix exigua/Eleocharis palustris*) shrub-dominated community borders the channel on low side bars. Uplands are dominated pinyon pine/juniper and mesquite woodlands.

Discussion.- The velvet ash phase of the Fremont's cottonwood-Arizona Sycamore community type may eventually succeed to a drier boxelder-ash community (as yet unclassified) or set back to a more mesic site dominated by the Fremont's cottonwood-Goodding's willow community type. Seedling reproduction occurs only on the lowest bars comprised of mixed gravels and sand, and small cobbles.

Documentation.- This description is based on plots 95PD024 and 95PD032.

3. Fremont's Cottonwood-Arizona Sycamore/Seepwillow
Populus fremontii-Platanus wrightii/Baccharis salicifolia
POPFRE-PLAWRI/BACSAL CT

Distribution.- The Fremont's Cottonwood-Arizona Sycamore/Seepwillow riparian forest community is known from the main stem of the Gila River at Spar Canyon and from the Lower Box.

Vegetation.- Fremont's cottonwood (*Populus fremontii*) and Arizona sycamore (*Platanus wrightii*) are the co-dominant overstory trees forming a closed canopy (50 to 70% cover). They are commonly multi-boled (likely as a response from previous flood events) and have sprawling canopies. Significant sub-canopy trees include Arizona walnut (*Juglans major*), netleaf hackberry (*Celtis laevigata* var. *reticulata*), oneseed juniper (*Juniperus monosperma*), lanceleaf cottonwood (*P.* x *acuminata*), and honeylocust (*Gleditsia triacanthos*) - an introduced tree. The dominant understory shrub is seepwillow (*Baccharis salicifolia*). Other shrubs include the vine, canyon grape (*Vitis arizonica*), skunkbush sumac (*Rhus trilobata*), California buckthorn (*Frangula californica* ssp. *ursina*), Mexican white sagebrush (*Artemisia ludoviciana* ssp. *mexicana*), as well as sapling-sized walnut (*J. major*) and honeylocust (*G. triacanthos*). There may be numerous herbs in the understory, though none are dominant. Often present are cheatgrass (*Bromus tectorum*), foxtail brome (*B. rubens*), bottlebrush squirreltail (*Elymus elymoides*), spidergrass (*Aristida ternipes*), sweet four o'clock (*Mirabilis longiflora*), sacred thornapple (*Datura wrightii*), Canadian horseweed (*Conyza canadensis*), spanish-needles (*Bidens bipinnata*), and sweetclover (*Melilotus officinalis*).

Environmental Setting.- The Fremont's Cottonwood-Arizona Sycamore/Seepwillow community occurs at elevations ranging between 1183 to 1408 meters (3880 to 4620 ft.). Flooding occurs at 25 to 50 year intervals with discharge ratios ranging from 4.32 to 6.4. Stream gradients range from .1% to .38%. Soils are represented by Typic Ustifluvents, Typic Ustochrepts, and Oxyaquic Torrifluvents.

Adjacent Vegetation.- Young successional stands of the Fremont's cottonwood/Seepwillow (*P. fremontii/B. salicifolia*) riparian community border these older groves along lower bars closer to the active channel. Reproduction of obligate riparian species occurs on the lowest alluvial bars. Barren intermittent channels dissect the floodplain, however those that haven't been flooded for many years are typically dominated by the Desert Willow/Rubber Rabbitbrush (*Chilopsis linearis/Chrysothamnus nauseosus*) community. The high terraces are dominated by the Arizona Walnut-Netleaf Hackberry/California Brickellbush (*Juglans major-Celtis laevigata* var. *reticulata*) community.

Discussion.- Mature groves of this community occupy older river terraces elevated far enough above the present river bed to be effected by only the largest flood events. They lack reproduction of the major dominant trees. The presence of drought and shade tolerant walnut saplings in the understory coupled with a lack of flooding is an indication of a successional shift toward an Arizona walnut community type.

Documentation.- This description is based on plots 95PD008, 95PD067 and 95PD070. It has previously been described by Muldavin (1987) for the confluence of Mogollon Creek and the Gila main stem.

4. Fremont's Cottonwood-Goodding's Willow
Populus fremontii-Salix gooddingii
POPFRE-SALGOO CT

The Fremont's Cottonwood-Goodding's Willow (*Populus fremontii-Salix gooddingiii*) riparian community type described below is a major riparian plant association of the southwest. As such, it is also common to both the Gila and San Francisco watersheds. Two trinomials have been developed that further characterize the dominant understory component. Recognized are: (1) Fremont's Cottonwood-Goodding's Willow/ Coyote Willow (*Populus fremontii-Salix gooddingii/Salix exigua*) and (2) Fremont's Cottonwood-Goodding's Willow/Seepwillow (*P. fremontii-S. gooddingii/Baccharis salicifolia*).

Distribution.- The Fremont's Cottonwood-Goodding's Willow community is known from both the San Francisco and Gila Rivers.

Vegetation.- Fremont's cottonwood (*Populus fremontii*) and Goodding's willow (*Salix gooddingii*) form a closed canopy (80-90% cover) almost to the exclusion of other species, and cottonwoods are typically the dominant tree. Trees are mature, and may be anywhere from 50 to 100 years old. Other woody species are widely scattered and may include juniper (*Juniperus monosperma*), seepwillow (*Baccharis salicifolia*) or coyote willow (*S. exigua*), as well as the exotic tree, tree-of-heaven (*Ailanthus altissima*). Herbs include the bromegrasses (*Bromus tectorum, B. sterilis,* and *B. rubens*), wild barley (*Hordeum pusillum*), and bermudagrass (*Cynodon dactylon*), along with several forbs as annual ragweed (*Ambrosia artemisiifolia*), Canadian horseweed (*Conyza canadensis*), and horehound mint (*Marrubium vulgare*).

Environmental Setting.- The Fremont's Cottonwood-Goodding's Willow community occurs at elevations ranging between 1220 to 1524 meters (4000 to 5000 ft.). Flooding is rare occurring at 100 year intervals. Discharge ratios range from 7 to 11 with stream gradients that range from .35% to .70%. Soils are represented by sandy or coarse-loamy Typic Ustifluvents that have wetness ranks of 12, and sandy Oxyaquic Torripsamments with a wetness rank of 9.5. They are dry and nonacidic soils. Plant available water is approximately 5% for both soil types.

Adjacent Vegetation.- Adjacent riparian vegetation is commonly dominated by denser and younger stands with a coyote willow dominated understory. Uplands are dominated by either pinyon pine/juniper and mesquite woodlands or have been converted to farm or pasture.

Discussion.- The Fremont's Cottonwood-Goodding's Willow Community Type occurs on high terraces several meters above the channel. Many stands are quite large and non-fragmented, and characteristically have dense canopies. As a result, understory cohorts are few and the forest floor is dominated by a thick leaf layer. Flooding rarely occurs. Consequently, reproduction of the dominants occurs only on the lowest bars away from the mature forest. The oldest forests of this type unless reset by floods eventually thin out and become more park-like. They also tend to be used as a haven from the sun and heat by cattle. These are the native "gallery forests" or "cottonwood-willow bosques" common to many southwestern river systems that were previously widespread before the advent of stream regulation.

Documentation.- This description is based on plots 95PD027, 95PD028, and 95PD063. Similar plant associations are well documented in California (Holland and Roye 1988), in Arizona (Laurenzi et al. 1983, Reichenbacher 1984, Szaro 1989, and Stromberg et al. 1991), and in New Mexico (Hink and Ohmart 1984, Dick-Peddie et al. 1987, Szaro 1989, Dick-Peddie 1993, and Durkin et al. 1995a).

5. Fremont's Cottonwood-Goodding's Willow/Coyote Willow
Populus fremontii-Salix gooddingii/Salix exigua
POPFRE-SALGOO/SALEXI CT

Distribution.- The Fremont's Cottonwood-Goodding's Willow/Coyote Willow riparian community type is known from main stem of the San Francisco River near Shelton Canyon, Holt Gulch and Gorilla Springs.

Vegetation.- Fremont's cottonwood (*Populus fremontii*) and Goodding's willow (*Salix gooddingii*) combine to form a relatively dense canopy over a sub-canopy dominated by coyote willow (*Salix exigua*). Trees are numerous and of varying size classes. Diameters at base height (dbh) ranges typically between 10 to 15 cm. (4 to 6 in.). Other obligate riparian trees species are well-represented and typically include sapling-sized Arizona sycamore (*Platanus wrightii*), and Arizona alder (*Alnus oblongifolia*). Boxelder (*Acer negundo*) and velvet ash (*Fraxinus velutina*) are present. Herbaceous species are numerous and diverse, though no one species dominates. Collectively, the cover provided by the herbaceous understory ranges between 15% to 35%. Common graminoidal species include redtop (*Agrostis gigantea*), annual rabbitsfootgrass (*Polypogon monspeliensis*), barnyard grass (*Echinochloa crus-galli*), Kentucky bluegrass (*Poa pratensis*), switchgrass (*Panicum virgatum*), knotgrass (*Paspalum distichum*), Torrey's rush (*Juncus torreyi*), American bulrush (*Scirpus americanus*), and common spikerush (*Eleocharis palustris*). Forbs include sweetclover (*Melilotus officinalis*), curlytop knotweed (*Polygonum lapathifolium*), rough cocklebur (*Xanthium strumarium*), alkali buttercup (*Ranunculus cymbalaria*), wild mint (*Mentha arvensis*), smooth horsetail (*Equisetum laevigatum*), and willow dock (*Rumex salicifolius*).

Environmental Setting.- The Fremont's Cottonwood-Goodding's Willow/Coyote Willow community occurs at elevations ranging between 1378 to 1524 meters (4520 to 5000 ft.). Flooding occurs at 1 to 5 year intervals on the lowest and more mesic sites where discharge ratios range from .36 to 6. Stream gradients range from .02% to .06%. Soils are represented by sandy Aquic Ustipsamments and sandy skeletal Oxyaquic Ustifluvents with a wetness rank of 8. They are dry and nonacidic soils. Plant available water is 1.5%.

Adjacent Vegetation.- The Rubber Rabbitbrush/Sand Dropseed (*Chrysothamnus nauseosus/Sporobolus cryptandrus*) community type occurs between the backwater channels where these young forests dominate on open, cobbly and sandy sites. Uplands are dominated by either pinyon pine/juniper and mesquite woodlands or have been converted to farm or pasture.

Discussion.- These young successional riparian forests form dense thickets along low alluvial bars. This is a major community type bordering low bars or backwater channels of broad floodplains (100 to 300 meters wide), or borders the main river channel in narrow canyons. It is the major community type of the San Francisco watershed. It is occasionally represented on high terraces as mature gallery forests.

Documentation.- This description is based on plots 95PD015, 95PD017, 95PD020, 95PD025, and 95PD029. Similar plant associations are well documented in California (Holland and Roye 1988), in Arizona (Laurenzi et al. 1983, Reichenbacher 1984, Szaro 1989, and Stromberg et al. 1991), and in New Mexico (Hink and Ohmart 1984, Dick-Peddie et al. 1987, Szaro 1989, Dick-Peddie 1993, and Durkin et al. 1995a).

6. Fremont's Cottonwood-Goodding's Willow/Seepwillow
Populus fremontii-Salix gooddingii/Baccharis salicifolia
POPFRE-SALGOO/BACSAL CT

Distribution.- The Fremont's Cottonwood-Goodding's Willow/Seepwillow riparian community type is known from main stem of the Gila River at Spar Canyon, Moonhull Canyon, and Harris Canyon near Redrock.

Vegetation.- Fremont's cottonwood (*Populus fremontii*) and Goodding's willow (*Salix gooddingii*) combine to form a dense canopy over a shrubby sub-canopy dominated by seepwillow (*Baccharis salicifolia*). Other trees present are scattered, yet can include Arizona walnut (*Juglans major*), Arizona sycamore (*Platanus wrightii*), Arizona alder (*Alnus oblongifolia*), velvet ash (*Fraxinus velutina*) and saltcedar (*Tamarix chinensis*). Other shrub associates include skunkbush sumac (*Rhus trilobata*), flameleaf sumac (*R. copallinum*), and Mexican white sagebrush (*Artemisia ludoviciana* var. *mexicana*). The herbaceous understory is sparse rarely exceeding 5% cover. Present are little barley (*Hordeum pusillum*), spidergrass (*Aristida ternipes*), sweet four o'clock (*Mirabilis longiflora*), Nuttall's sunflower (*Helianthus nuttallii*), sacred thornapple (*Datura wrightii*), Canadian horseweed (*Conyza canadensis*), rough cocklebur (*Xanthium strumarium*), and common ragweed (*Ambrosia artemisiifolia*).

Environmental Setting.- The Fremont's Cottonwood-Goodding's Willow/Seepwillow community occurs at elevations ranging between 1220 to 1408 meters (4000 and 4620 ft.). Flooding occurs at 1 to 5 year intervals on the lowest and more mesic sites where discharge ratios range from .095 to 2.4. Stream gradients range from .24% to .38%. Soils are represented by sandy skeletal Oxyaquic Ustifluvents and riverwash. Oxyaquic Ustifluvents have a wetness rank of 8 and plant available water is between 3% and 4%. Soils classified as riverwash are unconsolidated and nonstratified. Their wetness rank is 2 and plant available water is .5%. Two stands occurring on terraces are flooded at 25 to 100 year intervals. The discharge ratio ranges from 2.32 to 7 and stream gradients range from .25 to .35%. Soils are coarse loamy Oxyaquic Torrifluvents and sandy Oxyaquic Torripsamments. They both have a wetness rank of 9, and plant available water is 7.35% and 5.33% respectively.

Adjacent Vegetation.- The Rubber Rabbitbrush/Sand Dropseed (*Chrysothamnus nauseosus/Sporobolus cryptandrus*) community type occurs on open, cobbly and sandy sites. High terraces are dominated by the Arizona Walnut-Boxelder/Skunkbush Sumac (*Juglans major-Acer negundo/Rhus trilobata*). Uplands are dominated by either pinyon pine/juniper and mesquite woodlands or have been converted to farm or pasture.

Discussion.- These mid-successional riparian forests occur on wide depositional floodplains interrupted or dissected only by channel or the upland sideslopes. Seedling reproduction occurs on the lowest bars by the active channel.

Documentation.- This description is based on plots 95PD060, 95PD064, 95PD066, and 95PD071. Similar plant associations are well documented in California (Holland and Roye 1988), in Arizona (Laurenzi et al. 1983, Reichenbacher 1984, Szaro 1989, and Stromberg et al. 1991), and in New Mexico (Hink and Ohmart 1984, Dick-Peddie et al. 1987, Szaro 1989, Dick-Peddie 1993, and Durkin et al. 1995a).

7. Fremont's Cottonwood/Seepwillow
Populus fremontii/Baccharis salicifolia
POPFRE/BACSAL CT

Distribution.- The Fremont's Cottonwood/Seepwillow riparian community is known from the main stem of the Gila watershed near Spar Canyon, and from the main stem of the San Francisco near Sundial Mountain and Devil's Creek.

Vegetation.- Fremont's cottonwood (*Populus fremontii*) is the dominant overstory tree and forms a dense canopy (up to 90% cover) almost to the exclusion of other trees. Where breaks in the canopy occur other trees, such as Goodding's willow (*Salix gooddingii*) and Arizona alder (*Alnus oblongifolia*) may be well-represented. Seepwillow (*Baccharis salicifolia*) is the dominant understory shrub providing 25 to 33% cover. Other understory associates include coyote willow (*Salix exigua*) and sapling-sized trees of Fremont's cottonwood (*P. fremontii*) together with Arizona sycamore (*Platanus wrightii*), Goodding's willow (*S. gooddingii*), velvet ash (*Fraxinus velutina*) and occasionally saltcedar (*Tamarix chinensis*). The herbaceous component is generally sparse and poorly represented (cover rarely exceeds 5%). Present may be bermudagrass (*Cynodon dactylon*), annual rabbitsfoot grass and beardless rabbitsfoot grass (*Polypogon monspeliensis* and *P. viridis*), toad rush (*Juncus bufonius*), sweetclover (*Melilotus officinalis*), curlytop knotweed (*Polygonum lapathifolium*), seep monkeyflower (*Mimulus guttatus*), annual sunflower (*Helianthus annuus*), common ragweed (*Ambrosia artemisiifolia*), Fremont's goosefoot (*Chenopodium fremontii*), and common mullein (*Verbascum thapsus*).

Environmental Setting.- The Fremont's Cottonwood/Seepwillow community occurs at elevations ranging between 1215 and 1573 meters (3986 to 5163 ft.). Flooding occurs at two year intervals. Discharge ratios range from 1.23 to 2.1. Stream gradients range from .02% to .38%. Soils are represented by Aquic Ustipsamments, Aeric Fluvaquents, and riverwash. Aquic Ustipsamments have a wetness rank of 1, are primarily sandy, nonacidic, and plant available water is approximately 5%. Aeric Fluvaquents have a wetness rank of 3, are sandy skeletal, calcareous, and plant available water is 1.5%. Soils classified as riverwash, have a wetness rank of 2, are unconsolidated and non-stratified, are typically sandy and cobbly, and plant available water is approximately .5%.

Adjacent Vegetation.- Mature groves of the Fremont's Cottonwood-Arizona Sycamore/Seepwillow (*Populus fremontii-Platanus wrightii/Baccharis salicifolia*) community occupy older river terraces. Reproduction of obligate riparian species occurs on the lowest alluvial bars. Barren intermittent channels dissect the floodplain, however those that haven't been flooded for many years are typically dominated by the Desert Willow/Rubber Rabbitbrush (*Chilopsis linearis/Chrysothamnus nauseosus*) community. The high terraces are dominated by the Arizona Walnut-Netleaf Hackberry/California Brickellbush (*Juglans major-Celtis laevigata* var. *reticulata*) community.

Discussion.- These young successional riparian forests form dense thickets along low alluvial bars. They are excellent stabilizers of sand bars. Continued deposition from moderate floods eventually builds up the sediments and flood debris creating the terraces that support the mature Fremont's Cottonwood-Arizona Sycamore/Seepwillow forest community.

Documentation.- This description is based on plots 95PD009, 95PD011 and 95PD034. It has previously been described by Muldavin (1987) for the confluence of Mogollon Creek and the Gila main stem.

8. Fremont's Cottonwood/Sparse
Populus fremontii/Sparse Ground Cover
POPFRE/SPARSE CT

Distribution.- The Fremont's Cottonwood/Sparse riparian community type is known from the main stem of the San Francisco River near O Block Canyon and Spurgeon Mesa.

Vegetation.- Fremont's cottonwood (*Populus fremontii*) is the dominant overstory tree forming a dense canopy (up to 90% cover) almost to the exclusion of other trees, shrubs, or to the development of an herbaceous understory. Herbs present are primarily introduced and include bermudagrass (*Cynodon dactylon*), Canadian horseweed (*Conyza canadensis*), common ragweed (*Ambrosia artemisiifolia*), mint horehound (*Marrubium vulgare*), sweetclover (*Melilotus officinalis*), and silverleaf nightshade (*Solanum elaeagnifolium*).

Environmental Setting.- The Fremont's Cottonwood/Sparse community occurs at elevations ranging between 1524 and 1637 meters (5000 to 5370 ft.). It occurs on both side bars and terraces. On low sites flooding occurs annually. The discharge ratio is .78 with a stream gradient of .22%. Soils are represented by sandy Aquic Ustipsamments. Aquic Ustipsamments have a wetness rank of 5 and plant available water is approximately 5%. On higher and drier terraces flooding occurs every 100 years. The discharge ratio is 7.12 and the stream gradient is .7%. Soils are represented by sandy Typic Ustifluvents. They have a wetness rank of 12 and plant available water is 5.33.

Adjacent Vegetation.- The Rubber Rabbitbrush/Sand Dropseed (*Chrysothamnus nauseosus/Sporobolus cryptandrus*) community type occurs on open, cobbly and sandy sites.

High terraces are dominated by the Arizona Walnut-Boxelder/Skunkbush Sumac (*Juglans major-Acer negundo/Rhus trilobata*). Uplands are dominated by either pinyon pine/juniper and mesquite woodlands or have been converted to farm or pasture.

Discussion.- Mature communities of this type occur on high terraces. The dense canopies effectively provide shade and prohibit the development of a shrubby or herbaceous understory They lack reproduction of any obligate riparian species, and may also be a grazing induced sere. Where these communities form on low side bars the sparse ground cover may be attributed to previous scouring floods that carried heavy bedloads.

Documentation.- This description is based on plot 95PD018 and 95PD038. An ecologically similar community type has previously been described by Durkin et al. (1995a) for the Rio Grande basin where Rio Grande cottonwood (*Populus deltoides* ssp. *wislizenii*) is replaced by Fremont's cottonwood (*P. fremontii*).

III. Southwest Arroyo Forested Wetlands

These warm temperate, native forests or woodlands are restricted to lower elevations of southwestern New Mexico. They occur in entrenched canyons or across broad floodplains along perennial, intermittent, or ephemeral stream corridors that have not been stabilized by storage reservoirs. Major species have floristic ties to the Sierra Madrean biogeographic province. In the study area, these forests are represented by communities from the Desert Willow (*Chilopsis linearis*) Series, found along sandy back channels, and from the Netleaf Hackberry (*Celtis laevigata* var. *reticulata*) Series, usually found along the fringes of the floodplain, or on high and dry terraces.

IV. Broad-Leaved Deciduous Series Group

Forests dominated by rounded crown deciduous species. Needle-leaved species such as junipers (*Juniperus* spp.) may be present, but do not dominate.

V. Desert Willow (*Chilopsis linearis*) Series

The Desert Willow Series is a fairly common component in the riparian floodplain occupying open areas and intermittent channels in a natural mosaic with other native forests. It is known from the Gila watershed. One community type has been classified where Rubber Rabbitbrush is a prominent understory shrub. The Desert Willow/Rubber Rabbitbrush community occurs at approximately 1427 meters (4680 ft.). It typically occurs in sandy back channels or low bars. Flooding occurs at 50 year intervals. The discharge ratio equals 11.4 and the stream gradient is 1.33%. Soils are unclassified, but are very similar to the riverwash classification, which characteristically have a sandy texture, are generally very cobbly, and are unconsolidated and non-stratified.

Desert Willow/Rubber Rabbitbrush
Chilopsis linearis/Chrysothamnus nauseosus
CHILIN/CHRNAU CT

Distribution.- The Desert Willow/Rubber Rabbitbrush riparian community type is known from Mogollon Creek of the Gila watershed. It was also observed on the main stem of the Gila River. It is expected to occur in similar settings of the San Francisco watershed.

Vegetation.- Desert willow (*Chilopsis linearis*), a small tree native to the southwest and commonly considered an arroyo riparian species is the characteristic overstory dominant. Other trees are absent. Rubber rabbitbrush (*Chrysothamnus nauseosus*) is the prominent understory shrub. Several other shrubs are common and include singlewhorl burrobush (*Hymenoclea monogyra*), burroweed (*Isocoma tenuisecta*), seepwillow (*Baccharis salicifolia*), honey mesquite (*Prosopis glandulosa*), apacheplume (*Fallugia paradoxa*), field sagewort (*Artemisia campestris*), and viscid acacia (*Acacia neovernicosa*). The herbaceous layer is sparse. Grasses present include spidergrass (*Aristida ternipes*) and cheatgrass (*Bromus tectorum*). Forbs are infrequent.

Environmental Setting.- The Desert Willow/Rubber Rabbitbrush community occurs at approximately 1427 meters (4680 ft.). It typically occurs in sandy back channels or low bars. Flooding occurs at 50 year intervals. The discharge ratio equals 11.4 and the stream gradient is 1.33%. Soils are unclassified, but are very similar to the riverwash classification, which characteristically have a sandy texture, are generally very cobbly, and are unconsolidated and unstratified.

Adjacent Vegetation.- The Fremont's Cottonwood-Arizona Sycamore/Seepwillow (*Populus fremontii-Platanus wrightii/Baccharis salicifolia*) riparian forest community borders the community on slightly higher terraces. Uplands are dominated by oneseed juniper (*Juniperus monosperma*) and mesquite (*Prosopis glandulosa*).

Discussion.- The Desert Willow/Rubber Rabbitbrush community occupies open areas and intermittent channels within the floodplain. Though undersampled it is a common component of broad alluvial floodplains occurring in a natural mosaic with other native forests.

Documentation.- This description is based on one sampled plot 95PD059. This is a newly described riparian forest community for New Mexico and the Southwest and more data is needed to confirm composition and distribution.

V. Netleaf Hackberry (*Celtis laevigata* var. *reticulata*) Series

The Netleaf Hackberry Series represents a minor component of the riparian floodplain. It is known from the San Francisco watershed on high and dry terraces or at the toe of upland sideslopes. One community type has been classified where California brickellbush is the dominant understory shrub. It occurs at approximately 1372 meters (4500 ft.) where the stream discharge ratio is 10.9 and the stream gradient is .02%. Flooding occurs at 50 year intervals. Soils are represented by fragmental Lithic Ustipsamments.

Netleaf Hackberry/California Brickellbush
Celtis laevigata* var. *reticulata/Brickellia californica
CELLAER/BRICAL CT

Distribution.- The Netleaf Hackberry/California Brickellbush riparian community is known from the main stem of the San Francisco River near Sundial Mountain.

Vegetation.- Netleaf Hackberry (*Celtis laevigata* var. *reticulata*) dominates a short (5 meters or 15 ft) overstory tree canopy. Extending into the canopy, but not co-dominating are velvet mesquite (*Prosopis velutina*) and oneseed juniper (*Juniperus monosperma*). Collectively, the total tree canopy is dense (80% cover). Shrubs remain well-represented while the herbaceous understory is scarce. California brickellbush (*Brickellia californica*) is the sub-canopy dominant. Cheatgrass (*Bromus tectorum*) along with bermudagrass (*Cynodon dactylon*) and Canada wildrye (*Elymus canadensis*) are the grasses present, while desert penstemon (*Penstemon pseudospectabilis*), common mullein (*Verbascum thapsus*) and whitestem blazingstar (*Mentzelia albicaulis*) represent the forbs.

Environmental Setting.- The Netleaf Hackberry/California Brickellbush community occurs at approximately 1372 meters (4500 ft.). Flooding occurs at 50 year intervals. The stream discharge ratio is 10.9 and the stream gradient is .02%. Depth to the water table is greater than the depth of the soil pit. Soils are represented by fragmental Lithic Ustipsamments. They have a wetness rank of 12. Plant available water is .51%.

Adjacent Vegetation.- Adjoining this community are the Rubber Rabbitbrush/Sand Dropseed (*Chrysothamnus nauseosus/Sporobolus cryptandrus*) and Fremont's Cottonwood-Goodding's Willow/Seepwillow (*Populus fremontii-Salix gooddingii/Baccharis salicifolia*) communities creating a mosaic landscape.

Discussion.- The Netleaf Hackberry/California Brickellbush community represents a minor plant association. It occurs on high terraces or at the toe of the upland sideslopes. It occurs on low gradient reaches and is flooded on very rare occasions.

Documentation.- This description is based on one sampled plot 95PD012. This is a newly described riparian forest community for New Mexico and the Southwest and more data is needed to confirm composition and distribution.

I. SCRUB/SHRUB CLASS - SHRUBLANDS

Scrub/shrub wetlands are widely scattered communities dominated by woody, multi-stemmed shrubs that are generally 0.5 m to 5 m (1.5 ft. to 15 ft.) in height, and typically form canopies with greater than 50% cover. Open canopied (10-50%) stands have generally received some degree of disturbance (i.e., flooding). Tolerant of flooding, scrub/shrub wetlands tend to dominate the lowest depositional side- and mid-channel bars forming dense thickets in narrow strands. These shrublands are usually the first to become established on cobbly substrates. Hence, they are extremely effective streambank stabilizers. Scrub/shrub wetlands generally lack the overall diversity of the forested wetlands due to frequent scouring of the underlayers; though communities out of the immediate floodplain, or located along mountain tributaries, are able to develop lush understories.

II. Cold Temperate Riparian/Wetlands

Shrublands primarily of climates with cold to very cold winters and generally cool to mildly warm summers.

III. Rocky Mountain Montane Scrub/Shrub Wetlands

These native, cold temperate shrublands are of mountainous regions. They occur at mid-elevations and are dominated by cold tolerant species associated with the Rocky Mountain biogeographic province. In the study area, these shrublands are represented by communities of the Bluestem Willow (*Salix irrorata*) Series. They are common along low gradient, higher order streams on alluvial side bars directly bordering the narrow floodplain of the stream.

IV. Broad-Leaved Deciduous Series Group

Shrublands dominated by rounded crown deciduous species. Needle-leaved species from the adjacent uplands, such as blue spruce (*Picea pungens*), ponderosa pine (*Pinus ponderosa*), and junipers (*Juniperus* spp.) may be present, but do not dominate.

V. Bluestem Willow (*Salix irrorata*) Series

Bluestem willow is the major series of high tributary perennial streams at 2250 to 2439 meters (7380 to 8000 ft.). Two community types have been classified. A bluestem willow dominated community with a beaked sedge understory occurs in the upper Mimbres, while common spikerush is prominent in the underlayer of bluestem willow communities from the upper San Francisco watershed. These are typically lush and diverse communities. Flooding occurs annually. Stream discharge ratios are very low, ranging between .089 and .34, and stream gradients are fairly high, from 1% to 1.4%. Soils are wet and classified as either loamy skeletal Typic Fluvaquents or unconsolidated and non-stratified riverwash.

Bluestem Willow/Beaked Sedge
Salix irrorata/Carex rostrata
SALIRR/CARROS CT

Distribution.- The Bluestem Willow/Beaked Sedge riparian community is known from McKnight Canyon of the Mimbres basin.

Vegetation.- Bluestem willow (*Salix irrorata*) forms a tall and dense shrub canopy. Mixed within the shrub canopy are saplings of boxelder (*Acer negundo*), narrowleaf cottonwood (*Populus angustifolia*) and Arizona walnut (*Juglans major*). Ponderosa pine (*Pinus ponderosa*) occurs accidentally. Total overstory cover is 50%. Other lower shrubs present include Wood's rose (*Rosa woodsii*), American black currant (*Ribes americanum*) and mountain mahogany (*Cercocarpus montanus*). The herbaceous understory is diverse with numerous species, though no one is more dominant than beaked sedge (*Carex rostrata*) which provides up to 33% cover. Collectively, the graminoids provide nearly 50% cover while the forbs provide 20%. Common herbaceous species include fowl mannagrass (*Glyceria striata*), Kentucky bluegrass (*Poa pratensis*), smallwing sedge (*C. microptera*), longstyle rush (*Juncus longistylis*) along with Richardson's geranium (*Geranium richardsonii*), common selfheal (*Prunella vulgaris*), seep monkeyflower (*Mimulus guttatus*), Arizona bog violet (*Viola nephrophylla* var. *arizonica*), smooth horsetail (*Equisetum laevigatum*), woodland strawberry (*Fragaria vesca* var. *americana*), cutleaf coneflower (*Rudbeckia laciniata*), white milkwort (*Polygala alba*) and Wooton's ragwort (*Senecio wootonii*).

Environmental Setting.- The Bluestem Willow/Beaked Sedge community occurs at approximately 2250 meters (7380 ft.). Flooding occurs annually. The stream discharge ratio is .089 and the stream gradient is 1%. Soils are represented by unconsolidated and non-stratified riverwash. They have a wetness rank of 2 and plant available water is .51%.

Adjacent Vegetation.- Adjacent upland sideslopes are dominated by pinyon pine/juniper woodlands.

Discussion.- The Bluestem Willow/Beaked Sedge riparian community forms dense thickets often bordering and overhanging the banks of both sides of the creek. As such they are extremely effective in stabilizing banks. Streamflows are perennial and banks are well-armored by boulders or cobble, if not by the riparian vegetation. This is in sharp contrast to banks further downstream that lack riparian vegetation or armoring, and are actively eroding. The percentage of non-native species is low, and while many of the herbaceous species found in this community are facultative wetland species, beaked sedge (*C. rostrata*) is an obligate wetland plant.

Documentation.- This description is based on one sampled plot 95PD002 It is ecologically similar to those described by Szaro (1989) for Arizona and New Mexico.

2. Bluestem Willow/Common Spikerush
Salix irrorata/Eleocharis palustris
SALIRR/ELEPAL CT

Distribution.- The Bluestem Willow/Common Spikerush riparian community is known from the main stem of the San Francisco River near Luna where it enters into New Mexico from Arizona.

Vegetation.- Bluestem willow (*Salix irrorata*) forms a tall, dense and nearly continuous shrub canopy. Mixed within the shrub canopy are saplings of boxelder (*Acer negundo*). Other shrubs include Wood's rose (*Rosa woodsii*), scarlet elderberry (*Sambucus racemosa*), and redosier dogwood (*Cornus sericea* ssp. *sericea*). Total overstory cover is 75%. Graminoids and forbs are equally abundant and collectively provide approximately 60% cover, although no other species are as abundant as common spikerush (*Eleocharis palustris*). Common graminoidal species include fowl mannagrass and American mannagrass (*Glyceria striata* and *G. grandis*), Baltic rush and Rocky Mountain rush (*Juncus balticus* and *J. saximontanus*), water sedge and owlfruit sedge (*Carex aquatilis* and *C. stipata*) along with creeping bentgrass (*Agrostis stolonifera*) and American sloughgrass (*Beckmannia syzigachne*). Forbs include white clover (*Trifolium repens*), cutleaf coneflower (*Rudbeckia laciniata*), common plantain (*Plantago major*), alkali buttercup (*Ranunculus cymbalaria*), field horsetail (*Equisetum arvense*), silverweed cinquefoil (*Argentina anserina*), seep monkeyflower (*Mimulus guttatus*), water hemlock (*Cicuta douglasii*), Rocky Mountian iris (*Iris misssouriensis*), spotted beebalm (*Monarda punctata*), as well as the vine American hops (*Humulus americanus*).

Environmental Setting.- The Bluestem Willow/Common Spikerush community occurs at approximately 2439 meters (8000 ft.). Flooding occurs annually. The stream discharge ratio is .34 and the stream gradient is 1.4%. Soils are represented by loamy skeletal Typic Fluvaquents. They are nonacid and alkaline, and have a wetness rank of 2. Plant available water is 4.52%.

Adjacent Vegetation.- Bordering the floodplain are ponderosa pine (*Pinus ponderosa*) forests.

Discussion.- Like the Bluestem Willow/Beaked Sedge riparian community this community also develops along perennial reaches and forms dense thickets that border and overhang the banks of both sides of the creek. As such they are extremely effective in stabilizing banks. It is a diverse community with species 52 present and facultative wetland species are abundant.

Documentation.- This description is based on one sampled plot 95PD036. It is ecologically similar to those described by Szaro (1989) for Arizona and New Mexico.

II. Warm Temperate Riparian/Wetlands

These shrublands are found in warm temperate climates with cold to mild winters, and cool to warm summers.

III. Southwest Lowland Scrub/Shrub Wetlands

These native, warm temperate shrublands are generally restricted to lower montane regions or low-lying valleys of the southwestern United States. Major components have floristic ties to the Sierra Madrean biogeographic province. They are tolerant of flooding and are among the first to become established along low gradient, lower order streams. In the study area, these shrublands are represented by communities of the Coyote Willow (*Salix exigua*) and Seepwillow (*Baccharis salicifolia*) Series. Coyote willow dominated communities generally become established on freshly deposited coarse-sandy alluvium, while seepwillow communities are more common along cobbly tributary basins.

IV. Broad-Leaved Deciduous Series Group

Shrublands dominated by rounded crown deciduous species. In the study area, needle-leaved or sclerophyllous species, such as the exotic saltcedar (*Tamarix chinensis*) are present, but generally do not dominate.

V. Coyote Willow (*Salix exigua*) Series

The Coyote Willow Series represents a minor component of the riparian floodplain in the study area. Known from the San Francisco watershed, it generally forms a tall and dense shrub canopy at altitudes of 1378 to 1470 meters (4520 to 4820 ft.). One community type has been classified where common spikerush is the understory dominant among other mesic forbs. Advanced reproductive stages of Fremont's cottonwood and Goodding's willow trees often occur in these communities. Flooding of the communities occurs annually. The stream discharge ratio ranges from .03 to .33 and stream gradients range from .08% to .53%. Soils are either ponded at the surface, or are represented by sandy skeletal Typic Fluvaquents.

1. Coyote Willow/Common Spikerush
Salix exigua/Eleocharis palustris
SALEXI/ELEPAL CT

Distribution.- The Coyote Willow/Common Spikerush is known from the main stem of the San Francisco River near Harve Gulch and Gorilla Springs.

Vegetation.- Coyote willow (*Salix exigua*) generally forms a tall and dense shrub canopy. Mixed within the shrub canopy are saplings of Fremont's cottonwood (*Populus fremontii*) and Goodding's willow (*Salix gooddingii*). Other shrubs may include seepwillow (*Baccharis salicifolia*). Total overstory cover is 45 to 50%. The herbaceous understory is typically well-developed. Common spikerush (*Eleocharis palustris*) is abundant and dominates the understory. Other herbaceous species include knotgrass (*Paspalum distichum*), American bulrush and softstem bulrush (*Scirpus americanus* and *S. tabernaemontani*), toad rush (*Juncus bufonius*), annual rabbitsfoot grass (*Polypogon monspeliensis*) and barnyardgrass (*Echinochloa crus-galli*) together with sweetclover (*Melilotus officinalis*), curlytop knotweed (*Polygonum lapathifolium*), watercress (*Rorippa nasturtium-aquaticum*), smooth horsetail

(*Equisetum laevigatum*), broadleaf cattail (*Typha latifolia*) and black medic (*Medicago lupulina*).

Environmental Setting.- The Coyote Willow/Common Spikerush community occurs at elevations ranging from 1378 to 1470 meters (4520 to 4820 ft.). Flooding occurs annually. The stream discharge ratio ranges from .03 to .33. Stream gradients range from .08% to .53%. Soils are either ponded at the surface, or are represented by sandy skeletal Typic Fluvaquents. These are calcareous and alkaline, and have a wetness rank of 2. Plant available water is 4.0%.

Adjacent Vegetation.- The Fremont's Cottonwood-Goodding's Willow/Seepwillow (*Populus fremontii-Salix gooddingii/Baccharis salicifolia*) develops on nearby side bars while Fremont's Cottonwood-Arizona Sycamore/Seepwillow (*P. fremontii-Platanus wrightii/B. salicifolia*) develops on high terraces. Upland sideslopes are dominated by acacia (*Acacia neovernicosa*) and suffrutescent shrubs.

Discussion.- These communities are found along the larger rivers with predominantly sandy floodplains. They develop along perennial reaches forming dense, but narrow thickets along the banks. They are an early successional community that with continued deposition eventually develop into a forest community.

Documentation.- This description is based on plots 95PD014 and 95PD023 It is also documented by Durkin et al. (1995a) for the Rio Grande.

V. Seepwillow (*Baccharis salicifolia*) Series

The Seepwillow series is a fairly common component of the riparian floodplain. One community has been classified from the San Francisco River where American bulrush dominates the underlayer. This community occurs at approximately 1372 meters (4500 ft.). Flooding occurs annually. The stream discharge ratio is .80 and the stream gradient is .02%. Soils are represented by sandy skeletal Typic Fluvaquents. These lush communities are found along the larger rivers with predominantly cobbly floodplains. They develop along perennial and intermittent stream reaches and form dense, but narrow thickets along the banks. One other community is co-dominated by sapling-sized Arizona sycamore trees in a long and narrow strand. Known from the Gila River, the community developed on a cobble bar with a sparse understory. The community occurs at approximately 1463 meters (4800 ft.). Flooding occurs annually. The stream discharge ratio is 1.2 and the stream gradient is .23%. Soils are unclassified, but are very similar to the riverwash classification, which are characteristically sandy and generally very cobbly. They are unconsolidated and non-stratified.

1. Seepwillow/American Bulrush
Baccharis salicifolia/Scirpus americanus
BACSAL/SCIAME CT

Distribution.- The Seepwillow/American Bulrush riparian community is known from the main stem of the San Francisco River near Sundial Mountain.

Vegetation.- Seepwillow (*Baccharis salicifolia*) generally forms a tall and dense shrub canopy. Mixed within the shrub canopy are older seedlings of Fremont's cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), Arizona alder (*Alnus oblongifolia*), boxelder (*Acer negundo*), saltcedar (*Tamarix chinensis*). Other shrubs may include Coyote willow (*S. exigua*). Total overstory cover is 35%. The herbaceous understory is luxuriant and American bulrush (*Scirpus americanus*) is the sub-canopy dominant. Total canopy cover is 90%. Other herbs are scattered throughout the sub-canopy. These include knotgrass (*Paspalum distichum*) and smallwing sedge (*Carex microptera*) along with curlytop knotweed (*Polygonum lapathifolium*), watercress (*Rorippa nasturtium-aquaticum*), Canada goldenrod (*Solidago canadensis*), sweetclover (*Melilotus officinalis*), cinquefoil (*Potentilla pulcherima*), curly dock (*Rumex crispus*) and occasional cattails (*Typha latifolia*).

Environmental Setting.- The Seepwillow/American Bulrush community occurs at approximately 1372 meters (4500 ft.). Flooding occurs annually. The stream discharge ratio is .80 and the stream gradient is .02%. Soils are represented by sandy skeletal Typic Fluvaquents. They are calcareous and alkaline, and have a wetness rank of 2. Plant available water is 3.32%.

Adjacent Vegetation.- Directly bordering the community on a slightly higher side bar is the Fremont's Cottonwood-Goodding's Willow (*Populus fremontii-Salix gooddingii*) community. The Netleaf Hackberry/California Brickellbush community type occupies the highest terraces at the toe of the upland sideslopes. Uplands are dominated juniper and mesquite.

Discussion.- These lush communities are found along the larger rivers with predominantly cobbly floodplains. They develop along perennial reaches forming dense, but narrow thickets along the banks. They are an early successional community that with continued deposition eventually develop into a forest community.

Documentation.- This description is based on one sampled plot 95PD010. This is a newly described riparian forest community for New Mexico and the Southwest and more data is needed to confirm composition and distribution.

2. Seepwillow/Arizona Sycamore
Baccharis salicifolia/Platanus wrightii
BACSAL/PLAWRI CT

Distribution.- The Seepwillow/Arizona Sycamore is known from the main stem of the Gila River near the confluence of Turkey Creek.

Vegetation.- Seepwillow (*Baccharis salicifolia*) and saplings of Arizona sycamore (*Platanus wrightii*) form a moderately closed, but narrow canopy. No other shrubs or trees are present and the herbaceous understory is scant. Total canopy cover of the overstory is 40%. Grasses are absent, yet forbs include rough cocklebur (*Xanthium strumarium*), sweetclover (*Melilotus officinalis*), Canadian horseweed (*Conyza canadensis*), and whitestem blazingstar (*Mentzelia albicaulis*).

Environmental Setting.- The Seepwillow/Arizona Sycamore community occurs at approximately 1463 meters (4800 ft.). Flooding occurs annually. The stream discharge ratio is 1.2 and the stream gradient is .23%. Soils are unclassified, but are very similar to the riverwash classification, which are characteristically sandy and generally very cobbly. They are unconsolidated and non-stratified.

Adjacent Vegetation.- Arizona Sycamore/California Brickellbush (*Platanus wrightii/Brickellia californica*) develops on adjacent terraces. The Rubber Rabbitbrush/Sand Dropseed community dominates nearby cobble bars. Uplands are dominated by juniper/oak woodlands.

Discussion.- The stand developed on a large cobble bar adjacent to, but up to 2 meters above the active channel. Sycamore saplings are widely scattered throughout the long stringer-like stand. It is an early successional community that in time will likely develop into a mature sycamore forest.

Documentation.- This description is based on one sampled plot 95PD062. As more data is accumulated and analyzed for a final classification these previously described types may require re-classification.

III. Southwest Arroyo Scrub/Shrub Wetlands

These native, warm temperate shrublands are restricted to low-lying valleys of broad floodplains. They are found along intermittent and ephemeral sandy washes, back channels, or on broad mid-elevation bars. Major species have floristic ties to the Sierra Madrean biogeographic province. In the study area, these shrublands are represented by communities from the Rubber Rabbitbrush (*Chrysothamnus nauseosus*) Series.

IV. Broad-Leaved Deciduous Series Group

Shrublands dominated by rounded crown deciduous species. In the study area, needle-leaved or sclerophyllous species, such as the exotic saltcedar (*Tamarix chinensis*) are present, but generally do not dominate.

V. Rubber Rabbitbrush (*Chrysothamnus nauseosus*) Series

The Rubber Rabbitbrush Series is a major component of the San Francisco and Gila floodplains. It dominates open areas on cobbly and sandy bars in a mosaic with other native forests. One community type has been classified where sand dropseed is the dominant grass. Stands may be very open or closed and canopies are generally low. The community occurs at elevations ranging from 1402 to 1734 meters (4600 to 5689 ft.). Flooding occurs at 5- to 25-year intervals. Stream discharge ratios range from 3.2 to 5.3 and stream gradients range from .25% to .61%. Soils are unclassified, but are very similar to the riverwash classification, which are characteristically sandy, generally very cobbly, unconsolidated and non-stratified.

1 Rubber Rabbitbrush/Sand Dropseed
Chrysothamnus nauseosus/Sporobolus cryptandrus
CHRNAU/SPOCRY CT

Distribution.- The Rubber Rabbitbrush/Sand Dropseed riparian community is known from the main stem of the San Francisco River near Holt Gulch and Devil's Creek, as well as from the main stem of the Gila River at Alum Hot Springs, and from the West Fork of the Gila watershed.

Vegetation.- Rubber rabbitbrush (*Chrysothamnus nauseosus*) forms a low, but variably open to closed canopy. Other shrubs are infrequent, but commonly include Mexican white sagebrush (*Artemisia ludoviciana* ssp. *neomexicana*) or tassleflower brickellbush (*Brickellia grandiflora*). Total canopy cover ranges from 30 to 60%. The herbaceous understory, though generally scarce of forbs is dominated by sand dropseed (*Sporobolus cryptandrus*). Other grasses include alkali sacaton (*S. airoides*) and the pervasive cheatgrass (*Bromus tectorum*).

Environmental Setting.- The Rubber Rabbitbrush/Sand Dropseed community occurs at elevations ranging from 1402 to 1734 meters (4600 to 5689 ft.). Flooding occurs at 5 to 25 year intervals. Stream discharge ratios range from 3.2 to 5.3 and stream gradients range from .25% to .61%. Soils are unclassified, but are very similar to the riverwash classification, which are characteristically sandy, generally very cobbly, and are unconsolidated and non-stratified.

Adjacent Vegetation.- Side bars are dominated by Arizona Alder/Rice Cutgrass (*Alnus oblongifolia/Leersia oryzoides*) and terraces may be dominated by Narrowleaf Cottonwood/Kentucky Bluegrass (*Populus angustifolia/Poa pratensis*). Upland sideslopes are dominated by juniper/oak and ponderosa pine woodlands.

Discussion.- This is a common and major plant association of broad, sandy/cobbly bars within the floodplain. Two of the stands were recently flooded as evidenced by flood debris scattered throughout the bar and into the shrub canopy.

Documentation.- This description is based on plots 95PD026, 95PD035, 95PD053, and 95PD055. This is a newly described riparian community for New Mexico and more data is needed to confirm composition and distribution, but it is similar to rabbitbrush communities described by Medina (1986) for the Fort Bayard watershed in New Mexico.

I. PERSISTENT-EMERGENT WETLANDS CLASS - HERBACEOUS WETLANDS

Herbaceous persistent-emergent riparian/wetlands are dominated by perennial obligate riparian graminoids and forbs with occasional obligate riparian shrub representatives, or regenerating trees present.

II. Cold Temperate Riparian/Wetlands

Dominated by perennial herbaceous species primarily of climates with cold to very cold winters and generally cool to mildly warm summers.

III. Rocky Mountain Montane Persistent-Emergent Wetlands

Herbaceous Rocky Mountain montane wetlands are generally not well-represented in the study area. Fully developed and diversified communities are uncommon. Where they do develop, canopies may be up to two meters (6 ft.) in height, but generally are from 0.5 m to 1 m (1.5 ft. to 3 ft.). They usually develop in long, very narrow strands bordering the lowest bars, or form wet, marshes that occur either: 1) at the confluence of major tributaries; 2) along upper elevation low gradient higher order stream reaches; or 3) develop adjacent to upland fed springs. In the study area, these wetlands are represented by the American Bulrush (*Scirpus americanus*), Common Spikerush (*Eleocharis palustris*), and Softstem Bulrush (*S. tabernaemontani*) Series.

IV. Persistent-Emergent Series Group

Dominated by obligate riparian/wetland species - graminoids or forbs - that normally have their roots annually, periodically, or continually submerged in water.

V. American Bulrush (*Scirpus americanus*) Series

The American Bulrush Series is a major series of upper elevation perennial streams occurring at 1424 to 2000 meters (4670 6560 ft.). Two community types have been classified where common spikerush and smooth horsetail co-dominate, known only from the San Francisco and Gila watersheds. These are typically lush communities with wet soils. Flooding of the communities occurs annually. Stream discharge ratios range from 0.11 to 1.0, while stream gradients range from .11% to 1%. Soils are either unconsolidated, non-stratified riverwash or sandy skeletal Typic Fluvaquents.

1 American Bulrush-Common Spikerush
Scirpus americanus-Eleocharis palustris
SCIAME-ELEPAL CT

Distribution.- The American Bulrush-Common Spikerush riparian/wetland community is known from the main stem of the San Francisco River, as well as from the Gila watershed along Beaver Creek and the East Fork.

Vegetation.- The community is dominated by hydric graminoids where American bulrush (*Scirpus americanus*) and common spikerush (*Eleocharis palustris*) co-dominate. Other graminoids are well-represented. Total cover is 90%. Other forbs may be scarce or abundant

Environmental Setting.- The American Bulrush-Common Spikerush community occurs at elevations ranging from 1573 to 1951 meters (5160 to 6400 ft.). Flooding occurs annually. The stream discharge ratio ranges from .63 to 1 and the stream gradient ranges from .25% to 1%. The water table is either at the surface or within 30 cm. (75 in.). Soils are unclassified, but are very similar to the riverwash classification, which are characteristically sandy and generally very cobbly. They are unconsolidated and non-stratified.

Adjacent Vegetation.- Adjacent riparian vegetation has either drastically been altered by cattle grazing and in poor condition or is bordered by narrowleaf cottonwood/willow communities or the Arizona Walnut-Boxelder/Skunkbush Sumac (*Juglans major-Acer negundo/Rhus trilobata*) community. Uplands are dominated by pinyon pine/juniper/oak woodlands.

Discussion.- The community occurs in narrow, linear strands along riverbanks or along the margins of abandoned channels. It is dominated by obligate riparian/wetland species tolerant of saturated soils. The community is generally lush and well-developed. It is early successional and commonly colonizes and stabilizes new bars together with seedlings of obligate riparian species.

Documentation.- This description is based on plots 95PD33, 95PD046, and 95PD049. It has previously been documented by Durkin et al. (1995a) from the Rio Grande.

2. American Bulrush/Smooth Horsetail
Scirpus americanus/Equisetum laevigatum
SCIAME/EQULAE CT

Distribution.- The American Bulrush/Smooth Horsetail is known from the main stem of the San Francisco River near Dillon Mountain, Higgins Mountain and Shelton Canyon.

Vegetation.- The community is dominated by hydric herbs where American bulrush (*Scirpus americanus*) and smooth horsetail (*Equisetum laevigatum*) co-dominate. Total canopy cover ranges from 40% to 80%. Other graminoidal species commonly include common spikerush (*Eleocharis palustris*), creeping bentgrass (*Agrostis stolonifera*), meadow fescue (*Festuca pratensis*), as well as Baltic rush, poverty rush and Rocky Mountain rush (*Juncus balticus, J. tenuis* and *J. saximontanus*). Forbs include white and red clover (*Trifolium repens* and *T. pratensis*), sweetclover (*Melilotus officinalis*), cutleaf waterparsnip (*Berula erecta*), water hemlock (*Cicuta douglasii*), cutleaf coneflower (*Ratibida columnifera*), curlytop knotweed (*Polygonum lapathifolium*), curly dock (*Rumex crispus*) along with occasional seedlings of Fremont's cottonwood (*Populus fremontii*), narrowleaf cottonwood (*P. angustifolia*), boxelder (*Acer negundo*), and Arizona alder (*Alnus oblongifolia*).

Environmental Setting.- The American Bulrush/Smooth Horsetail community occurs at elevations ranging from 1424 to 2000 meters (4670 to 6560 ft.). Flooding occurs annually. The stream discharge ratio ranges from .11 to .56 and the stream gradient ranges from .11% to .26%. The water table is either at the surface or within 75 cm. (187.5 in.). Soils are represented by sandy skeletal or coarse skeletal Typic Fluvaquents. They have a wetness rank of 2 and plant available water ranges from .77% to 4.35%.

Adjacent Vegetation.- The Arizona Walnut-Netleaf Hackberry/California Brickellbush (*Juglans major-Celtis laevigata* var. *reticulata*) community adjoins these communities on high terraces. Uplands are dominated by pine/juniper/oak woodlands.

Discussion.- The American Bulrush/Smooth Horsetail community forms lush, marsh-like stands adjacent to both sides of the creek. It is dominated by obligate riparian/wetland species tolerant of saturated soils. It is early successional and commonly colonizes and stabilizes new bars together with seedlings of obligate riparian species.

Documentation.- This description is based on plots 95PD019, 95PD039 and 95PD044. It has previously been documented by Durkin et al. (1994 and 1995a) for the Pecos and Rio Grande watersheds.

V. Common Spikerush (*Eleocharis palustris*) Series

The Common Spikerush Series is a minor component of the riparian floodplain. One community has been classified and is known only from an upper elevation creek in the Gila watershed at 1976 meters (6480 ft.). Co-dominated by yerba mansa, the community forms a dense mat with nearly 100% cover. Exotic species are abundant and canopy height is rarely greater than one decimeter. In its present condition, the community is likely grazing-induced. Flooding occurs at 2 year intervals. The stream discharge ratio is 2.7 and the stream gradient is 1.85%. The water table is within 45 cm. (112.5 in.) of the surface. Soils are represented by sandy skeletal Typic Fluvaquents. They are gleyed within 20 cm (8 in.) of the surface, have a wetness rank of 2 and plant available water is 1.26%.

1. Common Spikerush/Yerba Mansa
Eleocharis palustris/Anemopsis californica
ELEPAL/ANECAL CT

Distribution.- The Common Spikerush/Yerba Mansa riparian/wetland community is known from Taylor Creek of the Gila watershed.

Vegetation.- Common spikerush (*Eleocharis palustris*) and yerba mansa (*Anemopsis californica*) together provide a dense canopy with nearly 100% cover. Other herbaceous species present include alkali buttercup (*Ranunculus cymbalaria*), mountain blueeyed grass (*Sysyrinchium montanum*), common selfheal (*Prunella vulgaris*), white clover (*Trifolium repens*), black medic (*Medicago lupulina*), common dandelion (*Taraxacum officinale*), and common yarrow (*Achillea millefolium*). Widely scattered are New Mexico olive (*Forestiera pubescens*) and saplings of narrowleaf cottonwood (*Populus angustifolia*).

Environmental Setting.- The Common Spikerush/Yerba Mansa community occurs at approximately 1976 meters (6480 ft.). Flooding occurs at 2 year intervals. The stream discharge ratio is 2.7 and the stream gradient is 1.85%. The water table is within 45 cm. (112.5 in.). Soils are represented by sandy skeletal Typic Fluvaquents. They are gleyed within 20 cm (8 in.) of the surface, have a wetness rank of 2 and plant available water is 1.26%.

Adjacent Vegetation.- The Arizona Walnut-Netleaf Hackberry/California Brickellbush (*Juglans major-Celtis laevigata* var. *reticulata*) community adjoins these communities on high terraces. Uplands are dominated by pine/juniper/oak woodlands.

Discussion.- The Common Spikerush/Yerba Mansa community occurs infrequently in the watershed. It is disturbance induced created by heavy cattle grazing. Exotic species are abundant and canopy height is rarely greater than 1 decimeter.

Documentation.- This description is based on one sampled plot 95PD047. As more data is accumulated and analyzed for a final classification these previously described types may require re-classification.

V. Softstem Bulrush (*Scirpus tabernaemontani*) Series

The Softstem Bulrush Series is a minor component of the riparian floodplain. It is known only from two marshes in the San Francisco and Gila watersheds. One community type has been classified where broadleaf cattail is the co-dominant. Stands are nearly monotypic. Due to the continually saturated conditions, most other species are precluded from the community except along the very fringes. It occurs at elevations ranging from 1878 to 1984 meters (6160 to 6509 ft.). Flooding is permanent and stream gradients are 0%. Soils are saturated at the surface and were unclassified. They are estimated to be dark, mineral soils, fine-textured over a sandy skeletal layer.

1. Softstem Bulrush/Broadleaf Cattail
Scirpus tabernaemontani/Typha latifolia
SCITAB/TYPLAT CT

Distribution.- The Softstem Bulrush/Broadleaf Cattail riparian/wetland community is known from the Tularosa River of the San Francisco watershed and from the East Fork of the Gila watershed near Fall Springs.

Vegetation.- Softstem bulrush (*Scirpus tabernaemontani*) forms an almost pure stand. Broadleaf cattail (*Typha latifolia*) is a strong associate in the forb layer and the co-dominant. Due to the continually saturated conditions, most other species are precluded from the community except along the very fringes.

Environmental Setting.- The Softstem Bulrush/Broadleaf Cattail community occurs at elevations ranging from 1878 to 1984 meters (6160 to 6509 ft.). Flooding is permanent and stream gradients are 0. Soils are saturated at the surface and were unclassified. They are estimated to be dark, mineral soils, fine-textured over a sandy skeletal layer.

Adjacent Vegetation.- Other forbs and grasses occur where water levels have drawn down and border the drier upland. These include mountain blueeyed grass (*Sisyrinchium montanum*), cinquefoil (*Potentilla pulcherrima*), Canada horseweed (*Conyza canadensis*), rough cocklebur (*Xanthium strumarium*), alkali buttercup (*Ranunculus cymbalaria*), Nuttall's sunflower (*Helianthus nuttallii*) together with American bulrush (*Scirpus americanus*), creeping bentgrass (*Agrostis stolonifera*), meadow fescue (*Festuca pratensis*), and dryspike sedge (*Carex foena*). Uplands are dominated by pine/juniper/oak woodlands.

Discussion.- This wetland community type is densely vegetated and found bordering ponded sites up to three feet. It is nearly a monotypic stand occurring on very low gradient streams. It is early successional and dependent on prolonged periods of flooding for maintenance. As water recedes and the site dries out other forbs and grasses are able to take hold. They then become more desirable and accessible to grazing by cattle, which then causes soil compaction and long-term damage to the site.

Documentation.- This description is based on plots 95PD040 and 95PD048. It is closely related to plant associations documented in Colorado by Kittel et al. 1994 and in Montana by Hansen et al. (1990).

II. Warm Temperate Riparian/Wetlands

Dominated by perennial herbaceous species primarily of climates with cold to mild winters, and cool to warm summers.

III. Southwest Lowland Persistent-Emergent Wetlands

Though uncommon in the study area, these herbaceous wetlands occur at low elevations. Canopies are from 0.5 m to 1 m (1.5 ft. to 3 ft.). They develop in either long, very narrow strands bordering the lowest bars, or they may completely dominate mid-channel bars. In the study area, these herbaceous wetlands are represented by the Knotgrass (*Paspalum distichum*) Series.

IV. Persistent-Emergent Series Group

Dominated by obligate riparian/wetland species - graminoids or forbs - that normally have their roots annually, periodically, or continually submerged in water.

V. Knotgrass (*Paspalum distichum*) Series

The Knotgrass Series is an important component of the riparian floodplain, though fully developed communities remain minor. One community type co-dominated by common spikerush is known only from the "lower box" of the Gila river. It develops on the lowest side- and mid-channel bars that are flood annually and remain completely saturated. The stream discharge ratio is .09 and the stream gradient is very low (0.1%). The community is typically lush, diverse, and comprised of few exotic species.

Knotgrass-Common Spikerush
Paspalum distichum-Eleocharis palustris
PASDIS-ELEPAL CT

Distribution.- The Knotgrass-Common Spikerush riparian/wetland community is known from the main stem of the Gila River at the Lower Box.

Vegetation.- Knotgrass (*Paspalum distichum*) dominates this predominantly grassy community providing >75% cover. Co-dominating the community is common spikerush (*Eleocharis palustris*), while barnyardgrass (*Echinochloa crus-galli*), rice cutgrass (*Leersia oryzoides*), annual rabbitsfoot grass (*Polypogon monspeliensis*), softstem bulrush (*Scirpus tabernaemontani*), and chufa flatsedge (*Cyperus esculentus*) are common. Forbs include curlytop knotweed (*Polygonum lapathifolium*), American speedwell (*Veronica americana*), sweetclover (*Melilotus officinalis*), rough cocklebur (*Xanthium strumarium*), and field horsetail (*Equisetum arvense*). Collectively, total canopy cover is nearly 100%.

Environmental Setting.- The Knotgrass-Common Spikerush community occurs at approximately 1183 meters (3880 ft.). Flooding occurs annually. The stream discharge ratio is .09 and the stream gradient is .1%. Soils are saturated at the surface and unclassified.

Adjacent Vegetation.- Higher bars are dominated by Fremont's Cottonwood-Goodding's Willow/Coyote Willow (*Populus fremontii-Salix gooddingii/S. exigua*). High terraces are dominated by Fremont's Cottonwood-Arizona Sycamore (*P. fremontii-Platanus wrightii*). Uplands are dominated by mesquite grasslands.

Discussion.- The Knotgrass-Common Spikerush community occurs on the lowest side or mid-channel bars and effectively stabilizes banks and bars. Soils are saturated at the surface and the community is typically lush, diverse, and undisturbed. The percentage of non-native species is low.

Documentation.- This description is based on one sampled plot 95PD068. It is apparently a newly described riparian community for New Mexico.

Vegetation Community Landscape and Hydrological Relationships

The vegetation communities described for the Gila, San Francisco and Mimbres Rivers occur in characteristic positions across the riparian landscape. Major variables that relate directly to the spatial relationships are flooding, groundwater conditions, and various soil properties (particularly as they relate to soil moisture). The pattern and distribution of communities, and topographic gradients within this landscape are in turn shaped by flow volumes and channel dynamics. Because the flow regimes of these rivers are in a relatively natural state, (i.e., unrestricted by major impoundments or diversions), channel configurations are widely variable and the vegetation communities encountered are represented by a diverse mix or mosaic of many communities rather than a long continuum of a single type.

Several cross-sections of different stream types are presented which demonstrate the common patterns of vegetation communities associated with the particular stream type. On each cross-section, the topographic position of the major communities of a site are indicated, along with the flows that would be required to flood that location, in cubic feet/second (cfs), as well as the average return interval of flood events in years. For example, in Figure 9 the location of three community types are shown along a stream cross-section in a narrow canyon for an upper reach of the Gila River. The communities represent a diverse mix of forests and shrublands typical of Southwest Lowlands. Here, because the channel is somewhat confined by steep sideslopes, there is limited development of a depositional floodplain. Rather, the riverbed consists of a mix of cobbles and boulders and the riverbanks are well-armored with boulders or bedrock. Under these conditions, typically the Arizona Alder/Rice Cutgrass community occurs adjacent to the channel where flooding is a yearly event and soils are poorly developed (Figure 10).

This cross-section is also representative of the conditions where the Rubber Rabbitbrush/Sand Dropseed community commonly occurs (Figure 11). This dry, "arroyo" riparian type normally occurs in washes with ephemeral flash floods, but also occurs in perennial stream beds like this one in a somewhat higher landscape where flooding is less frequent (4,600 cfs on average every five years). Soils are also commonly very cobbly with low water holding capacities. When flooding does occur, it can be very forceful, bringing with it destructive debris. The relatively dry conditions along with the destructive nature of the floods, favors a community dominated by relatively drought tolerant shrubs, grasses and forbs.

At the edge of the floodplain against the toeslope of the adjacent hillside, a typical Arizona Walnut-Netleaf Hackberry/California Brickellbush mature forested riparian/wetland has developed. Flooding is now rare on sites like this (>100-year return intervals), and the trees are probably maintained by moisture from the hillslope or by tapping groundwater through the sandy soils.

A cross-section of the San Francisco River demonstrates a different array of community types typical of a stream confined and entrenched within a steep walled canyon (Figures 12 and 13). Although the canyon is similarly incised to the above, the vegetation patterns are somewhat different. The channel substrate has few boulders and is more sandy. The moist, sandy soils along the channel favor the development of the Seepwillow/American Bulrush community, rather than an alder dominated community of the upper Gila site. The force of repeated annual flooding slows the development of a tree canopy and favors the maintenance of a shrubland with a lush herbaceous understory of obligate riparian species dependent on the very moist soil conditions.

Behind the streamside community there is a narrow, elevated sandy and cobbly bar where flooding occurs less frequently (1200 cfs every 2 years) and soil properties indicate that moisture is, on average, located deeper within the soil profile. The absence of repeated annual flooding and the drier soils allows for the development of a young forest community dominated by Fremont's cottonwood with a shrubby rather than herbaceous understory dominated by seepwillow.

Similar to the Gila example, the outer floodplain community (Netleaf Hackberry/California Brickellbush CT) occupies the driest site and is flooded only rarely. This is the most mature forest community of the site, and in time the riparian canopy trees will either be replaced by facultative upland trees in the sub-canopy (particularly juniper), or the forest will be removed along with the other communities of the canyon by a large scouring flood. Such a flood is estimated to occur at approximately 50-year intervals; a frequency twice that of the previous Gila site. Thus, the narrow and entrenched type of canyon prevents the development of very old stands of vegetation.

In contrast, the broad floodplain on the lower Gila River presents a considerably different landscape. Here a wide floodplain is essentially neither confined nor entrenched, and has become dissected by numerous channels, creating a complex landscape of depositional bars of varying ages and sizes (Figure 14 and 15). The riverbed here is composed of finer sediments, primarily gravels, sands, and silts.

In this floodplain, a diverse mix of riparian forests and shrublands typical of Southwest Lowlands and Arroyos occupy the various bars and terraces at specific positions and heights. The youngest communities, such as the Fremont's Cottonwood-Goodding's Willow/Seepwillow community, occur on the lowest bars bordering the main channel or backwater channels. During the spring, the recession of annual floodwaters exposes moist bars bordering these channels. A flush of cottonwood, willow, and seepwillow seedlings along with scattered sycamore seedlings quickly dominate the newly exposed bars. On the highest sites, either on larger island bars or sidebars, the most mature communities, such as a Fremont's Cottonwood-Arizona Sycamore/Seepwillow forest develop. These sites are still within the 25-year floodplain, where the force of flows averaging 18,000 cfs, even in this wide valley, can readily remove large trees and destabilize the bars, leading to radical changes in the floodplain landscape.

An example of a stream cross-section of the Mimbres River reveals a different riparian landscape from the Gila or San Francisco examples (Figure 16). Instead, the Mimbres at this site is entrenched within a broad and well-developed floodplain. The prominent forest community occurring along this floodplain is the Narrowleaf Cottonwood-Boxelder/Kentucky Bluegrass CT (Figure 17). Soils here are generally deep and the water table is commonly within 100 cm of the surface. Such moist soils are conducive to maintaining a diverse understory and dense forest. Flooding events are generally infrequent (2200 cfs on average every 25 years).

Across the channel, the soils are coarser, and even though the site is lower in the floodplain and flooded more often, the site is effectively drier. The cobbly soils are once again associated with Arizona alder, but narrowleaf cottonwood is also present with a shrubby understory dominated by California brickellbush. Up out of the entrenched channel, at the outer edge of the floodplain, an Arizona Walnut-Boxelder/Skunkbush Sumac community forms a long, continuous stand along the back of an old terrace (Figure 18). These forest are generally out of the 100-year floodplain, and the trees are likely maintained by groundwater sources deep in the soil profile or from hillside drainage.

Examples of these four basic riparian landscape configurations are repeated several times throughout the study area. How a channel is confined or entrenched, in addition to its gradient, has a significant effect on the types of floodplain landforms that are developed (or not developed), and consequently the type of vegetation community that occurs there. Other factors, such as elevation as it affects temperature, direct amounts of precipitation, and geologic substrates can also be important, leading to variability within a given type of channel configuration.

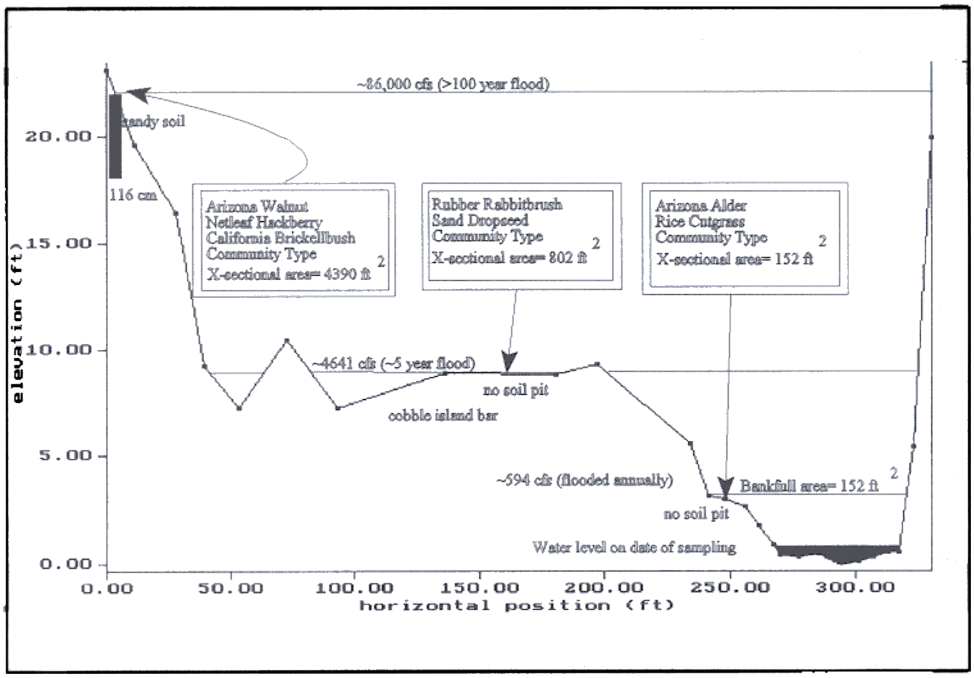

Figure 9. Cross-section of the Gila River in the Wilderness Area. The type of community depicted reflects the frequency of flood events. The community bordering the channel is flooded annually and dominated by obligate riparian species. Flows (cfs) are in cubic feet/second.

Figure 10. The Arizona Alder (*Alnus oblongifolia*)/Rice Cutgrass (*Leersia oryzoides*) Community Type of Southwest Lowland Forests. These dense, lush and structurally diverse forested wetlands are extremely effective streambank stabilizers. Photo: Mike Bradley

Figure 11. The Rubber Rabbitbrush (*Chrysothamnus nauseosus*)/Sand Dropseed (*Sporobolus cryptandrus*) Community Type of Southwest Arroyo Shrublands. The community commonly dominates cobble/sand bars such as this one. The stand of trees in the left background are Arizona Sycamores (*Platanus wrightii*). Photo: Mike Bradley

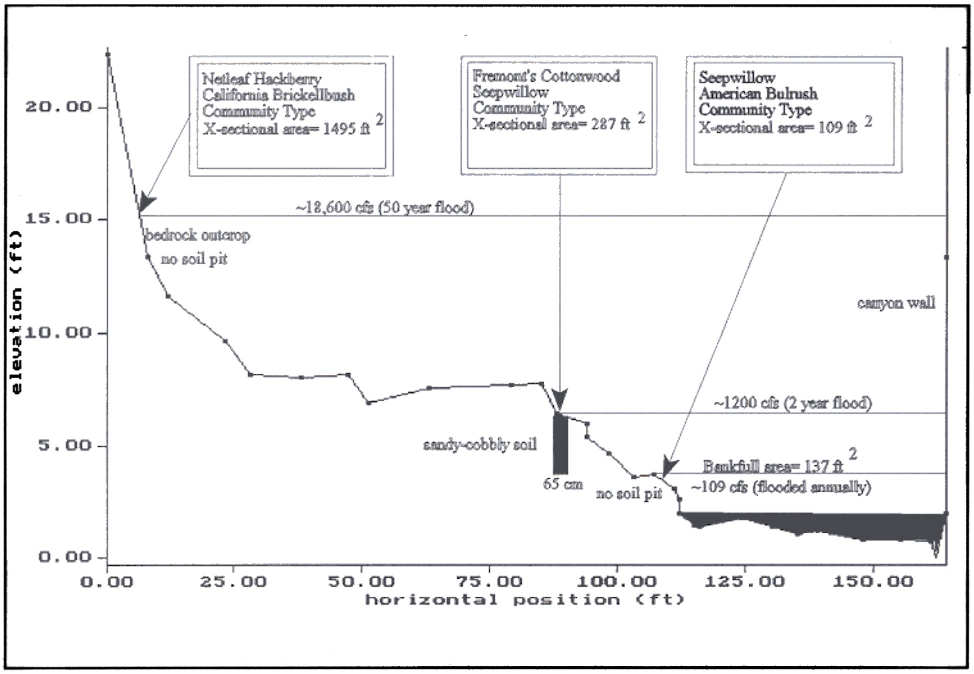

Figure 12. Cross-section of the San Francisco River below Pleasanton. The cross-section represents the position of the plant communities, flows, and average return intervals of flood events across the riparian landscape in relation to the channel which borders the canyon wall.

Figure 13. Southwest Lowland communities along the San Francisco River. The Seepwillow/American Bulrush is shown bordering the channel with a Fremont's Cottonwood/Seepwillow forest developing behind it. Photo: Mike Bradley

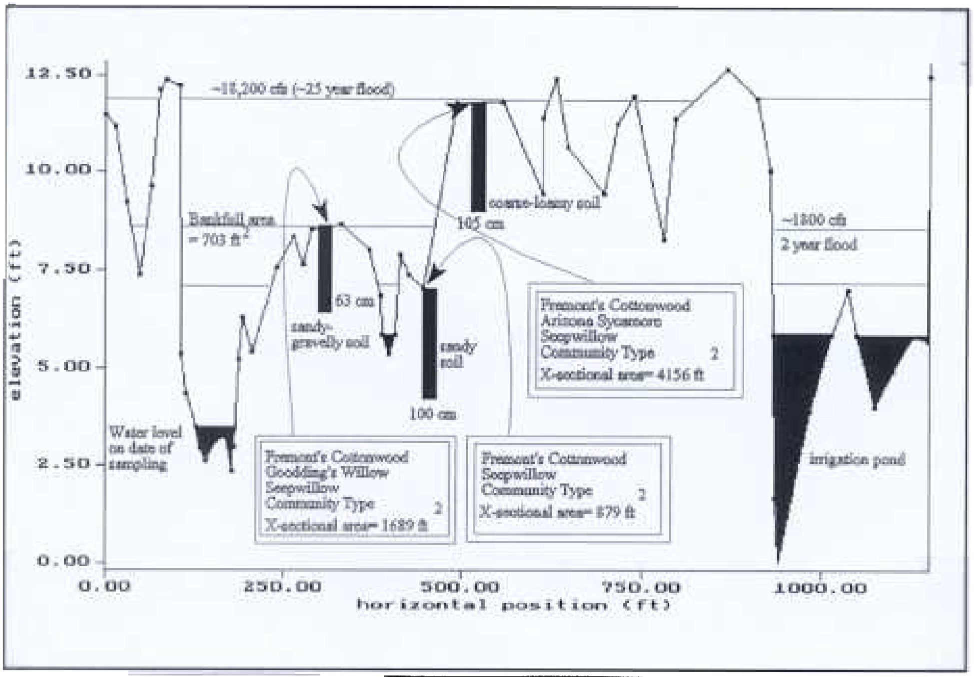

Figure 14. Cross-section of the Gila River just below the confluence of Mogollon Creek. Developing cottonwood forests are within the 2-year floodplain, while mature forests are infrequently flooded (18,200 cubic ft/second on average every 25 years).

Photo: Mike Bradley

Figure 15. View of the Gila River and floodplain. Note the structural diversity of the cottonwood forests and flush of reproduction along the low bars bordering the channel.

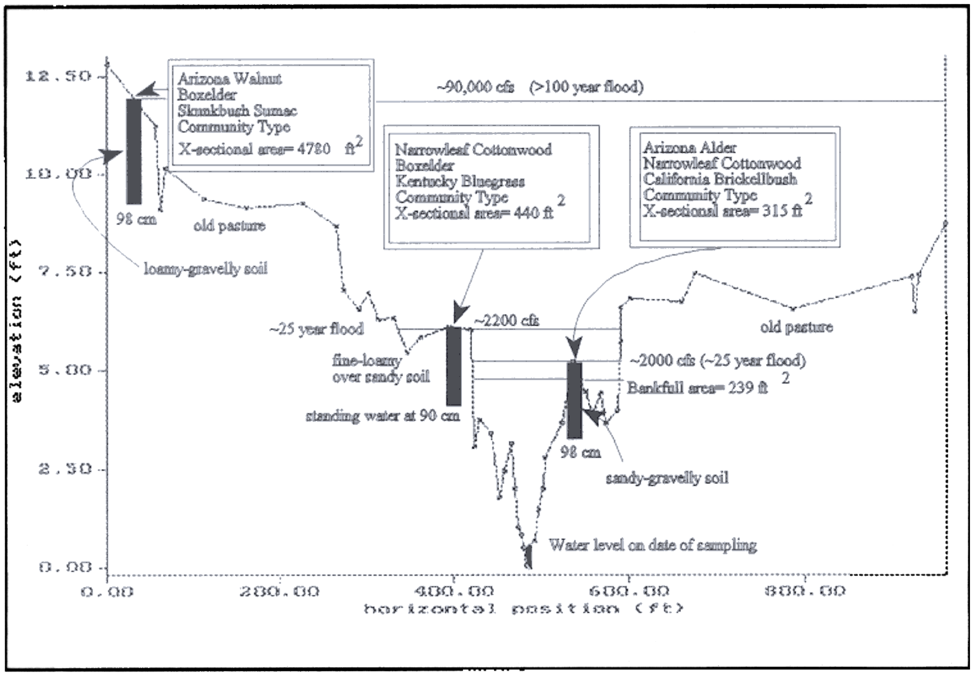

Figure 16. Cross-section of the Mimbres River near Bear Canyon Reservoir. The cross-section represents a downstream view of the channel and its well-developed floodplain bordered by forests wetlands of the Rocky Mountain Montane and Southwest Lowlands.

Photo: Mike Bradley

Figure 17. Portion of the Narrowleaf Cottonwood (*Populus angustifolia*)-Boxelder (*Acer negundo*)/Kentucky Bluegrass (*Poa pratensis*) Community Type along the banks of the Mimbres River.

Photo: Mike Bradley

Figure 18. The Arizona Walnut (*Juglans major*)-Boxelder (*A. negundo*)/Skunkbush Sumac (*Rhus trilobata* var. *trilobata*) Community Type located along the outer edge of the floodplain.

Riparian/Wetland Species

The riparian plant species surveyed are listed alphabetically by their most recent scientific, common and family names following Kartesz (1994). The list can be found in Appendix A. For each species, the wetlands indicator status, as described above and following Reed (1988), is also given, along with the species origin.

Two hundred and seventy-six species of vascular plants representing 192 genera and 73 families were surveyed within the floodplains of the Gila, San Francisco, and Mimbres watersheds. Seventeen per cent of the species belong to both the Asteraceae (composite) and Poaceae (grass) families. The Fabaceae (legumes) contained 5%, while the Cyperaceae (sedges) and the Rosaceae (rose) contained 4% of the species. All other families comprised less than 2% of the species present.

Wetland Species Indicator Status.— All of the plant species from the study area were evaluated for their wetland indicator status (see table 1 of Appendix A) and assigned to one of the following categories after Reed (1988): OBL, obligate riparian/wetland; FACW, facultative wetland; FAC, facultative; FACU, facultative upland; or UPL, upland. Half of the species (50%) found in the study area were not listed in Reed (1988). This coincides with Stromberg et al. (1996) who found that many of the riparian species which are commonly found on high terraces of floodplains in arid regions have been by default considered upland species in Reed (1988). Table 6 summarizes the wetland indicator status of all of the 276 species found in the riparian floodplain of the study area.

Table 6. Wetland indicator status/class of the woody and herbaceous species found in the Gila, San Francisco, and Mimbres floodplains. Acronyms are defined as OBL, obligate riparian/wetland; FACW, facultative wetland; FAC, facultative; FACU, facultative upland; or UPL, upland. Of the 276 plant species found in the study area, only 137 are listed in Reed (1988).

	OBL	FACW	FAC	FACU	UPL	TOTAL
Plant species from the study area listed in Reed (1988):						
Woody	3	13	4	10	0	
Herbaceous	28	35	25	18	1	
Total	31	48	29	28		
Percent of total	23	35	21	20	<1	
1996 evaluation of plant species in the study area:						
Woody	7	15	17	16	9	
Herbaceous	32	54	62	53		
Total	39	69	79	69	20	276
Percent of total	.4	25	29	25		

Based on our evaluation of the plant species in the study area (Table 6), 14% of the total number of woody and herbaceous species are obligate riparian species, 25% are facultative wetland species, 29% are facultative species, 25% are facultative upland species, and 7% are upland species.

Some disparities were found between Reed's (1988) classification of wetland species against our classification and knowledge of certain taxa. For instance, Goodding's willow (*Salix gooddingii*) of the Salicaceae has been classified in Reed (1988) as an obligate wetland species (OBL). This appears appropriate. However, the cottonwoods (*Populus* spp.) also of the Salicaceae and often co-occurring with Goodding's willow, have been classified as facultative wetland species (FACW). This appears to be an inappropriate classification, and should more appropriately be classified as obligate riparian/wetland species (OBL). For instance, both of these taxa, particularly Fremont's cottonwood (*P. fremontii*), have been well documented as requiring flooding for reproduction (Boles and Dick-Peddie 1983, Reichenbacher 1984, Brady et al. 1985, Fenner et al. 1985, Asplund and Gooch 1988, Siegel and Brock 1990, Howe and Knopf 1991, Brock 1994).

Introduced Species.— The origin of all of the plant species from the study area were evaluated (see Table 1 of Appendix A). Introduced species comprised 16% of the species found within the study area. Of these, the herbaceous species were significantly more prevalent than woody species. Ninety-one per cent of the total number of introduced species present are herbaceous compared to only 9% for the woody species.

A large majority or 34%, of the herbaceous exotics are from the grass family (Poaceae). Sixty-six per cent of the remaining herbaceous exotics belong to other families. For example, 12% are from the Asteraceae (composite), Brassicaceae (mustard), and Fabaceae (legume). The Chenopodiaceae (goosefoot), Lamiaceae (mint), and Polygonaceae (knotweed) contribute to 5% of the exotic herbaceous flora, while the Apiaceae (carrot), Caryophyllaceae (pink), Convolvulaceae (morning glory), Geraniaceae (geranium), and Scrophulariaceae (figwort) contribute 2%. The most common herbaceous exotics are the brome grasses, particularly cheatgrass (*Bromus tectorum*), which is often a common component in the understory of shrublands and forests on terraces. Other exotics are Eurasian in origin and include redtop (*Agrostis gigantea*), as well as bermudagrass (*Cynodon dactylon*), sweetclover (*Melilotus alba*), mint horehound (*Marrubium vulgare*), watercress (*Rorippa nasturtium-aquaticum*), Russian thistle (*Salsola kali*), mullein (*Verbascum thapsus*), the sowthistles (*Sonchus arvensis* and *S. asper*), docks or sorrels (*Rumex acetosella* and *R. crispus*), and the true clovers (primarily *Trifolium pratense* and *T. repens*). These species are usually found in moister sites, on bars, which have received a significant degree of disturbance.

Woody exotic species remain a relatively minor component of the riparian floodplain. Only four species are known from the study area. The most prevalent is saltcedar (*Tamarix chinensis*), particularly on the East Fork of the Gila, followed by Russian olive (*Elaeagnus angustifolia*), which is common on the Mimbres. Siberian elm (*Ulmus pumila*) and tree-of-heaven (*Ailanthus altissima*), are both widely scattered. One woody species, honey locust (*Gleditsia triacanthos*), while not exotic, but still a potential pest, is fast becoming established in the riparian floodplain of the Gila River, particularly through the Cliff/Gila valley.

Models of Riparian Ecosystem Dynamics

Although the rate of change in the floodplain ecology of the Gila, San Francisco and Mimbres Rivers has been accelerated by human settlement, these rivers, in their present condition remain relatively close to their natural state. Inherent to a healthy (i.e., functioning) riparian ecosystem are the sudden and often extreme natural physical changes caused by stream dynamics (Leonard et al. 1992). Intact fluvial processes of flooding, sediment deposition, lateral channel migration, and scouring effects on bars and terraces are a natural cyclic process of riparian ecosystem development to which most riparian species are adapted. For example, logs and other coarse debris is a natural component of southwestern rivers and enhances habitat and morphology of the stream by trapping sediments (Figure 19). On rivers with a significant amount of restrictions, such as the Rio Grande, there is a general absence of woody debris piles (Minkley and Rinne 1985). This cyclic process of building up sites and then removing them has been referred to as "site progression" by Leonard et al. (1992) and is thought to be a critical process in the maintenance, growth and reproduction of riparian/wetland plant communities (Muldavin et al. 1993, Durkin et al. 1994 and 1995). The communities encountered are also frequently influenced by other disturbance factors, such as fire, grazing or woodcutting (Figures 20 and 21).

Schematic, conceptual models of site progression dynamics portray stages of riparian landform development, and the successive changes in plant composition and dominance due to sediment accumulation, lateral cutting of the channel, or downcutting of the channel over time (Figures 22 and 23). The temporal influences of the models are drawn from data of the spatial relationships among plant communities in relation to soil type and flooding recurrence intervals. At any progression stage, beaver herbivory and other animal disturbances may accelerate or delay the progression of the site.

Based on the survey data gathered and the preliminary classification developed here, we have devised two preliminary conceptual models of different scenarios of site progression for the Gila, San Francisco and Mimbres watersheds. In each model we present the modal structure for a particular type of stream channel and geographic location. Model 1 represents what we perceive as site progression dynamics of common Southwestern riparian/wetland plant communities for the Gila and San Francisco watersheds (Figure 22), while Model 2 depicts the representative Rocky Mountain communities for all watersheds (Figure 23).

Southwestern riparian/wetland community development depicted in Figure 22 pertains to much of the Gila and San Francisco watersheds, and portions of the lower Mimbres River. Note that two community types presented in the model, Arizona Alder/Rice Cutgrass and Fremont's Cottonwood–Arizona Sycamore, are not expected to occur in the Mimbres basin due to structural differences between the different watersheds. In these southwestern systems, the general climatic environment is such that winters are mild and summers are hot and dry and the majority of precipitation occurs during winter storms as rainfall or during summer monsoonal storms. Vegetation communities are dominated by southwestern species with floristic affinities to the west in Arizona and California, and south into Mexico.

Photo: Mike Bradley

Figure 19. Large debris piles on the San Francisco River.

Photo: Mike Bradley

Figure 20. A fire recently swept through the Gila West Fork burning the Narrowleaf cottonwood (*Populus angustifolia*) forest. However, the forest is regenerating rapidly through asexual suckering.

Photo: Mike Bradley

Figure 21. The floodplain along the San Francisco River downstream of Reserve. The current river channel is to the right. Several disturbance factors have contributed to the degradation of the floodplain. Nearly all of the native riparian vegetation has been removed by over-utilization of livestock. The vegetation that remains is dominated by herbaceous exotics. The cottonwood forests that probably once bordered the river have also been removed presumably by extensive woodcutting and flood scour. The remaining forests are highly fragmented and border the upland sideslopes. The road which crosses the floodplain and river contributes to compaction of the soils. As a result, flood flows that travel through here flow unrestricted and have an increased potential of being destructive to the communities downstream.

The first stage in Model 1 is the development of unconsolidated bars formed from high sediment loads during runoff events (Figure 22). In the first few years, they either remain non-vegetated, or are dominated by annual herbs. If the floods coincide with seed set (a normal occurrence during spring runoff), the bars essentially become nurseries for obligate riparian tree species such as cottonwoods and willows (Brady et al. 1985, Siegel and Brock 1990, Stromberg et al. 1991). In more coarser drainages these bars are also excellent sites for Arizona sycamore and Arizona alder reproduction. With repeated flooding and deposition, at least at one- and two-year intervals, mid-channel and side bars become vegetated with perennial herbaceous communities like the Knotgrass–Common Spikerush Community Type in stage 2. In secondary, or abandoned channels, where flooding is less intense, the communities occurring there are periodically ponded early in the growing season. Shrubby seepwillows tend to dominate. As flooding continues, sediments collect in the vegetation, and the bars increase in height. Soils begin to develop from the riverwash as Typic Fluvaquents and perennial vegetation continues to become established. During this second stage cottonwoods and willows are still establishing.

In the third stage, ensuing floods may carry coarse woody debris, dissecting and scouring some bars as the debris lodges in the channel or accumulates on the bars. Sediments continue to accumulate and the bars are elevated further out of the active channel into the three- to 25-year floodplain and soils become deeper. As the soil surface becomes elevated further from the water table, aeration increases and soils become drier. Often they are represented by Oxyaquic Torrifluvents and are good sites for continued community development. Layers of vegetation stratify and species diversify. Frequently encountered are dense forests dominated by the Fremont's Cottonwood–Goodding's Willow Community Type. In narrow drainages, as on Pueblo Creek of the San Francisco watershed or Turkey Creek of the Gila watershed, soils may be still be unconsolidated and nonstratified and dense forests dominated by the Arizona Sycamore–Arizona Alder Community Type develop and dominate streamsides. At any point, floods may remove these forests back to a previous stage.

In the final stage, sediment accumulation slows down and bar building reaches its limit. Lateral migration or downcutting of the channel may occur, and seldomly flooded terraces result in even drier soils as in Typic Ustochrepts and Fluventic Haplustolls. Tree reproduction completely ceases and trees mature, eventually becoming senescent and dying, opening up the sub-canopy for facultative riparian shrubs, as in California brickellbush or skunkbush sumac, or for meadow grasses and forbs. A typical community type on high terraces, as in the Lower Box of the Gila, is the Fremont's Cottonwood–Arizona Sycamore CT, whereas the outermost fringe of the floodplain is often dominated by communities such as the Arizona Walnut–Boxelder/Skunkbush Sumac Community Type. This community occurs in both the Gila and San Francisco watersheds, along with the Mimbres basin.

PROGRESSION STAGE	LANDFORM	POTENTIAL PLANT COMMUNITY	MODAL SOIL TYPE	FLOOD RETURN INTERVAL
→ ↔	exposed river bar	non-vegetated/annual herbs, or reproduction of obligate riparian trees	Riverwash	annually
↑ ↓ ↔	abandoned channel	Seepwillow/American Bulrush	Typic Fluvaquent	annually
sediment accumulation				
↑ 2 ↔	stabilized river bar	Knotgrass–Common Spikerush, or	Riverwash [Typic Fluvaquent]	-2 years
↓ sediment accumulation				
↑ 3 ↔	aggregated river bar	Fremont's Cottonwood–Goodding's Willow, or Arizona Sycamore–Arizona Alder	Oxyaquic Torrifluvent Riverwash	3-25 years
↓ sediment accumulation lateral cutting/downcutting				
↑ ← 4 ↔	river terrace	Fremont's Cottonwood–Arizona Sycamore, or Arizona Walnut–Boxelder/Skunkbush Sumac	Typic Ustochrept Fluventic Haplustoll	$25\text{-}100^{+}$ years

Figure 22. Schematic representation (Model 1) of site progression dynamics of representative Southwestern riparian/wetland plant communities for the Gila and San Francisco watersheds, and portions of the lower Mimbres River. Soil types in brackets are potentially present, but unconfirmed.

The dynamics of site progression occurs similarly in Model 2 for Rocky Mountain communities (Figure 23). The communities, however, that develop at the different stages reflect the climate and hydrology of the region. In the higher elevations of the mountains, the climate is colder with frigid winters and cool summers. Communities, in general, tend to be dominated by bluestem willow and narrowleaf cottonwood and understories reflect the level of disturbance. Soils reflect the more equitable distribution of moisture through the year, and at the later progression stages are commonly Udifluvents (as opposed to the drier Ustifluvents of the lower elevations). Stream gradients on these mountain streams are usually steeper than the lowland rivers, and consequently they have coarser channel substrates leading to very gravelly and cobbly riparian soils. The floodplains are also narrower, resulting in limited floodplain or community development that corresponds to the one presented in the model. Under these conditions there is little or no site progression. Rather, the riparian zone is dominated by communities such as the Narrowleaf Cottonwood/Bluestem Willow CT. Aggregated bars in the three- to 25-year floodplain have more open canopies and are commonly co-dominated by boxelder, and where again meadow grasses, such as Kentucky bluegrass remain a common understory component. Older and higher river terraces are replaced by species of a more upland character as in Rocky Mountain juniper and grasses like sand dropseed.

These models are preliminary and based on limited sampling. But, they can provide the basis for future experimental design and testing of riparian dynamics and spatial patterns of the vegetation communities that exist at a site, or may potentially exist.

PROGRESSION STAGE	LANDFORM	POTENTIAL PLANT COMMUNITY	MODAL SOIL TYPE	FLOOD RETURN INTERVAL
→ ↔	exposed river bar	non-vegetated/annual herbs, or reproduction of obligate riparian trees	Riverwash	annually
↑ ↓ ↔ sediment accumulation	abandoned channel	Bluestem Willow/Beaked Sedge	Riverwash [Typic Fluvaquent]	annually
↑ 2 ↔ ↓ sediment accumulation	stabilized river bar	Narrowleaf Cottonwood/Bluestem Willow	Oxyaquic Ustifluvent	-2 years
↑ 3 ↔ ↓ sediment accumulation lateral cutting/downcutting	aggregated river bar	Narrowleaf Cottonwood–Boxelder/Kentucky Bluegrass	Typic Ustochrept	3-25 years
↑ ← 4 ↔	river terrace	Narrowleaf Cottonwood–Rocky Mtn. Juniper/ Sand Dropseed	Mollic Udifluvent	25-100^{+} years

Figure 23. Schematic representation (Model 2) of site progression dynamics of Rocky Mountain riparian/wetland plant communities of the Gila, San Francisco and Mimbres watersheds. The schematic is typical of smaller unregulated tributary basins of southern New Mexico. Soil types in brackets are potentially present, but unconfirmed.

Part II

Initial Riparian/Wetland Site Inventory

and

Quality Assessment

Gila, San Francisco and Mimbres Rivers

Photo: Mike Bradley

Aerial view of the riparian forest communities along the Gila River in the upper portion of the Cliff/Gila valley, not far from the Mogollon confluence. Note the multiple channels that helped form a mosaic of different aged stands, diversifying the floodplain.

In this part we report the results of our initial riparian/ wetland site inventory and evaluation of the Gila, San Francisco and Mimbres watersheds. We detail our protocols for site delineation and quality assessment, and then present full descriptions of sites chosen for ground inventory, sampling and evaluation (Appendix B), and an overview of riparian site quality by watershed and river reach.

Site Delineation

Initially, seventy-five potential riparian/wetland inventory and sampling sites (river segments) were delineated for initial site inventory and assessment using aerial photography, aerial and ground reconnaissance, and personal communications with knowledgeable individuals of the area (Table 7). Sites were delineated in the following manner. Within the Gila, San Francisco, and Mimbres watersheds, the primary rivers and streams were identified on the basis of significant riparian vegetation cover and significant stream flows. Then reaches of each river were then defined in terms of common stream morphology and geomorphology (such as a stretch of river that is confined within a canyon, or unconfined in a wide valley, etc.). A reach on occasion can refer to a small tributary to the main river or spring within a watershed. Within each reach, one or more stream segments were designated as sites on the basis of common plant communities and ecosystem quality (similar impacts or utilization). For example, a stream segment of a reach that was isolated from grazing or agriculture, compared to another segment would be considered a separate site. In some cases, a reach was not segmented, and therefore the reach and segment refer to the same stretch of river. The locations of sites are indicated by site number on the maps of figures 24-28. The site number on the maps corresponds to the site number in Table 7.

Community and Site Assessment Ranking Protocol

Each site was assessed for ecosystem quality and ranked following specific protocols. First, a community rank for individual stands of vegetation within site is determined. This Community Ranking System emphasizes current ecosystem condition based primarily on biological characteristics (species composition and reproduction capacity). Then an overall site ranking system is applied which looks at the stream segment as a whole and emphasizes landscape conditions and restorability of the riparian/wetland ecosystem along the segment.

Both systems are applied and an "average" rank for site determined, weighted for long term viability. For example, a site may support numerous stands of vegetation that are currently of high quality, but if the hydrological characteristics of the reach have been altered significantly since the establishment of those stands, then long term viability is questionable, and the overall rank would be lower than that based on vegetation alone. Even though the definitions for site quality ranks are somewhat well defined, the process of assessing riparian systems still remains largely a qualitative one. Overall assessment of some impacts like grazing (both upland and lowland), water diversions, roads, and their cumulative effects on riparian vegetation expression and health, can be difficult and require good background knowledge and experience.

Table 7. Locations of sites identified for the Gila, San Francisco and Mimbres watersheds, ordered by site number corresponding to maps in figures 24-28. Locations of sites are given by county, quadrangle, and UTMs (Northing and Easting).

Site number	Watershed	River	Reach	Site Name (segment)	County	Quad. map name	UTMs	
110	Mimbres Watershed	Gallinas Canyon	Gallinas Canyon	Gallinas Canyon	GRANT	MAVERICK MOUNTAIN	3636600	231740
111		Mimbres	Middle Mimbres	Mimbres	GRANT	SAN LORENZO	3637630	222890
112		Mimbres	Middle Mimbres	San Lorenzo	GRANT	SAN LORENZO	3637000	233700
113		Faywood Cienega	Faywood Cienega	Faywood Cienega	LUNA	TAYLOR MOUNTAIN	3606300	219400
114		Mimbres	Lower Mimbres	Taylor Mountain	LUNA	TAYLOR MOUNTAIN	3611000	228900
115		Mimbres	Upper Mimbres	Bloodgood Place	GRANT	HAY MESA	3660500	222440
116		Mimbres	Middle Mimbres	Bear Canyon Reservoir	GRANT	HENDRICKS PEAK	3643050	220120
117		Mimbres	Middle Mimbres	Allie Canyon	GRANT	ALLIE CANYON	3645300	780310
118		Skate Canyon	Skate Canyon	Skate Canyon	GRANT	ALLIE CANYON	3653200	769500
119		Cameron Creek	Cameron Creek	Cameron Creek	GRANT	FORT BAYARD	3639000	765900
120		Twin Sisters	Twin Sisters	Twin Sisters	GRANT	FORT BAYARD	3638900	764800
121		McKnight Canyon	McKnight Canyon	Kelly Mesa	GRANT	HAY MESA	3657830	226120
122		Mimbres	Middle Mimbres	Cottonwood Canyon	GRANT	ALLIE CANYON	3648000	779420
123	San Francisco Watershed	San Francisco	Luna Lake	Luna Lake	CATRON	LUNA	3744800	682100
124		San Francisco	Luna	Luna	CATRON	LUNA	3743600	691250
125		San Francisco	Dillon Mt.	Frisco Hot Spring	CATRON	DILLON MOUNTAIN	3745650	703240
126		Centerfire Bog	Centerfire Bog	Centerfire Bog	CATRON	CENTERFIRE BOG	3754100	700300

Table 7. (continued)

Site number	Watershed	River	Reach	Site Name (segment)	County	Quad. map name	UTMs	
127	San Francisco Watershed	San Francisco	Higgins Mt	Hudson Spring	CATRON	RESERVE	3736210	706940
128		San Francisco	Reserve	Pollies Spring	CATRON	RESERVE	3732900	707400
129		San Francisco	Reserve	S.F. Plaza	CATRON	RESERVE	3731000	707800
130		Tularosa	Tularosa River	Lower Tularosa	CATRON	RESERVE	3728400	707000
131		Negrito Creek	Negrito Creek	Negrito Creek	CATRON	MILLIGAN MOUNTAIN	3728400	710800
133		Apache Creek	Apache Creek	Kerr Canyon	CATRON	QUEEN'S HEAD	3753290	718660
134		Tularosa	Tularosa River	Tularosa Wetland	CATRON	SQUIRREL SPRINGS CANYON	3745990	720110
136		Cienega Canyon	Cienega Canyon	Cienega Canyon	CATRON	DILLON MOUNTAIN	3736200	706100
137		Starkweather Spring	Starkweather Spring	Starkweather Spring	CATRON	RESERVE	3734400	703150
139		Tularosa	Tularosa River	Jon S Mountain	CATRON	CRUZVILLE	3737200	714450
140		San Francisco	Kelly Mountain	Kelly Ranch	CATRON	O BLOCK CANYON	3713110	697960
141		Saliz Canyon	Saliz Canyon	Serna Ranch	CATRON	SALIZ PASS	3714900	696700
142		Saliz Canyon	Saliz Canyon	Gordon Canyon	CATRON	SALIZ PASS	3619960	696070
143		Pueblo Creek	Pueblo Creek	Pueblo Creek	CATRON	SALIZ PASS	3709210	690850
144		San Francisco	Kelly Mountain	Frying Pan Canyon	CATRON	SALIZ PASS	3709000	696700
145		San Francisco	Kelly Mountain	Devils Creek	CATRON	ALMA	3706810	695660
146		San Francisco	Alma	Spurgeon Mesa	CATRON	ALMA	3702060	692410
147		San Francisco	Alma	Racetrack Mesa	CATRON	ALMA	3695000	694800

Table 7. (continued)

Site number	Watershed	River	Reach	Site Name (segment)	County	Quad. map name	UTMs	
148	San Francisco Watershed	San Francisco	North Glenwood Canyon	Harve Gulch	CATRON	GLENWOOD	3692840	693900
149		San Francisco	North Glenwood Canyon	Sandy Wash	CATRON	GLENWOOD	3688740	696570
150		San Francisco	Glenwood	Old Oxbow	CATRON	GLENWOOD	3686310	696320
151		San Francisco	Glenwood	Holt Gulch	CATRON	GLENWOOD	3683960	697660
152		Whitewater Creek	Whitewater Creek	Lower Whitewater Creek	CATRON	HOLT MOUNTAIN	3692000	699900
153		Whitewater Creek	Whitewater Creek	The Catwalk	CATRON	HOLT MOUNTAIN	3694900	701200
155		San Francisco	Wilson Mountain	Sundial Mountain	CATRON	WILSON MOUNTAIN	3677340	696180
156		Mule Creek	Mule Creek	San Francisco Confluence	GRANT	WILSON MOUNTAIN	3675750	688800
157		Dryblue Creek	Dryblue Creek	Dryblue Creek	CATRON	MANESS PEAK	3735000	682700
158		Deep Creek	Deep Creek	Deep Creek	CATRON	MOGOLLON	3704200	705400
159	Gila Watershed	Apache Creek	Apache Creek	Apache Box	CATRON	CROOKSON PEAK	3645600	687360
160	San Francisco Watershed	Mule Creek	Mule Creek	Mule Spring	GRANT	MULE CREEK	3664350	688400
161	Gila Watershed	Duck Creek	Duck Creek	Buckhorn Marsh	GRANT	BUCKHORN	3656400	715800
163		West Fork Gila	Upper West Fork	EE Canyon	CATRON	LITTLE TURKEY PARK	3681330	752590
164		West Fork Gila	Gila Hot Springs	Cliff Dwellings	CATRON	LITTLE TURKEY PARK	3679740	755460
165		Middle Fork Gila	Middle Fork	North Mesa	CATRON	GILA HOT SPRINGS	3681310	757950
166		East Fork Gila	East Fork	CCC Canyon	CATRON	GILA HOT SPRINGS	3691000	769400
167		Gila	Upper Mainstem	Alum Mountain	CATRON	GILA HOT SPRINGS	3672420	760460

Table 7. (continued)

Site number	Watershed	River	Reach	Site Name (segment)	County	Quad. map name	UTMs	
168	Gila Watershed	Beaver Creek	Beaver Creek	Kemp Mesa	CATRON	WALL LAKE	3695570	767980
169		Taylor Creek	Taylor Creek	Whitewater Canyon	CATRON	WALL LAKE	3695020	773810
171		East Fork Gila	Fall Spring	Fall Spring	CATRON	BURNT CORRAL CANYON	3687290	767300
172		Diamond Creek	Diamond Creek	Northstar Canyon	CATRON	WALL LAKE	3685000	770500
173		Black Canyon	Black Canyon	Middle Mesa	CATRON	MIDDLE MESA	3675500	776680
174		Turkey Creek	Turkey Creek	Hidden Pasture	GRANT	CANYON HILL	3664200	734800
175		Gila	Upper Mainstem	Cave Canyon	GRANT	CANYON HILL	3662810	735440
176		Gila	Upper Mainstem	Hooker Dam Site	GRANT	CANTEEN CANYON	3660000	729600
177		Mogollon Creek	Mogollon Creek	Gila Confluence	GRANT	CANTEEN CANYON	3658930	730070
178		Gila	Cliff/Gila Valley	Upper Valley	GRANT	CANTEEN CANYON	3662810	735440
180		Gila	Cliff/Gila Valley	Middle Valley	GRANT	CLIFF	3651000	726300
183		Gila	Cliff/Gila Valley	Lower Valley	GRANT	MANGAS SPRINGS	3634560	723900
184		Mangas Creek	Mangas Springs	Mangas Springs	GRANT	MANGAS SPRINGS	3636100	732900
185		Gila	Gila Middle Box	Gila Middle Box	GRANT	MANGAS SPRINGS	3629100	723500
187		Gila	Redrock	Swan Canyon	GRANT	REDROCK	3621950	715220
188		Gila	Redrock	Harris Canyon	GRANT	NICHOLS CANYON	3618000	710180
189		Gila	Redrock	Blue Creek	GRANT	NICHOLS CANYON	3615000	704100
190		Gila	Gila Lower Box	Gila Lower Box	HIDALGO	NICHOLS CANYON	3612340	701200

Table 7. (continued)

Site number	Watershed	River	Reach	Site Name (segment)	County	Quad. map name	UTMs	
192	Gila Watershed	Gila	Virden	Virden	HIDALGO	DUNCAN	3617500	687100
193		Sapillo Creek	Sapillo	Lake Roberts	GRANT	COPPERAS PEAK	3658700	763200
194		Sapillo Creek	Sapillo Creek	Horse Mountain	GRANT	GRANNY MOUNTAIN	3658300	755200
195		East Fork Gila	East Fork	Lower East Fork	CATRON	GILA HOT SPRINGS	3675800	762180

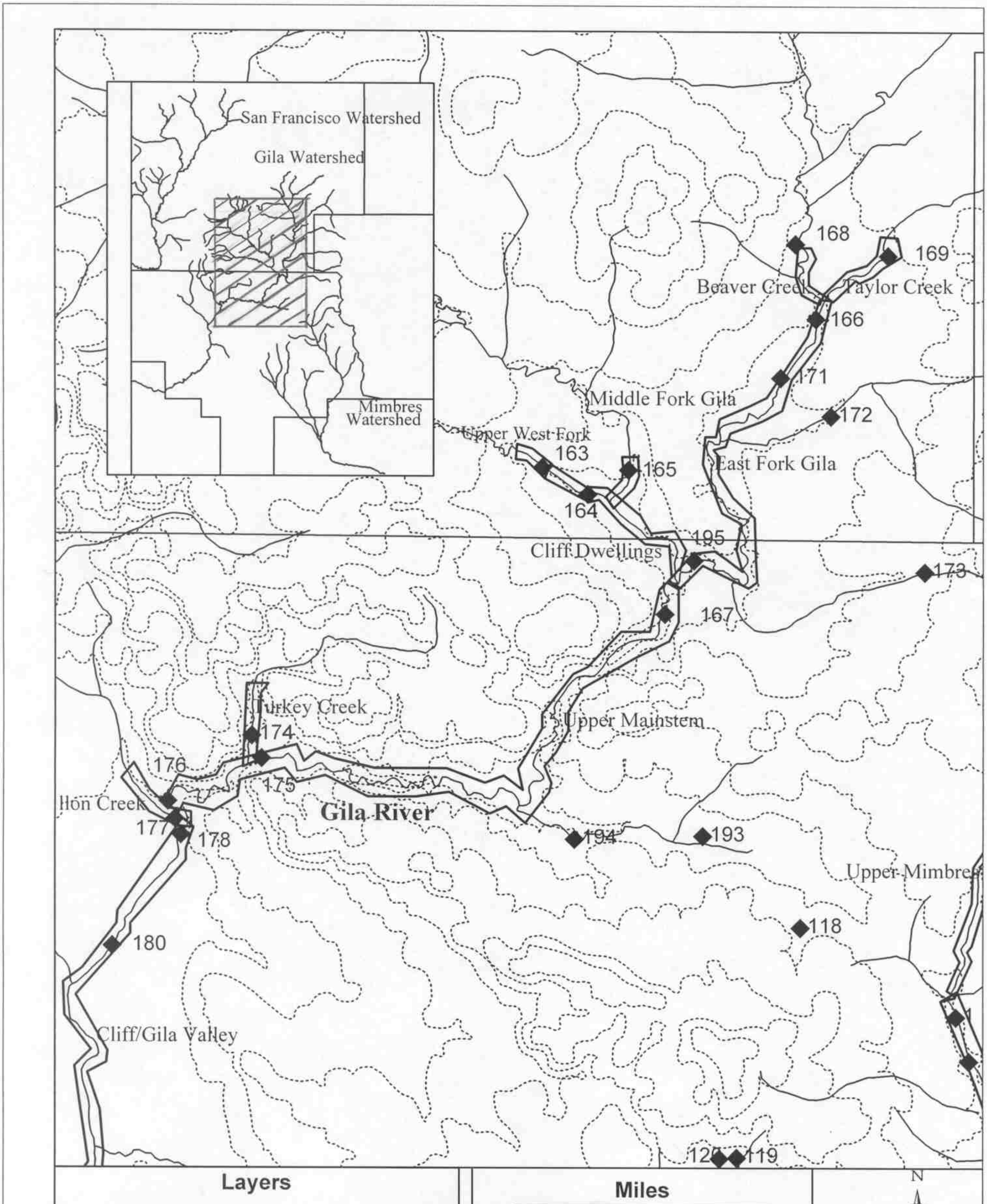

Figure 24. Stream reach locations and site numbers of the upper Gila Watershed.

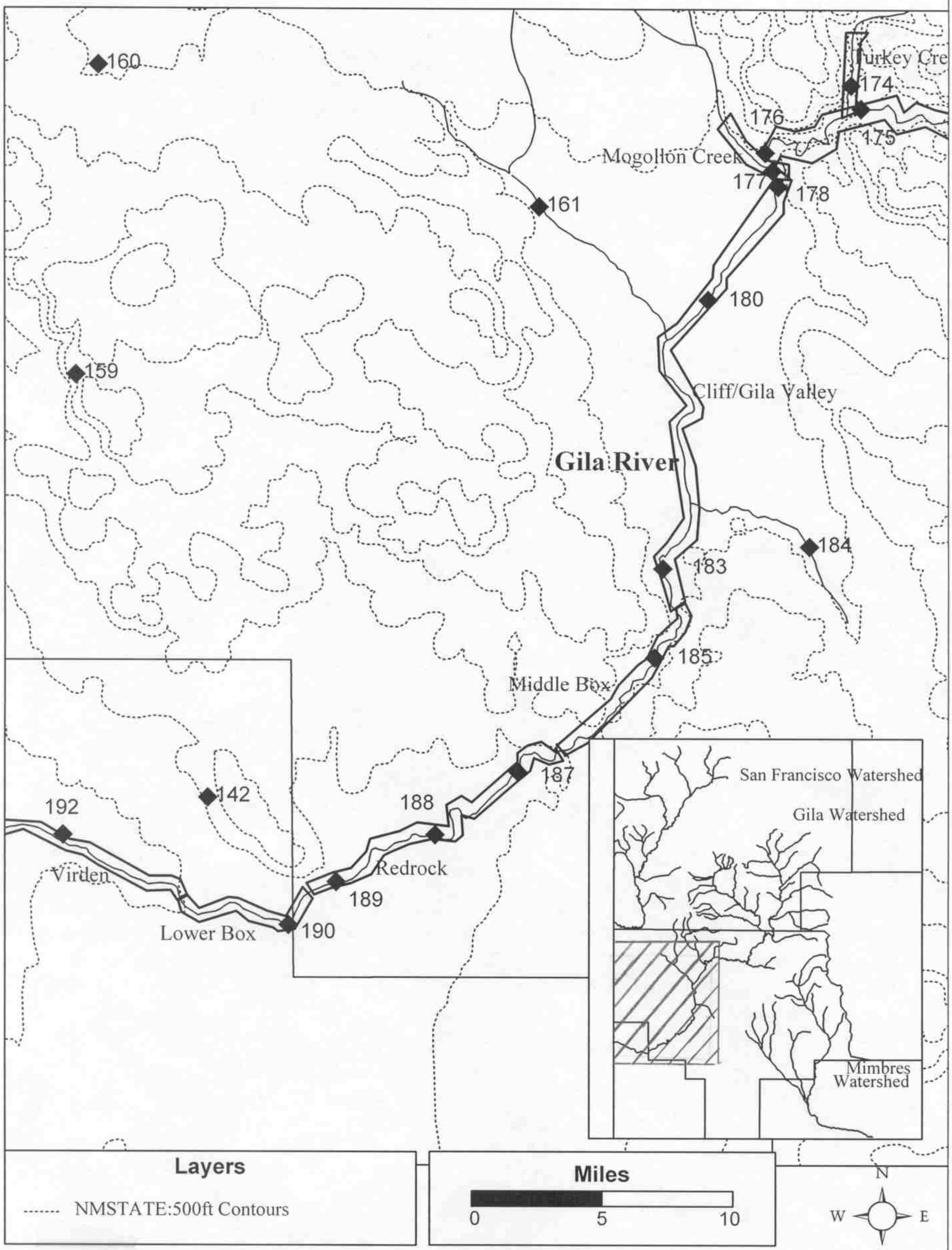

Figure 25. Stream reach locations and site numbers of the lower Gila Watershed.

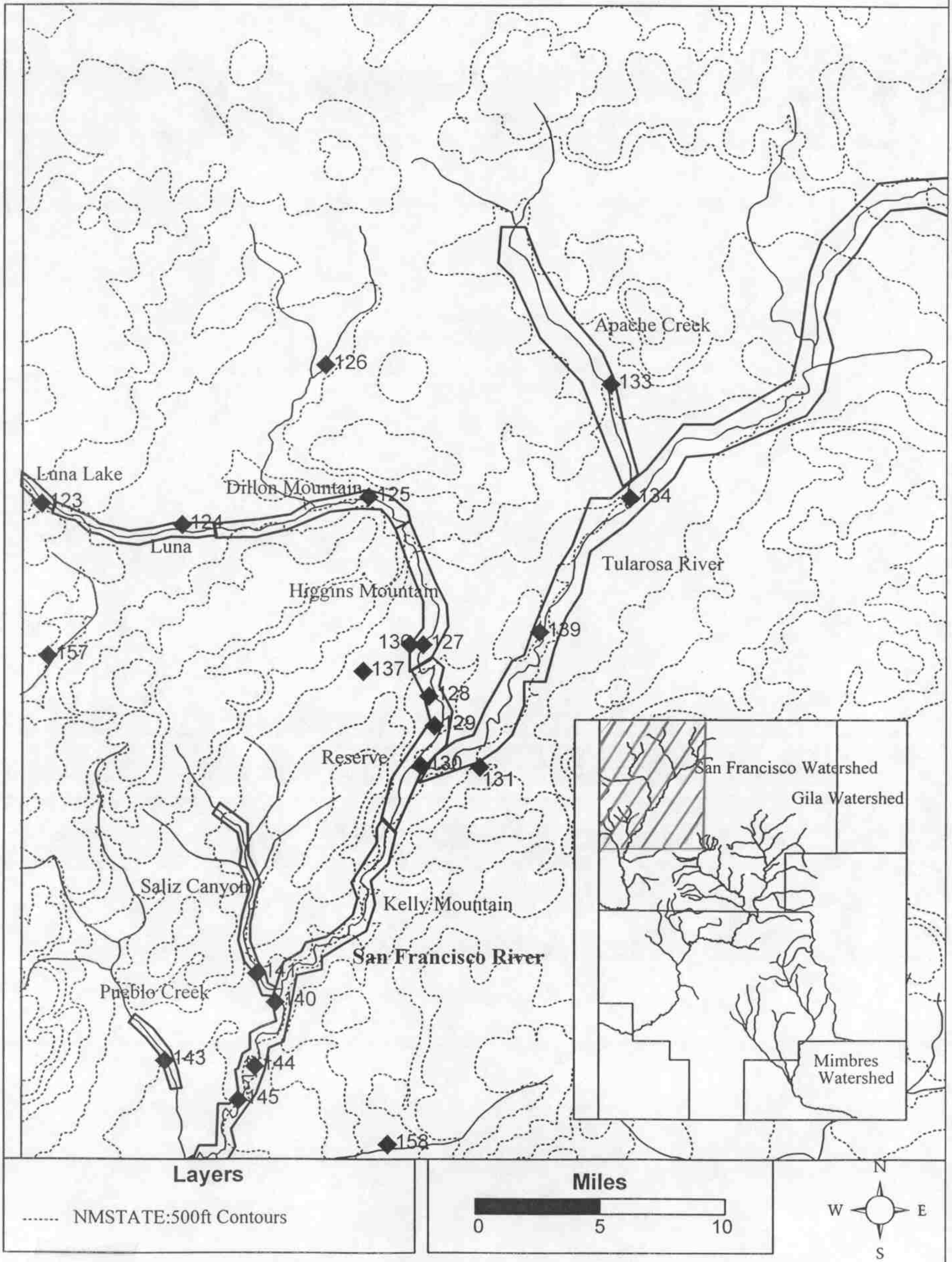

Figure 26. Stream reach locations and site numbers of the upper San Francisco Watershed.

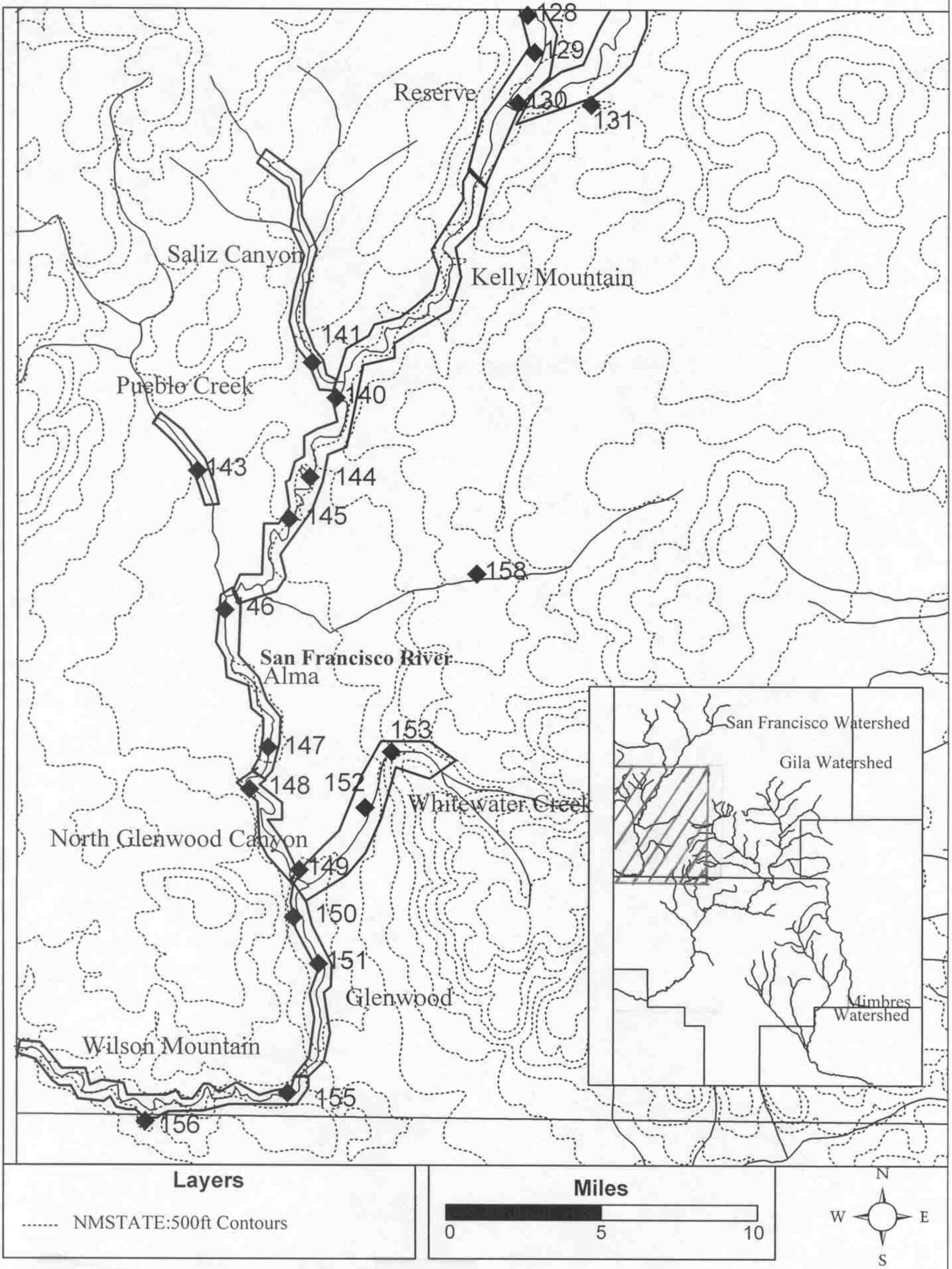

Figure 27. Stream reach locations and site numbers of the lower San Francisco Watershed.

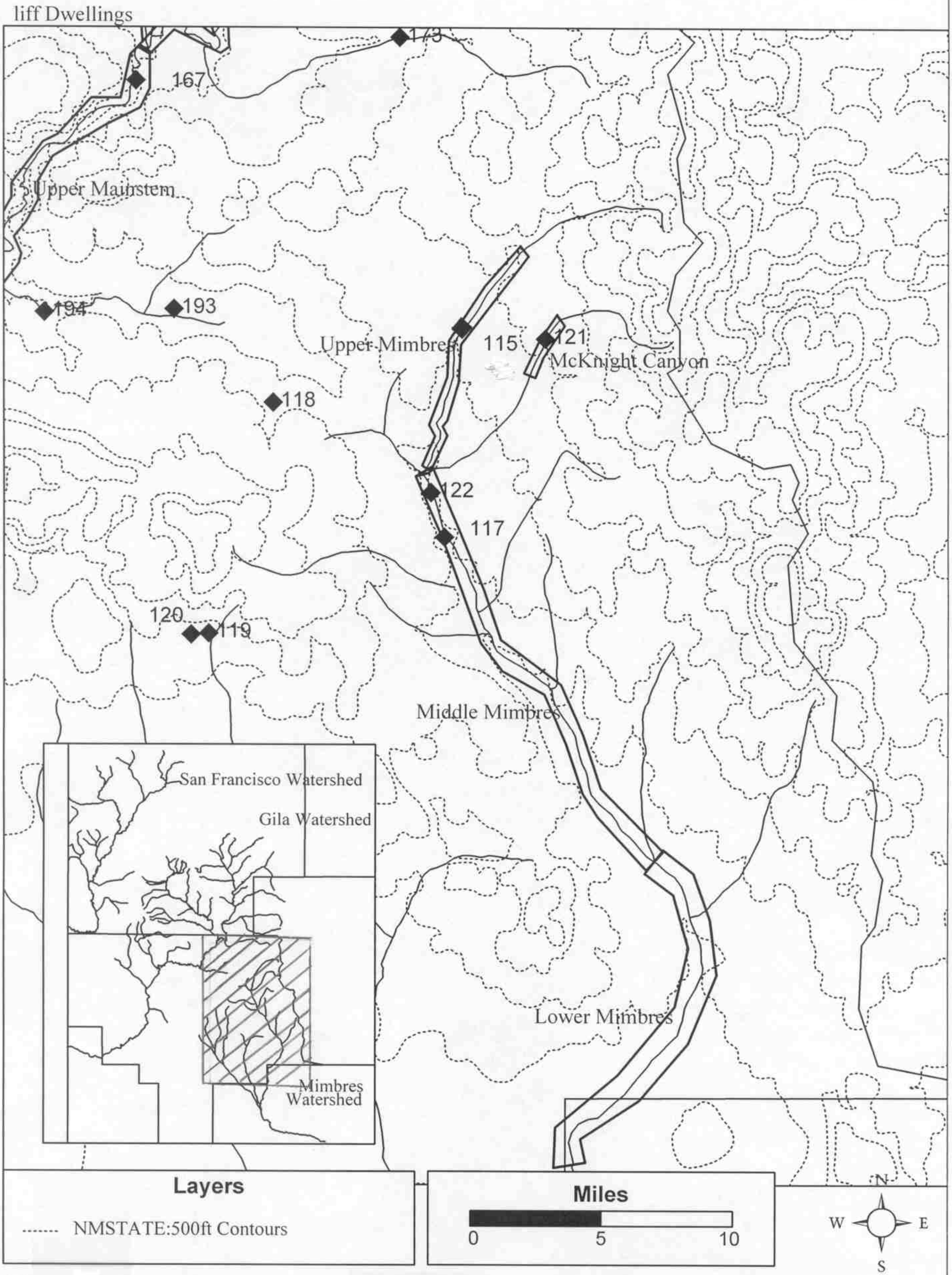

Figure 28 . Stream reach locations and site numbers of the Mimbres Watershed.

Community Ranking System.— All riparian communities were ranked from A to D based on national and State Heritage criteria. This system is based on several community aspects including condition (naturalness), quality (size, vigor, etc.), size, viability (evidence of regeneration) and defensibility (ease or difficulty of protecting). The variables of condition include grazing, herbivory, status of the hydrologic regime, road impacts and urbanization. The variables of quality include structural and species diversity, and exotics.

All variables of condition and quality were quantitatively defined. These definitions were then applied to the community, and in combination with the size and viability, a final community rank was calculated. What follows is a summarization of community ranks definitions:

"A" Rank: These communities are not disturbed by grazing, herbivory, roads, and not affected by buildings or structures. The hydrologic regime is completely intact. These communities are well developed in all layers. Reproduction and species diversity meet expectations, and exotics are predominantly absent.

"B" Rank: These communities may be slightly disturbed by either grazing, herbivory, roads, or structures, but not all. Also, these disturbances do not seem to affect vegetation expression. The hydrological regime may have small diversions, but the overall hydrological regime is more or less natural. All expected vegetation layers are present, but one may be slightly impacted. Most of the expected species are present. These communities are easily restorable.

"C" Rank: These communities are moderately disturbed by one or more of the above impacts. These disturbances seem to be degrading natural processes and will ultimately change vegetation expression. The hydrological regime is slightly altered by irrigation diversions, and excessive erosion is downcutting the channel and isolating terraces. One structural layer is absent, and other layers may be impacted. Many significant expected species are absent. These communities may be restorable to a "B" site.

"D" Rank: These communities are heavily disturbed by several impacts, and vegetation expression has been altered. The hydrograph is immediately affected by many diversions or by a reservoir upstream. Mines may be present. Roads may constrict the movement of the channel. Two structural layers are absent along with the keystone species. Generally, these communities are not restorable.

Site Ranking System.— Sites were ranked (from A to D) and assessed using the system created by Rondeau and Kittel (1996). Definitions of each site rank follows:

"A" Site: On average, these sites have "A" ranked riparian communities, and adjacent communities are in excellent condition as well. The hydrological regime is intact. No mines, irrigation diversions, or dams are located upstream. Moreover, dams are far enough upstream to have a minimal effect on the hydrograph. Streambanks are stabilized by vegetation and are not altered by flows.

"B" Site: On average, these sites have "B" ranked communities, and adjacent communities are in good condition as well. The hydrological regime is mostly intact (small irrigation diversions can occur, but no mines or large reservoirs are immediately upstream, so the hydrograph remains natural) and, like above, streambanks are mostly stabilized by vegetation and are mostly not altered by flows. These sites are easily restorable.

"C" Site: On average, these sites have "C" ranked communities, and adjacent communities are in fair condition as well. The hydrological regime is altered by excessive erosion, and mines, dams, and irrigation diversions affect base flows. Streambanks are eroding and there is little vegetation to stabilize them. These sites are partly restorable to a "B" quality site.

"D" Site: On average, these sites have "D" ranked communities, and adjacent communities are in poor condition as well. The hydrological regime is regulated by reservoirs or by major diversions that have an immediate effect on the hydrograph. Streambanks are mostly bare of any vegetation or other materials that may stabilize them. Generally, these sites are not restorable.

Initial Site Inventory and Quality Assessment

The quality rank of each site is presented in Table 8, ordered alphabetically by watershed, river, reach and site. Twelve of the 76 sites (16%) were ranked "AB" in quality, the highest rank given. These sites were all field sampled and riparian communities were generally "A" in quality. Riparian communities at these sites have a low number of exotics and well-developed vegetation layers. These sites had no immediate floodplain or channel impacts, and the overall hydrological regime was relatively intact. However, none of the sites were absolutely pristine, and the condition of adjacent areas can threaten, and affect their quality (e.g., grazing in the uplands).

Ten (13%) "B" quality sites were field sampled. These sites tended to have "B" ranked communities and minor floodplain and/or channel impacts within the site boundaries. Vegetation communities here had some herbaceous exotics and all vegetation layers were somewhat developed. Threats from adjacent areas were typically more severe as well. In addition, six "BC" quality ranked sites were identified. These had "B" quality communities, but more severe floodplain (primarily grazing) and channel impacts and were thought to be degrading these sites toward "C" quality. These sites were generally thought to be easily restored to "B" quality.

Eleven (14%) "C" quality sites were identified with floodplain and channel impacts which were more extreme. Vegetation composition at these sites was altered. Of these, two remain unsampled and quality was assessed by ground reconnaissance

Twelve (16%) "D" quality sites were identified where heavy channel manipulations and floodplain impacts had occurred and the vegetation was highly modified. Usually the herbaceous understory and shrub layer of these communities were highly altered or absent. Recoverability of these sites was generally thought to be difficult.

Twenty-three (32%) of the sites were identified as potential study areas but lacked sufficient information to make an accurate assessment. These sites were not field checked or sampled because of access problems through private lands or other logistical problems. They need further evaluation and should not be ignored.

Overall, 35 sites were ultimately chosen for field sampling and detailed evaluation (indicated as field sampled on Table 8). Complete descriptions of these sites with maps, photographs and details on vegetation composition and site conditions are presented in Appendix B. We summarize the finding by watershed and stream reach below.

Overview of Watersheds and Stream Reaches

The stream reaches identified and ground visited (Figures 24to 28) within the three watersheds are described below. The Gila watershed is described first (Figures 24 and 25) followed by the San Francisco (Figures 26 and 27), and then the Mimbres (Figure 28). Reaches are described from upstream to downstream. The various tributaries are then detailed.

Gila Watershed - Upper West Fork.— This is a mountainous stream reach that is primarily within the Gila Wilderness boundary. The upper part of the reach (the EE Canyon Site) is confined in a canyon, and the Arizona sycamore forests found there are high in quality. Downstream, the floodplain widens near Cliff Dwellings National Monument. Impacts here are minimal, but a recent fire burned down many narrowleaf cottonwood trees. However, they are actively regenerating themselves through asexual suckering.

Gila Watershed - Gila Hot Springs.— This reach begins at the North Mesa Site and continues downstream until the confluence with the West Fork of the Gila. It is a mountainous reach that is characterized by high quality Arizona alder forests. Much of this reach is in the Gila Wilderness, therefore riparian impacts are relatively minor. The lower part of the reach, however, (out of the Wilderness boundary) is less confined, and is the most heavily impacted. Saltcedar is scattered here. Hiking trails are common and a campground borders the floodplain.

Gila Watershed - East Fork.— This reach encompasses the entire East Fork of the Gila, from the confluence of Taylor and Beaver Creeks to its confluence with the West Fork. The East Fork is a highly sinuous stream that meanders back and forth across a relatively narrow floodplain with steep upland slopes. The two segments identified here are characterized by severe floodplain impacts. The upper segment (CCC Canyon Site) appears to have been continuously grazed. The floodplain consists mainly of herbaceous exotics (mostly clovers) with a few remaining coyote willows and narrowleaf cottonwoods. Invasion by saltcedar was noted as well. At the Lower East Fork Site, Arizona alders and few narrowleaf cottonwoods are present, but the riparian forests are fragmented by campgrounds, roads in the floodplain, and a recently installed power line. The site is grazed heavily as well. Due to the many impacts, the reach was not sampled.

Gila Watershed - Fall Spring.— Fall Spring originates in the upland slope of the East Fork of the Gila, eventually flowing into the river. The wetland, created by the spring, consists of cattails and bulrushes. Currently, cattle graze the marsh, the headwaters, and along the river nearby, adversely affecting the condition of the marsh. The Gila springsnail, which resides in the spring run above the marsh, is threatened by overgrazing.

Table 8. Site quality ranks and site size by hectares and stream length of all sites identified. Sites are ordered by watershed (Gila, San Francisco, and Mimbres), river, reach, and site name.

Watershed	River	Reach	Site name (segment)	Types of evaluation	Site quality	Site size (Ha)	Stream length (km)
Gila Watershed	Apache Creek	Apache Creek	Apache Box	Personal communication	No Rank		
	Beaver Creek	Beaver Creek	Kemp Mesa	Ground reconnaissance; personal communication; field sampled	B	14	1.9
	Black Canyon	Black Canyon	Middle Mesa	Ground reconnaissance	D	21.1	1.6
	Diamond Creek	Diamond Creek	Northstar Canyon	Ground reconnaissance	C	82.1	2.8
	Duck Creek	Duck Creek	Buckhorn Marsh	Personal communication; ground reconnaissance	C	141	3.7
	East Fork Gila	East Fork	CCC Canyon	Ground reconnaissance	C	25.8	1.8
	East Fork Gila	East Fork	Lower East Fork	Ground reconnaissance	C	68	5.2
	East Fork Gila	Fall Spring	Fall Spring	Personal communication; ground reconnaissance; field sampled	BC	4.7	0.3
	Gila	Cliff/Gila Valley	Lower Valley	USFS videography; ground reconnaissance; field sampled	B	345	7.5
	Gila	Cliff/Gila Valley	Middle Valley	Aerial reconnaissance	D	2096	20.8
	Gila	Cliff/Gila Valley	Upper Valley	USFS videography; ground reconnaissance; field sampled	B	244	5.3
	Gila	Gila Lower Box	Gila Lower Box	Ground reconnaissance; field sampled	AB	195	12.3
	Gila	Gila Middle Box	Gila Middle Box	USFS aerial videography	No Rank		
	Gila	Redrock	Blue Creek	Aerial reconnaissance	No Rank		
	Gila	Redrock	Harris Canyon	Aerial reconnaissance; field sampled	BC	138.4	3.7
	Gila	Redrock	Swan Canyon	Aerial reconnaissance	No Rank		

Table 8. (Continued)

Watershed	River	Reach	Site name (segment)	Types of evaluation	Site quality	Site size (Ha)	Stream length (km)
Gila Watershed	Gila	Upper Mainstem	Alum Mountain	Ground reconnaisance; field sampled	AB	39.9	4.2
	Gila	Upper Mainstem	Cave Canyon	Ground reconnaissance; field sampled	B	35.2	4.9
	Gila	Upper Mainstem	Hooker Dam Site	Personal communication; ground reconnaissance; field sampled	C	122	2.6
	Gila	Virden	Virden	Aerial reconnaissance	No Rank		
	Mangas Creek	Mangas Springs	Mangas Springs	Personal communication	No rank		
	Middle Fork Gila	Middle Fork	North Mesa	Ground reconnaissance; field sampled	AB	28.5	2.5
	Mogollon Creek	Mogollon Creek	Gila Confluence	Personal communication; ground reconnaissance; field sampled	B	82.1	3.1
	Sapillo Creek	Sapillo	Lake Roberts	Air photo interpretation	No Rank		
	Sapillo Creek	Sapillo Creek	Horse Mountain	Air photo interpretation	No Rank		
	Taylor Creek	Taylor Creek	Whitewater Canyon	Ground reconnaissance; personal communication; field sampled	C	35.2	2.5
	Turkey Creek	Turkey Creek	Hidden Pasture	Personal communication; ground reconnaissance; field sampled	AB	11.8	1
	West Fork Gila	Gila Hot Springs	Cliff Dwellings	Ground reconnaissance; field sampled	B	28.2	1.8
	West Fork Gila	Upper West Fork	EE Canyon	Ground reconnaissance; field sampled	AB	30.5	2.6
San Francisco Watershed	Apache Creek	Apache Creek	Kerr Canyon	Air photo interpretation; field sampled	C	98.5	4.3
	Centerfire Bog	Centerfire Bog	Centerfire Bog	Personnal communication; ground reconnaissance	No Rank		
	Cienega Canyon	Cienega Canyon	Cienega Canyon	Air photo interpretation; ground reconnaisance	No Rank		
	Deep Creek	Deep Creek	Deep Creek	Air photo interepretation	No Rank		
	Dryblue Creek	Dryblue Creek	Dryblue Creek	Air photo interpretation	No Rank		

Table 8. (Continued)

Watershed	River	Reach	Site name (segment)	Types of evaluation	Site quality	Site size (Ha)	Stream length (km)
San Francisco Watershed	Mule Creek	Mule Creek	Mule Spring	Ground reconnaissance	No Rank		
	Mule Creek	Mule Creek	San Francisco Confluence	Air photo interpretation	No Rank		
	Negrito Creek	Negrito Creek	Negrito Creek	Air photo interpretation; personal communication	No Rank		
	Pueblo Creek	Pueblo Creek	Pueblo Creek	Air photo interpretation; field sampled	AB	14.1	1.9
	Saliz Canyon	Saliz Canyon	Gordon Canyon	Ground reconnaissance; air photo interpretation; field sampled	C	99	6.6
	Saliz Canyon	Saliz Canyon	Serna Ranch	Air photo interpretation; ground reconnaissance	No rank		
	San Francisco	Alma	Racetrack Mesa	Personal communication; ground reconnaissance	D	106	2.5
	San Francisco	Alma	Spurgeon Mesa	Personal communication; ground reconnaissance, field sampled	BC	54	3
	San Francisco	Dillon Mt.	Frisco Hot Spring	Ground reconnaissance; field sampled	AB	15.4	3.7
	San Francisco	Glenwood	Holt Gulch	Ground reconnaissance; field sampled	B	28	0.7
	San Francisco	Glenwood	Old Oxbow	Aerial and ground reconnaissance; field sampled	AB	40	1
	San Francisco	Higgins Mt	Hudson Spring	Ground reconnaissance; field sampled	AB	14.1	1.5
	San Francisco	Kelly Mountain	Devils Creek	Ground reconnaissance; field sampled	BC	49.3	3.4
	San Francisco	Kelly Mountain	Frying Pan Canyon	Ground recconnaissance	D	16.4	1.3
	San Francisco	Kelly Mountain	Kelly Ranch	Ground reconnaissance; field sampled	C	42.2	3.7
	San Francisco	Luna	Luna	Ground reconnaissance	D	180.7	9.3
	San Francisco	Luna Lake	Luna Lake	Personal communication; field sampled	B	14.1	1.4
	San Francisco	North Glenwood Canyon	Harve Gulch	Ground reconnaissance; field sampled	BC	18.8	2.5

Table 8. (Continued)

Watershed	River	Reach	Site name (segment)	Types of evaluation	Site quality	Site size (Ha)	Stream length (km)
San Francisco Watershed	San Francisco	North Glenwood Canyon	Sandy Wash	Ground reconnaissance; field sampled	AB	28.2	2.5
	San Francisco	Reserve	Pollies Spring	Ground reconnaissance	No Rank		
	San Francisco	Reserve	S.F. Plaza	Ground and aerial reconnaissance	D	382.4	11.7
	San Francisco	Wilson Mountain	Sundial Mountain	Ground reconnaissance; field sampled	AB	61	5.5
	Starkweather Spring	Starkweather Spring	Starkweather Spring	Air photo interpretation	No Rank		
	Tularosa	Tularosa River	Jon S Mountain	Air photo interpretation	No Rank		
	Tularosa	Tularosa River	Lower Tularosa	Ground reconnaissance; personal communication	D	44.6	3
	Tularosa	Tularosa River	Tularosa Wetland	Air photo interpretation; ground reconnaissance, field sampled	AB	9.4	0.6
	Whitewater Creek	Whitewater Creek	Lower Whitewater Creek	Ground reconnaissance	D	86.8	5.9
	Whitewater Creek	Whitewater Creek	The Catwalk	Ground reconnaissance; air photo interpretation	C	7	0.3
Mimbres Watershed	Cameron Creek	Cameron Creek	Cameron Creek	Air photo interpretation	No Rank		
	Faywood Cienega	Faywood Cienega	Faywood Cienega	Personal communication; ground reconnaisance	No Rank		
	Gallinas Canyon	Gallinas Canyon	Gallinas Canyon	Air photo interpretation	No Rank		
	McKnight Canyon	McKnight Canyon	Kelly Mesa	Personal communication; air photo interpretation; field sampled	AB	11.7	3.1
	Mimbres	Lower Mimbres	Taylor Mountain	Ground reconnaissance	C	42.2	1.3
	Mimbres	Middle Mimbres	Allie Canyon	Personal communication; ground reconnaissance; field sampled	C	21.1	1.3
	Mimbres	Middle Mimbres	Bear Canyon Reservoir	Personal communication; field sampled	B	23.5	0.6
	Mimbres	Middle Mimbres	Cottonwood Canyon	Ground reconnaisance	D	49	2.3

Table 8. (Continued)

Watershed	River	Reach	Site name (segment)	Types of evaluation	Site quality	Site size (Ha)	Stream length (km)
Mimbres Watershed	Mimbres	Middle Mimbres	Mimbres	Ground reconnaissance; field sampled	BC	11.7	1.3
	Mimbres	Middle Mimbres	San Lorenzo	Aerial and ground reconnaissance	D	138.4	3.1
	Mimbres	Upper Mimbres	Bloodgood Place	Air photo interpretation; ground reconnaissance; field sampled	C	16.4	1.6
	Skate Canyon	Skate Canyon	Skate Canyon	Air photo interpretation	No Rank		
	Twin Sisters	Twin Sisters	Twin Sisters	Air photo interpretation	No Rank		

Gila Watershed - Beaver Creek.— Beaver Creek is located at the uppermost end of the Gila Watershed, and like the East Fork of the Gila, Beaver Creek is a highly sinuous stream that is confined by steep upland slopes. The reach begins at the Kemp Mesa Site and continues until the confluence of the East Fork of the Gila. From the confluence of the East Fork upstream to the Kemp Mesa Site, Beaver Creek is heavily grazed and the riparian vegetation consists primarily of exotic clovers. Arizona walnut and boxelder are found on the fringe of the floodplain. A few individual narrowleaf cottonwoods are present, and shrubby vegetation is mostly absent from streambanks. The Gila springsnail was observed at this reach as well. No evidence of grazing was seen at the Kemp Mesa site and streambanks are lined with wetland vegetation that is in good condition. Not much is known from the upstream reach of Kemp Mesa

Gila Watershed - Taylor Creek.— Taylor Creek is a small stream that is located in the northwest portion of the watershed. Throughout its course it is confined within a mountain canyon. The reach begins at the Whitewater Canyon Site and continues downstream until the river meets the confluence of Beaver Creek. It is heavily impacted and the quality of the riparian vegetation is poor. Shrub layers are mostly absent, and the reach is primarily composed of a few individual narrowleaf cottonwoods with an exotic understory dominated by clovers. Impacts to this reach include a mine, grazing, and a small reservoir (Wall Lake) that regulates flows to the lower end of the reach.

Gila Watershed - Black Canyon.— Black Canyon is a small mountain stream that is located in the northwest portion of the watershed. The reach is composed of the Middle Mesa Site, which is located in the middle of the canyon. The site is mostly within the Gila Wilderness boundary, but the site is heavily grazed and the quality of the riparian vegetation is poor. Understories and shrub layers are affected by grazing, and many of the narrowleaf cottonwood trees have been cut by beavers. However, some of the downed trees appear to be regenerating through asexual suckering. Besides the Middle Mesa Site, not much is known about other parts of this reach

Gila Watershed - Upper Mainstem Gila.— This long reach (almost 50 km) of the Gila begins at the confluence of the East and West Forks of the Gila and ends at the confluence of Mogollon Creek. This is a mountain reach where the majority of the reach is in the Gila Wilderness. Impacts appear low except at the upper end of the reach (Alum Mountain Site) from recreational bathers, and at the lower end (Hooker Dam Site) where off-road vehicles ford the river. For the most part, riparian communities are high quality, consisting mainly of Arizona sycamores and Arizona alders. Significant faunal occurrences include the Gila springsnail, the Southwest willow flycatcher, and the spikedace. The main threat to this site is the Hooker Dam proposal which would submerge the lower portion of this reach.

Gila Watershed - Turkey Creek.— Turkey Creek is a small tributary of the Gila located in the middle of the watershed. This mountain stream has a high gradient, and flooding events are short and intense. The reach begins at the Hidden Pasture Site and continues until the confluence of the Gila River. At the upper end of the reach, riparian forests consist of Arizona sycamores and Arizona alders. At the lower end of the reach, surface flows are intermittent. Here, Arizona alders are replaced by alligator junipers and gray oaks. Riparian communities are high quality throughout this reach.

Gila Watershed - Mogollon Creek.— Mogollon Creek is an intermittent stream located in the middle of the watershed. About one kilometer upstream of the confluence with the

Gila River (the Gila Confluence Site), the riparian communities consist primarily of good quality Arizona sycamores, alligator junipers and oaks. Not much is known about the reach upstream of the Gila Confluence Site. A road that fords the river at the confluence of the Gila was the only observed impact to this reach.

Gila Watershed - Duck Creek.— Duck Creek is a small tributary to the Gila that meets the river near the town of Cliff. The reach consists of the Buckhorn Marsh Site, which is located near the town of Buckhorn. The area is grazed heavily. It is suspected that a groundwater well upstream may affect base flows. The creek is incising and isolating the few cottonwoods that remain. The marsh itself is an old oxbow that is composed predominantly of cattails. The marsh is drying up however, and Russian olive encroachment is a serious threat. Due to the severe impacts, the reach was not field sampled.

Gila Watershed - Cliff/Gila Valley.— This reach begins at the Mogollon Creek confluence and continues until the Middle Box. It is composed of three contiguous segments. The upper segment (the Upper Valley Site) is characterized by good quality Fremont's cottonwood and Arizona sycamore forests. Young stands of Fremont's cottonwood and Goodding's willow are also found. The middle segment (the Middle Valley Site) is characterized by severe channel and floodplain impacts. Channel impacts include levees, water diversions and dredging. Agricultural fields and grazing pastures are very extensive in the floodplain throughout the Middle Valley Site. Generally, all that remains at this site are fragmented Fremont's cottonwood stands in poor condition. Due to these impacts and landowner problems, the site was not sampled. The lower segment (the Lower Valley Site) is just upstream of the middle box and is characterized by young and mature stands of Fremont's cottonwood and Goodding's willow that are in good condition. It remains unclear how these communities are affected by the water diversions and channel manipulations upstream. The Southwest willow flycatcher also occurs in this reach.

Gila Watershed - Middle Box.— The Middle Box of the Gila begins just downstream of the Lower Valley Site and continues until just upstream of the town of Redrock. The reach is characterized by a deeply entrenched eight kilometer long canyon. Due to the remoteness of the canyon the reach remains unsampled. Aerial reconnaissance of the box, showed patches of riparian vegetation at the ends of the box. However, due to a lack of depositional features, most of the canyon is relatively free of vegetation.

Gila Watershed - Redrock.— This reach extends from the mouth of the Middle Box and continues downstream to the Lower Box. It is characterized by a wide floodplain dominated by mature Fremont's cottonwood and Goodding's willow forests that are in fair condition. Impacts to the upper half of the reach (Swan Canyon Site) include levees, grazing, irrigation diversions, and a mine. This site remains unsampled. The lower half of the reach (Harris Canyon and Blue Creek Sites) has fewer levees and irrigation ditches. The Southwest willow flycatcher and Arizona Bell's vireo also occur in this reach.

Gila Watershed - Lower Box.— The Lower Box of the Gila begins downstream from Redrock and continues for about eight kilometers toward the town of Virden. Unlike the Middle Box, depositional bars and terraces support high quality, but small stands of young and mature of Fremont's cottonwood and Arizona sycamore forests. The only observed impact to this reach is from off-road vehicles that ford the channel and cross the floodplain.

Gila Watershed - Virden.— This is the last designated reach of the Gila in New Mexico. It extends from the end of the Lower Box and continues to the town of Virden. Aerial reconnaissance and topographic maps reveal that much of the reach is confined by a levee, irrigation canals. Agricultural fields are extensive in the floodplain. Despite these impacts several large cottonwood forests still occur in parts of the reach, but are fragmented. Due to logistical problems the reach was not field sampled.

San Francisco Watershed - Luna Lake.— This is a mountain reach that begins at the spillway of Luna Lake and continues for almost 10 kilometers until the floodplain widens, just upstream of the town of Luna. Luna Lake is a relatively small lake, and is located at the headwaters of the San Francisco at the Arizona-New Mexico border. It is used primarily for recreation. Flows through this reach are regulated by the lake. The riparian vegetation is dominated by bluestem willows with a spikerush understory. Ponderosa pine borders the stream in the surrounding uplands. The site is relatively undisturbed with impacts limited to elk grazing and light camping.

San Francisco Watershed - Luna.— This reach begins just upstream of the town of Luna and continues through a wide floodplain until the San Francisco enters the canyon near Dillon Mountain. The San Francisco in Luna is characterized by wide floodplains with few remaining narrowleaf cottonwoods and small patches of willows. The stream is downcut through much of the reach and floodplains are heavily grazed by cattle and other livestock. Forests are additionally fragmented by urbanization, a power line, and roads. As a result, site quality is low. Flood-scoured areas seen from aerial photography indicate that Luna Lake doesn't seem to effectively regulate flooding in this reach. Overall, impacts were too severe along this reach to warrant field sampling.

San Francisco Watershed - Dillon Mountain.— This reach begins with the mountain canyon downstream of the Luna reach, and continues through the canyon for more than 11 km to the San Francisco Box. The upper portion of this reach is very confined, and was not assessed due to access problems. The middle part is somewhat less confined, with small depositional floodplains, but the area is primarily pasture-land that is heavily grazed with little or no riparian vegetation. Roads fragment the few remaining stands of narrowleaf cottonwood as well. The lower segment (Frisco Hot Spring Site) remains high in quality and is characterized by herbaceous wetland communities composed of American bulrush and smooth horsetail, which line the streambanks over a two-mile segment. Impacts to the lower portion of the reach are minimal, but include grazing on the upland slopes, a road, hiking trails, and recreational bathers at the hot springs.

San Francisco Watershed - Higgins Mountain.— This reach includes the mountain canyon that includes the San Francisco Box and extends to the town of Reserve. The San Francisco is confined throughout most of this reach except at the deltas of tributaries, where the floodplain expands. Due to private inholdings, access was limited to the upper portion of this reach, and the area was not field checked. From the initial ground assessment, impacts here include a road that fords the river, and possibly grazing. The lower part of the canyon (Hudson Spring Site) is characterized by young, small stands of narrowleaf and Fremont's cottonwood in good condition. This was the northernmost observation of Fremont's cottonwood noted. The floodplain was only minimally affected by grazing.

San Francisco Watershed - Reserve.— The main portion of this reach is the wide floodplain that includes the town of Reserve. The reach ends as the San Francisco enters the canyon downstream, about 10 km from Reserve. Riparian vegetation at this site consists of a few fragmented stands of mature narrowleaf cottonwoods and willows. Impacts to the riparian areas are severe throughout much of this site. Agriculture and grazing are extensive in the floodplain, and in certain areas, the streambanks were channelized by a bulldozer. The site was not sampled because of the many impacts to the channel and vegetation.

San Francisco Watershed - Kelly Mountains.— This reach begins at the canyon downstream of Reserve and ends as the floodplain widens upstream of Alma. It is the longest of the canyon reaches, extending over 32 kilometers. Three segments were identified within this reach. At the northern most segment (Kelly Ranch Site), the channel was dry on the date of sampling, and the young stands of Fremont's cottonwood found appeared stressed with leaves that were drying and falling off. The site is heavily grazed and understories are dominated by exotics. Little is known about this reach upstream of Kelly Ranch. The middle segment (Frying Pan Canyon Site), is characterized by somewhat wider floodplains that are heavily irrigated and cultivated. Devil's Creek (the lower segment) had water in the channel on the date of sampling and is characterized by good quality, young narrow stands of Fremont's cottonwood with Goodding's willow. Elevated cobble bars consist of rubber rabbitbrush and some mature Arizona sycamores. Fremont's cottonwood can be found on small, isolated terraces. This was also the northernmost extent of Arizona sycamore noted.

San Francisco Watershed - Alma.— This reach begins as the floodplain widens in the Alma valley and ends as the river becomes confined in a canyon about 11 kilometers downstream. It is characterized by extensive agricultural fields in the floodplain. Grazing and roads are also common. Fremont's cottonwood and Goodding's willow forests are fragmented throughout this reach and are mainly found in narrow strips along the river. However, there are good quality stands of young Arizona alder, Arizona sycamores, and Fremont's cottonwood in the upper segment (Spurgeon Mesa Site). These stands may be important to the Southwestern willow flycatcher which occur here.

San Francisco Watershed - North Glenwood Canyon.— This reach extends through an eight kilometer long canyon from just below Alma to just upstream of Glenwood. It is an isolated canyon (especially the middle portion) and impacts are minimal throughout. However, cattle graze the upper end of the canyon. Two segments identified within this reach (the Harve Gulch and Sandy Wash Sites). Riparian vegetation consists of young stands dominated by Fremont's cottonwood, Goodding's willow, Arizona alder, and Arizona sycamore. Small isolated elevated terraces of Arizona walnut and Arizona sycamore can also be found.

San Francisco Watershed - Glenwood.— This reach begins at the town of Glenwood and continues through a relatively wide floodplain to the hot springs downstream. The riparian vegetation of this reach consists of young Fremont's cottonwood, Goodding's willow, and seepwillows. These young stands may also be important to the Southwestern willow flycatcher which occurs in this reach. Mature Fremont's cottonwood and Goodding's willow forests are fragmented by the extensive agricultural fields which dominate much of the floodplain, leaving the forests confined to narrow strips along the river. Good quality stands dominated by Fremont's cottonwood can be found at the Holt Gulch Site. Other impacts include grazing and water diversions.

San Francisco Watershed - Wilson Mountain.— This reach begins at the hot springs and continues through a narrow canyon into Arizona. Throughout this reach, the San Francisco is confined within a steep canyon, and there is little or no depositional floodplain. Like many of the other canyon reaches of the San Francisco, the riparian vegetation consists primarily of young Fremont's cottonwood, Goodding's willow, and seepwillows. Mature Fremont's cottonwood and Arizona sycamores can be found on isolated terraces. Due to its relative isolation, high quality riparian communities are found throughout this reach. The main impact here is off-road vehicles that ford the river and drive on the scoured side bars. Below the Sundial Mountain Site, little is known about this reach.

San Francisco Watershed - Tularosa River.— The Tularosa River is a major tributary to the San Francisco. The reach begins near town of Aragon and continues through the town of Apache Creek until it meets the San Francisco river in Reserve. Throughout its course, the Tularosa supports fragmented stands of narrowleaf cottonwood forests. Near the town of Apache Creek, however, a small parcel of U.S. Forest land (¼ section) consists of an undisturbed bulrush marsh (Tularosa Wetland Site). Overall, the majority of this reach is heavily grazed, however, and near Reserve the channel is bulldozed.

San Francisco Watershed - Apache Creek.— Apache Creek is a tributary to the Tularosa River in the northwest portion of the watershed. It is an intermittent stream that flows through a relatively wide floodplain. At the Kerr Canyon site, narrowleaf cottonwood forests are fragmented and pastures are interspersed. Arizona walnut are located on the fringe of the floodplain as well. Much of this reach is grazed heavily and much of the floodplain near the town of Apache Creek is bare of any woody vegetation. In addition, parts of the streambanks are riprapped to prevent erosion the creek from undercutting the adjacent roadway.

San Francisco Watershed - Pueblo Creek.— Pueblo Creek is a small tributary of the San Francisco in the western part of the watershed. It is a high gradient, intermittent stream confined within a mountain canyon. Flooding events are probably short and intense. It is a small site (<2 km) that consists primarily of high quality Arizona sycamore and Arizona alder forests. Current impacts to the reach include a recently installed power line and old corrals. The riparian area has been fenced and effectively restricts grazing.

San Francisco Watershed - Saliz Canyon.— Saliz Canyon is a small tributary of the San Francisco in the western part of the watershed. Throughout this reach the stream is confined within a mountain canyon. The reach consists of two contiguous segments. The upper segment (Gordon Canyon Site) consists primarily of Arizona alder stands with a few narrowleaf cottonwoods and junipers bordered by ponderosa pine forests. Impacts here include a road that crosses the floodplain, power lines, and small levees. The channel is dredged as well. Due to its isolation and lack of a road, the lower segment (Serna Ranch Site) remains unsampled, but it is suspected to be in better condition than the upstream site.

San Francisco Watershed - Whitewater Creek.— Whitewater Creek is a small stream that meets the San Francisco at the town of Glenwood. The two contiguous segments found in this reach differ in their plant communities. The upper segment (The Catwalk Site) consists primarily of Arizona sycamores and Arizona alders that are of fair quality. The creek here has a high stream gradient, is very confined by steep canyon walls and there is little or no depositional floodplain. The Catwalk Site is well developed (picnic area and old water line primarily) and not very isolated. The lower segment (Lower Whitewater Creek Site) is an arroyo, managed for flood control and has little vegetation. Streamflows are intermittent. The banks of the channel are heavily riprapped to protect the road to the Catwalk picnic area from floods. A spring near the town of Glenwood restores perennial flow to Whitewater Creek as it flows into the San Francisco river. Due to the many impacts, the reach was not sampled.

Mimbres Watershed - McKnight Canyon.— McKnight Canyon is a narrow mountain stream that is located in the upper end of the watershed. This is a small reach, consisting primarily of the Kelly Mesa Site, which is located in the middle of the canyon. The riparian communities here are high quality and are dominated by bluestem willow and beaked sedge. Below the Kelly Mesa Site, the stream is extremely downcut, and banks are highly erosive. The few narrowleaf cottonwoods that remain appear to be out of the active floodplain. The main impacts to this site include fish barriers and an artificial waterfall, both built by the Forest Service.

Mimbres Watershed - Upper Mimbres.— The Upper Mimbres is a narrow, mountainous reach where the river is confined by the valley slopes. This is a small reach, consisting mostly of the Bloodgood Place Site, which is located just a few kilometers downstream from the headwaters of the Mimbres River. The site is heavily grazed and many of the riparian trees have been cut for fuelwood. The riparian vegetation consists mainly of fragmented narrowleaf cottonwood and Arizona alder stands that are fair in quality.

Mimbres Watershed - Middle Mimbres.— This reach begins at the confluence of McKnight Canyon and continues until the town of San Juan. The reach is characterized by fragmented narrowleaf cottonwood and boxelder forests, which are common throughout. Agricultural fields and roads are extensive in the floodplain, and riparian forests are limited to small strips along the channel. However, good quality stands can be found at the Bear Canyon Reservoir Site. Hydrological impacts include a gravel mine in the upper part of this reach (Cottonwood Canyon Site) and many irrigation diversions. Water withdrawals can be severe in some areas as the stream becomes intermittent (San Lorenzo Site). Many areas throughout the reach are also grazed.

Mimbres Watershed - Lower Mimbres.— The Lower Mimbres site begins at the town of San Juan and continues downstream until stream flows are entirely subsurface near Taylor Mountain. This reach is defined by the presence of poor quality stands of Fremont's cottonwood and Goodding's willow. Agricultural fields encroach on riparian forests here, which limits them to narrow strips along the channel. Many areas are heavily grazed. This reach was not field sampled due to the many impacts which occur here.

CONCLUSIONS

The preliminary classification for riparian/wetland vegetation communities for the Gila, San Francisco and Mimbres presented here describes 35 types of communities within these watersheds and relates them to their hydrological regime and soils. In conjunction with biotic/environmental relationships, the dynamics and response of the communities to various disturbances and management practices is also evaluated (see Part I). Such knowledge of the composition and function of these communities is essential for the identification of high-quality sites during the inventory process, and in the long-term management and/or restoration of these ecosystems. The Gila, San Francisco and Mimbres classification will be incorporated into a comprehensive classification of the palustrine ecosystems of New Mexico. This statewide classification will be used to identify, assess the quality of, and map riparian/wetland communities across the state (see Part II).

Status of the Gila, San Francisco and Mimbres Riparian/Wetlands

The Gila, San Francisco and Mimbres rivers prevail among the last major undammed rivers in New Mexico. Both the Gila River and the San Francisco River flow unconstrained through some of the most remote and rugged terrain in New Mexico where accessibility is difficult and hydrological impacts relative to other rivers, such as the middle Rio Grande in central New Mexico, are minor. As a result, the majority of the vegetation along the Gila and San Francisco rivers remain in unparalleled condition (Wallace 1992), yet these rivers are still exposed to visible threats.

Healthy native riparian ecosystems require overbank flooding, which is important in nutrient cycling, as well as in creating seedbeds for reproduction of native riparian species (Brady et al. 1985, Fenner et al. 1985, Asplund and Gooch 1988, Siegel and Brock 1990, Stromberg et al. 1991, Crawford et al. 1993). Sufficient sediment loads are also necessary along with a certain degree of fluvial dynamism where the active channel is allowed to migrate across the floodplain for reproduction. The control of exotics is also linked to a healthy native riparian ecosystem. Although exotics will never be eliminated from these ecosystems, an intact or partially intact hydrological regime may prevent their dominance. The constant over-utilization by livestock degrades healthy systems and has been shown to increase soil compaction, reduce water infiltration and plant growth, increase the speed of runoff and adds excess sediments into the system (Chaney et al. 1991). Other effects includes the widening of the stream channel, which reduces the ability of native obligate riparian species, such as sedges, rushes, and perennial grasses to trap sediments and hold armoring gravels in place (Medina 1996, Neary and Medina 1996). Ultimately, the result is a system with decreased recovery rates that is less resilient to natural floods (Sewards and Valett 1996).

The principal ecological concerns for the Gila River include extensive over-utilization of riparian resources and upland resources for livestock, and water diversion or withdrawals. Livestock grazing, especially along the East Fork (Ohmart 1996), Beaver Creek and Taylor Creek is heavy. Continuous grazing on these floodplains may eventually suppress all riparian vegetation regardless of the status of the hydrologic regime, while over-utilization of upland resources may through increased runoff and sediment loads increase flood magnitudes and frequencies (Chaney et al. 1991). The majority of water diversion and groundwater withdrawals from the Gila occur in the lower elevations of the watershed in the Cliff/Gila valley and Redrock valley for agricultural development and industrial use (Wallace 1992). Farming and ranching occurs in the floodplain and the riparian corridor itself.

Farming, logging, grazing, and mining all occur within the San Francisco watershed, and water diversions are proportionately higher here than in the Gila. The majority of water usage (approximately 60%) is intended for farming. Of the farming consumption, an estimated 83% occurs in the valleys of Glenwood and Reserve (Wallace 1992). The lower San Francisco River, particularly from Glenwood to the Arizona border, is open to off-road vehicle (ORV) recreational use. Our observation suggest that long-term impacts from this activity has lead to certain channel modifications such as streambank erosion and soil compaction, and perhaps a loss or destruction of armoring gravels in the riverbed itself.

The Mimbres River though more accessible still has few hydrological impacts, but it is impacted in other ways such as gravel mining, deforestation, and heavy domestic livestock grazing. The degree of impacts is more severe, and, perhaps due to its easy accessibility, such impacts are more apparent and pose a substantial threat to the riparian ecosystem (Wallace 1992). All of these activities occur in the channel bed and immediate floodplain resulting in denuded and erosive streambanks, increased sediment loads, and in some places replacement of the native riparian herbaceous flora with exotic vegetation.

The vegetation patterns in a watershed are a reflection of its ecological condition. While the Gila, San Francisco and Mimbres rivers support some of the densest and most diversified riparian/wetland vegetation in the state, in certain stream reaches the riparian areas along these rivers are in fair to poor condition due to the present impacts. Considerable concern has been directed toward excessive livestock grazing of these floodplains. Many researchers consider this issue to be the single-most principal threat to southwestern watersheds as a whole (Krueper 1996). In our site evaluation (see Part II), the best sites were located in the wilderness or in remote canyon tributaries that lacked grazing. Furthermore, many of these sites, and sites we consider to be restorable, are shrinking and fragmented. In the most degraded sites streambanks are unstable and severely eroded, and the riparian productivity appeared in decline. Herbaceous exotics, such as cheatgrass and clovers, or upland invaders such as junipers have become common components of the floodplain.

Because riparian ecosystems on a whole are highly productive and resilient, we, as do other researchers (Chaney et al. 1991 and 1993, Crawford et al. 1996, DeBano et al. 1996, Finch 1996, Vincent 1996), believe restoration and enhancement are possible, but require proper management of the upland and riparian resources along with an intact hydrological regime. The point at which the system becomes non-restorable (a "D" quality site) may be when several impacts occur in combination with one another. Cumulative effects of both channel and floodplain impacts occurring at the same time may be the point at which all riparian dynamics come to a stop and the ecosystem quality and productivity decline. A highly regulated watershed, in combination with heavy grazing, may in effect put a stop to the system, and possibly set the stage for invasions from saltcedar or Russian olive, and the beginning of an entirely new, highly altered, ecosystem. Luckily, headwater dams in the study area like Luna Lake affect only a small portion of the watershed area and are less detrimental to the riparian ecosystem than a dam further downstream. This probably applies to other hydrological impacts in the watersheds such as irrigation diversions and mines.

The natural and restorable riparian/wetland ecosystems of New Mexico remain an invaluable resource for the State. Their protection ultimately enhances not only biological diversity, but also economic stability and environmental quality. With planning, these highly productive ecosystems can be managed in a natural, cost efficient way that can be compatible with many uses such as livestock grazing, recreation, and even agriculture and urbanization, and still maintain their overall biological diversity. Such an effort requires a systematic, comprehensive inventory based on the classification system and site quality evaluation criteria developed here, along with a program of ongoing research and monitoring to ensure the long-term sustainability of these vital resources. Through careful wetlands protection planning and implementation, the so called 'train wrecks' over issues such as rare and endangered species and water pollution may possibly be avoided.

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APPENDICES

Appendix A. Riparian Plant Species List

Appendix B. Site Descriptions

APPENDIX A.

Riparian Plant Species List of the

Gila, San Francisco, and Mimbres Watersheds

The riparian plant species surveyed are listed alphabetically by their most recent scientific, common and family names. Taxonomic nomenclature follows Kartesz (1994). LF refers to the lifeform of the species. For instance, 1 = tree, 2 = shrub, 3 = graminoid, and 4 = forb. The origin of the species is also included, where N refers to those species native to North America and I refers to those species introduced. The wetlands indicator status following Reed (1988) is also provided. Those species that were not assigned an indicator status (NI) were assigned an indicator status parenthetically. Several species had an indicator status assigned to them by Reed (1988), but based on knowledge of the taxa seemed to be an inappropriate classification and were reassigned an indicator status parenthetically.

Table A. Gila, San Francisco and Mimbres Rivers Riparian Plant Species List.

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Acacia neovernicosa	Isley	viscid acacia	2	Fabaceae	N	NI (UPL)
Acer negundo - adv regen	L.	box elder		Aceraceae	N	FACW-
Acer negundo - mature	L.	box elder		Aceraceae	N	FACW-
Acer negundo - yng regen	L.	boxelder		Aceraceae	N	FACW-
Achillea millefolium	L.	common yarrow	4	Asteraceae	N	FACU
Adiantum capillus-veneris	L.	common maidenhair	4	Adiantaceae	N	FACW+
Agrostis gigantea	Roth.	redtop	3	Poaceae		FACW+
Agrostis stolonifera	L.	creeping bentgrass	3	Poaceae	N	NI (FACW+)
Ailanthus altissima	(P. Mill.) Swingle	tree of heaven		Simaroubaceae		FACU
Ailanthus altissima - mature	(P. Mill.) Swingle	tree of heaven		Simaroubaceae		FACU
Ailanthus altissima - yng regen	(P. Mill.) Swingle	tree of heaven		Simaroubaceae		FACU
Alnus oblongifolia - adv regen	Torr.	Arizona alder		Betulaceae	N	FACW+
Alnus oblongifolia - mature	Torr.	Arizona alder	1	Betulaceae	N	FACW+
Alnus oblongifolia - yng regen	Torr.	Arizona alder		Betulaceae	N	FACW+
Ambrosia artemisiifolia	L.	annual ragweed	4	Asteraceae	N	FACU
Ambrosia trifida	L.	great ragweed	4	Asteraceae	N	FACW-
Amorpha fruticosa	L.	desert indigobush	2	Fabaceae	N	FACW+
Anaphalis margaritacea	(L.) Benth. & Hook. f.	western pearlyeverlasting	4	Asteraceae	N	NI (FAC)
Anemopsis californica	(Nutt.) Hook. & Arn.	yerba mansa	4	Saururaceae	N	OBL
Apocynum cannabinum	L.	Indianhemp	4	Apocynaceae	N	FAC+ (FACW)
Aquilegia chrysantha	Gray	golden columbine	4	Ranunculaceae	N	FACW
Arctium minus	Bernh.	lesser burdock	4	Asteraceae	I	NI (FACW)
Arctostaphylos pungens	Kunth	pointleaf manzanita		Ericaceae		NI (UPL)
Argentina anserina	(L.) Rydb.	silverweed cinquefoil		Rosaceae		OBL

Table A.1. **Gila, San Franciso and Mimbres Rivers Riparian Species List (Continued).**

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Aristida ternipes	Cav.	spidergrass	3	Poaceae	N	FAC
Artemisia campestris	L.	field sagewort	4	Asteraceae	N	FAC
Artemisia ludoviciana ssp. mexicana	(Willd. ex Spreng.) Keck	Mexican white sagebrush	4	Asteraceae	N	NI (FAC)
Asclepias subverticillata	(Gray) Vail	whorled milkweed	4	Asclepiadaceae	N	FACU
Aster praealtus	Poir.	willowleaf aster	4	Asteraceae	N	FACW-
Baccharis pteronioides	DC.	yerba de pasmo	2	Asteraceae	N	NI (FAC)
Baccharis salicifolia	(Ruiz & Pavon) Pers.	seepwillow	2	Asteraceae	N	FACW
Baccharis salicifolia - seedling	(Ruiz & Pavon) Pers.	seepwillow	2	Asteraceae	N	FACW
Baccharis thesioides	Kunth	Arizona baccharis	2	Asteraceae	N	NI (FAC)
Beckmannia syzigachne	(Steud.) Fern.	American sloughgrass	3	Poaceae	N	OBL
Berula erecta	(Huds.) Coville	cutleaf waterparsnip	4	Apiaceae	I	OBL
Bidens bipinnata	L.	spanish-needles	4	Asteraceae	N	NI (FACW)
Boerhaavia coccinea	P. Mill.	scarlet spiderling	4	Nyctaginaceae	N	NI (FAC)
Bothriochloa laguroides ssp. torrea	(Sw.) Rydb.	silver beardgrass	3	Poaceae	N	NI (FAC-)
Bouteloua barbata	Lag.	sixweeks grama	3	Poaceae	N	NI (FACU)
Bouteloua curtipendula	(Michx.) Torr.	sideoats grama	3	Poaceae	N	NI (FAC)
Brickellia californica	(Torr. & Gray) Gray	California brickellbush	2	Asteraceae	N	FACU+ (FAC)
Brickellia grandiflora	(Hook) Nutt.	tasselflower brickellbush	2	Asteraceae	N	NI (FACU+)
Bromus catharticus	Vahl	rescuegrass	3	Poaceae	I	NI (FACU)
Bromus inermis	Leyss.	smooth brome	3	Poaceae	N	NI (FACW)
Bromus japonicus	Thunb. ex Murr.	Japanese brome	3	Poaceae	I	FACU
Bromus rubens	L.	foxtail brome	3	Poaceae	I	NI (FAC)
Bromus sterilis	L.	poverty brome	3	Poaceae	I	NI (FAC)
Bromus tectorum	L.	cheatgrass	3	Poaceae	I	NI (FAC)
Capsella bursa-pastoris	(L.) Medik.	shepherd's purse	4	Brassicaceae	I	UPL
Carex aquatilis	Wahlenb.	water sedge	3	Cyperaceae	N	OBL

Table A.1. Gila, San Franciso and Mimbres Rivers Riparian Species List (Continued).

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Carex foena	Willd.	dryspike sedge	3	Cyperaceae	N	NI (FACW)
Carex microptera	Mackenzie	smallwing sedge	3	Cyperaceae	N	FACW
Carex praegracilis	W. Boott	clustered field sedge	3	Cyperaceae	N	FACW+
Carex rostrata	Stokes	beaked sedge	3	Cyperaceae	N	OBL
Carex stipata	Muh. ex Willd.	owlfruit sedge	3	Cyperaceae	N	OBL
Celtis laevigata var. reticulata	(Torr.) L. Benson	netleaf hackberry		Ulmaceae	N	FACU (FAC)
Cenchrus carolinianus	Walt.	sandbur	3	Poaceae	N	NI (UPL)
Cercocarpus montanus	Raf.	true mountain mahogany	2	Rosaceae	N	NI (UPL)
Chenopodium fremontii	S. Wats.	Fremont's goosefoot	4	Chenopodiaceae	N	NI (FAC)
Chilopsis linearis	(Cav.) Sweet	desert willow	1	Bignoniaceae	N	NI (FAC)
Chilopsis linearis - adv regen	(Cav.) Sweet	desert willow		Bignoniaceae	N	NI (FAC)
Chilopsis linearis - mature	(Cav.) Sweet	desert willow		Bignoniaceae	N	NI (FAC)
Chrysothamnus nauseosus	(Pallas ex.Prush)Britt.	rubber rabbitbrush	2	Asteraceae	N	NI (FAC)
Cicuta douglasii	(DC.) Coult. & Rose	western water hemlock	4	Apiaceae	N	OBL
Clematis drummondii	Torr. & Gray	Drummond's clematis	4	Ranunculaceae	N	NI (FAC)
Clematis ligusticifolia	Nutt.	western white clematis	4	Ranunculaceae	N	FAC
Cleome serrulata	Pursh	Rocky Mountain beeplant	4	Capparaceae	N	FAC
Clitoria mariana	L.	butterfly pea	4	Fabaceae	N	NI (FAC)
Coeloglossum viride var. virescens	(Muhl. ex Willd.) Luer	longbract frog orchid	4	Orchidaceae	N	NI (OBL)
Conyza canadensis	(L.) Cronq.	Canadian horseweed	4	Asteraceae	N	FACU (FAC)
Cornus sericea ssp. sericea	L.	redosier dogwood	2	Cornaceae	N	FACW
Corydalis aurea ssp. aurea	Willd.	scrambledeggs	4	Fumariaceae	N	NI (FACU)
Croton texensis	(Klotzsch) Muell.-Arg.	Texas croton	4	Euphorbiaceae	N	NI (FACU)
Cucurbita foetidissima	Kunth	Missouri gourd	4	Cucurbitaceae	N	NI (FAC)
Cuscuta cuspidata	Engelm.	cusp dodder	4	Cuscutaceae	N	NI (UPL)
Cynodon dactylon	(L.) Pers.	bermudagrass	3	Poaceae		FACU

Table A.1. Gila, San Francisco and Mimbres Rivers Riparian Species List (Continued).

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Cyperus esculentus	L.	chufa flatsedge	3	Cyperaceae	N	FACW
Cyperus squarrosus	L.	bearded flatsedge	3	Cyperaceae	N	NI (FACW)
Dactylis glomerata	L.	orchardgrass	3	Poaceae	I	FACU+ (FAC)
Datura wrightii	Regel	sacred thornapple	4	Solanaceae	N	NI (FAC)
Descurainia pinnata ssp. halictorum	(Cockerell) Detling	western tanseymustard	4	Brassicaceae		NI (FACU)
Descurainia sophia	(L.) Webb ex Prantl	herb sophia	4	Brassicaceae		NI (FACU)
Dichanthelium oligosanthes	(J.A. Schultes) Gould	Heller's rosette grass	3	Poaceae	N	FACU (FACW)
Digitaria sanguinalis	(L.) Scop.	hairy crabgrass	3	Poaceae	N	FACU
Dugaldia hoopesii	(Gray) Rydb.	owlsclaws	4	Asteraceae	N	FAC+
Echinochloa crus-galli	(L.) Beauv.	barnyardgrass	3	Poaceae		FACW- (FACW)
Elaeagnus angustifolia - mature	L.	Russian olive		Elaeagnaceae		FACW-
Eleocharis palustris	(L.) Roemer & Shultes	common spikerush	3	Cyperaceae	N	OBL
Elymus canadensis	L.	Canada wildrye	3	Poaceae	N	FAC (FACW)
Elymus elymoides	(Raf.) Swezey	bottlebrush squirreltail	3	Poaceae	N	NI (FACU)
Elymus glaucus	Buckl.	blue wildrye	3	Poaceae	N	FACU
Elymus lanceolatus	(Scribn. & J.G. Sm.) Gould	streambank wheatgrass	3	Poaceae	N	NI (FACW)
Elymus trachycaulus	(Link.) Gould ex Shinners	slender wheatgrass	3	Poaceae	N	FAC
Epilobium ciliatum	Raf.	hairy willowherb	4	Onagraceae	N	FACW
Equisetum arvense	L.	field horsetail	4	Equisetaceae	N	FACW- (FACW)
Equisetum laevigatum	A. Braun	smooth horsetail	4	Equisetaceae	N	FACW
Eragrostis cilianensis	(All.) Lut. ex Janchen	stinkgrass	3	Poaceae		FACU+
Ericameria laricifolia	(Gray) Shinners	turpentine bush	2	Asteraceae	N	FACU (UPL)
Erigeron bellidiastrum	Nutt.	western daisy fleabane	4	Asteraceae	N	NI (FAC-)
Erigeron flagellaris	Gray	trailing fleabane		Asteraceae	N	FAC-
Eriogonum jamesii	Benth.	James' buckwheat		Polygonaceae	N	NI (FACU)
Eriogonum polycladon	Benth.	sorrel buckwheat		Polygonaceae	N	NI (FACU)

Table A.1. **Gila, San Franciso and Mimbres Rivers Riparian Species List (Continued).**

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Erodium cicutarium	(L.) L'Her. ex Ait.	redstem stork's bill				NI (UPL)
Erysimum asperum	(Nutt.) DC.	plains wallflower				NI (FACU)
Euphorbia chamaesula	Boiss.	mountain spurge				NI (FACU)
Fallugia paradoxa	(G. Don) Endl. ex Torr.	Apacheplume				NI (FAC)
Festuca arizonica	Vasey	Arizona fescue				NI (FACU)
Festuca pratensis	Huds.	meadow fescue				NI (FAC)
Forestiera pubescens var. pubescens	Nutt.	New Mexico olive			N	FACU (FAC)
Fragaria vesca ssp. americana	(Porter) Staudt	woodland strawberry			N	NI (FACU)
Frangula californica ssp. ursina	(Greene) Kartesz & Gandhi	California buckthorn			N	NI (FACU)
Frasera speciosa	Dougl. ex Griseb.	showy frasera			N	NI (FACU)
Fraxinus velutina - adv regen	Torr.	velvet ash			N	FAC+ (FACW)
Fraxinus velutina - mature	Torr.	velvet ash			N	FAC+ (FACW)
Fraxinus velutina - yng regen	Torr.	velvet ash			N	FAC+ (FACW)
Gaillardia pulchella	Foug.	firewheel	4		N	NI (FACU)
Galium aparine	L.	stickywilly	4		N	FACU (FAC)
Gaura coccinea	Nutt. ex Pursh	scarlet beeblossom	4		N	NI (FACU)
Gaura parviflora	Dougl. ex Lehm.	velvetweed	4		N	NI (FACU)
Geranium caespitosum	James	pineywoods geranium	4		N	NI (FAC)
Geranium richardsonii	Fisch. & Trautv.	Richardson's geranium	4		N	FAC
Geum aleppicum	Jacq.	yellow avens	4		N	FAC-
Geum macrophyllum	Willd.	largeleaf avens	4		N	FACW
Glandularia wrightii	(Gray) Umber	Davis Mountain mock vervai	4		N	NI (FACU)
Gleditsia triacanthos - adv regen	L.	honeylocust			N	FAC
Gleditsia triacanthos - mature	L.	honeylocust	1		N	FAC
Gleditsia triacanthos - yng regen	L.	honeylocust	1		N	FAC
Glyceria grandis	S. Wats.	American mannagrass	3		N	OBL

Table A.1. Gila, San Franciso and Mimbres Rivers Riparian Species List (Continued).

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Glyceria striata	(Lam.) A.S. Hitchc.	fowl mannagrass	3	Poaceae	N	OBL
Gutierrezia sarothrae	(Pursh) Britt. & Rusby	broom snakeweed	2	Asteraceae	N	NI (UPL)
Gymnosperma glutinosum	(Spreng.) Less	gumhead	2	Asteraceae	N	NI (UPL)
Helianthus annuus	L.	common sunflower	4	Asteraceae	N	FAC-
Helianthus nuttallii	Torr. & Gray	Nuttall's sunflower	4	Asteraceae	N	FACW
Heliomeris multiflora	Nutt.	showy goldeneye	4	Asteraceae	N	NI (UPL)
Heterotheca subaxillaris	(Lam.) Britt. & Rusby	camphorweed	4	Asteraceae	N	NI (UPL)
Heuchera parvifolia	Nutt. ex Torr. & Gray	littleleaf alumroot	4	Saxifragaceae	N	NI (FAC)
Hordeum pusillum	Nutt.	little barley	3	Poaceae	N	FAC
Humulus americanus	Nutt.	American hops	4	Cannabaceae	N	NI (FACW)
Hymenoclea monogyra	Torr. & Gray ex Gray	singlewhorl burrobush	4	Asteraceae	N	NI (FAC)
Hypericum scouleri	Hook.	Scouler's St. Johnswort	4	Clusiaceae	N	NI (FAC)
Ipomoea purpurea	(L.) Roth	tall morningglory	4	Convolvulaceae	I	NI (FACU)
Ipomopsis aggregata	(Pursh) V. Grant	skyrocket gilia	4	Polemoniaceae	N	NI (FACU)
Iris missouriensis	Nutt.	Rocky Mountain iris	4	Iridaceae	N	FACW-
Isocoma tenuisecta	Greene	burroweed	2	Asteraceae	N	NI (UPL)
Juglans major - adv regen	(Torr.) Heller	Arizona walnut	1	Juglandaceae	N	FACW-
Juglans major - mature	(Torr.) Heller	Arizona walnut	1	Juglandaceae	N	FACW-
Juglans major - yng regen	(Torr.) Heller	Arizona walnut		Juglandaceae	N	FACW-
Juncus balticus	Willd.	Baltic rush		Juncaceae	N	OBL
Juncus bufonius	L.	toad rush		Juncaceae	N	OBL
Juncus longistylis	Torr.	longstyle rush		Juncaceae	N	FACW
Juncus saximontanus	A. Nels.	Rocky Mountain rush		Juncaceae	N	FACW
Juncus tenuis	Willd.	poverty rush		Juncaceae	N	FACW-
Juncus torreyi	Coville	Torrey's rush		Juncaceae	N	FACW (OBL)
Juniperus deppeana	Steud.	alligator juniper		Cupressaceae	N	NI (FACU)

Table A.1. Gila, San Franciso and Mimbres Rivers Riparian Species List (Continued).

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Juniperus deppeana - adv regen	Steud.	alligator juniper	1	Cupressaceae	N	NI (FACU)
Juniperus deppeana - mature	Steud.	alligator juniper	1	Cupressaceae	N	NI (FACU)
Juniperus deppeana - yng regen	Steud.	alligator juniper	1	Cupressaceae	N	NI (FACU)
Juniperus monosperma	(Engelm.) Sarg.	oneseed juniper		Cupressaceae	N	NI (FACU)
Juniperus monosperma-adv regen	(Engelm.) Sarg.	oneseed juniper		Cupressaceae	N	NI (FACU)
Juniperus monosperma-mature	(Engelm.) Sarg.	oneseed juniper		Cupressaceae	N	NI (FACU)
Juniperus monosperma-yng regen	(Engelm.) Steud.	oneseed juniper		Cupressaceae	N	NI (FACU)
Juniperus scopulorum - adv regen	Sarg.	Rocky Mountain juniper		Cupressaceae	N	NI (FACU)
Juniperus scopulorum - mature	Sarg.	Rocky Mountain juniper		Cupressaceae	N	NI (FACU)
Juniperus scopulorum - yng regen	Sarg.	Rocky Mountain juniper		Cupressaceae	N	NI (FACU)
Kochia scoparia	L. Schrad	common kochia	4	Chenopodiaceae	I	FAC
Lactuca serriola	L.	prickly lettuce	4	Asteraceae		FAC
Lactuca tartarica var. pulchella	(Pursh) Breitung	blue lettuce	4	Asteraceae	N	NI (FAC)
Lappula occidentalis	(Gray) Higgens	flatspine stickseed	4	Boraginaceae	N	NI (FACU)
Leersia oryzoides	(L.) Sw.	rice cutgrass	3	Poaceae	N	OBL
Lemna minor	L.	common duckweed	4	Lemnaceae	N	OBL
Lobelia cardinalis	L.	cardinalflower	4	Campanulaceae	N	OBL
Lotus wrightii	(Gray) Greene	Wright's deervetch	4	Fabaceae	N	NI (FACU)
Lycium pallidum	Miers	pale wolfberry	2	Solanaceae	N	NI (FACW)
Machaeranthera asteroides	(Torr.) Greene	New Mexico tansyaster	4	Asteraceae	N	NI (FACU)
Machaeranthera gracilis	(Nutt.) Shinners	slender goldenweed	4	Asteraceae	N	NI (FACU)
Machaeranthera pinnatifida var pinnatifida	(Nutt.)	lacy tansyaster	4	Asteraceae	N	NI (FACU)
Machaeranthera tanacetifolia	(Kunth) Nees	tanseyleaf aster	4	Asteraceae	N	NI (FACU)
Marrubium vulgare	L.	horehound	4	Lamiaceae	I	FAC+
Medicago lupulina	L.	black medick	4	Fabaceae	I	FAC
Melilotus officinalis	(L.) Lam	yellow sweetclover	4	Fabaceae	I	FACU+

Table A.1. **Gila, San Franciso and Mimbres Rivers Riparian Species List (Continued).**

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Mentha arvensis	L.	wild mint		Lamiaceae	N	FACW
Mentha spicata	L.	spearmint		Lamiaceae	I	FACW
Mentzelia albicaulis	(Dougl.ex Hook.)Dougl.ex Torr.	whitestem blazingstar		Loasaceae	N	NI (FAC)
Mentzelia nuda	(Pursh) Torr. & Gray	bractless blazingstar		Loasaceae	N	NI (FACU)
Mimulus guttatus	DC.	seep monkeyflower		Scrophulariaceae	N	OBL
Mirabilis longiflora	L.	sweet four o'clock		Nyctaginaceae	N	NI (FACW)
Monarda fistulosa	L.	wildbergamot beebalm		Lamiaceae	N	FAC+
Monarda fistulosa ssp. fistulosa	L.	wildbergamot beebalm		Lamiaceae	N	NI (FAC+)
Monarda punctata	L.	spotted beebalm		Lamiaceae	N	NI (FAC+)
Morus microphylla	Buckl.	Texas mulberry		Moraceae	N	FAC
Muhlenbergia racemosa	(Michx.) B.S.P.	marsh muhly		Poaceae	N	FACW
Muhlenbergia rigens	(Benth.) A.S. Hitchc.	deergrass		Poaceae	N	FACW
Oenothera villosa	Thunb.	hairy eveningprimrose		Onagraceae	N	FACW
Opuntia imbricata	(Haw.) DC.	tree cholla		Cactaceae	N	NI (UPL)
Opuntia phaeacantha	Engelm.	tulip pricklypear		Cactaceae	N	NI (UPL)
Oxalis alpina	(Rose) Rose ex R. Knuth	alpine woodsorrel		Oxalidaceae	N	NI (FACU)
Oxalis dillenii	Jacq.	Dillen's oxalis		Oxalidaceae	N	NI (FACU)
Panicum capillare	L.	witchgrass		Poaceae	N	FAC
Panicum virgatum	L.	switchgrass		Poaceae	N	FAC+
Parthenocissus quinquefolia var. quinquefolia	(L.) Planch.	Virginia creeper		Vitaceae	N	NI (FACW)
Pascopyrum smithii	(Rydb.) Love	western wheatgrass		Poaceae	N	NI (FACU)
Paspalum distichum	L.	knotgrass		Poaceae	N	OBL
Penstemon barbatus	(Cav.) Roth.	beardlip penstemon		Scrophulariaceae	N	NI (UPL)
Penstemon pseudospectabilis	Jones	desert penstemon		Scrophulariaceae	N	NI (UPL)
Penstemon pseudospectabilis v. connatifolius	(A. Nels.) Keck	desert beardtongue		Scrophulariaceae	N	NI (UPL)
Phleum pratense	L.	timothy		Poaceae	I	FACU

Table A.1. Gila, San Francisco and Mimbres Rivers Riparian Species List (Continued).

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Phoradendron macrophyllum ssp. macrophyllum	(Engelm.) Cockerell	Colorado Desert mistletoe		Viscaceae	N	NI (UPL)
Pinus edulis	Engelm.	pinyon pine		Pinaceae	N	NI (FACU)
Pinus edulis - adv regen	Engelm.	pinyon pine		Pinaceae	N	NI (FACU)
Pinus edulis - yng regen	Engelm.	pinyon pine		Pinaceae	N	NI (FACU)
Pinus ponderosa - mature	P. & C.Lawson	ponderosa pine		Pinaceae	N	NI (FACU)
Pinus ponderosa - yng regen	P. & C. Lawson	ponderosa pine		Pinaceae	N	NI (FACU)
Piptochaetium fimbriatum	(H.B.K.) Hitchc.	pinyon ricegrass	3	Poaceae	N	NI (FACU)
Plantago major	L.	common plantain	4	Plantaginaceae	N	FACW
Platanus wrightii - adv. regen	S. Wats.	Arizona sycamore		Platanaceae	N	FACW- (FACW)
Platanus wrightii - mature	S. Wats.	Arizona sycamore		Platanaceae	N	FACW- (FACW)
Platanus wrightii - yng regen	S. Wats.	Arizona sycamore		Platanaceae	N	FACW- (FACW)
Pluchea sericea	(Nutt.)Cav.	arrowweed		Asteraceae	N	FACW-
Poa pratensis	L.	Kentucky bluegrass		Poaceae	N	FACU
Polemonium foliosissimum	Gray	towering Jacobsladder		Polemoniaceae	N	FAC
Polygala alba	Nutt.	white milkwort		Polygalaceae	N	NI (FACW-)
Polygonum amphibium	L.	water knotweed		Polygonaceae	N	OBL
Polygonum lapathifolium	L.	curlytop knotweed		Polygonaceae	N	OBL
Polypogon monspeliensis	(L.) Desf.	annual rabbitsfoot grass		Poaceae	I	FACW+ (OBL)
Polypogon viridis	(Gouan) Breistroffer	beardless rabbitsfoot		Poaceae	I	FACW+ (OBL)
Populus angustifolia - adv regen	James	narrowleaf cottonwood		Salicaceae	N	FACW (OBL)
Populus angustifolia - yng regen	James	narrowleaf cottonwood		Salicaceae	N	FACW (OBL)
Populus angustifolia- mature	James	narrowleaf cottonwood		Salicaceae	N	FACW (OBL)
Populus fremontii - adv regen	S. Wats.	Fremont's cottonwood		Salicaceae	N	FACW (OBL)
Populus fremontii - mature	S. Wats.	Fremont's cottonwood		Salicaceae	N	FACW (OBL)
Populus fremontii - seedling	S. Wats.	Fremont's cottonwood		Salicaceae	N	FACW (OBL)
Populus fremontii - yng regen	S. Wats.	Fremont's cottonwood		Salicaceae	N	FACW (OBL)

Table A.1. Gila, San Franciso and Mimbres Rivers Riparian Species List (Continued).

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Populus x acuminata - adv regen	Rydb.	lanceleaf cottonwood		Salicaceae	N	FACW (OBL)
Populus x acuminata - mature	Rydb.	lanceleaf cottonwood		Salicaceae	N	FACW (OBL)
Potentilla norvegica	L.	Norwegian cinquefoil	4	Rosaceae	N	FAC
Potentilla pulcherrima	Lehm.	beautiful cinquefoil	4	Rosaceae	N	NI (FACW)
Prosopis glandulosa	Torr.	honey mesquite	2	Fabaceae	N	NI (FACU)
Prosopis glandulosa - mature	Torr.	honey mesquite	2	Fabaceae	N	NI (FACU)
Prosopis velutina	Woot.	velvet mesquite	2	Fabaceae	N	NI (FACU)
Prunella vulgaris	L.	common selfheal	4	Lamiaceae	N	FACW-
Prunus serotina	Ehrh.	black cherry	2	Rosaceae	N	FACU (FACW)
Ptelea trifoliata	(Benth.) M.E. Jones	common hoptree	2	Rutaceae	N	FACU
Quercus emoryi	Torr.	Emory's oak		Fagaceae	N	FAC
Quercus emoryi - adv regen	Torr.	Emory's oak		Fagaceae	N	FAC
Quercus emoryi - mature	Torr.	Emory's oak	1	Fagaceae	N	FAC
Quercus emoryi - yng regen	Torr.	Emory's oak	1	Fagaceae	N	FAC
Quercus gambelii	Nutt.	Gambel's oak		Fagaceae	N	NI (FACU)
Quercus gambelii - adv regen	Nutt.	Gambel's oak	1	Fagaceae	N	NI (FACU)
Quercus gambelii - mature	Nutt.	Gambel's oak	1	Fagaceae	N	NI (FACU)
Quercus gambelii - yng regen	Nutt.	Gambel's oak		Fagaceae	N	NI (FACU)
Quercus grisea	Liebm.	gray oak		Fagaceae	N	NI (FAC)
Quercus grisea - mature	Liebm.	gray oak	1	Fagaceae	N	NI (FAC)
Quercus grisea - yng regen	Liebm.	gray oak	1	Fagaceae	N	NI (FAC)
Quercus hypoleucoides	A. Camus	silverleaf oak		Fagaceae	N	NI (FACU)
Ranunculus aquatilis	L.	whitewater crowfoot	4	Ranunculaceae	N	OBL
Ranunculus cymbalaria	Pursh	alkali buttercup	4	Ranunculaceae	N	OBL
Ratibida columnifera	(Nutt.) Woot. & Standl.	upright prairie coneflower	4	Asteraceae	N	NI (FAC)
Rhus copallinum	L.	flameleaf sumac	2	Anacardiaceae	N	NI (FACU)

Table A.1. Gila, San Francisco and Mimbres Rivers Riparian Species List (Continued).

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Rhus glabra	L.	smooth sumac	2	Anacardiaceae	N	NI (FACU)
Rhus trilobata var. trilobata	Nutt.	skunkbush sumac	2	Anacardiaceae	N	NI (FAC)
Ribes americanum	P. Mill.	American black currant	2	Grossulariaceae	N	FACW
Rorippa nasturtium-aquaticum	(L.) Hayek	watercress	4	Brassicaceae	I	OBL
Rorippa sphaerocarpa	(Gray) Britt.	roundfruit yellowcress	4	Brassicaceae	N	OBL
Rosa woodsii	Lindl.	Woods' rose	2	Rosaceae	N	FACU
Rudbeckia laciniata	L.	cutleaf coneflower	4	Asteraceae	N	FACW- (FACW)
Rumex acetosella	L.	common sheep sorrel	4	Polygonaceae	I	FACW
Rumex crispus	L.	curly dock	4	Polygonaceae	I	FACW
Rumex salicifolius	Weinm.	willow dock	4	Polygonaceae	N	FACW
Salix exigua	Nutt.	coyote willow	2	Salicaceae	N	OBL
Salix gooddingii - adv regen	Ball	Goodding's willow	1	Salicaceae	N	OBL
Salix gooddingii - mature	Ball	Goodding's willow	1	Salicaceae	N	OBL
Salix gooddingii - seedling	Ball	Goodding's willow	1	Salicaceae	N	OBL
Salix gooddingii - yng regen	Ball	Goodding's willow	1	Salicaceae	N	OBL
Salix irrorata	Anderss.	bluestem willow	2	Salicaceae	N	FACW+ (OBL)
Salix lutea	Nutt.	yellow willow	2	Salicaceae	N	OBL
Salsola kali	L.	prickly Russian thistle	4	Chenopodiaceae	I	FACU
Salvia reflexa	Hornem.	lanceleaf sage	4	Lamiaceae	N	NI (FAC)
Sambucus racemosa	L.	scarlet elderberry	2	Caprifoliaceae	N	FACU (FACW)
Scirpus americanus	Pers.	American bulrush	4	Cyperaceae	N	OBL
Scirpus tabernaemontani	K.C. Gmel.	softstem bulrush	3	Cyperaceae	N	OBL
Scrophularia parviflora	Woot. & Standl.	pineland figwort	4	Scrophulariaceae	N	NI (FACU)
Senecio neomexicanus	Gray	New Mexico groundsel	4	Asteraceae	N	NI (FACU)
Senecio sanguisorboides	Rydb.	burnet ragwort	4	Asteraceae	N	NI (FAC)
Senecio wootonii	Greene	Wooton's ragwort	4	Asteraceae	N	NI (FAC)

Table A.1. Gila, San Franciso and Mimbres Rivers Riparian Species List (Continued).

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Setaria leucopila	(Scrib. & Merr.) K. Schum.	streambed bristlegrass	3	Poaceae	N	NI (FACW)
Sisymbrium altissimum	L.	tall tumblemustard	4	Brassicaceae	I	FAC
Sisyrinchium montanum	Greene	mountain blueeyed grass	4	Iridaceae	N	FACW
Solanum elaeagnifolium	Cav.	silverleaf nightshade	4	Solanaceae	N	NI (FACU)
Solanum nigrum	L.	nightshade	4	Solanaceae	N	FAC
Solanum ptychanthum	Dunal	nightshade	4	Solanaceae	N	NI (FACU)
Solidago canadensis	L.	Canada goldenrod	2	Asteraceae	N	FACU (FAC)
Sonchus arvensis	(Britt. ex Arsene) G.N. Jones	field sowthistle	4	Asteraceae	I	NI (FACW)
Sonchus asper	(L.) Hill	spiny sowthistle	4	Asteraceae		NI (FACW)
Sphaeralcea fendleri	Gray	Fendler's globemallow	4	Malvaceae	N	NI (FACU)
Sporobolus airoides	(Torr.) Torr.	alkali sacaton	3	Poaceae	N	FAC
Sporobolus cryptandrus	(Torr.) Gray	sand dropseed	3	Poaceae	N	FACU- (FAC)
Sporobolus wrightii	Munro	giant sacaton	3	Poaceae	N	NI (FAC)
Stachys coccinea	Jacq.	scarlet hedgenettle	4	Lamiaceae	N	NI (FAC)
Stellaria media	(L.) Vill.	common chickweed	4	Caryophyllaceae		NI (FACU)
Tamarix chinensis	Lour	saltcedar		Tamaricaceae		NI (FACW)
Tamarix chinensis - adv regen	Lour.	saltcedar		Tamaricaceae		NI (FACW)
Tamarix chinensis - mature	Lour.	saltcedar		Tamaricaceae		NI (FACW)
Tamarix chinensis - seedling	Lour.	saltcedar		Tamaricaceae		NI (FACW)
Tamarix chinensis - yng regen	Lour.	saltcedar		Tamaricaceae		NI (FACW)
Taraxacum officinale	G.H. Weber ex Wiggers	common dandelion	4	Asteraceae		FACU
Thalictrum fendleri	Engelm. ex Gray	Fendler's meadowrue	4	Ranunculaceae	N	FACU-
Thermopsis rhombifolia var. montana	(Nutt.) Isely	mountain thermopsis	4	Fabaceae	N	NI (FACU)
Thlaspi arvense	L.	field pennycress	4	Brassicaceae		NI (UPL)
Toxicodendron radicans s. radicans	(L.) Kuntze	poison ivy	2	Anacardiaceae	N	NI (FAC)
Tragopogon pratensis	L.	meadow salsify	4	Asteraceae		NI (FAC)

Table A.1. **Gila, San Francisco and Mimbres Rivers Riparian Species List (Continued).**

Scientific Name	Authority	Common Name	LF	Family	Origin	Wetland Status
Trifolium fragiferum	L.	strawberry clover	4	Fabaceae	I	NI (FAC)
Trifolium pratense	L.	red clover	4	Fabaceae	I	NI (FAC)
Trifolium repens	L.	white clover	4	Fabaceae	I	NI (FAC)
Tripterocalyx carnea var. wootonii	(Standl.) L.A. Gal.	Wooton's sandpuffs	4	Nyctaginaceae	N	NI (FAC)
Typha latifolia	L.	broadleaf cattail	4	Typhaceae	N	OBL
Ulmus pumila - adv regen	L.	Siberian elm	1	Ulmaceae	I	NI (FAC)
Ulmus pumila - yng regen	L.	Siberian elm	1	Ulmaceae	I	NI (FAC)
Urtica doica	L.	stinging nettle	4	Urticaceae	I	NI (FACW)
Urtica gracilenta	Greene	mountain nettle	4	Urticaceae	N	NI (FACW)
Verbascum thapsus	L.	common mullein	4	Scrophulariaceae	I	NI (FAC)
Veronica americana	Schwein. ex Benth.	American speedwell	4	Scrophulariaceae	N	OBL
Vicia americana	Muhl. ex Willd.	american vetch	4	Fabaceae	N	NI (FACW)
Viola canadensis	L.	Canadian white violet	4	Violaceae	N	NI (FACW)
Viola nephrophylla var. arizonica	(Greene) Kearney & Peebles	Arizona bog violet		Violaceae	N	NI (FACW)
Vitis arizonica	Engelm.	canyon grape		Vitaceae	N	FAC (FACW)
Vulpia octoflora var. octoflora	(Walt.) Rydb.	sixweeks fescue		Poaceae	N	NI (FACU)
Xanthium strumarium	L.	rough cocklebur		Asteraceae	N	NI (FACW)

APPENDIX B.

Site Descriptions

What follows are detailed descriptions of all thirty-five sites that were field sampled and evaluated. Sites are ordered alphabetically by river, reach, and by site name, and correspond to the order in Table 8 of the text. Each site description contains information on vegetation composition, site characteristics, and site condition. Accompanying each description is 1) a site map with site boundaries, 2) a representative cross-section(s) of the site detailing typical vegetation community location in the landscape with their soil textures, and the modeled flows required to flood each community, and 3) a site photograph (not included for the Kelly Mesa site). On each map, primary site boundaries attempt incorporate the area field sampled and assessed, the 100-year floodplain, and stands of contiguous community types.

Watershed: Gila Watershed **River:** Beaver Creek **Reach:** Beaver Creek

Site Name: Kemp Mesa **Site Number:** 168 **Basin Number** 1504001

County: CATRON **Quad. Map Name:** WALL LAKE

Town: 1 S **Range:** 12W **Section:** 06 **Northing:** 3695570 **Easting** 767980

Data Sources: Ground reconnaissance; personal communication; field sampled

Site Quality: B

Site Description: The Kemp Mesa site is characterized by a lush American bulrush and common spikerush wetland that lines stream banks. Knotgrass, an obligate riparian species, is also common. Along the fringe of the floodplain Arizona walnut and boxelder predominate. Skunkbush sumac and California brickellbush are also common associates also. A small narrowleaf cottonwood and Arizona walnut forest also occurs at the mouth of a wash. Threats to this site include grazing, which is heavy in areas immediately downstream, and encroachment by herbaceous exotics. Otherwise, impacts are few, and riparian communities are in good condition.

Vegetation Communities:	Community Quality Ranks:
Arizona walnut/box elder	B
American bulrush/common spikerush	B+

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are common.
Grazing:	no	But other parts of the reach are heavily grazed and the site has been grazed in the past.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	yes	A small road bisects the small narrowleaf cottonwood forest
Mowing:	no	
Other Impacts:	yes	Old corrals are present.

Data

Cross Section: Beaver Creek 1

Plots: 95PD045 95PD046

Jurisdiction: private; Gila National Forest

Survey Date: 7/21/95

Investigators: Bradley, Durkin

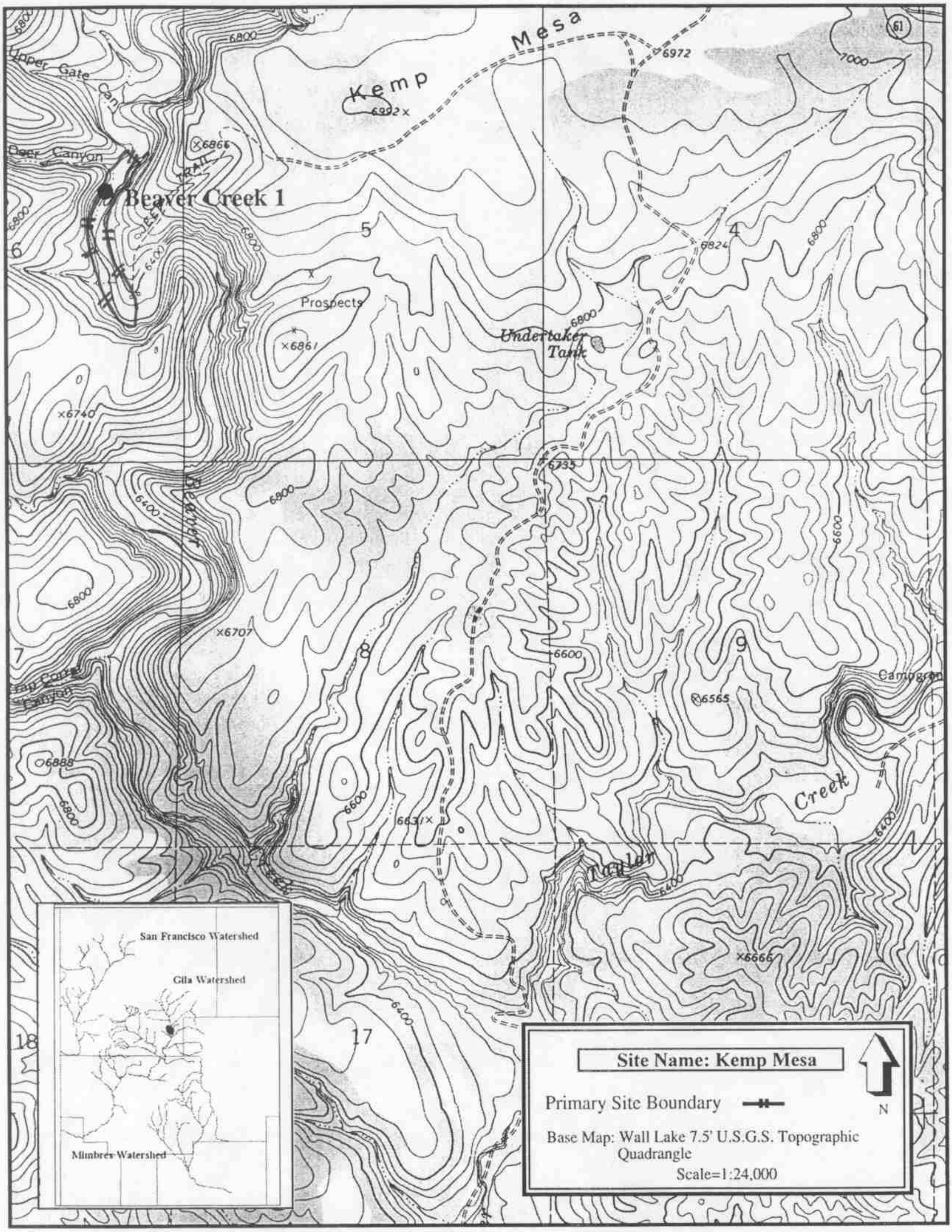

Figure B.1. The Kemp Mesa Site. Black dot indicates location of stream cross-section.

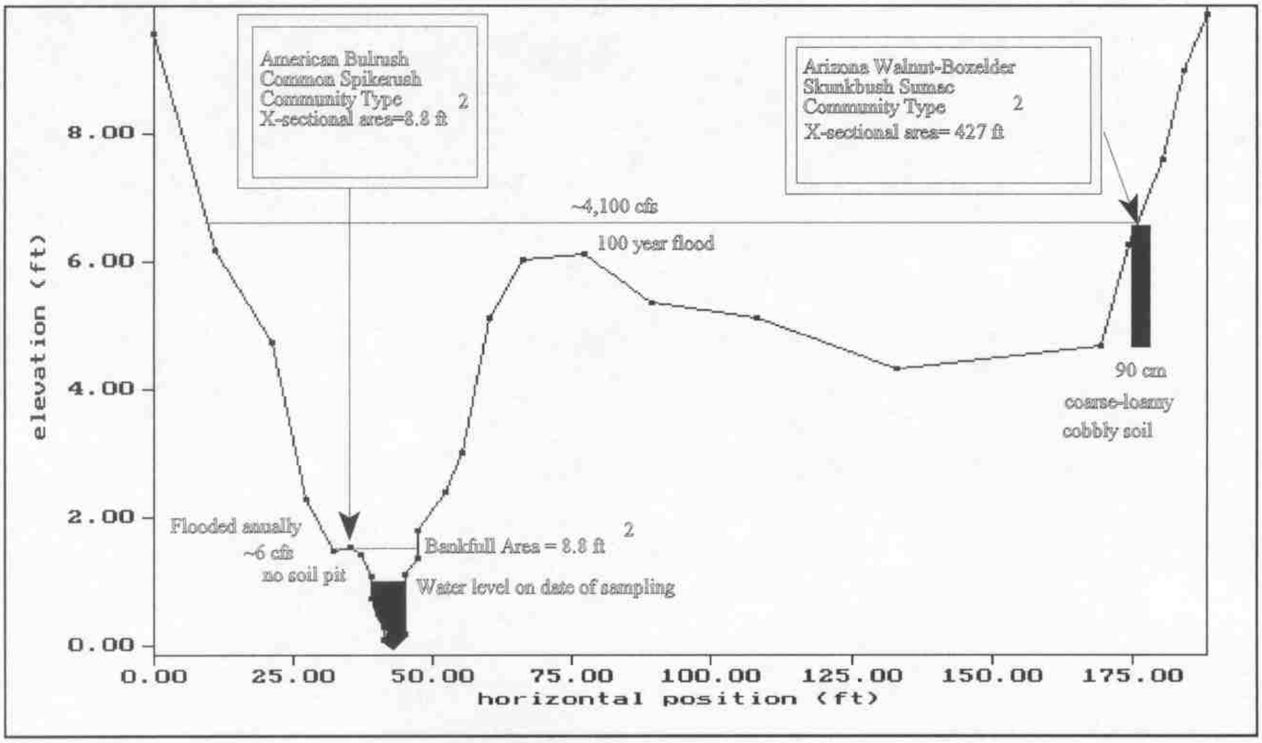

Figure B.2. Cross-section of Beaver Creek (Beaver Creek 1) at the Kemp Mesa Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.3 Beaver Creek at the Kemp Mesa Site. Wetland vegetation along streambanks consists primarily of American bulrush and spikerushes.

Watershed: Gila Watershed **River:** East Fork Gila **Reach:** Fall Spring

Site Name: Fall Spring **Site Number:** 171 **Basin Number** 15040001

County: CATRON **Quad. Map Name:** BURNT CORRAL CANYON

Town: 11S **Range:** 12W **Section:** 31 **Northing:** 3687290 **Easting** 767300

Data Sources: Personal communication; ground reconnaissance; field sampled

Site Quality: BC

Site Description: Fall Spring is a densely vegetated marsh, which borders the East Fork. It is composed primarily of American bulrush and common spikerush. Deeper water of the marsh are dominated by cattails and softstem bulrush. Other common graminoids include knotgrass, Baltic rush, and meadow fescue. Currently, the marsh is heavily grazed and its condition would improve greatly if the cattle were removed. Encroachment of saltcedar is a threat to this site as well.

Vegetation Communities:	Community Quality Ranks:
softstem bulrush/broadleaf cattail	B
American bulrush/common spikerush	B

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Excellent

Streambank Condition: Poor

Floodplain Impacts:

Exotic veg dominant:	no	But saltcedar is common upstream in willow communities as are herbaceous exotics.
Grazing:	yes	Heavy, both in the marsh and in the surrounding riparian area.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	no	
Mowing:	no	
Other Impacts:	no	

Data

Cross Section: East Fork

Plots: 95PD049 95PD048

Jurisdiction: Gila National Forest

Survey Date: 7/28/95

Investigators: Bradley, Durkin

Figure B.4. The Fall Spring Site. Black dot indicates location of stream cross-section.

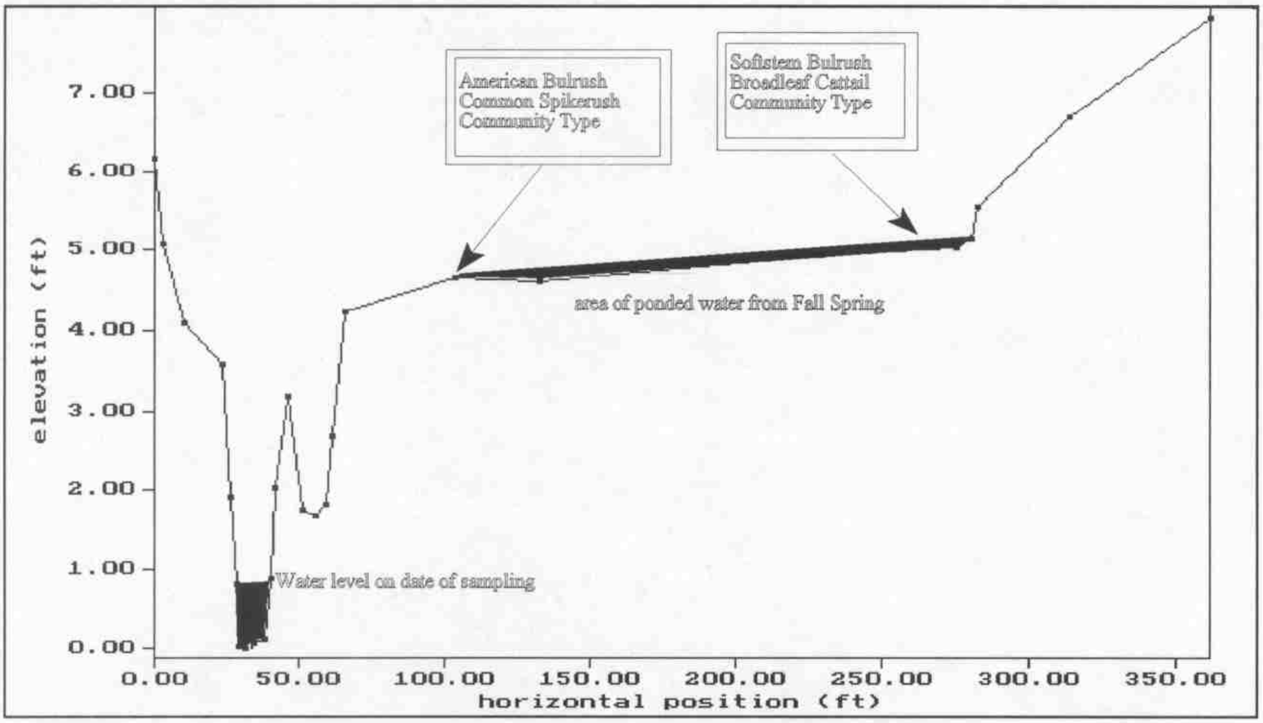

Figure B.5. Cross-section of Fall Spring (East Fork 1) at the Fall Spring Site showing the locations of the community types, water level required to flood them, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.6. The Fall Spring Site on the East Fork of the Gila River. The vegetation of the marsh consists primarily of bulrushes, spikerushes, and cattails. Note the streambanks of the East Fork are void of any shrubby vegetation.

Watershed: Gila Watershed **River:** Gila **Reach:** Cliff/Gila Valley

Site Name: Lower Valley **Site Number:** 183 **Basin Number** 15040002

County: GRANT **Quad. Map Name:** MANGAS SPRINGS

Town: 17S **Range:** 17W **Section:** 16 **Northing:** 3634560 **Easting** 723900

Data Sources: USFS videography; ground reconnaissance; field sampled

Site Quality: B

Site Description: The Lower Valley site is dominated by good quality stands of mature Fremont's cottonwood and Goodding's willow. Mature Arizona sycamores are also widely scattered. Overflow channels and side bars are dominanted by small young stands of Fremont's cottonwood and Goodding's willow with seepwillow interspersed. Arizona walnuts and netleaf hackberrys are common on talus slopes that the fringe of the floodplain. Base flows are lowered by a water diversion to Bill Evans Lake (appropriated for the copper mine). Encroachment by herbaceous exotics is a threat to this site.

Vegetation Communities:	Community Quality Ranks:
Arizona walnut/netleaf hackberry/California brickellbush	A
Fremont's cottonwood/Goodding's willow/seepwillow	B

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But a pasture in the floodplain is dominated by herbaceous exotics.
Grazing:	yes	The pasture is grazed moderately.
Fuel Wood:	unknown	
Dumping:	no	No evidence seen.
ORV Use:	no	
Roads:	yes	A road is in the floodplain.
Mowing:	unknown	
Other Impacts:	yes	Water is diverted for the copper mine.

Data

Cross Section: Gila 5

Plots: 95PD065 95PD066

Jurisdiction: Gila National Forest

Survey Date: 8/19/95

Investigators: Bradley, Durkin

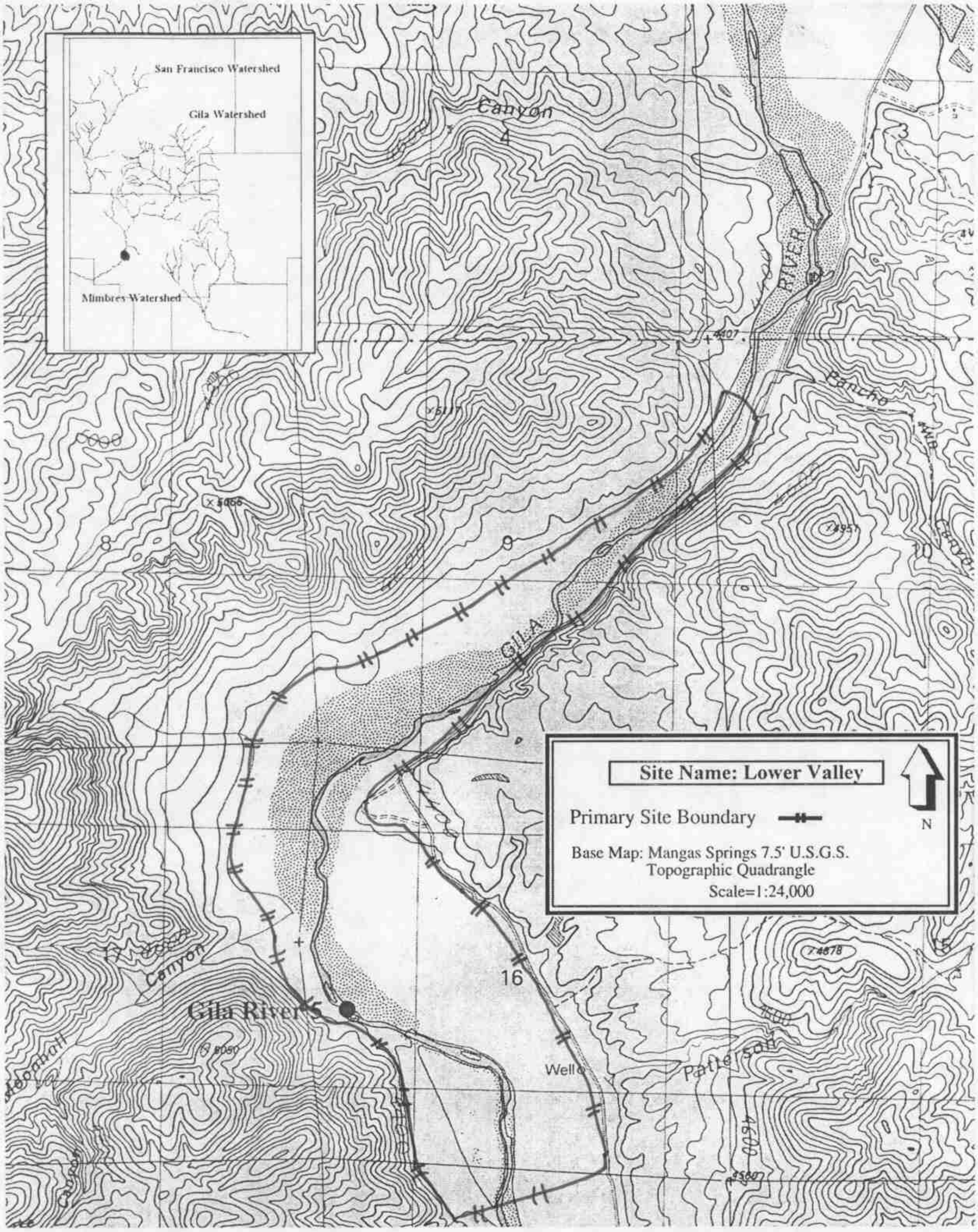

Figure B.7. The Lower Valley Site. Black dot indicates location of stream cross-section.

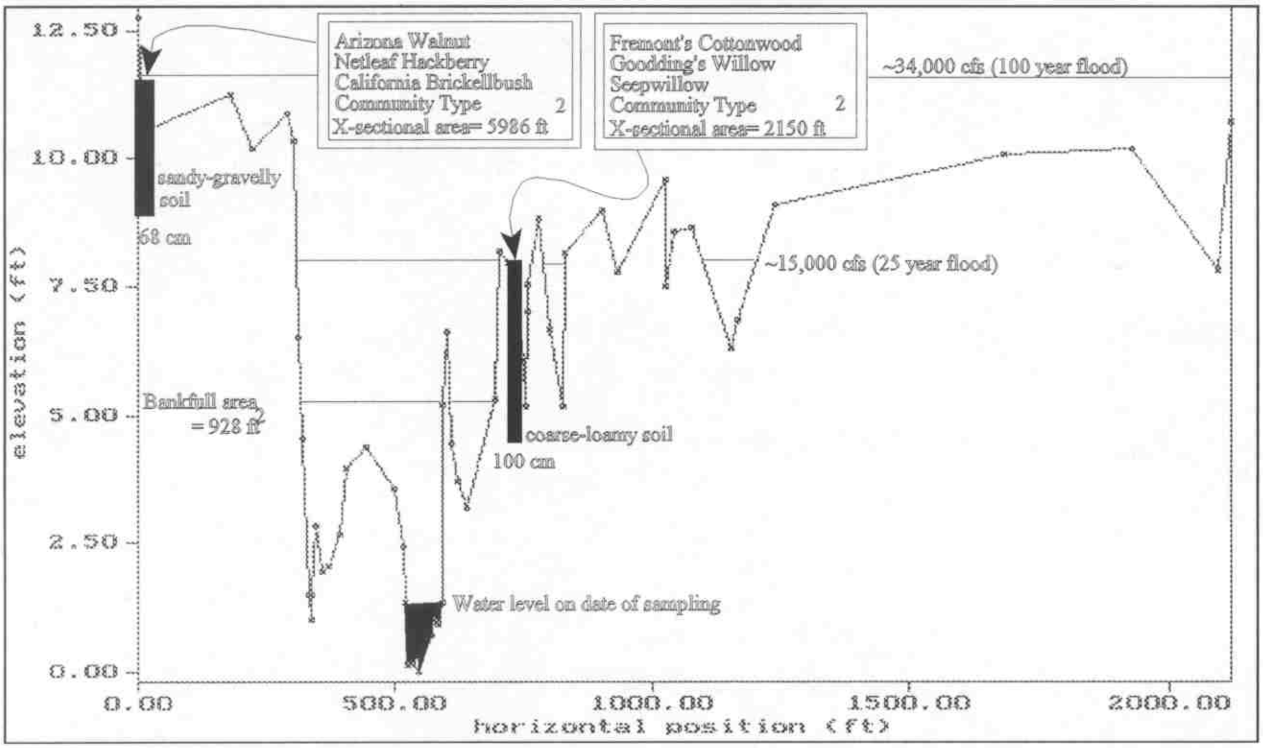

Figure B.8. Cross-section of the Gila River (Gila 5) at the Lower Valley Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.9. The Gila River at the Lower Valley Site just upstream of the Middle Box. Mature Fremont's cottonwoods and Goodding's willow dominate much of this site.

Watershed: Gila Watershed **River:** Gila **Reach:** Cliff/Gila Valley

Site Name: Upper Valley **Site Number:** 178 **Basin Number** 15040002

County: GRANT **Quad. Map Name:** CANTEEN CANYON

Town: 15S **Range:** 16W **Section:** 06 **Northing:** 3662810 **Easting** 735440

Data Sources: USFS videography; ground reconnaissance; field sampled

Site Quality: B

Site Description: The Upper Valley site begins at the confluence of Mogollon Creek and continues downstream for about a mile and a half. This is a wide floodplain with many overflow channels. Lateral movement of the main channel is common. Old isolated terraces are dominated by good quality stands of mature Arizona sycamore and Fremont's cottonwood, which also dominate much of the landscape. Understories of these forests tend to be dominated by herbaceous exotics including cheatgrass and Japanese brome. Young fluvial landforms are dominated by many high quality, small stands of Fremont's cottonwood and Goodding's willow with Arizona sycamores and seepwillow interspersed. Base flows are affected by an irrigation pond, which diverts approximately half of the rivers flow. A cement lined ditch carries water to the agricultural fields which are more common downstream. In addition, the most recent flood has scoured island and side bars and downcut some streambanks.

Vegetation Communities:	Community Quality Ranks:
Fremont's cottonwood/Arizona sycamore/seepwillow	B
Fremont's cottonwood/seepwillow	A
Fremont's cottonwood/Goodding's willow/seepwillow	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** Partial **Jetty Jacked** No

Leveed Partial **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are common, and black locusts and saltcedar are scattered.
Grazing:	no	No evidence seen.
Fuel Wood:	yes	Some collecting done for campfires.
Dumping:	no	No evidence seen.
ORV Use:	yes	ORV's drive on scoured bars.
Roads:	yes	Roads are in the floodplain and bisect riparian forests.
Mowing:	no	
Other Impacts:	yes	Part of a secondary channel is dredged to form an irrigation pond.

Data

Cross Section: Gila 2, Gila 7

Plots: 95PD060 95PD071 95PD008

Jurisdiction: private, Gila National Forest

Survey Date: 6/23/95

Investigators: Bradley, Durkin

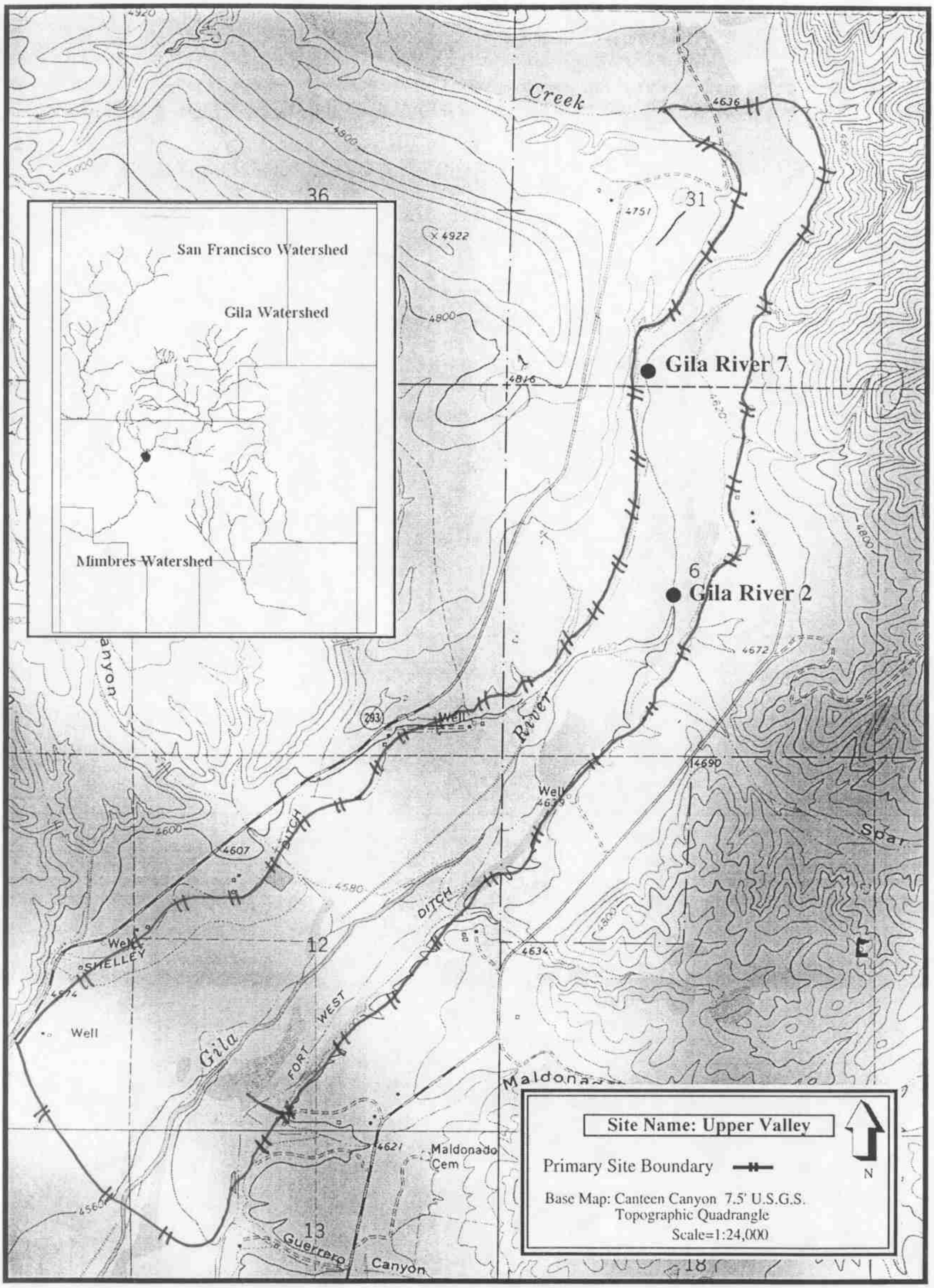

Figure B.10. The Upper Valley Site. Black dots indicate locations of stream cross-sections.

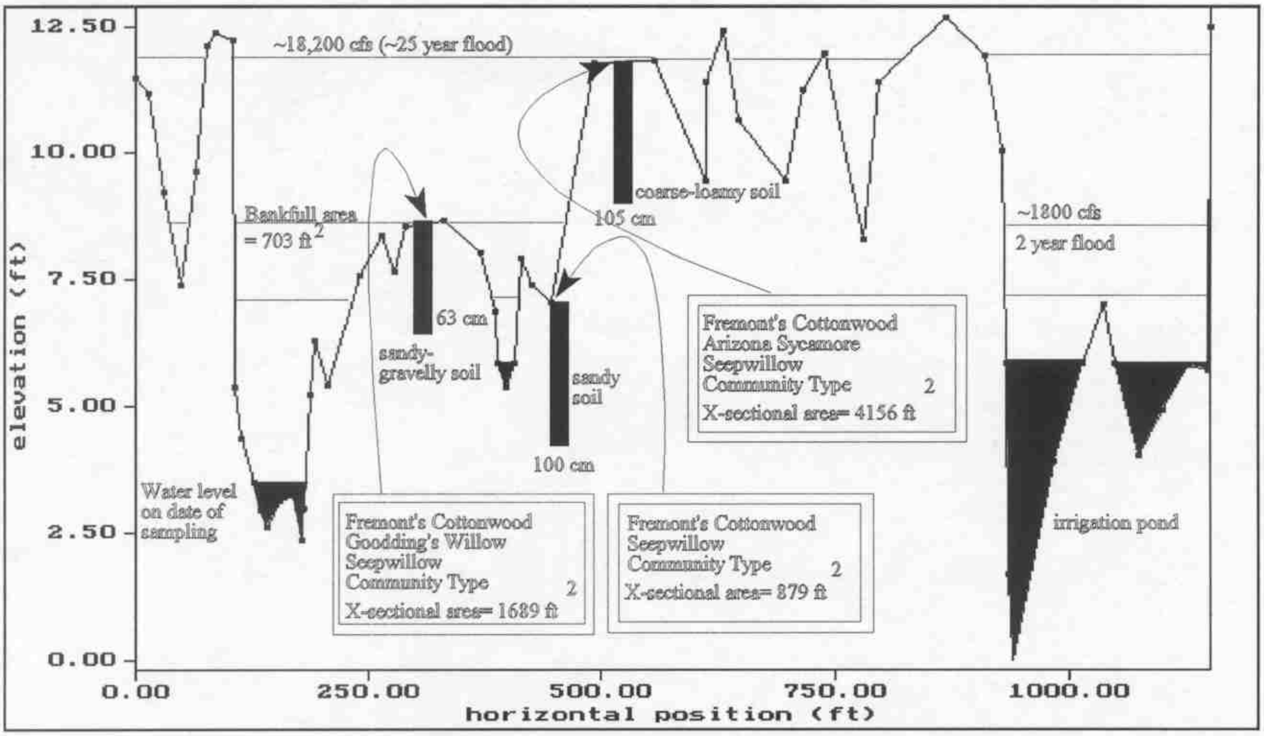

Figure B.11. Cross-section of the Gila River (Gila 2) at the Upper Valley Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

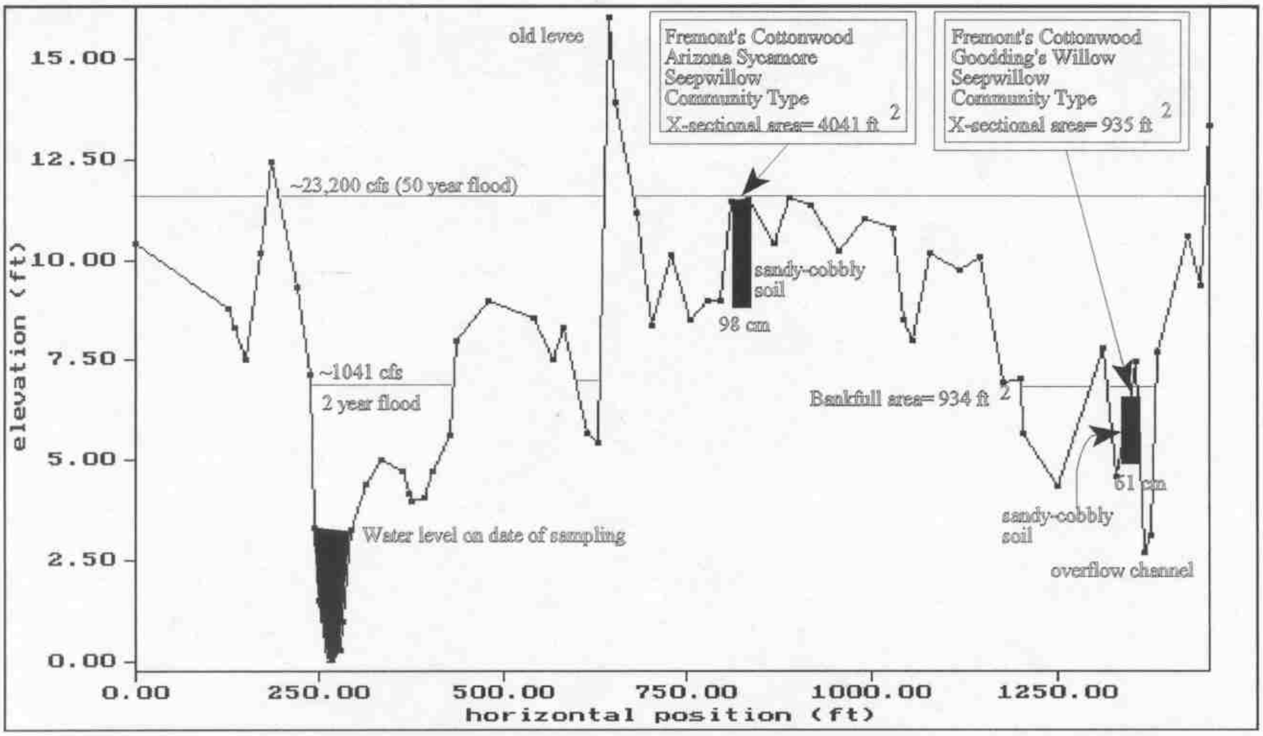

Figure B.12. Cross-section of the Gila River (Gila 7) at the Upper Valley Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.13. The Upper Valley Site on the Gila River. Mature Fremont's cottonwood and Arizona sycamore dominate much of the floodplain at this site.

Watershed: Gila Watershed **River:** Gila **Reach:** Gila Lower Box

Site Name: Gila Lower Box **Site Number:** 190 **Basin Number** 15040002

County: HIDALGO **Quad. Map Name:** NICHOLS CANYON

Town: 19S **Range:** 20W **Section:** 25 **Northing:** 3612340 **Easting** 701200

Data Sources: Ground reconnaissance; field sampled

Site Quality: AB

Site Description: The Lower Box is characterized by high quality shrubby riparian communities that consist primarily of seepwillows and young Fremont's cottonwood. In isolated areas where some deposition has occured, mature stands of Arizona sycamore and Fremont's cottonwood are common. Common associates in these mature stands include honey mesquite, burrobrush, and Rocky Mountain juniper. Lining the banks, in areas where the channel pools, knotgrass and common spikerush form a lush band along the river's edge. Other common graminoids include rice cutgrass, chufa flatsedge, and softstem bulrush. Since the area is routinely scoured, the effect of ORV use is unknown. If water levels change, encroachment of upland species may threaten this site.

Vegetation Communities:	Community Quality Ranks:
Fremont's cottonwood/Arizona sycamore/seepwillow	A
knotgrass/common spikerush	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are common.
Grazing:	no	Grazing on uplands is heavy.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	yes	ORV's drive on scoured side and island bars and occasionally ford the river.
Roads:		
Mowing:		
Other Impacts:	no	

Data

Cross Section: Gila 6

Plots: 95PD067 95PD068

Jurisdiction: BLM

Survey Date: 8/20/95

Investigators: Bradley, Durkin

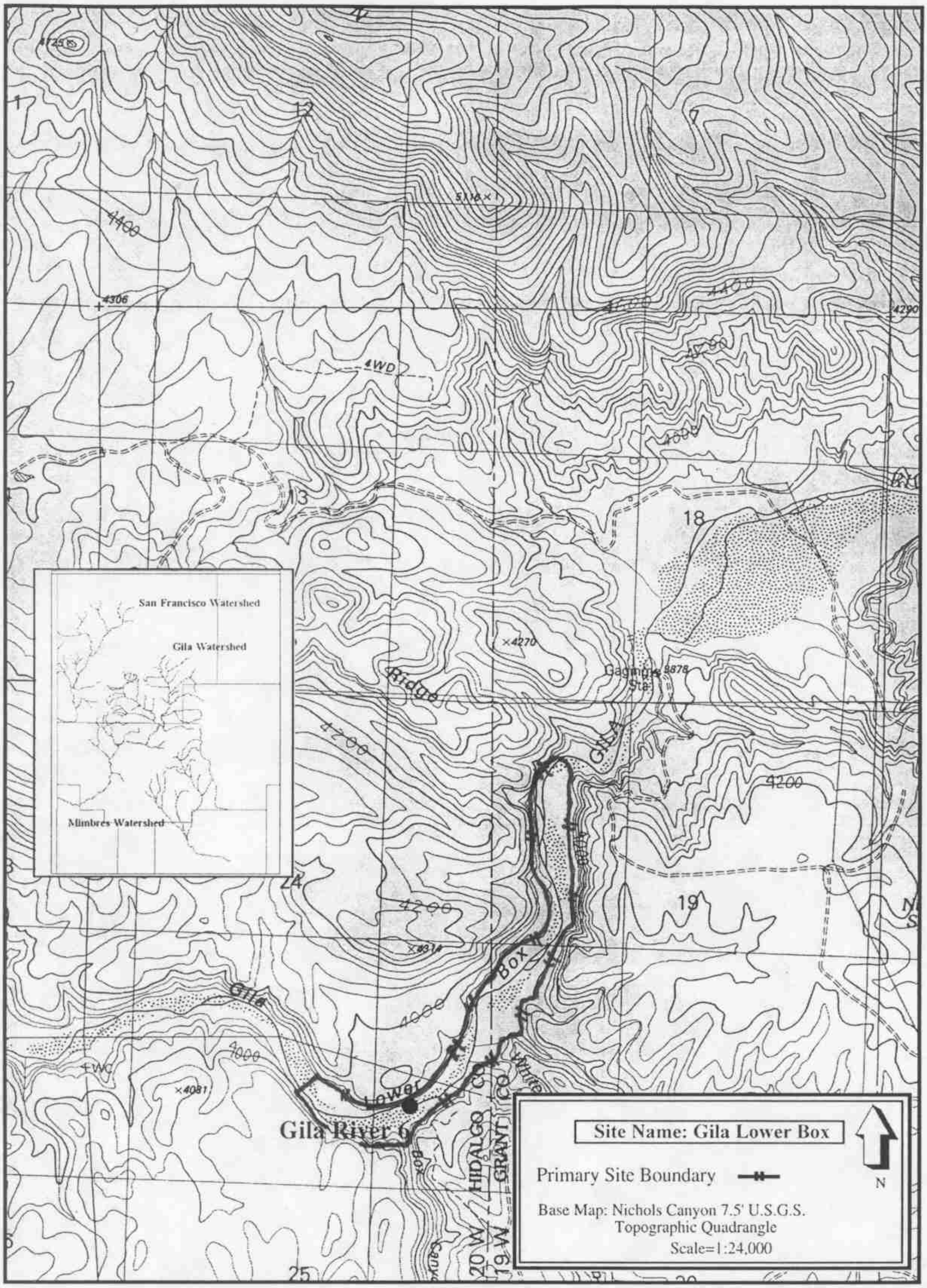

Figure B.14. The Lower Box Site. Black dot indicates location of stream cross-section.

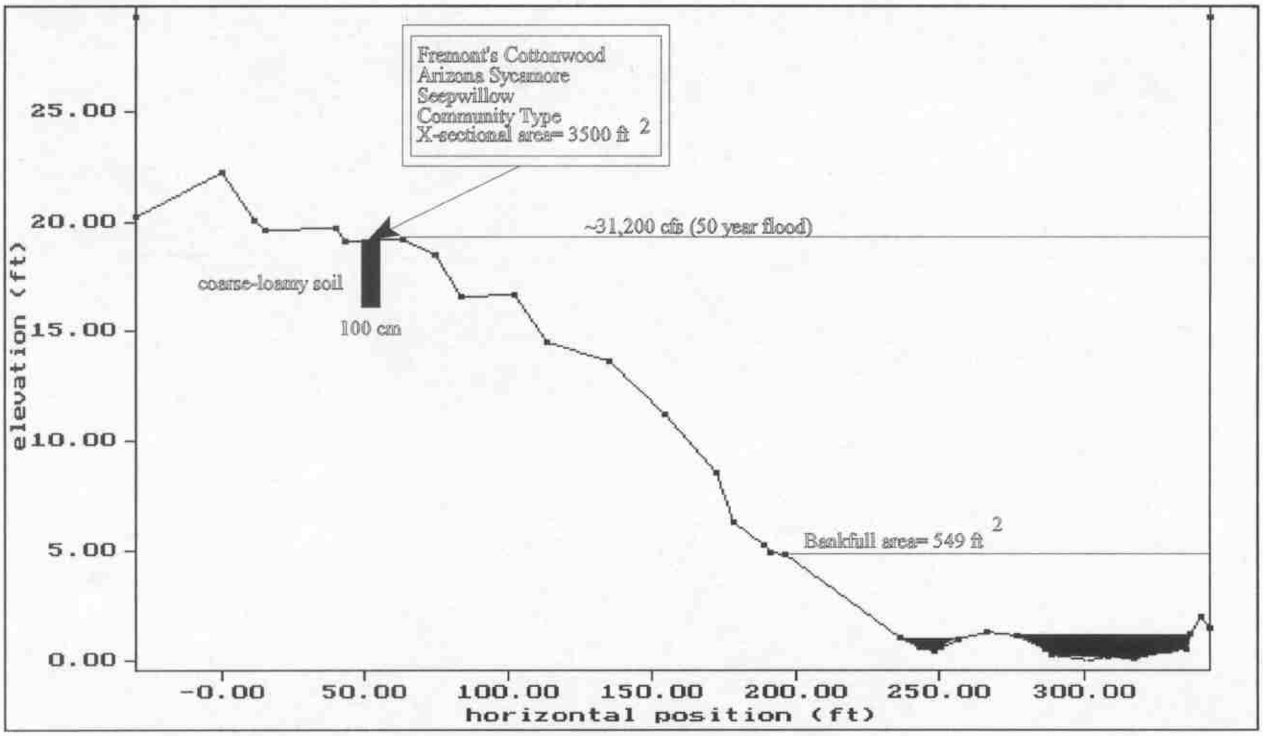

Figure B.15. Cross-section of the Gila River (Gila 6) at the Gila Lower Box Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.16. The Lower Box Site on the Gila River. The site contains nice stands of Fremont's Cottonwood–Arizona Sycamore and Seepwillow communities, as well as herbaceous communities along the banks of the channel.

Watershed: Gila Watershed **River:** Gila **Reach:** Redrock

Site Name: Harris Canyon **Site Number:** 188 **Basin Number** 15040002

County: GRANT **Quad. Map Name:** NICHOLS CANYON

Town: 19S **Range:** 19W **Section:** 01 **Northing:** 3618000 **Easting** 710180

Data Sources: Aerial reconnaissance; field sampled

Site Quality: BC

Site Description: Recent high flows at the Harris Canyon site have scoured much of the active floodplain. Riparian vegetation therefore consists primarily of either mature forests or very young seedlings. Small dense stands of juvenile cottonwoods are scattered. Mature riparian forests are in good to fair condition, but are extensive and consist primarily of stands of Fremont's cottonwood and Goodding's willow. These stands tend to be fragmented, but large occurrences are found (>1 Ha). Directly adjacent to the channel, on bars that are saturated, seedlings of Fremont's cottonwood and Goodding's willow occur. Also common on these nursery bars are seedlings of saltcedar. Herbaceous exotics such as whiteclover and sweetclover are common as well. Base flows are reduced by irrigation diversions. Further encroachment by exotics threatens this site.

Vegetation Communities:	**Community Quality Ranks:**
Fremont's cottonwood/Goodding's willow	B
Fremont's cottonwood/Goodding's willow/seepwillow	C

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed Partial **Overall Hydrologic Regime:** Fair

Streambank Condition: Fair

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are common in pastures and saltcedar is widely scattered.
Grazing:	yes	Pastures in floodplain are heavily grazed.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	yes	Roads are on the fringe of the floodplain.
Mowing:	no	
Other Impacts:	yes	Irrigation diversions may affect base flows.

Data

Cross Section: Gila 4

Plots: 95PD063 95PD064

Jurisdiction: private, BLM

Survey Date: 8/17/95

Investigators: Bradley, Durkin, Muldavin, Gruver

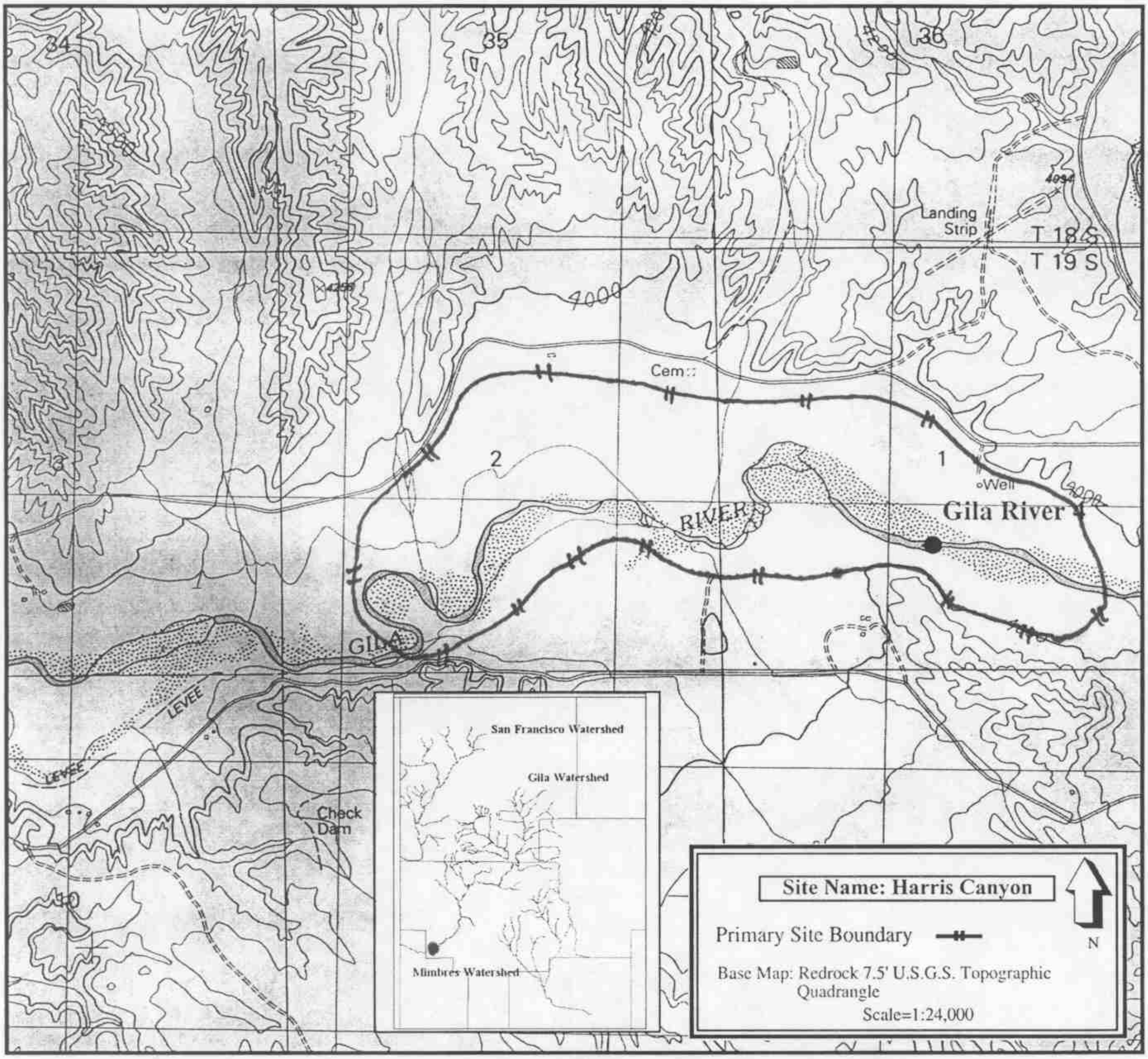

Figure B.17. The Harris Canyon Site. Black dot indicates location of stream cross-section.

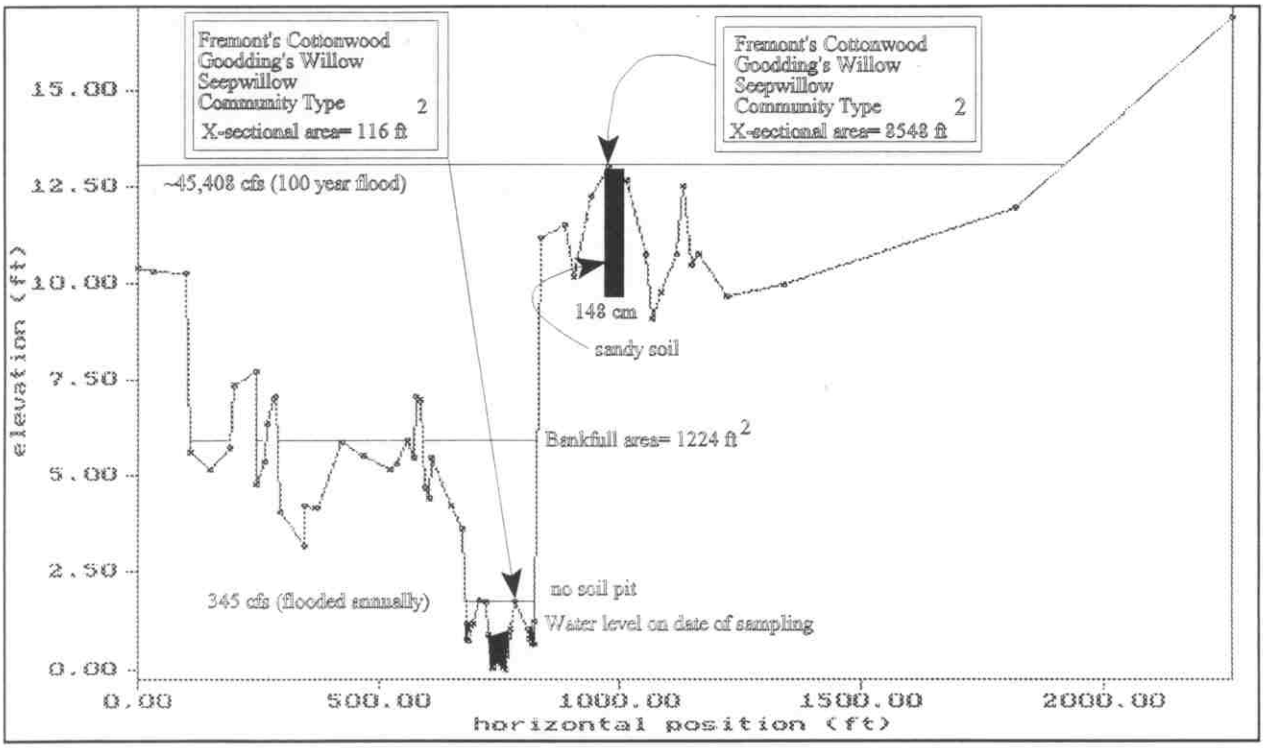

Figure B.18. Cross-section of the Gila River (Gila 4) at the Harris Canyon Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

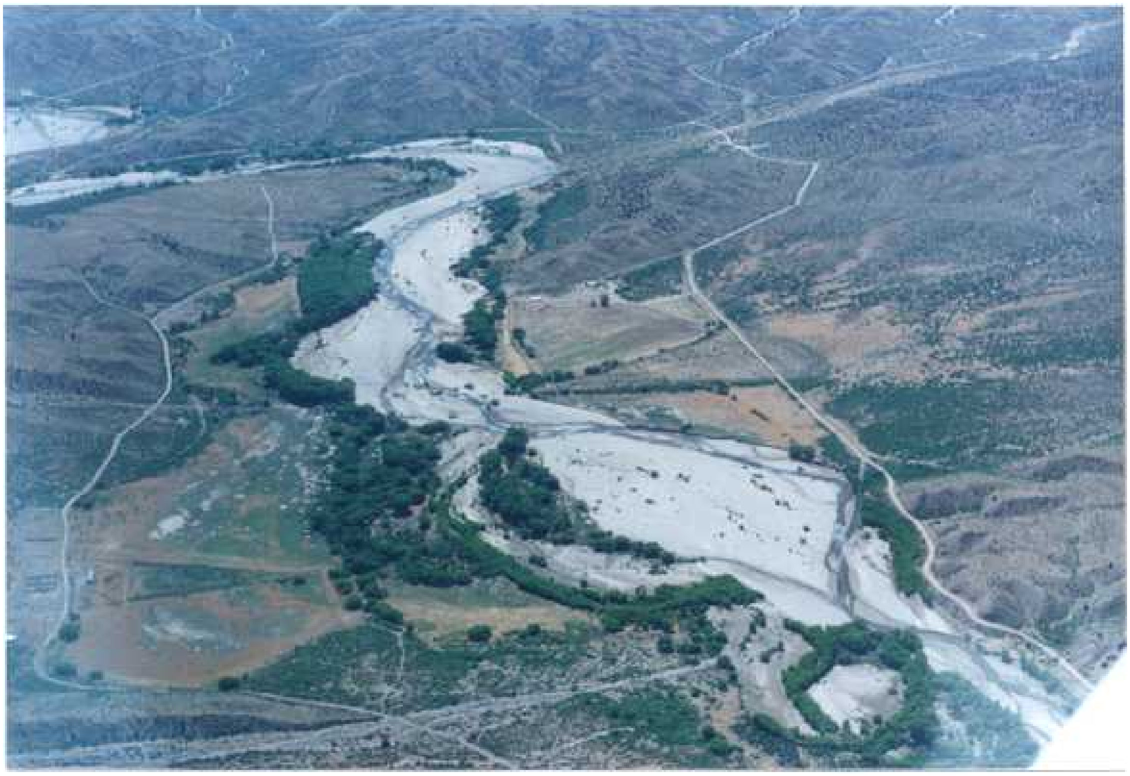

Photo: Paula Durkin

Figure B-19. The Harris Canyon Site on the Gila River near Redrock. Many of the young seral communities have been scoured at this site. However, some big stands of mature Fremont's cottonwood remain.

Watershed: Gila Watershed **River:** Gila **Reach:** Upper Mainstem

Site Name: Alum Mountain **Site Number:** 167 **Basin Number** 15040001

County: CATRON **Quad. Map Name:** GILA HOT SPRINGS

Town: 13S **Range:** 13W **Section:** **Northing:** 3672420 **Easting** 760460

Data Sources: Ground reconnaisance; field sampled

Site Quality: AB

Site Description: The Alum Mountain site is characterized by narrow stands of Arizona alder with a dense understory that is dominated by rice cutgrass. Elevated cobble bars are dominated by rubber rabbitbrush with a grassy understory that is of sand dropseed. Mature trees are widely scattered on terraces but include Arizona sycamore, lanceleaf and narrowleaf cottonwoods, and boxelder. The fringes of the floodplain are dominated by netleaf hackberry and Arizona walnut although oaks and junipers are very common as well. Encroachment by weedy herbaceous exotics (primarily white clover) is a threat, but presently other impacts are few and the riparian communities are in excellent condition.

Vegetation Communities:	Community Quality Ranks:
Arizona alder/rice cutgrass	A
Arizona walnut/netleaf hackberry	B
rubber rabbitbrush/sand dropseed	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are common.
Grazing:	no	No evidence seen.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	no	
Mowing:	no	
Other Impacts:	yes	A hiking trial and use by recreational bathers.

Data

Cross Section: Gila 1

Plots: 95PD052 95PD053

Jurisdiction: Gila National Forest

Survey Date: 8/4/95

Investigators: Bradley, Durkin

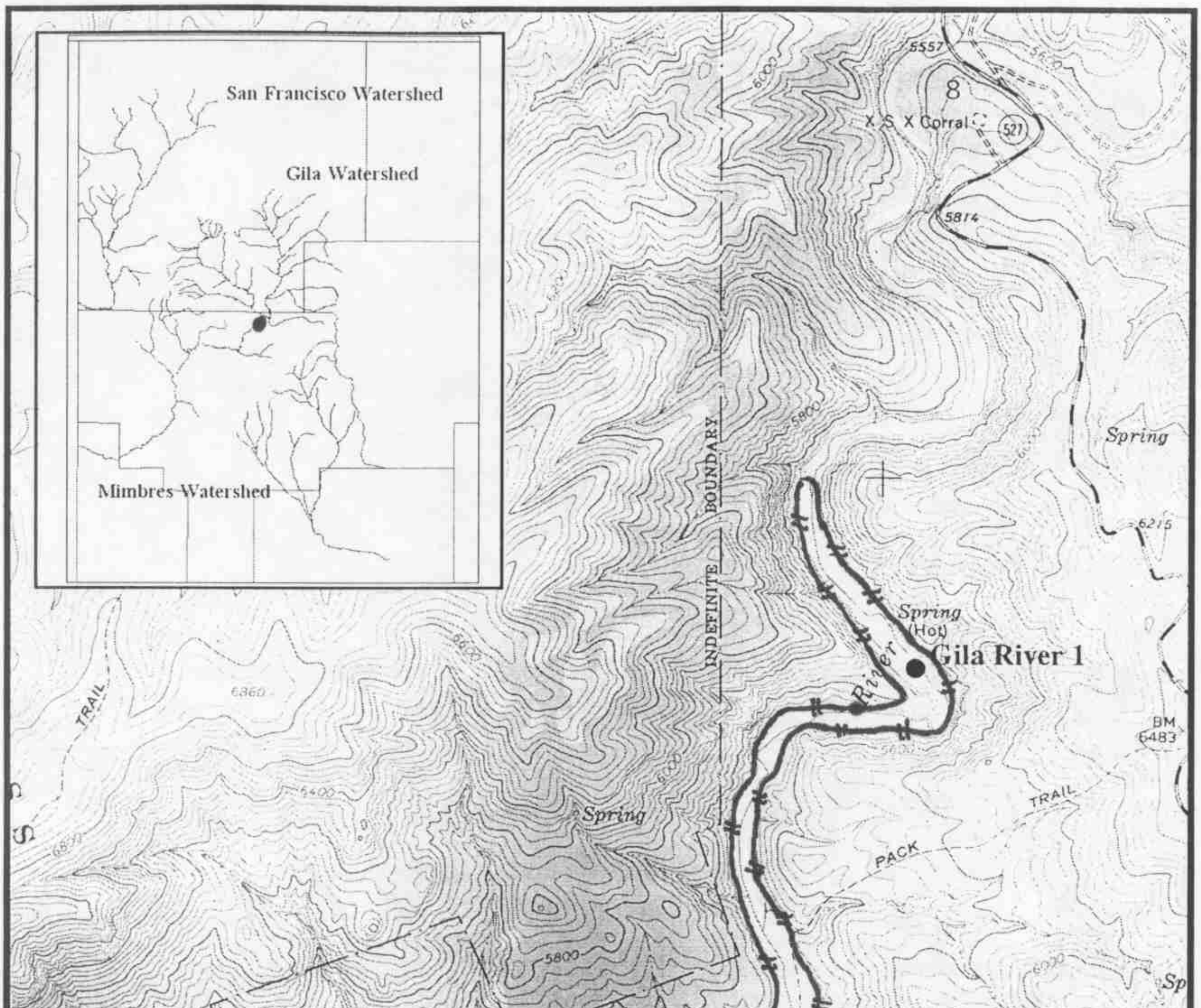

Figure B.20. The Alum Mountain Canyon Site. Black dot indicates location of stream cross-section.

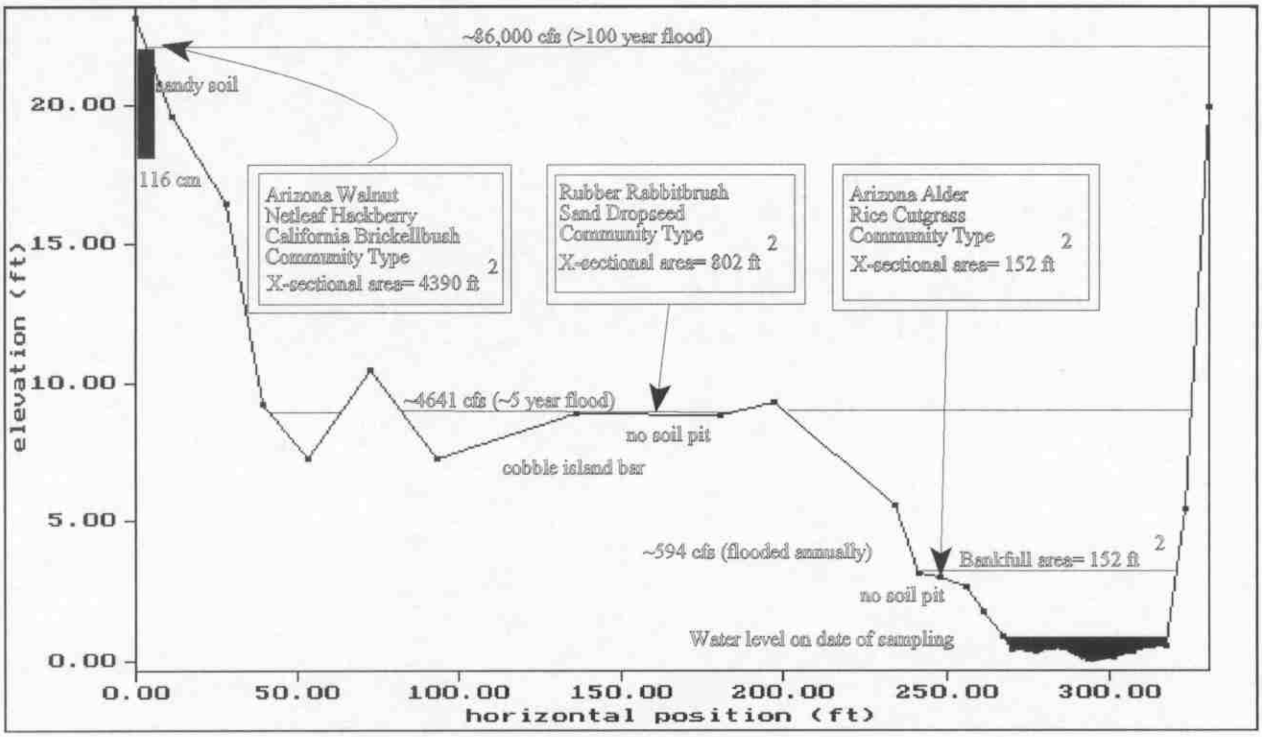

Figure B.21. Cross-section of the Gila River (Gila 1) at the Alum Mountain Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.22. The Alum Mountain Site on the Gila River. Streambanks at this site are composed primarily of Arizona alders and rice cutgrass.

Watershed: Gila Watershed **River:** Gila **Reach:** Upper Mainstem

Site Name: Cave Canyon **Site Number:** 175 **Basin Number** 15040001

County: GRANT **Quad. Map Name:** CANYON HILL

Town: 14S **Range:** 16W **Section:** **Northing:** 3662810 **Easting** 735440

Data Sources: Ground reconnaissance; field sampled

Site Quality: B

Site Description: Terraces of the Hidden Pasture site are infrequent, but are dominated by high quality stands of mature Arizona sycamores with a California brickellbush understory. Young and small stands of Arizona alder are common a few meters from the channel. Good quality seepwillows and regenerating Arizona sycamores are found on cobble side bars (see x-sectional diagram). Impacts to this site include recent high flows that have downcut stream banks and a road that is in the floodplain that occasionally fords the river. A mayor threat to this site is the Hooker Dam proposal, which would submerge a portion of the site.

Vegetation Communities:	Community Quality Ranks:
Arizona sycamore/California brickellbush	B
seepwillow/Arizona sycamore	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But a few herbaceous exotics are present.
Grazing:	no	No evidence seen.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	yes	Vehicle tracks are common up to the wilderness boundary.
Roads:	yes	A road crosses floodplain and occasionally fords the river.
Mowing:	no	
Other Impacts:	no	

Data

Cross Section: Gila 3

Plots: 95PD061 95PD062

Jurisdiction: Gila National Forest, Gila Wilderness

Survey Date: 8/10/95

Investigators: Bradley, Durkin

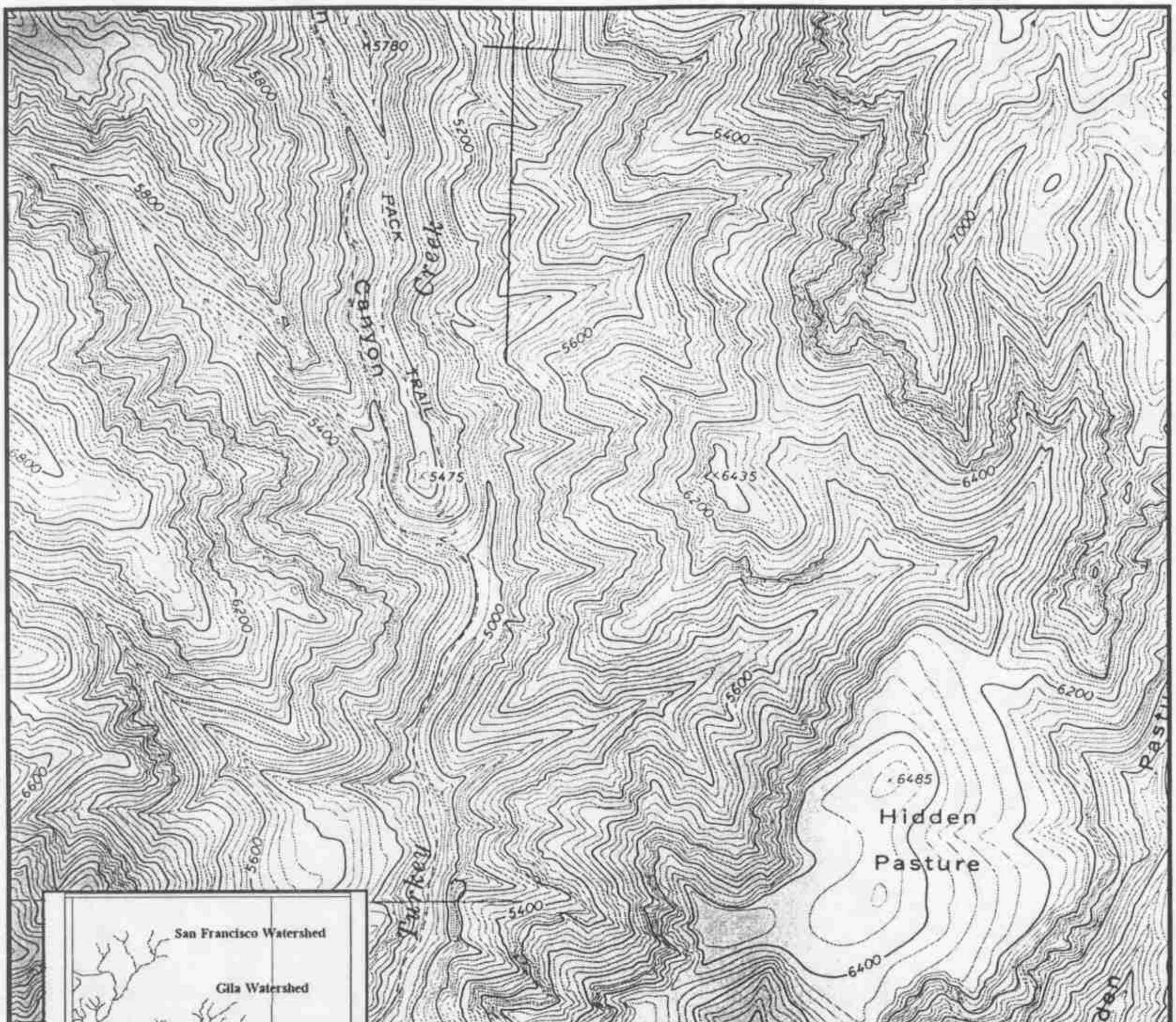

Figure B.23. The Cave Creek Site. Black dot indicates location of stream cross-section.

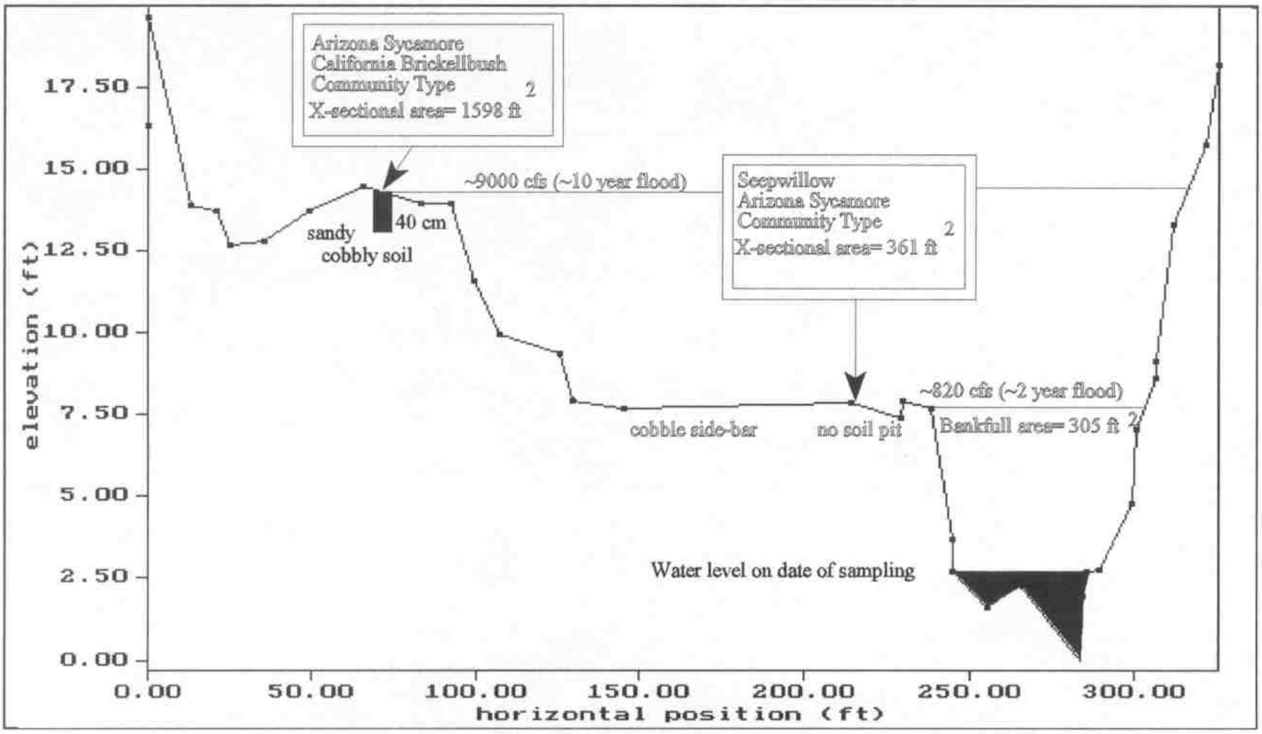

Figure B.24. Cross-section of the Gila River (Gila 3) at the Cave Canyon Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.25. The Cave Canyon Site on the Gila River. A few mature Arizona sycamores can be found at this site, but mostly, the riparian vegetation consists of seepwillows and other shrubs.

Watershed: Gila Watershed **River:** Gila **Reach:** Upper Mainstem

Site Name: Hooker Dam Site **Site Number:** 176 **Basin Number** 15040001

County: GRANT **Quad. Map Name:** CANTEEN CANYON

Town: 14S **Range:** 16W **Section:** 30 **Northing:** 3660000 **Easting** 729600

Data Sources: Personal communication; ground reconnaissance; field sampled

Site Quality: C

Site Description: The dominant forest of the Hooker Dam site is the Arizona walnut-netleaf hackberry community. Other common associates are honey mesquite and California brickellbush. This community occurs on the extreme fringe of the floodplain near the upland slope and forms a ribbon along the edge of an adjacent old pasture. The community is in good condition, but the site is dominated by the old pasture and site quality is adversely affected. Much of the immediate floodplain is scoured but young stands of Fremont's cottonwood and willows are found. Recent high flows have downcut banks as well. The Hooker Dam proposal is a major threat to this site as well.

Vegetation Communities:	Community Quality Ranks:
Arizona walnut/netleaf hackberry/California brickellbush	B

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Fair

Floodplain Impacts:

Exotic veg dominant:	no	But the pasture is dominated by herbaceous exotics.
Grazing:	no	Past grazing history is still evident.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	yes	Trespass vehicles were observed. Old tracks are still visibble.
Roads:	yes	A road is on old pasture.
Mowing:	no	
Other Impacts:	yes	An old pasture dominates much of the floodplain.

Data

Cross Section: Gila 8

Plots: 95PD072

Jurisdiction: State of New Mexico

Survey Date: 9/25/95

Investigators: Bradley, Durkin, Muldavin

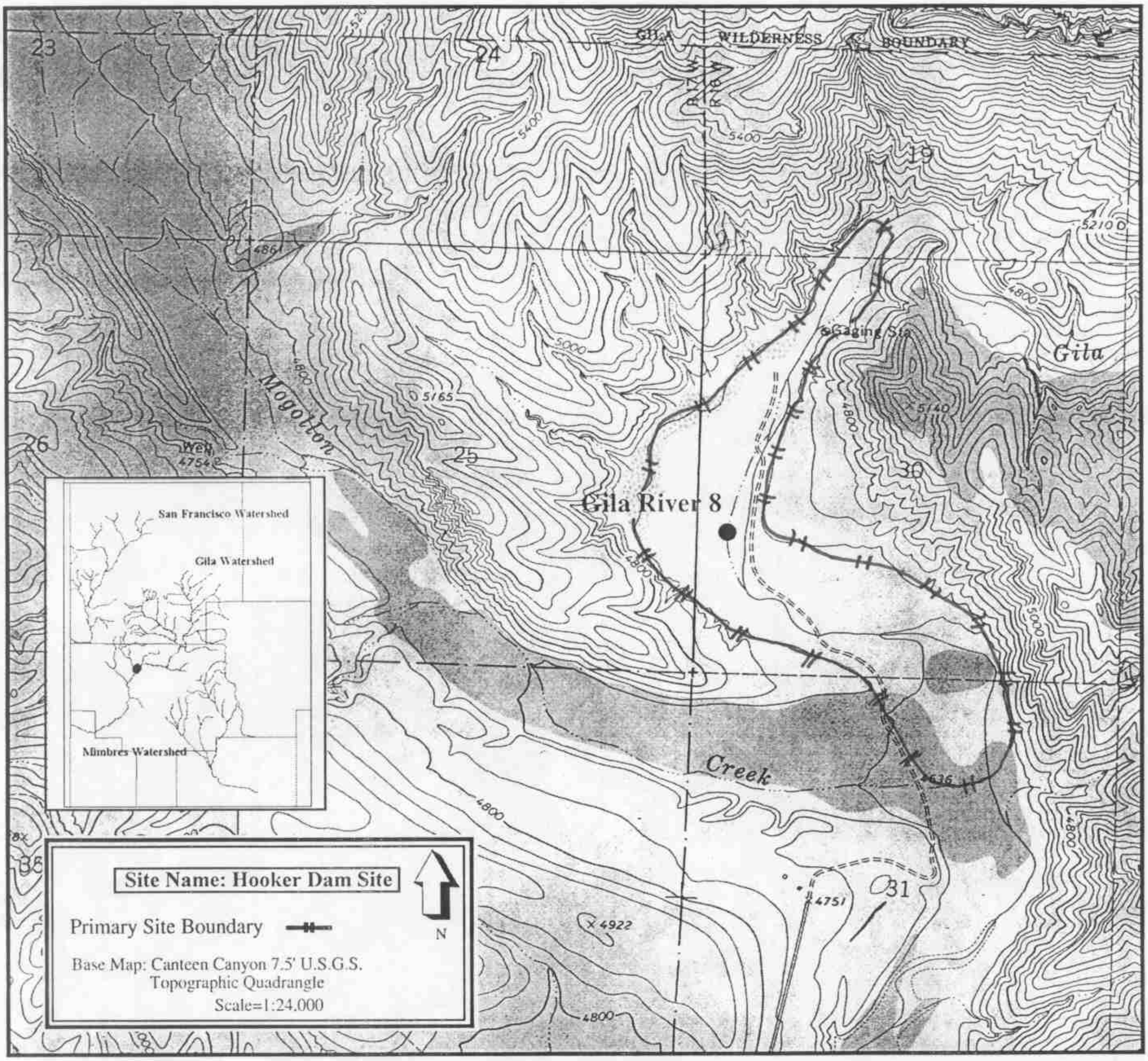

Figure B.26. The Hooker Dam Site. Black dot indicates location of stream cross-section.

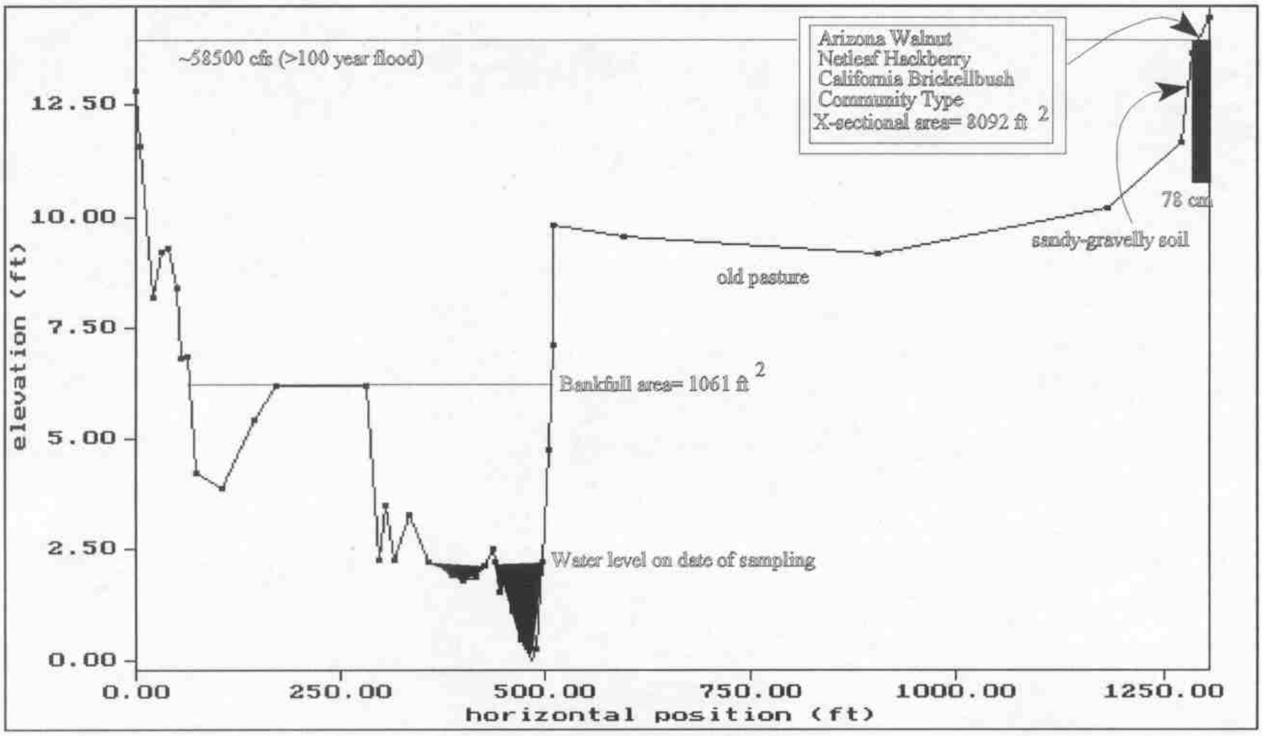

Figure B.27. Cross-section of the Gila River (Gila 8) at the Hooker Dam Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.28. The Hooker Dam Site on the Gila River, just upstream of the Mogollon Creek confluence. The Arizona walnut-netleaf hackberry community occurs along the fringe of the floodplain.

Watershed: Gila Watershed **River:** Middle Fork Gila **Reach:** Middle Fork

Site Name: North Mesa **Site Number:** 165 **Basin Number** 1504001

County: CATRON **Quad. Map Name:** GILA HOT SPRINGS

Town: 12S **Range:** 14W **Section:** **Northing:** 3681310 **Easting** 757950

Data Sources: Ground reconnaissance; field sampled

Site Quality: AB

Site Description: The most distinctive riparian community of this site is the Arizona alder/rice cutgrass plant association. The herbaceous layer of is lush and consists of a variety of other graminoids. Stream banks are well stabilized by this community. Mature riparian trees are widely scattered but include, Arizona sycamore, narrowleaf cottonwood, boxelder, and Arizona walnut. Impacts to this site are few and, as a result, riparian communities are in excellent condition.

Vegetation Communities:	**Community Quality Ranks:**
Arizona alder/rice cutgrass	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Excellent

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant:	no	
Grazing:	no	No evidence seen.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	no	
Mowing:	no	
Other Impacts:	yes	

Data

Cross Section: Mid-Fork

Plots: 95PD051

Jurisdiction: Gila Wilderness

Survey Date: 8/3/95

Investigators: Bradley, Durkin

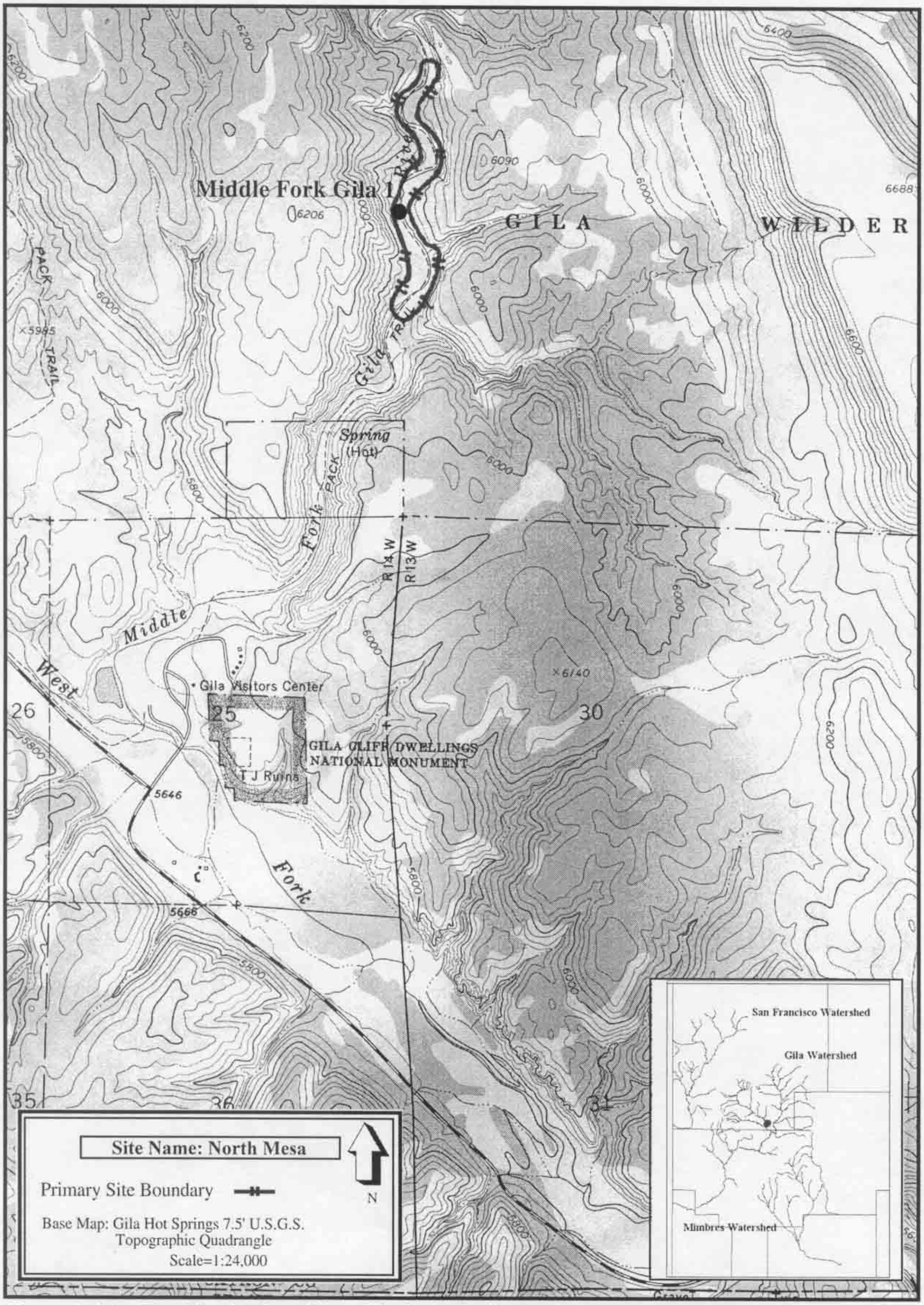

Figure B.29. The North Mesa Site. Black dot indicates location of stream cross-section.

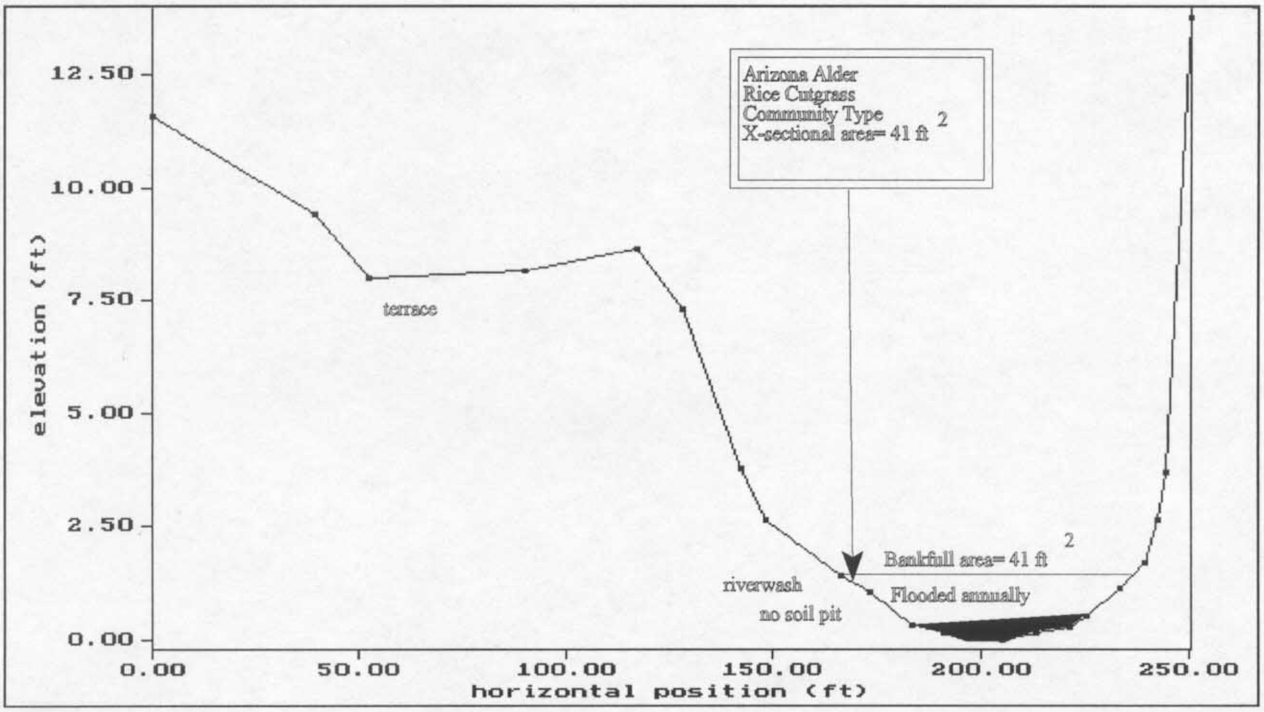

Figure B.30. Cross-section of the Middle Fork of the Gila (Mid-Fork 1) at the North Mesa Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo Mike Bradley

Figure B.31. The North Mesa Site on the Middle Fork of the Gila. Stream-side vegetation consists primarily of Arizona alder and rice cutgrass.

Watershed: Gila Watershed **River:** Mogollon Creek **Reach:** Mogollon Creek

Site Name: Gila Confluence **Site Number:** 177 **Basin Number** 15040001

County: GRANT **Quad. Map Name:** CANTEEN CANYON

Town: 14S **Range:** 16W **Section:** 31 **Northing:** 3658930 **Easting** 730070

Data Sources: Personal communication; ground reconnaissance; field sampled

Site Quality: B

Site Description: Mogollon Creek is an intermittent stream. Its floodplain is bisected by several overflow channels and the vegetation consists primarily of good quality stands of mature Arizona sycamores with Emory's oak. Junipers and velvet ashes are common associates as well. Understories are predominately exotic and include cheatgrass and horehound. Desert willow and rubber rabbitbrush dominate dry cobble bars, but seepwillow and catclaw are also common. This is a relatively dry site and encroachment of upland species is a threat.

Vegetation Communities:	**Community Quality Ranks:**
Arizona sycamore/Emory's oak	B
desert willow/rubber rabbitbrush	B

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Excellent

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are present
Grazing:	no	No evidence seen. Uplands have been heavily grazed however.
Fuel Wood:	no	
Dumping:		
ORV Use:	yes	Moderate use occurs at the confluence of the Gila.
Roads:	yes	A dirt road fords the creek bed at the confluence of the Gila.
Mowing:		
Other Impacts:		

Data

Cross Section: Mogollon Creek

Plots: 95PD058 95PD059

Jurisdiction: Gila National Forest

Survey Date: 8/8/95

Investigators: Bradley, Durkin

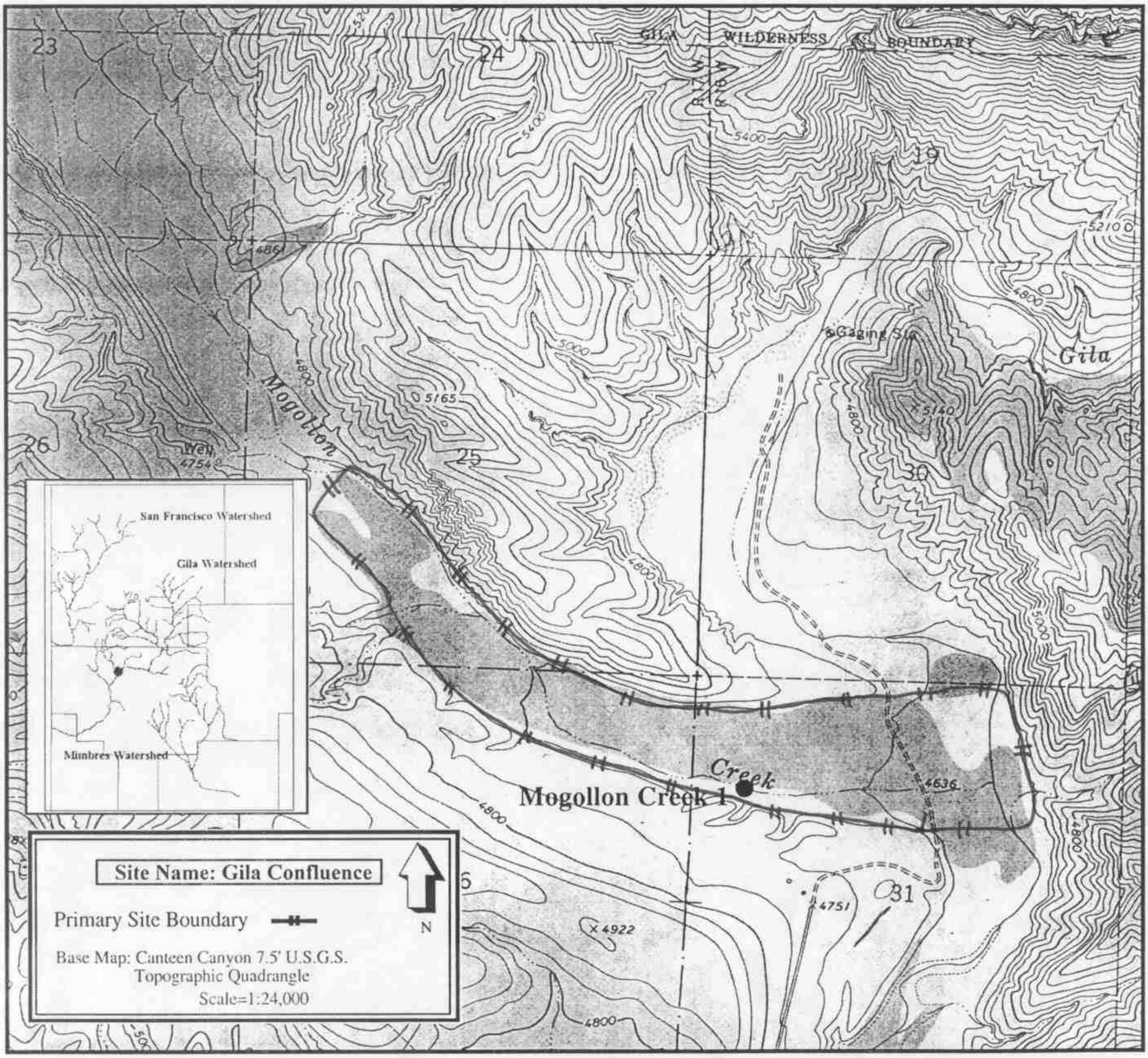

Figure B.32. The Gila Confluence Site. Black dot indicates location of stream cross-section.

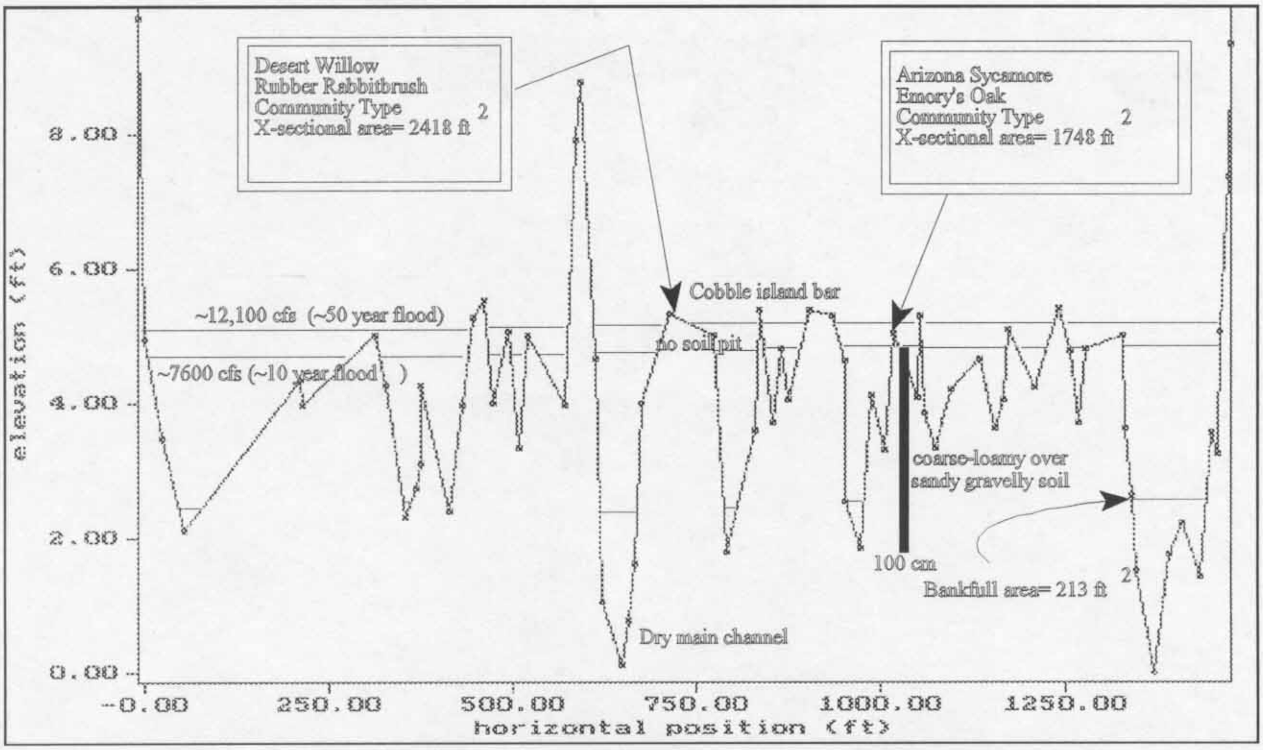

Figure B.33. Cross-section of Mogollon Creek (Mogollon 1) at the Gila Confluence Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.34. The Gila Confluence Site on Mogollon Creek. Arizona sycamores, alligator junipers, and Emory's oaks dominate the floodplain at the lower end of Mogollon Creek.

Watershed: Gila Watershed **River:** Taylor Creek **Reach:** Taylor Creek

Site Name: Whitewater Canyon **Site Number:** 169 **Basin Number** 1504004

County: CATRON **Quad. Map Name:** WALL LAKE

Town: 11S **Range:** 12W **Section:** 02 **Northing:** 3695020 **Easting** 773810

Data Sources: Ground reconnaissance; personal communication; field sampled

Site Quality: C

Site Description: The riparian forest of this site is largely restricted to a few scattered narrowleaf cottonwoods and junipers. The common spikerush and yerba mansa community borders the creek. This community is maintained by a high water table that may be bedrock controlled (see x-sectional diagram). The status and its effects on stream hydrology, of an upstream mine are unknown. Encroachment by saltcedar is a threat to this site. The site is grazed heavily and many riparian communities are absent. Remaining communities are in fair condition.

Vegetation Communities:	**Community Quality Ranks:**
common spikerush/yerba mansa	C

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Poor

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are common and saltcedar is widely scattered.
Grazing:	yes	Heavy.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	yes	A road crosses the floodplain at the downstream end of the segment.
Mowing:	no	
Other Impacts:	yes	A mine just upstream.

Data

Cross Section: Taylor Creek

Plots: 95PD047

Jurisdiction: private, Gila National Forest

Survey Date: 7/27/95

Investigators: Bradley, Durkin

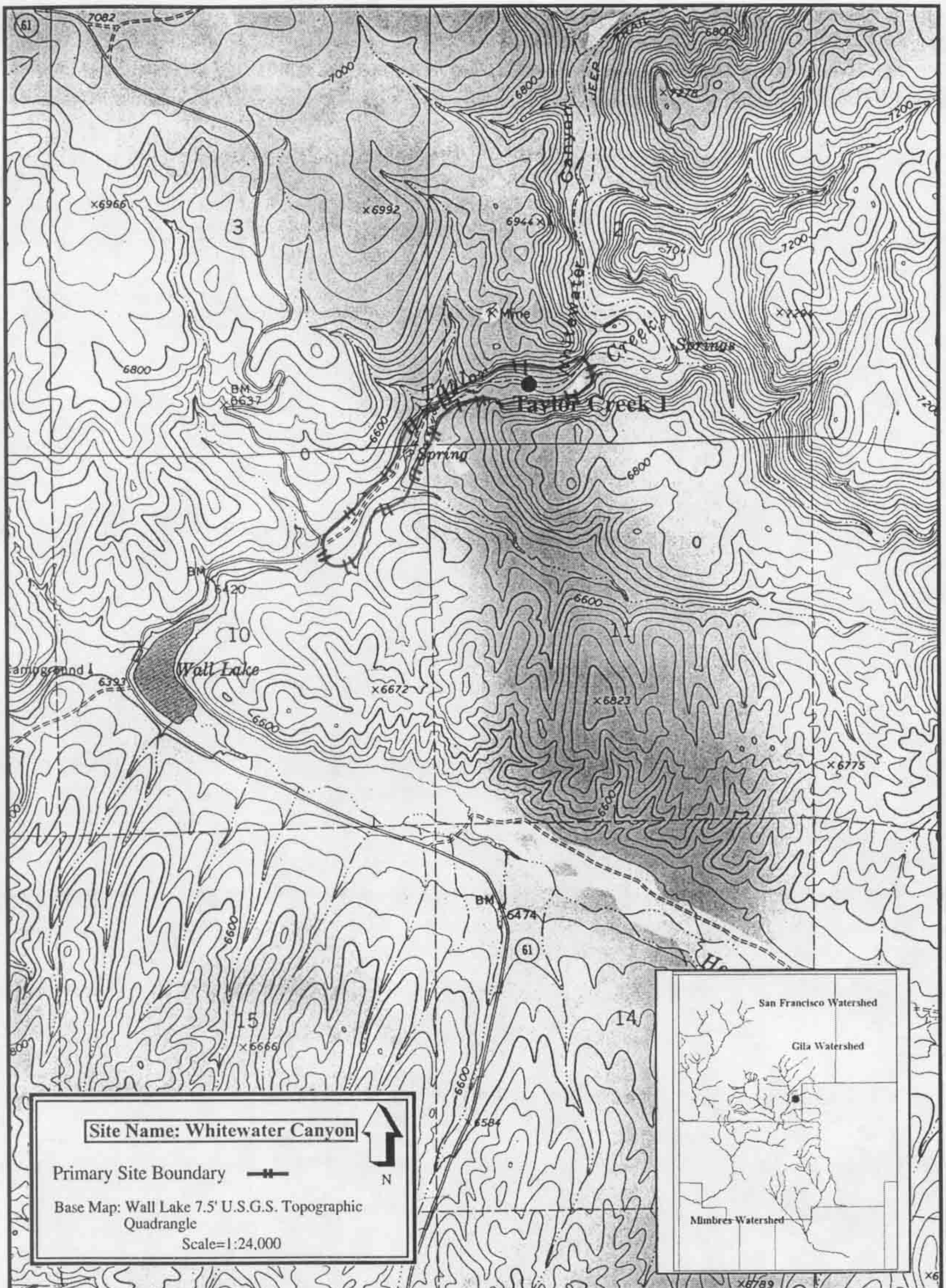

Figure B.35. The Whitewater Canyon Site. Black dot indicates location of stream cross-sectic

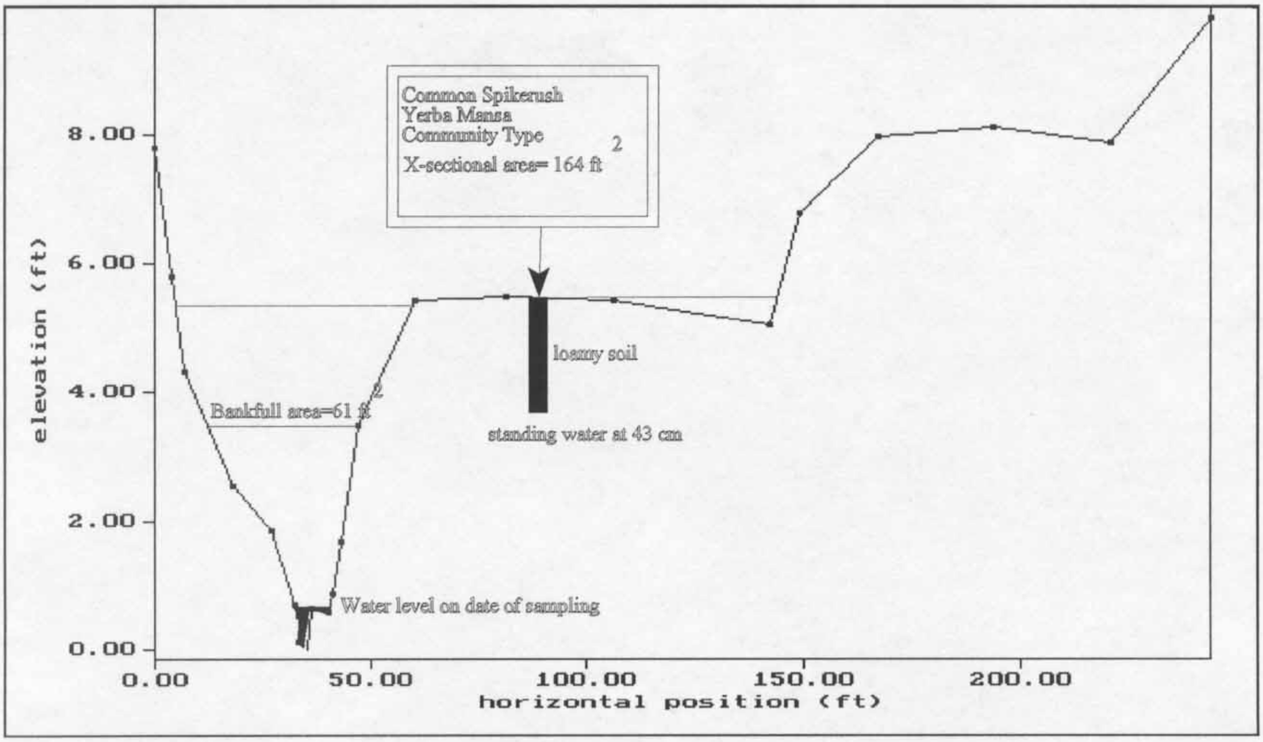

Figure B.36. Cross-section of Taylor Creek (Taylor Creek 1) at the Whitewater Canyon Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.37. The Whitewater Canyon Site on Taylor Creek. This site is heavily grazed and much of the stream-side vegetation has been removed.

Watershed: Gila Watershed **River:** Turkey Creek **Reach:** Turkey Creek

Site Name: Hidden Pasture **Site Number:** 174 **Basin Number** 15040001

County: GRANT **Quad. Map Name:** CANYON HILL

Town: 14S **Range:** 16W **Section:** **Northing:** 3664200 **Easting** 734800

Data Sources: Personal communication; ground reconnaissance; field sampled

Site Quality: AB

Site Description: The riparian vegetation of Turkey Creek is dominated by mature Arizona sycamore and Arizona alder forested wetlands. These forests are found on cobble bars and where stream flow is generally perennial. Other common associates include California brickellbush, boxelder, grey oak and alligator juniper. Impacts to this site are minimal and riparian communities are in excellent condition.

Vegetation Communities:	Community Quality Ranks:
Arizona sycamore/Arizona alder/California brickellbush	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Excellent

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant: no

Grazing:	no	No evidence seen.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	no	
Mowing:	no	
Other Impacts:	yes	A hiking trail.

Data

Cross Section: Turkey Creek 1

Plots: 95PD057

Jurisdiction: Gila National Forest, Gila Wilderness

Survey Date: 8/6/95

Investigators: Bradley, Durkin

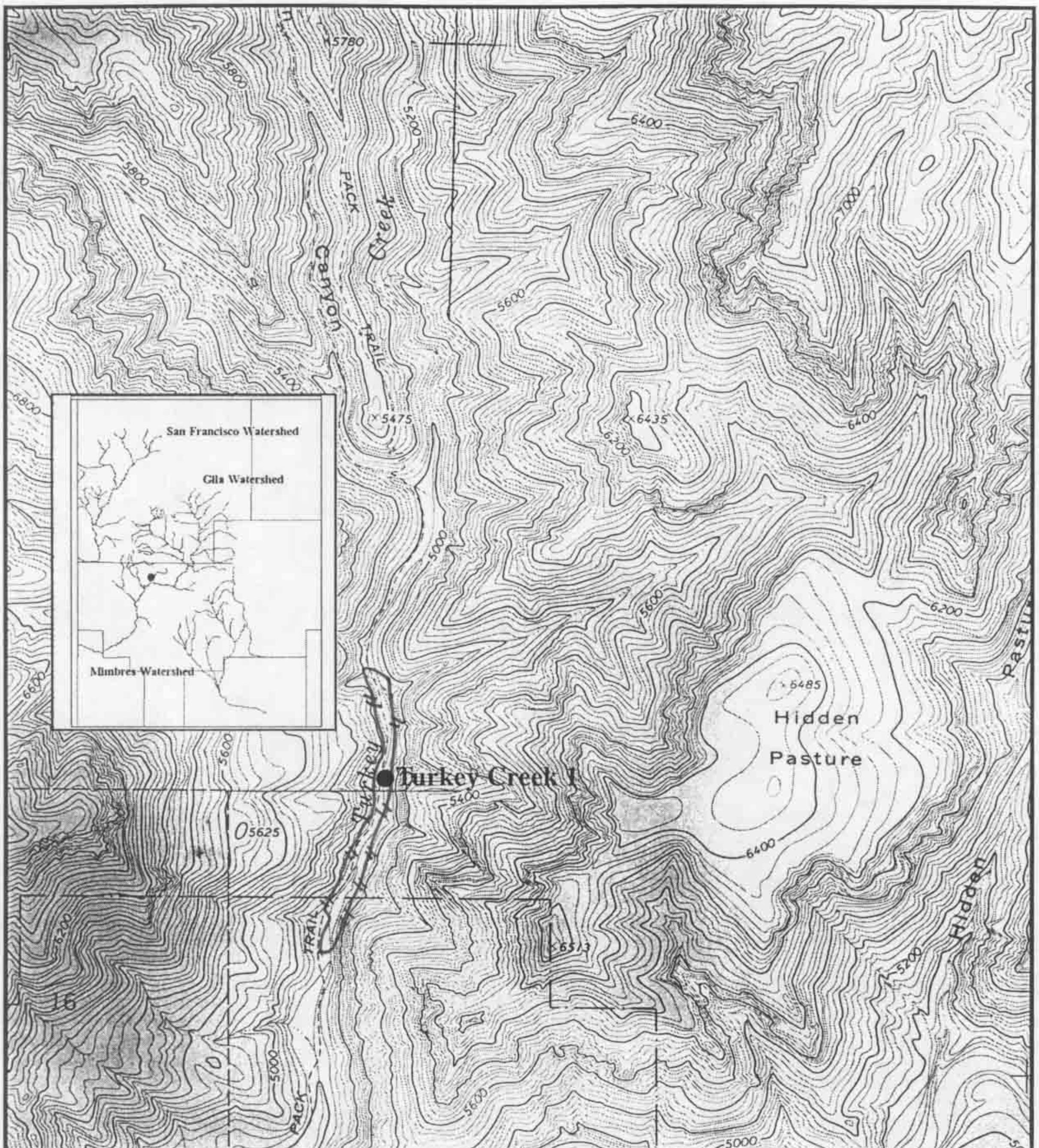

Figure B.38. The Hidden Pasture Site. Black dot indicates location of stream cross-section.

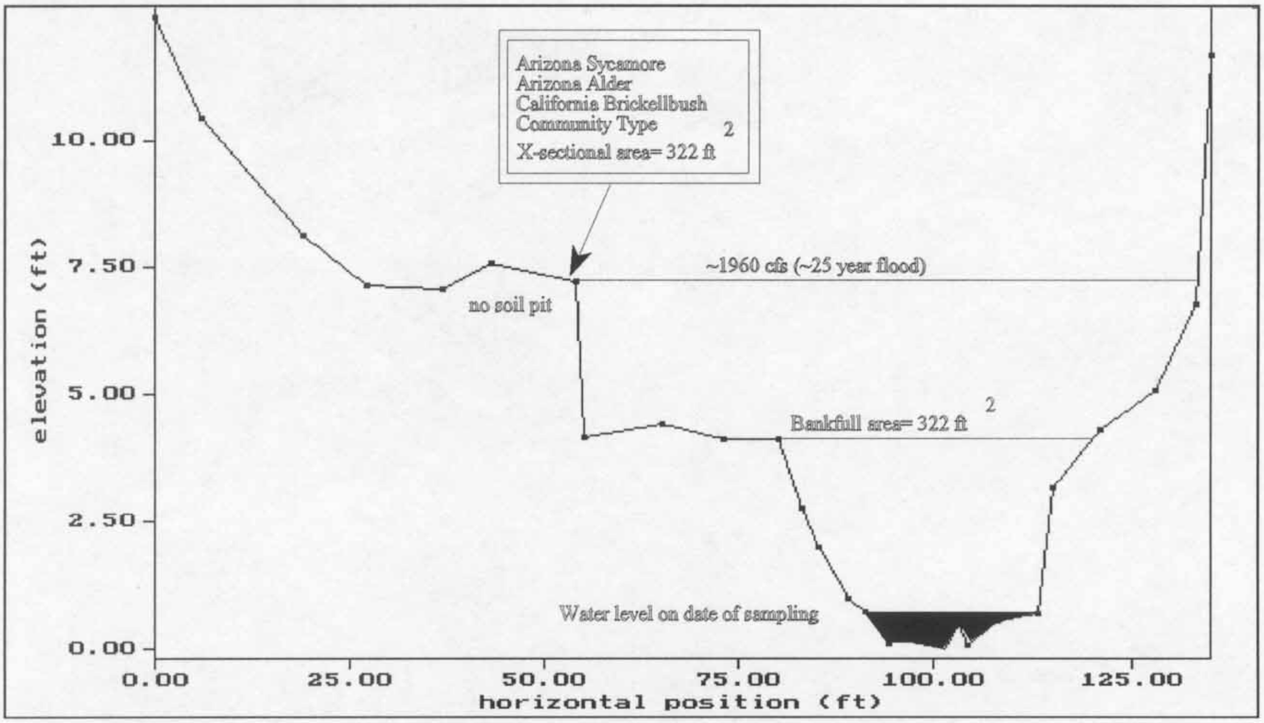

Figure B.39. Cross-section of Turkey Creek (Turkey Creek 1) at the Hidden Pasture Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.40. The Hidden Pasture Site on Turkey Creek (the canyon on the right, flowing into the Gila). This isolated site is composed primarily of Arizona sycamores and Arizona alders.

Watershed: Gila Watershed **River:** West Fork Gila **Reach:** Gila Hot Springs

Site Name: Cliff Dwellings **Site Number:** 164 **Basin Number** 15040001

County: CATRON **Quad. Map Name:** LITTLE TURKEY PARK

Town: 12S **Range:** 14W **Section:** 26 **Northing:** 3679740 **Easting** 755460

Data Sources: Ground reconnaissance; field sampled

Site Quality: B

Site Description: Much of this site is dominated by mature stands of narrowleaf cottonwood forests with grassy understories composed of Kentucky bluegrass. This forest inhabits old island bars and other mature fluvial landforms. On elevated cobble bars, rubber rabbitbrush and sand dropseed dominate. Grazing and other floodplain impacts are minimal and communities are in good to excellent condition. The effect of the paved highway on stream hydrology is unknown. Human activity is a threat to this site as well.

Vegetation Communities:	Community Quality Ranks:
rubber rabbitbrush/sand dropseed	A
narrowleaf cottonwood/Kentucky bluegrass	B

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Fair

Floodplain Impacts:

Exotic veg dominant:	no	But understories are predominantly exotic.
Grazing:	yes	Light horse grazing.
Fuel Wood:	yes	Campers collect flood debris for fire wood.
Dumping:	yes	
ORV Use:	no	
Roads:	yes	Paved highway on terrace.
Mowing:	no	
Other Impacts:	yes	Horse trails and an a small concrete bridge destroyed by recent floods are present.

Data

Cross Section: West Fork Gila 2

Plots: 95PD055 95PD056

Jurisdiction: Gila National Forest

Survey Date: 8/5/95

Investigators: Bradley, Durkin

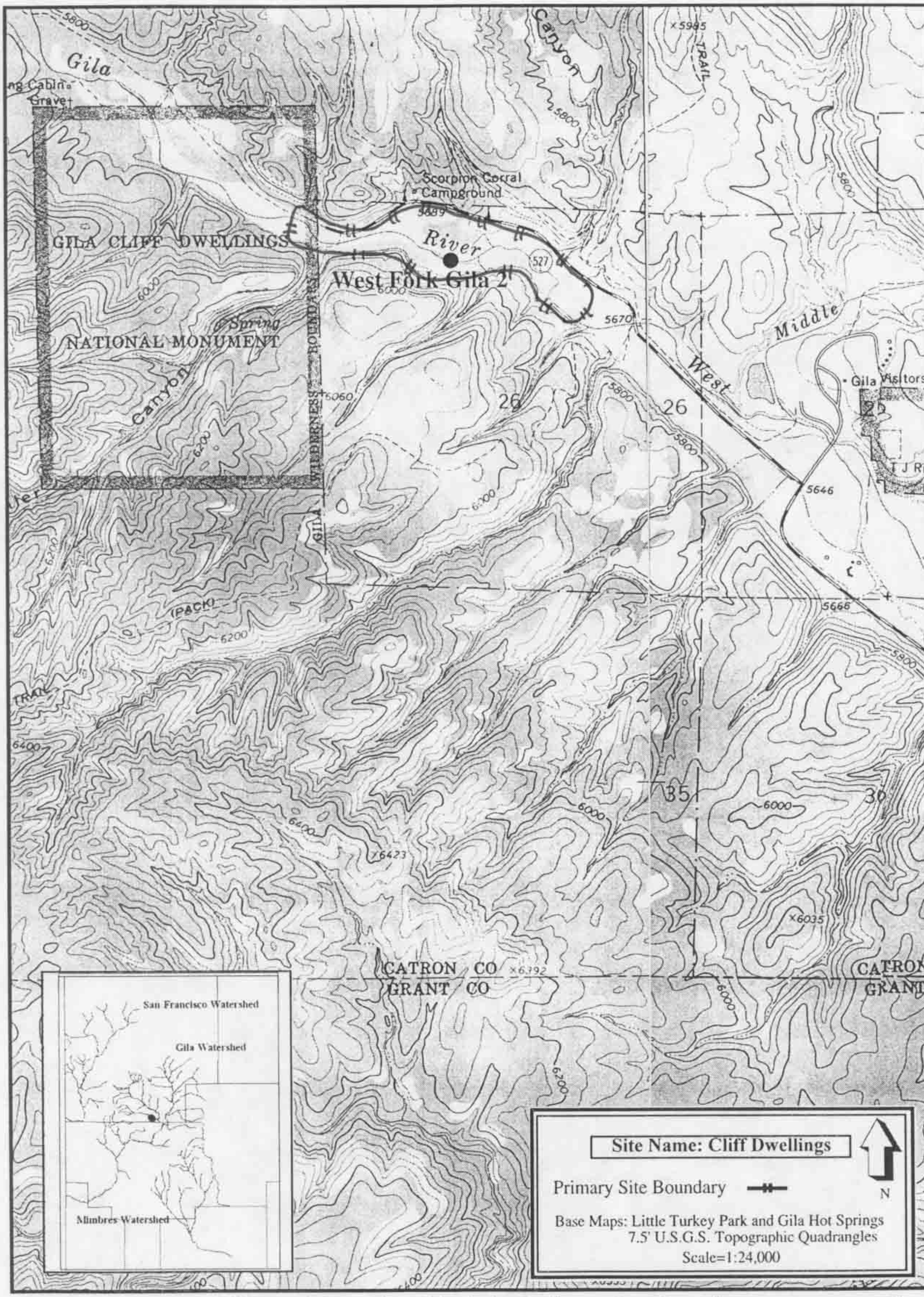

Figure B.41. The Cliff Dwellings Site. Black dot indicates location of stream cross-section.

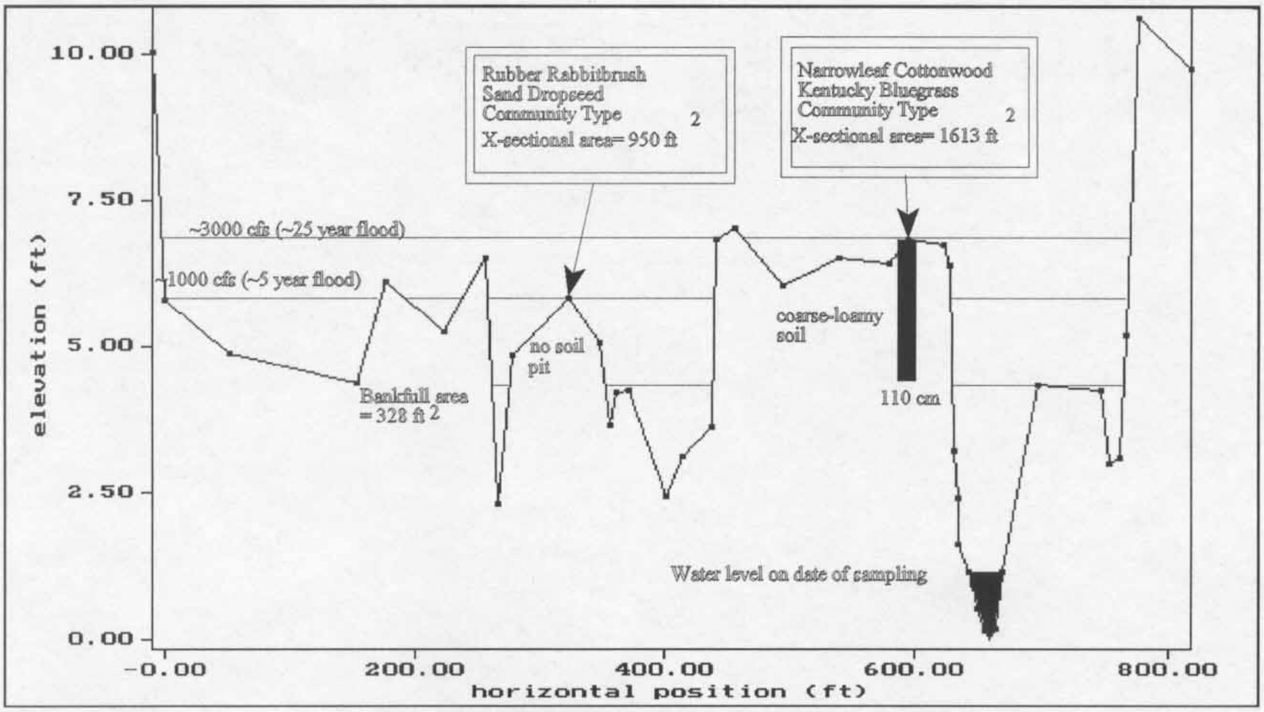

Figure B.42. Cross-section of the West Fork of the Gila River (West Fork 2) at the Cliff Dwelling Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.43. The Cliff Dwellings Site on the West Fork of the Gila River. The narrowleaf cottonwood forests that occur at this site seem to be naturally fragmented by the river.

Watershed: Gila Watershed **River:** West Fork Gila **Reach:** Upper West Fork

Site Name: EE Canyon **Site Number:** 163 **Basin Number** 15040001

County: CATRON **Quad. Map Name:** LITTLE TURKEY PARK

Town: **Range:** **Section:** **Northing:** 3681330 **Easting** 752590

Data Sources: Ground reconnaissance; field sampled

Site Quality: AB

Site Description: High quality forested wetlands composed of Arizona alder and Arizona sycamore dominate much of the EE Canyon Site. Mature forests are found on old side bars. Regeneration can be found along the banks or on young side bars. Other common associates include narrowleaf cottonwood, boxelder, and Arizona walnut, with some Fremont's cottonwood interspersed. Understories are well developed in the shrub and herbaceous layers. Bluestem willows dominate nursery bars and banks are well stabilized by alder, willows or streambank sedges. A hiking trail is the only impact to this isolated site.

Vegetation Communities:	Community Quality Ranks:
Arizona sycamore/Arizona alder	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Excellent

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant:	no	No exotics seen.
Grazing:	no	No evidence seen.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	no	
Mowing:	no	
Other Impacts:	no	

Data

Cross Section: West Fork Gila

Plots: 95PD050

Jurisdiction: Gila Wilderness

Survey Date: 8/2/95

Investigators: Bradley, Durkin

Figure B.44. The EE Canyon Site. Black dot indicates location of stream cross-section.

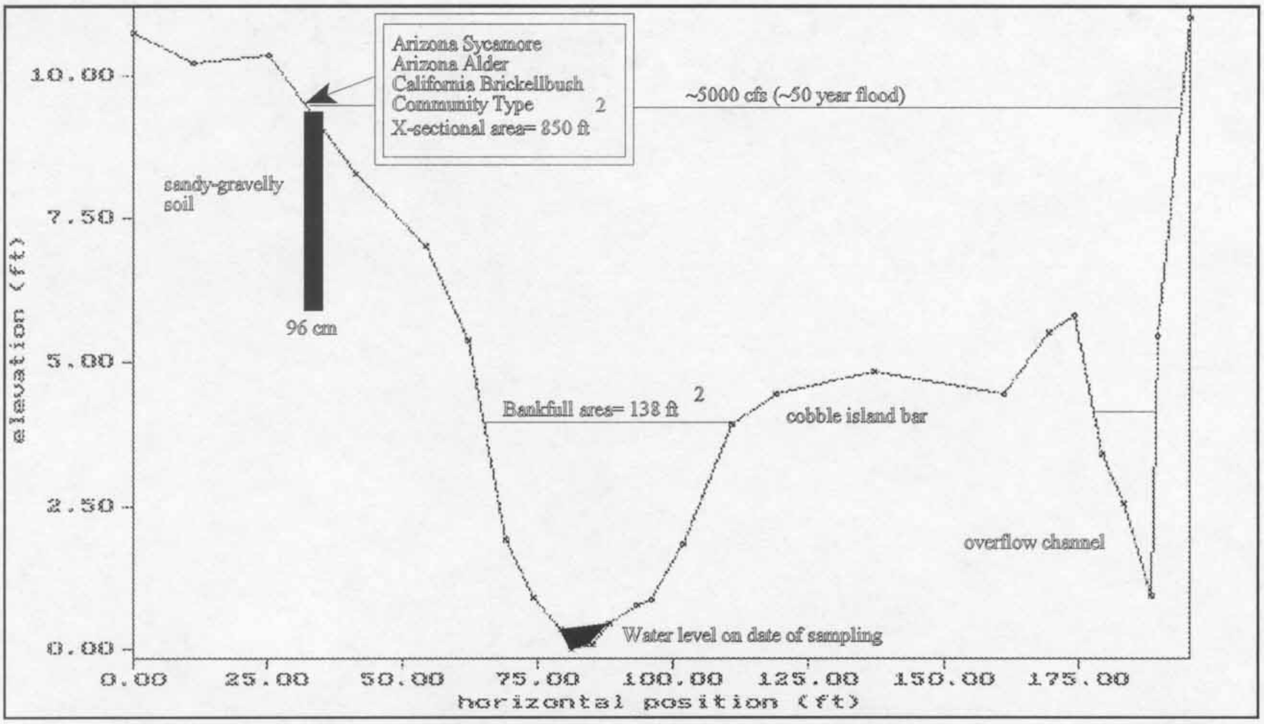

Figure B.45. Cross-section of the West Fork of the Gila River (West Fork 1) at the EE Canyon Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

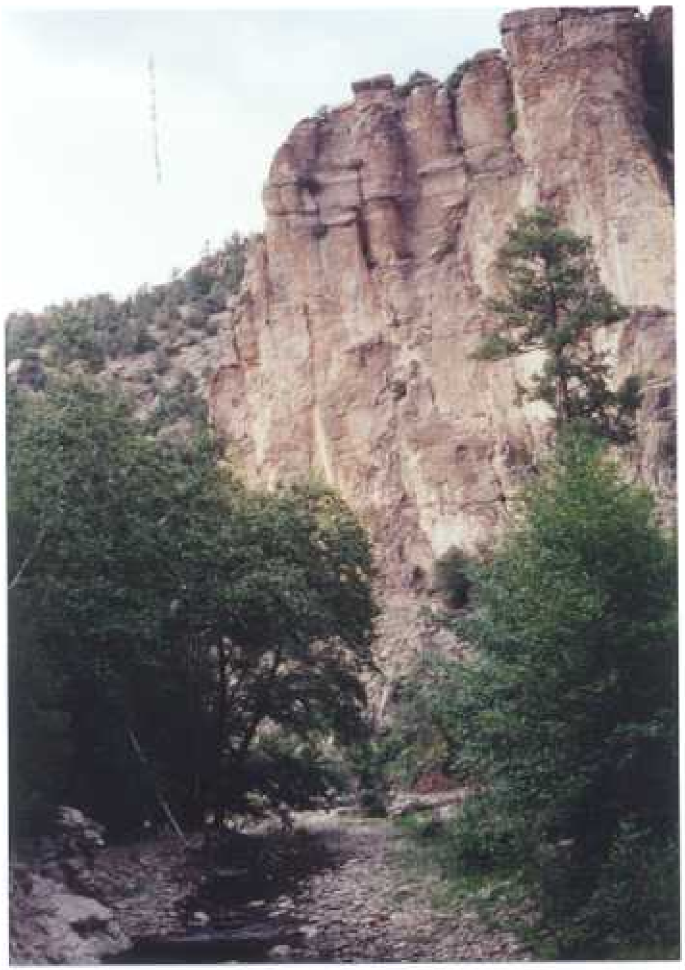

Photo: Mike Bradley

Figure B.46. The EE Canyon Site on the West Fork of the Gila River. Vegetation consists primarily of Arizona alders and Arizona sycamores.

Watershed: San Francisco Watershed **River:** Apache Creek **Reach:** Apache Creek

Site Name: Kerr Canyon **Site Number:** 133 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** QUEEN'S HEAD

Town: 05S **Range:** 17W **Section:** 05 **Northing:** 3753290 **Easting** 718660

Data Sources: Air photo interpretation; field sampled

Site Quality: C

Site Description: Fragmented narrowleaf cottonwood and boxelder forests dominate the Kerr Canyon site. Communities may be progressing toward a dryer site, as a few of the narrowleaf cottonwoods are dying and junipers and Arizona walnut saplings are common in the understory. The stream channel was also dry on the date of sampling. On the fringe of the floodplain, near the upland slope, Arizona walnuts and boxelders are common. Community and site quality ranks are adversely affected by heavy grazing practices, fragmentation by pastures and roads in the floodplain, and a lack of regeneration.

Vegetation Communities:	Community Quality Ranks:
narrowleaf cottonwood/box elder/Kentucky bluegrass	B
Arizona walnut/box elder	C

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** Partial **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are common.
Grazing:	yes	The site is grazed heavily.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	yes	A dirt road fords the channel, and is in the floodplain.
Mowing:	no	
Other Impacts:	no	

Data

Cross Section: Apache Creek

Plots: 95PD041 95PD042

Jurisdiction: Gila National Forest, private

Survey Date: 7/23/95

Investigators: Bradley, Durkin

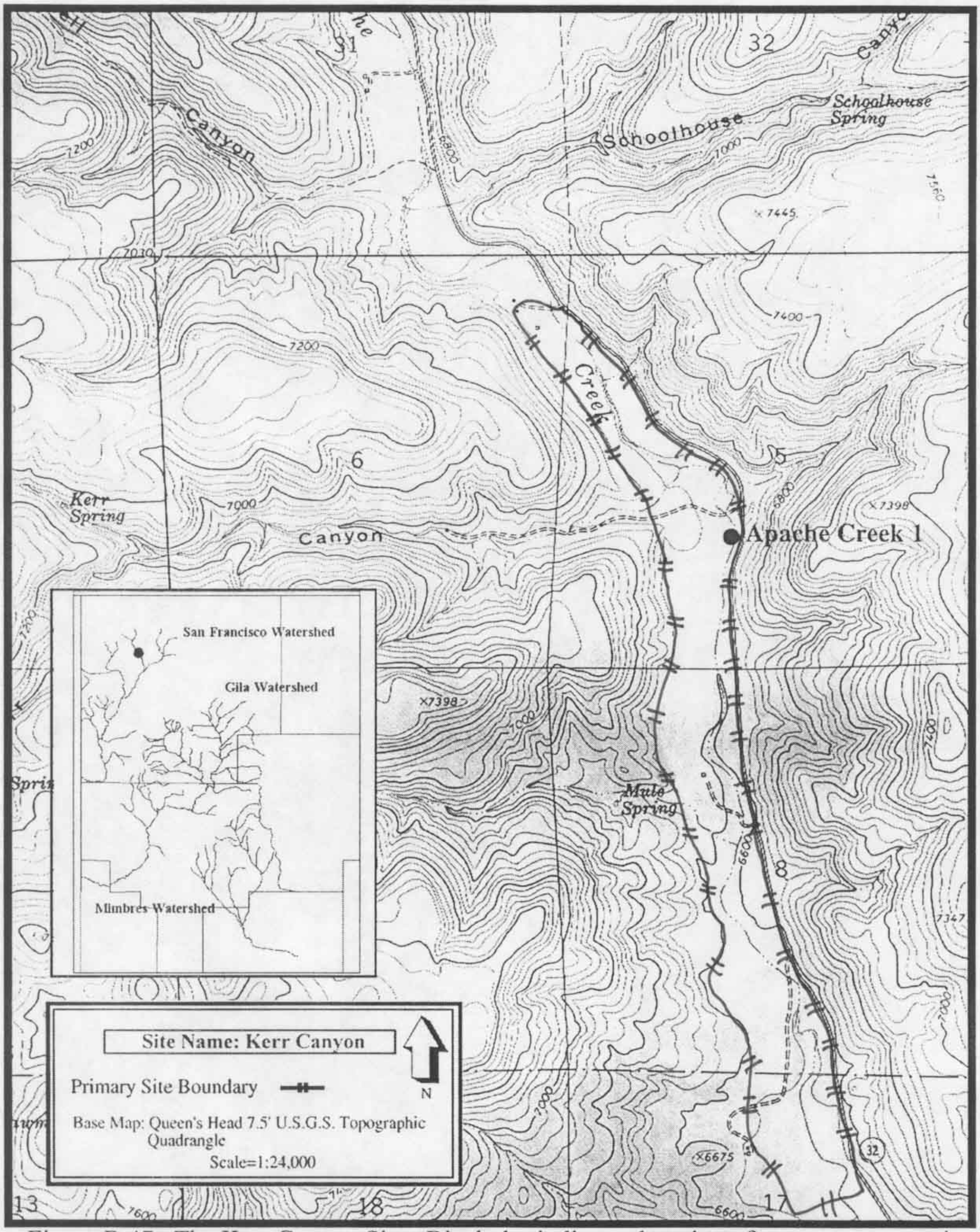

Figure B.47. The Kerr Canyon Site. Black dot indicates location of stream cross-section,

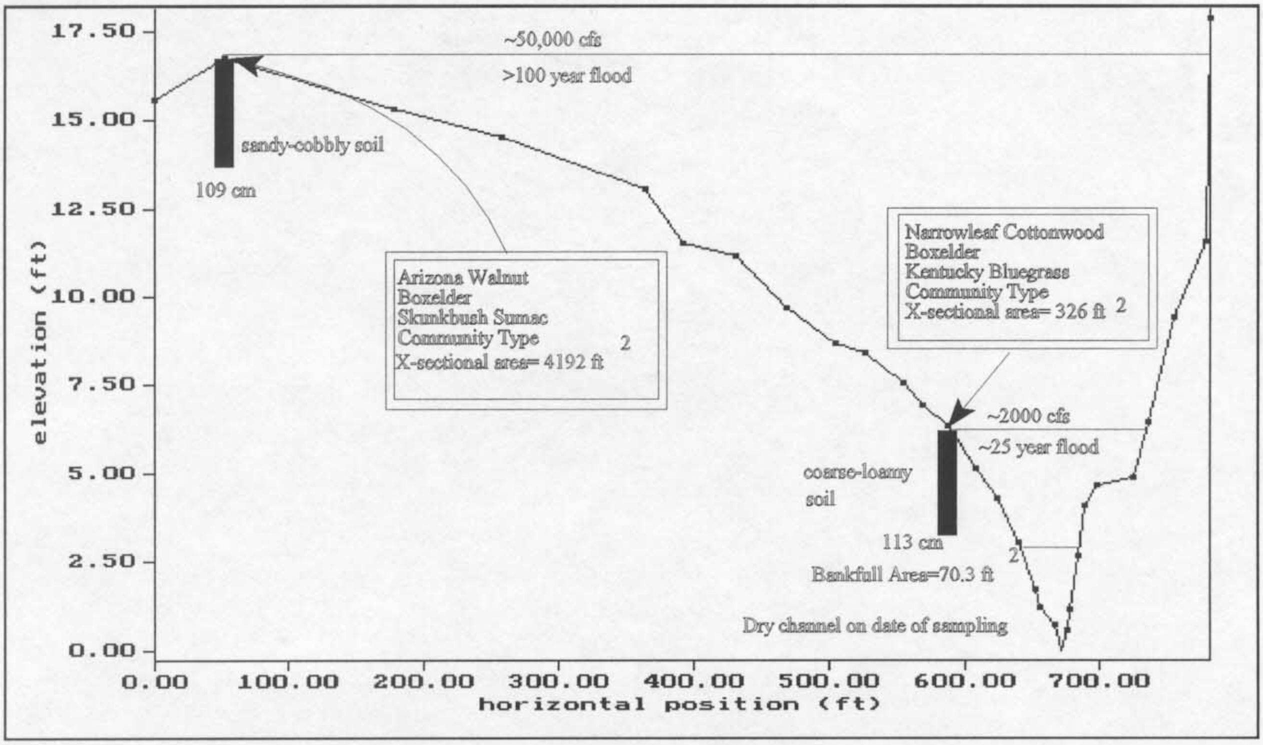

Figure B.48. Cross-section of Apache Creek (Apache Creek 1) at the Kerr Canyon Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.49. The Kerr Canyon Site on Apache Creek. Fragmented narrowleaf cottonwood forests and pastures dominate the floodplain at this site.

Watershed: San Francisco Watershed **River:** Pueblo Creek **Reach:** Pueblo Creek

Site Name: Pueblo Creek **Site Number:** 143 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** SALIZ PASS

Town: 09S **Range:** 20W **Section:** 19 **Northing:** 3709210 **Easting** 690850

Data Sources: Air photo interpretation; field sampled

Site Quality: AB

Site Description: The Pueblo Creek site is characterized by stands of Arizona sycamore and Arizona alder forests that are in good to excellent condition. The creek is intermittent and when floods do occur they are short and intense. Banks are vegetated by alders and are further stabilized by cobbles and stones. The site is isolated and channel and flooplain impacts are minimal except for a power line on the upland slope and an old corral. The riparian area is fenced off from grazing.

Vegetation Communities:	**Community Quality Ranks:**
Arizona sycamore/Arizona alder/sparse undergrowth	B+

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Excellent

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant: no

Grazing:	no	But old corrals seen: the area may have been historically grazed.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	no	
Mowing:	no	
Other Impacts:	yes	Powerline installed on the uplands.

Data

Cross Section: Pueblo Creek

Plots: 95PD021

Jurisdiction: Gila National Forest

Survey Date: 6/29/95

Investigators: Bradley, Durkin, Hartmann

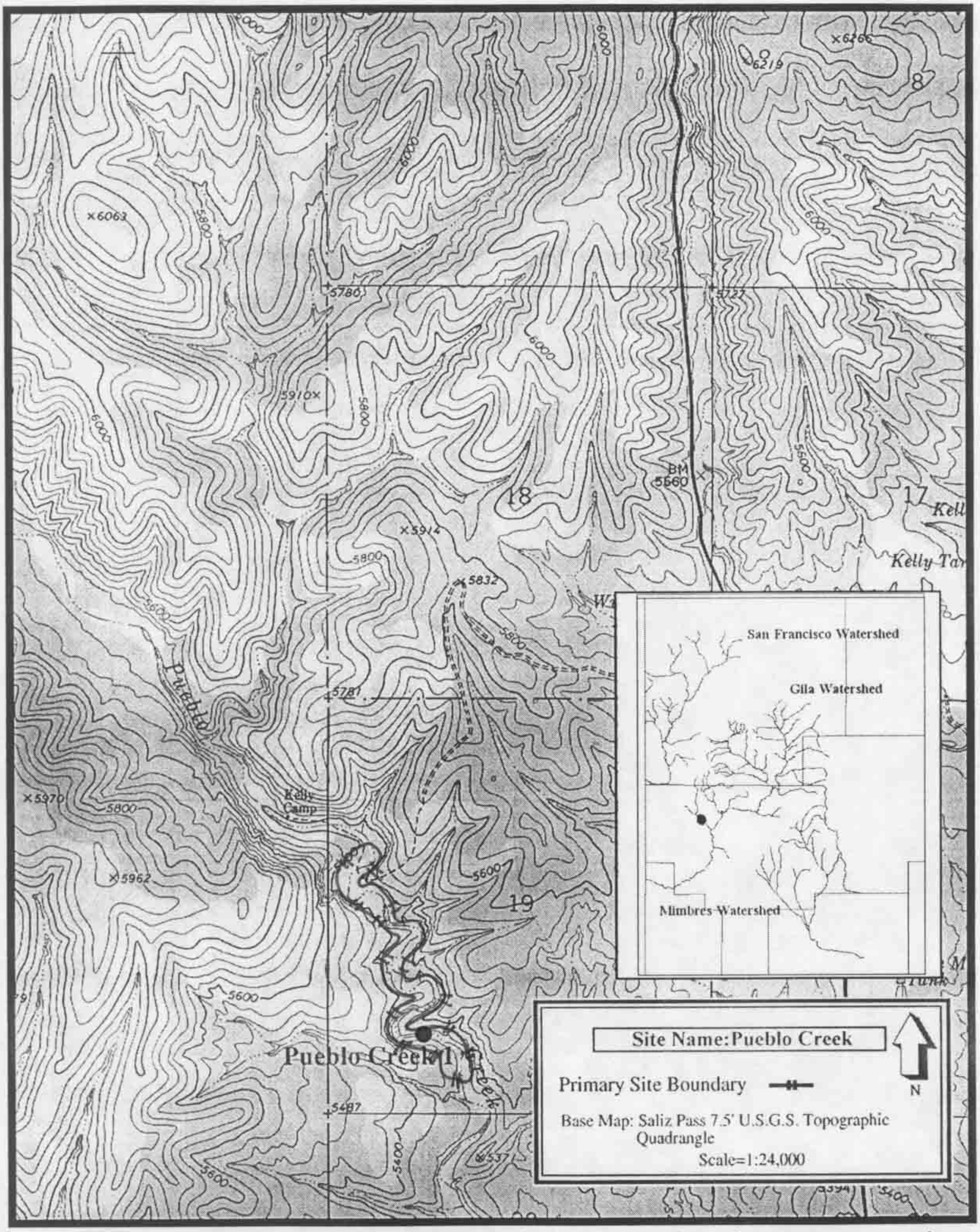

Figure B.50. The Pueblo Creek Site. Black dot indicates location of stream cross-section.

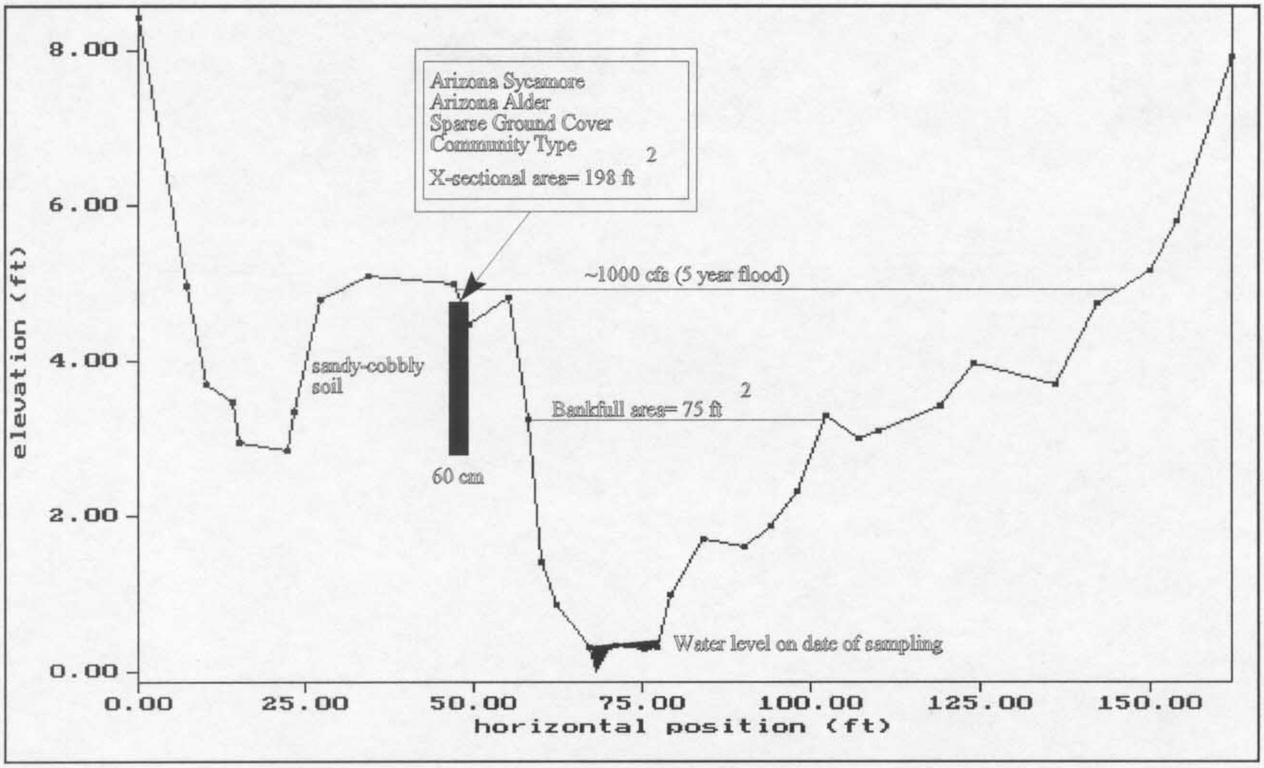

Figure B.51. Cross-section of Pueblo Creek (Pueblo Creek 1) at the Pueblo Creek Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.52. The Pueblo Creek Site is dominated by Arizona alders and Arizona sycamores.

Watershed: San Francisco Watershed **River:** Saliz Canyon **Reach:** Saliz Canyon

Site Name: Gordon Canyon **Site Number:** 142 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** SALIZ PASS

Town: 08S **Range:** 20W **Section:** 22 **Northing:** 3619960 **Easting** 696070

Data Sources: Ground reconnaissance; air photo interpretation; field sampled

Site Quality: C

Site Description: The predominant vegetation consists of this site is young dense stands of Arizona alder and bluestem willow that line the streambanks. Regenerating narrowleaf cottonwoods are also common. Stream terraces are uncommon, but when they occur the're composed primarily of narrowleaf cottonwood and Rocky Mountain juniper with grassy understories. Beaver evidence is present. Reproduction of narrowleaf cottonwoods on the terrace is primarily by asexual suckering. Community quality ranks reflect the relative isolation of the area sampled. The rest of the site, however, is heavily impacted. Riparian forests at this site have been cleared for lumber, roads, and a power line. Stream hydrology is affected by small levees, dredging, and roads that ford the river.

Vegetation Communities:	Community Quality Ranks:
narrowleaf cottonwood/Rocky Mountain juniper/sand dropseed	B
Arizona alder/bluestem willow	B

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** Partial **Jetty Jacked** No

Leveed Partial **Overall Hydrologic Regime:** Good

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant:	no	
Grazing:	no	No evidence seen.
Fuel Wood:	yes	Some deadwood is gathered for campfires.
Dumping:	no	
ORV Use:	no	
Roads:	yes	A dirt road is in and out of the floodplain.
Mowing:	no	
Other Impacts:	yes	A small lumber operation and a power line a few kilometers upstream.

Data

Cross Section: Saliz Canyon

Plots: 95PD030 95PD031

Jurisdiction: Gila National Forest

Survey Date: 7/10/95

Investigators: Bradley, Durkin

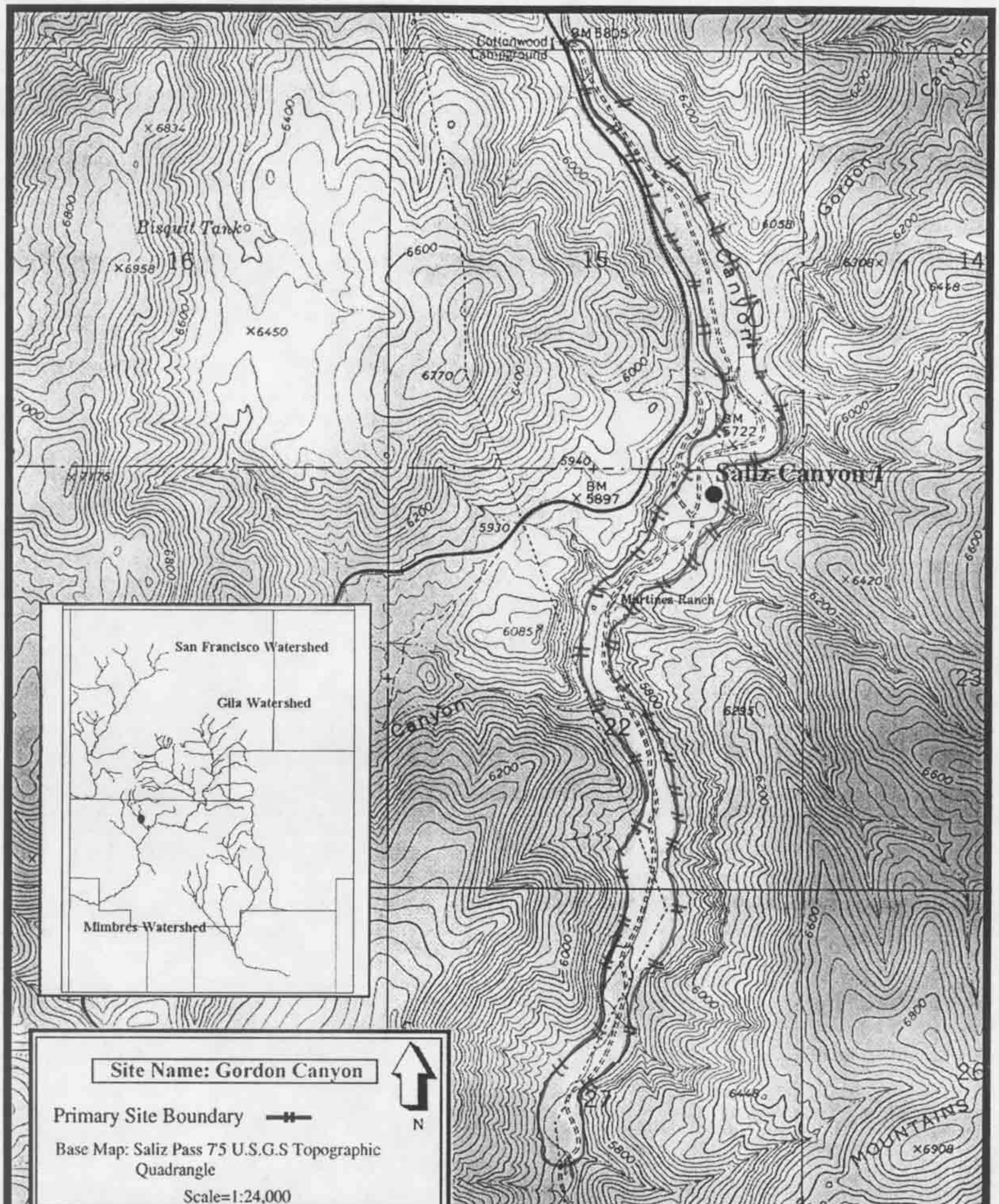

Figure B.53. The Gordon Canyon Site. Black dot indicates location of stream cross-section.

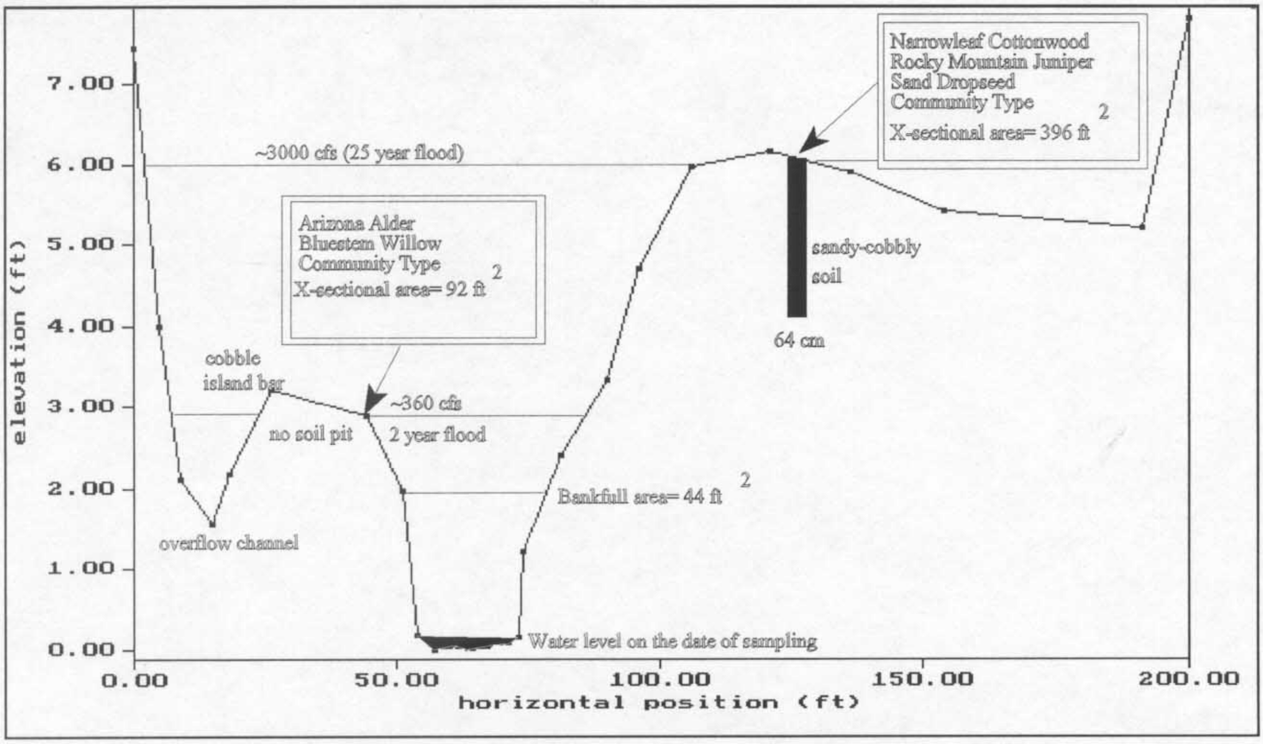

Figure B.54. Cross-section of Saliz Canyon (Saliz Canyon 1) at the Gordon Canyon Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.55. The Gordon Canyon Site in Saliz canyon Narrowleaf cottonwoods are common throughout this site.

Watershed: San Francisco Watershed **River:** San Francisco **Reach:** Alma

Site Name: Spurgeon Mesa **Site Number:** 146 **Basin Number** 1504004

County: CATRON **Quad. Map Name:** ALMA

Town: 10S **Range:** 20W **Section:** 17 **Northing:** 3702060 **Easting** 692410

Data Sources: Personal communication; ground reconnaissance, field sampled

Site Quality: BC

Site Description: At the Spurgeon Mesa site, terraces are dominated by good to fair quality stands of mature Fremont's cottonwood and Goodding's willow forested wetlands. Understories tend to be sparse due to heavy grazing. Young fluvial landforms such as side bars support dense young stands of Fremont's cottonwood, Goodding's willow and coyote willow. Arizona alders are also common in overflow channels and on streambanks. Younger herbaceous communities are absent, due to a recent flood that scoured much of the area and the bulldozing of streambanks. Encroachment of exotic species is a threat to this site as well.

Vegetation Communities:	Community Quality Ranks:
Fremont's cottonwood/Goodding's willow	B-
Fremont's cottonwood/Goodding's willow/coyote willow	B

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** Partial **Jetty Jacked** No

Leveed Partial **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are present and saltcedar and Russian olive are widely scatterd.
Grazing:	yes	Heavy.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	unknown	
Roads:	yes	Dirt roads are in the floodplain.
Mowing:	no	
Other Impacts:	yes	Parts of the bank are moved by a bulldozer.

Data

Cross Section: San Francisco 7

Plots: 95PD028 95PD029

Jurisdiction: Private

Survey Date: 7/9/96

Investigators: Bradley, Durkin

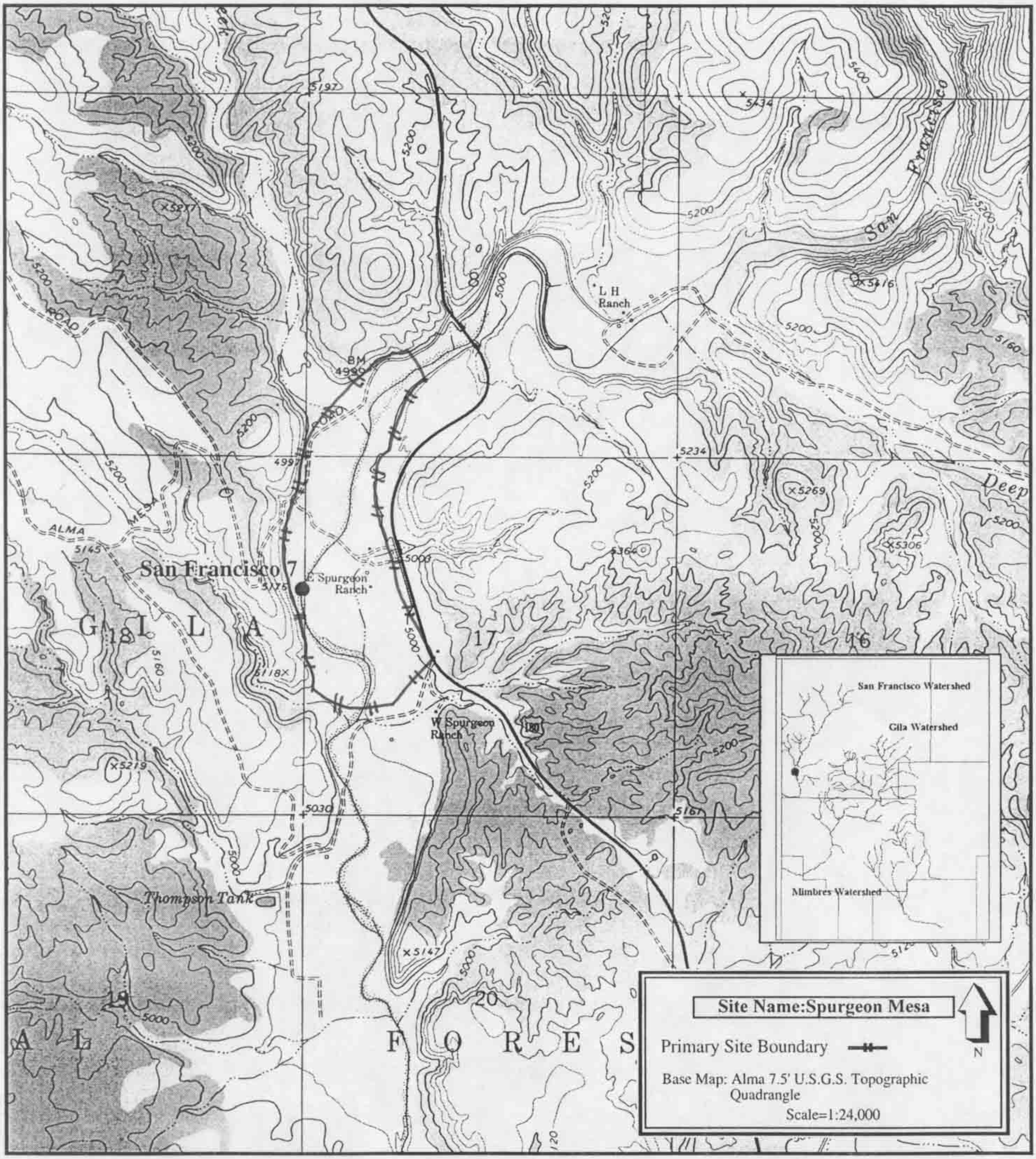

Figure B.56. The Spurgeon Mesa Site. Black dot indicates location of stream cross-section.

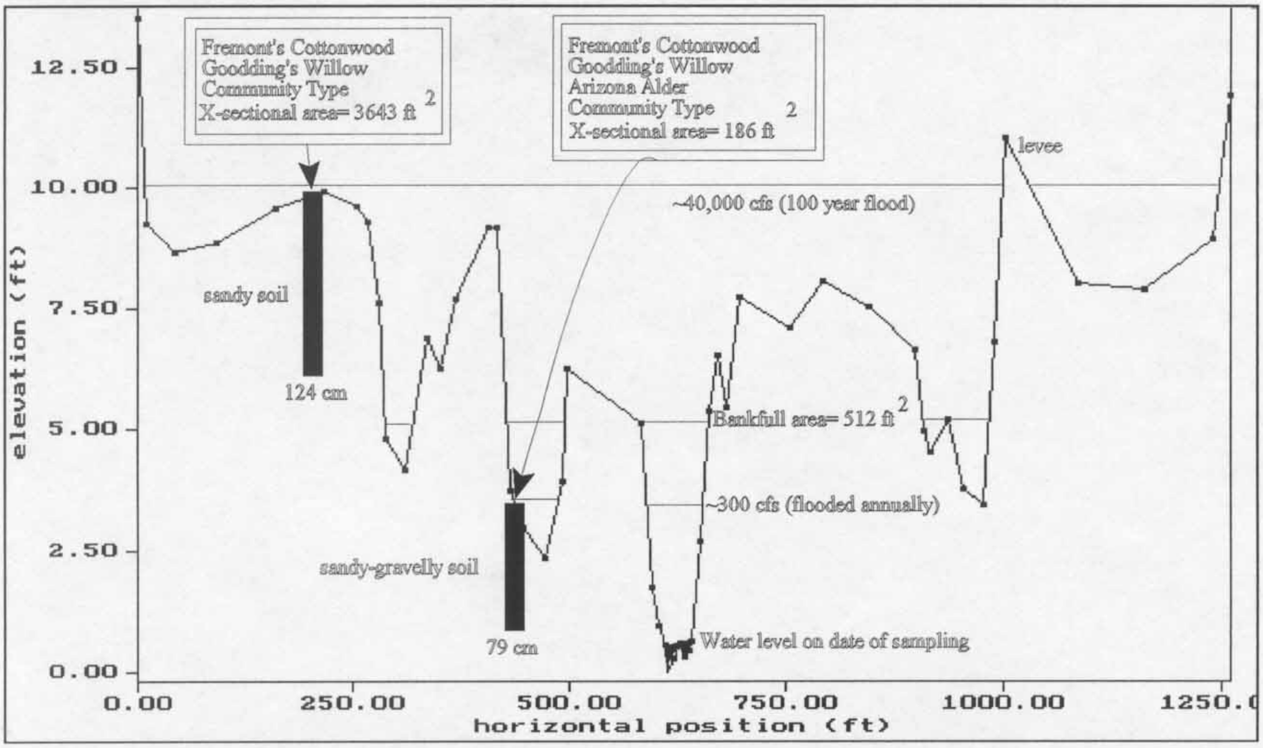

Figure B.57. Cross-section of the San Francisco River (San Francisco 7) at the Spurgeon Mesa Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.58. The Spurgeon Mesa Site on the San Francisco River. Agricultural fields have encroached on riparian forests throughout this site.

Watershed: San Francisco Watershed **River:** San Francisco **Reach:** Dillon Mt.

Site Name: Frisco Hot Spring **Site Number:** 125 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** DILLON MOUNTAIN

Town: 05S **Range:** 19W **Section:** 34 **Northing:** 3745650 **Easting** 703240

Data Sources: Ground reconnaissance; field sampled

Site Quality: AB

Site Description: A lush wetland consisting of American bulrush and smooth horsetail dominates the Dillon Mountain site. The wetland community is extensive, extending over a two-mile reach. On drier terraces narrowleaf cottonwoods and junipers are common. The effects of impacts are negligible, and communities are high in quality.

Vegetation Communities:	**Community Quality Ranks:**
American bulrush/smooth horsetail	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Excellent

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant:	no	
Grazing:	no	No evidence seen.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	yes	A dirt road does cross the channel.
Mowing:	no	
Other Impacts:	yes	Hikers and recreational bathers use the area.

Data

Cross Section: San Francisco

Plots: 95PD039

Jurisdiction: Apache National Forest

Survey Date: 7/15/95

Investigators: Bradley, Durkin, Keeshen

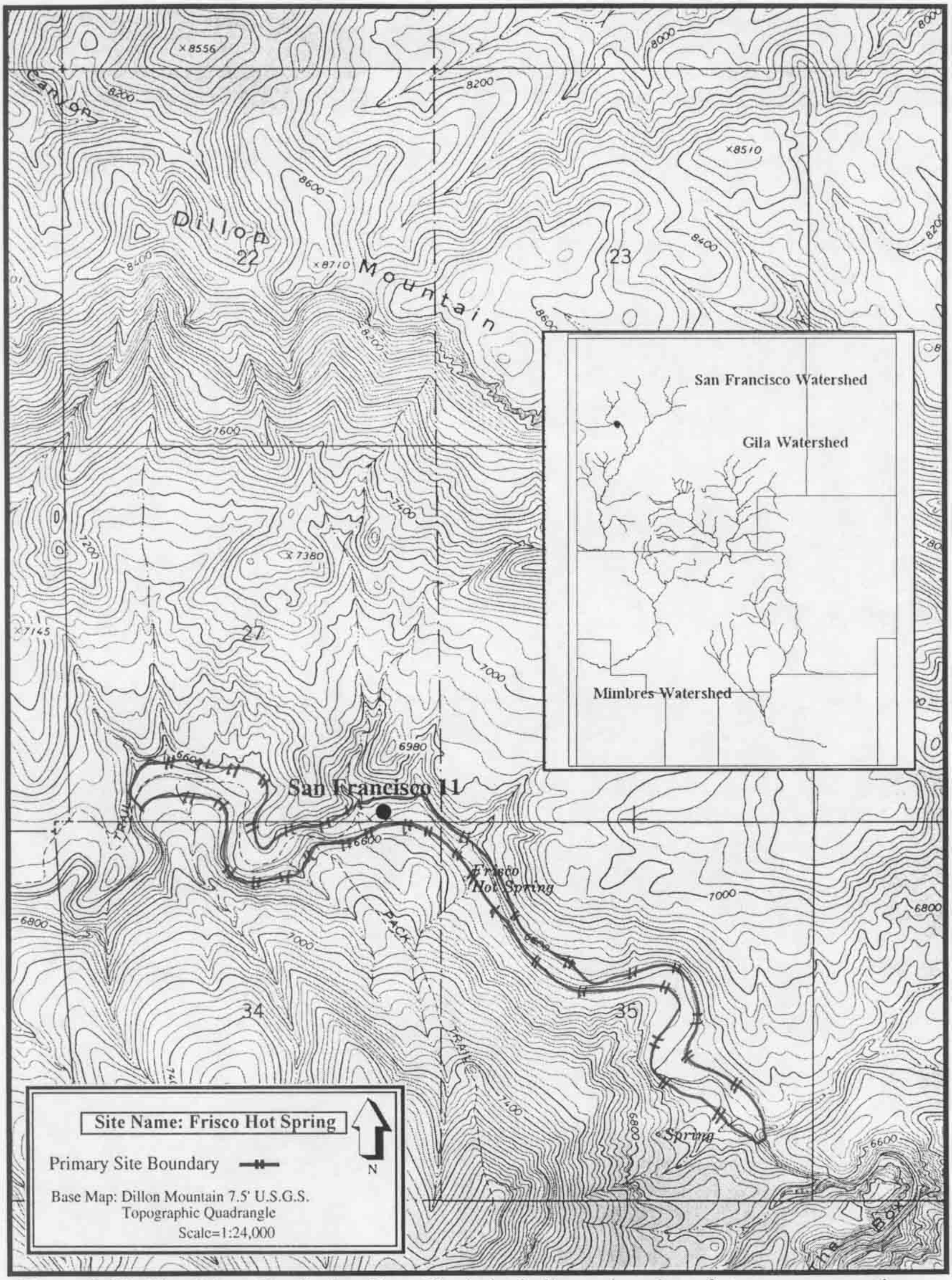

Figure B.59. The Frisco Hot Spring Site. Black dot indicates location of stream cross-section.

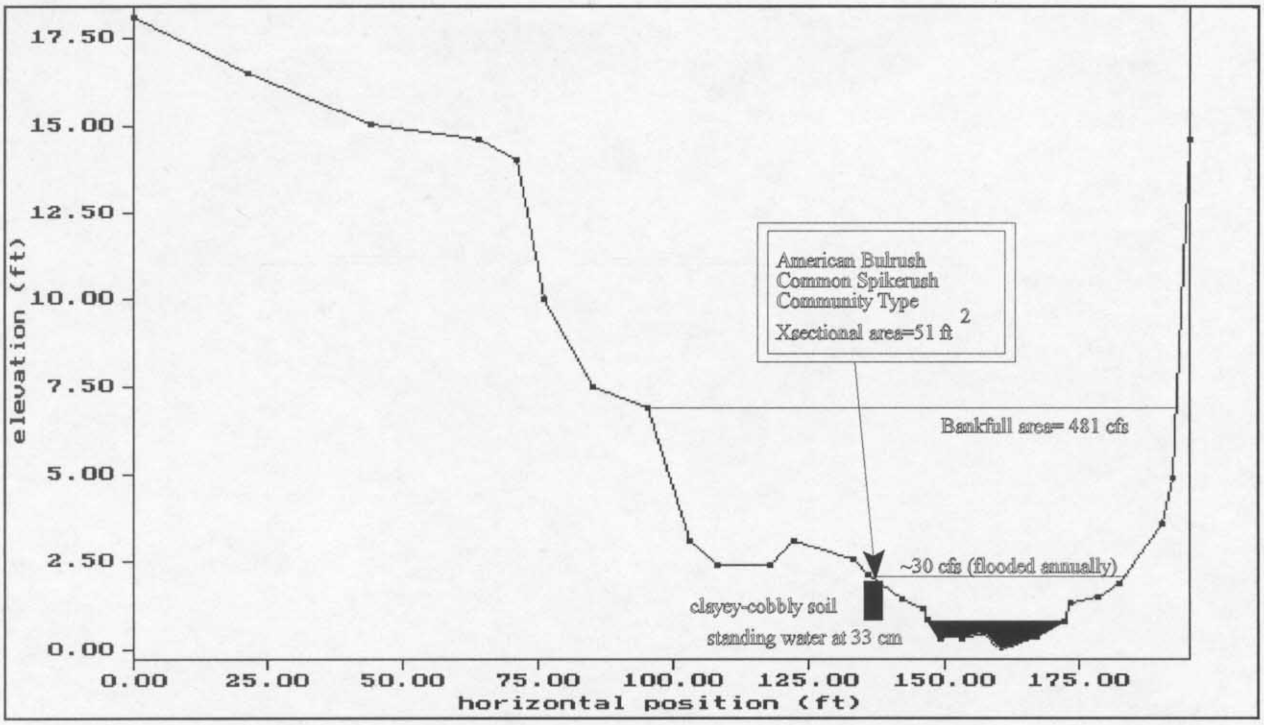

Figure B.60. Cross-section of the San Francisco River (San Francisco 11) at the Frisco Hot Spring Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.61. The Frisco Hot Spring Site on the San Francisco River. Streambanks are lined with American bulrush and smooth horsetail throughout much of this site.

Watershed: San Francisco Watershed **River:** San Francisco **Reach:** Glenwood

Site Name: Holt Gulch **Site Number:** 151 **Basin Number** 1504004

County: CATRON **Quad. Map Name:** GLENWOOD

Town: 12S **Range:** 20W **Section:** 11 **Northing:** 3683960 **Easting** 697660

Data Sources: Ground reconnaissance; field sampled

Site Quality: B

Site Description: Much of the floodplain at the Holt Golch site is scoured, but in areas that are vegetated, Fremont's cottonwood predominates. In an old overflow channel, adjacent to the upland slope, a young, dense, and lush stand composed primarily of Fremont's cottonwood, Goodding's willow and coyote willow occurs. Dry elevated cobble bars are dominated by rubber rabbitbrush and sand dropseed. On the narrow terrace that occurs on the opposite floodplain, good quality mature stands of Fremont's cottonwood and Goodding's willow predominate. This terrace is bisected by a levee that is no longer functional. To alleviate this problem, another levee was built (see x-sectional diagram). Irrigation diversions upstream probably affect base flows. Encroachment by exotics threaten the native communities.

Vegetation Communities:	Community Quality Ranks:
Fremont's cottonwood/Goodding's willow/coyote willow	A
rubber rabbitbrush/sand dropseed	B
Fremont's cottonwood/Goodding's willow	B

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed Partial **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But a few herbaceous and shrubby exotics are present.
Grazing:	no	No evidence seen
Fuel Wood:	no	
Dumping:	no	
ORV Use:	yes	ORV's use is moderatedl heavy through the channel and bars.
Roads:	no	
Mowing:	no	
Other Impacts:	yes	Irrigation diversion upstream

Data

Cross Section: San Francisco 6

Plots: 95PD025 95PD026

Jurisdiction: Private

Survey Date: 7/8/95

Investigators: Bradley, Durkin, Hartmann

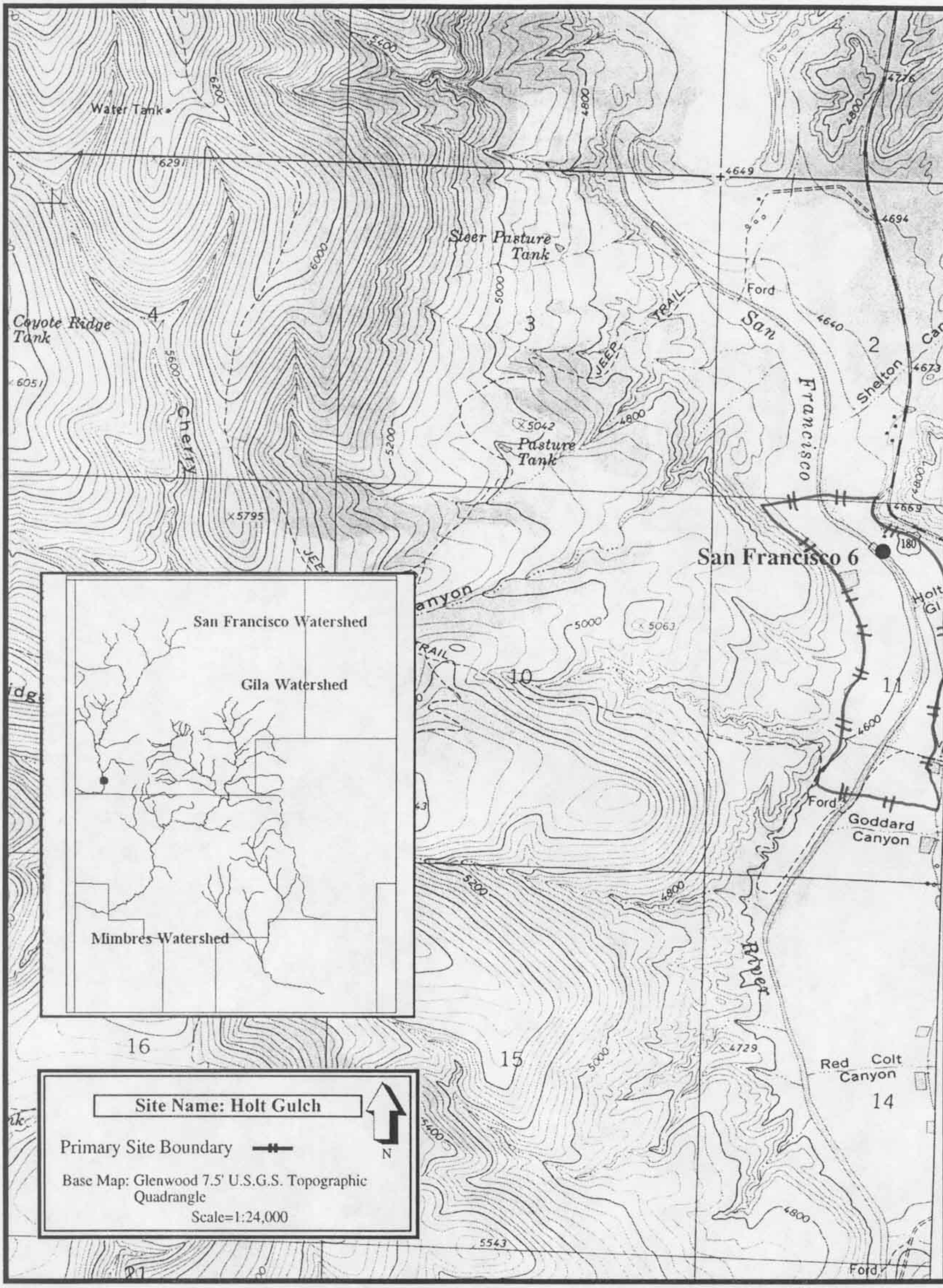

Figure B.62. The Holt Gulch Site. Black dot indicates location of stream cross-section.

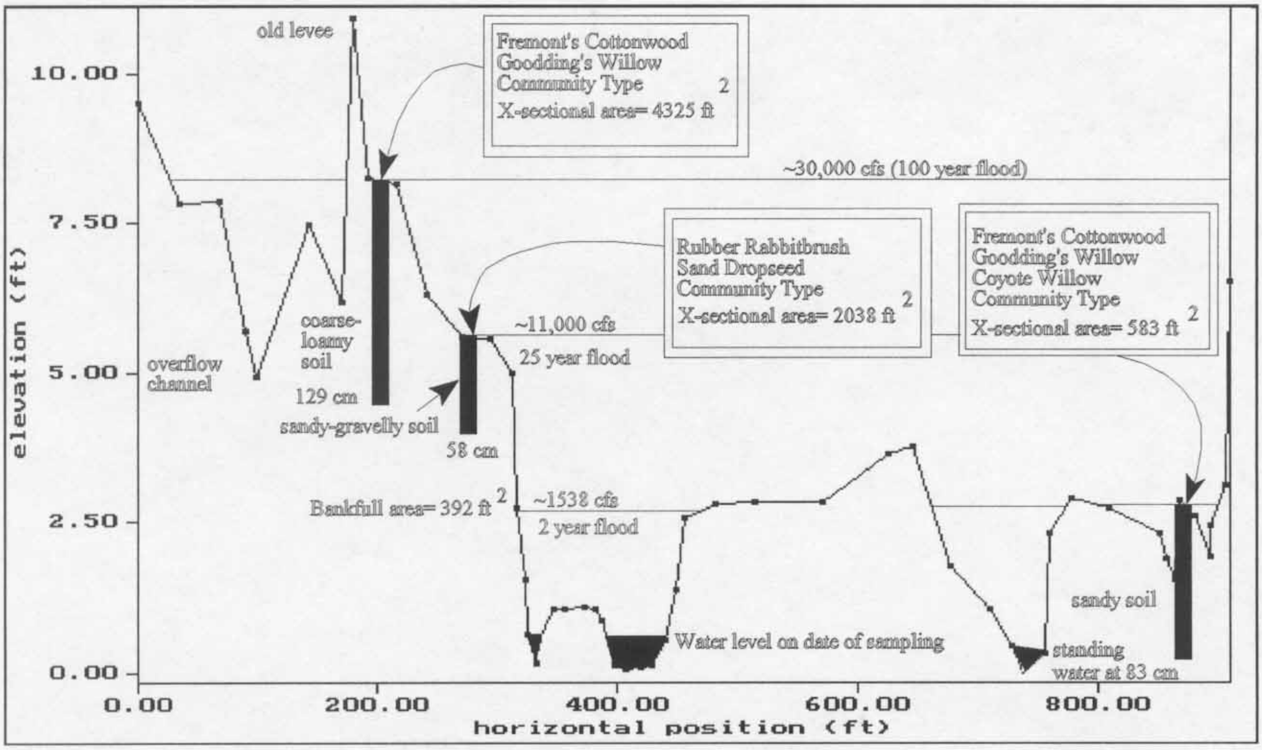

Figure B.63. Cross-section of the San Francisco River (San Francisco 6) at the Holt Gulch Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.64. The Holt Gulch site on the San Francisco River. Agriculture and urbanization have limited riparian forests to narrow strips along the channel.

Watershed: San Francisco Watershed **River:** San Francisco **Reach:** Glenwood

Site Name: Old Oxbow **Site Number:** 150 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** GLENWOOD

Town: 11S **Range:** 20W **Section:** 34 **Northing:** 3686310 **Easting** 696320

Data Sources: Aerial and ground reconnaissance; field sampled

Site Quality: AB

Site Description: This site is characterized by a mosaic of high quality riparian communities. Overflow channels are dominated by American bulrush and smooth horsetail. Streambanks are well stabilized by a variety of young riparian trees but Fremont's cottonwood and Gooding's willow dominate. On higher fluvial landforms, mature Fremont's cottonwood with a dense litter layers are found. The highlight of this site, however, is an old oxbow that is vegetated by thousands of young Fremont's cottonwood and willows. Floodplain and channel impacts to this reach are few, but include a road around the periphery of the oxbow and a few herbaceous exotics.

Vegetation Communities:	Community Quality Ranks:
Fremont's cottonwood/sparse undergrowth	B+
American bulrush/smooth horsetail	B
Fremont's cottonwood/Goodding's willow/coyote willow	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are common.
Grazing:	no	No evidence seen.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	yes	Roads cross the floodplain and are around the perimeter of the oxbow
Mowing:	no	
Other Impacts:	no	

Data

Cross Section: San Francisco 4

Plots: 95PD018 95PD019

Jurisdiction: Gila National Forest

Survey Date: 6/27/95

Investigators: Bradley, Durkin, Hartmann, Gruver

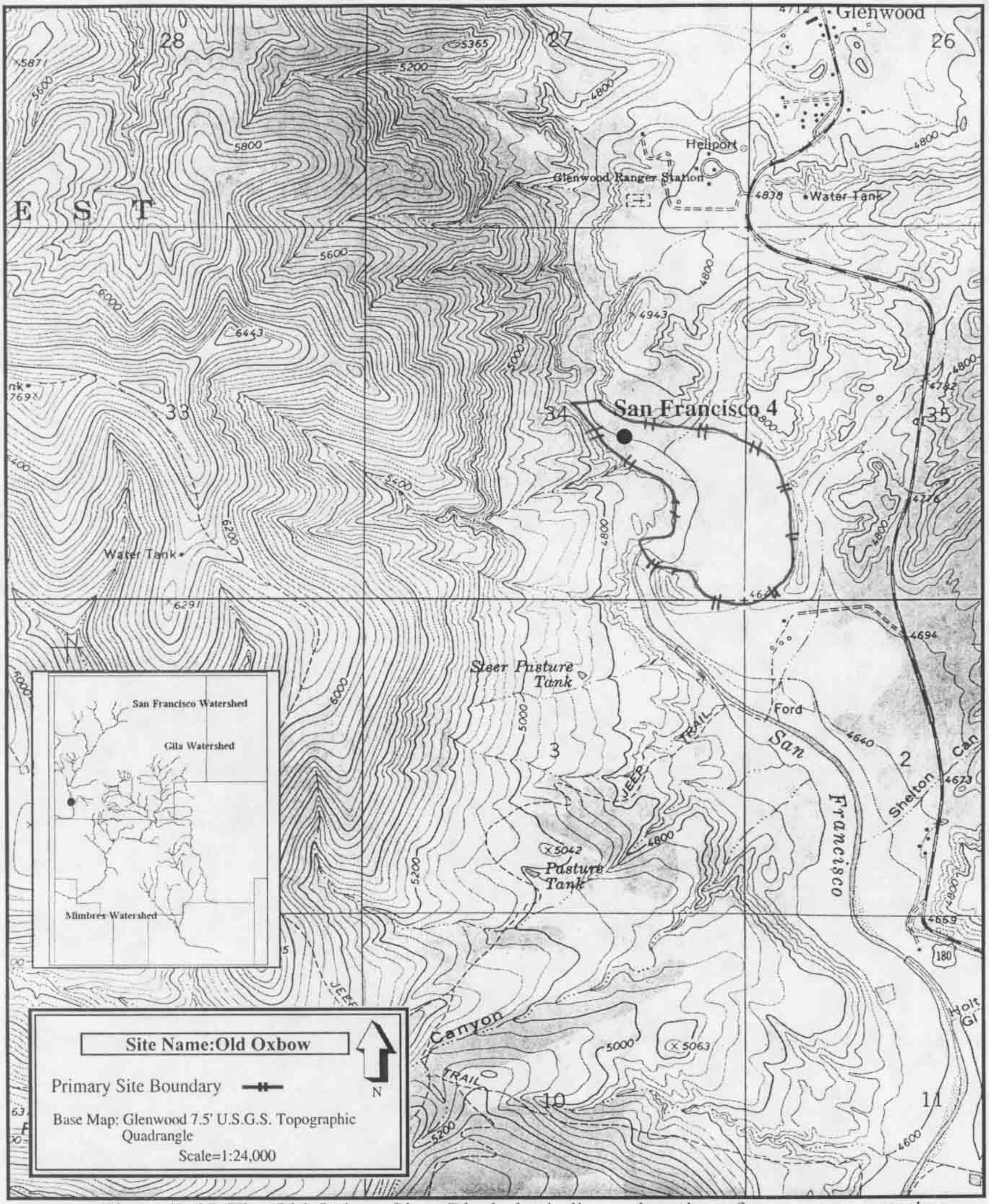

Figure B.65. The Old Oxbow Site. Black dot indicates location of stream cross-section.

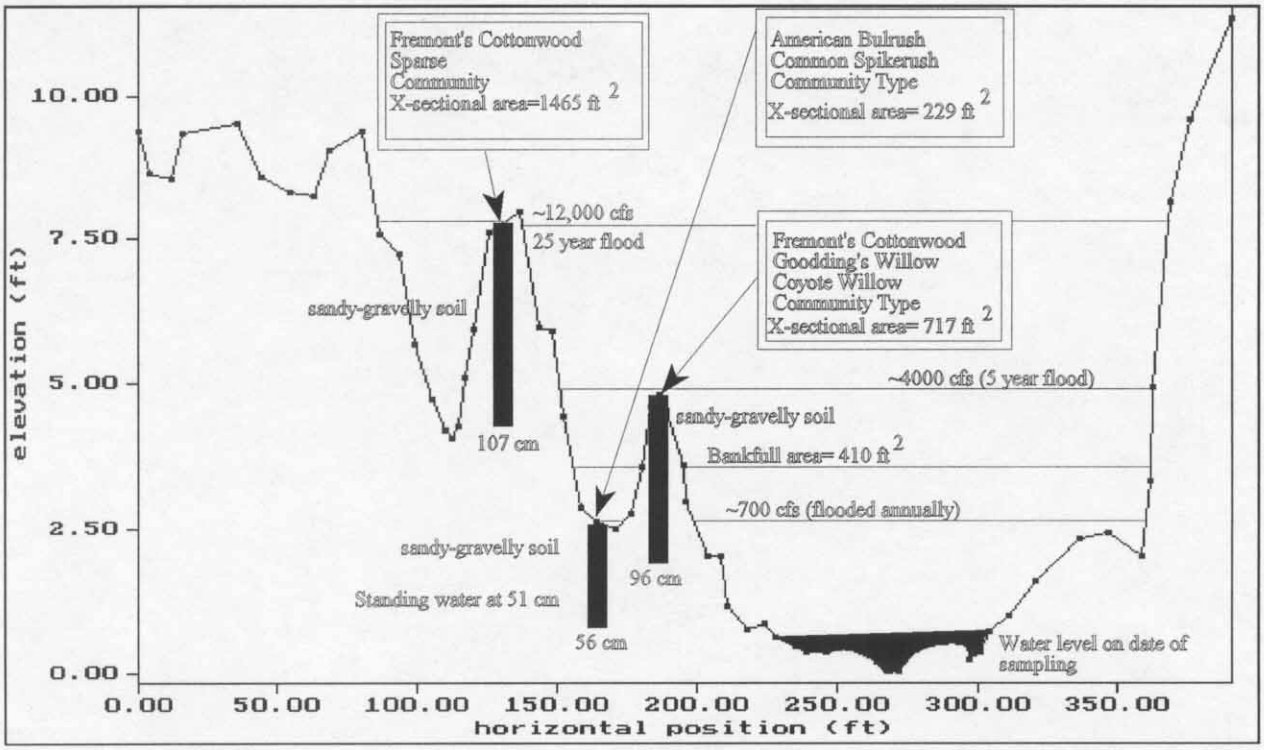

Figure B.66. Cross-section of the San Francisco River (San Francisco 4) at the Old Oxbow Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.67. The Old Oxbow Site on the San Francisco River is dominated by dense stands of juvenile Fremont's cottonwoods and coyote willow shrublands.

Watershed: San Francisco Watershed **River:** San Francisco **Reach:** Higgins Mt

Site Name: Hudson Spring **Site Number:** 127 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** RESERVE

Town: 06S **Range:** 19W **Section:** 26 **Northing:** 3736210 **Easting** 706940

Data Sources: Ground reconnaissance; field sampled

Site Quality: AB

Site Description: The Hudson Spring site is characterized by good quality stands of juvenile Fremont's cottonwood and narrowleaf cottonwood. Tree communities are dense and are found primarily on low side bars. The average age of trees is 5-25 years. Herbaceous communities are lush as well and are comprised primarily of American bulrush and smooth horsetail. Overflow channels have cattails and softstem bulrushes as well. Due to the isolation of the site, floodplain and channel impacts are minimal.

Vegetation Communities:	Community Quality Ranks:
narrowleaf cottonwood/bluestem willow	B
American bulrush/smooth horsetail	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Excellent

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are common.
Grazing:	no	But grazing occurs upstream and in the uplands.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	no	
Mowing:	no	
Other Impacts:	no	

Data

Cross Section: San Francisco 12

Plots: 95PD043 95PD044

Jurisdiction: Gila National Forest

Survey Date: 7/23/95

Investigators: Bradley, Durkin

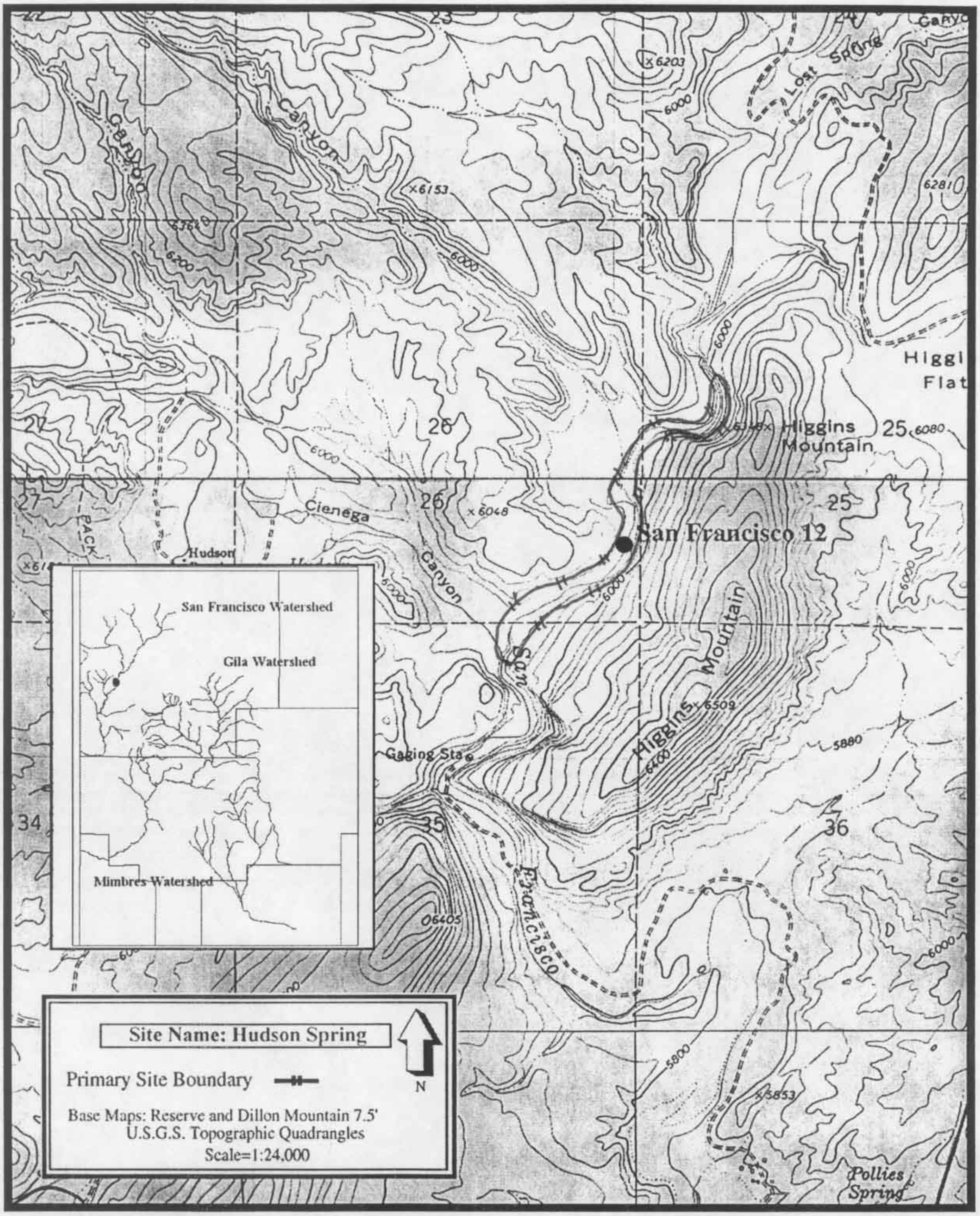

Figure B.68. The Hudson Spring Site. Black dot indicates location of cross-section.

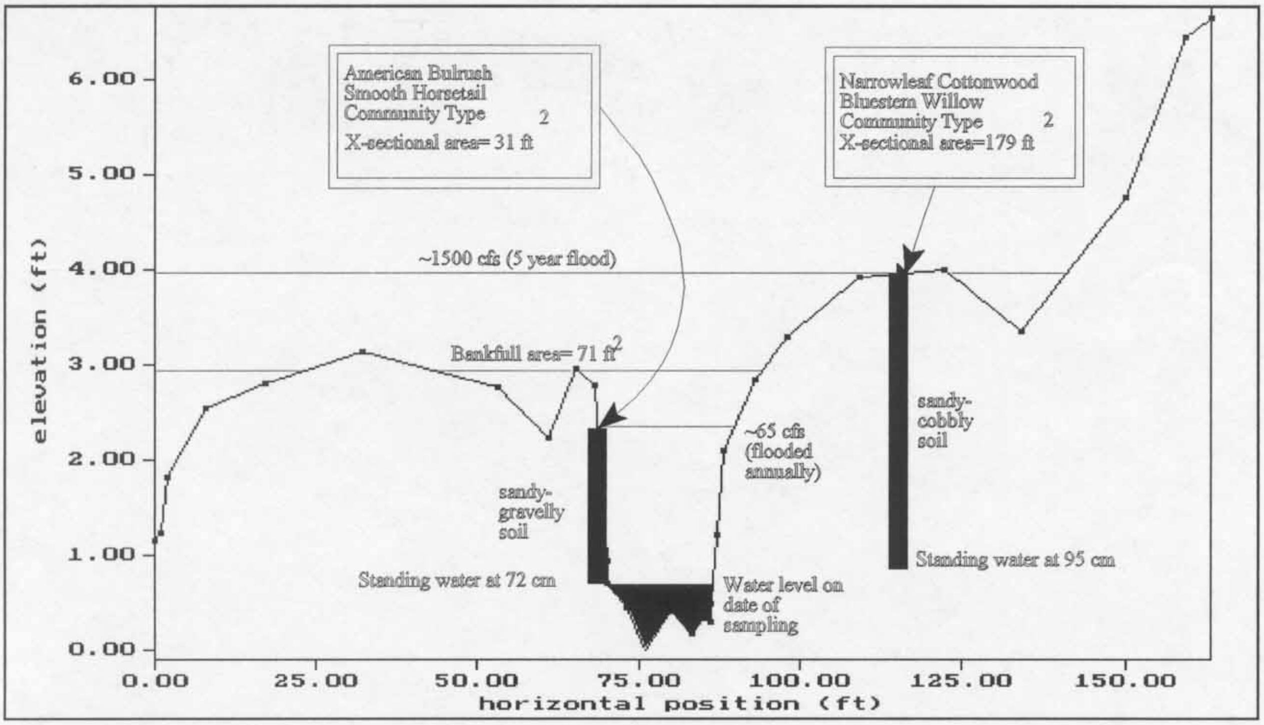

Figure B.69. Cross-section of the San Francisco River (San Francisco 12) at the Hudson Spring Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.70. The Hudson Spring Site on the San Francisco River. This site is dominated by young Fremont's cottonwood and narrowleaf cottonwoods. Older trees can be found where the floodplain widens.

Watershed: San Francisco Watershed **River:** San Francisco **Reach:** Kelly Mountain

Site Name: Devils Creek **Site Number:** 145 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** ALMA

Town: 09S **Range:** 20W **Section:** 34 **Northing:** 3706810 **Easting** 695660

Data Sources: Ground reconnaissance; field sampled

Site Quality: BC

Site Description: Much of the Devils Creek Site is dominated by good quality stands of young Fremont's cottonwood and seepwillows with Gooding's willow interspersed. These young communities are dense, and occur on side bars that are within a few meters of the channel. In certain areas, bulrushes and spikerushes are found adjacent to the active channel. Rubber rabbitbrush and sand dropseed is common on elevated cobble bars. Terraces are few, but are dominated by Fremont's cottonwood and Arizona sycamores. Other common species on these isolated terraces include velvet ash, Rocky Mountain juniper, and boxelder. Water diversions upstream may be drying the site. Encroachment of exotics is a threat to this site as well.

Vegetation Communities:	Community Quality Ranks:
Fremont's cottonwood/Arizona sycamore/velvet ash	B
American bulrush/common spikerush	B
Fremont's cottonwood/seepwillow	B
rubber rabbitbrush/sand dropseed	B

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But exotic herbaceous species are present and salt cedar was scattered.
Grazing:	yes	The site is moderately grazed.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	no	
Mowing:	no	
Other Impacts:	yes	Irrigation diversions upstream probably affect base flow.

Data

Cross Section: San Francisco 8

Plots: 95PD032 95PD033

Jurisdiction: Gila National Forest

Survey Date: 7/10/95

Investigators: Bradley, Durkin

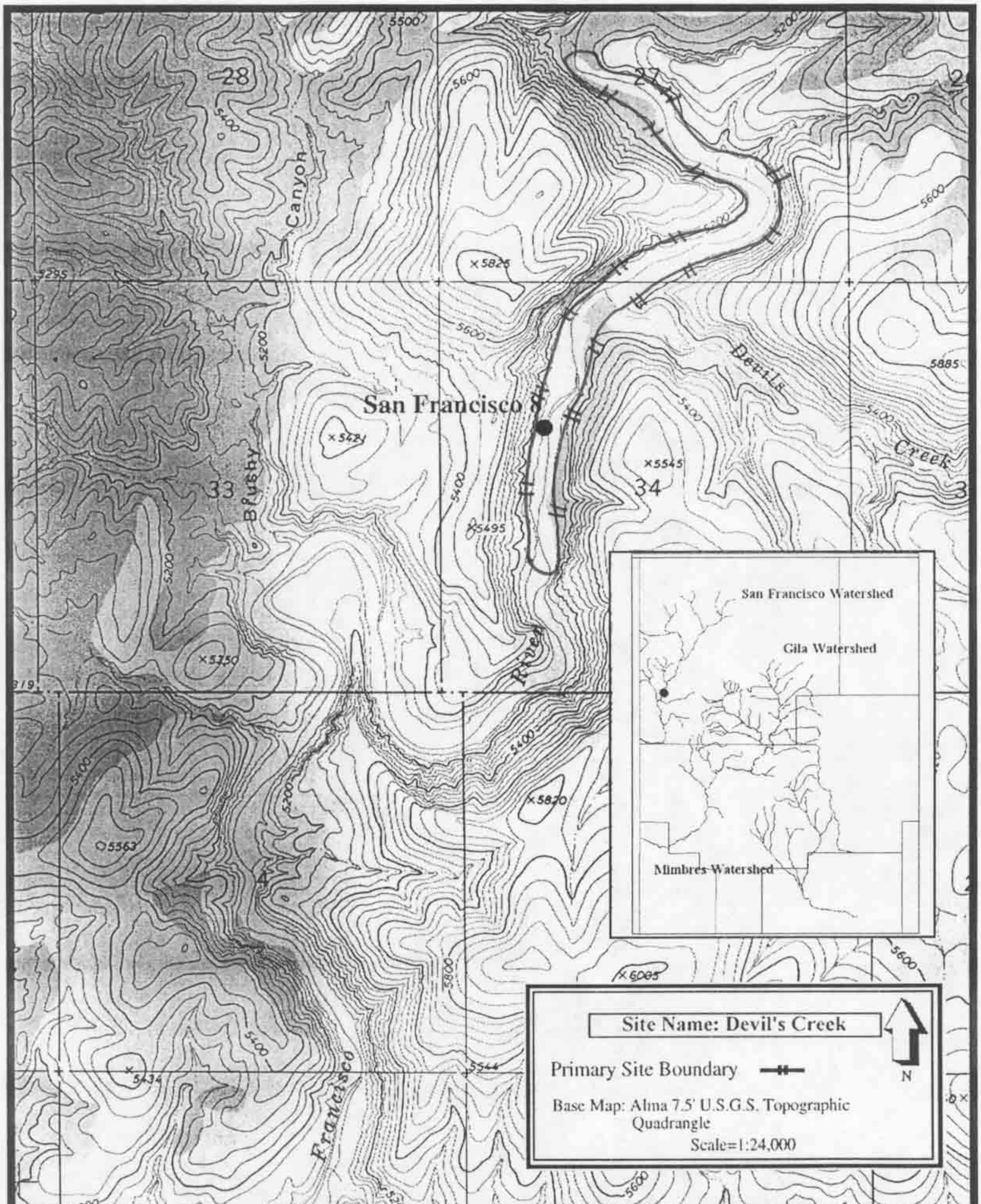

Figure B.71. The Devils Creek Site. Black dot indicates location of cross-section.

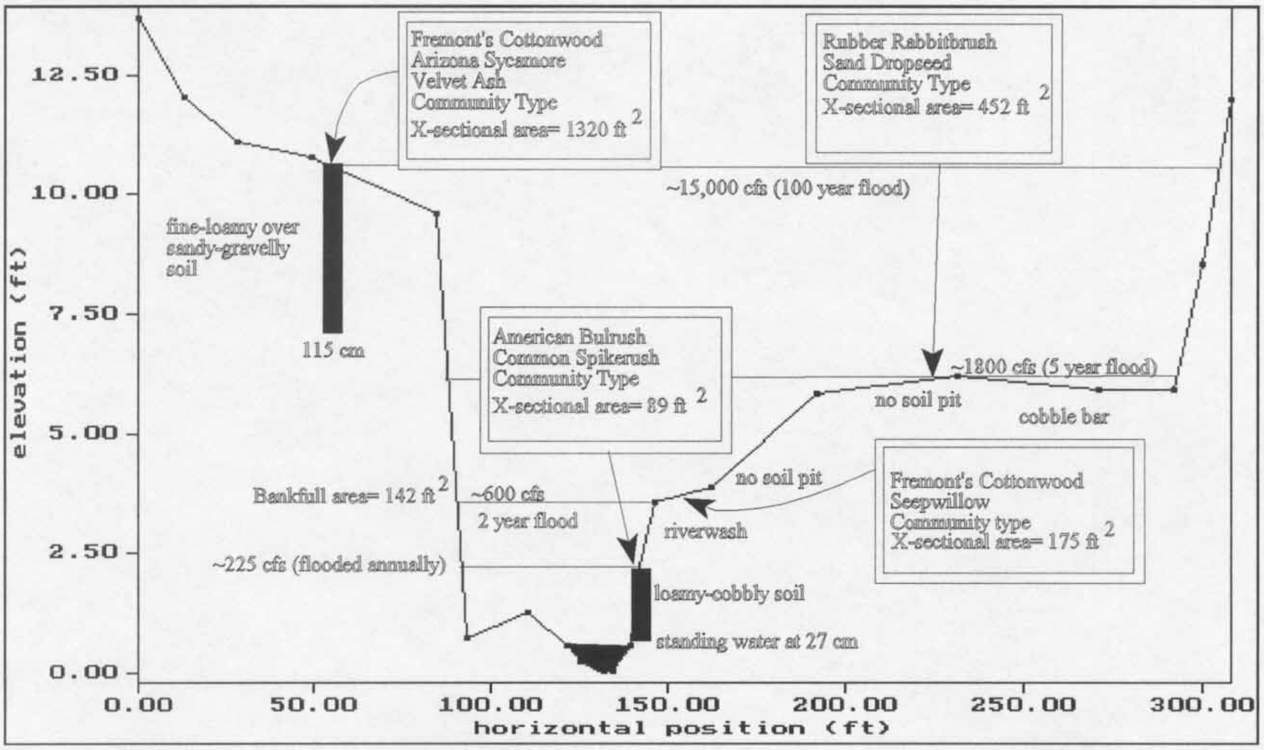

Figure B.72. Cross-section of the San Francisco River (San Francisco 8) at the Devils Creek Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.73. The Devils Creek Site on the San Francisco River. This is a confined site where the dominant vegetation consists of regenerating cottonwoods and other willows.

Watershed: San Francisco Watershed **River:** San Francisco **Reach:** Kelly Mountain

Site Name: Kelly Ranch **Site Number:** 140 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** O BLOCK CANYON

Town: 09S **Range:** 20W **Section:** 11 **Northing:** 3713110 **Easting** 697960

Data Sources: Ground reconnaissance; field sampled

Site Quality: C

Site Description: The dominant riparian vegetation of the Kelly Ranch Site is young stands of Fremont's cottonwood with sparse understories. These stands are in fair in quality, and are common along the banks of the channel. Goodding's willow and seepwillow are also widely dispersed. The health and viability of these young stands is in question as much of the stand shows signs of stress, with many leaves turning prematurely yellow. Irrigation diversions and other hydrological impacts upstream in the town of Reserve may be responsible for the dry channel seen on the date of sampling. The fringes of the floodplain are predominantly Arizona walnut and New Mexico olive. Other common associates on these high dry terraces include netleaf hackberry, California brickellbush, and alligator juniper. Understories are primarily composed of herbaceous exotics including cheatgrass, horehound, and silverleaf nightshade. Snakeweed, indicative of overgrazing, is also common.

Vegetation Communities:	Community Quality Ranks:
Fremont's cottonwood/sparse undergrowth	B-
Arizona walnut/New Mexico olive	C

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are common.
Grazing:	yes	Heavy.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	yes	A dirt road is on the fringes of the floodplain.
Mowing:	no	
Other Impacts:	yes	The stream channel was dry on date of sampling, and the riparian vegetation seems stressed (dying leaves).

Data

Cross Section: San Francisco 10

Plots: 95PD038 95PD037

Jurisdiction: Gila National Forest

Survey Date: 7/13/95

Investigators: Bradley, Durkin

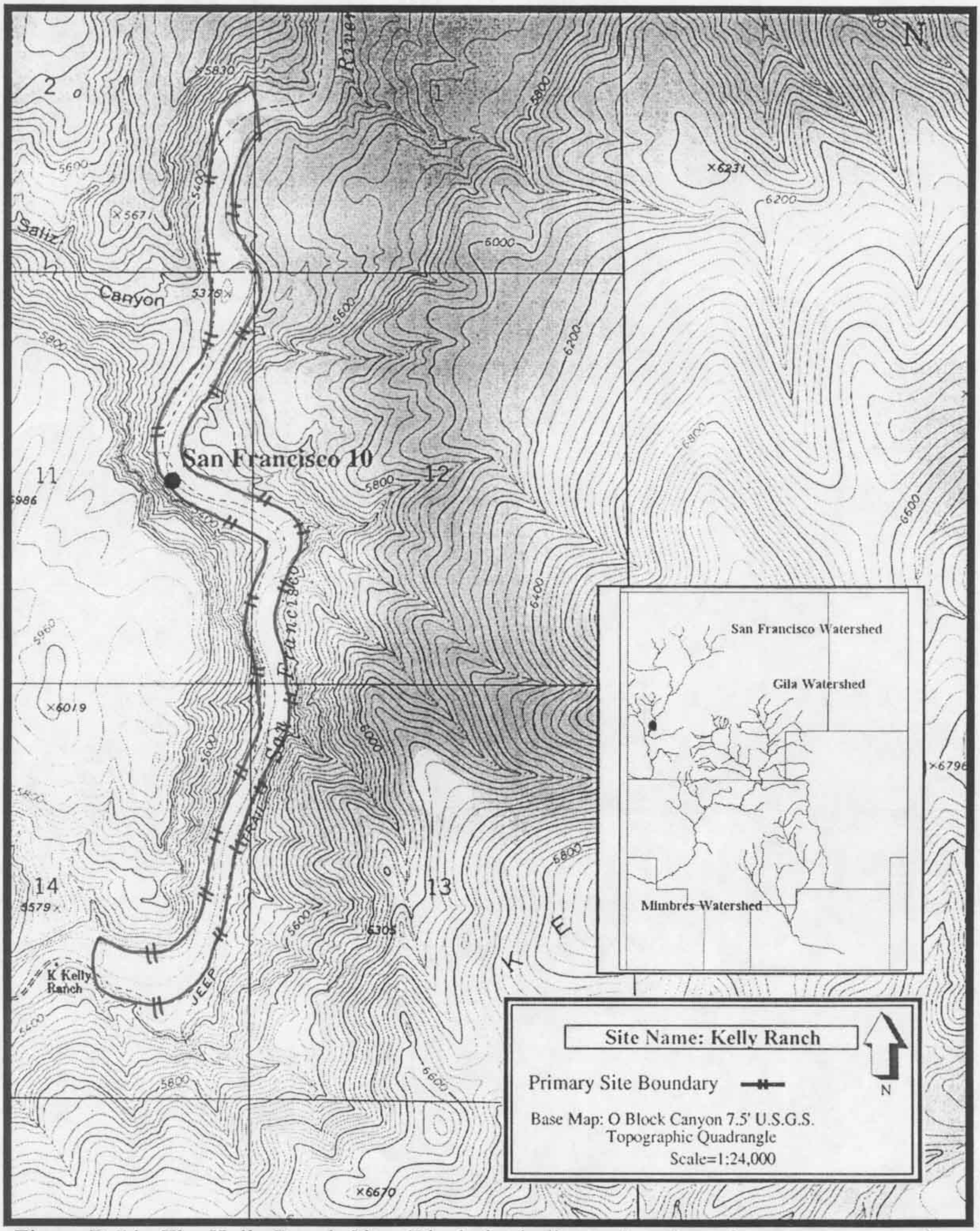

Figure B.74. The Kelly Ranch Site. Black dot indicates location of stream cross-section.

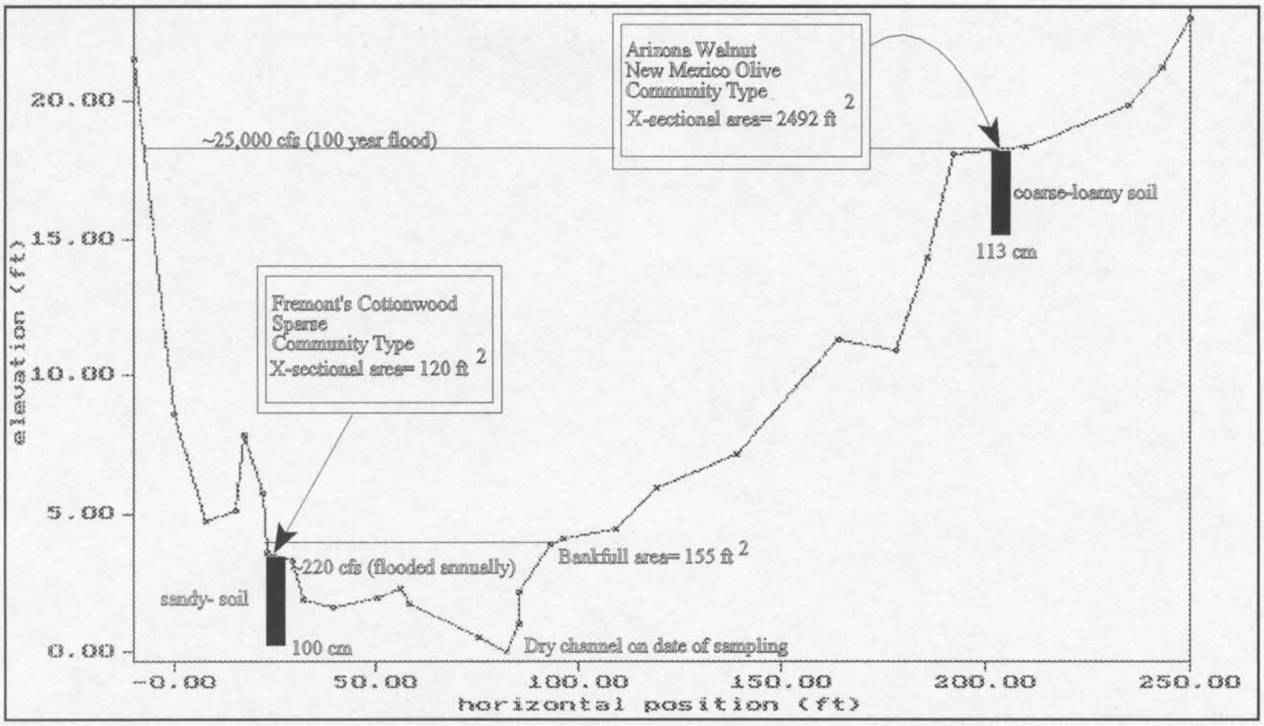

Figure B.75. Cross-section of the San Francisco River (San Francisco 10) at the Kelly Ranch Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.76. The Kelly Ranch Site on the San Francisco River. On the date of sampling, the channel was dry, possibly explaining the color of the leaves on these young Fremont's cottonwoods.

Watershed: San Francisco Watershed **River:** San Francisco **Reach:** Luna Lake

Site Name: Luna Lake **Site Number:** 123 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** LUNA

Town: 05S **Range:** 21W **Section:** 33 **Northing:** 3744800 **Easting** 682100

Data Sources: Personal communication; field sampled

Site Quality: B

Site Description: The dominant vegetation of the Luna Lake site is the bluestem willow/common spikerush community. This community is good in quality, and forms a fairly long and continous stand throughout this site. A few mature narrowleaf cottonwoods are found from the channel and most are dead or dying. These trees may have been isolated when Luna Lake was constructed. Other impacts are negligible.

Vegetation Communities:	**Community Quality Ranks:**
bluestem willow/common spikerush	B

Hydrologic Impacts:

Flow Regulation: Yes **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant: no

Grazing:	yes	Elk graze in the area.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	yes	One dirt road is out of the floodplain.
Mowing:	no	
Other Impacts:	yes	Campers and picnickers.

Data

Cross Section: San Francisco 9

Plots: 95PD036

Jurisdiction: Apache National Forest

Survey Date: 7/12/95

Investigators: Bradley, Durkin

Figure B.77. The Luna Lake Site. Black dot indicates location of stream cross-section.

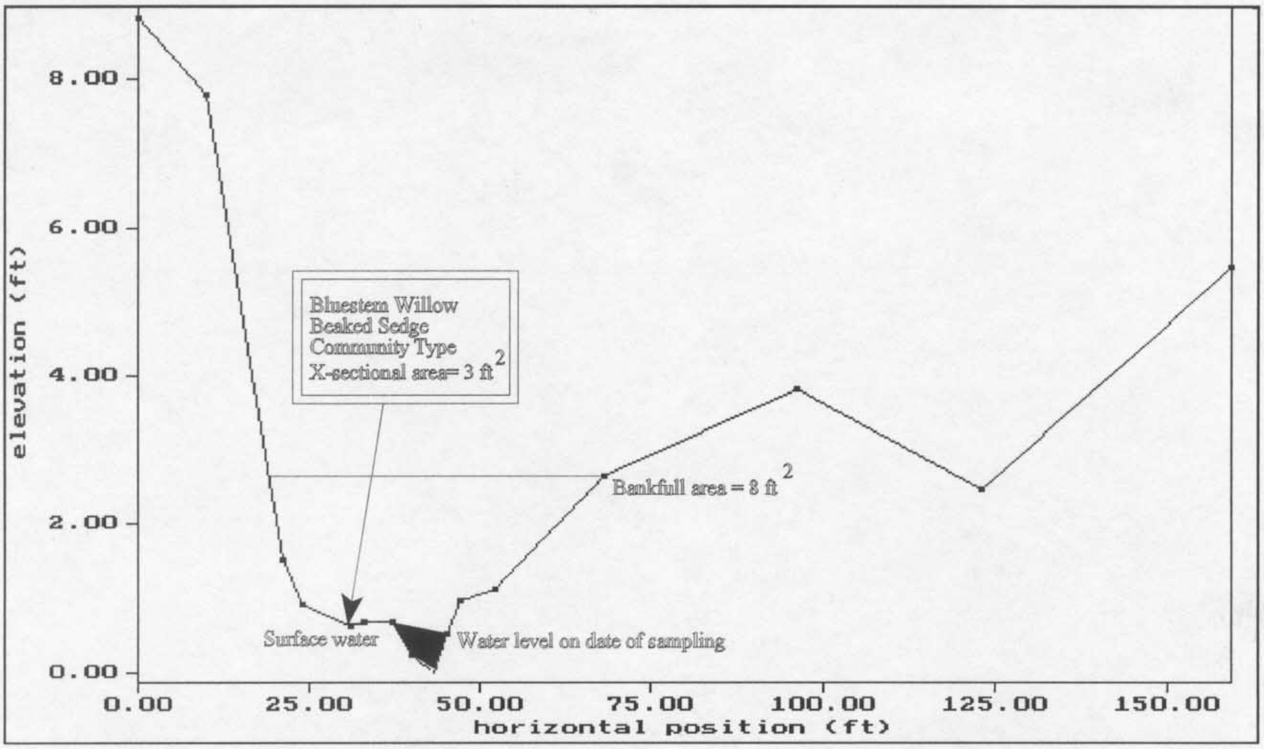

Figure B.78. Cross-section of the San Francisco River (San Francisco 9) at the Luna Lake Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.79. The Luna Lake Site at the upper end of the San Francisco River. Bluestem willows dominate much of this site.

Watershed: San Francisco Watershed **River:** San Francisco **Reach:** North Glenwood Canyon

Site Name: Harve Gulch **Site Number:** 148 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** GLENWOOD

Town: 11S **Range:** 20W **Section:** 09 **Northing:** 3692840 **Easting** 693900

Data Sources: Ground reconnaissance; field sampled

Site Quality: BC

Site Description: Forested wetlands at the Harve Gulch Site are dominated by good quality, young stands of Fremont's cottonwood and Arizona sycamore. Other trees include velvet ash, three species of willows, and saltcedar. Directly adjacent to the channel, coyote willow and spikerushes are common. On isolated terraces, Arizona walnut and New Mexico olive predominate with other associates including netleaf hackberry and boxelder common. The herbaceous understory here are primarily exotic, with cheatgrass dominating. These terraces tend to be high and dry and in the 100 year floodplain (see x-sectional diagram). Water diversions in the town of Alma may be drying this site. Encroachment of exotic species is a threat as well.

Vegetation Communities:	Community Quality Ranks:
Arizona walnut/New Mexico olive	B
coyote willow/common spikerush	B
Fremont's cottonwood/Arizona sycamore/velvet ash	B

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Fair

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are present and saltcedar is widely scattered.
Grazing:	yes	Moderate to heavy.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	no	
Mowing:	no	
Other Impacts:	yes	Water diversions upstream affect base flows.

Data

Cross Section: San Francisco 5

Plots: 95PD023 95PD024

Jurisdiction: Gila National Forest

Survey Date: 6/30/95

Investigators: Bradley, Durkin, Hartmann

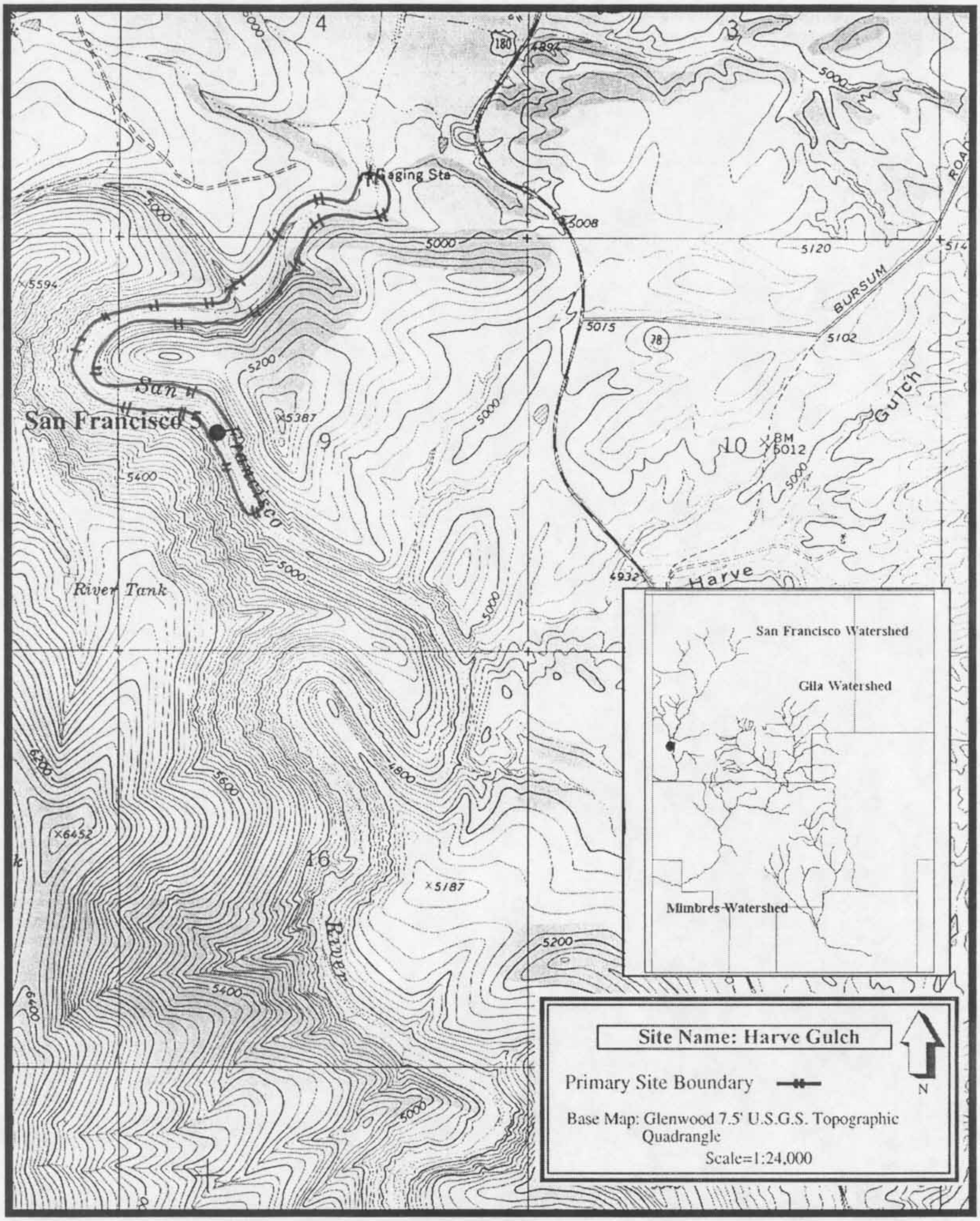

Figure B.80. The Harve Gulch Site. Black dot indicates location of stream cross-section.

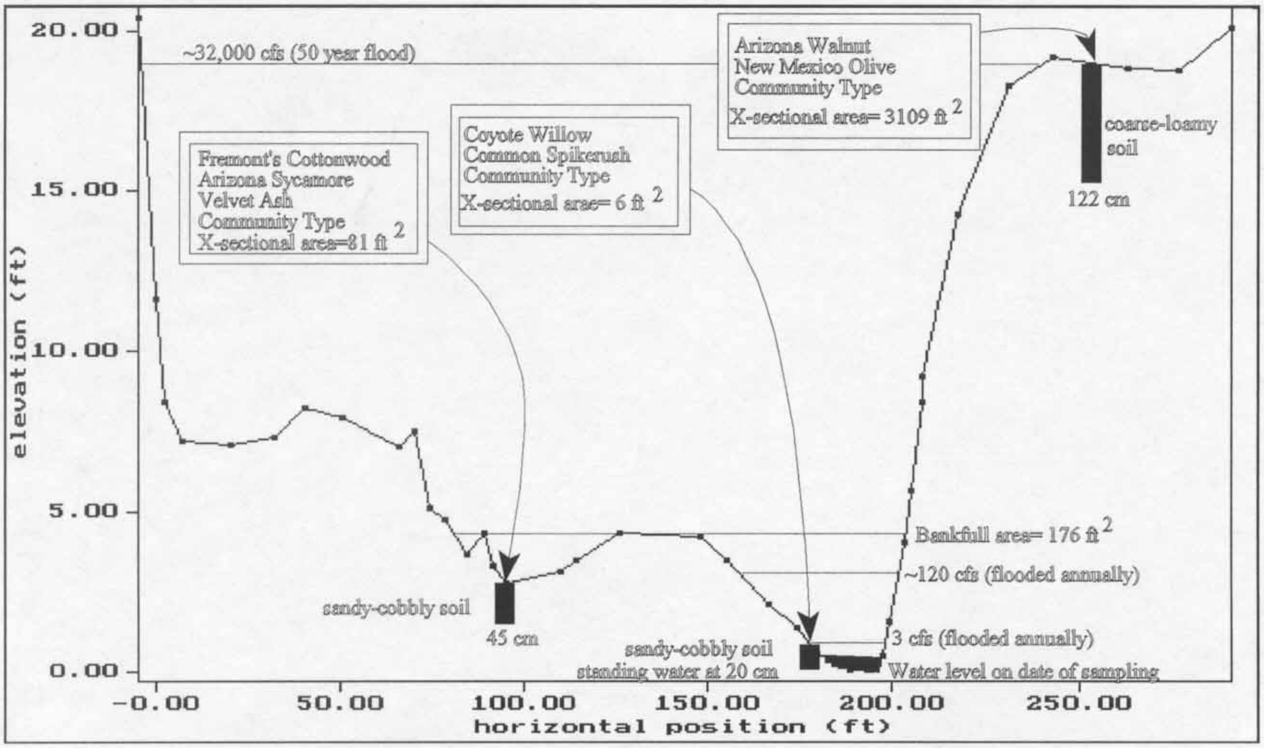

Figure B.81. Cross-section of the San Francisco River (San Francisco 5) at the Harve Gulch Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.82. The Harve Gulch Site on the San Francisco River. A recent flood has scoured much of this site leaving small stands of young Fremont's cottonwood, Arizona sycamore, and willows.

Watershed: San Francisco Watershed **River:** San Francisco **Reach:** North Glenwood Canyon

Site Name: Sandy Wash **Site Number:** 149 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** GLENWOOD

Town: 11S **Range:** 20W **Section:** 27 **Northing:** 3688740 **Easting** 696570

Data Sources: Ground reconnaissance; field sampled

Site Quality: AB

Site Description: The Sandy Wash site of North Glenwood Canyon is isolated and riparian vegetation is dominated by young and dense stands of Fremont's cottonwood and Gooding's willow forested wetlands. Common associates include coyote willow and Arizona alder. Regenerating Arizona sycamores are also found in these stands along the cobbly streambanks. Terrace formation is infrequent. Where terraces do occur, they are usually small and dominated by mature Arizona sycamores with grassy understories. In addition, a spring seeps out of the steep bluff wall on the west end of the narrow floodplain. Impacts to this site are negligible, and the riparian communities are in good condition. Encroachment of exotic species is a minor threat.

Vegetation Communities:	Community Quality Ranks:
Arizona sycamore/sand dropseed	B
Fremont's cottonwood/Goodding's willow/coyote willow	B+

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are present and saltcedar is scattered.
Grazing:	no	No evidence seen.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	no	
Mowing:	no	
Other Impacts:	no	

Data

Cross Section: San Francisco 3

Plots: 95PD016 95PD017

Jurisdiction: Gila National Forest

Survey Date: 6/26/95

Investigators: Bradley, Durkin, Hartmann

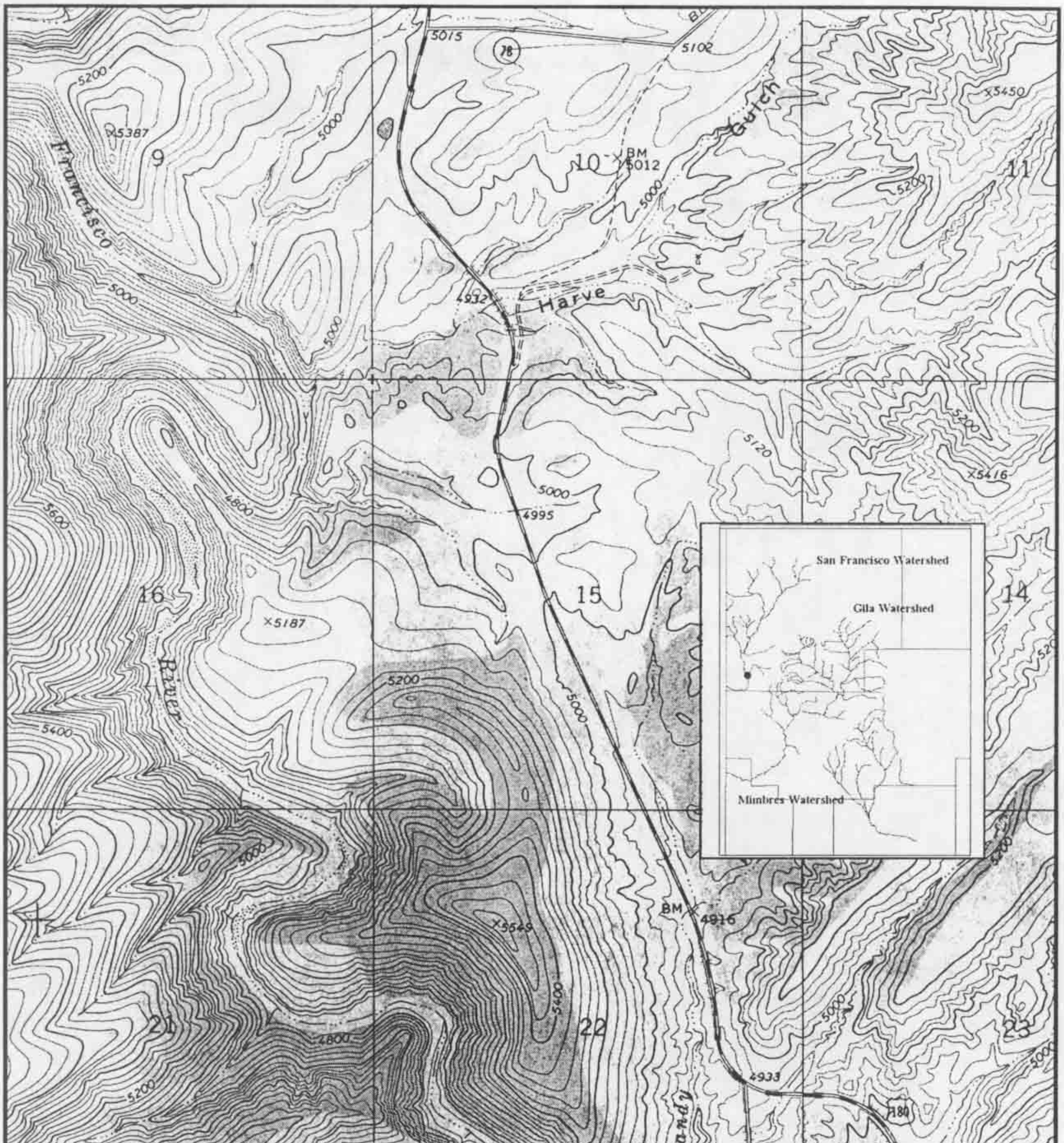

Figure B.83. The Sandy Wash Site. Black dot indicates location of stream cross-section.

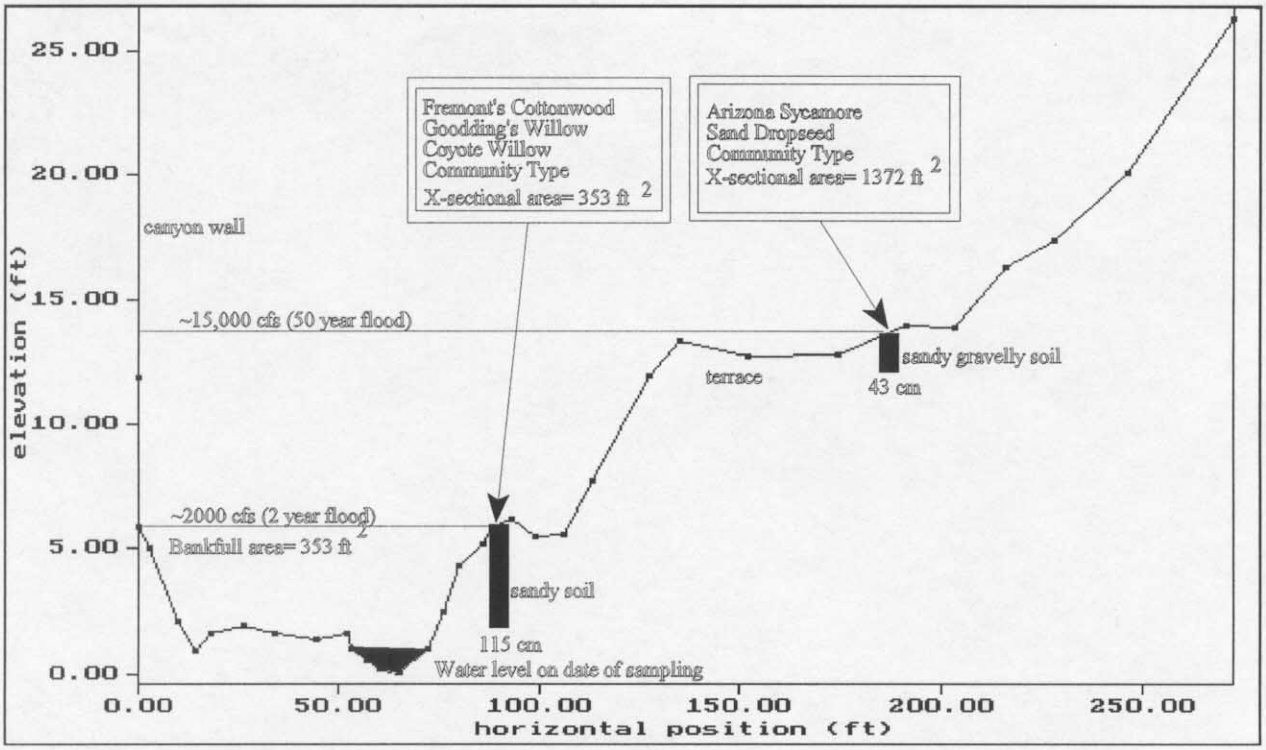

Figure B.84. Cross-section of the San Francisco River (San Francisco 3) at the Sandy Wash Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.85. The Sandy Wash Site on the San Francisco River. Streambanks are well stabilized by juvenile Fremont's cottonwood and Goodding's willow.

Watershed: San Francisco Watershed **River:** San Francisco **Reach:** Wilson Mountain

Site Name: Sundial Mountain **Site Number:** 155 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** WILSON MOUNTAIN

Town: 20S **Range:** 20W **Section:** 34 **Northing:** 3677340 **Easting** 696180

Data Sources: Ground reconnaissance; field sampled

Site Quality: AB

Site Description: The Sundial Mountain site is characterized by diverse riparian communities that are in good to excellent condition. In areas were the channel pools, the channel is lined with American bulrush and common spikerush. Banks are well stablized by a variety of young trees and shrubs including seepwillow, coyote willow, Arizona alder, Fremont's cottonwood, and Gooding's willow. Terraces formation is infrequent. Where they occur they are dominated by mature Arizona sycamores and Fremont's cottonwood. The effects of ORV's at this site may be negligible as herbaceous communities are suppressed here by scouring floods. Encroachment by exotics is a small threat to this site as well.

Vegetation Communities:	Community Quality Ranks:
Fremont's cottonwood/seepwillow	A
seepwillow/American bulrush	A
netleaf hackberry/California brickellbush	B
Arizona sycamore/Arizona alder/seepwillow	A
coyote willow/common spikerush	B
Fremont's cottonwood/Goodding's willow/coyote willow	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Excellent

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics and saltcedar are widely scatted.
Grazing:	no	No evidence seen. Some light grazing by horses is probable however.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	ORV's drive on scoured island and side bars and ford the river
Roads:	no	
Mowing:	no	
Other Impacts:	no	

Data

Cross Section: San Francisco 2, San Francisco 3

Plots: 95PD013 95PD014 95PD011 95PD012

Jurisdiction: Gila National Forest

Survey Date: 6/24/95

Investigators: Bradley, Durkin, Hartmann

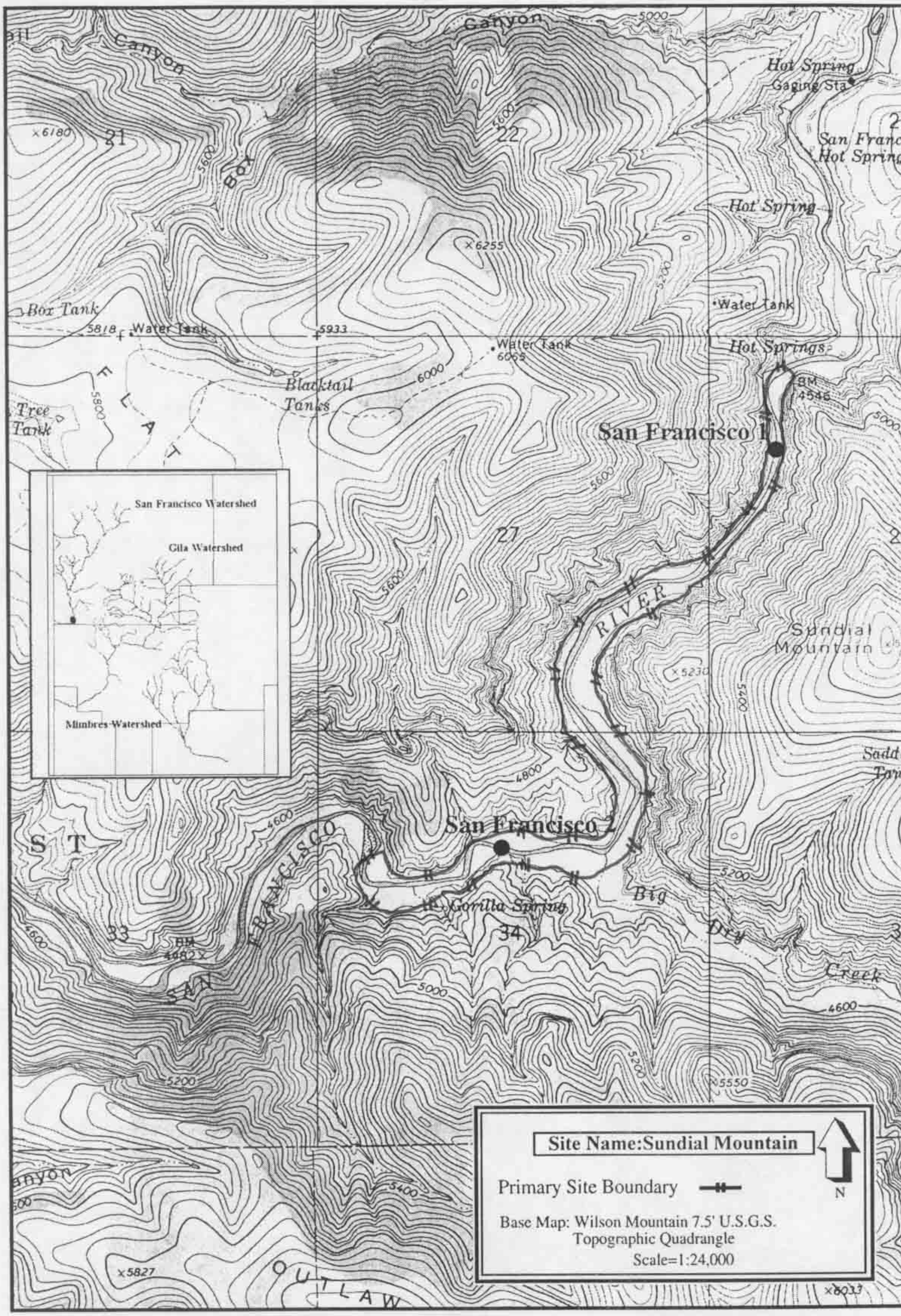

Figure B.86. The Sundial Mountain Site. Black dots indicate locations of stream cross-sections.

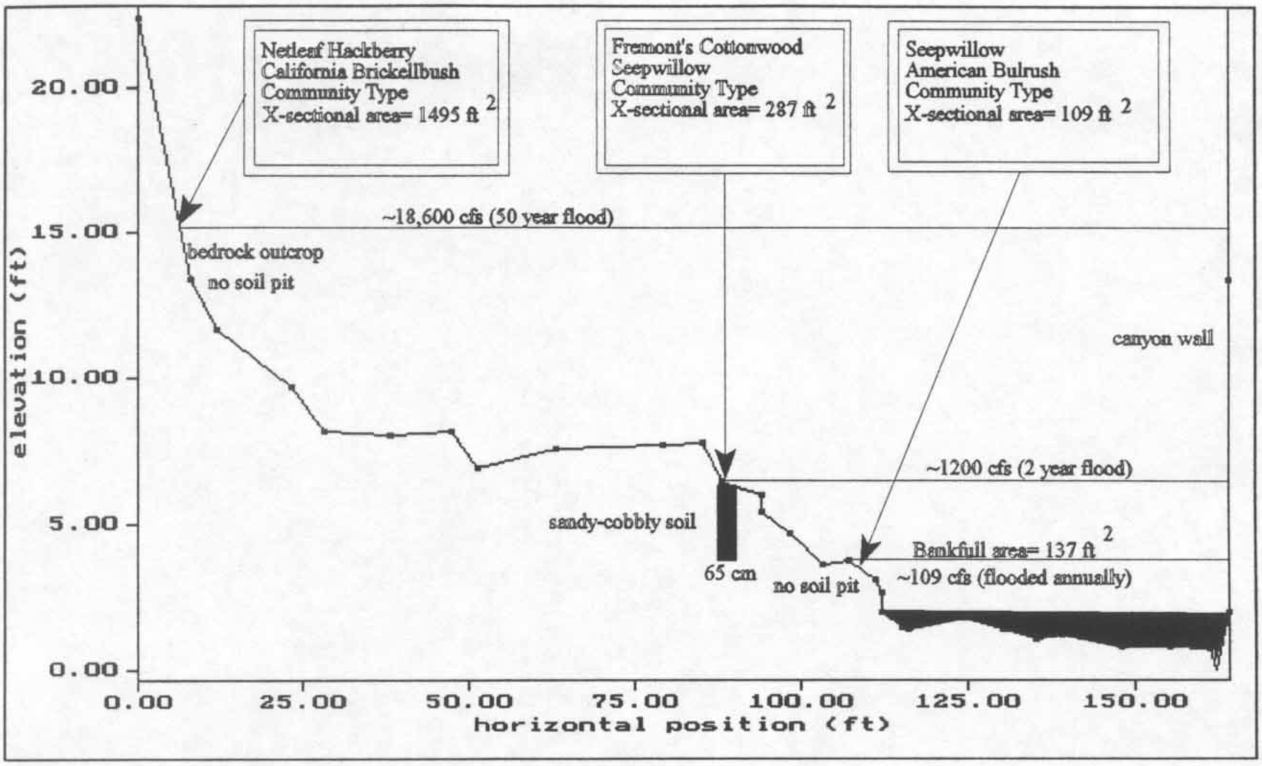

Figure B.87. Cross-section of the San Francisco River (San Francisco 1) at the Sundial Mountain Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

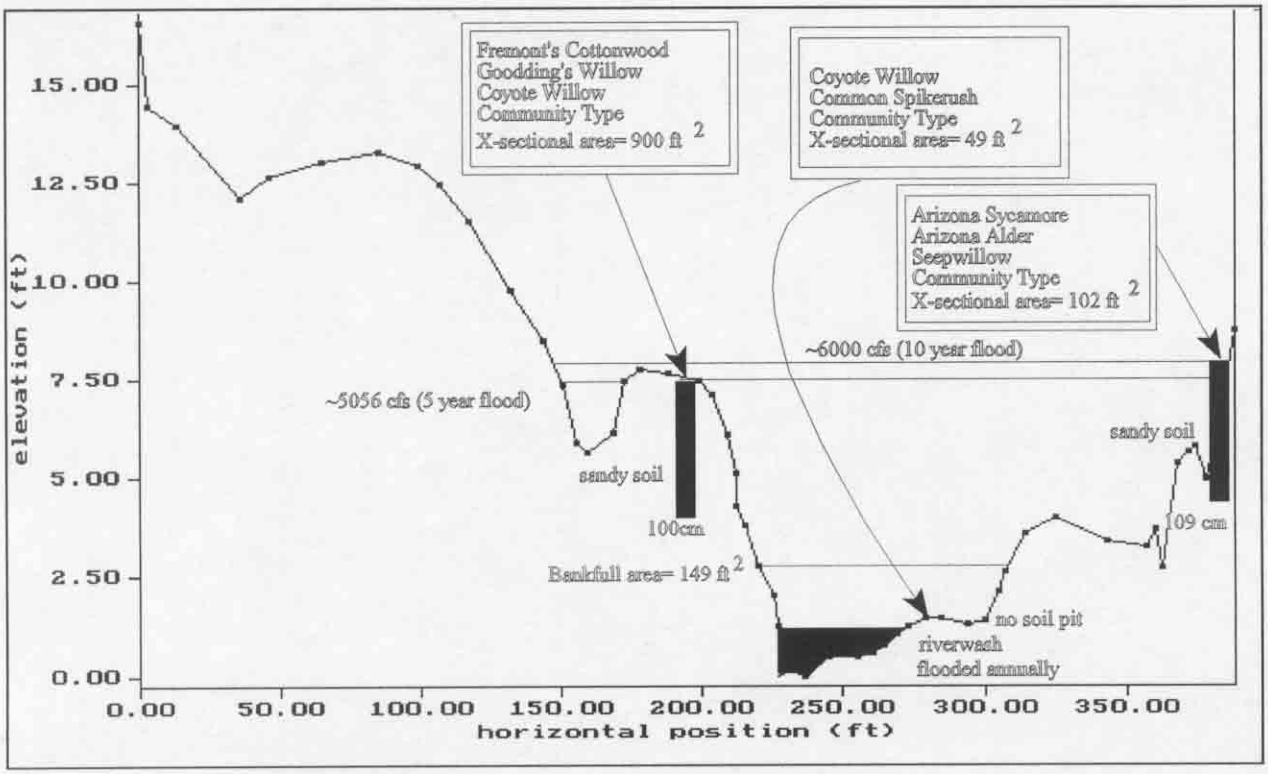

Figure B-88. Cross-section of the San Francisco River (San Francisco 2) at the Sundial Mountain Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.89. The Sundial Mountain Site on the San Francisco near the Arizona-New Mexico border. Where the channel pools, stream-side vegetation consists primarily of bulrushes, spikerushes, and willows.

Watershed: San Francisco Watershed **River:** Tularosa **Reach:** Tularosa River

Site Name: Tularosa Wetland **Site Number:** 134 **Basin Number** 15040004

County: CATRON **Quad. Map Name:** SQUIRREL SPRINGS CANYON

Town: 05S **Range:** 17W **Section:** 33 **Northing:** 3745990 **Easting** 720110

Data Sources: Air photo interpretation; ground reconnaissance, field sampled

Site Quality: AB

Site Description: The Tularosa River at this site is dominated by a high quality marsh. Wetland vegetation including softstem bulrush and cattails dominate the edges of the channel. The banks of the wetland are composed of other wet meadow grasses including American bulrush and dryspike sedge. A bridge across the wetland seems to have little effect, and a small mud dam downstream pools the stream under the bridge. The origin of the mud dam is not certain.

Vegetation Communities:	**Community Quality Ranks:**
softstem bulrush/broadleaf cattail	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	
Grazing:	no	But portions upstream are heavily grazed.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	no	
Mowing:	no	
Other Impacts:	yes	A bridge across the wetland and a mud dam (beaver?) a few meters downstream.

Data

Cross Section: Tularosa 1

Plots: 95PD040

Jurisdiction: Gila National Forest, Private

Survey Date: 7/16/95

Investigators: Bradley, Durkin

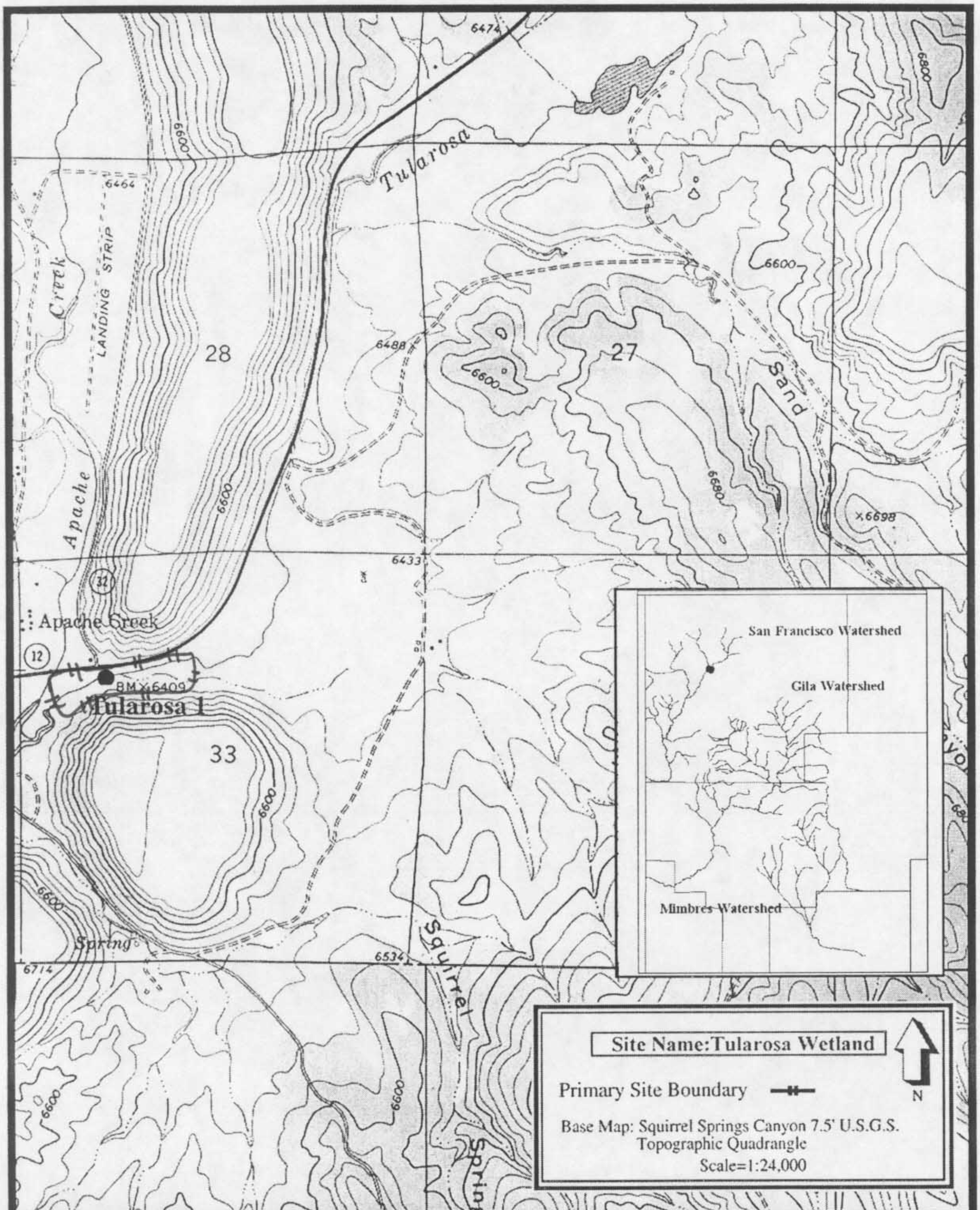

Figure B.90. The Tularosa Wetland Site. Black dot indicates location of stream cross-section.

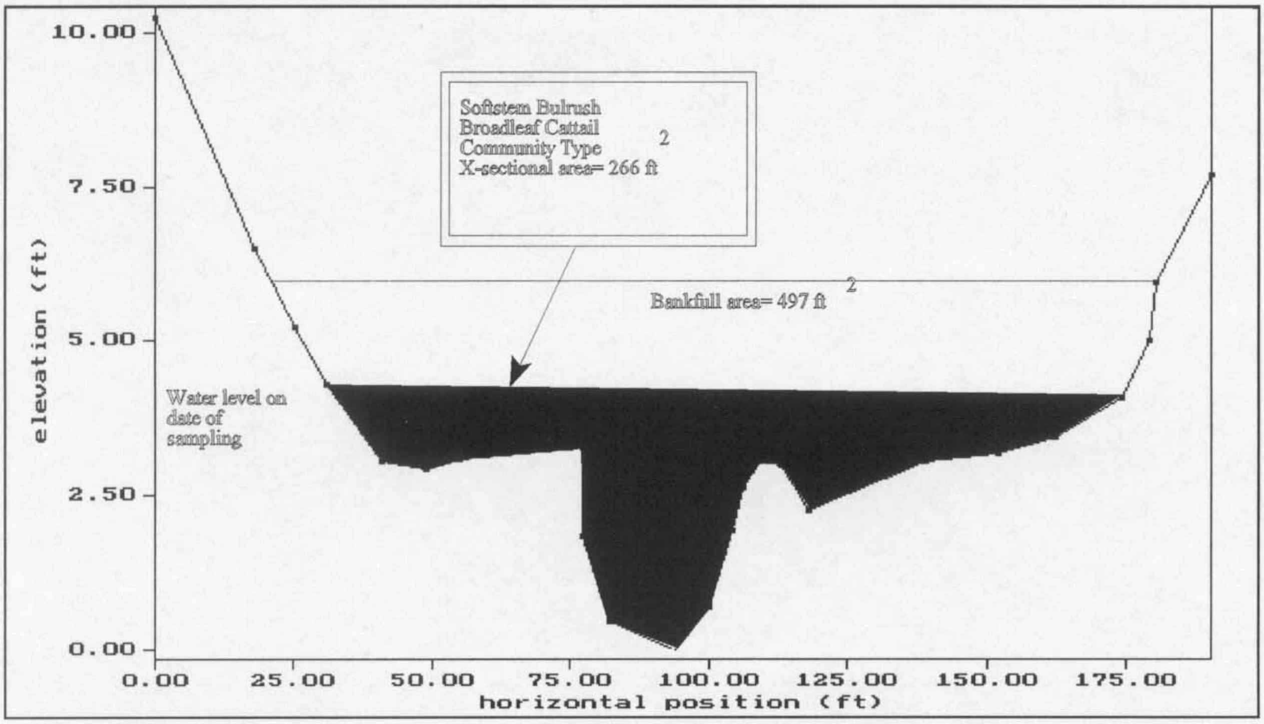

Figure B.91. Cross-section of the Tularosa River (Tularosa 1) at the Tularosa Wetland Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.92. The Tularosa Wetland Site near Apache Creek. The dark green area near the top of the photograph consists of a softstem bulrush marsh. Areas upstream of this are grazed heavily (lighter green).

Watershed: Mimbres Watershed **River:** McKnight Canyon **Reach:** McKnight Canyon

Site Name: Kelly Mesa **Site Number:** 121 **Basin Number** 13030202

County: GRANT **Quad. Map Name:** HAY MESA

Town: 15S **Range:** 11W **Section:** 01 **Northing:** 3657830 **Easting** 226120

Data Sources: Personal communication; air photo interpretation; field sampled

Site Quality: AB

Site Description: At the Kelly Mesa Site, a lush bluestem willow and beaked sedge community occurs in a continuous stretch for several hundred meters above an artificial waterfall. Individual narrowleaf cottonwoods and Arizona walnuts are found in slightly drier areas at this site. Major impacts are absent throughout this site, and the community is high in quality. Fish barriers are present in the channel. Their impact on the community is not known.

Vegetation Communities:	**Community Quality Ranks:**
bluestem willow/beaked sedge	A

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Excellent

Streambank Condition: Excellent

Floodplain Impacts:

Exotic veg dominant:	no	
Grazing:	no	No evidence seen.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	no	
Mowing:	no	
Other Impacts:	yes	An artificial waterfall, and fish barriers (logs across stream).

Data

Cross Section: McKnight Canyon 1

Plots: 95PD002

Jurisdiction: Gila National Forest

Survey Date: 6/14/95

Investigators: Bradley, Durkin, Hartmann

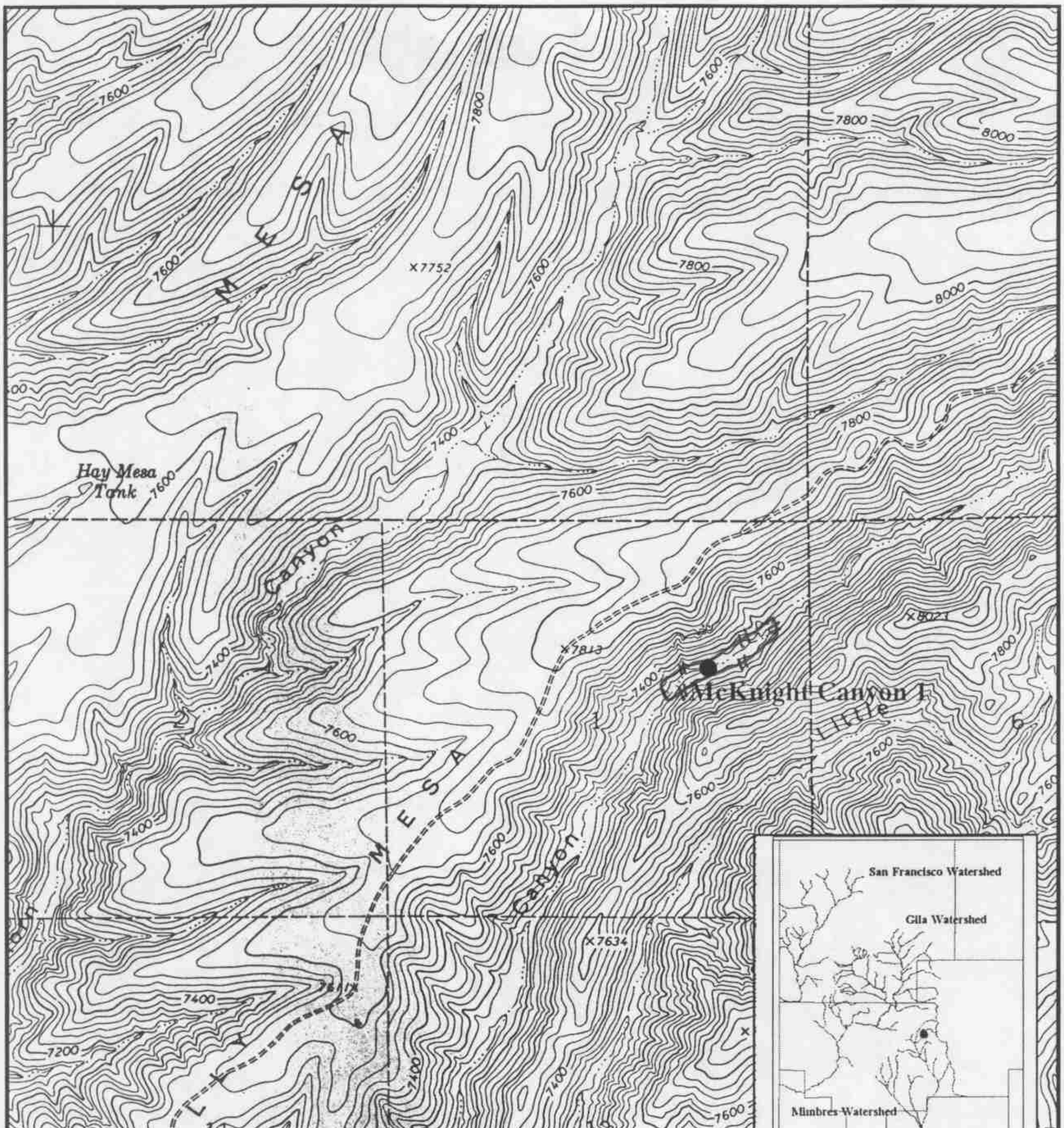

Figure B.93. The Kelly Mesa Site. Black dot indicates location of cross-section.

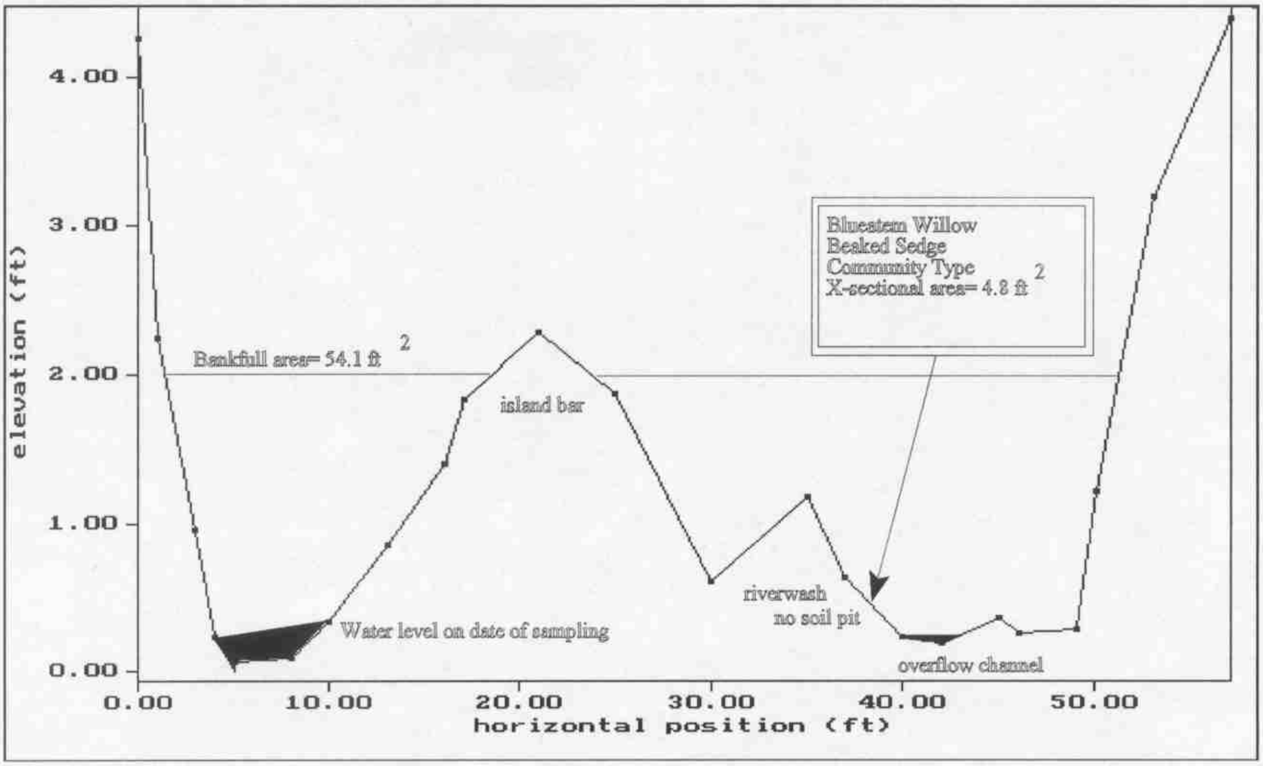

Figure B.94. Cross-section of McKnight Canyon (McKnight Canyon 1) at the Kelly Mesa Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Watershed: Mimbres Watershed **River:** Mimbres **Reach:** Middle Mimbres

Site Name: Allie Canyon **Site Number:** 117 **Basin Number** 13030202

County: GRANT **Quad. Map Name:** ALLIE CANYON

Town: 16S **Range:** 11W **Section:** 17 **Northing:** 3645300 **Easting** 780310

Data Sources: Personal communication; ground reconnaissance; field sampled

Site Quality: C

Site Description: The forested wetlands of the Allie Canyon Site are fair in quality, and comprised mainly of mature narrowleaf cottonwood and boxelder. Goodding's willow, Arizona alder and regenerating Arizona walnut are also mixed in the floodplain. Streambanks are downcut and eroding, and are undercutting the forests. Despite a gravel mine immediately upstream, the hydrograph appears natural. Pastures are extensive throughout the floodplain.

Vegetation Communities:	Community Quality Ranks:
narrowleaf cottonwood/box elder/Kentucky bluegrass	C

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Fair

Streambank Condition: Fair

Floodplain Impacts:

Exotic veg dominant:	no	But herbaceous exotics are common.
Grazing:	yes	Heavy.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	yes	Roads are common in pastures and throughout the floodplain.
Mowing:	no	
Other Impacts:	yes	Gravel mine a few kilometers upstream.

Data

Cross Section: Mimbres

Plots: 95PD001

Jurisdiction: private

Survey Date: 6/13/95

Investigators: Bradley, Durkin, Hartmann

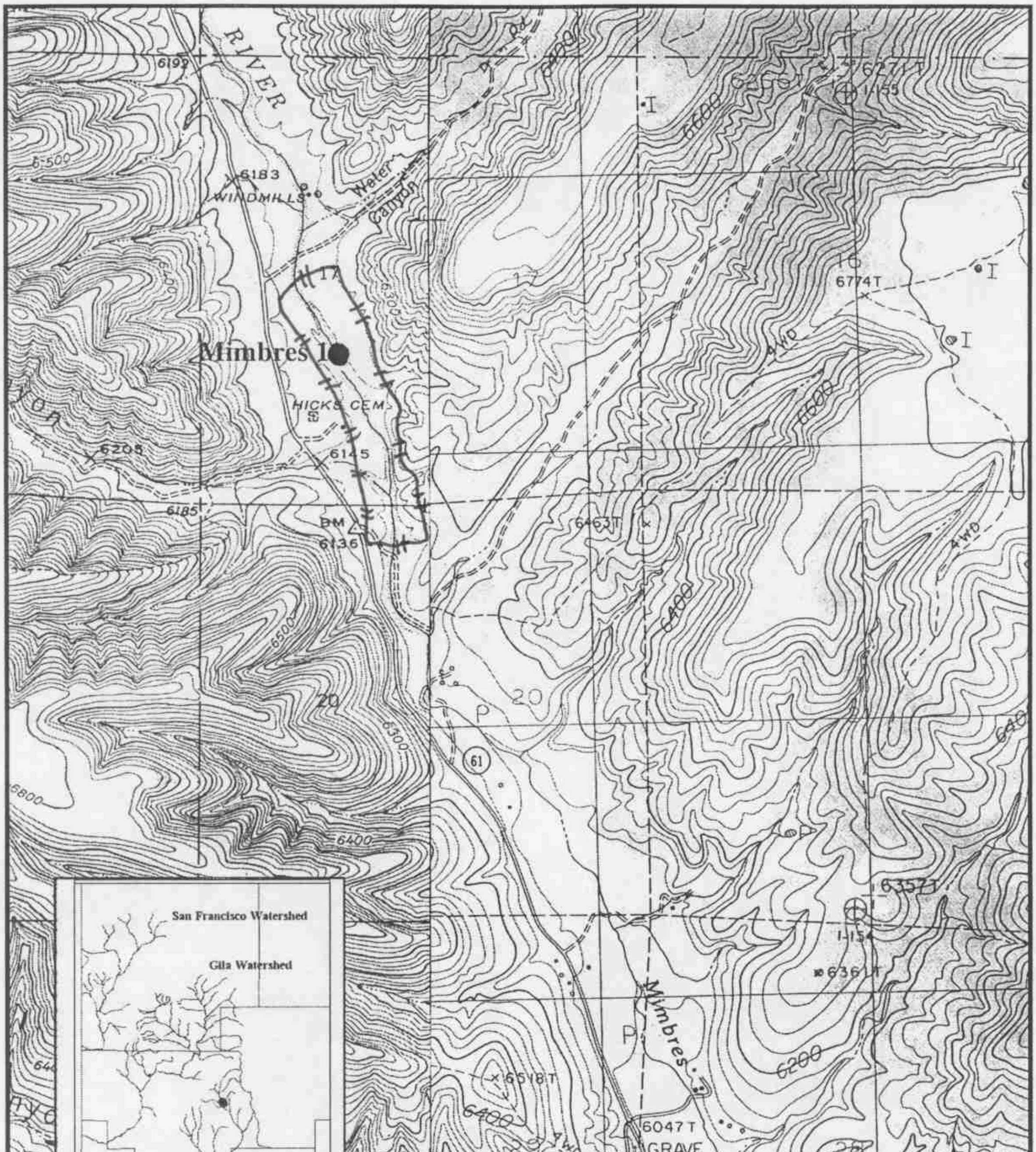

Figure B.95. The Allie Canyon Site. Black dot indicates location of cross-section.

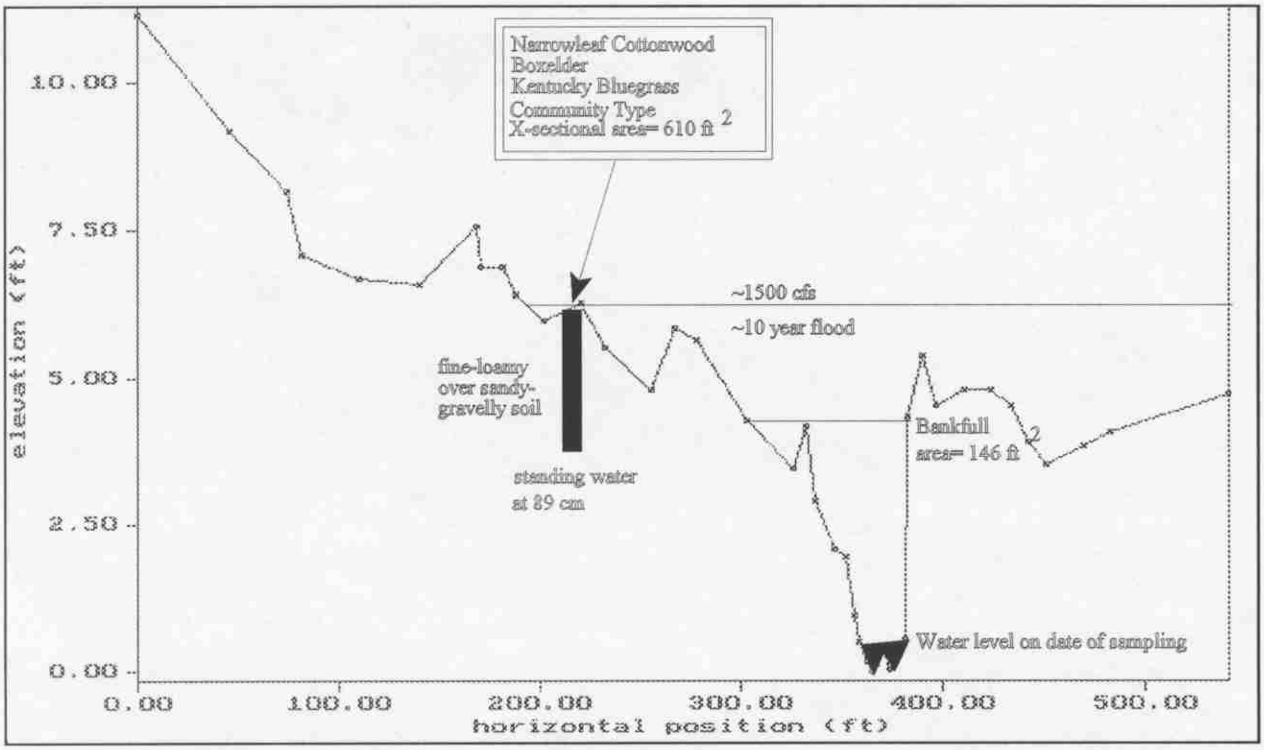

Figure B.96. Cross-section of the Mimbres River (Mimbres 1) at the Allie Canyon Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.97. The Allie Canyon Site on the Mimbres River. Narrowleaf cottonwoods and boxelders are common throughout this site.

Watershed: Mimbres Watershed **River:** Mimbres **Reach:** Middle Mimbres

Site Name: Bear Canyon Reservoir **Site Number:** 116 **Basin Number** 13030202

County: GRANT **Quad. Map Name:** HENDRICKS PEAK

Town: 16S **Range:** 11W **Section:** 29 **Northing:** 3643050 **Easting** 220120

Data Sources: Personal communication; field sampled

Site Quality: B

Site Description: The Mimbres River floodplain at this site is dominated by good quality stands of fragmented mature narrowleaf cottonwood and boxelder forests. Small Arizona alder and Goodding's willow communities are interspersed. These forests are in the 10-to-25 year floodplain (see x-sectional diagram) and appear viable. Along the fringe of the floodplain Arizona walnut and boxelder forests are extensive. Streambanks are not vegetated and the channel is not shaded allowing algae to grow in areas of standing water. Old pastures are extensive in the floodplain and are dominated by herbaceous exotics. The hydrograph appears intact despite a gravel mine and irrigation ditches upstream.

Vegetation Communities:	**Community Quality Ranks:**
Arizona alder/narrowleaf cottonwood/California brickellbush	B+
narrowleaf cottonwood/box elder/Kentucky bluegrass	B+

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	But exotic herbaceous species are common.
Grazing:	no	The floodplain was historically grazed and cattle sometimes still tresspass.
Fuel Wood:	no	
Dumping:	no	
ORV Use:	no	
Roads:	yes	A dirt road fords the river on both ends of the segment.
Mowing:	no	
Other Impacts:	yes	A gravel mine is a few kilometers upstream, and old irrigation ditches are found on the edge of the floodplain.

Data

Cross Section: Mimbres 2

Plots: 95PD003 95PD004

Jurisdiction: private

Survey Date: 6/15/95

Investigators: Bradley, Durkin, Hartmann

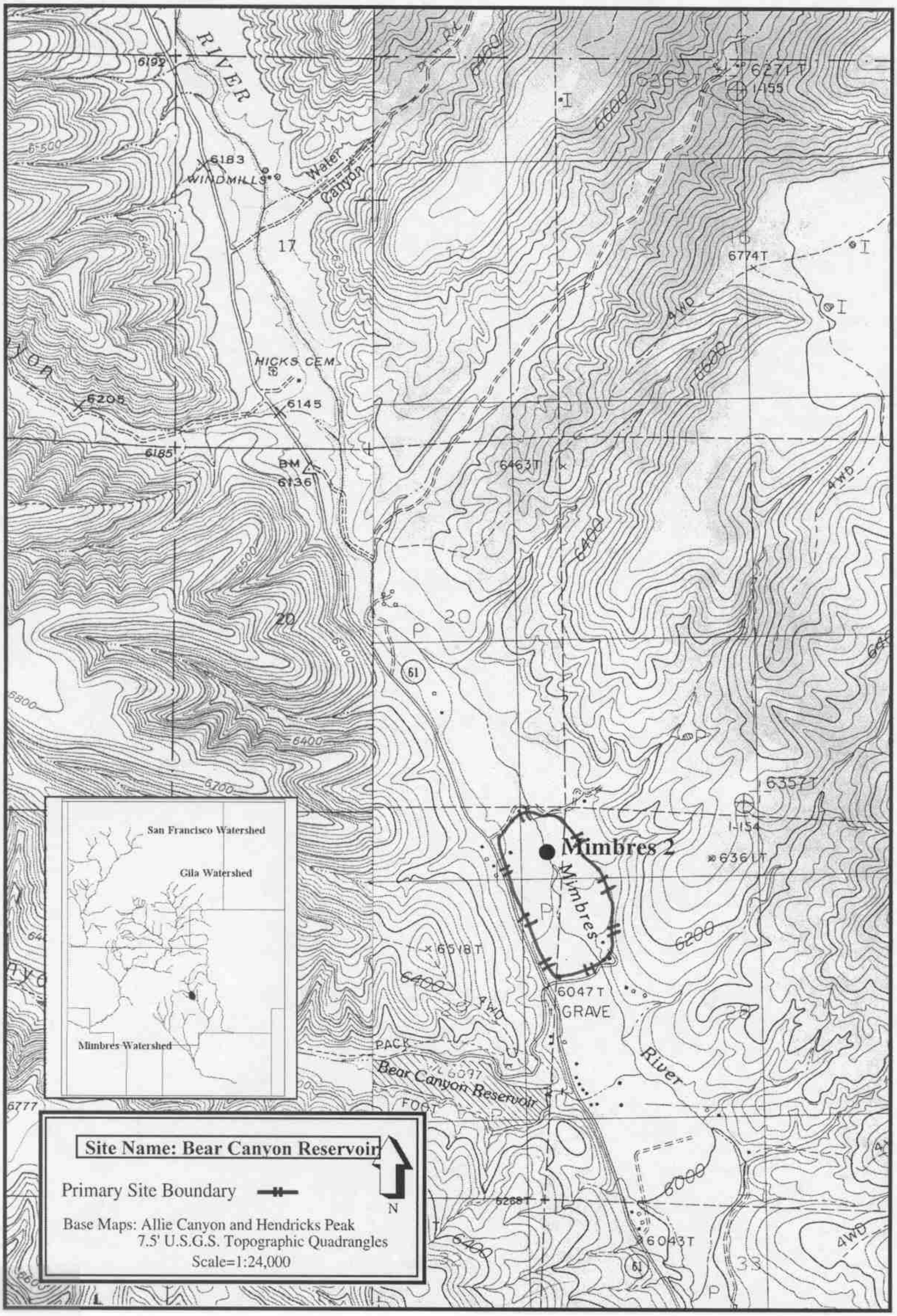

Figure B.98. The Bear Canyon Reservoir Site. Black dot indicates location of stream cross-section.

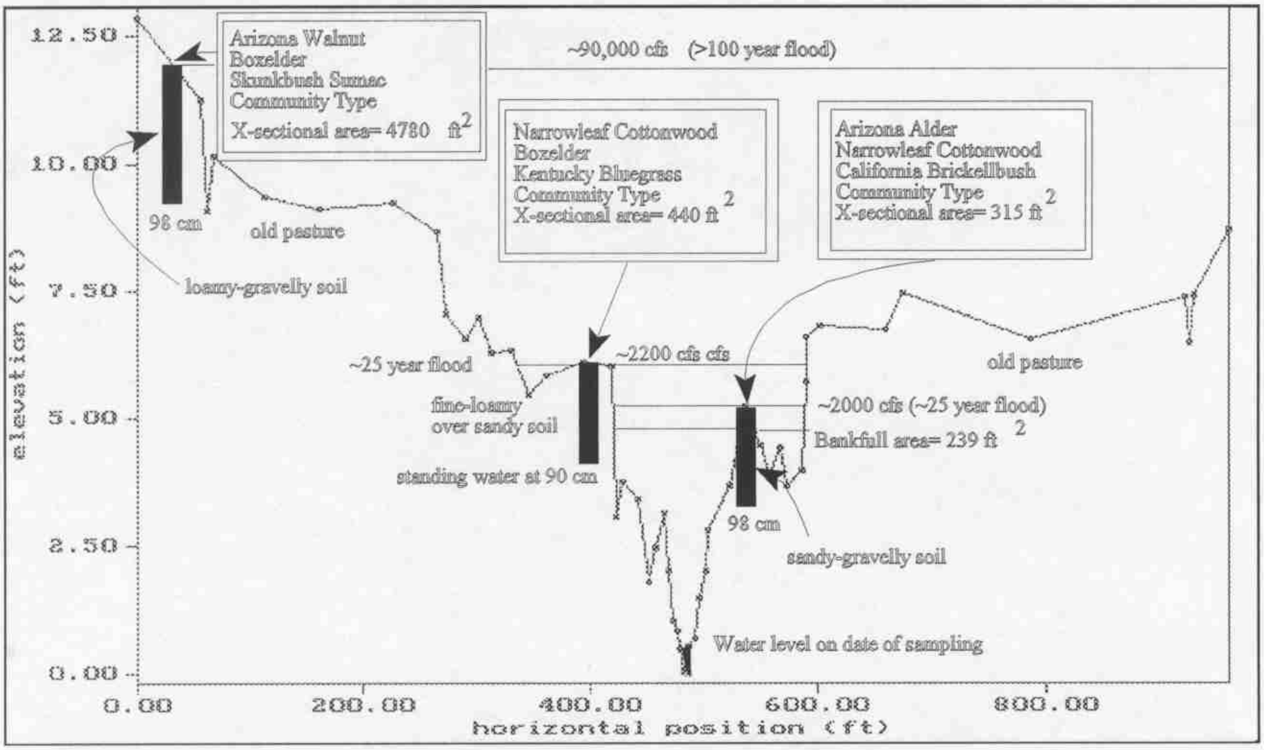

Figure B.99. Cross-section of the Mimbres River (Mimbres 2) at the Bear Canyon Reservoir Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.100. The Bear Canyon Reservoir Site on the Mimbres River. Old pastures, narrowleaf cottonwoods, and boxelders dominate much of the floodplain at this site. Boxelder and Arizona walnut are common along the fringe of the floodplain.

Watershed: Mimbres Watershed **River:** Mimbres **Reach:** Middle Mimbres

Site Name: Mimbres **Site Number:** 111 **Basin Number** 13030202

County: GRANT **Quad. Map Name:** SAN LORENZO

Town: 17S **Range:** 11W **Section:** 10 **Northing:** 3637630 **Easting** 222890

Data Sources: Ground reconnaissance; field sampled

Site Quality: BC

Site Description: The Mimbres River at the Mimbres site is characterized by a mixture of mature narrowleaf, Fremont's, and lanceleaf cottonwood forests that are good to fair in quality. Other common woody species include boxelder, netleaf hackberry and junipers. Presently, riparian communities reside mainly on high, dry terraces that may be out of the 100 year floodplain (see stream x-sectional diagram). Stream geometry is canal-shaped and there are no depositional features for young seral communities to develop. Community quality is diminished by the presence of exotics and questions about community viability. The present hydrograph remains relatively natural despite a gravel mine and irrigation diversions upstream. Riparian forests are fragmented by a few dirt roads, and agricultural fields are extensive in the old floodplain. Encroachment from herbaceous exotics is a threat as well.

Vegetation Communities:	**Community Quality Ranks:**
narrowleaf cottonwood/box elder/Kentucky bluegrass	B-
narrowleaf cottonwood/alligator juniper/California brickellbush	B-

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Fair

Floodplain Impacts:

Exotic veg dominant:	no	But Siberian elm and Russian olives are scattered. Herbaceous exotics are also common in the understory.
Grazing:	no	No evidence seen within the Game and Fish boundary. Grazing does occur immediately adjacent to the Game and Fish boundary.
Fuel Wood:	unknown	
Dumping:	no	
ORV Use:	no	
Roads:	yes	Roads are in the floodplain, and occasionally ford the river.
Mowing:	no	
Other Impacts:	yes	Gravel mine a few kilometers upstream.

Data

Cross Section: Mimbres 3

Plots: 95PD005 95PD006

Jurisdiction: New Mexico Game and Fish

Survey Date: 6/17/95

Investigators: Bradley, Durkin, Hartmann

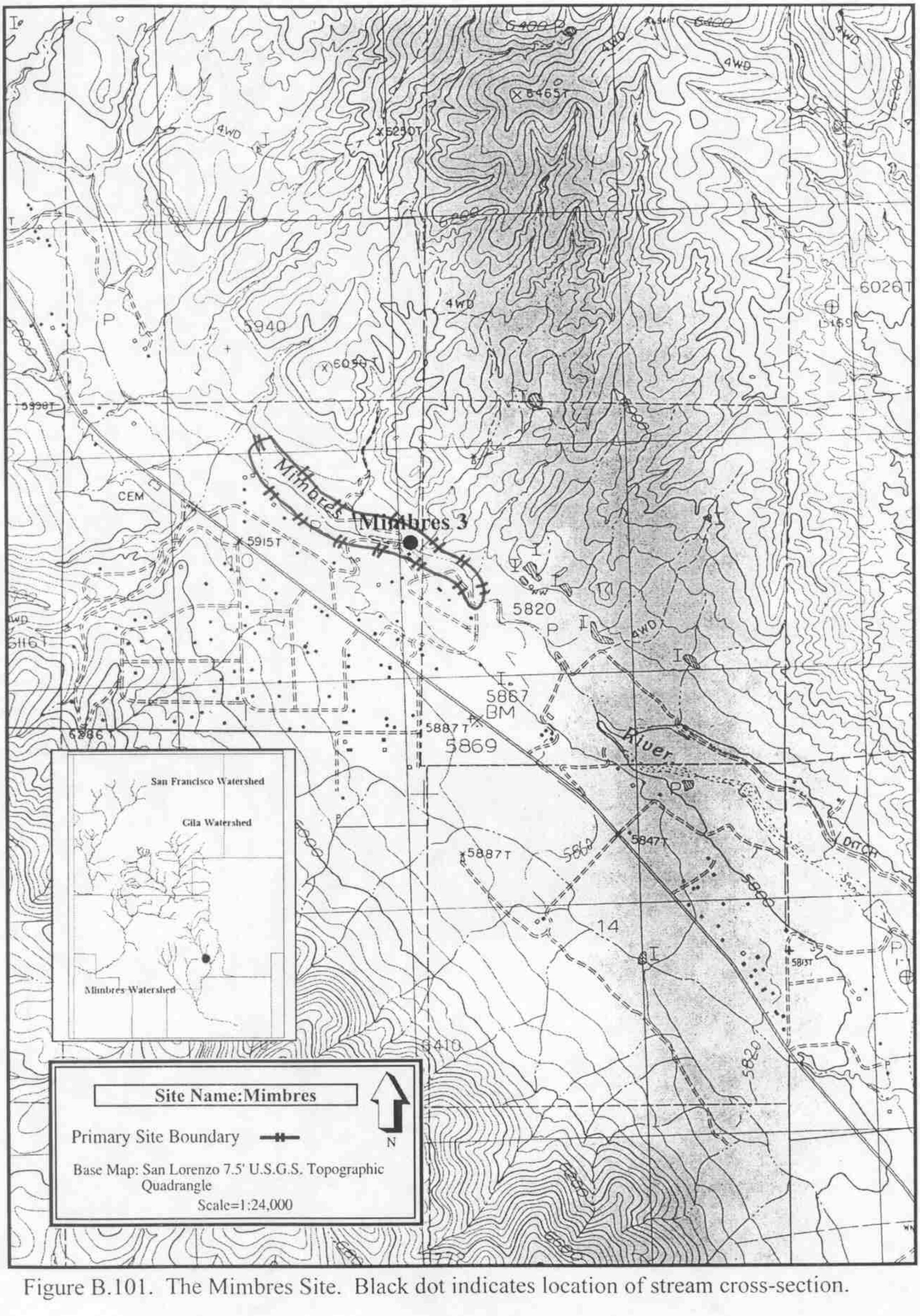

Figure B.101. The Mimbres Site. Black dot indicates location of stream cross-section.

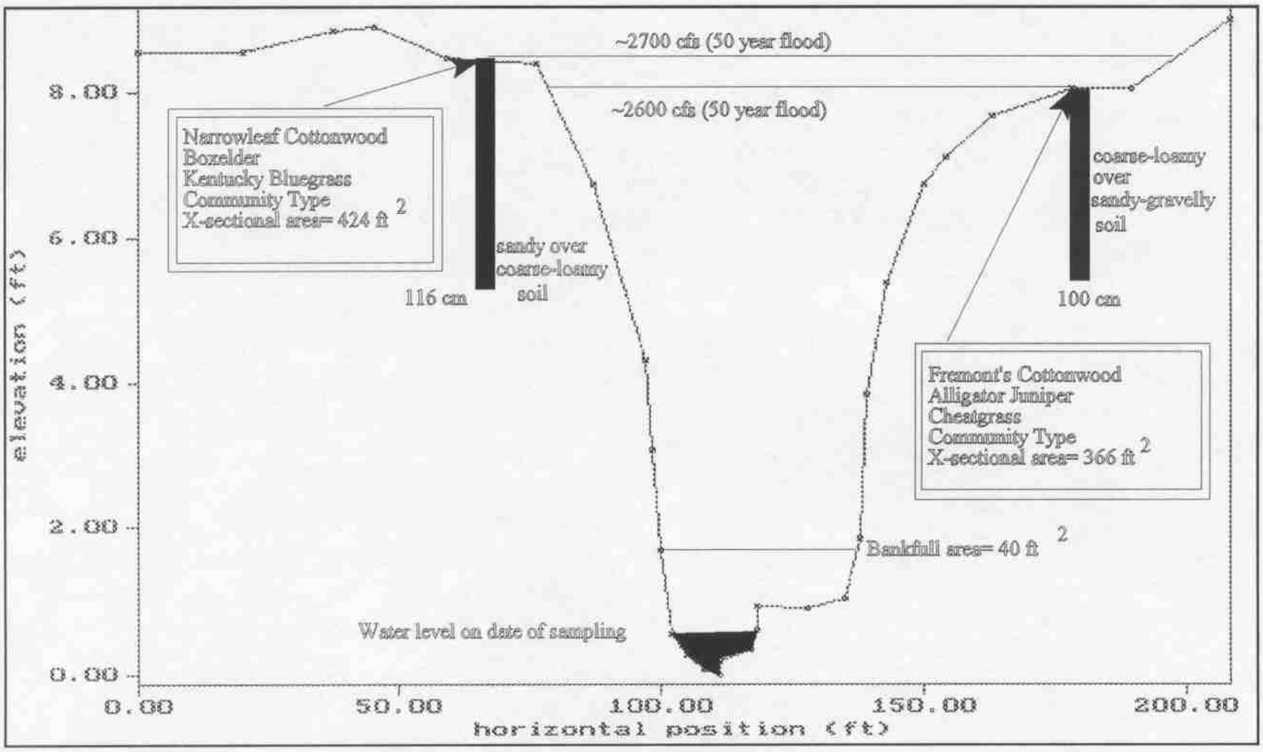

Figure B.102. Cross-section of the Mimbres River (Mimbres 3) at the Mimbres Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Ted Cline

Figure B.103. The Mimbres Site on the Mimbres River. Riparian forests are limited to narrow strips along the channel due to encroachment from urbanization and pastures.

Watershed: Mimbres Watershed **River:** Mimbres **Reach:** Upper Mimbres

Site Name: Bloodgood Place **Site Number:** 115 **Basin Number** 13030202

County: GRANT **Quad. Map Name:** HAY MESA

Town: 14S **Range:** 11W **Section:** **Northing:** 3660500 **Easting** 222440

Data Sources: Air photo interpretation; ground reconnaissance; field sampled

Site Quality: C

Site Description: The Bloodgood Place Site is characterized by fair quality narrow, fragmented stands of mature narrowleaf cottonwood and Arizona alder. The stands are small and cottonwood reproduction consists primarily of asexual suckers. Heavy grazing practices have affected the development of the herbaceous layer and many mature trees have been cut. The current hydrological regime is unregulated and other hydrological impacts seem to be small.

Vegetation Communities:	Community Quality Ranks:
Arizona alder/narrowleaf cottonwood/California brickellbush	C

Hydrologic Impacts:

Flow Regulation: No **RipRapped:** No **Dredged:** No **Jetty Jacked** No

Leveed No **Overall Hydrologic Regime:** Good

Streambank Condition: Good

Floodplain Impacts:

Exotic veg dominant:	no	
Grazing:	yes	Moderate to heavy.
Fuel Wood:	yes	Deadwood is gathered for campfires and several mature trees have been cut.
Dumping:	no	
ORV Use:	no	
Roads:	yes	A dirt road is out of floodplain.
Mowing:	no	
Other Impacts:	no	

Data

Cross Section: Mimbres 4

Plots: 95PD007

Jurisdiction: Gila National Forest

Survey Date: 6/17/95

Investigators: Bradley, Durkin, Hartmann

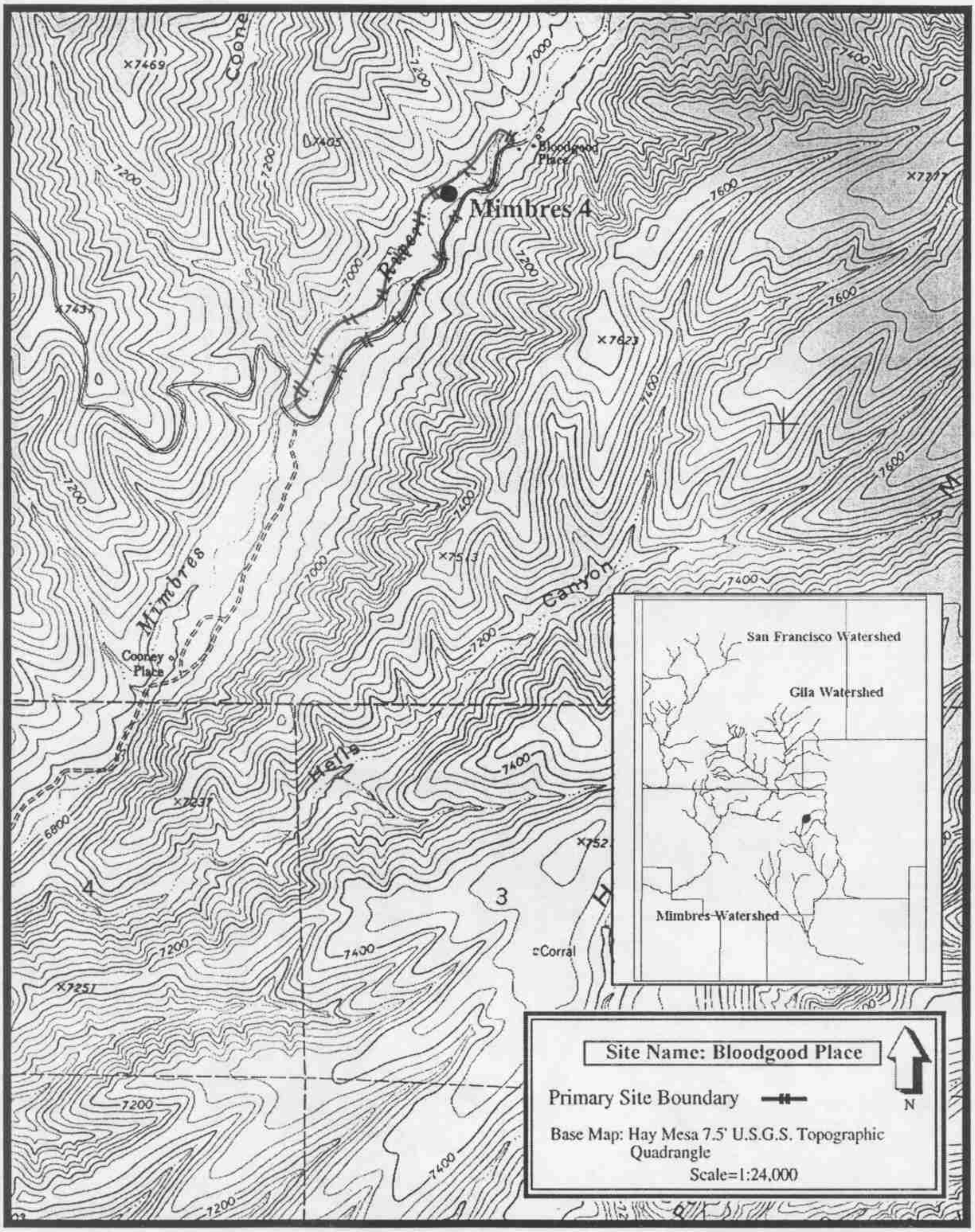

Figure B.104. The Bloodgood Place Site. Black dot indicates location of stream cross-section.

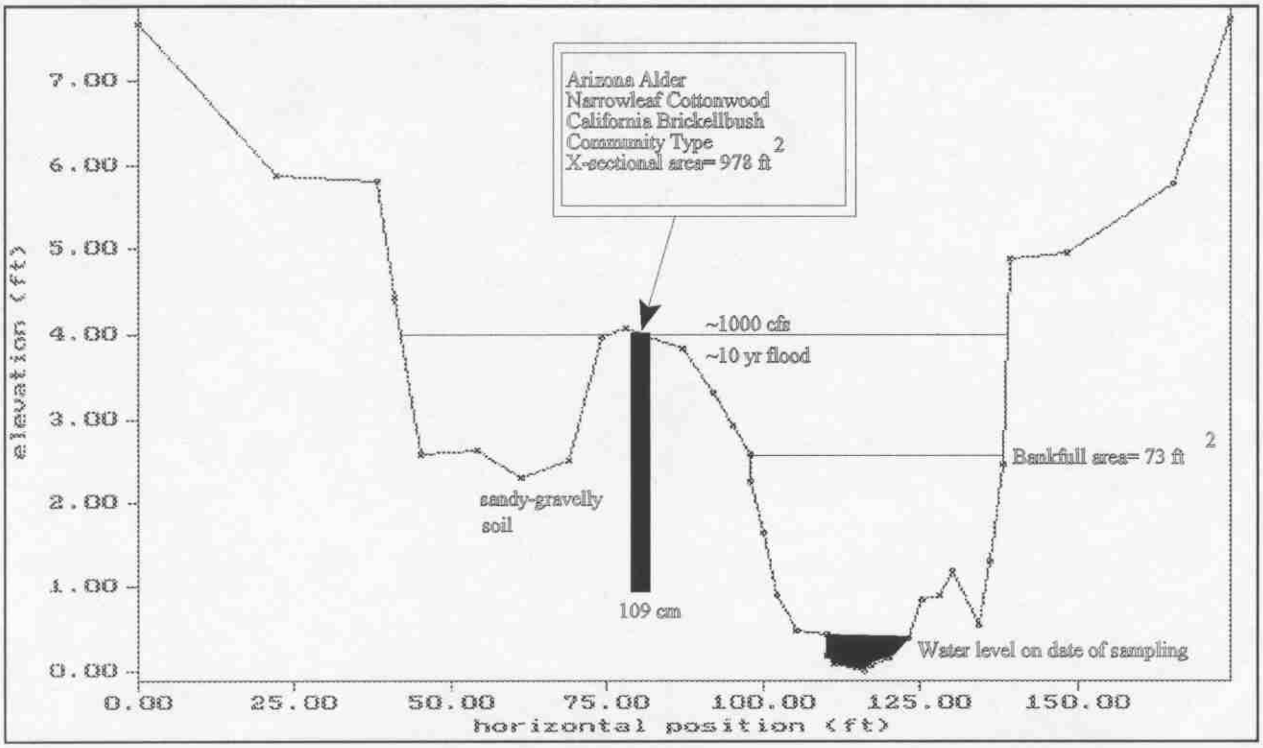

Figure B.105. Cross-section of the Mimbres River (Mimbres 4) at the Bloodgood Place Site showing the locations of the community types, water levels required to flood them, their respective cross-sectional areas, bankfull cross-sectional area, predominant soil texture, and depth of the soil pit(s) (black bar).

Photo: Mike Bradley

Figure B.106. The Bloodgood Place Site in the upper Mimbres River watershed. Arizona alder and narrowleaf cottonwood dominate the riparian forests at this site.