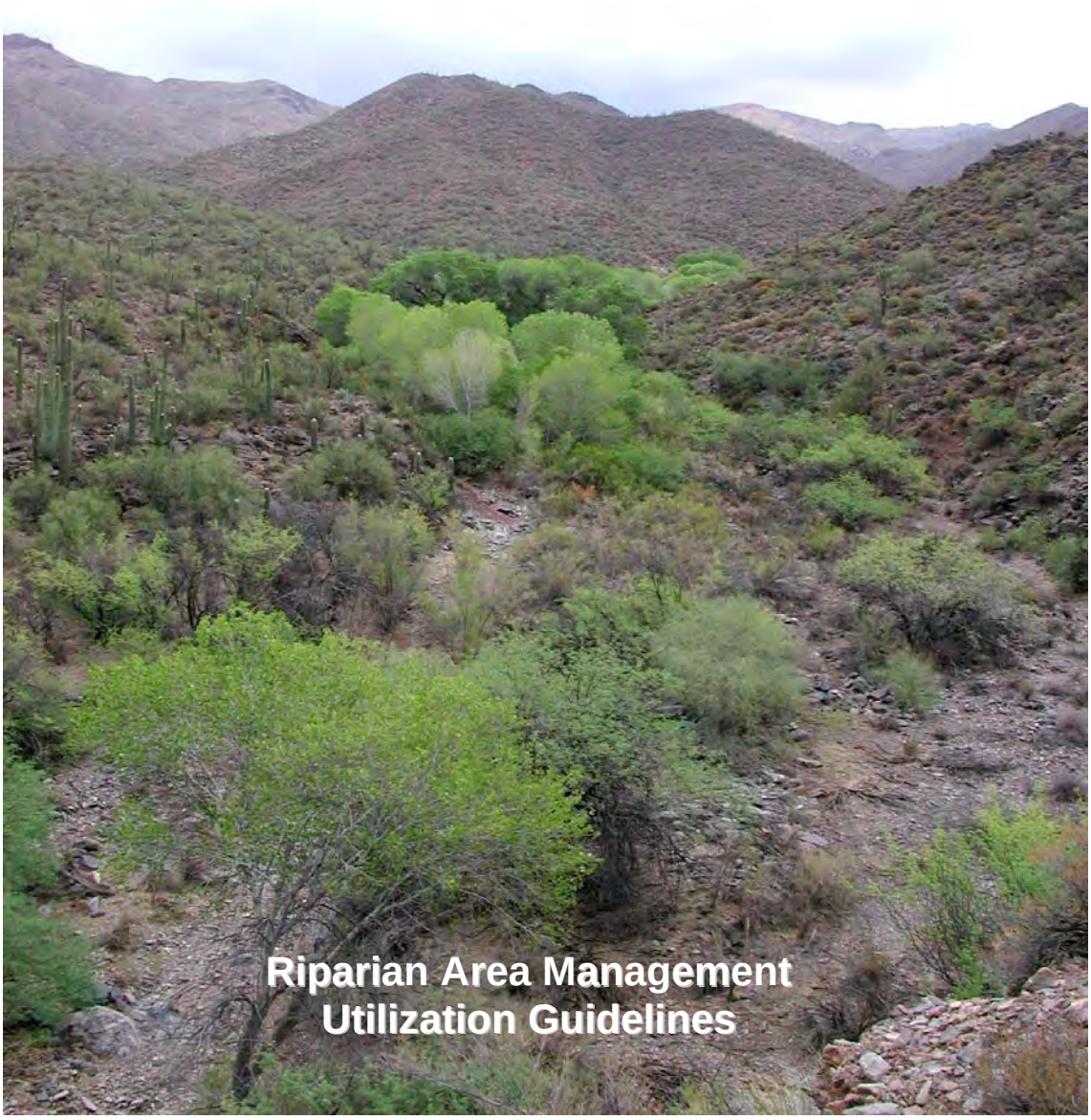

Tonto National Forest

2002

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Introduction

Riparian areas are a vitally important component of the Tonto National Forest. They are characterized by their high productivity and ecological diversity. Riparian areas provide habitat for countless species of aquatic and terrestrial wildlife, and forage for domestic livestock. In addition, these "oases" are the focal point for many recreational activities. As water is limited in the arid southwest, so are riparian areas. On the Tonto N.F., they comprise only one percent of the total land area.

The direction for managing riparian areas on the Tonto N.F. is provided in the Forest Service Manual 2526 (USDA Forest Service 2000), Regional Guide for the Southwestern Region (USDA Forest Service 1983), and the Tonto National Forest Plan (USDA Forest Service1985). The goals, objectives, and desired conditions stated within these documents clearly state that riparian areas should be managed for the protection and improvement of soil, water, vegetation, and wildlife and fish populations.

Lawsuits filed in 1997 and 1998 for failure to comply with the National Forest Management Act (NFMA) (1976)[1], National Environmental Policy Act (NEPA) (1969)[2] and the Endangered Species Act (ESA) (1973)[3] asserted that livestock grazing on all National Forests in Arizona and New Mexico (Region 3) was having a detrimental effect on riparian areas. Grazing utilization guidelines were developed in response to the litigation to assure compliance with the Tonto National Forest Plan and ESA Section 7 consultation requirements.

[1] 16 U.S.C. 1600 (note)
[2] 42 U.S.C. 4321 et. seq.
[3] 16 U.S.C. 1531 et. seq.

The purpose of this paper is to review direction for riparian area management on the Tonto N.F., outline the rationale for implementing utilization guidelines in riparian areas, and provide practical methods for measuring utilization on riparian vegetation and streambanks.

Riparian Area Management Direction

Forest Service Manual Direction (FSM 2526)

Nationwide direction contained in the Forest Service Manual states that our objective is "to protect, manage, and improve riparian areas while implementing land and resource management activities." Our policy is to manage riparian areas under the principles of multiple use and sustained yield, with an emphasis on protection and improvement of soil, water, vegetation, fish, and wildlife resources.

Regional Guide for the Southwestern Region

The Regional Guide provided a basis for the development of Forest Plans in the Southwestern Region, listing standards and guidelines for watershed and riparian area management. The Guide states that Forests in Region 3 should "recognize the importance and distinct values of riparian areas in Forest Plans", giving "preferential consideration to resources dependent on riparian areas over other resources" (USDA Forest Service 1983). Further, regional direction indicates that "other resource uses and activities may occur to the extent that they support or do not adversely affect riparian dependent resources."

Tonto National Forest Plan

The Tonto National Forest Plan was completed and approved in October 1985. During the planning process, issues and concerns of the public, other organizations, and the Forest Service were identified. Planning was directed primarily at responding to these issues. The Tonto N.F. identified 16 major issues to be addressed, one of which was the condition of Forest riparian areas.

Riparian area management direction is found in several places throughout the Tonto National Forest Plan. According to the Plan, approximately half of the riparian acreage (12,500 acres) on the Tonto N.F. is in acceptable condition (fair or better). A stated expectation for implementing the Forest Plan is to improve the remaining 13,400 acres of riparian areas to acceptable condition by the year 2035.

Forest Plan goals are desired conditions to be achieved in the future. The following goals relating to riparian areas are found under "Management Direction for Soil, Water and Air Quality (USDA Forest Service 1985):"

1. Meet minimum water quality standards
2. Emphasize improvement of water quality
3. Enhance riparian ecosystems by improved management
4. Have all major riparian areas under intensive management by 1995

Standards and guidelines are a key element of Forest Plans as they set forth the bounds and constraints under which all management activities are to be carried out in achieving Forest Plan objectives (USDA Forest Service 1996). More specifically, standards and guidelines set forth policies and time schedules for addressing major Forest resource activity. In addition, they specify mitigation measures and coordinating requirements needed to protect resources and the environment. There are two categories of standards and guidelines: those that apply Forest-wide, and those that apply to a specific area within the Forest.

The standards and guidelines for riparian areas on the Tonto N.F. primarily take the form of qualitative goal statements (desired conditions) as opposed to specific, measurable, or practical measures. The only quantifiable guideline in the Forest Plan limits utilization on woody species to 20% of current annual growth by volume. This parameter is not easily or directly measurable in the field. As a result, it has generally been disregarded. Expected future conditions

for riparian areas include the above “20%” utilization standard and the following elements:

- Overstory crown cover enhanced to 80% of its potential natural community; and
- 50% of cottonwood-willow forest structural stage 1 (multiple stories) in fifty years.

Amendment to Forest Plans – Threatened and Endangered Species

The Restricted Riparian Area Guidelines for Mexican Spotted Owl and the General Guidelines for Northern Goshawk habitat in the Record of Decision for Amended Forest Plans (USDA Forest Service 1996) emphasize maintenance and restoration of riparian areas through compliance with Forest Plan standards and guidelines and recovery of degraded areas occurring as soon as possible. The guidelines also state that damage to riparian vegetation, streambanks, and channels should be prevented.

Implementing Forest Plan Standards through Utilization Guidelines

Riparian area utilization guidelines were developed in 1998 to ensure compliance with Forest Plan standards and guidelines and/or comply with Section 7 Consultation requirements of the Endangered Species Act. These guidelines (listed below) are intended to limit impacts on three interrelated elements of riparian areas: obligate riparian woody species, obligate riparian herbaceous species, and streambank or greenline features. The guidelines also address salting and grazing in riparian pastures. The specific levels of utilization were selected based on the known ecology of Southwestern riparian ecosystems, existing conditions of the Forest's riparian areas, available research and the availability of sampling techniques.

These guidelines are currently assessed on an annual basis through compliance monitoring

Obligate woody riparian species:
Limit use to < 50% of terminal leaders on top 1/3 of plants that are accessible to livestock (≤ 6.0 ft tall).

Herbaceous riparian species:
Limit use to < 50% of plant species biomass.

Streambanks/Greenline:
Limit trampling impacts to < 20% of alterable bank or greenline.

Salting:
Salting should not occur within ¼ mile of water, including riparian areas, stream channels, or developments.

Riparian Pastures:
Riparian pastures should not be utilized as holding facilities, for trailing livestock, or for drought relief. Winter use is most likely to be successful. Regardless of season of use, the above use guidelines should be followed. Winter use periods are defined by the elevational range in which the pasture is located: < 3000 ft. Nov.-Feb., 3000-5000 ft. Nov.-Mar., and > 5000 ft mid-Oct. – mid-April.

A protocol for measuring streambank impacts and the vegetation attributes associated with the guidelines was also developed in 1998. The current adaptation of the Protocol for Monitoring Utilization in Riparian Areas (APPENDIX A) outlines procedures for selecting key areas, characterizing the

riparian area, measuring annual woody and herbaceous utilization, and estimating streambank impacts.

Rationale for the Development of Riparian Area Utilization Guidelines

The importance of riparian areas for stream function, water quality and quantity, wildlife and fisheries habitat, recreation, and livestock forage is well documented in the literature (Elmore 1992, Chaney et al. 1990). The negative effects of livestock grazing on riparian vegetation and stream channels are also well documented (Skovlin 1984, General Accounting Office 1988, Platts 1991, Elmore and Kaufman 1994, Pieper 1994, Ohmart 1996, Belsky et al. 1999). However, the negative effects of grazing can be minimized or eliminated with proper management (Mosley et.al. 1999); including the use of utilization guidelines, best management practices, and grazing management strategies.

The development of grazing intensity guidelines and compliance monitoring methods are appropriate techniques for both upland and riparian areas (Holechek and Galt 2000, Bailey 1996a & 1996b). They are particularly relevant for riparian areas to indicate distribution problems within a pasture. Utilization guidelines are best applied when they are developed on a site-specific basis with an understanding of site condition, site potential, and grazing strategy (Bailey 1996a, 1996b, Mosley et al. 1999, Holechek and Galt 2000 and Clary and Leininger 2000). However, the dilemma public land management agencies face in developing site-specific guidelines is both the lack of time to comply with legal mandates and lack of practical recommendations derived from research. For example, there are over 100 grazing allotments on the Tonto N.F., and most of them have multiple riparian areas supporting several threatened and endangered species.

Determination of site potential is also a problem. There is little information on site potential or desired conditions for riparian areas in the Southwest. Further, the reference areas needed to characterize or describe site potential or desired conditions on the Tonto N.F. are lacking. Thus, there is little understanding of

either recovery rates or the corresponding utilization levels that will allow for improved condition. The Tonto's riparian area utilization guidelines are intended to provide provisional thresholds of annual use until site-specific analysis can be completed. Use guidelines are being modified based on the site-specific environmental analysis completed during allotment management planning (NEPA). The Tonto N.F. is currently in the process of developing techniques for measuring long-term vegetation trend. Trend data will provide an understanding of potential conditions, the link between site potential and use levels, and allow for the development of desired conditions. In the interim, these guidelines supply specific, practical, and measurable guidelines for implementing Forest Plan direction into grazing management activities on the Tonto N.F.

How the Utilization Guidelines were Selected

Woody Vegetation

The majority of riparian ecosystems on the Tonto N.F. have the potential to support broadleaf deciduous trees, such as red willow (*Salix laevigata* Bebb.), Goodding's willow (*Salix gooddingii* Ball), Fremont cottonwood (*Populus fremontii* Wats.), narrowleaf cottonwood (*Populus angustifolia* James), velvet ash (*Fraxinus velutina* Torr.), Arizona alder (*Alnus oblongifolia* Torr.), and Arizona sycamore (*Platanus wrightii* Wats.), with several age classes of these species represented (Figure 1).

Stromberg (1993) reviewed studies that examined the effects of grazing on Southwestern riparian systems, including tree species regeneration. Although the studies cited in her review infer that grazing adversely affects the density and recruitment of native riparian trees, they do not address specific factors of livestock grazing management, such as utilization levels or season of use. These studies did not recommend management practices or thresholds of utilization that would sustain or increase the level of riparian tree species density or recruitment. Studies that do provide recommendations on utilization have

Multi-storied stand

Figure 1. Multi-storied riparian forest comprised of a deergrass understory and several age/size classes of riparian obligate tree species (i.e. Arizona ash, Goodding's willow, Fremont cottonwood). Sycamore Creek 1998, Tonto National Forest.

been developed for other geographic areas and multi-stemmed shrub species (not Southwestern tree species) (Mosley et al. 1999).

The Tonto National Forest Plan limits use to 20% of tree and shrub annual production *by volume*. The guideline developed in 1998 limits utilization to 50% of the total number of terminal leaders on trees (< 6 ft. tall) accessible to livestock and wild ungulates. The intent of this guideline is to facilitate the growth of seedling and sapling tree species into larger size classes. The desired future conditions stated in the Tonto National Forest Plan with regards to riparian vegetation structure are to enhance overstory crown cover to 80% of its potential and assure that at least 50% or more of the cottonwood-willow stands on the Forest have multiple stories (i.e. adequate regeneration).

The percent of leaders browsed was chosen as a surrogate guideline in place of percent volume because volume is an extremely difficult parameter to assess on an annual basis. The method employed for determining the percent of leaders browsed is an expedient and repeatable sampling technique. Mathematical relationships between the number of twigs browsed and percent of current annual growth removed have been established in previous studies (Stickney 1966, USDA Forest Service 1991a).

Herbaceous Vegetation – *Revised and Edited by Kelly M. Kessler, T.N.F. Monitoring Team*

Utilization limits for herbaceous riparian vegetation are intended to do two things: 1) protect plant vigor and 2) provide physical protection of streambanks or the sediment on the greenline that could develop into a bank feature. "Herbaceous understory vegetation in Sonoran cottonwood-willow systems has been substantially altered" (Stromberg 1993). The most impacted vegetation layer in riparian areas on the Tonto N.F. is the herbaceous layer. Based on observations of ungrazed riparian areas on the Forest, herbaceous species diversity, cover, and frequency are significantly less in grazed sites. Many of the emergent spike

rushes, sedges, rushes, and other species (cat-tail and horse-tail) are found infrequently and with very low cover and density in grazed riparian areas.

The Tonto N.F. initially proposed a use guideline of 50% by weight for herbaceous species. However, there were no sampling methods specific to estimating percent use of riparian herbaceous species by weight. Height-weight relationships have been determined for many upland grasses, but not for Southwestern riparian species.

Since that time, a height-weight curve has been developed for deergrass (*Muhlenbergia rigens* (Benth.) Hitchc.). Deergrass was selected as the key species to monitor because it is the most common obligate, riparian, native, perennial grass on the Tonto N.F. (Figure 2). Deergrass is considered to be at best moderately palatable forage (Humphery 1970). It is far more common than many of the more palatable sedges, rushes and other emergents; all of which are too infrequent to measure on the Tonto. Heavy grazing on deergrass is an indicator that the more palatable riparian graminoids may have been reduced due to selective grazing pressure (Humphery 1970).

Deergrass exhibits a number of traits that make it an ideal stream-stabilizing plant. These traits include stems which are dense, sturdy, non-brittle, and uniform, and a dense root network that extends as deep as the streambank is tall (Cornwall 1998, Coppin and Richards 1990).

The above ground attributes of deergrass serve 3 primary functions in preventing soil loss. These attributes include friction, soil protection, and infiltration (Cornwall 1998). Densely spaced, sturdy, and uniform stems create more friction, thereby decreasing flow velocity and streambank erosion (Cornwall 1998, Brown 1984, Knight and Bottorff 1984). Secondly, because deergrass is a large bunchgrass, often with stems exceeding 1 meter in length, it is capable of providing soil protection from animal or human traffic, and forms a protective

Deergrass

Figure 2. Large (~ 1-2 meters tall) deergrass plants (*Muhlenbergia rigens* (Benth.) Hitchc.) inhabiting the greenline. Silver Creek 1998, Bureau of Land

layer between the soil surface and impact from raindrops and flowing water (Cornwall 1998).

As with the above ground attributes of deergrass, the root system also provides 3 erosion-preventing functions on streambanks. These functions are soil reinforcement, infiltration, and soil protection. The underwater root mat of deergrass consists of dense, fine roots at a depth equal to bank height (Cornwall 1998). This attribute provides cohesion of soil particles by binding and surrounding particles with organic exudates, and elastic roots (Cornwall 1998, Waldron and Dakessian 1982, Gray and Ohashi 1983). The second benefit of this attribute increases soil shear strength (Cornwall 1998, Waldron and Dakessian 1982, Gray and Ohashi 1983) by increasing transpiration rates, which result in a reduced soil moisture content of the streambank. Lower moisture content increases soil strength and decreases its weight, thereby improving the stability of the streambank (Cornwall 1998, Coppin and Richards 1990). The second erosion preventing function of the plant's dense and deep root system is the ability to encourage infiltration with its near-surface roots and on the underwater soil surface (Cornwall 1998). A study conducted by Ambasht et al. (1984) concluded that soil stability was greater under herbaceous species with a spreading root system than under those with a tap root system. Finally, the root system provides the underwater soil surface stability and protection from water flow (Cornwall 1998, Smith 1992).

Streambank/Greenline Alteration

A crucial need in riparian area management is to consider practices for preserving streambank structure and channel morphology in order to support fish habitat and hydrologic function (Clary and Webster 1989). "Streambanks are morphological features of the stream channel created by the erosion and deposition forces of stream flow" (Cowley 2002). The importance of stable streambanks to stream channel function, and wildlife and fish habitat is widely discussed in the literature (Cooper 1980, Armour et al. 1994, Skovlin 1984,

Kauffman and Krueger 1984, Kauffman et al. 1985, Bohn and Buckhouse 1986, Platts 1991, Kovalchik and Elmore 1992, Ohmart 1996). Streambank condition directly influences channel dynamics, in turn affecting the aquatic habitat and water quality (USDA Forest Service 1997a).

The majority of streams on the Tonto N.F. are “non-functioning” or “functioning-at-risk” as defined by the Proper Functioning Condition assessment method (Barrett et al. 1995). Indicators of these ratings are generally over-widened, shallow channels and an absence of functioning floodplains or distinct streambank features (Figure 3). The Tonto N.F. developed a guideline that limits physical impacts by livestock to 20% of alterable bank features or the greenline. “Alterable” streambank or greenline features have exposed sediment. In other words, these features are not protected by vegetation (i.e. obligate species with deep root systems), boulder, cobble, or bedrock. Streambank alteration is due to forces other than natural disturbances (i.e. water, ice, and debris flow), such as livestock grazing, recreation, construction, and logging (Cowley 2002). Livestock physically impair streambanks by trampling and chiseling through hoof action (Figure 4). Thus, alterable banks are vulnerable to hoof action because they are uncovered, which can increase erosion and streambank degradation. The prevailing concept behind limiting annual impacts to streambanks is to support streambank integrity so that it is not impaired beyond its natural state of recovery (USDA Forest Service 1997a).

Cowley and Burton (2002) propose a method for establishing allowable streambank alteration levels based on Rosgen stream type. For streams with critical management considerations (i.e. threatened and endangered species, domestic water supplies) they recommend that allowable alteration be limited to between eight and ten percent of the streambank. For other streams, alteration is limited to between 16 and 20%, depending on stream type. They recommend

Figure 3. Non-functioning, degraded stream exhibiting a shallow, widened, and braided channel. Tonto Creek 1995, Tonto National Forest.

Figure 4. Livestock trampling that is breaking down the streambank feature. Verde River 1999, Tonto National Forest.

decreasing allowable bank alteration by 50% when streams support less than 70% of the potential amount of late seral species along streambanks.

The Inland Native Fish Strategy (USDA Forest Service 1995) for 22 National Forests in the Intermountain, Northern, and Pacific Northwest Regions specifies that 80% bank stability should be maintained. However, many of these Forests had already set allowable limits for streambank alteration by livestock and wildlife. For example, the Beaverhead (Svoboda et al. 1990) and Helena National Forests (USDA Forest Service 1997b) limit annual streambank impacts to less than 20% of alterable banks. The Ochoco Forest Plan (USDA Forest Service 1989) standards and guidelines require that upper streambanks be maintained in a stable condition along at least 80% of stream length. The Modoc National Forest (USDA Forest Service 1991b) also limits streambank disturbance caused by livestock trampling to less than 20%. Most recently, riparian standards that limit streambank disturbance to less than 20% of the stream reach have been incorporated into the Sierra Nevada Forest Plan Amendment (USDA Forest Service 2001).

Additional Considerations for Riparian Area Management

Stubble Height vs. Utilization

The maintenance of residual vegetation or stubble heights may be more critical to riparian areas than utilization levels. When herbaceous utilization guidelines were first proposed in 1998, an additional guideline was suggested that would maintain 2/3 of the plant's stubble height. We have yet to implement this guideline, as we have opted to measure deergrass use based on a height-weight curve. There is literature available on recommended stubble heights of riparian graminoids (Clary and Leininger 2000, Thornton et al. 1993, Mosley et al.1999, Clary and Webster 1989, Bell 1998), but generally for rhizomatous species that form a continuous sod cover and in riparian areas in good condition. Currently,

there is no recommended stubble height for deergrass or other comparable bunchgrass species.

Critical Periods for Grazing Management

Mosley et al. (1999) discusses the importance of determining critical periods of a particular riparian area, and then limiting grazing to no more than once every three or four years. For many geographic regions, the critical period is defined as the time necessary for adequate re-growth to allow for stream channel protection prior to periods of precipitation or runoff events (i.e. snowmelt). In Southwestern riparian areas, maintenance of riparian vegetation along the streambank or greenline is critical for both winter rains (November through mid-April) and the summer monsoons (mid-July through mid-September). Thus, higher utilization levels may be allowable in the spring (April-May) while lower utilization levels may be more appropriate in late summer and early fall.

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APPENDIX A

PROTOCOL FOR MONITORING UTILIZATION IN RIPARIAN AREAS

TONTO NATIONAL FOREST

Revision by Kristen Widmer-McBride
10/22/2002

Original Authors: Janet Johnson, Mike Ross, and Kristen Widmer (1998)

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INTRODUCTION

In this document, procedures outlined for:

- Stratifying stream reaches
- Describing the riparian area
- Photographing the reaches
- Using GPS units to locate sites
- Measuring use on tree species
- Measuring use on grass species
- Describing streambanks and measuring annual impacts

HOW MONITORING SITES ARE SELECTED

Aerial photographs, National Wetland Inventory Maps, and knowledgeable people are used to provide information on the location of key riparian areas within each pasture/allotment. This process includes the Riparian Ecologist, Forest Hydrologists, District Range Conservationist, Monitoring Coordinator, and allotment permittee. Key reaches are primarily chosen based on representativeness and accessibility. However, key reaches may also include areas that are not representative, but those that have a high potential for recovery (i.e. spring fed sections of an intermittent stream). Stream reaches are further stratified according to the following pre-field procedures.

Pre-field Procedures

Key Area Selection

Stratifying Stream Reaches

Physical, chemical and biological attributes of streams vary between watersheds because of differences in climate, hydrology, geology, landform, vegetation and soils. Streams reflect this variability in their gradient, channel substrate, sinuosity,

stream size and riparian vegetation. As a result, they exhibit differing responses to natural disturbance and management activities.

Stream reach stratification is an office procedure that uses existing information (aerial photographs, topographic maps, National Wetland Inventory maps and local knowledge) to identify stream reaches and provide a basis for collecting field data.

The first step in stream reach stratification is to delineate valley bottom segments (USDA Forest Service 1996**)**. A valley bottom is defined as the land area that includes the stream, adjacent floodplain, benches, terraces, and other gentle terrain and valley toe slopes that directly effect or are influenced by the stream. They are mappable and describable land features. They are mapped at 1:24000 as line segments or polygons.

Valley bottom segments are delineated first by valley width and gradient. Riparian vegetation, flow regime (perennial/intermittent), and stream junctions (USDA Forest Service 1992) may be used to further delineate valley bottom segments. The valley segments should be additionally subdivided based on land use or ownership, allotment and pasture boundaries. The minimum, recommended valley bottom and associated stream reach length for mapping and sampling is 1,000 feet, although springs and shorter reaches may also be sampled.

FIELD PROTOCOL

Equipment List

Digital Camera	**Flagging**	**Clipboard**
Pencils	**Photo board**	**Dry Erase Marker**
Ziplock Bags	**GPS Unit**	**Batteries**
NWI Map	**Allotment Map**	**7 ½' Quad**
Data Sheets	**Forest Map**	**Aerial Photos**
100 ft tape	**Yard Stick**	**Compass**

Describing the Riparian Area

In addition to collecting data on vegetation use and streambank parameters, data will be collected that characterizes the riparian area and its environment. These data can be used for Forest and project level inventory, mapping, monitoring and planning purposes. Ocular data will be collected that broadly describes the fluvial surfaces (stream channel, floodplain and terraces) and vegetation within the valley segment associated with each stream reach. Valley segment mapping units can either be polygons or line segments depending on the width of the unit being mapped.

Before collecting data, walk the full length of the reach to be monitored

On the comments form (SECTION III), note key areas of utilization, degree of utilization, bank condition, amount of alterable bank, utilization of key species and uniformity throughout the reach. Record any additional observations that may be helpful in describing condition, use, and characterization of the reach.

If there are no signs of use in the reach, complete the summary and riparian area vegetation description forms (SECTION III), and record lack of use on the comments form with any other important observations.

Valley Bottom Cross-Section Sketch

Sketch a cross section of the valley bottom and side slopes in the space provided on the vegetation description form, including all the fluvial surfaces (Figure 1). As you continue walking the reach, reassess the representativeness of your sketch.

Number each fluvial surface.

Estimate the width (to the nearest 10 feet) of each fluvial surface.

For each fluvial surface, estimate the distance (to the nearest foot) from the fluvial surface to the bottom of the stream channel.

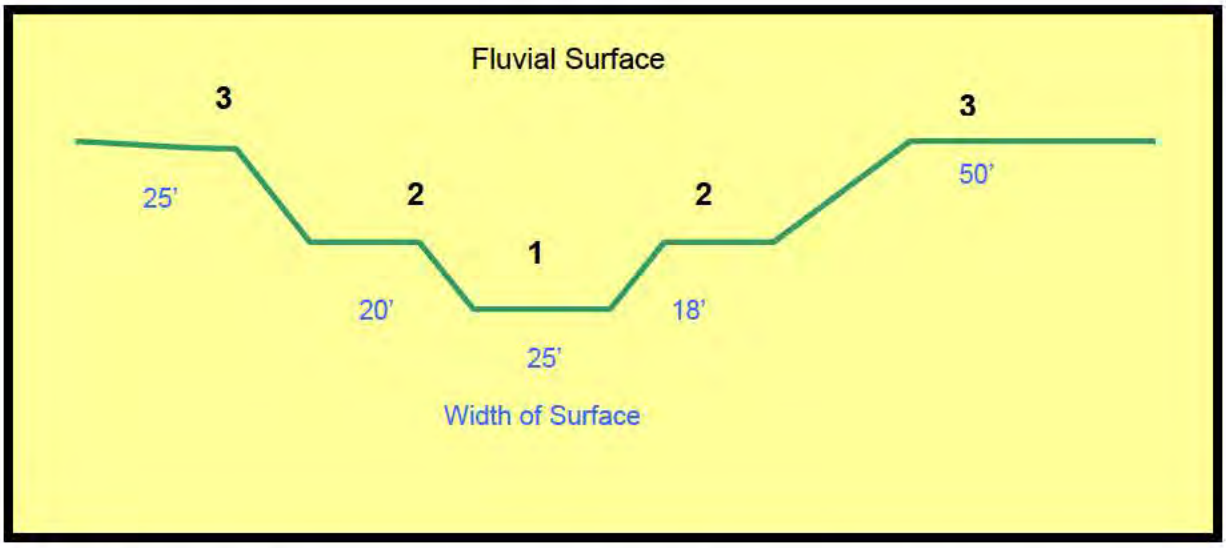


Figure 1. Valley bottom cross-section sketch illustrating stream channel morphology.

Estimate Vegetation Cover for Each Fluvial Surface

For each fluvial surface, list the dominant tree, shrub, forb and graminoid species. Occularly estimate the total canopy cover for each shrub species. Use the following cover classes:

0 < 1% = T	25 > 50% = 3
1 < 5% = 1	50 > 75% = 4
5 < 25% = 2	75 > 100% = 5

For trees, estimate the canopy cover for each species (break out total number by size class):

Seedlings	< 1" dbh or < 4.5 ft. tall	Saplings	1.0 - 4.9" dbh
Pole	5.0 - 8.9" dbh	Medium	9.0 - 20.9" dbh
Large	21.0 - 32.9" dbh	Very large	30 .0" +

Estimate the total cover for annual and perennial forbs and graminoids. In addition, if known, list the dominant forb and grass species and estimate their cover values. Use the same cover classes as listed above.

GPS Documentation

Before beginning the utilization transect, start the GPS Unit and acquire a minimum of 3 satellites. Record the UTM coordinates on the field form, and save the coordinates as a waypoint in the GPS Unit. Repeat this process at the conclusion of the transect.

Photographs/Photo Points/Video

Take a photograph at the beginning and end of the sampling reach.

Use a photo board to document site location. Write the allotment name, pasture name, stream name, date, and an arrow indicating upstream or downstream view on the board. Position the photo board in the lower left or right hand corner of the photograph so that it is visible and legible (Figure 2).

Figure 2. Photo documentation of the stream reach using a photo board to indicate site location and view.

Use of Video Camera for Documentation is Optional

Take video using a stable platform. Be discreet when zooming and be sure to pan landscape slowly. Label the video with stream name, reach, date and location of coverage. It is extremely beneficial to use video documentation when accessing areas that are remote, so that managers can link the visual information to the data collected without having to make the extended trip.

UTILIZATION SAMPLING

Woody and Herbaceous Plant Utilization

At either end of the key reach, use a random numbers table or seconds hand on a watch to randomly select the number of paces to travel to the start point for utilization monitoring.

From the start point, extend a measuring tape 20 ft. and position it along the streambank or greenline feature (Figure 3). If there is no definitive streambank or greenline feature, have the recorder pace an additional 20 ft. into the stream reach and stop.

Within this 20 ft. interval, three parameters will be measured:

- ✓ Woody Plant Utilization
- ✓ Herbaceous Plant Utilization
- ✓ Streambank Alteration

Woody Plant Utilization

Woody plant utilization is measured on key riparian obligate trees. Key riparian tree species include *Salix* spp.(willows), *Populus fremontii (*Fremont cottonwood)*, Populus angustifolia* (Narrowleaf cottonwood), and *Fraxinus velutina* (Arizona ash).

Select the nearest key tree species to the start point of the 20 ft. interval. The tree must be less than 6 ft. tall (or the dominant leaders of the plant must be accessible to cattle and wild ungulates). You can travel laterally as much as necessary within the 20 ft. interval to locate a key species.

Count the total number of dominant leaders on the top 1/3 of the plant, and the number of those leaders that have been browsed. Assess either current year's or previous year's growth, depending on the season of use by livestock. Dominant leaders include the central stems and leaders that diverge from the central stem. If there is not a woody, riparian plant rooted in the 20' interval, leave it blank.

Calculations: percent utilization on woody plants is calculated by dividing the number of leaders grazed by the total number of leaders available for each species, and for all species combined. Report these values on the Summary Form (SECTION III).

Herbaceous Plant Utilization

Herbaceous utilization is measured on deergrass (*Muhlenbergia rigens*). A height-weight curve was developed for deergrass culms (not the inflorescence) to establish the relationship between grazed stubble height and utilization by weight (SECTION II).

Select the nearest deergrass plant from the start point of the 20 ft. interval.

First, estimate the average stubble height of the grazed portion of the plant (to the nearest 0.5") and record (do not include the inflorescence).

Second, estimate the percentage of the blades that were eaten and record. This estimate is a "top-down" view of the plant.

Also, measure the heights of 15 ungrazed deergrass plants within the reach.

If there is not a deergrass plant rooted in the 20' interval, leave it blank on the data form.

Calculations: See SECTION II.

Streambank Alteration

Streambank or greenline alteration is measured along:

- The water's edge on perennial stream reaches.
- A well-defined streambank or greenline feature on intermittent streams.
- Key areas identified by hydrologists, riparian ecologists or fisheries biologists.

***If none of the above criteria apply to the stream reach, omit this measurement from the monitoring protocol.

Position the measuring tape 1 foot away from the water's edge or top of the streambank feature to delineate a 20 ft.^{2} belt transect (Figure 3).

Estimate the amount of cover (to the nearest 1 ft.) contributed by the following alterable and unalterable categories.

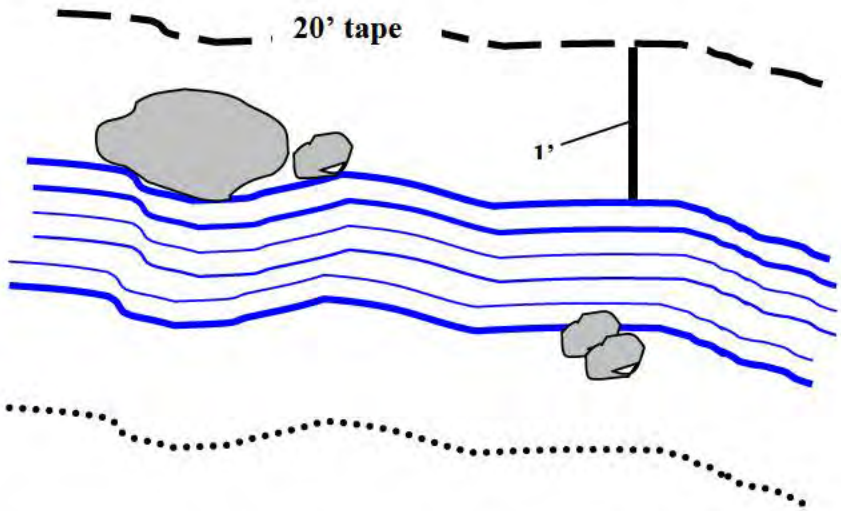


Figure 3. Position of measuring tape for estimating streambank alteration on perennial streams.

Streambank Alteration Continued

Alterable Categories (uncovered or lightly vegetated streambank):

- No Impact
- Altered by livestock
- Altered by wildlife
- Altered, but unable to determine cause of impact
- Altered by other cause (i.e. recreation)

Unalterable Categories

- Bedrock/boulders/large cobble (>5")
- Dense vegetation (i.e. deer grass or woody species)
- Inaccessible to cattle

Calculations: Determine the amount of the reach that was alterable (total of all alterable categories) and unalterable (total of unalterable categories). Divide alterable bank impacted by livestock, wildlife, undetermined, and recreation combined by total amount of bank sampled. Divide the amount impacted by livestock only by the total amount of alterable bank. Report these values on the Summary Form (SECTION III)

Continue to estimate woody and herbaceous plant utilization and streambank alteration in 20 ft. intervals, alternating the measuring tape from one-side of the stream to the other.

Sample fifty, 20 ft. intervals and include a 20 ft. spacer between each. If the key reach is shorter, sample 30-40 intervals and omit the spacer.

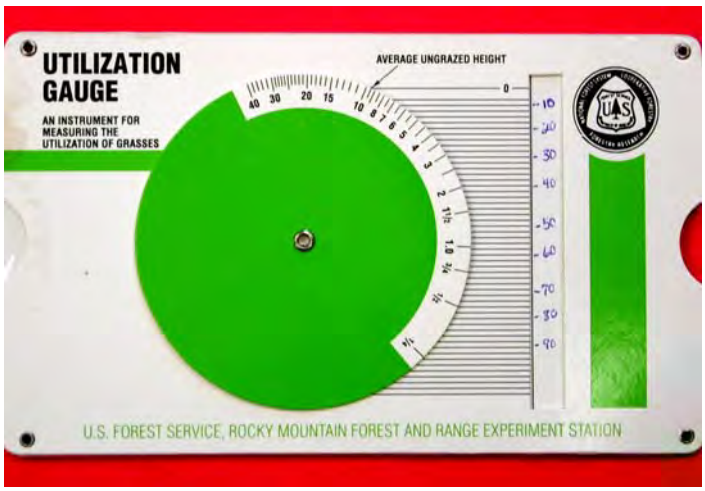
SECTION II. Calculating Deergrass Utilization

The Tonto National Forest (Phoenix, Arizona) worked in conjunction with Arizona Cooperative Extension (Payson, Arizona) to determine a height-weight relationship for deergrass plants using the culms (not the inflorescence). This relationship was transferred to a Utilization Gauge (shown below), which is used to calculate utilization of deergrass by weight.

To obtain a copy of these data or a utilization gauge, contact Janet Grove (Riparian Ecologist, TNF) at (602) 225-5255 (jgrove@fs.fed.us), Kristen McBride (Monitoring Team Coordinator, TNF) at (480) 610-3336 (kamcbride@fs.fed.us), or Jim Sprinkle (Gila County Extension Director) at (928) 474-4160 (sprinkle@ag.arizona.edu).

Calculate the average ungrazed height of deergrass using the 15 ungrazed samples from the reach (See Deergrass Utilization form in SECTION III).

Set the wheel of the Utilization Gauge to the average ungrazed height.



Once the utilization gauge is set at the average ungrazed height, determine the minimum and maximum stubble heights for the following utilization classes (follow the horizontal lines across from the percent value in the vertical window on the right, to the height value on the wheel):

Utilization	1 – 20 %	21 - 40%	41 – 60%	61 – 80 %	81 – 100%
Midpoint	10	30	50	70	90

The midpoint (or rank multiplier) of the above utilization classes is used to calculate an adjusted utilization. Mature deergrass plants can have basal diameters of 1-2 ft. across. Thus, **adjusted utilization** incorporates the stubble height value of the grazed blades (vertical view) with the percentage of blades that were actually eaten (top-down view).

Multiply the observed “Percent Grazed” by the midpoint value of the utilization class that the observation falls into (see example below).

Example:

Percent Grazed	None	1-20	20-40	40-60	60-80	80-100		%Utilization
40				50			=	20

* Multiply percent grazed value/100 X grazed class value. (.40 x 50 = 20% adjusted utilization)

Repeat this calculation for each observation.

Total the average heights and divide by the total number of observations to determine Average Stubble Height (in) of deergrass in the key reach.

Total the adjusted percent utilization values and divide by the total number of observations to determine Average Utilization on deergrass in the key reach.

Report these values on the Summary Form (SECTION III).

SECTION III - TONTO N.F. RIPARIAN UTILIZATION FIELD FORMS

REACH#: 1
STREAM:
PASTURE:
ALLOTMENT:
DISTRICT:
SEASON OF USE:
KIND/CLASS OF ANIMALS: Cow/Calf

TOPO QUAD:
NWI CODE:
REACH LENGTH:
REACH BOUNDARIES:
UTM: Beginning

Ending

LEGAL DESCRIPTION: T: N
R: E
S:

SITE PRIORITY #:
PURPOSE OF TRIP: Riparian
Monitoring

FIELD RECORDERS:

FIELD DATE:

DATA ENTRY OPERATOR:
DATE:

DATE e-mailed:
e-mailed to:

DIRECTIONS/NOTES:

Palatable Obligate Riparian Woody Species Within Sample Reach:

# of Plants	Species	% Browsed
	Pofr (Fremont Cottonwood)	
	Frve (Velvet Ash)	
	Sala (Red Willow)	
	Sago (Goodding Willow)	
	Saex (Coyote Willow)	

Total average % palatable woody leaders browsed:
Total number of plants measured within reach:

Herbaceous:
Average Percent Utilization of Deergrass (Muri) Within Sample Reach:

Average Deergrass Height (in.): Grazed:

Ungrazed:

Total number of transects within reach:
Total number of plants measured within reach:

Streambank Evaluation:

Percent Alterable Bank:
Not Impacted:
Altered by Livestock:
Not Altered by Livestock (See Streambank Alteration Form):
Altered (Undetermined):

Percent Unalterable Bank:
Bedrock/Boulder/Cobble:
Dense Vegetation:
Inaccessible:

Streambank Alteration by Livestock:
Total Streambank Alteration:

COMMENTS

REACH#:	COMMENTS:
STREAM:	
PASTURE:	
ALLOTMENT:	
DISTRICT:	
FIELD DATE:	
FIELD	
RECORDERS:	
DATA ENTRY	
OPERATOR:	
DATE:	

Include Comments on the Following:

Were all 3 parameters measured at this site (if no, why not)?
Livestock or livestock sign present?
Water (availability/length of flow)?
Permittee Attendance/Discussion/Participation.
Use on old and/or new growth.
Condition of fences or other improvements?
Streambank composition/width and depth.
Side slope gradient
Recruitment of woody and herbaceous species.
Wildlife presence (fish, deer sign, T&E species, etc)?
Other impacts to riparian area (OHV, camping, flooding)?
Species diversity, general adjacent upland community type (i.e. semidesert grassland)?
Noxious weed occurence.

PALATABLE WOODY SPECIES

WOODY VEGETATION BROWSED		Palatable (Current Growth)																		
		Pofr (Fremont Cottonwood)			Frve (Velvet Ash)			Sala (Red Willow)			Sago (Goodding Willow)			Saex (Coyote Willow)					
		Meristems	Browsed	%	Meristems	Browsed	%	Meristems	Browsed	%	Meristems	Browsed	%	Meristems	Browsed	%	Meristems	Browsed	%
	1																		
REACH#:	2																		
	3																		
STREAM:	4																		
	5																		
PASTURE:	6																		
	7																		
ALLOTMENT:	8																		
	9																		
DISTRICT:	10																		
	11																		
FIELD DATE:	12																		
	13																		
FIELD	14																		
RECORDERS:	15																		
	16																		
	17																		
DATA ENTRY	18																		
OPERATOR:	19																		
	20																		
DATE:	21																		
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	35																		
	36																		
	37																		
	38																		
	39																		
	40																		
	41																		
	42																		
TM=Total Meristems	43																		
TB=Total Meristems Browsed	44																		
	45																		
AMB=Average Meristems Browsed		TM	TB	AMB	TM	TB	AMB	TM	TB	AMB	TM	TB	AMB	TM	TB	AMB	TM	TB	AMB

DEERGRASS UTILIZATION

REACH# Location:

STREAM General Field Notes:

PASTURE Ungrazed Plant Heights (in):

ALLOTMENT

DISTRICT

FIELD DATE

FIELD RECORDERS

DATA ENTRY OPERATOR

DATE

Total Number of Transects:

Total Number of Grazed Plants:

				Utilization Point Hits										Utilization Point Hits							
				Degree of Utilization										Degree of Utilization							
				None	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%					None	1 - 20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%		
		Rank Multiplier →		0	10	30	50	70	90			Rank Multiplier →		0	10	30	50	70	90		
	#	Avg Height	Percent Grazed	Record utiltization based on culmless stubble height shown below.						Adjusted Utilization*	#	Avg Height	Percent Grazed	Record utiltization based on culmless stubble height shown below.						Adjusted Utilization*	
	1										26										
	2										27										
	3										28										
	4										29										
	5										30										
	6										31										
	7										32										
	8										33										
	9										34										
	10										35										
	11										36										
	12										37										
	13										38										
	14										39										
	15										40										
	16										41										
	17										42										
	18										43										
	19										44										
	20										45										
	21										46										
	22										47										
	23										48										
	24										49										
	25										50										
		Avg.										Avg.									

Average Stubble Height (in):

Average Utilization (%):

Example:	Percent Grazed	None	1-20	20-40	40-60	60-80	80-100	%
Utilization deergrass	40				50			20

* Multiply percent grazed value/100 X grazed class value. (.40 x 50 = 20% utilization)

VEGETATION DESCRIPTION

REACH#:

STREAM:

PASTURE:

ALLOTMENT:

DISTRICT:

FIELD DATE:

FIELD RECORDERS:

DATA ENTRY OPERATOR:

DATE:

Codes:

Cover Classes
0<1%=T, 1<5%=1
5<25%=2, 25<50%=3
50<75%=4, 75<100%=5

Tree Sizes (dbh)
SE=Seedlings<1"
SA=Sapling 1.0-4.9"
PT=Pole Trees 5-8.9"
MT=Med Trees 9-20.9"
LT=Large Trees 21.0-32.9"
VLT=Very Large Trees 33.0"

A=Down stream right
B=Down stream left

VEGETATION DESCRIPTION

Fluvial Surface # 1 Width:
Distance from bottom:

Dominant Trees	TC	SE	SA	PT	MT	LT	VLT

Dominant Shrubs	TC

Graminoids: % Annuals:	TC	Forbs: %Annuals:	TC
% Perennials:		% Perennials:	

Fluvial Surface # 2 Width:
Distance from bottom:

Dominant Trees	TC	SE	SA	PT	MT	LT	VLT

Dominant Shrubs	TC

Graminoids: % Annuals:	TC	Forbs: %Annuals:	TC
% Perennials:		% Perennials:	

Fluvial Surface # 3 Width:
Distance from bottom:

Dominant Trees	TC	SE	SA	PT	MT	LT	VLT

Dominant Shrubs	TC

Graminoids: % Annuals:	TC	Forbs: %Annuals:	TC
% Perennials:		% Perennials:	

Fluvial Surface # Width:
Distance from bottom:

Dominant Trees	TC	SE	SA	PT	MT	LT	VLT

Dominant Shrubs	TC

Graminoids: % Annuals:	TC	Forbs: %Annuals:	TC
% Perennials:		% Perennials:	

Fluvial Surface # Width:
Distance from bottom:

Dominant Trees	TC	SE	SA	PT	MT	LT	VLT

Dominant Shrubs	TC

Graminoids: % Annuals:	TC	Forbs: %Annuals:	TC
% Perennials:		% Perennials:	

STREAMBANK ALTERATION

REACH#:

STREAM:

PASTURE:

ALLOTMENT:

DISTRICT:

RECORDERS:

FIELD DATE:

DATA ENTRY OPERATOR:

DATE:

KEY

NO IMP = No Impact
LVSTCK = Livestock
WLDLF = Wildlife
OTHER = OHV, Rec.
UNDET = Undetermined
B/B/C = Bedrock/Boulder/ Cobble
VEG = Dense Vegetation
INACC = Inaccessible

Total Streambank Length Assessed:

0 - 200'

	1	2	3	4	5	6	7	8	9	10
NO IMP										
LVSTCK										
WLDLF										
OTHER										
UNDET										
B/B/C										
VEG										
INACC										
Total:										

200' - 400'

	1	2	3	4	5	6	7	8	9	10
NO IMP										
LVSTCK										
WLDLF										
OTHER										
UNDET										
B/B/C										
VEG										
INACC										
Total:										

400' - 600'

	1	2	3	4	5	6	7	8	9	10
NO IMP										
LVSTCK										
WLDLF										
OTHER										
UNDET										
B/B/C										
VEG										
INACC										
Total:										

600' - 800'

	1	2	3	4	5	6	7	8	9	10
NO IMP										
LVSTCK										
WLDLF										
OTHER										
UNDET										
B/B/C										
VEG										
INACC										
Total:										

800' - 1000'

	1	2	3	4	5	6	7	8	9	10
NO IMP										
LVSTCK										
WLDLF										
OTHER										
UNDET										
B/B/C										
VEG										
INACC										
Total:										

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USDA Forest Service, Intermountain Region. 1992. Integrated Riparian Evaluation Guide. Intermountain Region, Odgen , Utah . 60 p. & appendices.

USDA Forest Service, Northern Region. 1996. Ecosystem Inventory and Analysis Guide (ECODATA). Chapter 6. Northern Region, Missoula, MT.