# Chapter Three: Affected Environment

## INTRODUCTION

This Chapter summarizes the physical, biological, social, and economic environments of the project area and is the baseline for the comparisons of environmental consequences in Chapter 4. Resources were not placed in order of importance; rather the resources were organized by issues as identified in Chapter 1 and to provide organizational flow and understanding.

## WATER QUALITY

In this section, a description of existing hydrologic conditions that may be affected by the alternatives is presented. This description provides the basis for assessing the projected environmental effects of the alternatives discussed in the section that follows.

### CLIMATE

Mean annual precipitation in the project area is approximately 15-40 inches (DRI, 1997). However, the project area is currently under drought conditions with less rainfall than normal for the past five (5) years (U.S. Drought Monitor, 2003). Most precipitation occurs as snow and/or rain during the winter and spring months. The driest time of the year tends to be during the summer months of July and August. Due to snowmelt, the highest stream flows occur most often from March through June (USGS, 2003).

### SURFACE WATER FEATURES

The project area ranges in elevation from 5,000-9,700 feet and contains 22 sub-watersheds that flow down either side of the north-south trending Santa Rosa Mountain Range. The west side of the project area flows into the Quinn River watershed and east side of the project area flows into the Little Humboldt River watershed. The Quinn River flows southwest from the National Forest and terminates in the Black Rock Desert. The Little Humboldt River also flows southwest, but joins into the Humboldt River, which then terminates at the Humboldt Sink in the Humboldt Wildlife Management Area. The portions of these watersheds within the project area can be divided into the 22 sub-watersheds listed in Table 4-T, which are identified by their sixth-level hydrologic unit codes (HUC). Table 4-T also correlates the sub-watersheds with grazing allotment names, and major streams, creeks, and rivers).

There are two distinct landscapes within the project area. The southern half of the project area is characterized by steep terrain incised by canyons along both the east and west side of a backbone type mountain range. The north half is dominated by a broad basin with more gently sloping stream valleys.

The project area also contains a number of seeps and springs that are formed when groundwater flows through geologic pathways, such as fractures or faults, onto the ground surface. There are at least 300 known seeps/springs in the project area. Many contribute flow to or are the source of streams. These seeps and springs are valuable water sources for wildlife and vegetation. A number of springs are also water sources for livestock water developments. There are approximately 90 known water developments in the project area. Most are troughs fed by springs, and some are pit tanks dug into ground that are also fed by springs and/or collect surface runoff. When installed at an appropriate location, the water developments help to disperse livestock from streams and riparian areas. However, many of the water developments and/or their associated fencing are in need of repair.

At least four (4) streams that originate on the Forest have water diversions; these include Andorno Creek, Falls Canyon, Willow Creek, and Martin Creek. All but the Andorno Creek diversion are located off the Forest. The others are still important to this project, however, because of their cumulative effects (see Chapter 4).

**Table 4-T: Watersheds in Martin Basin Rangeland Project Area**

| Watershed | Sub-Watershed HUC | Major Stream | Allotment |
|---|---|---|---|
| **Quinn River** | 160402010802 | East Fork Quinn River | Indian |
| | 160402010803 | South Fork Quinn River | |
| | 160402010804 | Jakes Creek | |
| | 160402010702 | Two-Mile Creek | |
| | 160402010706 | Three-Mile Creek | Westside Flat Creek |
| | 160402010708 | Canyon Creek | |
| | 160402010403 | Pole Creek | |
| | 160402010404 | Skull Creek | |
| | 160402010408 | Rebel Creek | Rebel Creek |
| | 160402010305 | Wood Canyon Creek | |
| | | Rock Creek | |
| | 160402010306 | Antelope Creek | |
| | | McConnell Creek | |
| | | Dog Creek | |
| | | Horse Canyon | Buffalo |
| | | Falls Canyon | |
| | | Pine Creek | |
| | 160402010307 | Buffalo Canyon | |
| | | Austin Creek | |
| | | Andorno Creek | |
| | 160402011301 | Peterman Creek | |
| | | Chimney Creek | |
| | | Porcupine Creek | |
| | 160402010406 | Willow Creek | Granite Peak |
| | | South Fork Willow Creek | |
| | | Gabica Fork | |
| **Little Humboldt River** | 160401090502 | Indian Creek | Granite Peak |
| | | South Fork Indian Creek | |
| | 160401090303 | Coleman Creek | |
| | | Solid Silver Creek | |
| | | Mullinix Creek | |
| | 160401090302 | Big Cottonwood Creek | |
| | | South Fork Big Cottonwood Creek | |
| | 160401091103 | Long Canyon Creek | Martin Basin, Bradshaw, and Buttermilk |
| | | North Fork Little Humboldt | |
| | 160401090507 | Martin Creek | |
| | | Siard Creek | |
| | | North Fork Cabin Creek | |
| | | Cabin Creek | |
| | | Bradshaw Creek | |
| | 160401090506 | Dutch John Creek | |
| | | Lye Creek | |
| | | Road Creek | |
| | | Alkali Creek | |
| | | Deep Creek | |
| | | Harvey Creek | |
| | | Round Corral Creek | |
| | 160401090501 | Buttermilk Creek | |
| | 160401090506 | Dry Creek | |
| | | Spring City Creek | |

*Note: HUC = Hydrologic unit code*

## RIPARIAN AREA AND STREAM CHANNEL CONDITIONS

A riparian habitat is the area immediately adjacent to flowing water (e.g., streams) where vegetation communities are strongly influenced by the presence of water. It is essentially a transitional area on the stream banks between the aquatic environment within the stream and the upland environment on the slopes above. Vegetation types typically found in riparian habitats in the project area include, but are not limited to willow and alder shrubs, cottonwood trees, and graminoids, such as sedge and grass. Riparian areas are

typically a minor portion of the landscape, but ecologically serve a much larger role. For example, a properly functioning riparian area would filter sediments and nutrients from floodwaters and upland runoff, prevent erosion during flood flows by binding stream banks, provide wildlife habitat, and provide thermal cover for aquatic and terrestrial life (Mosely, et. al. 1997). A non-functioning riparian area would lack some or all of these attributes.

To determine if riparian areas in the project area were functioning properly, proper functioning condition (PFC) assessments were conducted during the 2002-grazing season (May 21 through September 31) on representative streams. A PFC assessment is a qualitative methodology for assessing the condition of a riparian area by evaluating its hydrology, vegetation, and erosion/deposition (soils) attributes and processes (BLM 1998).

PFC assessment results from the 2002-grazing season are presented in Table 5-T; this is a qualitative assessment of riparian conditions. Falls Canyon Creek was determined to be functioning properly. Streams surveyed in the Martin Basin, Buttermilk, and West Side Flat Creek allotments are Nonfunctional or Functional / At Risk. Two (2) of the five (5) streams were assessed to be "Functional / At Risk" and on a downward trend; therefore, they may soon lose their ability to function. The other streams assessed as Functional / At Risk were on an upward trend. With proper management, they would likely recover and be functional again (Photographs 1-P and 2-P).

**Table 5-T:**
**Assessment of Proper Function Condition (PFC) for Selected Drainages in the Martin Basin Rangeland Project Area**

| Grazing Allotments | Drainage Name | Functional Rating |
|---|---|---|
| **Martin Basin, Bradshaw, and Buttermilk** | Martin Creek | Functional-At Risk / downward trend |
| | Siard Creek | Nonfunctional |
| | North Fork Cabin Creek | Nonfunctional |
| | Cabin Creek | Functional-At Risk / downward trend |
| | Lye Creek (headwaters) | Nonfunctional |
| | Dutch John Creek | Functional-At Risk / upward trend |
| | Deep Creek | Functional-At Risk / upward trend |
| **Indian** | South Fork Quinn River | Functional-At Risk / upward trend |
| **Granite Peak** | No PFC Assessment | No PFC Assessment |
| **West Side Flat Creek** | Three-Mile Creek | Nonfunctional |
| **Buffalo/Rebel Creek[1]** | Falls Canyon Creek | Proper Functioning Condition |

*Notes: PFC = Proper Functioning Condition*
*[1]Falls Canyon Creek is considered representative of conditions in both the Buffalo and Rebel Creek allotments.*

Table 6-T contains General Aquatic Wildlife System (GAWS) survey data collected by the Nevada Department of Wildlife (NDOW, 1986-2001). These are quantitative data that describe the condition of representative stream channels in the project area. The values presented in Table 6-T represent stream averages. Values for any one location may vary, with some locations having better condition and some worse.

A low width/depth ratio of less than 10 is considered ideal for a stream channel (FS 1995). Streams with low width/depth ratios are narrow and deep and therefore, tend to have lower water temperatures and are better able to transport sediment and maintain channel integrity. The streams measured all had width/depth ratios greater than 10 (Table 6-T). Most had high width/depth ratios, ranging from 21.84-36.0. The ability of these streams to transport sediment and maintain channel integrity has been reduced. There were only four streams with width/depth ratios that are considered moderate (14.47-18.1): Cabin Creek, Flat Creek, Andorno Creek, and Falls Canyon Creek. With the exception of Cabin Creek in the Martin Basin Allotment, these streams all flow down the west side of the Santa Rosa Range.

Bank vegetation stability is a parameter that gives an indication of streambank condition, which determines how well a stream bank would withstand erosion during high stream flows. A stable bank would be covered by vigorous vegetation and/or have rock material, which bind streambank soils. With the exception of fair ratings for the North Fork of Cabin Creek, Buffalo Canyon, and Horse Canyon, all the streams listed in Table 6-T had vegetation and soil stability ratings that are considered good or excellent. None of the streams had poor ratings.

The ungulate damage rating is an indicator of physical damage (e.g., bank sloughing) that animal hoofs cause to a streambank. Most streams were determined to have moderate ungulate damage (26-50%) as defined by

the GAWS protocol (Table 6-T). The North Fork of Cabin Creek and Round Corral had high ungulate damage ratings (>50%). None had an excessive ungulate rating.

**Photograph 1-P:**

A stream in Nonfunctional Condition. Siard Creek.

**Photograph 2-P:**

A stream in Proper Functioning Condition. Falls Canyon.

Canopy density is a parameter that measures the amount of cover the streambank vegetation provides over the streams. Ideally, a stream should have 100% canopy density. Streams measured in the project area had canopy densities from 32.0 to 85.7 (Table 6-T). Streams with the lower canopy densities are likely to have higher water temperatures due to the lack of shade.

**Table 6-T:**
**General Aquatic Wildlife Survey (GAWS) Data for Streams in the Martin Basin Rangeland Project Area**

| Grazing Allotment | Stream[1] | Width / Depth Ratio[2] | Canopy Density[3] | Bank Vegetation Stability[4] | Ungulate Damage Rating[5] |
|---|---|---|---|---|---|
| **Martin Basin, Bradshaw, and Buttermilk** | Martin Creek 2001 (1993 survey) | 27.4 | 53.4 (44.7) | 79.7 (63.7) | 24.3 (18.0) |
| | North Fork Little Humboldt River 1998 (1993 survey) | No data | 42.6 (25.8) | 68.3 (62.3) | 7.8 (25.3) |
| | Long Canyon 1998 (1993 survey) | No data | 58.0 (37.0) | 73.2 (63.2) | None (26.2) |
| | Dutch John 2000 (1995 survey) | 25.6 Mainstem 42.9 Mid Fork 43.0 N. Fork | 81.5 | 88.9 (57.8) | 12.8 |
| | Cabin Creek 1998 (1993 survey[8]) | 18.1 | 62.2 (59.0) | 81.0 (73.4) | 17.3 (2.5) |
| | North Fork Cabin 1997 (1993 survey) | 22.1 | 58.0 (62.2) | 55.7 (79.6) | 53.1 (3.4) |
| | Deep Creek 2000(1995 survey) | 36.0 | 83.3 | 86.1 (76.2) | 37.0 (21.9) |
| | Lye Creek 2000 (1994 survey) | 34.1 | 75.9 (59.0) | 93.2 (95.4) | 3.2 (3.9) |
| | Round Corral 2000 (1995 survey) | 27.7 | 81.2 | 78.0 (87.3) | 50.8 (24.2) |
| | Siard Creek 2001 (1993 survey) | 22.1 | 80.6 (51.4) | 67.9 (70.7) | 10.7 |
| | Road Creek 2000(1994 survey) | 31.9 | 85.7 | 86.8 (80.0) | 20.2 (17.8) |
| **Indian** | South Fork Quinn River 1987 | No data | 24.4 | 59.0 | 23.4 |
| | East Fork Quinn River 1997 (1992) | No data | 25.6 | 65.6 (73.1) | 27.2 (21.0) |
| | Jakes Creek 1987 | No data | No data | 63.8 | 24.5 |
| **Granite Peak** | Mullinix Creek 2000 (1995 Survey) | 21.97 | 56.3 | 77.3 (72.7) | 23.9 (20.0) |
| | Indian Creek 2000 (1995 Survey) | 34.63 | 62.1 | 74.3(89.8) | 33.4 (4.4) |
| | South Fork Indian Creek 2000 (1995 Survey) | 21.84 | 73.9 | 91.3(91.0) | 33.4 (4.4) |
| | Willow Creek 1986 | No data | 32.0 | 58.9 | 32.3 |
| **West Side Flat Creek** | Flat Creek 2001 | 15.09 | No data | No data | No data |
| | South Fork Flat Creek 1997 | No data | 45.2 | 63.2 | 35.6 |
| | Three-Mile Creek 1997 | No data | 53.1 | 56.4 | 46.9 |
| **Buffalo/Rebel Creek** | Andorno Creek 2001 (1996 survey) | 16.00 | 77.0 (64.0) | 91.0 (79.5) | None (0.4) |
| | Buffalo Canyon 1986 | 28.8 | No data | 43.6 | 25.0 |
| | Falls Canyon 1998 (1986 survey) | 14.47 | 51.8 | 80.2 (54.0) | 16.1 (35.2) |
| | Horse Canyon 1986 | No data | No data | 43.4 | 31.6 |

*Notes:*
*[1]Data presented for each stream is from latest General Aquatic Wildlife System (GAWS) survey. Comparison data is in parenthesis from past years.*
*[2]Low flow-wetted width/depth ratio*
*[3]Optimum is considered 100 % density.*
*[4]Optimum is >80% of streambanks covered by vegetation in vigorous condition or by boulders and rubble.*
*[5]Optimum is considered 0%-25% bank damage from ungulate use (little or no bank erosion or sloughing).*

Many of the streams presented in Table 6-T have two sets of data; the values in the parentheses represent an earlier set of data. Because there are two data sets, some general trends about stream conditions can be observed. For most streams, the data show a general improvement of stream conditions between surveys. In the early 1990s, Andorno Creek, Falls Canyon, Buffalo Canyon, and Horse Canyon in Buffalo allotment shifted to a “rest rotation”, due to both changes in grazing permit holders and the implementation of Amendment 2 maximum allowable utilization levels, resulting in significantly better improvement than other allotments. However, the following streams appear to be on a general downward trend: North Fork of Cabin Creek, Round Corral, Siard Creek, Indian Creek, and South Fork of Indian Creek.

### WATER QUANTITY

Soil compaction and ground cover removal caused by livestock grazing, especially in riparian areas, have the potential to increase runoff into streams by reducing the amount of precipitation infiltrating into the ground. Instead of the precipitation being retained and slowly released by soil and vegetation, increased runoff creates peak stream flows with quicker response times and greater intensity. Less infiltration also decreases groundwater recharge and storage, resulting in lower base flows in streams and decreased groundwater supply to seeps/springs, wet meadows, and riparian areas. This decrease in water quantity would likely have a negative effect on aquatic life and the condition (or type) of vegetation in these areas.

There are currently no gauging stations within the project area watersheds for collecting long-term stream flow data that would show the effects of grazing on water quantity. However, because water quantity is related to soil conditions and the health of vegetation communities, the PFC results for riparian areas presented in Table 2 can be used to assess the impact to water quantity. It is not likely that water quantity has been impacted in streams determined to be functional. However, water quantity has likely been impacted in streams determined to be nonfunctional or functional-at risk. Given that most streams are nonfunctional or functional-at risk, it is likely that grazing has had a detrimental effect on water quantity in the project area. The magnitude of this effect is not known.

### WATER QUALITY

During the 2002 grazing season, water samples were collected from representative streams in the project area and analyzed for parameters that are typically affected by grazing activities. Twenty samples were analyzed in a laboratory for nitrate as nitrogen (EPA Method 300) and total phosphorous (EPA Method 365.3). Field water quality data were also collected at each sample location for temperature, pH, turbidity, and dissolved oxygen. Map 4-M displays water quality sample locations. The water quality data from the 2002-grazing season are presented in the Table 7-T.

The State of Nevada has identified Martin Creek, North Fork of the Little Humboldt River, and South Fork Quinn River as class A waters, which are held to the numerical standards in NAC 445A.124. In addition, the State of Nevada has established in NAC 445A.145 (the “Tributary Rule”) that waters without specified numerical standards that flow into a water with numerical standards must be held to the same numerical standards. Surface waters that dry up before reaching a water body with numerical standards, however, do not have numerical standards and must comply with the narrative standards in NAC 445A.121. The narrative standards consists mostly of statements requiring waters to be “free from” things such as, material that change existing turbidity, high temperature, organisms pathogenic to human beings, and substances toxic to human, animal, plant, or aquatic life. This means that human activities, such as livestock grazing, are not allowed to alter the natural water quality as specified in NAC 445A.121. It does not mean that numerical water quality measurements cannot be used to determine compliance with NAC 445A.121. Even though numerical standards are not specified for a given water body, it is appropriate to use numerical measurements of water quality to determine if natural conditions have been altered by human activities. For the surface waters listed in Table 7-T, class A standards apply to all with the exception of Canyon Creek, Three Mile Creek, and Upper Willow Creek, which have narrative standards.

The State of Nevada recognizes in NAC 445A.120 that natural water quality conditions may on occasion be outside the limits established by the standards. This might occur, for example, under drought conditions. The “non-compliance,” however, is only allowable if caused by nature. Human activities are not allowed to contribute to the problem.

Nitrate concentrations were very low, being below the laboratory reporting limit, for all samples. The total phosphorous concentrations were generally low (<10 mg/l) with a few exceptions. At sample location No. 1 on the South Fork Quinn River, total phosphorous was detected at 0.14 mg/l, which is slightly in excess of the 0.10 mg/l concentration allowable for Class A waters (total phosphorous standard was calculated as 1/3 of the 0.30 mg/l standard for phosphate in Class A waters). Siard Creek, a tributary to a class A water, also had one sample (location No. 16) slightly above the 0.10 mg/l limit. These data suggest that nutrient levels are generally low in the project area surface waters. This is consistant with what Amache and others (2004) found in the surface waters of central Nevada. They found that nutrient inputs were generally very low for surface waters on National Forest lands, but increased substantially as they flowed through private land with fenced grazing areas and irrigated fields.

For the Class “A” waters and their tributaries, field measurements for temperature, pH, and dissolved oxygen met State standards. With the exception of the slightly higher pH measurement on Willow Creek, the field

measurements for the non-class waters met the standards for class A waters. While higher than class A standards, the 8.57 pH reading for Willow Creek is actually within the EPA's national recommended water quality criteria for pH in freshwater (pH 6.5-9.0) (EPA, 2002). It is important to note that neither this EPA criteria nor the class A standards legally apply to the non-class waters that are not tributaries to a class A water. Because the non-class waters only have narrative standards (not numerical), the above comparisons to numerical standards and recommended criteria were only used to give a reference point for comparison. In this case, the comparison simply suggests that the non-class waters have water quality similar to what is expected in class A waters.

Class A waters have no numerical standards for turbidity. However, the EPA has identified 4.3 NTU as a reference condition for turbidity in sub-ecoregion 13 surface waters, which include the project area surface waters (EPA, 2000). The 4.3 NTU reference value does not represent an enforceable standard, but is useful as a means of comparison. With the exception of two turbidity readings slightly above 4.3 NTU, all other values were at or below the reference condition. This suggests that project area streams have an overall turbidity comparable to the reference condition, which is likely the ideal.

**Map 4-M: 2002 Water Sampling Locations**

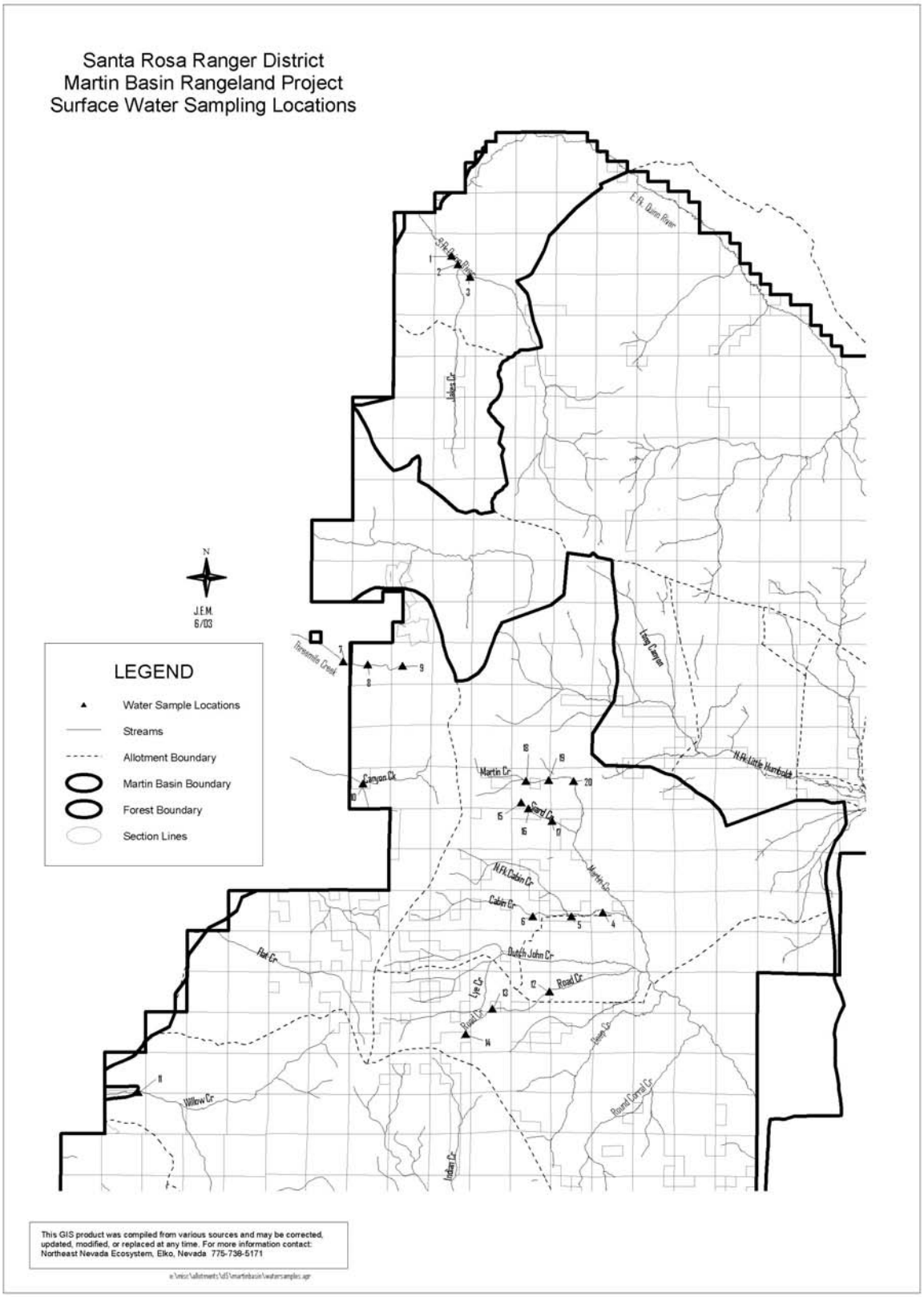


**Table 7-T: Water Quality Sampling Results**

| Water Quality – Streams | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Laboratory Data | | Field Data | | | |
| Sampling Location # | Surface Water Drainage | Nitrate (N) (mg/L) | Phosphorous (P) Total (mg/L) | Temperature (ºC) | pH | Turbidity (NTU) | Dissolved Oxygen (mg/L) |
| 1 | South Fork Quinn River | <0.5 | 0.14 | 10.6 | 8 | 0 | 10 |
| 2 | | <0.5 | 0.07 | 8.8 | 7.9 | 4 | 10 |
| 3 | | <0.5 | 0.06 | 9.1 | 8.2 | 1 | 8 |
| 4 | Cabin Creek | <0.5 | 0.05 | 10.6 | 8.3 | 2.67 | 7 |
| 5 | | <0.5 | <0.02 | 9.1 | 8.2 | 2.68 | 11 |
| 6 | | <0.5 | <0.02 | 9.1 | 8.1 | 3.95 | 10 |
| 7 | Three Mile Creek | <0.5 | 0.02 | 10.7 | 7.8 | 0 | 9 |
| 8 | | <0.5 | 0.02 | 10.7 | 7.9 | 0 | 9 |
| 9 | | <0.5 | 0.05 | 10.1 | 7.6 | 1 | 9 |
| 10 | Canyon Creek | <0.5 | 0.06 | 10.2 | 8.4 | 2.07 | 7 |
| 11 | Upper Willow Creek | <0.5 | 0.03 | 15.7 | 8.6 | 1.56 | 10 |
| 12 | Road Creek | <0.5 | 0.06 | 12.8 | 8.3 | 2.37 | 7 |
| 13 | | <0.5 | 0.03 | 9.9 | 8.2 | 4.66 | 6 |
| 14 | | <0.5 | 0.03 | 11.4 | 8.2 | 3.69 | 7 |
| 15 | Siard Creek | <0.5 | 0.1 | 13.4 | 7.9 | 5.43 | 9 |
| 16 | | <0.5 | 0.11 | 13.7 | 7.7 | 4.3 | 8 |
| 17 | | <0.5 | 0.07 | 11.7 | 7.3 | 3.22 | 9 |
| 18 | Martin Creek | <0.5 | 0.06 | 15.7 | 7.9 | 2.5 | 8 |
| 19 | | <0.5 | 0.04 | 15.4 | 7.7 | 1.49 | 7 |
| 20 | | <0.5 | 0.1 | 17.4 | 7.9 | 1.67 | 7 |

*Notes:*
*°C = Degrees Celsius*
*mg/L = Milligrams per lite*
*NA = Not applicable (No standard recommended)*
*NTU = Nephelometric Turbidity Units*

Forest Service personnel collected no fecal coliform samples during the 2002 grazing season due to the difficulty of meeting laboratory hold times for samples collected in the remote National Forest System lands. There is, however, a limited amount of fecal coliform data from the Nevada Division of Environmental Protection (NDEP) (Vargas 2003). Surface water samples were collected during the 2002 grazing season from one location each on Cabin Creek and the North Fork of the Little Humboldt River. The North Fork Little Humboldt sample had a fecal coliform concentration of 31 per 100 mL, which is in compliance with the Nevada standards for Class "A" waters. In comparison, much higher results were obtained in two samples (one a duplicate) from Cabin Creek, which had fecal coliform concentrations of >2005 per 100 mL. While these high fecal coliform concentrations are cause for concern, it would not be prudent to make broad assumptions about fecal coliform concentrations in the project area based on this limited quantity of data. More data are needed to properly assess the affects of grazing on fecal coliform concentrations throughout the project area.

Turbidity and sediment levels in streams are important indicators of grazing impacts on water quality because they correlate to the degree of soil disturbance leading to soil erosion. As discussed above, turbidity is generally low in project area surface streams. The turbidity results alone may make it appear like sedimentation is not a problem in project area streams; however, measurements of sediment (<4 mm size class) in spawning gravels and the embeddedness of stream substrate materials by fines indicate just the

opposite (Table 8-T). Most areas were found to have in excess of 30% sediment, and substrate was 30% or more embedded (stream average). Latest stream survey data show that three streams had 50% or more substrate embeddedness (< 25% is desirable). The apparent contradictory results are likely due to the fact that turbidity is the measurement of suspended particles, such as silt, clay, and organic matter; sediment data are generated by measuring the quantity of material that has settled onto the streambed. The turbidity data in Table 7-T were taken during base flow conditions. During periods of high flow, turbidity values are likely to increase as the substrate material is disturbed and additional sediment is washed into the stream.

**Table 8-T:**
**Substrate Condition-Fine Sediment Levels and Embeddedness for Surface Water Drainages in the Martin Basin Rangeland Project Area**

| Grazing Allotment | Stream Name | Spawning Gravel Sediment Level (< 4mm size) (%) (2002 surveys) | Substrate Embeddedness by Fines[2] |
|---|---|---|---|
| **Martin Basin, Bradshaw, and Buttermilk** | Martin Creek, 2001(1993 survey) | 31.1 | 38.2 (34.9) |
| | North Fork Little Humboldt River 1998 | No data | 47.8 |
| | Long Canyon Creek 1998 | No data | 38.2 |
| | Dutch John Creek | 23.4-Site 1 Up | 43.8 (2000 Survey) |
| | | 50.7-Site 1 Down | |
| | Cabin Creek 1998 (1993 survey) | 47.1 | 44.5 (44.0) |
| | North Fork Cabin Creek 1997 | 45.9 | 64.3 (46.0) |
| | Deep Creek 2000 | No data | 38.0 |
| | Lye Creek 2000 (1994 survey) | No data | 33.1(43.4) |
| | Round Corral 2000 | No data | 50.0 |
| | Siard Creek 2001 (1993 survey) | 40.02 | 38.3 (54.8) |
| | Road Creek 2000 | No data | 38.9 |
| **Indian** | South Fork Quinn River | No data | 30.0 |
| | Jakes Creek | No data | 51.5 |
| **Granite Peak** | Mullinix Creek 2000 | 54.11 | 31.6 |
| | Indian Creek 2000 (1995 survey) | No data | 33.1 (28.3) |
| | South Fork Indian Creek 2000 (1995 survey) | 48.43 | 37.2 (23.2) |
| | Willow Creek | No data | 27.2 |
| **Grazing Allotment** | **Stream Name** | **Spawning Gravel Sediment Level (< 4mm size) (%) (2002 surveys)** | **Substrate Embeddedness by Fines[2]** |
| **West Side Flat Creek** | Three-Mile Creek | 35.10 | 40.2 |
| **Buffalo/Rebel Creek** | Andorno Creek 2001 | No data | 37.6 |
| | Buffalo Canyon 1986 | 38.541 | 11.4 |
| | Falls Canyon | 50.631 | 35.5(20.8) |
| | Horse Canyon 1986 | No data | 15.6 |
| | Willow Creek 1986 | No data | 27.2 |

*Notes:*
*[1]Limited sample size, additional samples should be taken to get a complete analysis.*
*[2]Stream average.*

# SOIL QUALITY

## PROJECT AREA GEOLOGY AND PHYSIOGRAPHY:

The Martin Basin Project Area lies within the Santa Rosa Mountain Range and the Owyhee Desert Volcanic Plateau. The following is summarized from Geology and Mineral Deposits of Humboldt County (Willden, 1964).

The Santa Rosa Range contains Humboldt County's highest point (Granite Peak, at 9,732 feet) and nearly thirty miles of the main ridge stand above 8,000 feet, forming imposingly steep slopes as viewed from adjacent valleys. The higher parts of the range are glaciated to levels as low as 7,500 feet elevation. Most of the Santa Rosa Range is underlain by a very thick sequence of Upper Triassic to Jurassic shales and sandstones that were tightly folded and metamorphosed to phyllites and quartzites prior to late Cretaceous, or possibly early Tertiary time. A number of granitic stocks then intruded these formations. All of these basement rocks were deeply eroded by middle Tertiary time, and they were intruded and covered by a volcanic rocks consisting of andesites, basalts, dacites, and rhyolites. Later erosion removed the volcanic rocks from almost all of the main Santa Rosa Ridge, but the volcanic sequence still is exposed locally near the base of the range, and it closes completely over the granitic and metamorphic rocks north of Buckskin Mountain.

The Owyhee Desert Volcanic Plateau lies to the east of the Santa Rosa Range. The area is characterized by moderate to low relief except on the south border and near the deeply incised channels of Martin Creek and, to a much lesser extent, the North Fork of the Little Humboldt River and the East Fork of the Quinn River. Tertiary rocks mostly underlie the area. The Tertiary rocks are divided into four units:

- Dikes, plugs, and stocks and rhyolite porphyry, dacite, and diabase;
- Basalt and andesite flows;
- Rhyolitic to dacitic flows and welded tuffs; and
- Sedimentary rocks including shale, tuffaceous shale, sandstone, and diatomaceous shale.

## PROJECT AREA SOIL CHARACTERISTICS

Soil variability within the project area results from residual and transported parent geologic materials subsequently influenced by topography, climate, vegetation, and weathering rates.

Information on basic soil types in conjunction with potential natural vegetation communities was first published in 1986 and updated in 1991 (Humboldt National Forest, 1991). Baseline soil data were collected by reconnaissance-level surveys completed for the eastern part of Humboldt County by the National Cooperative Soil Survey in 1991-1992 (Denny, 2002).

Soil series are a group of soils, which have profiles that are almost alike, except for differences in texture of the surface layer. All the soils in a single series have horizons that are similar in composition, thickness, and arrangement. Two or more kinds of soil series or soil series and smaller miscellaneous inclusions large enough to be delineated at the scale of 1:24000 are combined into soil association mapping units used in the Soil Survey of Humboldt County. Map 5 –M in Appendix C is a simplified soils map showing the dominant soil series type for each soil association mapping unit. A dominant soil type is the soil series that comprises the largest area within a soil association mapping unit. Table 9-T in Appendix C presents a summary of selected properties for the soil series occurring in the project area based on the *Soil Survey of Humboldt County*.

The selected properties listed for each soil series are: approximate acres, soil class, predominant surface texture, predominant range site name, potential for compaction, potential for water erosion, potential for wind erosion, and soil loss tolerance. Specific map locations of a soil series or inclusion within a soil association cannot be determined within the association due to the order of accuracy used when the original Soil Survey of Humboldt County developed.

Well over half of the soils in the project area have a surface texture of gravelly to bouldery loam. The remainder is mostly loam and silt loam. Approximately 4% of the area is comprised of barren rock outcrop and rubble land.

Based on data from the Soil Survey of Humboldt County, predictions may be made for areas most sensitive to adverse soil impacts. Many of these acreages overlap and an area may be susceptible to more than one type of potential adverse soil impact.

Potential for compaction may be predicted from soil texture, permeability, drainage, and range site vegetation information. Well-drained soils with a low clay or silt content generally have a low compaction potential. Less well drained soils with higher clay or silt contents generally have a moderate compaction potential. Areas with riparian vegetation generally have a high compaction potential due to a permanent or seasonally elevated water table. Approximately 2,081 acres in riparian areas are expected to have a high potential for compaction. A moderate potential for compaction is predicted to occur on 133,633 acres of upland area.

Potential for water erosion on bare soil may be predicted by multiplying the Erosion Factor 'K' for sheet and rill erosion by the percent of the slope. Values from 0-4 are given a low erosion potential, values from 4-8 are given a moderate erosion potential, values from 8-12 are given a high erosion potential, and values from above 12 are given a very high erosion potential. A high potential for water erosion is predicted to occur on 84,976 acres.

Potential for wind erosion may be predicted based on the Wind Erodibility Group classification. The different groups indicate the susceptibility of soil to blowing. It is based on the assumption that the soil is bare, lacks a surface crust, or occurs in an unsheltered position. There is a close correlation between soil blowing and the size and durability of surface clods, rock fragments, organic matter and calcareous reaction. Pure sands are generally most susceptible to wind erosion by blowing. Susceptibility decreases as silt and clay content increase (U.S. Department of Agriculture, Natural Resources Conservation Service, 2002). A high potential for wind erosion is predicted to occur on 4,352 acres.

Soil loss tolerance may be predicted using the Erodibility 'T' Factor. It is an estimate of the maximum average rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year. The thinner the organic rich "A" horizon soil layer is, the more the vegetation productivity would be adversely affected by soil loss from erosion (Denny, 2002). Shallow soils, where soil loss through erosion at a rate exceeding one ton per acre per year by wind or water would adversely affect crop productivity over a sustained period, are predicted to occur on 60,524 acres. Newsprint is thicker than the soil lost in 1-2 tons per acre.

### HUMAN INFLUENCES

The history of use of the rangeland in the project area is similar to other comparable regions throughout the West: early settlement, rapid development of livestock industry, and influx of many nomadic grazing herds. These nomadic herds, lacking a base of operations, stayed on the ranges as long as weather permitted. This use coupled with the grazing herds of the local ranchers and settlers, together with game herds increasing under protection by law, modified much of the rangeland from its original condition prior to the establishment of the Santa Rosa Ranger District in 1911 (Robertson, 1971).

These initial events of inappropriate grazing and a long history of continued grazing likely had an adverse effect upon the soil resources. Generally, greater declines in soil quality and productivity are associated with greater intensities of grazing, roads, recreational use, mining, and fire (Reid, 1993).

Soil forming and soil recovery processes can be slow; therefore, disruption of soils can lead to long-term changes in ecological conditions, including biological and hydrologic processes. Areas with thick fertile topsoil are most likely to recover after a disturbance. In areas where much of the topsoil is lost, the site may no longer be able to support the historic vegetation (USDA, Natural Resources Conservation Service, 2001, Rangeland Sheet 1). Indicators of soil quality that may affect short and long term soil productivity include: compaction, livestock trampling, soil nutrient cycling, water erosion, and wind erosion.

The magnitude of the effects of grazing on soils or the degree of recovery that may have occurred has not been measured quantitatively in subsequent years. There is no historic quantitative soil quality monitoring data for the Martin Basin Project Area. Previous monitoring (Site Analysis Summary-Green Sheets) rated soil condition based on a combination of ground cover and soil movement. Although ground cover was generally evaluated using quantitative methods comparable to those currently used, soil movement evaluations appear to be qualitative and focused mainly on the presence or absence of erosion features (U.S. Department of

Agriculture, Forest Service, 1983). Thus, there is no well-defined benchmark for determining changes in soil quality associated with past livestock grazing in the project area.

### MEASURED CURRENT SOIL CONDITIONS

To provide more detail regarding soil types and quality in the Martin Basin Project Area, Humboldt-Toiyabe personnel conducted additional site-specific soil and vegetation sampling from 1995-2002. The purpose of this monitoring was to document baseline soil and vegetation conditions for riparian areas. These sites occur mostly on the wet meadow and dry to moist meadow vegetative groups. Map 6-M shows the locations of these “eco-plot” sites. Table 10-T presents a summary of selected site-specific soil properties for the twenty-two additional samples.

**Map 6-M: Monitoring Locations**

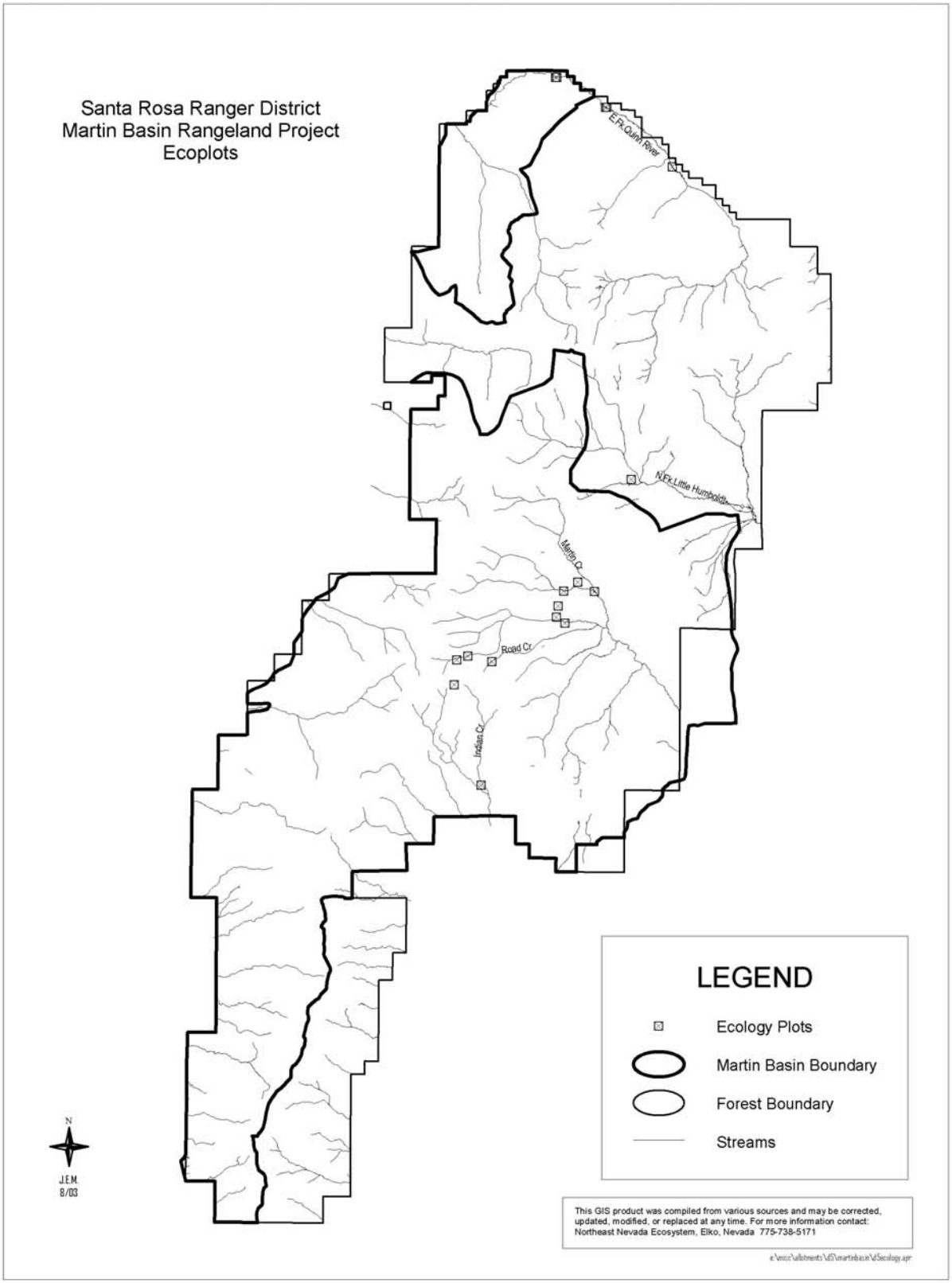


**Table 10-T: Soil Pit Summary ("eco-plots")**

| Plot Number | Area Location | Allotment Name | Depth-to-Saturation | Rangeland Type | Topsoil Texture | Depth of "A" Horizon (cm) | Rooting depth (cm)* | Bare ground (% Area)* | Soil Surface Horizon Structure* | Soil Structure in Root Zone* |
|---|---|---|---|---|---|---|---|---|---|---|
| **21963** | Spring City | Buttermilk | 150 | Dry meadow | silt loam | 12 | 4 | 38 | medium granular | Extremely coarse platy |
| **21964** | NF Cabin Creek | Martin Basin | 150 | Dry meadow | silt loam | 42 | 14 | 22 | thin platy | Coarse angular blocky |
| **21965** | Bradshaw Creek | Bradshaw | 69 | Wet meadow | silt loam-sandy clay loam | 100+ | 17 | 26 | thin platy | Coarse angular blocky |
| **21971** | Granite Peak | Granite Peak | 84 | Moist meadow | silt loam-loam | 100+ | 14 | 31 | medium granular | Medium platy |
| **22983** | Falls Creek | Buffalo | 150 | Cotton-wood | sandy loam | 63 | 8 | 2 | fine granular | Coarse granular |
| **22985** | Granite Peak | West Side Flat Creek | 49 | Cotton-wood | silty clay loam | 34 | 9 | 1 | fine granular | Sub-angular blocky |
| **22986** | Solid Silver Creek | Granite Peak | 150 | Moist meadow | silt loam | 50 | 6 | 1 | fine granular | Granular |
| **95800** | Cabin Creek 1A | Martin Basin | 39 | Dry meadow | silt loam | 29 | 13 | 17 | fine granular | Fine sub-angular blocky |
| **95801** | Cabin Creek 1B | Martin Basin | 36 | Wet meadow | loam | 21 | 13 | n/a | fine granular | Coarse blocky |
| **95802** | Cabin Creek 2 | Martin Basin | 51 | Wet meadow | loam-fine sandy loam | 9 | 9 | 20 | fine granular | Medium sub-angular blocky |
| **95803** | Bradshaw Field | Bradshaw | 25 | Wet meadow | silt loam | 54 | 18 | 10 | medium granular | Coarse Platy |
| **95804** | Lye Creek 2 | Buttermilk | 150 | Dry meadow | loam | 36 | 10 | 7 | fine granular | Medium sub-angular blocky |
| **95805** | Lye Creek 2 | Buttermilk | 150 | Dry meadow | loam | 22 | 13 | 4 | fine granular | Coarse sub-angular blocky |
| **95806** | Dutch John 1A | Bradshaw | 150 | Dry meadow | very fine sandy loam-loam | 22 | 5 | 76 | fine granular | Coarse sub-angular blocky |
| **95807** | Dutch John 1B | Bradshaw | 90 | Wet meadow | silt loam-loam | 28 | 28 | 4 | fine granular | Medium sub-angular blocky |
| **95808** | Dutch John 1C | Bradshaw | 40 | Wet meadow | very fine sandy loam-loam | 28 | 28 | 21 | medium granular | Fine sub-angular blocky |
| **95809** | Dutch John 1D | Bradshaw | 60 | Moist meadow | fine sandy loam-loam | 16 | 16 | 1 | fine granular | Fine granular |
| **95810** | Road Creek 1 | Buttermilk | 102 | Dry meadow | silt loam | 20 | 6 | 1 | fine granular | Coarse sub-angular blocky |
| **95814** | Martin Creek 1 | Martin Basin | 34 | Wet meadow | fine sandy loam-loam | 6 | 6 | 23 | fine granular | Medium platy |
| **95815** | Indian Creek 1 | Granite Peak | 76 | Moist meadow | sandy loam | 9 | 22 | 1 | fine granular | Medium sub-angular blocky |
| **99935** | Devil's Gate 1 | Indian | 160 | Dry meadow | loam | 27 | 8 | 2 | very fine platy | Medium platy |
| **99936** | Devil's Gate 2 | Indian | 150 | Dry meadow | loam-fine sandy loam | 48 | 5 | 0 | coarse blocky | Medium angular blocky |

*Notes:*
** = Soil Criteria from Matrices for Functioning Condition*
*NF = North Fork*

Quantitative and qualitative factors for soil condition, along with parameters for vegetation, hydrology, and disturbance have been combined into matrices for eight representative vegetative groups that occur in the project area. The categories of vegetative groups are: wet meadow group, stream/riparian corridor, dry to moist meadow group, cottonwood group, Wyoming big sagebrush group, mountain big sagebrush group, aspen group, and mountain brush group. These eight groups are simplified from the range site descriptions for potential vegetation communities present in the project area (Humboldt National Forest, 1991) and from the site-specific soil and vegetation sampling conducted by Humboldt-Toiyabe personnel from 1995-2002.

With the matrices, a vegetative group may be quickly evaluated to see if it is:

- Functioning as desired,
- Does not meet desired function, or
- Crosses below a threshold.

"Functions as desired" describes what a vegetative group should look like as management direction is implemented. "Does not meet desired function" indicates that the site has management problems that may be corrected to bring the site back to a "functions as desired" condition. "Crosses below a threshold" indicates that the site has crossed an ecological threshold and is not easily restorable to a "functions as desired" ecological condition.

Applying the soil parameters from the matrices to the 22 riparian sample sites suggests that soil health is impaired for at least one parameter on every site except 95809. At approximately one third of the sites, none of the soil criteria appears to be functioning as desired. At all but seven of the sites, the majority of the soil parameters suggest that they do not meet desired function. These statements of soil function apply to these sites at the time the monitoring was done and may not reflect present conditions on sites where the allotment is currently vacant. It is likely that historic and current grazing practices, perhaps combined with the effects of drought have contributed to impaired soil health. Soil condition alone is not used to classify a site as functioning as desired. The combination of soils, vegetation, hydrology, and disturbance parameters from the matrices are used to classify a site.

### ESTIMATED CURRENT SOIL CONDITIONS

Erosion and runoff estimates that incorporate vegetation, soil type, slope, and local climate are available using the Water Erosion Prediction Project technology (WEPP, 2001). Likely erosion, sediment transport, and rainfall runoff were modeled for the eight vegetative groups using matrix vegetation and ground cover criteria for the three functioning conditions. Constants used in the model were: Orovada, Nevada climate, 100-foot slope length, and a 50-year simulation. Results indicate that the likelihood of runoff and sedimentation increase as vegetation and ground cover decrease. Sedimentation rates may approach 1 ton per acre for silt loam soils on steep slope short grass and sagebrush sites that are in a crosses below threshold condition. Sedimentation rates for riparian sites that are in a "Crosses Below Threshold" condition may approach 0.16 ton per acre. The remainder of the vegetative groups may yield from 0.00 tons per acre when functioning as desired up to 0.07 tons per acre when in a crosses below threshold condition.

# FISHERIES

The project area supports the federally listed as threatened Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*), an inland subspecies of cutthroat trout endemic to the Lahontan basin of northern Nevada, eastern California, and southern Oregon. Other fish species present in the watershed include: rainbow trout (*Oncorhynchus mykiss*), brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta*), hybrid trout (rainbow x cutthroat), Lahontan redside shiner (*Richardsonius egregious*), and Lahontan speckled dace (*Rhinichthys osculus robustus*). The *Forest Plan* directs that habitat for identified MIS be maintained at levels that exceed requirements for minimum viable populations. Lahontan cutthroat trout and other desirable trout species are considered to be MIS (*Forest Plan*, Table II-5, pp. II-10 and Amendment #2).

Lahontan cutthroat trout (LCT) were listed by the U.S. Fish and Wildlife Service (USFWS) as “endangered” in 1970 (Federal Register Vol. 35, p. 13520) and then reclassified as “threatened” in 1975 to facilitate management and allow angling (Federal Register Vol. 40, p. 29864). The Martin Basin Rangeland Project is located within the range of the LCT Northwestern Lahontan Basin Distinct Population Segment (DPS) and the Humboldt River Basin DPS as defined by the USFWS. Interagency teams have been developed for both DPSs to implement actions and conduct research necessary for LCT recovery.

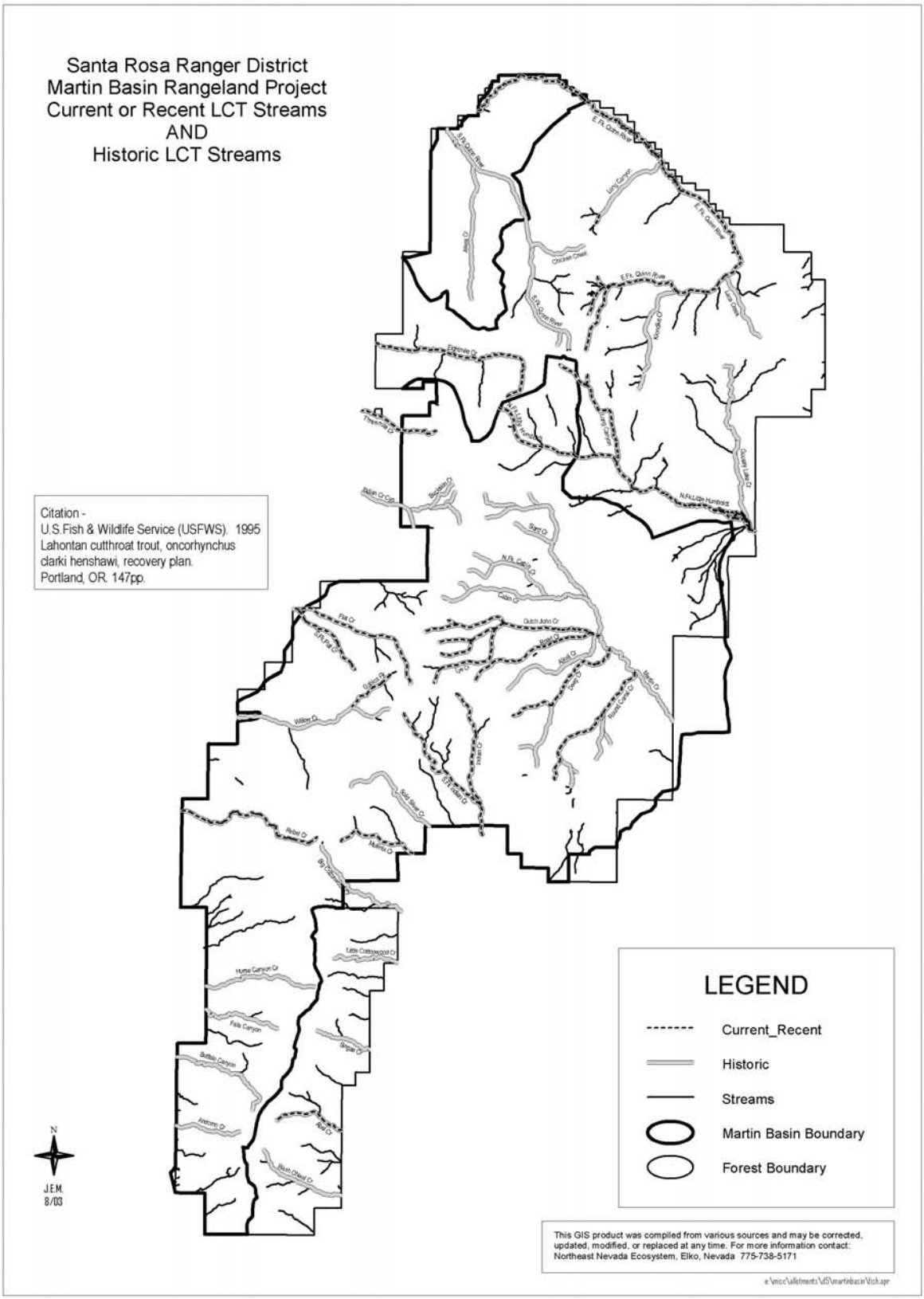
LCT inhabit both lakes and streams, but spawn in freshwater streams. Optimum LCT habitat is characterized by well-vegetated, stable stream banks; stream bottoms with relatively silt-free gravel/rubble substrate; cool water; and pools in close proximity to cover and velocity breaks (USFWS 1995). LCT generally spawn from April through July, depending upon stream flow, elevation, and water temperature (Calhoun 1943, La Rivers 1962, McAfee 1966, Lea 1968, Moyle 1976 in USFWS 1995). Eggs are deposited in ¼-½ inch gravel, and spawning beds must be well oxygenated and fairly silt-free for good egg survival. Fry would remain in shallow shore areas with hiding cover.

Historic habitat for LCT included much of northern, central, and western Nevada, eastern California, and southeastern Oregon. Principal threats to LCT include: habitat loss associated with land management practices; reduction and alteration of stream discharge; alteration of stream channels and morphology; degradation of water quality; and hybridization or competition with non-native fish species (USFWS 1995). Other threats within the Martin Basin Project area are fire and drought.

Stream habitat surveys have been conducted throughout the project area from 1986 to the present by the Nevada Department of Wildlife (NDOW). These surveys were performed according to Forest Service General Aquatic Wildlife System (GAWS), Level III procedures. Spawning gravel sediment samples were collected in 2002, according to the procedures described by Grost, et. al. 1991. Fish population data has also been collected extensively throughout the entire area, beginning in the 1950s. There has been a documented loss of LCT presence from their historical range (Map 7-M). This loss can be attributed to the principal threats listed above as well as fire and drought.

For this analysis, the fisheries affected environment has been divided into major watershed areas: Martin Basin Area (includes Martin Basin, Bradshaw, and Buttermilk Allotments), Rebel Creek/Buffalo, Granite Peak, Westside Flat Creek, and Indian allotments.

**Map 7-M: Lahontan Cutthroat Trout (LCT) Streams**



## HUMBOLDT RIVER BASIN DISTINCT POPULATION SEGMENT (DPS)

### Martin Basin Area

The Martin Basin Area is an important potential metapopulation site for the recovery of LCT. Major streams within the Martin Basin Area include: Martin Creek and its major tributaries (Dutch John, Cabin, North Fork Cabin, Deep, Lye, Round Corral, Road, and Siard Creeks), and the headwaters of North Fork Little Humboldt River (NFLHR) and one of its tributaries, Long Canyon. Martin Creek originates from the east side of Buckskin Mountain, at an elevation of near 2,439 meters (8,000 feet). Water flow for the stream and main tributaries is mainly from springs and snowmelt. NFLHR has its inception at an elevation of 2,219 meters (7,280 feet) from the east side of Buckskin Mountain.

Some stream and riparian habitat conditions within the Martin Basin Area (and throughout the entire project area) have improved since the implementation of Amendment #2 of the *Forest Plan* in 1992 (Table 11-T). Data presented in Table 11-T is a calculated average for each parameter over the entire stream. Many areas of localized habitat problems have been observed in recent Proper Functioning Condition assessments and sediment surveys, as well as during GAWS surveys. Problems included unstable streambanks and erosion, lack of riparian vegetation regeneration, upland vegetation encroachment, and stream headcuts.

Of particular concern in the Martin Basin area is the high percentage of fine sediment (< 4mm size class) found in the spawning gravels and the level of substrate embeddedness (Table 8-T in the Water Quality section). Many areas were found to have in excess of 30% fine sediment, and substrate was 30% or more embedded (stream average). Latest stream survey data showed many areas where substrate was 30% or more embedded by fine sediment. Land management activities that increase sediment levels in streams are known to reduce the productive potential and threaten the viability of fish populations (Thurow and Burns 1993). Specifically, high sediment levels in streams are known to negatively impact salmonid reproduction and incubation of embryos (Thurow and King 1991). During 2002 surveys, Martin Creek was found to have moderate to heavy ungulate damage, including high sediment levels at 31.1% (Table 8-T in the Water Quality section).

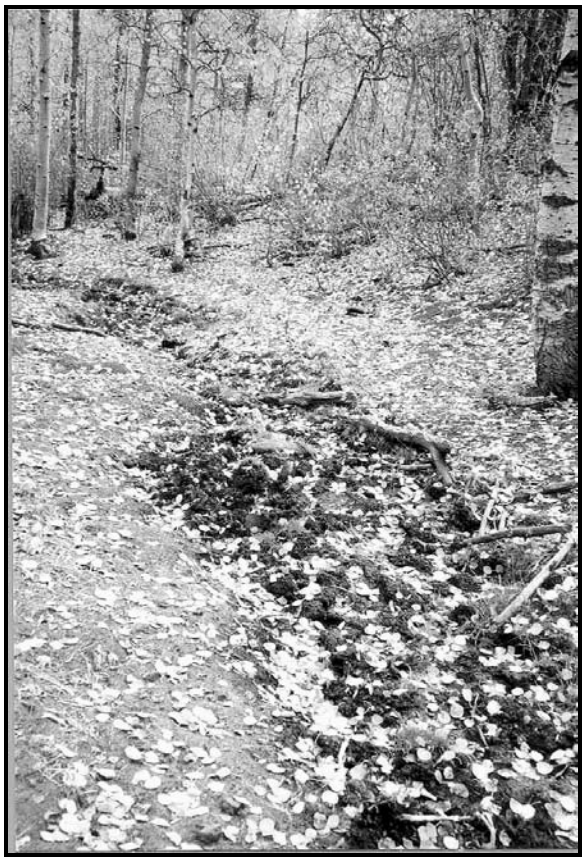
Stream and riparian habitat parameters have declined overall on the North Fork (NF) Cabin Creek. North Fork Cabin Creek is considered a potential recovery stream for LCT within the Martin Creek watershed and was historically occupied by LCT (USFWS 1995). Bank vegetation and soil stability was 55.7 and 49.8% respectively during the 1997 survey. Ungulate damage was recorded at 53.1 percent. During surveys in 2002, conditions were noted as being in a continued downward trend, similar to 1997. Sagebrush was encroaching on the stream in areas, indicating a lowering water table and willows had classic “mushroom” shape from over use. Sediment samples taken in 2002 found sediment levels to be 45.9% (< 4mm size) (Table 8-T).

**Photograph 3-P:**

Headwater area above road crossing. North Fork Cabin Creek. October 10, 2002.

**Photograph 4-P:**

Hummocked soils from recent ungulate damage. North Fork Cabin Creek Headwaters. October 10, 2002.



Siard Creek was surveyed in 2001 and found to be below optimum condition. Bank vegetation and soil stability showed declines since the 1993 survey and were measured in 2001 at 67.9% and 53.9% respectively. The Forest conducted a Proper Functioning Condition assessment on Siard Creek in September 2002, which resulted in a rating of "Nonfunctional." Observations at the time of the assessment noted the area in poor condition, with heavy livestock damage including: bank shearing, lack of willow regeneration, sediment levels at 40%, and streamside willows heavily used with "mushroom" shape.

The NFLHR, surveyed in 1998, also had localized problem areas that included heavy embeddedness recorded at several stations in the lower end of the system (between 50-60%). Overall embeddedness was averaged at 47.8%, indicating high sediment levels in the system. Of special concern within the NFLHR watershed is poor water quality associated with the Buckskin Mine. At Station 972, downstream of the Buckskin Mine tailings, pH was measured at 3.0 and sulfate levels were 80.0 mg/l. No fish or aquatic invertebrates were present until two (2) miles downstream of the area.