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RIPARIAN SYSTEM RECOVERY AFTER REMOVAL OF LIVESTOCK FROM SANTA ROSA ISLAND, CHANNEL ISLANDS NATIONAL PARK, CALIFORNIA

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Technical Report NPS/NRWRD/NRTR-2004/324

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December 2004

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WATER RESOURCES DIVISION

National Park Service - Department of the Interior
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United States Department of the Interior
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EXECUTIVE SUMMARY

In 1995, the California Central Coast Regional Water Quality Board, through a Cleanup or Abatement Order, directed Channel Islands National Park (CHIS) to correct cattle grazing and road-related water quality problems on Santa Rosa Island. The Order alleged that CHIS, by permitting improper transportation and riparian grazing management practices, was discharging unlawful concentrations of bacteria and sediment into waters of the State in violation of the Regional Water Quality Control Plan for the Central Coast Basin.

To respond, CHIS needed a rapid evaluation of riparian conditions on the island and wanted to know if changes to existing livestock management (year-round grazing by ~5000 cattle) would help achieve water quality goals. A team comprised of CHIS, NPS Water Resources Division (WRD), U.S. Forest Service, and Bureau of Land Management (BLM) personnel decided to use BLM's "Process for Assessing Proper Functioning Condition" (PFC) method to evaluate ten stream reaches in seven of the island's watersheds. Three of the ten reaches were "reference reaches" that were largely or completely inaccessible to cattle, while the other seven were subject to year-round cattle grazing. The PFC rapid assessment method uses an interdisciplinary team to evaluate riparian functional condition according to 17 hydrology, vegetation, and stream geomorphology factors. Possible riparian assessment ratings include "Proper Functioning Condition," "Functional At-Risk" or "Nonfunctional."

Field work for the initial assessment was completed in March, 1995 and results were published in an NPS-WRD technical report. Of the seven stream reaches that were subject to year-round cattle grazing, six were Nonfunctional and one was rated Functional-at Risk. Of the three reference reaches, two were in Proper Functioning Condition and one was rated Functional-at Risk. The Nonfunctional systems were missing almost all characteristics of properly functioning riparian areas. An oversupply of sediment from upland and channel sources had exceeded the streams' transport capability, resulting in mostly braided channel forms, high lateral instability, and other characteristics that were out of balance with the landscape setting. Riparian-wetland vegetation was almost completely absent, exposing banks to excessive erosion in each flood event.

Ultimately the NPS eliminated cattle from the island in 1998 and also substantially reduced deer numbers. After cattle were removed, CHIS saw dramatic improvements in riparian vegetation cover and water quality. In 2004, the park requested assistance from WRD to perform post-grazing riparian reassessments on the island. The idea was to re-apply the same techniques (PFC assessments and repeat photography) on the stream reaches evaluated in 1995 to document any vegetative and geomorphic changes. Specifically, the park wanted to know if riparian areas that were rated Nonfunctional in 1995 recovered to Proper Functioning Condition simply by removing cattle and reducing the deer population, or were additional management steps necessary for recovery?

The 2004 team found that all six reaches that were rated Nonfunctional in 1995 had recovered to Proper Functioning Condition. The sediment-choked, braided channels evident in 1995 have progressed to narrower, deeper, meandering channels with well-

developed floodplains that are in balance with the landscape settings. Herbaceous riparian-wetland vegetation cover went from near 0% in 1995 to more than 90% on almost all study reaches. The remarkable improvement in Santa Rosa Island's riparian conditions since 1995 demonstrates these systems' ability to "self-restore" once the major stressor, year-round cattle grazing, was removed. The transitions from nonfunctional to properly functioning riparian systems became possible when vegetation recovery in the watersheds led to decreased runoff and sediment delivery to the island's stream systems and when appropriate riparian-wetland vegetation became established.

The PFC method proved to be a very useful tool for evaluating the basic physical stability components of riparian system recovery on Santa Rosa Island. However, even though a riparian system may be in Proper Functioning Condition with respect to geomorphic stability, it may not be fully capable of achieving the site's potential natural vegetation community or other desired condition. For example, though Arlington Canyon, Old Ranch Canyon and other watersheds recovered from Nonfunctional in 1995 to Proper Functioning Condition in 2004, the expected and important woody riparian components of these systems (willows and cottonwoods) have not become re-established. Therefore, in addition to reporting PFC functionality ratings, the 2004 team recommended supplemental management actions that would put recovering riparian systems on a trajectory toward achieving desired future riparian-wetland vegetation conditions.

INTRODUCTION

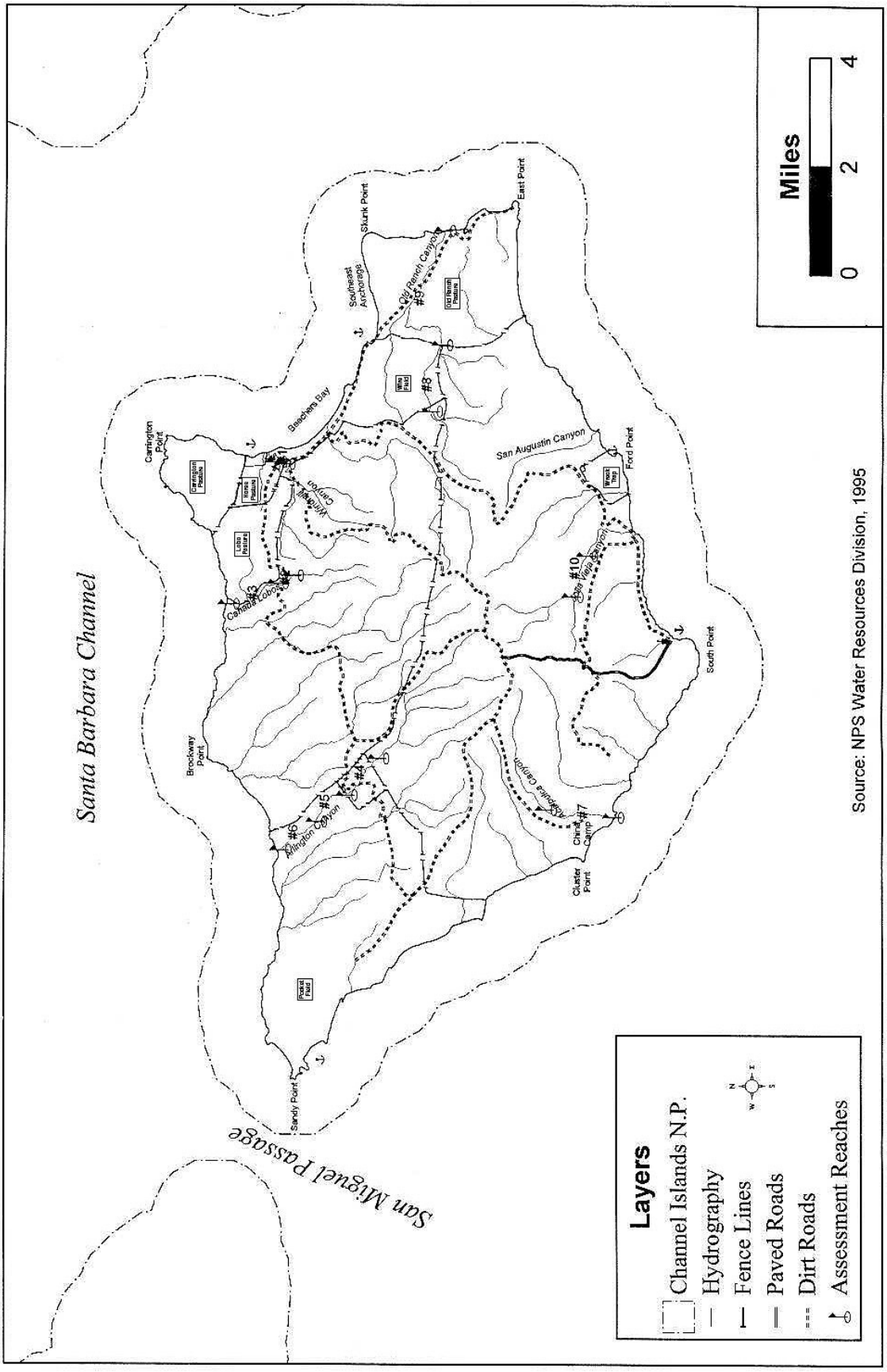
In 1995, the California Central Coast Regional Water Quality Board, through a Cleanup or Abatement Order, directed Channel Islands National Park (CHIS) to correct cattle grazing and road-related water quality problems on Santa Rosa Island. The Order alleged that CHIS, by permitting improper transportation and riparian grazing management practices, was discharging unlawful concentrations of bacteria and sediment into waters of the State in violation of the Regional Water Quality Control Plan for the Central Coast Basin.

As part of its effort to comply with the State's order, CHIS required a rapid evaluation of riparian area conditions on Santa Rosa Island and an assessment of whether modifications to the existing livestock grazing management scheme could be used to meet water quality goals. An interdisciplinary team comprised of personnel from the park, the NPS Water Resources Division, the U.S. Forest Service, and the Bureau of Land Management (BLM) completed the field portion of that assessment during the week of March 20, 1995. The team used the BLM's "Process for Assessing Proper Functioning Condition" (USDI, 1993) to evaluate the functional condition of ten stream reaches on seven of the island's second order streams (Figure 1). Three of the ten reaches were "reference reaches" that were largely or completely inaccessible to cattle (Lobo and Windmill Canyons), while the other seven were subject to year-round cattle grazing. The underlying premises for these analyses were that: 1) riparian area functional condition influences water quality in watersheds grazed by domestic livestock; and 2) many riparian areas can be restored to "Properly Functioning Condition" (thereby improving water quality) through changes in livestock grazing management.

The team's findings and recommendations for improved grazing management were published in a report titled "Federal Interagency Riparian Assessment and Recommendations for Achieving Water Quality Management Goals – Santa Rosa Island, Channel Islands National Park (Rosenlieb, et al. 1995). Of the seven stream reaches that were subject to year-round cattle grazing, six were rated as "Nonfunctional" and one was rated "Functional - at Risk." Of the three reference reaches, two were in "Proper Functioning Condition" and one was rated "Functional-at Risk." The authors concluded that Santa Rosa Island's degraded riparian areas had a very good chance of recovering if livestock management moved from year-round continuous grazing in most of the pastures to management that allowed for multi-year, or at least seasonal, rest from grazing. To that end, the report offered several alternative grazing strategies for consideration.

Ultimately the NPS, under a settlement agreement pursuant to a lawsuit regarding ungulate management on Santa Rosa Island, eliminated cattle from the island as of 1998 and also substantially reduced deer numbers. Elk populations have remained at

Figure 1: Riparian assessment reaches, Santa Rosa Island, CHIS



approximately the same level during 1995–2004. Since the cattle were removed, CHIS staff have observed dramatic improvements in riparian vegetation cover and water quality. In 2004, the park requested technical assistance from WRD to perform a post-grazing reassessment of Santa Rosa Island riparian areas. The idea was to apply the same techniques (PFC assessments and repeat photography) on the same stream reaches that were evaluated in 1995 to document vegetative and geomorphic changes in the six years since cattle were removed. Specifically, we wanted to see if riparian areas that were rated as "Nonfunctional" or "Functional – at Risk" in 1995 had recovered to "Proper Functioning Condition" simply by removing livestock, or if additional management steps are necessary to promote such recovery.

METHODS

Process for Assessing "Proper Functioning Condition" of Riparian-Wetland Systems

Based on a review of available methods for evaluating riparian functional condition, the 1995 team chose to apply the Bureau of Land Management's "Proper Functioning Condition" method for the Santa Rosa Island riparian assessments. WRD and CHIS decided that the most appropriate way to reassess riparian areas in 2004 was to have a comparable team of subject matter experts (vegetation ecology, fluvial geomorphology, hydrology, riparian-wetland science) re-apply the same methods at the same sites and compare the results. Updated documentation for the PFC method can be found in "A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas" (USDI, 1998).

The PFC technique uses an interdisciplinary team to assess the "functional condition" of riparian systems according to 17 hydrology, vegetation, and stream geomorphology factors. The "Proper Functioning Condition" of a riparian area refers to the stability of the physical system, which in turn is dictated by the interaction of geology, soil, water, and vegetation. A properly functioning riparian area is in dynamic equilibrium with its streamflow forces and channel processes. The channel adjusts in slope and form to handle larger runoff events with limited perturbation of channel characteristics and associated riparian-wetland plant communities. Because of this stability, properly functioning riparian areas can maintain fish and wildlife habitat, water quality enhancement, and other important ecosystem functions even after larger storms. In contrast, nonfunctional systems subjected to the same storms might exhibit excessive erosion and sediment loading, loss of fish habitat, loss of associated wetland habitat, and so on.

Proper Functioning Condition does <u>not</u> refer to the seral stage or potential natural vegetation community of a riparian-wetland system. Rather, the evaluation is based on the concept that in order to manage for desired vegetation communities or habitat characteristics, the basic elements of a geomorphically stable system must first be in place and functioning properly. For example, riparian vegetation recovering from a recent fire may be in an early seral stage, and may even be missing an important component (e.g., woody vegetation was destroyed by the fire), but it may still be in

proper functioning condition with respect to basic physical stability and the capacity to recover desired vegetation and habitat attributes over time.

Based on assessments of the 17 hydrologic, vegetative, and geomorphology elements of the riparian area, the interdisciplinary team assigns one of the following three functionality ratings to a site:

Proper Functioning Condition (PFC): Streams and associated riparian areas are functioning properly when adequate vegetation, landform, or large woody debris is present to:

1. Dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality;
2. filter sediment, capture bedload, and aid floodplain development;
3. improve floodwater retention and groundwater recharge;
4. develop root masses that stabilize stream banks against cutting action;
5. develop diverse ponding and channel characteristics to provide habitat and the water depths, durations, temperature regimes, and substrates necessary for fish production, waterfowl breeding, and other uses; and
6. support greater biodiversity.

Functional-At Risk: These riparian areas are in functional condition, but an existing soil, water, vegetation, or related attribute makes them susceptible to degradation. For example, a stream reach may exhibit attributes of a properly functioning riparian system, but it may be poised to suffer severe erosion during a large storm in the future due to likely migration of a headcut or increased runoff associated with recent urbanization in the watershed. When this rating is assigned to a stream reach, then its "trend" toward or away from PFC is assessed.

Nonfunctional: These are riparian areas that clearly are not providing adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows, and thus are not reducing erosion, improving water quality, sustaining desirable channel and riparian habitat characteristics, and so on as described in the PFC definition. The absence of certain physical attributes such as a floodplain where one should exist is an indicator of nonfunctioning conditions.

Photographic Documentation

The 2004 team further documented post-grazing riparian recovery by relocating 1995 photo points and taking new photos from the same locations. With the 1995 photos in hand, team members walked the assessment reaches and used visual clues to determine the locations and camera angles necessary to re-shoot the photos. Side-by-side photo comparisons from 1995 and 2004 are presented in this report for most of the assessment reaches.

RESULTS AND DISCUSSION

Table 1 summarizes the results of the PFC analyses for the 10 stream reaches surveyed in 1995 (year-round cattle grazing in most watersheds) and again in 2004 (six years after cattle were removed). The table shows that each of the six stream reaches that were rated "Nonfunctional" in 1995 recovered to "Proper Functioning Condition" since cattle were removed in 1998. The two Lobo Canyon reaches maintained their 1995 "Proper Functioning Condition" ratings in 2004 (although they experienced remarkable vegetation changes as discussed below). Windmill Canyon (#1) and Acapulco Canyon (#7) are the only reaches that did not achieve "Proper Functioning Condition" ratings in 2004. Both remain "Functional – At Risk."

Table 1. Comparison of riparian condition assessment results from 1995 (year-round cattle grazing) and 2004 (six years after cattle were removed)

Stream Reach (name and ID# from Figure 1)	1995 PFC Rating	2004 PFC Rating
[1]Windmill Canyon (1)	Functional – At Risk (High)	Functional – At Risk (High)
[1]Lobo Canyon (2)	Proper Functioning Condition	Proper Functioning Condition
[1]Lobo Canyon (3)	Proper Functioning Condition	Proper Functioning Condition
Arlington Canyon (4)	Nonfunctional	Proper Functioning Condition
Arlington Canyon (5)	Nonfunctional	Proper Functioning Condition
Arlington Canyon (6)	Nonfunctional	Proper Functioning Condition
Acapulco Canyon (7)	Functional – At Risk	Functional – At Risk
Quemada Canyon (8)	Nonfunctional	Proper Functioning Condition
Old Ranch Canyon (9)	Nonfunctional	Proper Functioning Condition
Jolla Vieja Canyon (10)	Nonfunctional	Proper Functioning Condition

[1] *reference reach*

The following sections provide details of the 2004 assessments with comparisons to the 1995 results, including repeat photography for most reaches. The PFC "Standard Checklist" results and explanatory field notes for all stream reaches are presented in the Appendix.

Windmill Canyon

Reach ID #1: Upper horse pasture fence to Smith Highway cutoff

1995 PFC Rating: Functional – At Risk (High)
2004 PFC Rating: Functional – At Risk (High)

1995 Assessment: According to Rosenlieb et al. (1995), this reach was being grazed by horses for part of the year in 1995, but had not been grazed by cattle for some time. Therefore, it was one of three stream reaches that the 1995 team used as "controls" or "reference reaches" that were largely or completely inaccessible to cattle. The 1995 team rated this reach as **Functional – At Risk (High)**, with no apparent trend. They felt that there was sufficient woody bank vegetation to dissipate stream energies, retain existing bank integrity, and capture significant quantities of sediment during larger floods (as evidenced by response to a recent large flood event). However, the lack of herbaceous bank vegetation, the out of balance channel width-depth ratio, and excessive bed and washload sediment from heavily-grazed upland and channel sources upstream (Figure 2) represented substantial risk to the future stability of this reach.

2004 Assessment: The team determined that despite removal of cattle from the watershed in 1998, bedload and washload sediment delivery from upstream is still well in excess of what the existing channel can handle efficiently. The excess sediment may be due to continued effects of past stream manipulation by ranchers and continued deer and elk browsing that may be slowing the recovery of riparian and upland vegetation. The channel form now appears to be in transition. It is mostly a braided channel with boulder/cobble bars, but meandering channel segments with point bars occur intermittently. Channel aggradation and incision occur in close proximity to each other in areas where excessive sediment deposition causes the channel to oversteepen and incise for short distances.

Arroyo willow (*Salix lasiolepis*) is the dominant woody riparian species in this reach (several age classes are represented in the channel bottom and on the banks and bars). Mule fat (*Baccharis salicifolia*) is also present, but to a much lesser degree. As was the case in 1995, there is very little herbaceous wetland vegetation to help stabilize the system against erosion (Figure 2). The cobble and sand substrate may not retain moisture long enough near the surface in this intermittent drainage to support herbaceous wetland vegetation. The woody riparian species, which can tap into deeper water sources, are the critical factor in stabilizing this reach.

While this transitional channel form is out of balance with the landscape setting, the amount of flood energy it would take to significantly destabilize and "unravel" the system would be very high (though still possible). Our team judged the reach to be stable enough to handle a 20-year flow event or more, though some short stretches could incise as discussed above. But there are serious risk factors that could change this. The willows are highly stressed due to drought, insect damage, and severe deer and elk browsing in

Figure 2: Windmill Canyon, ID Reach #1 (1995 and 2004)

the upper part of the reach. Continued willow decline could destabilize the system, allow excessive lateral erosion, and result in significant loss of wildlife value.

The team rated this reach **Functional – At Risk (High)**. The trend was rated "not apparent" because, although willows have spread substantially into the channel since 1995, all willows now appear highly stressed and may be lost. If the woody riparian community overcomes current stresses and is allowed to mature before being blown out by a large flood, and if deer and elk browsing in the watershed is brought under control (less runoff and sediment contribution), then a more efficient channel could eventually form with the stream power to move sediment through the system. Under those circumstances, the reach could eventually achieve PFC.

Lobo Canyon

Reach ID #2: Between oak grove and cattle exclosure fence

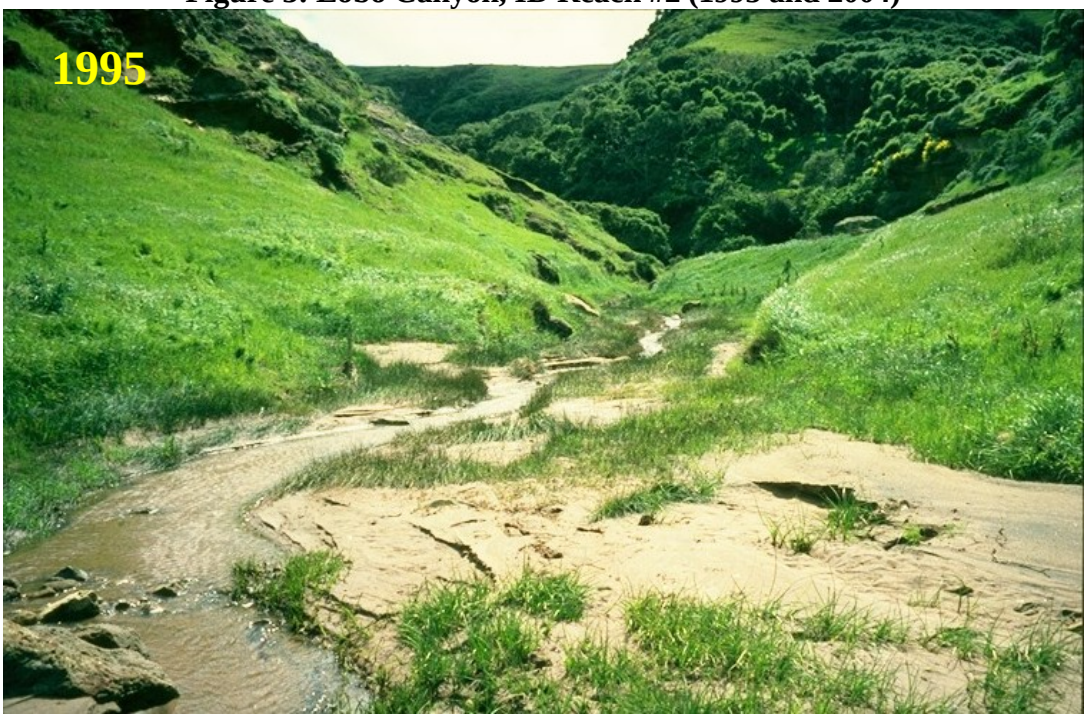
1995 PFC Rating: Proper Functioning Condition
2004 PFC Rating: Proper Functioning Condition

<u>1995 Assessment</u>: Although this reach is outside of the exclosure fence that was built in 1993, the steepness of the canyon slopes discouraged cattle grazing. Therefore, it was treated as one of the three control or "reference reaches." The 1995 team found that the riparian system was in **Proper Functioning Condition** based upon attributes such as appropriate channel and floodplain form and sufficient herbaceous vegetation to dissipate stream energies and maintain channel bank stability during large runoff events. The excessive sediment deposition evident in Figure 3 was probably derived from upland soil slips that occurred after recent heavy rains. Although somewhat out of balance with the sediment being supplied by the watershed, the riparian system was handling this excess sediment without undue changes in form or function. The team also noted that this reach was probably not at its potential relative to desired plant communities (note lack of woody riparian vegetation in Figure 3).

<u>2004 Assessment</u>: This reach is clearly still in **Proper Functioning Condition** based upon positive evaluations of its geomorphology, vegetation, and erosion/deposition characteristics. Channel sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, valley slope, and bioclimatic region), and the channel is able to access the floodplain and dissipate energy in relatively frequent flow events. The stream is now in balance with the water and sediment being supplied by the watershed (no excessive erosion or deposition), which may be attributable to widespread recovery of vegetation since cattle were removed from the island.

One of the most significant changes in the reach is the strong recruitment and spread of herbaceous vegetation (see photo point comparison in Figure 3). Mexican rush (*Juncus mexicanus*), common threesquare (*Scirpus pungens*), smooth scouring rush (*Equisetum*

Figure 3: Lobo Canyon, ID Reach #2 (1995 and 2004)



laevigatum), cattail (*Typha* sp.), and sticky Baccharis (*Baccharis douglasii*) are now the dominant species in a diverse community covering nearly 100% of the potential riparian-wetland zone. All of these native species have root masses capable of withstanding high stream flow events, providing strong protection against stream bank erosion.

Perhaps even more significant is the addition of a woody riparian component to the recovering vegetation community. Arroyo willow (*Salix lasiolepis*), which was absent in 1995, is now well-established in many areas and new recruitment was evident along much of the reach. This adds further stability to the riparian system and introduces a wildlife habitat component that was missing during the cattle grazing era. Mature willows within the former exclosure downstream (ID Reach #3) were the likely seed source for willow establishment in this reach.

Reach ID #3: Within former livestock exclosure (downstream of Reach ID #2)

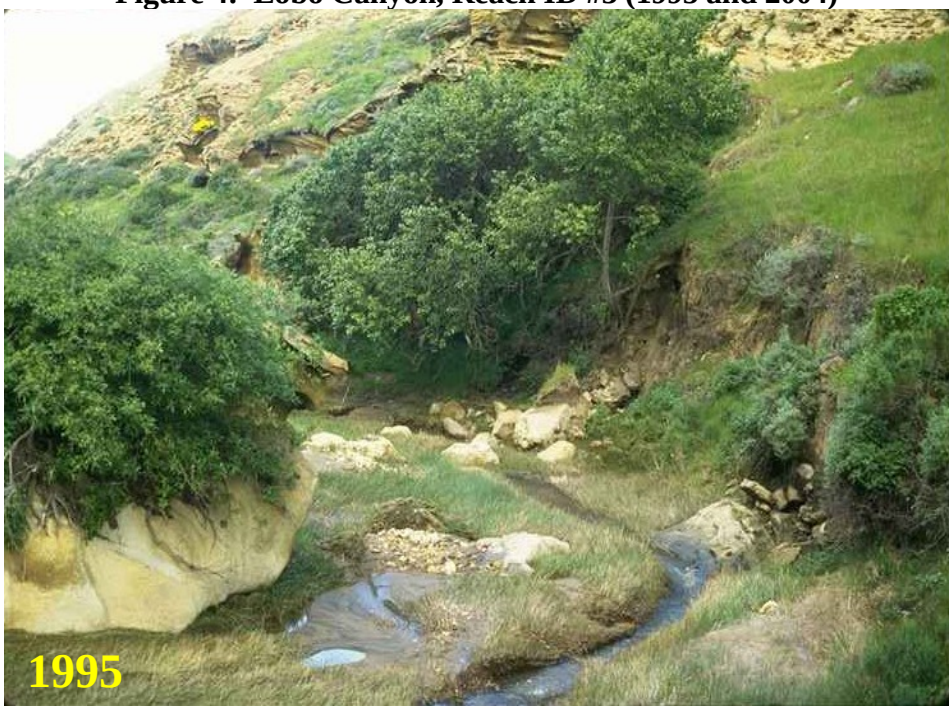
1995 PFC Rating: Proper Functioning Condition
2004 PFC Rating: Proper Functioning Condition

1995 Assessment: The 1995 team selected this reach as one of three "control" reaches that were largely or completely inaccessible to cattle. A fence constructed across the canyon in 1993 excluded cattle completely, but prior to that, the steepness of the canyon slopes also discouraged cattle access. The 1995 team determined this control reach to be in **Proper Functioning Condition**. They described it as having "nearly ideal" channel characteristics, including low width/depth ratio and gradient and channel/floodplain morphology appropriate to the landscape setting. Herbaceous and woody riparian vegetation was described as diverse, energy-dissipating, and bank-protecting. Arroyo willow, black cottonwood (*Populus trichocarpa*), Mexican elderberry (*Sambucus mexicana*), saltgrass (*Distichlis spicata*), and Mexican rush were the dominants in what was described as "perhaps indicative of the potential natural community for riparian areas on Santa Rosa Island." However, deer and elk browsing were substantial, reducing tree and shrub vigor and reproduction.

2004 Assessment: As was the case in 1995, channel sinuosity, width/depth ratio, and gradient are in balance with the landscape setting, and the stream is able to access the floodplain in relatively frequent flow events. The only difference from the 1995 checklist responses is that the stream is now in balance with the water and sediment being supplied by the watershed (no excessive erosion or deposition), which again may be attributable to recovery of vegetation in the watershed since cattle were removed from the island. The team's assessment for this reach was the same as the 1995 conclusion: **Proper Functioning Condition**.

Comparison of the 1995 and 2004 repeat photos (Figure 4) illustrates the striking growth, spread, and overall recovery of herbaceous and woody riparian-wetland vegetation. The dominant herbaceous plant species list expanded in 2004 to include common threesquare and smooth scouring rush. We observed very strong recruitment of arroyo willow

Figure 4: Lobo Canyon, Reach ID #3 (1995 and 2004)



(several age classes represented), and the spread of native herbaceous wetland perennial species was remarkable (vegetative cover is virtually 100%). Black cottonwood is spreading vegetatively, though we did not observe recent recruitment from seed. Positive benefits from this vegetation recovery and development include more energy dissipation during flood events, increased channel bank and bed stabilization, and improved fish and wildlife habitat. Increased production and dispersal of arroyo willow and black cottonwood seeds is another important benefit, since this is one of the few healthy stands of willow and the only cottonwood stand on Santa Rosa Island.

Possible reasons for the significant vegetation recovery in this "control" reach include: 1) depending on the construction date for the fence, cattle were excluded for only 1-2 growing seasons prior to the 1995 assessment (limited time for vegetative recovery); and 2) deer/elk browsing pressure may have been significantly reduced in Lobo Canyon after cattle were removed from the island, deer numbers were greatly reduced, and vegetation recovery progressed island-wide (many more sources of riparian-wetland vegetation became available).

Arlington Canyon

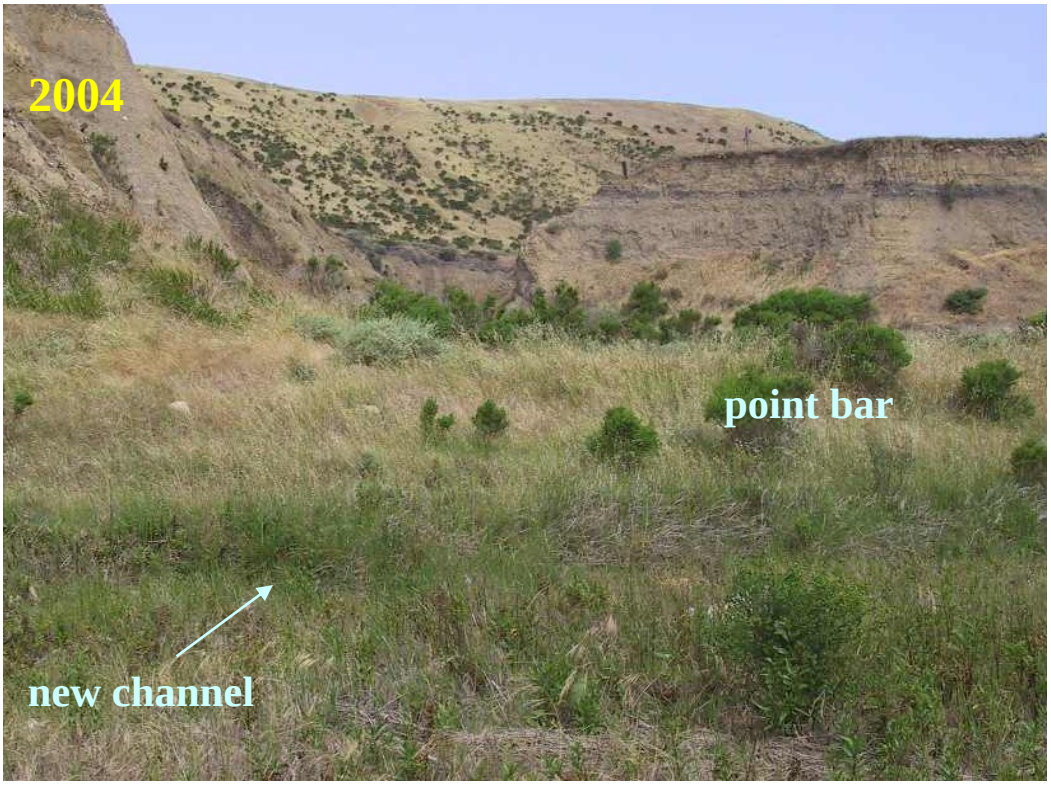
Reach ID # 4, #5 and #6: ¼ mi upstream of Arlington Corrals to the ocean

1995 PFC Rating: Nonfunctional
2004 PFC Rating: Proper Functioning Condition

1995 Assessment: The 1995 team conducted separate assessments on three contiguous reaches in Arlington Canyon, and all were rated **Nonfunctional.** Only subtle differences existed between their hydrologic, geomorphic, vegetation, and erosion/deposition attributes, so they were grouped together for analysis. These reaches were missing almost all of the components required for a properly functioning riparian area. An oversupply of sediment from upland and channel sources had exceeded the stream's transport capability, resulting in a mostly braided channel form, high lateral instability, high width/depth ratios, and other characteristics that were out of balance with the landscape setting (Figure 5). Riparian-wetland vegetation was absent, exposing banks to excessive erosion in each flood event. Vertical stability due to bedrock control and low to moderate gradients led the team to conclude that Arlington Canyon had a high potential for natural riparian restoration if appropriate grazing management changes were made.

2004 Assessment: We walked the three reaches identified by the 1995 team and conducted PFC assessments on ID Reach #4 and on ID Reaches #5 and #6 (combined). Results of these assessments were very similar to each other in their hydrologic, geomorphic, vegetation, and erosion/deposition attributes (see PFC Checklist responses and notes in the Appendix), so they are grouped together here for comparison to the 1995 Arlington Canyon conditions. Based upon the team's evaluation of these attributes, Reaches 4-6 have recovered to **Proper Functioning Condition** since 1995.

Figure 5: Arlington Canyon, Reach ID #5 (1995 and 2004)



Arlington Canyon experienced what may be the most dramatic recovery of riparian systems on the island after removal of cattle. Repeat photography in Figure 5 shows such significant geomorphic and vegetative change that only canyon wall features and other upland reference points confirm that the photos were taken from the same location. The sediment-choked, braided channel evident in most stream segments in 1995 has progressed to a narrower, deeper, meandering channel with a well-developed floodplain and a gradient that is in balance with the landscape setting. Recovery of chaparral and riparian vegetation has apparently reduced excess runoff and erosion to the point where the stream is now in balance with the water and sediment being supplied by the watershed. Point bar development along the new meandering channel is one of the most striking geomorphic changes. For example, the large point bar at the center of the photo in Figure 5, which rises several feet above the current channel, did not exist in 1995.

In contrast to 1995 conditions when vegetation was largely absent, there has since been very strong establishment of bank-stabilizing herbaceous wetland vegetation along the channel. We observed >90% cover of such wetland species on >90% of the channel banks (except for the narrow shale bedrock segments where such cover is not possible and not necessary to maintain stability). The two most dominant wetland species, saltgrass (*Distichlis spicata*) and sticky Baccharis (*Baccharis douglasii*) are native perennials with root masses capable of withstanding high stream flow events, providing strong protection against stream bank erosion. The third dominant, water bent grass (*Agrostis viridis*), is non-native, but it is also a perennial wetland species with good soil stabilizing capability.

The riparian vegetation recovery in Arlington Canyon to date does not include the expected woody riparian component (willows or cottonwoods). This may be due to lack of nearby seed sources and the fact that any plants that do get established would be quickly and preferentially eaten by deer and elk. Presence of willows and cottonwoods may not be absolutely necessary here for bank and floodplain stabilization, but they would enhance such stability, help dissipate flood energy, trap sediment, and provide valuable wildlife habitat that would have likely occurred historically in the canyon.

Acapulco Canyon

Reach ID # 7: Mainstem from mid-watershed to the ocean

1995 PFC Rating: Functional At-Risk (limited risk, <u>trend not apparent</u>)
2004 PFC Rating: Functional At-Risk (limited risk, <u>upward trend</u>)

<u>1995 Assessment</u>: In 1995, this stream channel and floodplain form was judged to be in balance with its landscape setting. Sinuosity and width/depth ratios were near their potential, and the geomorphic relationship between the channel and its floodplain was considered to be appropriate. A **Functional At-Risk** rating was assigned because of the nearly complete lack of a riparian-wetland vegetation community on the channel banks

and point bars (Figure 6). Lack of bank-stabilizing and energy-dissipating vegetation leaves the system vulnerable to erosion in large runoff events, though that risk was considered limited in this relatively small watershed.

2004 Assessment: Since cattle were removed from the island, there has not been much change in Acapulco Canyon's channel and floodplain form (see repeat photography in Figure 6). Channel sinuosity and width/depth ratios are still in balance with the landscape setting, and the channel/floodplain morphology is very similar to the 1995 form, except for the addition of some larger boulders on the floodplain. The stream is still in balance with the water and sediment being supplied by the watershed (water and sediment move efficiently through the system without excessive erosion or sedimentation).

The most notable difference in the 2004 assessment is the establishment of limited herbaceous wetland vegetation on the channel banks and some stabilizing vegetation on the floodplain. The only two riparian-wetland species observed, saltgrass and water bent grass, have root masses capable of withstanding large flows. However, cover was much more patchy than in the other recovering watersheds we visited (<70% cover on <70% of the streambank area), diversity was obviously low, and there was no woody riparian component to the community.

Based upon the limited amount of stabilizing riparian-wetland vegetation recovery, the 2004 team determined that the riparian system in Acapulco Canyon is still **Functional At-Risk (Limited)**. At a minimum, the system could revert to 1995 conditions in a moderate to large runoff event, even if it doesn't come completely unraveled geomorphically. However, we rated the trend as "upward" (compared to "not apparent" in 1995) based on the establishment of bank-stabilizing and energy-dissipating vegetation in many channel bank and floodplain areas where it did not exist in 1995. Continued recovery of perennial herbaceous riparian-wetland vegetation along the channel banks and floodplain (more diverse communities with more complete cover) may bring this stream system into Proper Functioning Condition in the future.

Quemada Canyon

Reach ID # 8: Approx. 1 mi reach west of Old Ranch Pasture fence

1995 PFC Rating: Nonfunctional
2004 PFC Rating: Proper Functioning Condition

1995 Assessment: Most of this reach had a deeply incised, relatively straight channel with bedrock control both vertically and laterally. In the few wider areas where point bars existed, the channel banks and bars were poorly vegetated and susceptible to erosion in large flood events (Figure 7). The high channel width/depth ratios and sediment loads in these areas (both negative attributes for fish habitat) were out of balance with the landscape setting. Without the establishment of adequate riparian-wetland vegetation and

Figure 6: Acapulco Canyon, Reach ID #7 (1995 and 2004)

Figure 7: Quemada Canyon, Reach ID #8 (1995 and 2004)

reduced sediment and runoff from the watershed, there is little opportunity for recovery of proper channel form and desirable habitat attributes in the channel or on the associated floodplain.

2004 Assessment: The step pool channel form in the bedrock controlled segments and the sinuous channel in the wider valley bottom areas now have sinuosity, width/depth ratios, and gradients in balance with their landscape settings. In most areas the riparian-wetland zone has achieved its maximum potential extent, primarily through channel narrowing and deepening (note new channel and bank vegetation in Figure 7 that did not exist in 1995).

The dominant riparian-wetland plant species are now cattails, saltgrass, and water bent grass. Although herbaceous wetland plant diversity was relatively low, the species observed do have root masses capable of stabilizing and maintaining channel bank integrity during large flows. Heavy use by deer in the narrow riparian corridor was evident, and hoof action and browsing are leaving some channel bank areas bare. However, the team agreed that the bedrock control in the straight segments and the remaining riparian-wetland vegetation in the sinuous segments were sufficient to withstand the erosive effects of moderate to larger floods. Willows and cottonwoods were absent, which again may be due to limited seed sources and preferential feeding on any newly established plants by deer and elk.

Based upon the bedrock control in most of the reach, the recovery of appropriate channel forms throughout the reach, and development of an herbaceous community that is adequate to maintain channel and floodplain integrity in larger flow events, the team gave this reach a **Proper Functioning Condition** rating. However, the addition of a woody riparian component would further enhance stability, help dissipate flood energy and trap sediment, and provide valuable wildlife habitat that would likely have occurred historically in the canyon. This may not be possible until deer and elk populations are brought under control.

Old Ranch Canyon

Reach ID # 9: Lower reach within Old Ranch Pasture

1995 PFC Rating: Nonfunctional
2004 PFC Rating: Proper Functioning Condition

1995 Assessment: Old Ranch Canyon provided an especially good example of a riparian system that was **Nonfunctional** (high width/depth ratios, exposed point bars and channel banks, poor sinuosity), but that had high restoration potential if grazing management was improved. The low to moderate gradients in this reach would naturally enhance sediment deposition, the current high sediment loads would provide ample material for bank and floodplain reconstruction, and the loamy soils were an excellent substrate for the natural reestablishment of woody and herbaceous riparian-wetland vegetation.

2004 Assessment: Repeat photography in Figure 8 illustrates the dramatic recovery of channel morphology and vegetation (both riparian and upland) since cattle were removed from this pasture. New narrower channels and associated floodplains have established within the prior (1995) incised channel on about 30% of the reach. These channels have well-formed meanders and width/depth ratios approaching 1:1. The rest of the reach has become a vegetated wet swale, with herbaceous wetland species providing nearly 100% cover between the older incised banks in most areas. Flood debris 1-2 feet above the new channels in the meandering segments indicated that the stream accesses its floodplain during relatively frequent runoff events. The team felt that the trend toward development of stable, meandering channel/floodplain forms within the vegetated swale areas would continue in the future.

Dominant herbaceous wetland plant species include saltgrass, Australian brass buttons (*Cotula australis*), cattails, glasswort (*Salicornia virginica*), and sticky Baccharis (*Baccharis douglasii*). Rabbitsfoot grass (*Polypogon monspeliensis*), water bent grass, and Mexican rush (*Juncus mexicanus*) were also represented in some areas of this relatively diverse community. All but the non-native annuals *Cotula australis* and *Polypogon monspeliensis* have root masses capable of withstanding high stream flow events, and we saw no evidence that recent, moderately large flows had any destabilizing effects on the channel or floodplain. We saw a couple of small, well-browsed arroyo willows and one dead mule fat (*Baccharis salicifolia*) along this reach. However, as in most other recovering riparian plant communities we visited, the expected woody riparian component is almost completely missing. Again, any willow or cottonwood plants that manage to get established would be quickly and preferentially browsed by introduced deer and elk that remain on the island.

The team found this reach to be in **Proper Functioning Condition** based upon the stable channel and floodplain forms, the predominance of stabilizing wetland vegetation, and other positive characteristics indicated on the PFC Checklist form in the Appendix. Although it appears that a woody riparian community component is not necessary to maintain a basic functional riparian condition in Old Ranch Canyon, reintroduction of willows and other woody species would bring increased stability and important wildlife habitat components to this riparian ecosystem.

Figure 8: Old Ranch Canyon, Reach ID #9 (1995 and 2004)

Jolla Vieja Canyon

Reach ID # 10

1995 PFC Rating: Nonfunctional
2004 PFC Rating: Proper Functioning Condition

1995 Assessment: The 1995 team determined that the heavily grazed watershed was delivering excessive sediment and runoff to this stream. The floodplain was seldom inundated by flood waters, and stabilizing riparian-wetland vegetation was largely absent from the point bars and channel banks. As a result, the channel exhibited excessive erosion and lateral migration. The lateral channel migration was widening the arroyo as it cut into the walls (Figure 9), which further increased sediment loads. In summary, the stream/floodplain form was out of balance with the landscape setting and out of balance with the water and sediment being delivered to it by the watershed. Therefore, the 1995 team rated this reach as **Nonfunctional**.

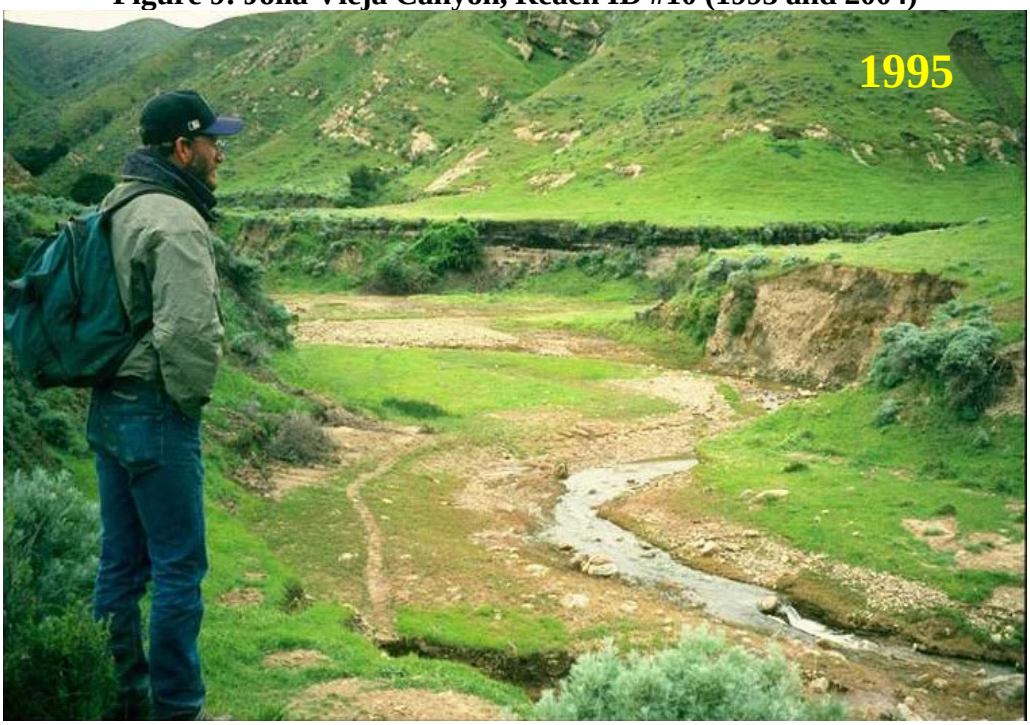
2004 Assessment: Jolla Vieja Canyon provides another example of substantial riparian system recovery after removal of livestock from Santa Rosa Island. The channel has narrowed significantly, point bars and channel banks have become well-vegetated with bank-stabilizing herbaceous wetland species, and the riparian zone has widened to its potential extent. Recently deposited flood debris on the well-vegetated floodplain is evidence that the channel is now able to access the floodplain in relatively frequent above-bankfull events (flood energy is dissipated).

Herbaceous wetland species found along this reach, including water bent grass, saltgrass, cattails, California bulrush (*Scirpus californicus*), brown-head rush (*Juncus phaeocephalus*), and Mexican rush, are all perennials with well-developed root masses that can withstand large flood flows and stabilize channel banks.

Deer and elk browsing appear to be strongly limiting the re-establishment of arroyo willows. Only two small willows were observed on the assessment reach, but they are plentiful in upstream locations where deer and elk can't reach them. However, like most other riparian areas we evaluated, the herbaceous vegetation seems to adequately protect banks and point bars from erosion (channel shows no evidence of degradation after recent flood events). Absence of willows may be more an issue of lost habitat structure and supplemental energy dissipation and bank stabilization than a problem for basic geomorphic stability.

Based upon observations of channel and floodplain morphology appropriate to the landscape setting, adequate vegetation to protect channel banks and point bars against erosion, and other positive attributes listed on the 2004 PFC Checklist (Appendix), this riparian system has recovered to **Proper Functioning Condition.**

Figure 9: Jolla Vieja Canyon, Reach ID #10 (1995 and 2004)



CONCLUSIONS AND RECOMMENDATIONS

The remarkable improvement in Santa Rosa Island's riparian conditions since 1995 demonstrates the ability of these systems to "self-restore" once the major stressor, year-round cattle grazing, was removed. The transitions from nonfunctional to properly functioning riparian systems became possible when vegetation recovery in the watersheds led to decreased runoff and sediment delivery to the island's stream systems and when appropriate bank-stabilizing and energy-dissipating vegetation became established in the riparian areas.

The Proper Functioning Condition method proved to be a very useful tool for evaluating riparian system recovery on the island. However, we emphasize two points that are critical to a successful evaluation using this method: 1) the team must be carefully assembled to assure proper (and repeatable) application of the method; and 2) the team must understand that even though a riparian system may be in Proper Functioning Condition with respect to geomorphic stability, it may not be on a trajectory toward a site's potential natural vegetation community or other desired condition.

Regarding the first point, the 1995 and 2004 PFC teams included subject matter experts in all of the core assessment areas (vegetation ecology, fluvial geomorphology, hydrology, riparian-wetland science) who were also experienced in applying the PFC method. Although the PFC method is based on the BLM's well-established quantitative riparian assessment techniques (Leonard et al. 1992), team members must be able to draw on their experience with such methods to make rapid qualitative evaluations of the 17 checklist elements based on observations of field indicators. We were also careful to include local team members (CHIS staff), who helped calibrate both teams' evaluations by clarifying land use history, identifying relic or "reference areas," providing local vegetation expertise, and so on. Three members of the 1995 team were included on the 2004 team, which helped promote consistency in application of the PFC method for the two assessments.

The second point is illustrated by the fact that even though stream reaches in Arlington, Quemada, Old Ranch, and Jolla Vieja Canyons recovered from "Nonfunctional" in 1995 to "Proper Functioning Condition" in 2004, the expected woody riparian components of these systems (willows and cottonwoods) have not become re-established. Therefore, in addition to reporting PFC functionality ratings, the team should also identify management actions that may be necessary to put functional systems on a trajectory toward desired future riparian-wetland vegetation conditions.

An important reason for the absence of willows and cottonwoods on these reaches may be a lack of nearby seed sources. Unlike many herbaceous wetland plants whose seeds can persist in soils for decades, cottonwood and willow seeds are very short-lived (~1-2 weeks) and do not form seedbanks. Their wind-borne seeds are released in late spring or early summer, and in order to germinate and become established, they must fall on appropriate riparian substrates (bare, moist, mineral soils) during that short period of viability. Therefore, the few remaining willow and cottonwood stands on the island may

not be reliable seed sources for re-populating the more remote watersheds, at least for the near term. And, even if a few seeds do periodically find their way into these watersheds, we believe that the introduced deer and elk that remain on the island would quickly and preferentially eat any seedlings that manage to get established.

Presence of willows, cottonwoods, and other woody riparian species may not be absolutely necessary in most of the drainages for channel bank and floodplain stabilization, but they would enhance such stability, help dissipate flood energy, trap sediment, and provide valuable wildlife habitat that would have likely occurred historically in the canyons. Therefore, the following recommendations are presented to further riparian ecosystem recovery:

1. Consistent with management constraints such as the Court Settlement Agreement and the park's enabling legislation, reduce or eliminate deer and elk from Santa Rosa Island.

2. As soon as possible, plant locally-derived willow and cottonwood cuttings at strategic locations in watersheds where existing seed sources are inadequate to support natural re-establishment. (Simple seed rain traps can be constructed and monitored to evaluate the need for the cuttings, if desired.) These cuttings would need to be protected from browsing and allowed to mature so they can serve as seed sources for re-populating these watersheds once deer and elk are removed from the island.

3. Consider growing and planting plugs of perennial herbaceous wetland vegetation in watersheds with particularly depauperate communities, especially if the opportunity for passive seed re-introductions is low.

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APPENDIX:

2004 PFC Standard Checklists and Notes for ID Reaches 1-10

Lotic Standard Checklist

Name of Riparian-Wetland Area: Windmill Canyon
Date: 5-19-2004 Segment/Reach ID: #1
Miles: _____ Acres: _____
ID Team Observers: Wagner, Reiner, Chaney, Martin, Noon, Denn

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
	X		3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
X			4) Riparian-wetland area is widening or has achieved potential extent
	X		5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			6) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		7) There is diverse composition of riparian-wetland vegetation for maintenance/recovery)
	X		8) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
	X		10) Riparian-wetland plants exhibit high vigor
	X		11) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
		X	12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
	X		13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
	X		16) System is vertically stable
	X		17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1999)

* - see remarks on reverse

Remarks (numbers correspond to checklist items)

1. Recently deposited flood debris evident on floodplains (in segments that have point bars and on mid-channel bars and margins of braided channels).
3. Unstable gradient – incision and aggradation occurring in same reach. Mostly braided channel form with boulder/cobble bars; meandering channel forming only intermittently.
4. Riparian-wetland area fills entire braided channel area; no invasion by upland species except at top of point bars (in stream segments that have them).
6. Yes for woody species (several age classes of willows), but not for herbaceous (very little herbaceous cover of any kind on these sand/cobble substrates).
7. Willow (*S. lasiolepis*) dominant; mulefat (*Baccharis salicifolia*) present but to a much lesser degree. Very little herbaceous wetland vegetation.
8. Yes for woody riparian vegetation, but not for herbaceous. Cobble/sand may not hold sufficient moisture long enough near the surface in this intermittent drainage to establish/support herbaceous vegetation, while woody species tap into deeper water sources.
10. Many willows are severely stressed by drought and insects.
13. Energy is dissipated by remobilization of bed material.
14. Yes on the few stretches where there are point bars, but most of reach is braided channel.
16. Substantial evidence of vertical scour/incision in some areas, evidence of major sediment transport/aggradation in others.
17. Excessive deposition in many areas.

Summary Determination

Functional Rating:		Trend for Functional – At Risk:	
Proper Functioning Condition	_____	Upward	_____
Functional – At Risk	__X_ (high risk)	Downward	_____
Nonfunctional	_____	Not Apparent	__X__
Unknown	_____		

Notes: Bedload and washload sediment is well in excess of what the existing channel can handle efficiently. Excess sediment may be due to past stream manipulation by ranchers, as well as year-round grazing by livestock and deer. The channel oversteepens due to excessive deposition, causing some areas to incise. While this site is out of balance with the landscape setting, the amount of flood energy it would take to "unravel" the system (loss of riparian vegetation, massive incision, etc.) would be very high, though still possible. Overall, we judged the site to be stable enough to handle a 20-year flow event (though some short stretches would incise as discussed above). But there are serious risk factors that could change this: 1) Willows are highly stressed due to drought, insect damage, and severe browsing in the upper part of the reach (most likely by deer). Continued willow decline could destabilize the banks and floodplain, which would result in significant loss of wildlife values. 2) Even if willows survive, a large flood event (>20 year) in the next few years would likely mobilize excessive sediment and destroy existing vegetation, setting the clock back to 1995 conditions. The trend was rated "not apparent" because although willow cover has increased substantially since 1995, the plants are now highly stressed and may be lost. Bottom line: If riparian trees overcome current stresses and are allowed to mature before being blown out by a large flood, and if deer browsing in the watershed is brought under control (less runoff and sediment contribution), then it's possible that a more efficient channel could form with the stream power to move sediment through the system. In the mean time, the site is at high risk.

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes _____
No ___X_

If yes what are those factors?

___ Flow regulations ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)_____

Lotic Standard Checklist

Name of Riparian-Wetland Area: Lobo Canyon – oak grove to exclosure fence
Date: 5-21-2004 Segment/Reach ID: #2 (upstream reach)
Miles: _____ Acres: _____
ID Team Observers: Wagner, Martin, Chaney, Faulkner, Reiner, Noon, Denn

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
X			4) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
X			4) Riparian-wetland area is widening or has achieved potential extent
X			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			10) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
X			11) There is diverse composition of riparian-wetland vegetation for maintenance/recovery)
X			12) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			13) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
X			14) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
		X	15) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			16) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
	X		15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
X			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1999)

Remarks (numbers correspond to checklist items)

6. Unlike most other streams we've visited, this is true for woody component (*S. lasiolepis*) as well as very strong recruitment/spread of native herbaceous perennials.
7. Dominants: *S. lasiolepis*, *Juncus mexicanus*, *Scirpus pungens*, *Equisetum laevigatum*, *Typha* sp., *Baccharis douglasii*. *Festuca arundinacea* (exotic) also present.
11. Virtually 100% cover with bank-stabilizing perennial herbaceous and woody species.
15. Heavy vegetation growth is restricting lateral migration in some areas - stream has moved into a relatively straight channel alongside dense *Typha*.

Summary Determination

Functional Rating:

Proper Functioning Condition	X
Functional – At Risk	_____
Nonfunctional	_____
Unknown	_____

Trend for Functional – At Risk:

Upward	_____
Downward	_____
Not Apparent	_____

Notes: Although this reach was outside the grazing exclosure that was constructed in 1993, steep slopes leading into the canyon discouraged livestock grazing to some degree. Therefore, even in 1995, this reach had a significant bank-stabilizing herbaceous component (e.g., *J. mexicanus*, *S. pungens*, *Eleocharis acicularis*) and was in proper functioning condition. In 2004, *S. lasiolepis* provides a significant woody riparian component, more riparian-wetland herbaceous species exist, and cover has increased to near 100%.

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes _____
No __X___

If yes, what are those factors?

___ Flow regulations ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)_____

Lotic Standard Checklist

Name of Riparian-Wetland Area: Lobo Canyon – downstream of old exclosure fence
Date: 5-21-2004 Segment/Reach ID: #3 (within former livestock exclosure)
Miles: _____ Acres: _____
ID Team Observers: Wagner, Martin, Chaney, Faulkner, Reiner, Noon, Denn

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
X			5) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
X			4) Riparian-wetland area is widening or has achieved potential extent
X			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			14) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
X			15) There is diverse composition of riparian-wetland vegetation for maintenance/recovery)
X			16) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			17) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
X			17) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
		X	18) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			19) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
X			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1999)

Remarks (numbers correspond to checklist items)

6. *S. lasiolepis* recruitment is strong (several age classes) as well as very strong recruitment/spread of native herbaceous perennials. *Populus trichocarpa* (black cottonwood) is spreading vegetatively but did not see seedling recruitment.
7. Dominants: *S. lasiolepis*, *Populus trichocarpa*, *Sambucus mexicanus*, *Scirpus pungens*, *Juncus mexicanus*, *Equisetum laevigatum*.
11. Virtually 100% cover with bank-stabilizing herbaceous perennial and woody species.

Summary Determination

Functional Rating:

Proper Functioning Condition	X
Functional – At Risk	_____
Nonfunctional	_____
Unknown	_____

Trend for Functional – At Risk:

Upward	_____
Downward	_____
Not Apparent	_____

Notes: Comparison of 1995 photos with 2004 conditions indicates substantial development of riparian vegetation cover. This reach is the location of several "founder willows" that existed in 1995 and have now spread throughout the canyon (including the upstream reach #2). This is also the only known location of black cottonwood on the island, which should provide a seed source for future establishment.

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes _____
No __X___

If yes, what are those factors?

___ Flow regulations ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)_____

Lotic Standard Checklist

Name of Riparian-Wetland Area: Arlington Canyon: From corrals upstream approx ¼ mi.
Date: 5-21-2004 Segment/Reach ID: #4
Miles: _____ Acres: _____
ID Team Observers: Wagner, Martin, Chaney, Faulkner, Reiner, Noon, Denn

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
X			6) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
X			4) Riparian-wetland area is widening or has achieved potential extent
X			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			18) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
X			19) There is diverse composition of riparian-wetland vegetation for maintenance/recovery)
X			20) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			21) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
X			20) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
		X	21) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			22) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
X			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1999)

Remarks (numbers correspond to checklist items)

1. Flood debris from recent above-bankfull flow events evident on floodplain and point bars.
3. Well-developed meanders have formed; gradient and sinuosity appropriate to landscape setting.
4. Meanders widening, point bars vegetating, and channel narrowing all contribute to riparian area widening.
6. Not in woody component, but very strong recruitment/spread of herbaceous component.
7. Dominants: *Distichlis spicata*, *Baccharis douglasii*, *Agrostis viridis*, *Cotula australis*, *Plantago* sp (native). *Eleocharis acicularis* and *Juncus* sp. also well represented.
11. Overall answer is yes, but there are some small areas where lateral migration is still scouring banks (some unvegetated bank areas). This is part of the natural increase in sinuosity as the site heals from its previous overgrazed condition.
15. See note 11 above. The entire channel form is migrating naturally in one direction, not widening on both sides as it might when impacted by overgrazing.

Summary Determination

Functional Rating:

Proper Functioning Condition _X___
Functional – At Risk _____
Nonfunctional _____
Unknown _____

Trend for Functional – At Risk:

Upward _____
Downward _____
Not Apparent _____

Notes: Continued deer and elk grazing is strongly limiting re-establishment of willows, but the system appears to be stabilized with just the herbaceous component. Factors influencing this conclusion included: 1) good cover with herbaceous wetland/riparian species having stabilizing root systems; and 2) observations that recent storms leaving flood debris 1-2 feet above bankfull had few adverse consequences on stability. Lack of willows is more a loss of habitat structure and value issue than a problem for geomorphic stability.

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes _____
No __X___

If yes, what are those factors?

___ Flow regulations ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)_____

Lotic Standard Checklist

Name of Riparian-Wetland Area: Arlington Canyon: Corrals downstream to ocean
Date: 5-21-2004 Segment/Reach ID: #5 and #6 (combined)
Miles: _____ Acres: _____
ID Team Observers: Wagner, Martin, Chaney, Faulkner, Reiner, Noon, Denn

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
X			7) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
X			4) Riparian-wetland area is widening or has achieved potential extent
X			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			22) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
X			23) There is diverse composition of riparian-wetland vegetation for maintenance/recovery)
X			24) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			25) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
X			23) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
		X	24) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			25) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
X			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1999)

Remarks (numbers correspond to checklist items)

2. Flood debris from recent above-bankfull flow events evident on floodplain and point bars.
3. Well-developed meanders have formed; gradient and sinuosity appropriate to landscape setting. Numerous bedrock outcrops have strong control on morphology in some segments (no vegetation and a narrow straight channel in shale segments). But between those segments, there is development of stable meanders within the older (cattle grazing era) degraded channel.
4. Channel is narrowing and point bars are revegetating, which result in a widening riparian-wetland area.
6. Not in woody component, but very strong recruitment/spread of herbaceous perennial component.
7. Dominants: *Distichlis spicata*, *Baccharis douglasii*, *Agrostis viridis*, *Cotula australis*, *Plantago* sp (native). *Eleocharis acicularis* and *Juncus* sp. also well represented.
11. >90% cover with bank-stabilizing herbaceous species on > 90% of channel banks (except in shale segments, where such cover is not possible and is not necessary to maintain stability).
13. Sinuosity, good access to the well-vegetated floodplain, well-anchored channel bank and bottom vegetation all dissipate energy. Channel shows no evidence of degradation after recent flood events.

14-17. Some lateral cutting into terraces evident, but viewed as a natural process of creating a stable channel within the older (cattle grazing era) channel. New channel appears to be handling this sediment load efficiently. Numerous bedrock outcrops exert strong control on stream morphology, both vertically and horizontally.

Summary Determination

Functional Rating:

Proper Functioning Condition	X
Functional – At Risk	_____
Nonfunctional	_____
Unknown	_____

Trend for Functional – At Risk:

Upward	_____
Downward	_____
Not Apparent	_____

Notes: Continued deer and elk grazing is strongly limiting re-establishment of willows, but the system appears to be stabilized with just the herbaceous component. Factors influencing this conclusion included: 1) strong cover (> 90%) with herbaceous wetland/riparian species having stabilizing root systems; and 2) observations that recent storms leaving flood debris 1-2 feet above bankfull had little to no adverse effect on stability. Lack of willows is more a loss of habitat structure and value issue than a problem for geomorphic stability. Willows occur further upstream in the watershed. Park is planting protected willows downstream that will also serve as a seed source for willow establishment once deer and elk are removed.

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes _____
No __X___

If yes, what are those factors?

___ Flow regulations ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)_____

Lotic Standard Checklist

Name of Riparian-Wetland Area: Acapulco Canyon
Date: 5-20-2004 Segment/Reach ID: #7
Miles: _____ Acres: _____
ID Team Observers: Wagner, Martin, Chaney, Faulkner, Reiner, Noon, Denn

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
X			8) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
X			4) Riparian-wetland area is widening or has achieved potential extent
X			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			26) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
	X		27) There is diverse composition of riparian-wetland vegetation for maintenance/recovery)
X			28) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			29) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
	X		26) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
		X	27) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			28) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
X			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1999)

Remarks (numbers correspond to checklist items)

1. Recently deposited flood debris on floodplain adjacent to channel.
3. Sinuosity and width/depth ratio appropriate to the landform.
4. Riparian-wetland area widening through channel narrowing and establishment of appropriate vegetation on developing floodplain.
5. Despite some apparent bank contributions to sediment load and limited stabilizing vegetation, the system has held together and the channel has not degraded (very similar to 1995 photo point channel/floodplain structure except for some larger boulders on 2004 floodplain).
6. No woody riparian species present. Only two herbaceous wetland-riparian species observed (*Distichlis spicata* and *Agrostis viridis*), but both are reproducing and spreading.
7. No woody species present, and only the two herbaceous species. *Typha*, *Juncus*, *Scirpus*, etc. completely absent.
8. Very low diversity as discussed above.
9. *Distichlis spicata* and *Agrostis viridis* both have good soil stabilization ability.
11. No, because cover, though much more than 1995, is considerably less than other channels we have seen (< 70% cover on < 70% of stream bank area – patchy).

13/17. Basing these "yes" answers mainly on this channel and floodplain's ability to maintain its form despite limited vegetation component.

Summary Determination

Functional Rating:

Proper Functioning Condition	____
Functional – At Risk	_X__
Nonfunctional	_____
Unknown	_____

Trend for Functional – At Risk:

Upward	__X_
Downward	_____
Not Apparent	_____

Notes: The limited riparian-wetland vegetation development leaves this site at risk. At a minimum, the system could revert to 1995 conditions in a moderate to large runoff event, even if it doesn't come completely unraveled geomorphically. The trend is considered upward based on the amount of stabilizing riparian-wetland vegetation that has established since 1995. However, such vegetation has not developed enough in cover or species diversity to eliminate the risk of degradation in moderate to large floods. Also, the woody species component is missing entirely. In the words of Sarah Chaney: *"This stream has no back-up plan."*

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes _____
No __X___

If yes, what are those factors?

___ Flow regulations ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)_____

Lotic Standard Checklist

Name of Riparian-Wetland Area: Quemada Canyon
Date: 5-21-2004 Segment/Reach ID: #8
Miles: _____ Acres: _____
ID Team Observers: Wagner, Martin, Chaney, Faulkner, Reiner, Noon, Denn

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
X			9) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
X			4) Riparian-wetland area is widening or has achieved potential extent
X			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			30) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
X			31) There is diverse composition of riparian-wetland vegetation for maintenance/recovery)
X			32) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			33) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
	X		29) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
		X	30) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			31) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
X			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1999)

Remarks (numbers correspond to checklist items)

3. Primarily a bedrock control channel, though some segments have more sediment. The step pool structure in the bedrock segments and the sinuous channel in areas with more sediment have sinuosity, w/d ratio, and gradient in balance with landscape setting.
4. In most segments, riparian-wetland area has achieved maximum extent.
7. Dominants: *Typha* sp., *Distichlis spicata*, *Agrostis viridis* (no woody riparian species present). *Cotula australis* and *Baccharis pilularis* (coyote brush) also present.
11. Deer are using the riparian corridor as a "highway" – hoof action and grazing are leaving some areas devoid of vegetation.
13. Despite 11), the deer impacts are not considered significant enough to destabilize the physical system (most is bedrock control, and vegetation in other segments appears sufficient to withstand moderate floods.
15. Mostly bedrock control, therefore largely irrelevant.

Summary Determination

Functional Rating:

Proper Functioning Condition	X
Functional – At Risk	_____
Nonfunctional	_____
Unknown	_____

Trend for Functional – At Risk:

Upward	_____
Downward	_____
Not Apparent	_____

Notes: Although now in proper functioning condition, deer and elk are impacting the system, as evidenced by loss of vegetation and absence of woody riparian component. Once deer and elk are removed, the reintroduction of willows should put this reach on a path toward much improved riparian habitat value.

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes _____
No __X___

If yes, what are those factors?

___ Flow regulations ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)_____

Lotic Standard Checklist

Name of Riparian-Wetland Area: Old Ranch Canyon
Date: 5-19-2004 Segment/Reach ID: #9
Miles: _____ Acres: _____
ID Team Observers: Wagner, Reiner, Chaney, Martin, Noon, Denn

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
X			10) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
X			4) Riparian-wetland area is widening or has achieved potential extent
X			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			34) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
X			35) There is diverse composition of riparian-wetland vegetation for maintenance/recovery)
X			36) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			37) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
X			32) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
		X	33) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			34) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
X			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1999)

Remarks (numbers correspond to checklist items)

1. New floodplain established within prior (1995) incised channel. Flood debris from recent above bankfull flow events evident on new floodplain.
3. Width/depth ratio approaching 1:1. Meander pattern well formed on approximately 30% of channel length; other 70% is a grassy swale. Overall upward trend in this characteristic.
4. Full width of new floodplain vegetated with herbaceous wetland species. Woody riparian species (*S. lasiolepis*) rarely observed. (Sara Chaney noted that any willows or mulefat plants that do establish in the riparian area are quickly and preferentially eaten by deer and elk that remain on the island.)
6. Herbaceous wetland vegetation is healthy, near 100% cover, spreading, and stabilizing the channel and floodplain.
7. Herbaceous dominants: *Distichlis spicata*, *Cotula australis*, *Typha* sp., *Salicornia virginica*, *Baccharis douglasii*. Also represented but not dominant: *Polypogon monspeliensis*, *Agrostis viridis*, *Juncus mexicanus*. A weed of concern, *Festuca arundinacea*, found occasionally near channel. Upland species *Baccharis pilularis*, *Bromus diandrus*, and *Bromus hordeaceus* observed in some areas, perhaps due to relatively dry conditions in the last 3 years. One dead mulefat plant (*Baccharis salicifolia*) observed.
9. *Distichlis spicata*, *Baccharis douglasii*, *Typha* sp., *Salicornia virginica* all have root systems capable of withstanding high streamflow events. Plentiful evidence that recent overbank flow events had virtually no adverse effect on these species.
11. Very evident from recent overbank flow event (flood debris 1-2 feet above bankfull common with no degradation).
14. Fully vegetated on the 30% of the channel where sinuosity/point bars exist.
15. Definitely accessing floodplain, no lateral erosion.

Summary Determination

Functional Rating:

Proper Functioning Condition	X
Functional – At Risk	_____
Nonfunctional	_____
Unknown	_____

Trend for Functional – At Risk:

Upward	_____
Downward	_____
Not Apparent	_____

Notes: Although lack of willows or other woody riparian species can put some stream and riparian systems at risk, the team determined that the very strong herbaceous component was sufficient to provide stabilization and functionality on this reach. Factors influencing this conclusion included: 1) near 100% cover with native herbaceous wetland/riparian species having stabilizing root systems, 2) relatively low gradient channel, and 3) observations that recent storms leaving flood debris up to 2 feet above bankfull had no adverse consequences on stability.

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes _____
No __X___

If yes, what are those factors?

___ Flow regulations ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)_____

Lotic Standard Checklist

Name of Riparian-Wetland Area: Jolla Vieja Canyon
Date: 5-20-2004 Segment/Reach ID: #10
Miles: _____ Acres: _____
ID Team Observers: Wagner, Martin, Chaney, Faulkner, Reiner, Noon, Denn

Yes	No	N/A	HYDROLOGY
X			1) Floodplain above bankfull is inundated in "relatively frequent" events
		X	2) Where beaver dams are present they are active and stable
X			11) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)
X			4) Riparian-wetland area is widening or has achieved potential extent
X			5) Upland watershed is not contributing to riparian-wetland degradation

Yes	No	N/A	VEGETATION
X			38) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
X			39) There is diverse composition of riparian-wetland vegetation for maintenance/recovery)
X			40) Species present indicate maintenance of riparian-wetland soil moisture characteristics
X			41) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high-streamflow events
X			10) Riparian-wetland plants exhibit high vigor
X			35) Adequate riparian-wetland vegetative cover is present to protect banks and dissipate energy during high flows
		X	36) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery)

Yes	No	N/A	EROSION/DEPOSITION
X			37) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) are adequate to dissipate energy
X			14) Point bars are revegetating with riparian-wetland vegetation
X			15) Lateral stream movement is associated with natural sinuosity
X			16) System is vertically stable
X			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)

(Revised 1999)

Remarks (numbers correspond to checklist items)

1. Recently deposited flood debris on floodplain adjacent to channel.
3. Sinuosity well-developed, channel gradient appropriate and stable.
4. Channel has narrowed significantly and point bars and channel margins have vegetated with riparian-wetland species. The riparian-wetland zone has widened and probably reached its potential extent.
6. Willows are minimally represented on assessment reach (only 2 found), but a lot of willow evident upstream where remaining grazing animals (deer, elk) can't get to them. Herbaceous wetland vegetation very well developed and spreading.
7. Dominants: *Agrostis viridis, Polypogon monspeliensis, Distichlis spicata, Cotula australis*, and *Typha* sp. (in deeper areas). Also represented: *Scirpus californicus, Juncus phaeocephalus, Juncus mexicanus*.
9. *Distichlis*, *Scirpus*, both *Juncus* species, *Agrostis*, and *Typha* are all wetland-riparian perennials with well-developed root masses.
13. Sinuosity, good access to the well-vegetated floodplain, well-anchored channel bank and bottom vegetation, and step pools all dissipate energy. Channel shows no evidence of degradation after recent flood events.
14. *Distichlis spicata* predominant on point bars, a couple of *Salix lasiolepis* found.

Summary Determination

Functional Rating:

Proper Functioning Condition	X
Functional – At Risk	_____
Nonfunctional	_____
Unknown	_____

Trend for Functional – At Risk:

Upward	_____
Downward	_____
Not Apparent	_____

Notes: Continued deer and elk grazing is strongly limiting re-establishment of willows, but the system appears to be stabilized with just the herbaceous component. Factors influencing this conclusion included: 1) good cover with herbaceous wetland/riparian species having stabilizing root systems; and 2) observations that recent storms leaving flood debris well above bankfull had few adverse consequences on stability. Lack of willows is more a loss of habitat structure and value issue than a problem for geomorphic stability.

Are factors contributing to unacceptable conditions outside the control of the manager?

Yes _____
No __X___

If yes, what are those factors?

___ Flow regulations ___ Mining activities ___ Upstream channel conditions
___ Channelization ___ Road encroachment ___ Oil field water discharge
___ Augmented flows ___ Other (specify)_____

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

CHIS D-185 December 2004