

AN APPLICATION OF BLM'S RIPARIAN INVENTORY PROCEDURE TO RANGELAND RIPARIAN RESOURCES IN THE KERN AND KAWEAH RIVER WATERSHEDS¹

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Abstract: The Bakersfield District of the Bureau of Land Management conducted an inventory of rangeland riparian systems using a new method developed by a Bureau-wide task force to inventory, monitor and classify riparian areas. Data on vegetation composition were collected for 65 miles of streams and entered into a hierarchical vegetation classification system. Ratings of hydrologic function, vegetative structure, and vegetative use by grazing animals were employed to measure impacts by land uses and potential for recovery with proper management. The data for each of 116 stream reaches was entered into a dBase III program for tabular analyses and will be entered into the Geographic Information System (GIS) for spatial analysis and cartographic output.

In 1987, the Bakersfield District of the Bureau of Land Management (BLM) inventoried 65 stream miles of rangeland riparian habitats in the Kern and Kaweah River watersheds. This inventory employed state-of-the-art methods developed by the Bureau's Riparian Area Management Field Task Force. These methods (U.S. Dept. Interior 1987a) include procedures for extensive and intensive inventories, monitoring, and vegetation classification of riparian areas. To adapt the procedure to this specific area, we used these methods as a broad guideline, and included some modifications from the work of Platts and others (1987). We found this combination of methods effective in describing, quantifying and classifying riparian ecosystems under the Bureau's management. In contrast to efforts in 1982 that centered on wildlife and water resource data needed for a grazing Environmental Impact Statement, this effort included information on vegetative structure, composition, stream morphology, and apparent trend.

This work provides an overview of the structure and condition of the riparian systems in the Kern and Kaweah River Watersheds in central California. The inventory has been used to select sites for more intensive monitoring.

Field Procedure

The first step was to examine thoroughly the results of earlier inventories. Then we developed a form to record data (fig. 1). The form includes selected parameters that had been sampled in the earlier inventories and could be resurveyed to estimate trend in conditions. In addition, it includes a combination of parameters suggested by the Bureau's Riparian Area Management Task Force (U.S. Dept. Interior 1987 a and b), Platts and others (1987).

All perennial streams on public lands in the Kern and Kaweah River watersheds were inventoried. In the field, the inventory crew stratified each stream into reaches. Homogeneous reaches contained similar vegetation composition, channel morphology, degree of impact from grazing, or other management influences. A separate reach was established when any significant change in one of these three factors occurred. Most streams had several reaches since few were homogeneous enough to be considered one reach. Each reach was then marked on 7.5' scale topographic maps and on 1:24,000 scale color aerial photographs. The form in figure 1 was completed for each reach. It provided data on physical features, a riparian site function rating, and a vegetation classification for each reach.

Physical Features

The form records data on physical features such as landform, soil characteristics, channel substrate, channel and side slope gradient, and morphological processes. These data are used in conjunction with aerial photographs and topographic maps to generally describe the stream's character and physical constraints, and to indicate its potential for improvement in condition.

The interaction between these physical features and the vegetation, animal and land use practices at a site creates complex ecosystems capable of frequent changes in conditions. Collecting this information for stratified stream reaches aids in subdividing the streams into more manageable units and identifying those critical reaches in need of special management considerations or rehabilitation.

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Stream: Chimney Creek #3 Date: 8/4/87 Observer: McNeill-Nelson

Reach: 1 Legal Location: T24S, R36E Sec 24

Watershed: Chimney Ck Flow Duration: Intermittent Perennial

BLM Stream Miles: .76 Stream Order: 3rd Landform: Broad Valley

Upstream Elevation: 5560 ft. Downstream Elevation: 5400 ft.

Streambank Soil Texture: Sandy Bank Rock Fragments:
Gravel Cobble Stones Boulders

Substrate: Sand Silt Muck Gravel Rubble Boulder Bedrock

Soil Wetness: Wet Drained Riparian Width 15-25 ft

Channel Gradient: 4 % Sideslope Gradient: R gentle L gentle

Channel Sinuosity: Straight Winding Meandering

Channel Confinement: Occasionally Frequently Confined Entrenched

Channel Entrenchment: Aggrading Equilibrium Partly Entrenched Incised

Lateral Movement: None Avulsion Progression Channel Width: 3-4'

Streamflow: .094/42 cfs/gpm Water Width 18"

Water Source: Transport Inchannel Seeps Lateral Seeps Water Temp. 15°C

Manmade Alterations: (list & map) Dirt road & PCT cross creek. Old pipes
near large cottonwood tree.

Erosion Processes: Headcutting Gullying Sheet Erosion Bank Collapse
Livestock Trampling

Apparent Water Quality Impacts: Fecal Algae Growth Minerals
Suspended Sediments Trash Mining Wastes

Soil Alteration Rating: 3 Vegetative Bank Protection: 2

Subsurface Water Status: 3 Riparian Site Function Rating: 2.66-Good

Vegetation Classification: Formation: Riparian Scrub

Climatic Zone: Cold temperate Biome: Sierran-Cascade Riparian Scrub

Series: Salix spp. Association: Salix/Eleocharis

Phase: Tree Canopy Cover: Forest (+61%) Woodland (20-60%)

Species: 1 Populus Only

Shrub Canopy Cover: Solid Clumped Sparse

Species: Salix spp.

Herbaceous Cover: 0-25% 26-50% 51-75% +76%

Species: Eleocharis-Melilotus-Juncus

Ungrazed _____ Grazed X 0-25% 26-50% 51-75% 76-100%

Age Distribution of Woody Dominants : Young even-aged stand
All-aged stand Old even-aged stand Decadent

Improvement Potential: Moderate-restricted cattle use; instream structures in lower
half to stabilize channel.

COMMENTS: Photo #1-15-11 with overlay; Lamont Peak 15' Quad. (Comments
continued on reverse)

Figure 1 — Extensive stream riparian inventory field form

Riparian Site Function Rating

The Riparian Site Function Rating (U.S. Dept. Interior 1987a) just below the center of figure 1, was the average of three ratings assigned for each reach. The three ratings, the Streambank Soil Alteration Rating, the Vegetative Bank Protection Rating, and the Subsurface Water Status Rating, evaluate interdependent factors that influence hydrologic function of the riparian site. The ratings range from "4" for excellent conditions to "1" for poor conditions.

The Streambank Soil Alteration Rating (Platts and others 1983) assesses the extent of bank modification and instability caused by natural forces, livestock grazing, and other land uses (table 1). Streambank ratings are based on how far they deviate from the optimum conditions that would exist in an undisturbed state.

The Vegetative Bank Protection Rating (Pfankuch 1975) was developed in recognition of the important role vegetative cover and root mats play in stabilizing streambank (table 2). In turn, stable streambanks support a greater density and variety of riparian vegetation. The vegetation protects banks from erosive forces by reducing the velocity of flood flows.

Table 1 - Streambank Soil Alteration Rating (Platts and others 1983)

| Rating Value | Percent | Description |
|--------------|-----------|--|
| 4 | 0 | Streambanks are stable and are not being altered by water flows or animals. |
| | 1 to 25 | Streambanks are stable, but are being lightly altered along the transect line. Less than 25 percent of the streambank is receiving any kind of stress, and if stress is being received, it is very light. Less than 25 percent of the streambank is false, broken down, or eroding. |
| 3 | 26 to 50 | Streambanks are receiving only moderate alteration along the transect line. At least 50 percent of the streambank is in a natural stable condition. Less than 50 percent of the streambank is false, broken down, or eroding. False banks are rated as altered. Alteration is rated as natural, artificial, or a combination of the two. |
| 2 | 51 to 75 | Streambanks have received major alteration along the transect line. Less than 50 percent of the streambank is in a stable condition. Over 50 percent of the streambank is false, broken down, or eroding. A false bank that may have gained some stability and cover is still rated as altered. Alteration is rated as natural, artificial, or a combination of the two. |
| 1 | 76 to 100 | Streambanks along the transect lines are severely altered. Less than 25 percent of the streambank is in a stable condition. Over 75 percent of the streambank is false, broken down, or eroding. A past damaged bank, now classified as a false bank, that has gained some stability and cover is still rated as altered. Alteration is rated as natural, artificial, or a combination of the two. |

The Subsurface Water Status Rating uses the presence of hydrophytic plant species as an indicator of whether a shallow aquifer exists (table 3). When lateral erosion or channel incision occurs, the recharging of the aquifer is impaired. The water table in the riparian aquifer is lowered, and hydrophytic species begin to decline and are replaced by upland species.

Table 2 - Vegetative Bank Protection Rating (Pfankuch 1975)

| Rating Value | Description |
|--------------|---|
| 4 | Excellent: Trees, shrubs, grass, and forbs combined cover more than 90 percent of the ground. Openings in this nearly completed cover are small and evenly dispersed. A variety of species and age classes are represented. Growth is vigorous and reproduction of species in both the under and overstory is proceeding at a rate to insure continued ground cover conditions. A deep, dense root mat is inferred. |
| 3 | Good: Plants cover 70 to 90 percent of the ground. Shrub species are more prevalent than trees. Openings in the tree canopy are larger than the space resulting from the loss of a single mature individual. While the growth vigor is generally good for all species, advanced reproduction may be sparse or lacking entirely. A deep root mat is not continuous and more serious erosive incursions are possible in the openings. |
| 2 | Fair: Plant cover ranges from 50 to 70 percent. Lack of vigor is evident in some individuals and/or species. Seedling reproduction is nil. This condition ranked fair, based mostly on the percent of the area not covered by vegetation with a deep root mat potential and less on the kind of plants that make up the overstory. |
| 1 | Poor: Less than 50 percent of the ground is covered. Trees are essentially absent. Shrubs largely exist in scattered clumps. Growth and reproduction vigor are generally poor. Root mats are discontinuous and shallow. |

Table 3 - Subsurface Water Status Rating (U.S. Dept. Interior 1987a)

| Rating Value | Description |
|--------------|---|
| 4 | Riparian site vegetation composition dominated by hydrophytic plants; reproduction evident. Little or no encroachment of upland plants (plants intolerant to prolonged saturated soil). Upland plants limited largely to the riparian/upland interface. |
| 3 | Riparian site vegetation composition dominated by hydrophytic plants. Some evidence of hydrophytic species decline and corresponding increase in upland plants, with upland species advancing from the riparian/upland interface. |
| 2 | Riparian site vegetation composition is a roughly equal mix of hydrophytic and upland plant species. Upland species reproducing; little or no reproduction of hydrophytes. Water stress may be apparent in hydrophytic plants. |
| 1 | Riparian site vegetation composition dominated by upland species, with some extending to stream channel edge. Hydrophytic species mostly scattered clumps. In extreme cases, hydrophytic species may be totally lacking. Former aquifer presence may be indicated only by isolated hydrophytic remnants such as <i>Salix</i> stumps, etc. |

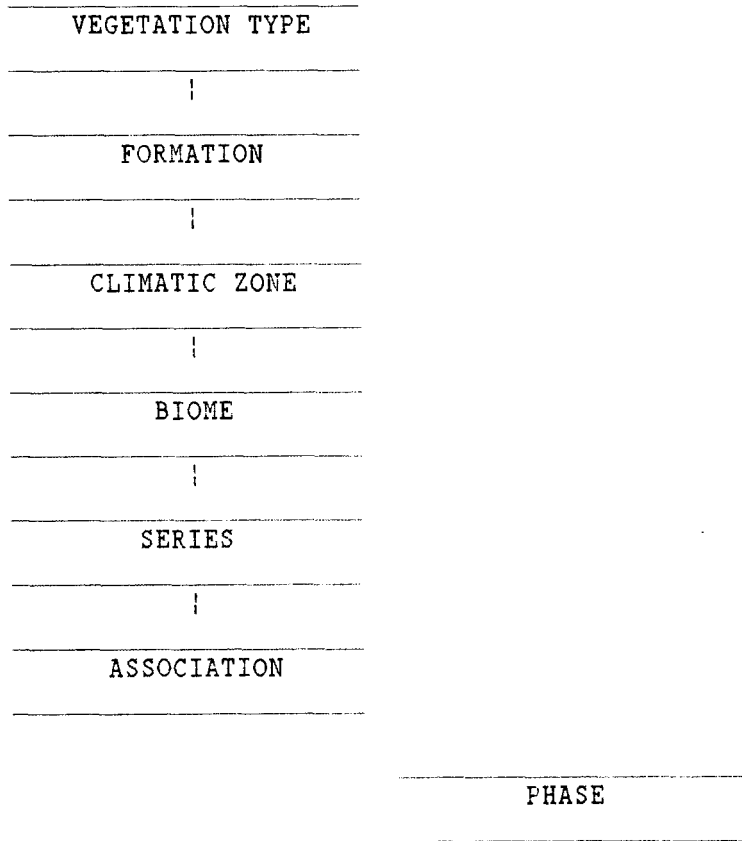


Figure 2 - Structure of the Vegetation Classification System (U.S. Dept. Interior 1987b)

The three ratings are summed and divided by three to obtain the mean. This value can be used to rank stream reaches by riparian site function. The reaches can be assigned a descriptive term for riparian site function using Table 4.

Table 4 - Riparian Site Function Rating

| Mean Rating Score | Rating |
|-------------------|-----------|
| 4 | Excellent |
| 3-3.9 | Good |
| 2-2.9 | Fair |
| 1-1.9 | Poor |

Vegetation Classification

A system for classifying vegetation was adopted by the Bureau's Riparian Area Management Field Task Force (U.S. Dept. Interior 1987b). A vegetation classification system permits the user to group similar biotic conditions and to establish and quantify the types of habitats present. Classifying vegetation also aids when extrapolating the results of studies to other

similarly classified locations. The approach used by the Bureau's task force was adapted from the work of Brown and others (1979, 1980) and from Paysen and others (1982).

The vegetation classification data appears on the lower one-third of the form (fig. 1). The system is hierarchical such that larger, more broadly defined units are split into smaller units as one progresses down the system (fig. 2).

The highest level of classification is the Vegetation Type. The two wildland vegetation types are "upland" and "wetland." Obviously all of the inventoried streams fall under the Wetland Type, so "Vegetation Type" was not listed as an entry on figure 1.

The Vegetation Type is followed by the Formation. Of the six choices defined in the Bureau's system, most of our streams fell in the "Riparian Forest" or "Riparian Scrub" Formations.

The Formation is followed by selection of one of four Climatic Zones. The inventoried streams fell into the "Warm temperate" or the "Cold temperate" Climatic Zones.

Biomes are defined as natural communities characterized by a distinctive vegetation physiognomy and climatic regime within a formation (Brown and others 1979). Commonly identified Biomes were the "California Riparian Deciduous Forest and Woodland," "Sierran-Cascade Riparian Deciduous Forest," "California Deciduous Riparian Scrub," and "Sierran-Cascade Riparian Scrub."

The Biomes are followed by classification into a Series. The Series and the remaining levels of classification are based on the system of Paysen et. al. (1982). The Series is defined by the dominant species or set of species in the overstory. Dominance is determined by aerial crown cover. Examples are "Salix Series" and "Populus Series."

The Association is the lowest level in the classification system and is defined as the dominant species or set of species in both the overstory layer and in subordinate layers. An example would be "Salix/Eleocharis Association". Similar Associations are aggregated into a Series, similar Series into a Biome, and so on.

The category Phase is used to add further information into the classification system, primarily as a means of improving its utility for specific management applications. Phase is offset here to show that it is independent of classification level and can be used anywhere in the hierarchy. We gathered the following data under the Phase: Tree Canopy Cover, Shrub Canopy Cover, Herbaceous Cover, Grazed or Ungrazed, Percent Vegetative Use by Animals (Platts and others 1987) and Age Distribution of Woody Dominants.

Mapping

Each reach was mapped on topographic maps (7.5') and on 1:100,000 scale land status maps. Mapping of reaches by vegetation classification or by other parameters allows the manager to view the spatial relationship between habitat types or areas of impact. An overlay was prepared for 1:24,000 scale color aerial photographs allowing the user to pinpoint areas of interest. Reaches were identified on the overlay along with other important information such as highly impacted areas and areas of erosion. Color slides were taken of each stream reach, and additional photographs were taken of impacted areas.

The data can also be used in the Bureau's Geographic Information System (GIS). Each stream is assigned a reach number and is digitized at 1:24,000 scale from the USGS topographic maps and aerial photographs. The GIS can then be used to integrate the riparian inventory information with other map themes such as grazing allotments, upland vegetation, range improvements, big game seasonal ranges, roads, etc. In addition, computer

plots can be generated to display the spatial distribution of stream reaches by vegetative classification, riparian site function rating, or other parameter. The total miles of stream for any parameter can also be calculated by GIS.

Results and Discussion

The 65 miles of inventoried streams were broken into 116 stream reaches that are fairly homogeneous in terms of vegetation composition, channel morphology and degree of impact from livestock grazing. For each of these reaches we collected baseline data on physical features, a classification of vegetation that includes general composition, structure and impacts, and a rating of hydrologic function in the riparian site function rating.

The data was entered into a dBase III program that has been used to group reaches with similar conditions. Reaches can be grouped according to watershed, vegetation use by animals, erosion or water quality conditions, or by any other inventoried parameter that has been entered into the program. Table 5 lists stream reaches that are in three watersheds. The reaches in these watersheds can then be arrayed with any combination of input parameters. In this example, we also asked for the Riparian Site Function Rating (RSFRATING), whether it was grazed and the amount of vegetation use by animals (GRAZEPHASE), the Streambank Soil Alteration Rating (SSARATING) and the Vegetative Bank Protection Rating (VBPROTECT).

This type of data analysis has aided in drawing conclusions and making recommendations. We have ranked the reaches by the riparian site function rating. For those with good or excellent ratings, we have developed objectives to maintain these conditions and have not proposed detailed monitoring. For those reaches with a fair to poor rating we have developed specific objectives for improvement and an intensive monitoring procedure that is being conducted at several of these sites.

| STREAM | WATERSHED | RSFRATING ¹ | GRAZEPHASE ² | SSARATING ³ | VBPROTECT ⁴ |
|-----------------------------|---------------|------------------------|-------------------------|------------------------|------------------------|
| Caliente Ck. | Caliente Ck. | 2.0/Fair | G/Extreme | Severe | Poor |
| Caliente Ck. | Caliente Ck. | 2.3/Fair | G/Extreme | Severe | Good |
| Caliente Ck. | Caliente Ck. | 1.3/Poor | G/Extreme | Severe | Poor |
| Berts Canyon/ Coyote Sp. | Canebrake Ck. | 3.0/Good | U/Mod. | Major | Good |
| Canebrake Ck. | Canebrake Ck. | 2.7/Fair | G/Mod. | Severe | Good |
| Canebrake Ck. | Canebrake Ck. | 2.0/Fair | G/High | Severe | Fair |
| Canebrake Ck. | Canebrake Ck. | 1.7/Poor | G/High | Severe | Fair |
| Canebrake Ck. | Canebrake Ck. | 1.3/Poor | G/Mod. | Severe | Poor |
| Cow Canyon Ck. | Canebrake Ck. | 3.0/Good | G/Light | Severe | Excellent |
| Cow Canyon Ck. | Canebrake Ck. | 4.0/Excellent | G/Light | Light | Excellent |
| Cow Canyon Ck. | Canebrake Ck. | 2.0/Fair | G/Light | Major | Fair |
| Cow Canyon Ck. | Canebrake Ck. | 3.3/Good | G/Light | Mod. | Good |
| Cow Canyon Ck. | Canebrake Ck. | 3.0/Good | G/High | Mod. | Good |
| Spring Canyon Ck. | Canebrake Ck. | 1.7/Poor | G/Light | Severe | Fair |
| Three Pines Ck. | Canebrake Ck. | 1.7/Poor | G/High | Severe | Poor |
| Three Pines Ck. | Canebrake Ck. | 2.0/Fair | G/Extreme | Severe | Fair |
| Three Pines Ck. | Canebrake Ck. | 2.7/Fair | G/Mod. | Severe | Good |
| Three Pines Ck. | Canebrake Ck. | 2.0/Fair | G/Extreme | Severe | Fair |
| Chi mney Ck. # 1 | Chi mney Ck. | 4.0/Excellent | U/Light | Light | Excellent |
| Chi mney Ck. # 1 | Chi mney Ck. | 4.0/Excellent | U/Light | Light | Excellent |
| Chi mney Ck. # 1 | Chi mney Ck. | 4.0/Excellent | U/Light | Light | Excellent |
| Chi mney Ck. # 2 | Chi mney Ck. | 3.7/Good | G/Mod. | Light | Excellent |
| Chi mney Ck. # 2 | Chi mney Ck. | 3.3/Good | G/High | Mod. | Good |
| Chi mney Ck. # 3 | Chi mney Ck. | 2.7/Fair | G/High | Mod. | Fair |
| Chi mney Ck. # 4 | Chi mney Ck. | 3.0/Good | G/High | Major | Good |
| Chi mney Ck. # 4 | Chi mney Ck. | 4.0/Excellent | U/Light | Light | Excellent |
| Chi mney Ck. # 4 | Chi mney Ck. | 3.3/Good | G/Mod. | Mod. | Good |
| Chi mney Ck. I. T. #1 | Chi mney Ck. | 2.7/Fair | G/Light | Mod. | Fair |
| Chi mney Ck. I. T. #2 | Chi mney Ck. | 3.0/Good | G/Mod. | Mod. | Good |
| Chi mney Ck. P. T. #1 | Chi mney Ck. | 4.0/Excellent | U/Light | Light | Excellent |
| Chi mney Ck. P. T. #1 | Chi mney Ck. | 4.0/Excellent | U/Light | Light | Excellent |
| Chi mney Ck. P. T. #2 | Chi mney Ck. | 2.3/Fair | G/High | Mod. | Fair |
| Chi mney Ck. P. T. #2 | Chi mney Ck. | 3.0/Good | G/Mod. | Mod. | Good |
| Chi mney Ck. P. T. #2 | Chi mney Ck. | 1.3/Good | G/High | Major | Poor |
| Chi mney Ck. P. T. #2 | Chi mney Ck. | 3.0/Good | G/Mod. | Mod. | Good |
| Chi mney Ck. P. T. #3 | Chi mney Ck. | 3.0/Good | G/Light | Mod. | Good |
| Chi mney Ck. P. T. #3 | Chi mney Ck. | 2.7/Fair | G/High | Major | Fair |
| Chi mney Ck. P. T. #4 | Chi mney Ck. | 3.0/Good | U/Light | Mod. | Good |
| Chi mney Ck. P. T. #4 | Chi mney Ck. | 3.7/Good | U/Light | Mod. | Excellent |
| Chi mney Ck. P. T. #4 | Chi mney Ck. | 2.7/Fair | U/Mod. | Major | Fair |
| Chi mney Ck. P. T. #5 | Chi mney Ck. | 3.0/Good | U/Light | Mod. | Good |
| Chi mney Ck. P. T. #6 | Chi mney Ck. | 3.0/Good | U/Light | Mod. | Good |
| Upper Chi mney Ck. | Chi mney Ck. | 3.3/Good | U/Light | Mod. | Excellent |
| Upper Chi mney Ck. | Chi mney Ck. | 3.7/Good | U/Light | Light | Excellent |
| Upper Chi mney Ck. | Chi mney Ck. | 2.0/Fair | U/Light | Severe | Fair |

¹Riparian Site Function Rating

²Whether the stream was grazed and the amount of vegetative use by animals

³Streambank Soil Alteration Rating

⁴Vegetative Bank Protection Rating

Table 5-Data from a dBase III printout of inventory data including stream reaches in three watersheds

Data manipulation within the dBase III program permits us to easily quantify the extent and type of riparian systems in this area. With the vegetation classification data in particular, we are able to describe the riparian systems under our management in ways that were not possible in the past. For example, we know now that the "riparian scrub" formation is dominant on public lands in the Kern River watershed with smaller amounts of "riparian forest," "riparian marshland," and "riparian strand lands" present. By contrast, riparian areas on public lands in the Kaweah River watershed are almost entirely riparian forests. For each reach, comparisons between parameters such as "percent vegetative use by animals" and the riparian site function rating provide an indication of impacts from grazing.

This inventory method and the analysis of the data in a dBase program have provided us a great amount of new information in a relatively brief period of time. The emphasis on collection of vegetative and morphological information has been an effective method of assessing the effects of livestock grazing.

We recommend that this method be used in other areas in this district where this type of data is lacking. For public lands in the Kern and Kaweah River watersheds, it has documented baseline characteristics and conditions. A good baseline inventory is needed to decide where management practices should be changed and where projects should be implemented. With such data we can make better decisions on where projects should be implemented when the funds become available. The results of this inventory provide the data needed to establish management objectives and to monitor our progress toward meeting them. In addition, we have data that can be used as a starting point to assess what the appropriate levels of livestock grazing should be on these reaches.

Finally, the records can be easily maintained and amended on the dBase III program. We have strongly justified the need for monitoring selected stream reaches. Maintaining an up-to-date inventory and monitoring critical reaches are required by the Federal Land Policy and Management Act of October 21, 1976 (43 U.S.C. 1701), the Public Rangelands Improvement Act of Octo-

ber 25, 1978 (92 Stat. 1803) and the Bureau's riparian area management policy. This procedure provides the method to meet these mandates and to ultimately improve the condition of riparian areas in the Bakersfield District.

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