RIPARIAN ECOSYSTEMS

RIPARIAN MONITORING

Riparian areas are highly complex and contain important resource values. Establishing Desired Conditions for riparian areas and monitoring for condition continues to increase in importance.

Riparian areas may include open running water, marshy areas, and extensive areas with permanently or seasonally moist soils. The complexity of riparian areas requires that more than one environmental indicator and associated monitoring technique be used for assessing the condition of a given key area. The monitoring techniques used will depend on specific information needs. Monitoring herbaceous and woody plants, can provide a measure of either residual vegetation, or annual utilization. The Proper Functioning Condition (PFC) assessment provides a general assessment of riparian function. Streambank Alteration is a short- term measure of direct impacts to streambanks. Stream Condition Inventory (SCI) surveys provide a measure of physical stream channel fish habitat condition, and trend using standard protocols to measure key stream attributes.

The intensity of monitoring needs to be specific to the level of information required to assure management objectives are being met. Different allotments have different needs, therefore more than one technique may be appropriate on a forest, or even district as monitoring techniques.

When selecting a monitoring technique to be used, it is important to understand why the monitoring is needed. Monitoring is conducted to evaluate the effects of management actions on achieving management objectives. A less intensive technique can be used where you have a willing permittee to anticipate problems and move livestock when needed to meet management objectives. More intensive monitoring techniques are appropriate where high value or sensitive areas are being evaluated, or where more information to accurately evaluate resource conditions is required.

Herbaceous And Woody Plant Monitoring

The status of herbaceous and woody riparian vegetation can be monitored using techniques documented in *Sampling Vegetation Attributes, 1996*, included as part of Chapter 3. The monitoring of annual utilization and residual vegetation can be conducted using techniques documented in *Utilization Studies and Residual Measurements, 1996*, included as part of Chapter 4. The selection of key areas, key species and monitoring technique needs to be done as part of an interdisciplinary process that evaluates site specific issues and information needs.

Proper Functioning Condition (PFC)

Proper Functioning Condition (PFC) is a process developed by the Bureau of Land Management (BLM) for assessing the general health and functioning of the riparian ecosystem. An Interdisciplinary Team (IDT) of skilled resource specialists conducts an assessment of a riparian-wetland area to determine if it is functioning Properly, At Risk, or is Nonfunctional. Properly Functioning is the minimum acceptable level which is providing a functioning condition; and is in dynamic equilibrium with streamflow forces. PFC is not equivalent to Desired Condition, which includes additional management needs.

The PFC protocol should not be changed or modified. It is important the protocol is carried out by an ID Team working together and not as individual specialists doing functional responses. The PFC protocol is located in the Guidebook following page 5-16.

Streambank Alteration

Streambank Alteration is an environmental indicator associated with livestock grazing. Susceptibility of streambanks to livestock impacts is inversely correlated to streambank stability. Streambank alteration can be evaluated in conjunction with other short-term riparian monitoring methods such as stubble height, residual vegetation and woody browse utilization to effectively determine impacts of livestock grazing.

Three techniques for measuring streambank alteration are included in this guidebook. These are currently being evaluated for accuracy and effectiveness for monitoring.

REPRESENTATIVE REACH METHOD--STREAMBANK ALTERATION, is based on techniques used in Region 2, and the Modoc National Forest in the Pacific Southwest Region. This technique is not as precise as the other two techniques included in this guide, however, it can give an estimate as to whether or not management objectives are being met. This method is generally used in conjunction with monitoring vegetation stubble height and browse utilization on identified key areas. See page 5-6.

PLOT METHOD--STREAMBANK ALTERATION, is based on a DRAFT protocol being evaluated as part of the Region's Stream Condition Inventory (SCI) program. This protocol can be used in conjunction with stream inventories, or by itself. It includes more classes of disturbance than the Representative Reach Method, and should provide a more precise measure of alteration (disturbance). See page 5-16.

POINT METHOD--STREAMBANK ALTERATION, is based on a DRAFT protocol being evaluated as part of the Region's SCI program. This protocol is designed to be more precise than the previous two techniques. It is designed to evaluate the condition of a stream reach, rather than a more limited representative key area associated with the Representative Reach method. It is more statistically accurate than the other two methods but is also more labor intensive to perform. See page 5-10.

Stream Condition Inventory (SCI)

Stream Condition Inventories are used to collect data on some key channel and fish habitat attributes. The draft protocol provides guidance on selecting stream reaches and attributes to be measured. Reach and attribute selection should be interdisciplinary in nature and is based on consideration of proposed management actions, possible effects on riparian and aquatic resources, and channel sensitivity and type. Channel attributes measured may include: width/depth ratios, particle size distribution, surface fines on pool tail substrate, large woody debris, streambank angle (from which percent overhanging bank is also derived), surface shade, pool frequency and residual pool depths, channel stability, and temperature. Data collection at this level of inventory (field intensive) is relatively intensive, and is designed to provide for comparisons between streams and over time that have a high level of confidence. The SCI has been applied primarily to reaches of 2nd and 3rd order watersheds, and is untried on larger river systems.

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REPRESENTATIVE REACH METHOD for measuring STREAMBANK ALTERATION

GENERAL DISCUSSION

Measuring streambank alteration consists of walking the green line in a riparian area and determining the percentage of streambank altered by livestock during the current grazing season. The overriding concept behind the procedure is to ensure streambank integrity is not altered beyond its natural rate of recovery. Most often, the best indicators of a reduction in bank integrity are livestock hoofprints, sloughing, and dislodged stones or logs along the bank/water interface. Physical alteration of the bank by trampling results in widening and shallowing of the stream channel, and eventually leads to a loss of riparian function.

This method is to be used in conjunction with other short-term riparian monitoring methods, primarily stubble height and woody browse utilization. This method should be taught to permittees so that the results can be used to determine when to move out of a pasture, before the riparian community is damaged. It is extremely important to realize all riparian communities are unique and some stream systems are much more sensitive to alteration than others.

TRAINING

The Representative Reach Method does not require intensive training for field application. Examiners must be able to recognize trampling impacts from livestock and to record the amount of the streambank altered.

PERSONNEL AND EQUIPMENT

One person can complete and record streambank alteration transects, however it is easier and more efficient for a second person to function as a recorder. Equipment required is a 100' tape, camera, and tally sheet.

SAMPLING PROCEDURE

Locate streambank alteration transects in key areas. The concept behind measuring streambank alteration is making sure that the integrity of the streambank remains intact. This is a comparison of how well the streambank can resist erosion to the same extent it would in a "natural" situation.

Bank alteration should be approached by not only asking, "Is it causing erosion?", but also "Is it preventing recovery?"

A 100' section of stream representative of a 1000' reach is selected. This implies that the observer(s) walks 1000' of the stream before selecting the 100' section to be measured. It is important to select a key area for monitoring that is representative of the stream reach being evaluated. A 100' tape is stretched along the representative reach vegetation on each side of the stream. The observer walks along one side of the creek and then the other side counting number of feet that show signs of alteration. The readings are then totaled and divided by 200 giving you the % of streambank alteration. For example:

$$\frac{\text{45 feet of alteration}}{\text{200 feet of transect length}} = 23\% \text{ streambank alteration}$$

DETERMINE ALTERATION

The effect of hoofprints on bank integrity will always be a judgment call on the part of the surveyor. It is important to calibrate observations with other people to ensure consistency. Some things to look for are:

- Is bare soil exposed to running water as a result of hoofprint action?
- Have the roots of bank stabilizing vegetation been exposed to air or water?
- Has the bank moved away from the center of the stream?
- Are hoofprints continuous or isolated?
- Is pioneering vegetation along the water's edge on gravel bars being trampled enough to allow displacement of bar material?
- Do pedestals exist along the streambank?
- Bank alteration can be counted 12-18 inches back from the bank, if it would eventually lead to the entire section falling into the stream during peak flow.
- If livestock have walked along the foot of an existing cutbank, then the bank is considered to be altered. Hoofprints alone are enough to alter the bank in this situation.
- Vertical cut banks, where there is no evidence of hoofprints along the top of the bank are not counted as altered.

Streambanks with a high percentage of bedrock, large boulders, and grapefruit-size cobbles are poor candidates for this method.

PHOTOGRAPHS

A set of photographs should be taken of both the right and left streambank alteration transects, looking upstream. The first photograph should be at the starting point, looking upstream on one side, and the last photo should be at the ending point, loooking upstream on the opposite side. Additional photographs can be taken along the transect as desired.

STREAMBANK ALTERATION

FOREST	DISTRICT	LOCATION
BIGHORN NF	BUFFALO RD	

ALLOTMENT NAME AND NUMBER	PASTURE
TABLE MOUNTAIN	PAT PARK

KIND/CLASS & NUMBER OF ANIMALS	PERIOD OF USE	ACTUAL USE
825 C/C	6/1 - 7/15	1238 Animal Months

DATE	EXAMINER(S)
07/21/94	J.DAWKINS

	T1	T2	T3	T4
Total Alteration (feet)	45	67	14	28
Total Transect Length (feet)	200	200	200	200
Percent of Alteration	23	34	7	17

STREAMBANK ALTERATION

FOREST	DISTRICT	LOCATION

ALLOTMENT NAME AND NUMBER	PASTURE

KIND/CLASS & NUMBER OF ANIMALS	PERIOD OF USE	ACTUAL USE Animal Months

DATE	EXAMINER(S)

	T1	T2	T3	T4
Total Alteration (feet)				
Total Transect Length (feet)				
Percent of Alteration				

POINT METHOD for measuring STREAMBANK ALTERATION

GENERAL DISCUSSION

Streambank condition is an important component of a stream and influences channel dynamics, aquatic habitat and aquatic populations. Natural, human and livestock caused lateration (disturbance) influences streambank condition. Physically altered streambanks are often a primary source of sediment in alluvial streams. The overriding concept behind measuring streambank alteration is to ensure streambank integrity and a healthy aquatic ecosystem.

Livestock can physically alter steambanks by trampling which often results in widening and shallowing of a stream, and eventually can lead to a loss of riparian and aquatic function. In addition, livestock utilization of riparian vegetation can reduce stream shade, recruitment of organic material to a stream, and bank stability provided by vegetation. This method of measuring streambank alteration separates natural, human (e.g. recreation), and livestock streambank disturbance and measures alteration using a non-biased protocol.

Grazing management objectives lunked to this measure are: 1) protect and maintain the basic soil and water resources; 2) restore watersheds; 3) protect and enhance the habitat of fisheries and riparian dependent species; and 4) ensure that multiple-uses are sustainable over time. If these objectives are not met, then grazing management can be adjusted to meet the desired conditions.

Measuring streambank alteration consists of selecting a reach of stream (approx. 1 km) which is representative of streambank conditions. If multiple streams exist within an area and are significantly different from one another, then several stream reaches may need to be measured. This protocol involves measuring disturbance along transects established perpendicular to the steam channel, extending past bankfull and on both sides of the stream. Measurements are used to monitor against a standard level of allowable streambank alteration. Monitoring will help to prevent excessive streambank alteration, facilitate restoration of disturbed streambank areas, and help to protect aquatic organisms and their habitat.

The following protocol should be considered a "draft" since testing of the sampling method for variance, and clarity will occur in 1997 and could replace or supplement this method.

TRAINING

The Point Method for determining streambank alteration requires training to ensure consistent application of the protocol and definitions of disturbance. However, the Point Method does not require an aquatic specialist to take the measurements. Examiners need to be able to recognize natural, human and livestock disturbance and to record the amount of streambank altered.

PERSONNEL AND EQUIPMENT

One person can complete and record streambank alteration transects, however, it is much easier and more efficient for two people to conduct the measurements. Equipment needed:

- A 50 meter tape, fiberglass and double-sided if possible.
- Worksheets and pens to record data.
- Camera, 35mm if possible.
- Sharp pointers (2 for holding the tape measure, one for sighting)
- Calculator (for rough calculations of transect spacing, etc.)

SAMPLING PROCEDURE

How Many Measurements to Take:

Timing: Streambank alteration should be measured at least once during the grazing season to determine if the limit on streambank alteration will be met piror to the end of the grazing season. Ideally, streambank alteration would be measured during and after the grazing season annually along randomly selected reaches within sensitive stream channel types on grazing allotments.

Frequency: 500 point samples. 10 points are samples at each of 50 transects (25 transects on each side of the stream).

Where to Take the Measurement:

Step 1. Identify the stream reach to be measured, often this will be a reach sensitive to livestock disturbance. Select a survey segment if the sensitive reach is longer than 1,000 m. To do so, after having measured the length of the potential sampling reach subtract 1,000 m. The difference is the length within which the start of the survey is randomly selected. For example, if the potential sampling reach is 1,750 m long, subtracting 1,000 equals 750 m. Determine a random number between 0 and 750. This number is the distance from the downstream end of the potential survey reach where the survey segment will begin. Thus, if 350 is the selected random number, the survey segment begins at 350 m upstream from the start, or "zero", end of the potential survey reach. To generate random numbers use a random number table or a calculator with a random number generator.

Step 2. Locate the transects. On 1,000 m survey segments, transects will be located on each side of the stream every 40 m. For survey segments less than 1,000 m, there would still be 50 transects (25 each side of the stream), however, the length of the survey segment would be divided by 25 to determine transect interval. For example, one 800 m survey reach would yield 32 m between transects. For survey reaches less than 100 m. use bankfull width as a minimum between transects. This would mean fewer transects over all and may not have as high a statistical confidence.

Step 3. The location of each transect is as follows:

IF bankfull can be identified, THEN:
a) from water's edge to 1 meter past bankfull

IF top of bank is easily identified, THEN:
b) from water's edge to 1 meter past the top of the bank

IF top of bank is not easily identified, THEN:
a) from water's edge to a break in slope, or maximum of 10 meters.

IF the distance from the water's edge to one meter (3 ft.) past a, b, or c above, is greater than 33 meters (100 ft.), THEN: sample the 33 meters (100 ft.) adjacent to the channel.

Extend the tape perpendicular to the streamflow and measure the distance of the transect. It is important to avoid channel point bars and other active substrate transport areas when laying out the transects. Transects should cover areas that would or could be vegetated under natural disturbance regimes. Divide the distance by 9 and sample ten points equally spaced along the tape starting at the water's edge. Note the length of the transect on the data sheet next to the transect number.

How to Take the Measurement:

Use a pointer and drop it straight down at each of the ten sample points along the tape. Whatever the end of the pointer contacts as it meets the soil surface will be the hit. Sight along the shaft of the pointer as it is lowered to the ground and determine what it hits (the key is to let the pointer go down, sight quickly and move on to the next point).

- Assign the hit to one of the six categories:
- livestock disturbed (crushed or trampled) vegetation (LDV)
- other (non-livestock) disturbed (crushed or trampled) vegetation (ODV)
- undisturbed vegetation (UV)
- livestock disturbed (chiseled or trampled) bare ground (LDB)
- other (non-livestock) disturbed (chiseled or trampled) bare ground (ODB)
- undisturbed bare ground (UB).

If the point hits open water, do not record it, and continue along the transect to complete 10 data points. If the point falls on an anomaly that cannot be resolved, do not record it, and continue along the transect to complete the 10 sample points. If a point or points fall on a vertical or overhanging bank, record the point hit at the bottom, then move to the top edge of the overhang and resume counting at the top edge of the cliff or overhang, continuing until 10 points are recorded.

PHOTOGRAPHS

Take a photograph downstream and a photograph upstream showing the reach being sampled. The back of the worksheet may be used to write the date, location, roll number, photograph number, and transect number for use as a photographic record. If there is great variation within the reach, several photos may need to be taken at different transects (note the transect number on the data sheet of the photo).

CALCULATING THE RATING

A total of 500 data points should have been taken and the percent streambank disturbance is determined by adding up the total number of disturbed hits and dividing by 5. This rating provides an estimate of the percent streambank disturbance for a sampled sensitive reach. If several stations were taken, then the average or weighted average is calculated as the estimate for the entire reach.

DEFINITIONS

Disturbance: The physical impact on vegetation or the soil surface. Livestock disturbance is brought about by movements or congregation of animals. A plant is considered disturbed if the roots of a plant(s) have been cut or exposed or the plant(s) have been broken or obviously crushed so that it will not rebound or recover. Bare ground that has been churned-up, displaced, or compacted. The physical impact on the soil surface brought about by the movements or congregation of livestock or humans as measured by the presence hoof marks, foot marks, tire marks, or the evidence of soil movement. Livestock trails bordering the stream or crossing it are included in disturbance measures when basal vegetation has been removed and bare ground has been exposed.

Streambank Channel Slope Break: A geomorphic feature that consists of the unbroken slope adjacent to the stream channel. The stream channel slope break can sometimes be distinguished on the landscape by an inner gorge, gully or terrace feature which distinctly separates the stream channel from upslope areas.

Stream Reach: A continuous portion of stream with homogenous physical characteristics; a specified portion of stream. Within this context stream reaches are normally defined by major channel types based upon stream gradient, streambank morphology, and channel substrates, as described by Rosgen (1995) and Montgomery and Buffington (1993).

Vegetation: Any live rooted vegetative covering, including root crown.

Bare Ground: An area of soil that has no vegetation (includes gravel and rock less than or equal to 0.5 inch diameter).

Streambank Alteration Point Method Data Form

Forest_____ Stream_____ Allotment_____ Date_____

Reach ID_____ Reach Location: Lat._____ Long._____ Sen. Reach Length_____

Channel Gradient _____ Channel Type Rosgen/Montgomery (circle one)_____

USGS Quad_____ Crew_____

RIGHT BANK

Transect Length	Enter codes for points along transects 1	2	3	4	5	6	7	8	9	10	Comments
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											

LEFT BANK

Transect Length	Points along transects 1	2	3	4	5	6	7	8	9	10	Comments
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
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21											
22											
23											
24											
25											

LDV=Livestock Disturbed Vegetation; **ODV**=Non-livestock Disturbed Vegetation; **UV**=Untrampled Vegetation;
LDB=Livestock Disturbed Bare Ground; **ODB**=Non-livestock Disturbed Bare Ground; **UB**=Untrampled Bare Ground

PLOT METHOD for measuring STREAMBANK ALTERATION

GENERAL DISCUSSION

Importance: Bank disturbance (use) due to livestock grazing, especially in alluvial channels, is a primary factor in increasing, decreasing, or maintenance of bank stability. Due to tendencies of cattle to concentrate in riparian areas, normal utilization monitoring does not adequately address the bank disturbance component of grazing impacts. This data will determine the level of bank disturbance.

TRAINING

Objectives of the measurement:

1. To be able to perform a field analysis of the level of bank disturbance (use) for the purposes of (a) monitoring; and (b) determining when cattle need to be moved to achieve range management objectives.
2. To be able to perform a more in-depth analysis of the amount of bank disturbance (use) for correlation with long-term trends in bank stability and over-hanging bank habitat formation.

How many observations to make:

50 plots (1 foot wide), 25 each side of the stream within the reach.

SAMPLING PROCEDURE

Where to take the measurement:

Step 1. Identify the sensitive reach. Select a survey segment if the sensitive reach is longer than 1,000 m (see page 11, SCI Handbook Version 3.4).

Step 2. Locate the transects on which the plots will be established. See page 13, SCI Handbook Version 3.4, for information on locating these on 1,000 m and shorter segment lengths, or you may choose your own transect interval for plots (e.g. 10 feet or 3 paces between plots, be sure to note the interval on the data sheet).

Step 3. Streambank disturbance plots can be located at every other SCI transect or approximately 40 meters apart. However, if more measurements are required, then plots can be located at every SCI transect or approximately 20 meters apart, or at a spacing that fits your situation. The location of each top and bottom of each foot wide plot is as folllows:

IF bankfull can be identified, THEN:
a) from water's edge to 1 meter past bankfull

IF top of bank is easily identified, THEN:
b) from water's edge to 1 meter past the top of the bank

IF top of bank is not easily identified, THEN:
a) from water's edge to a break in slope, or maximum of 10 meters.

IF the distance from the water's edge to one meter (3 ft.) past a, b, or c above, is greater than 10 meters (approx. 30 ft.), THEN: sample the 10 meters adjacent to the channel.

Walk along the top of the bank parallel to the stream flow. When a Streambank Disturbance Plot transect is encountered, stand at the outer most edge of the disturbance plot (away from the stream) and visualize a one foot wide plot extending from where you are standing to the water's edge. It is within this plot that the disturbance class is determined.

How to Take the Measurement:

There are five classes (levels) of use within the plot from which to choose: 0, 1-25%, 26-50%, 51-75%, 76-100%. Using only an ocular estimate, one level is identified and entered on the data sheet. The easiest way to arrive at the level of use is to first decide whether or not there is vegetation or soil disturbance; if so, then you decide whether or not the level of use is above or below 50%, from there, you decide on the final level.

Disturbance is measured by the presence of hoof marks or trampled vegetation. Livestock trails are included in trampling when bare ground has been exposed. Vegetation is trampled if the roots of the plant have been cut or exposed, or the plant has been broken or obviously crushed so that it will not rebound or recover. Only livestock disturbance is considered, other disturbance such as human foot or vehicle traffic is not counted.

Calculating Streambank Disturbance:

Quick calculation: Tally the number of plots with any level of use greater than zero. Convert into percentage. "Level of use" calculation: Tally the number of observations in each disturbance class. Using the average of the class (0, 0.13, 0.38, 0.63, 0.88), calculate the sum of all classes. Convert to percentage. (Note: if 100 data points, no conversion is necessary).

Streambank Disturbance Plot Method Data Form

Forest_____ Stream_____ Allotment_____ Date_____
Reach ID_____ Reach Location: Lat._____ Long._____ Sen. Reach Length_____
Channel Gradient _____ Channel Type Rosgen/Montgomery (circle one)_____
USGS Quad_____ Crew_____

Enter class for Plot: 0, 1 = 1-25%, 2 = 26-50%, 3 = 51-75%, 4 = 76-100%

RIGHT BANK		LEFT BANK	
Class:	Comments:	Class:	Comments:
1)		1)	
2)		2)	
3)		3)	
4)		4)	
5)		5)	
6)		6)	
7)		7)	
8)		8)	
9)		9)	
10)		10)	
11)		11)	
12)		12)	
13)		13)	
14)		14)	
15)		15)	
16)		16)	
17)		17)	
18)		18)	
19)		19)	
20)		20)	
21)		21)	
22)		22)	
23)		23)	
24)		24)	
25)		25)	