EFFECTIVENESS MONITORING
FOR STREAMS AND RIPARIAN AREAS

SAMPLING PROTOCOL FOR VEGETATION PARAMETERS

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

Fish
& Aquatic
Ecology Unit

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

EEFECTIVENESS MONITORING
FOR STREAMS AND RIPARIAN AREAS

SAMPLING PROTOCOL FOR VEGETATION PARAMETERS

BY

PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program (PIBO-EM)
Staff – Multi Federal Agency Monitoring Program; Logan, UT

CONTACT INFORMATION

If there are questions or comments about this protocol or the PIBO program contact:

Eric Archer (Program Leader)
US Forest Service
860 North 1200 East
Logan, UT 84321
435 755-3565 (office)
435 757-3233 (cell phone)
earcher@fs.fed.us

or

Ryan Leary (Asst. Field Team Leader)
US Forest Service
860 North 1200 East
Logan, UT 84321
435 755-3560 (office)
435 757-0771 (cell phone)
rleary@fs.fed.us

PIBO-EM website: http://www.fs.fed.us/biology/fishecology/emp/index.html

ACKNOWLEDGEMENTS

This protocol is built upon the pioneering work of Alma Winward (a retired Forest Service ecologist). Insight into riparian monitoring has also been provided by employees within the Forest Service, Dave Weixelman, Mary Manning, Kate Dwire, Dave Merritt, Gregg Riegel, and BLM employees Erv Cowley and Tim Burton. PIBO-Effectiveness Monitoring employees who have assisted in the development of these methods include Rick Henderson, Eric Archer, Boyd Bouwes, Alison Kelly, and Peter Ebertowski. Since 2003, over 50 field technicians have provided valuable feedback about the methods through use of this protocol.

Figure 1/Cover Photo: Goat Creek, Sawtooth National Recreational Area, Sawtooth National Forest, Idaho (Reach Name: 116-01-IS-I1-03)

TABLE OF CONTENTS

Introduction 1
Sampling Summary 2
    Data Collection Tasks 4

Estimating Cover in Quadrats 5

Greenline Vegetation 7
    What Data to Collect 7
    Where to Collect Data 7
    Determining the Greenline 9

Riparian Cross-sections 11
    What Data to Collect 11
    Where to Collect Data 12

Tree Belt-Transects 14
    What Data to Collect 14
    Where to Collect Data 15

Unknown Species 17

Collecting Specimens 18

Literature Cited 20

Appendix A: Types of Sampling Sites 21

Appendix B: Dry Sites 22

Appendix C: Data Sheets/Forms 22

Appendix D: Equipment List 27

Appendix E: Species Not Used to Determine the Greenline 28

Appendix F: Archer PDA Troubleshooting 29

Appendix G: Forms Data Backup using Sprite Backup (Archer Handheld) 30

Appendix H: Sampling Sites with Beaver Activity 31

Appendix I: Sampling with Two PDA's at a Reach 31

INTRODUCTION

The Pacific Anadromous Fish Strategy (PACFISH) and Inland Fish Strategy (INFISH) Biological Opinion Effectiveness Monitoring Program (PIBO – EM) for aquatic and riparian resources was developed in 1998 in response to monitoring needs addressed in the Biological Opinions for bull trout (U.S. Department of the Interior, Fish and Wildlife Service 1998) and steelhead (U.S. Department of Commerce, National Marine Fisheries Service 1995). An interagency team representing the U.S. Department of Agriculture, Forest Service, the U.S. Department of Interior, Bureau of Land Management and U.S. Fish and Wildlife Service, and the U.S. Department of Commerce, National Marine Fisheries Service was convened to develop a large-scale monitoring program with the primary objective of determining whether PACFISH/INFISH management practices are maintaining, degrading, or improving biological and physical attributes, processes, and functions of riparian and aquatic habitats throughout the upper Columbia River Basin.

A list of attributes that were thought to be important in defining aquatic habitat conditions and their relationship with listed fish species were identified. The list of attributes was then translated into measurable criteria and compiled to create sampling protocols for stream channel attributes and vegetation parameters (the protocol for stream channel attributes is available through contact information on title page). The team also specifically stated that existing methods be used to measure each attribute.

Given this direction, PIBO – EM uses modifications of several riparian vegetation methods. The greenline and riparian cross-section sampling methods are modifications of methods developed by Winward (2000). The major change from Winward's methods was to record species cover values in defined quadrats rather than recording community types over an undefined area. This change was driven by the difficulty of consistently and accurately characterizing riparian vegetation using community types. Levels of repeatability for methods that use community types limit their usefulness for many monitoring questions that seek to detect change (Coles-Ritchie and others 2004). The ground cover assessment method was developed based on the USDA Forest Service Region 4 soils protocol (USDA 1989). The tree belt-transect method was developed based on commonly used methods of measuring tree density and composition, such as those presented in Bonham (1989).

The protocol and the individual methods have been designed, tested, and modified specifically to sample and describe each attribute at the stream reach scale, to increase repeatability among observers, and to monitor the effects of management activities in a specific set of sub-watersheds. Sample locations for PIBO – EM are stream reaches on U.S. Forest Service or Bureau of Land Management lands which have a gradient less than 3%, and have a wadeable channel with bankfull widths up to 24 m. The vegetation sampling area corresponds to a reach length that is 20 channel bankfull widths, with a minimum reach length of 160 m and a maximum reach length of 480 m. PIBO – EM feels that the sampling methods used in this protocol should not be used in other stream types without additional review and testing.

Data at the reach and basin scale are analyzed to detect the direction and the rate of change over time as well as spatial variability due to environmental or management differences. The data analysis techniques are presented in separate documents (available through contact information on title page)

SAMPLING SUMMARY

For both the greenline and riparian cross-sections, the vegetation is assessed using a Daubenmire (1959) quadrat frame (50 cm x 20 cm) to determine species cover. Belt-transects are used to determine the abundance and species of trees at a sampling reach. Figure 2 shows an example of a reach layout with greenline, riparian cross-section quadrats, and tree belt-transects.

While in the field, PIBO – EM technicians enter data into hand-held computers referred to as Personal Digital Assistants (PDA's). There are many advantages to entering data electronically rather than on paper. A PDA allows for required entries or fields that prevents incomplete data and has drop-down menus to avoid spelling errors and illegible handwriting. Data recorded in the PDA's are downloaded to laptop computers at a field office and then sent to the centralized PIBO – EM office at the Rocky Mountain Research Station in Logan, UT where the data are imported to a database. When a PDA malfunctions, paper forms are used for data collection (appendix C) and the data are later entered into the database.

Sampling begins at channel transect 1, which is randomly located between 0 and 7 m upstream from the bottom of reach, and continues upstream until the last transect of the reach (almost always 21 to 25). The bottom (downstream end) and top (upstream end) of the reach and channel transects are determined and flagged by the stream technicians.

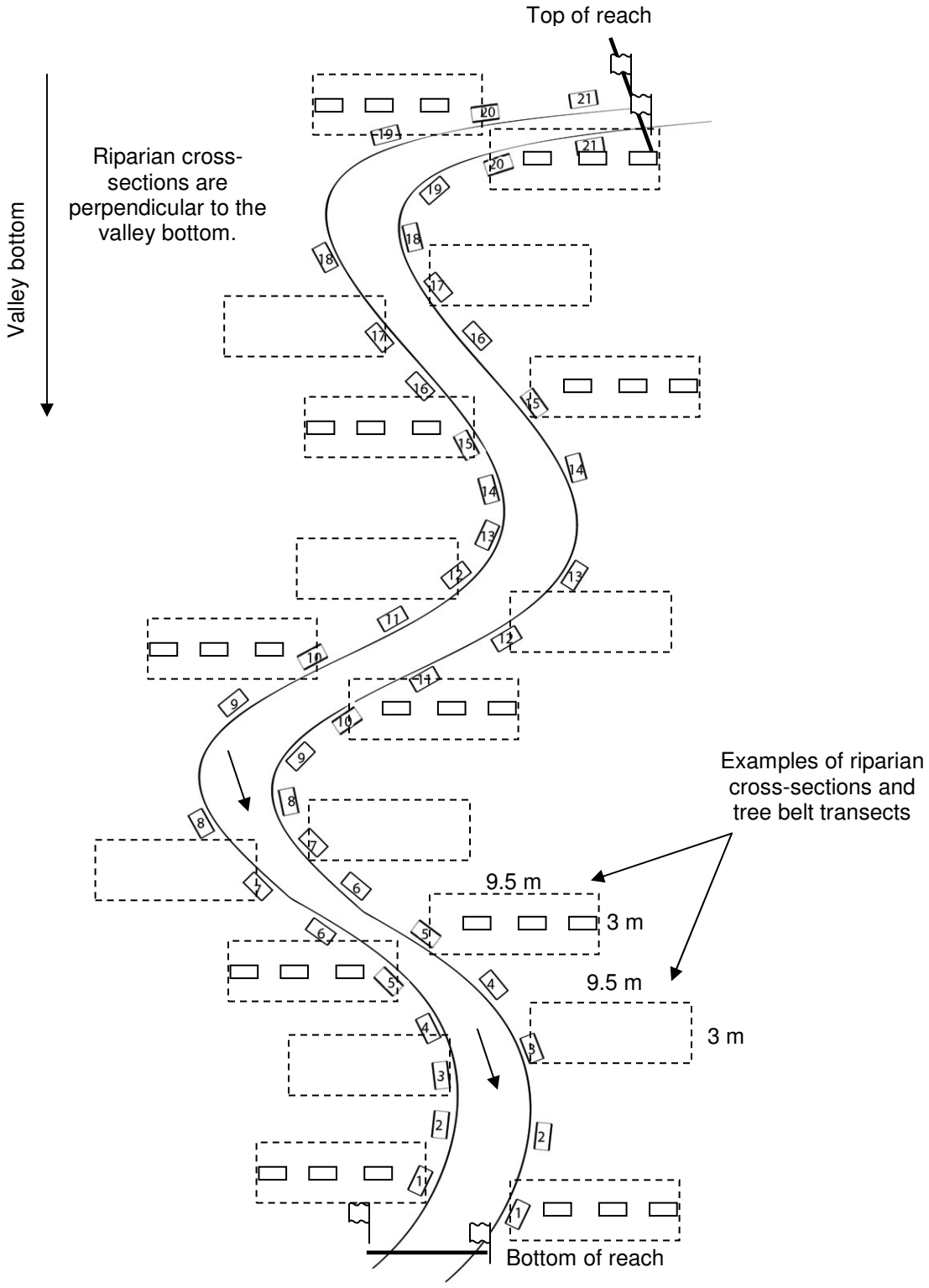

Figure 2 – Layout of greenline and riparian cross-section quadrats at a reach (quadrat size is exaggerated). Tree belt-transect area also shown for riparian cross-section transects.

Data Collection Tasks

Greenline Vegetation Data
Collect data at all channel transects on both banks, which includes:

1. species and percent cover in or over quadrats; and
2. plant height.

Riparian Cross-Section Data
Collect data at channel transects 1, 5, 10, 15, and 20, which includes:

1. species and percent cover in or over quadrats;
2. plant height; and
3. ground cover assessment.

Tree Belt-Transects
Collect data at all riparian cross-section transects and channel transects 3, 7, 12, and 17, which includes:

1. species or standing dead;
2. distance from greenline flag; and
3. Diameter at Breast Height (DBH).

Specimen Collection
Collect specimens for unknown and dominant plant species at every reach. The four most dominant plant species are collected at every reach, regardless if you have collected the same species as a dominant at another reach for that hitch.

The same data collection tasks and methods are used at every reach regardless of the type of site. (see appendix A for types of sites)

It will generally take about 6-8 hours to complete a reach, which includes 42-50 greenline quadrats, 30 cross-section quadrats, 18 tree belt-transects, and plant specimen collections. At the beginning of sampling it is often necessary to spend extra time identifying the most abundant species. If extra time is taken for quadrats early in the day, then quadrats later in the day will need to be done much quicker.

If you finish before the stream technicians, then assist them to complete the reach by drawing the site map, operating the data logger or holding the tape or stadia rod. Ask the stream technicians how you can help.

The rest of this document explains the sampling methods in detail.

ESTIMATING COVER IN QUADRATS

A 50 cm x 20 cm Daubenmire (1959) quadrat frame (figure 3) is the area to consider for determining vegetation cover. Cover is considered to be “the vertical projection of all vegetation parts…onto the ground” (Bonham 1989).

Vegetation that is Counted as Cover

1. Live vascular vegetation (leaves, branches, stems, tree trunks, or exposed roots) in, or over the quadrat (vegetation does NOT need to be rooted in the quadrat to count as cover).
2. Senesced leaves or plants from the current year.

Do not count dead branches or leaves of previous season as cover. They should be moved if they obscure live vegetation. Also, do not count vegetation as cover if it overhangs the quadrat and is rooted on the opposite side of the stream or is in the streambed.

To Determine Cover

1. First, look down at a 90 degree angle from the quadrat to determine what species have coverage at or below 1 m over the quadrat. Estimate the percent cover of each species that is visible at the 1 m height (imagine that there is no other vegetation above 1 m). When looking down, do not move live vegetation that is below 1 m to see obscured vegetation: for example, small forbs under sedges or grasses.
2. Second, look straight up (directly overhead, not a 90 degree angle from the quadrat) to determine percent cover of each species above 1 m over the quadrat. When looking up, only consider the vegetation visible from the quadrat from a height of 1 m; do not move around to see more and do not move live vegetation above 1 m to see obscured vegetation: for example, trees over shrubs.

If a quadrat only has species with cover below 1 m then the total percent cover should not exceed 100% (although the sum of the cover class midpoints may slightly exceed 100%). If a quadrat has cover below 1 m and above 1 m, then the total percent cover may be up to 200% for the quadrat. If a species has cover in both layers then record the total area covered by that species, which is not necessarily the sum of percentages from both layers.

Record percent cover for each species in a quadrat with greater than 5% cover using the Daubenmire cover classes (table 1). Do not record species that have less than 5% cover in a particular quadrat.

The painted areas on the quadrat frame (figure 3) are to help in assigning Daubenmire cover classes (table 1). The painted areas correspond to 5%, 25%, 50%, 75%, and 95% of the quadrat.

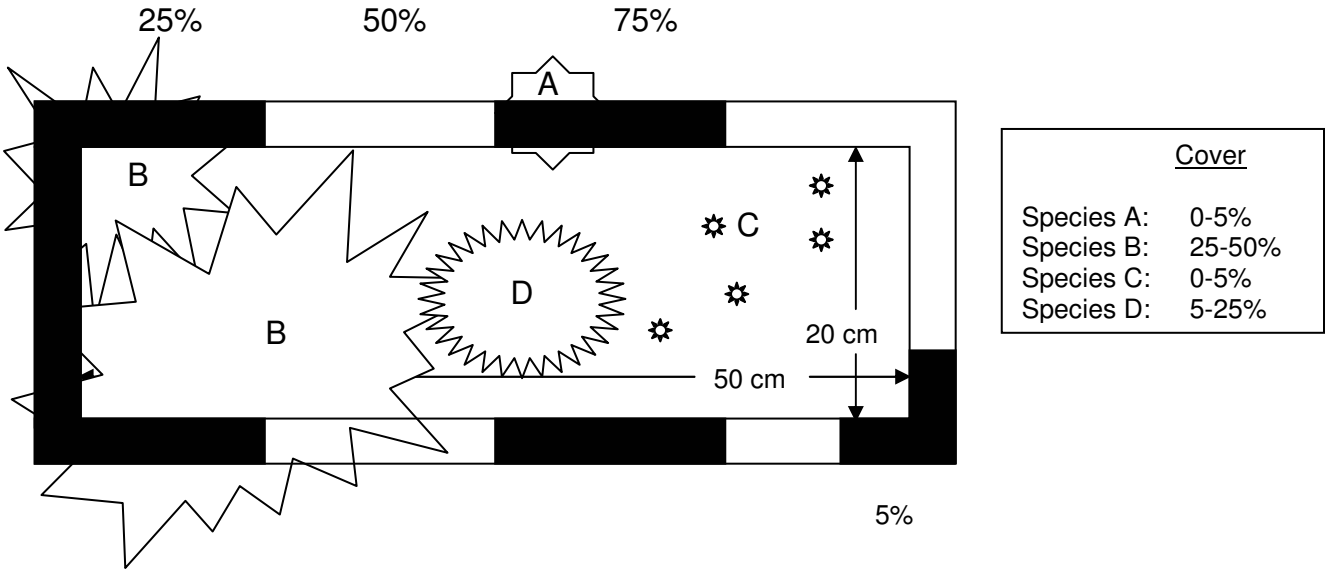

Figure 3 – The Daubenmire quadrat frame used to define the area where species cover will be estimated.

Table 1 – Cover classes and cover ranges.

Cover class	Range of cover (%)	Cover class midpoint
1	0 to 5	2.5
2	5 to 25	15.0
3	25 to 50	37.5
4	50 to 75	62.5
5	75 to 95	85.0
6	95 to 100	97.5

GREENLINE VEGETATION

The concept of the "greenline" as a location to sample and monitor streamside vegetation was presented by Winward (2000) who described it as "the first perennial vegetation …on or near the water's edge". The greenline is a useful location to measure vegetation along streams because it is the dynamic interface of the stream and terrestrial ecosystems.

Objective

To describe the vegetation immediately adjacent to the stream.

What Data to Collect

1. Species cover: record species cover data for each quadrat associated with a channel transect, on both sides of the stream. If no individual species has greater than 5% cover, then record the species with the highest cover, which is the only time to record species with less than 5% cover.
2. Plant height: record the height of each species with cover over the quadrat. Record the tallest height (inside or outside the quadrat) of an individual with at least some cover over the quadrat using the following categories:
    a. 0 – 0.5 m (0 – 1.6 ft)
    b. 0.5 – 1 m (1.6 – 3.3 ft)
    c. 1 – 2 m (3.3 – 6.6 ft)
    d. 2 – 4 m (6.6 – 13 ft)
    e. 4 – 8 m (13 – 26 ft)
    f. >8 m (>26 ft)

Where to Collect Data

1. Collect data at all channel transects (usually 21 to 25 per reach). The channel transects will be 8 – 24 m apart depending on the channel bankfull width category, or 6 m apart at designated monitoring areas/key sites.
2. Each channel transect will have one flag on each bank. Ideally, flags are numbered or labeled (such as "O" for odd numbered transects and "E" for even numbered transects). Transects 1, 5, 10, 15, and 20 will have different color flags than the other transects to indicate transects where riparian cross-section data is collected.
3. At each channel transect find the two flags (one on each bank) associated with that transect and imagine a line connecting the two flags. Both greenline quadrats will be along that imaginary line (figure 4).
4. Place the quadrat frame with the long sides (50 cm sides) parallel to the stream while keeping the streamside, mid-point of the quadrat on the imaginary line (figures 3 and 4). This point is known as the pivot point.
5. The quadrat frame can be rotated, from the pivot point, up to an angle of 45 degrees to capture more rooted vegetation. This is especially useful on cut-banks where part of the quadrat may be hanging over water.
6. Place the quadrat so that the streamside of the frame is at the base of perennial vegetation, whether herbaceous or woody.
    a. Most of the time the canopy, especially with sedges, grasses, and forbs, is the same as the base (left side figure 5). However, the canopy does not

always indicate where to place the quadrat, especially for shrubs and trees. If plants are hanging over the edge of the stream, but are not the first rooted vegetation, then move away from the stream on the imaginary line until the first rooted perennial vegetation is encountered (right side of figure 5).

7. Place a yellow flag at the streamside mid-point of the quadrat frame and leave the flag there all day. This greenline flag should be in line with both channel transect flags and the corresponding greenline flag on the opposite bank (figure 4). The stream technicians will measure the distance from their stability plot to the greenline flag. This measurement helps correlate stream transect data with vegetation data.
8. On a vertical streambank with perennial vegetation on the vertical face, move the quadrat away from the stream along the imaginary line until the quadrat frame is at a 45 degree angle or flatter. If a hillslope with vegetation next to a stream is greater than 45 degrees, and the quadrat would have to be moved more than one meter, then it is ok to place the quadrat at an angle > 45 degrees.
9. If there is no transect flag do not collect greenline, riparian cross-section, or tree belt-transect data for that transect on that bank but make a comment in the PDA as to why there is no data. This situation may arise due to a sinuous stream or when a transect would be at the mouth of a tributary.

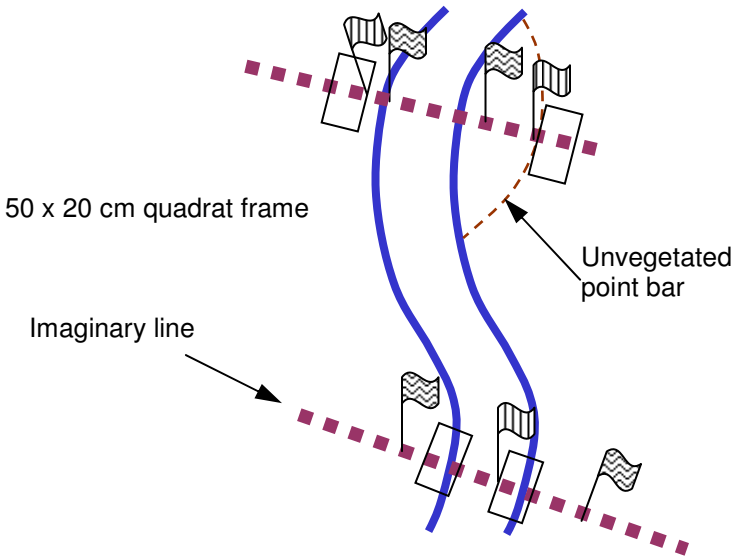

Figure 4 – The relationship of channel transect flags (wavy lines), greenline flags (vertical lines) and greenline quadrats on the imaginary line.

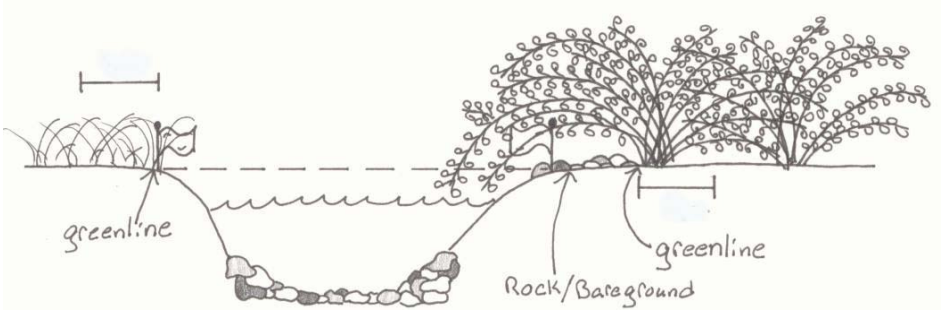

Figure 5 – Greenline location at the rooted point of vegetation, not necessarily at the canopy of woody vegetation (right) or transect flag.

Determining the Greenline

The greenline is the vegetation closest to the stream, or in the stream margin, that meets the following criteria:

- At least 25% cover of live, perennial, vascular species rooted in the quadrat (regardless if the rooted vegetation is obscured by other live vegetation ≤ 1 m).
    1. Cover can be from one species or a combination of species.
    2. The only situation where vegetation is moved to see obscured vegetation below is when the obscuring vegetation is less than 1 m, not rooted in the quadrat, and a greenline can be obtained by moving the obscuring vegetation.
    3. Always record both the full cover of rooted vegetation that was <u>used to define the greenline</u>, even if it is obscured by vegetation within 1 m of the ground, and the vegetation that was obscuring the greenline. This is the only situation where a quadrat could have over 200% coverage.
- Indicators that a plant is perennial: woody tissue (above or below ground), leaves/stems present from previous year, or roots stained brown rather than white.
- Annuals, biennials, and species that are sometimes annuals, are <u>not</u> used to define the greenline, but are recorded in a qualifying greenline quadrat.
- The vegetation does not need to be continuous along the stream to be the greenline. Patches of vegetation surrounded by bare areas can be considered the greenline when there are no bare patches 10 cm in diameter or greater within the quadrat. Bare is defined as soil, sand, and gravel <2.5 cm. The bare patch within the quadrat can have up to 20% litter.
- The greenline will never extend below where the streambed meets the stream bank (this is especially important on dry streams and when veg extends into the water). The location where the streambed and stream bank meet can be identified by:
    1. Break in the relatively steep stream bank slope to a more gently sloping streambed.
    2. Rapid fining of particles from relatively coarse streambed particles to the finer stream bank particles.
    3. Normally (but not always) below the current water level.
    4. The streambed usually has <50% terrestrial vegetation cover.
    5. The stream bank material is usually consolidated versus the streambed material which is unconsolidated.
- The greenline may be distant from the water in the case of sandbars, gravel bars, cut-banks, or heavily forested systems. Record the first perennial vegetation, even if it is an upland species such as sagebrush.
- The greenline may be in the water at high flows or when bank building is occurring, as sometimes happens with sedges (*Carex* spp.), rushes (*Juncus* spp.), spikerushes (*Eleocharis* spp.), bulrushes (*Scirpus* spp.), and willows *(Salix spp.)*. Vegetation in the water can be the greenline if the greenline quadrat is not below where streambed and stream bank meet.

    Do not over-estimate percent cover of vegetation that is bent over by flowing water.
- Islands in the channel are not the greenline. Islands are defined by having an elevation greater than or equal to bankfull. When there is a question or situation as to what is or is not an island ask the stream technicians for assistance and clarification.

- The greenline can never be on the opposite side of the stream that the transect flag is placed on. If this occurs do not collect data and make a comment in the PDA.
- Aquatic species:
    1. Free floating, totally submersed, or bottom rooted and floating aquatic species (middle four plants of figure 6) are <u>not</u> used to define the greenline. Some common aquatic species that do not define the greenline are: common duckweed (*Lemna minor*), spike water-milfoil (*Myriophyllum spicatum*), American white waterlily (*Nymphaea odorata*), watercress (*Nasturtium officinale*), whitewater crowfoot (*Ranunculus aquatilis*), water speedwell *(Veronica anagallis-aquatica)* and water knotweed (*Polygonum amphibium*). If such species are part of a qualifying greenline then their cover should be recorded.
    2. Totally emergent aquatic species <u>are</u> used to define the greenline (left and right side of figure 6) Emergent aquatic species are typically grasses and grass-likes that include: *Carex aquatili*s, *Scirpus microcarpus*, *Glyceria grandis*, *Typha latifolia*, and *Eleocharis palustris*.

Figure 6 – Aquatic plants.

- Slump blocks are pieces of the bank that are detaching or that have detached from the streambank. Slump blocks are only considered the greenline if the slump block has re-attached itself to the stream bank. Consider the slump block unattached if only gravity/friction is keeping it in place.
- When wood, logs, root wads, or stumps greater than 70 cm in diameter, or a group of logs that together are 70 cm in diameter are streamside and adjacent to the greenline then record “not veg: log >70 cm” and <u>always</u> record the vegetation on the riparian side of the wood. If a log extends exactly parallel to the imaginary transect line, preventing the identification of the greenline until the distant end of the log then record the greenline vegetation just upstream of the log.
- A log with a qualifying greenline suspended over the stream or ground is <u>not</u> the greenline. When a log is on the ground and part of the bank and has a qualifying greenline on top of the log then it is considered the greenline.

- When a large rock is streamside and adjacent to the greenline or there is a massive rock feature record:
    1. "not veg: rock >70 cm" – for a rock that is >70 cm in diameter along any axis. Vegetation data on the riparian side (opposite of stream side) of the rock are always recorded.
    2. "not veg: massive rock feature" – for a talus slope or a cliff. Vegetation data are not recorded at the location of the massive rock feature, which includes:
        a. talus – a sloping mass of loose rocks that is part of the hillslope; or
        b. cliff – a high, steep face of rock (and possibly loose sediment) that is part of the hillslope, and not part of the valley bottom. A cut-bank is not a cliff, because it is within the valley bottom.
- Burned sampling locations:
    1. If a burned transect has no greenline within 10 m of the transect flag (established by stream technicians) then place the greenline quadrat at the transect flag and record the appropriate "not veg" category, any vegetation cover over 5%, and put "burned" in the comments in the PDA.

RIPARIAN CROSS-SECTIONS

Objective

To describe the vegetation and ground cover in the riparian area.

What Data to Collect

1. Valley bottom or hillslope/upland: to distinguish valley bottom from hillslope/upland, use landform as the only indicator. The valley bottom is the generally flat area constrained by the hillslope/upland, which has been formed by flooding from the stream. Terraces are included within the valley bottom (figure 7). Hillslope/uplands will generally be on a slope, but not always.
2. Ground cover: place the quadrat on the ground or rest it on vegetation that covers the ground. If there is live vegetation at or below 1 m covering any corner of the quadrat frame, looking from directly above, then record the number of corners with "vegetation". For corners of the quadrat without vegetation cover slide a flag pin against each of the inside corners of the quadrat and record the number of points in each of the following categories:
    a. bare = soil, sand, and rock <2.5 cm
    b. wood = woody stem >10 cm in diameter lying on the ground
    c. rock = > 2.5 cm
    d. litter/moss = downed organic matter (leaves, needles, and branches <10 cm)
    e. vegetation = live leaves, stems, or branches

    The total number of points should always be 4.
3. Species cover: same as greenline, except:
    a. A riparian cross-section quadrat is never moved, even if it has <25% total cover of live vegetation. When looking from 1m and below record the appropriate "not veg" category if any of the following are >5% for a quadrat:
        i. not veg: bare (soil, sand, and rock <2.5 cm) (XS only)
        ii. not veg: litter/moss (XS only) (defined above)
        iii. not veg: log or stump >10 cm (XS only)

iv. not veg: massive rock feature (defined in determining the greenline)
v. not veg: rock >2.5 cm (XS only)

If >5% of a quadrat is water record what the substrate is or what is underneath the water.

4. Plant height: same as greenline

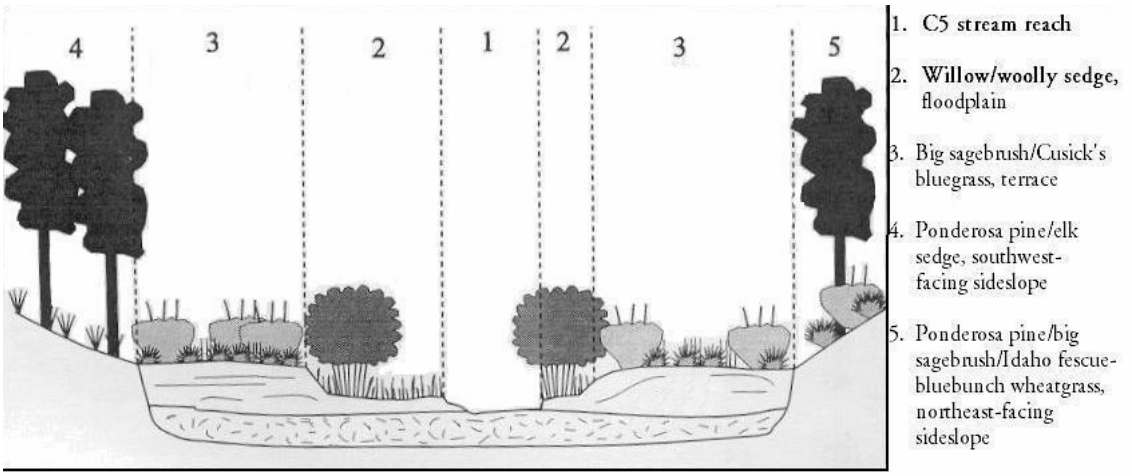

Figure 7 – Diagram showing changes in topography that correspond to different communities and the distinction between valley bottom (numbers 1, 2, and 3) and hillslope/upland (numbers 4, and 5) (from Crowe and Clausnitzer 1997, used with permission).

Where to Collect Data

1. Channel transect numbers 1, 5, 10, 15, and 20 (not 25).
2. Riparian cross-sections begin at the greenline quadrat flag and extend into the riparian area or hillside perpendicular to the direction of the valley bottom, not necessarily perpendicular to the stream (figure 2).
3. Align a compass to the direction of the valley bottom where the sample reach is located, add 90 degrees to the bearing, and use this new bearing (or 180 degrees from that when walking the other direction) for all five riparian cross-sections and record it in the PDA "Reach" form.
4. At each riparian cross-section transect collect data and place a flag at 3, 6, and 9 m from the greenline quadrat flag in the direction of the established compass bearing. When setting up quadrats, measure distance along the ground using a measuring stick/depth rod to determine the 3, 6, and 9 m quadrat placements.
5. Place the quadrat frame:
    a. with the long side (50 cm) parallel to the riparian cross-section line;
    b. at the 3, 6, or 9 m point and continuing to 3.5, 6.5, or 9.5 m; and
    c. with the short side (20 cm) centered along the riparian cross-section line.
6. If the stream is very sinuous, a riparian cross-section may intersect the stream. When measuring the riparian cross-section distance do not measure areas within the streambed (figure 8).
7. Riparian cross-section quadrats can be on the greenline if the stream is parallel to the cross-section bearing (figure 8).
8. Riparian cross-sections may be close together, or along the same line, if the channel is very sinuous (figure 8). They should not cross since they use the same bearing and are therefore parallel.

9. Do not record any data on islands or measure any cross-section distance on islands (figure 8).
10. Riparian cross-section quadrats can be placed on a slope at an angle >45 degrees and are not moved as in the greenline.
11. When a quadrat is inaccessible because the vegetation is very thick or thorny or the slope is too steep to safely access then estimate the ground cover and species cover as best possible from a distance.
12. If an entire riparian cross-section or an individual quadrat cannot be estimated, then make a comment in cross-section quadrats for each quadrat where data could not be collected.
13. When there is a massive rock feature for a transect or quadrat where riparian cross-section data is supposed to be collected do the following:
    a. talus – collect data in the talus field, if it can be done safely, using "not veg" categories and any species data present. If the entire cross-section is talus then start measuring the 3, 6, and 9 m distances from the transect flag; or
    b. cliff – use "not veg: massive rock feature" and no vegetation data is collected.

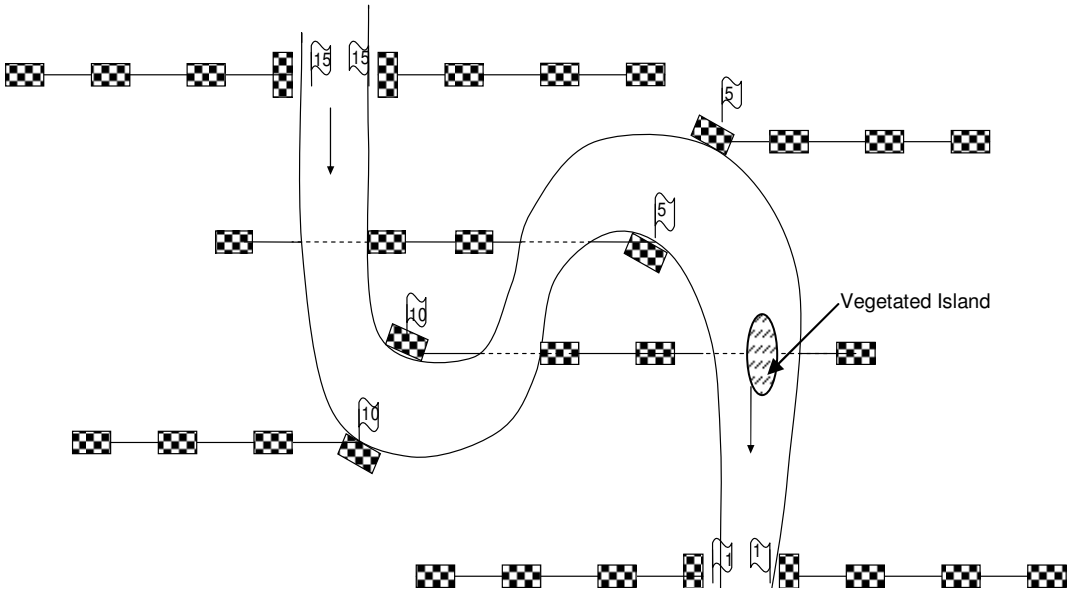

Figure 8 – Riparian cross-sections that intersect the channel on a sinuous stream.

TREE BELT-TRANSECTS

Objective

To determine the number, size, and species of trees in the riparian area.

What Data to Collect

1. Data are collected for each tree with a trunk that is:
    a. entirely within the 3 x 9.5 m belt-transect at a height of 1.4 m above the ground;
    b. ≥4 cm in diameter;
    c. ≥1.4 m tall; and
    d. living, or standing dead trees that are free standing.
2. Also record data for trees that are partially within (boundary trees) the 9.5 x 3 m zone at a height of 1.4 m above the ground, based on the following criteria:
    a. Include boundary trees that are on the right side when walking back towards the greenline flag (figure 9).
    b. Exclude boundary trees that are on the left side (it is "left out") when walking back towards the greenline flag (figure 9).
    c. If the boundary tree straddles the 0 m or 9.5 m boundary, then include it the first time this situation is encountered, but exclude it the next time there is a boundary tree at 0 m or 9.5 m for that reach (figure 9).
3. Record the following:
    a. If there are no qualifying trees in the 3 x 9.5 m belt-transect then check the box titled "No trees ≥ 4cm DBH" in the "Tree transects" table and the "Trees data" table does not need to be entered.
    b. If there are qualifying trees in the 3 x 9.5 m belt-transect then record:
        i. Species, unknown #, or ".standing dead".
        ii. Distance from the greenline flag to the closest edge of the tree at 1.4 m above the ground along the riparian cross-section (use the flags at 3, 6, and 9 m as reference points) (figure 10).
            - If two individuals of the same species and of the same DBH class are at the same distance, then give them slightly different distances (for example, 4.5 m and 4.6 m) since there can only be one individual of each species, of a given size class, in the PDA at each distance.
        iii. Diameter at Breast Height (DBH) in centimeters, at 1.4 m above the ground, according to the following classes:
            - 4 – 10 cm
            - 10 – 20 cm
            - 20 – 40 cm
            - 40 – 80 cm
            - 80 – 160 cm
            - >160 cm
        iv. Do not count the same tree twice if it occurs in 2 belt-transects due to a sinuous stream.

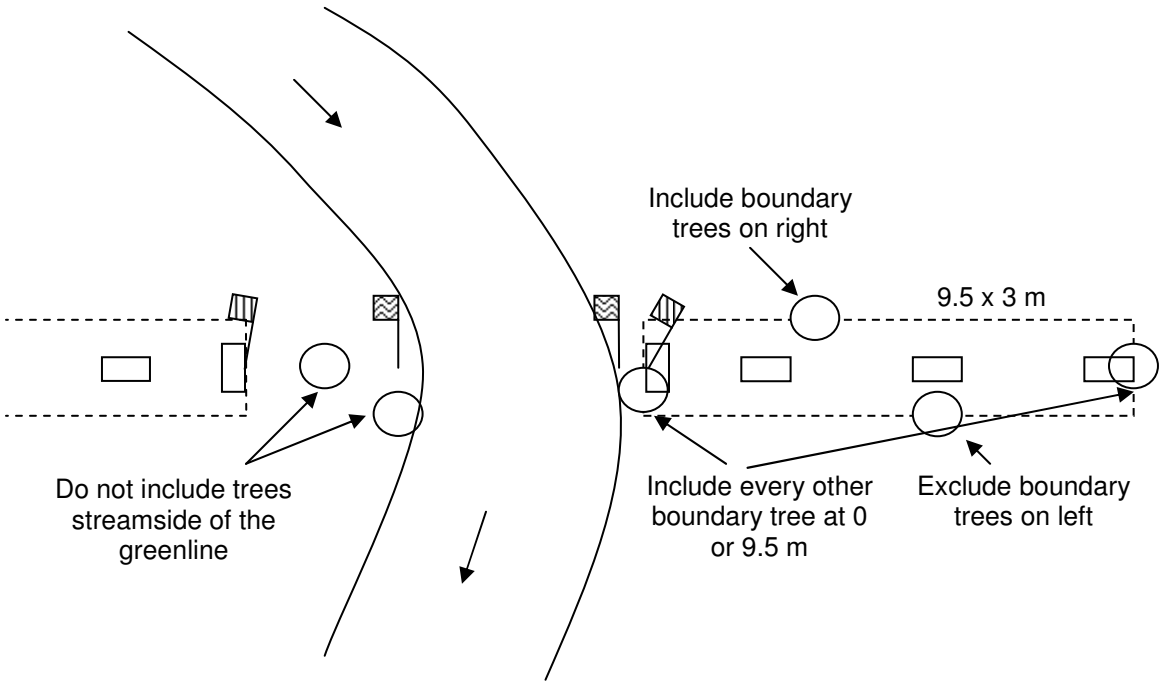

Figure 9 – Boundary trees and trees streamside of the greenline. Greenline flags (vertical lines), transect flags (wavy lines), and quadrats shown.

Where to Collect Data

1. Record trees at each riparian cross-section (channel transects 1, 5, 10, 15, and 20), and at the 2nd channel transects after those (3, 7, 12, and 17). Do not collect data at transects 22 and 25.
2. The area of consideration is 1.5 m on both sides of the cross-section line, beginning at the greenline flag (0 m) and extending to the end of the cross-section (9.5 m) (figure 3 and 9). Do not count trees that are streamside of the greenline flag (figure 9).
3. Use the same bearing that is used for riparian cross-sections.
4. When walking along the cross-section line hold a measuring stick/depth rod to determine which tree trunks are within 1.5 m on each side of the cross-section line (using the flags at meters 9, 6, 3, and the greenline as a guide).
5. If a tree has multiple trunks or boles (sometimes with cottonwoods or conifers) do the following:
    a. if the trunk forks below 1.4 m, then measure each trunk as an individual, as long as it meets the above criteria for being counted; or
    b. if the trunk forks exactly at 1.4 m, then measure the DBH below the fork.
6. Always measure the DBH from the same height, using the following critera:
    a. on slopes, measure the DBH 1.4 m above the ground on the uphill side of the tree (figure 11);
    b. for inclined/leaning trees, measure the DBH at 1.4 m above the ground (figure 10); and
    c. measure the DBH perpendicular to the stem of the tree (figure 10 and 11).

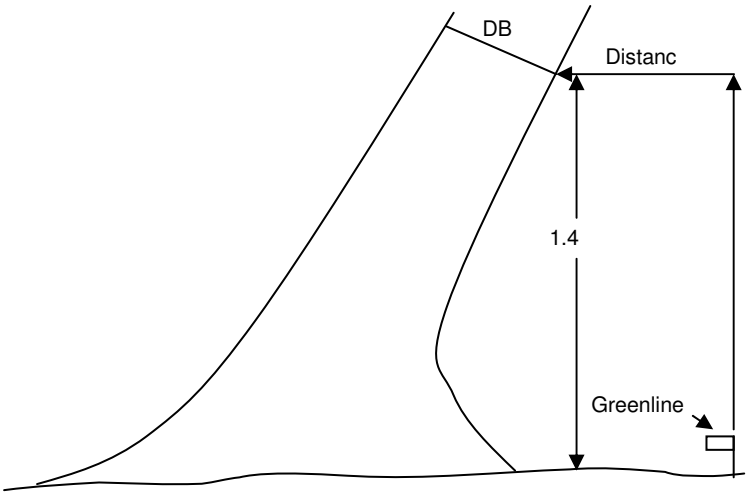

Figure 40 – Measuring DBH and distance from greenline flag to the closest edge of a leaning tree.

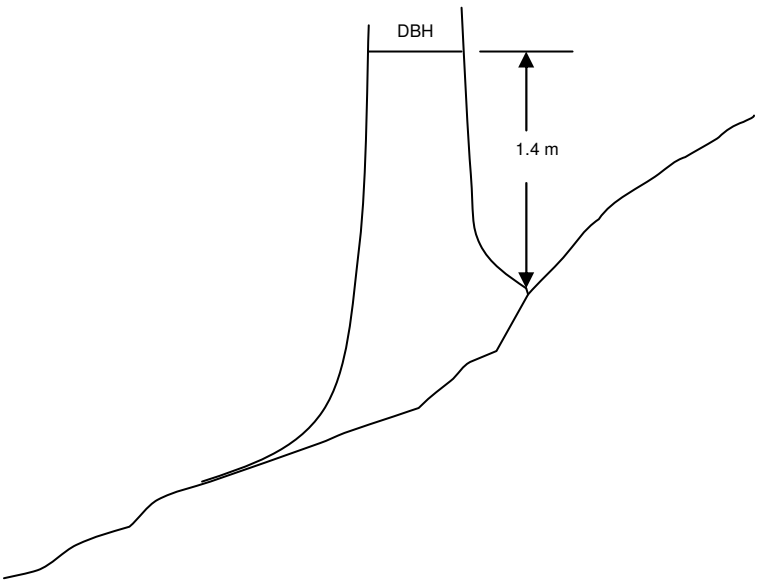

Figure 41 – Measuring trees on hillslopes.

Tree Definition

For this study, a tree is a species that grows as a single-stemmed individual most of the time (pines, firs, spruces, cottonwoods, and aspens). Woody plants NOT recorded for this method include species with multiple stems, such as many willows (for example, *Salix boothii*), alders (for example, *Alnus incana*), Rocky Mountain maple (*Acer glabrum*), red-osier dogwood (*Cornus sericea*), or water birch (*Betula occidentalis*). There is a list of trees to choose from in the PDA. You can also add a species if you think it is single-stemmed, and it is not in the list.

UNKNOWN SPECIES

When an unknown species is encountered and it is greater than 5% cover in a quadrat, do the following:

1. Key it out using *The Flora of the Pacific Northwest* or another appropriate key.
    a. In general, do not spend more than 10 minutes keying out any particular species or 20 minutes total at a quadrat. If a certain species looks abundant at the reach then it may be worthwhile to spend some extra time identifying it.
2. Some species cannot be identified in the field because a microscope is necessary, or because flowers are not available. In such cases, collect a specimen (see instructions on collecting specimens below), rather than spending time trying to identify it.
3. If a plant species cannot be identified then collect it. At each reach record the first plant collected as "unknown 1" and number subsequent unknowns sequentially for that reach. At the next reach start with "unknown 1" for the first plant collected at that reach.
4. Record all unknowns in the "Specimens" table in the PDA and field notebook:
    a. Use the exact same name on the plant label, in your field notebook and in the PDA.
    b. Call each unknown the same thing for the entire reach; do not change the identification of an unknown while at a reach. If the identification of an unknown is determined later in the day, continue entering that plant as "unknown #" and in the "Specimens" table record the correct ID in the comment field.
5. **Even if the identification of an unknown is later determined for a reach, collect a specimen to send to the office.**

NOTEBOOK

In your notebook, please record some basic information for each reach. Start each reach at the top of a page and record the following information:

1. Group, Order, Reach Type, Reach ID, and Stream Name
2. Date and Crew
3. List of specimens collected (all unknowns, dominants, and TES)
    a. Note some distinguishing features so that the specimen can be recalled when it is seen again (for example: clumped grass with open panicle, short sedge with terminal spike, small forb with yellow petals, etc.)
4. Comments about site ("PDA crashed on transect 14") and about missing data or where data could not be collected and explaining why data is missing.
5. Questions about:
    a. methods; or
    b. difficult species

During the field season your notebook can help answer questions for database managers. At the end of the field season **all technicians will turn in their notebook(s).**

COLLECTING SPECIMENS

When to Collect Plant Specimens

Unknown Specimens
Collect a specimen of all unknown plants with more than 5% cover in a quadrat. Collect a specimen only once for that species at a reach.

Dominant Specimens
At the end of sampling each reach, collect specimens of the four plant species that are the most abundant (total percent cover for sampled quadrats) at the reach. The specimen must be a species that was recorded in the PDA for that reach.

Threatened and Endangered Species
When a TES (threatened and endangered species) plant is encountered, and there are more than 20 individuals, only collect a portion of the plant (the parts necessary for positive identification). Do not dig up the plant, thus negatively impacting it. If there are fewer than 20 individuals of the TES plant do not collect any portion of the plant. Write careful notes about all encountered threatened and endangered species (for example: the shape of the inflorescence, rooting type, habitat, etc.).

How to Collect Plant Specimens

1. Follow the 1 in 20 rule; if there are fewer than twenty individuals at the reach do not collect the plant. If this is the case then enter the species in the PDA and describe the habitat, characteristics, etc.
2. Collect all specimens (including dominants) from a quadrat, while at that quadrat.
3. Collect as much of the plant as can be easily obtained (except for TES species; see above) including:
    a. Roots: dig 2” down (with trowel) and 2” around the plant to obtain some of the roots. Shake the sediment from the roots or rinse the roots in the stream.
    b. Flowers and mature fruits, if both are present.
    c. For woody plants collect branches with leaves and flowers/fruits/cones. A good sample includes older growth, not just the current season’s growth.
    d. At least two pieces, with one label, so that we can dissect some without destroying everything (for example, multiple stems and inflorescences of a grass or multiple branches of a woody plant).
4. Every specimen must have a label (figure 43). If provided labels are not used while in the field, then transfer the information to a correct label at the end of the hitch.
5. Place the specimen and label between newspaper, with the label folded (only once) around the specimen and the writing facing inward, and then between felt blotters in the plant press.
6. Medium-sized newspapers (often the free ones) work well. Try not to use anything smaller than the field press. Fold the newspaper only once, do not gift wrap.
7. Envelopes are provided for small plants and seeds/fruits.
8. Make sure specimens can air out so that they do not get moldy. Don’t keep presses in plastic tubs because plants will not dry out. Also, try to keep presses off of the bottom of the bed of the truck so that it will not get wet.
9. Record all collected specimens (unknowns, dominants, and TES) in the “Specimen” table in the PDA and in your field notebook.

10. At the end of the reach put newspaper around all the specimens for the reach and write on the outside newspaper the group, order, reach type, reach ID, stream name, and crew.

How to Label Plant Specimens

For each specimen, fill out and attach one of the plant labels provided (figure 43) with the following information:

1. Plant ID: record the species or unknown # that is also recorded in the PDA and field notebook.
2. Reason collected: circle all categories that apply.
3. Habit/Comment: record information that will be useful to identify this plant in the lab, which may not be apparent when the specimen is looked at later (for example: inflorescence color, number of petals, sepals, stamens, stigmas, plant height, root structure, etc.).
4. Greenline or Cross-section: bank, transect, and meter (cross-section only).

Specimens that are not well labeled are useless.
Some technicians may want to key out an unknown species at a later time. If an unknown species is identified add that information to the label, BUT DO NOT ERASE OR CHANGE ANYTHING ON THE LABEL, BECAUSE THAT IS OUR ONLY LINK BETWEEN THE SPECIMEN AND THE DATA IN THE PDA.

LITERATURE CITED

Bonham, C. D. 1989. Measurements for Terrestrial Vegetation. John Wiley and Sons, Inc. New York.

Coles-Ritchie, M.C.; Henderson, R.C.; Archer E.A.; Kennedy, C.; Kershner J.L. 2004. The repeatability of riparian vegetation sampling methods: how useful are these techniques for broad-scale, long-term monitoring? Gen.Tech.Rep.Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Crowe, E.A. and R.R. Clausnitzer. 1997. *Mid-Montane Wetland Plant Associations of the Malheur, Umatilla and Wallowa-Whitman National Forests*. USDA Forest Service Pacific Northwest Region. R6-NR-ECOL-TP-22-97.

Daubenmire, R.F. 1959. *Plants and environment: a textbook of plant autecology.* John Wiley and sons. New York.

U.S. Department of Agriculture, Forest Service, Intermountain Region. 1989. Soil quality monitoring methods. Internal publication. Ogden, UT. 60 p.

U.S. Department of Interior, Fish and Wildlife Service, 1998. Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for the Klamath River and Columbia River Distinct Population Segments of Bull Trout Final Rule. Federal Register June 10, 1998 (Volume 63, Number 11, Pages 31647-31674) 50 CFR Part 17, RIN 1018-AB94.

Winward, A.H. 2000. *Monitoring the Vegetation Resources in Riparian Areas*. USDA Forest Service, Rocky Mountain Research Station. RMRS-GTR-47.

Appendix A: Types of PIBO – EM Sampling Sites

PIBO – EM feels that the sampling methods used in this protocol should not be used in other stream types without additional review and testing. Riparian vegetation and stream habitat data are collected at two different types of sampling sites: integrators and designated monitoring areas or DMA's (also known as key sites).

Integrator Sites

Integrator sites are the most common PIBO-EM sampling site. They are called integrator sites because they are intended to capture the integrated effects of disturbance in the watershed upstream of the sample site. Integrator sites are between 160 and 480 m in length, measured along the stream's thalweg. Sample length is proportionate to the bankfull width; with a minimum transect spacing of 8 m and a maximum transect spacing of 24 m. Integrator sites are established in 6th field Hydrologic Unit Code (HUCs) watersheds in which seven are randomly selected from a group of 20. Within the 6th field HUC watershed, integrator sites are located at the furthest downstream location with over 50% federal land ownership and a stream gradient less than 3%. Approximately 15% of integrator sites have stream gradients between 3 and 5%. Integrator sites are sampled on a five year rotation.

Designated Monitoring Sites

Designated monitoring area sites are sampled because:

1. livestock grazing was targeted in the biological opinions as being a primary management activity of concern on USFS and BLM lands; and
2. DMA's provide a direct link between implementation monitoring (was the direction in the allotment management plans followed?) and effectiveness monitoring (are management practices effective in maintaining or restoring the structure and function of riparian and aquatic habitats?).

DMA sites are not randomly located; rather their location is specifically selected, usually by local districts, to assess the impacts of livestock on riparian vegetation and stream habitat. DMA sites are evaluated during and after the grazing season to insure that the pasture received proper use (implementation monitoring). For the effectiveness monitoring component, PIBO – EM will sample a subset of all DMA sites within the study area. Specifically, PIBO – EM will sample one DMA site in all grazed watersheds where an integrator reach is sampled. At DMA sites there will always be 21 channel transects set up at 6 m intervals, regardless of the average channel bankfull width, and the reach length will always be 120 m (see below for exceptions).

Large River (Unwadeable) DMA Sites
Although this is a rare occasion, some DMA sites are located along large, unwadeable rivers (for example, the John Day, Grande Ronde, and Deschutes Rivers) on BLM land in eastern Oregon and are sampled in a different way. Only one side of the river is sampled due to an unwadeable channel and methodologies not being established for such large size rivers. Therefore, 42 transects will be set up with a spacing of 6 m per transect. Sampling methods are the same for large river DMA sites except that data is collected from only one side of the river:

1. collect greenline data at all 42 transects;
2. riparian cross-section data is collected at every 5th transect (1, 5, 10, 15, 20, 25, 30, 35, and 40); and
3. tree data is collected at the riparian cross-section transects and at the 2nd channel transect after those (3, 7, 12, 17, 22, 27, 32, 37, and 42).

Integrator Sentinel Sites

Sentinel sites are integrator sites that are sampled every year.
Sentinel sites serve two purposes:

1. determine how fast attribute conditions change through time; and
2. generate a yearly estimate of site variability (for example, high water year vs. low water year).

Some of these integrator, key, or sentinel sites are sampled more than once each year, by different crews, to evaluate variability among crews. At these repeat sites all data are collected independently by the different crews.

Appendix B: Dry Sites

At the time of sampling, some reaches (integrator or DMA) may only have water in part of the channel or may have no water at all. All data is collected at these reaches and normal sampling procedures are followed. If a reach has no water, then the determination for greenline will start where the streambed meets the stream bank. Move away from the stream along the imaginary line between the two transect flags until a qualifying greenline is reached. Never collect data in the streambed, even if there is a qualifying greenline.

Appendix C: Data Sheets/Forms

1 – Greenline and Riparian Cross-section Data Collection Form
2 – Tree Data Collection Form
3 – Specimen Data Collection Form
4 – Specimen Plant Labels

Plant ID:___________________________ Group:_____Order:______Type: I K S Q Other____

Reason Collected: UNKNOWN DOMINANT TES

Habit/Comment:____

Greenline
Bank: L R
Channel Transect #:___________

OR

Cross-Section
Bank: L R
Channel Transect #:_________ Meter: 3 6 9

Plant ID:___________________________ Group:_____Order:______Type: I K S Q Other____

Reason Collected: UNKNOWN DOMINANT TES

Habit/Comment:____

Greenline
Bank: L R
Channel Transect #:___________

OR

Cross-Section
Bank: L R
Channel Transect #:_________ Meter: 3 6 9

Plant ID:___________________________ Group:_____Order:______Type: I K S Q Other____

Reason Collected: UNKNOWN DOMINANT TES

Habit/Comment:____

Greenline
Bank: L R
Channel Transect #:___________

OR

Cross-Section
Bank: L R
Channel Transect #:_________ Meter: 3 6 9

Plant ID:___________________________ Group:_____Order:______Type: I K S Q Other____

Reason Collected: UNKNOWN DOMINANT TES

Habit/Comment:____

Greenline
Bank: L R
Channel Transect #:___________

OR

Cross-Section
Bank: L R
Channel Transect #:_________ Meter: 3 6 9

Plant ID:___________________________ Group:_____Order:______Type: I K S Q Other____

Reason Collected: UNKNOWN DOMINANT TES

Habit/Comment:____

Greenline
Bank: L R
Channel Transect #:___________

OR

Cross-Section
Bank: L R
Channel Transect #:_________ Meter: 3 6 9

Appendix D: Equipment List

PDA
PDA charger for outlet
PDA charger auto adapter
PDA secure digital (SD) memory cards
PDA lithium ion battery
PDA clear protective box (space maker pencil box)
Compass
Lumbar pack
Hand lens with Lanyard
Field Rite-in-the-Rain notebook (pocket size)
Pencils/Pens
Plant digger
Small field plant press
Plant labels
Standard plant press with cardboard and felt (you need to get newspaper)
Probes
Protocol
Quadrat frame
Yellow flags (at least 50)
Ruler
Forceps
Field vest
DBH measuring tape
Clipboard and/or Tatum
Key to *Salix* from Intermountain Flora: Vascular Plants of the Intermountain West, U.S.A., Vol. 2, Part B, (Holmgren et al. 2005)
Flora of the Pacific Northwest (Hitchcock and Cronquist 1998)
Plant Identification Guide for PIBO
Field Guide to Intermountain Rushes (Hurd et al. 1997)
Field Guide to Intermountain Sedges (Hurd et al. 1998)
Field Guide to the Willows of East Central Idaho (Brunsfeld and Johnson 1985), with added key
Plant Identification Terminology (Harris and Harris, 1999)
Montana Wetland Plants
Color photo plant guide (Plants of the Rocky Mountains or Plants of Southern Interior British Columbia and the Inland Northwest)

Appendix E: Species Not Used to Determine the Greenline

Species that are not perennial and should not be used to determine the greenline (this is not a complete list)		
Aegilops cylindrical	Deschampsia danthonioides	Mertensia oblongifolia
Alopecurus carolinianus	Descurainia pinnata	Milium vernale
Alopecurus myosuroides	Descurainia Sophia	Mimulus floribundus
Alyssum alyssoides	Dipsacus fullonum	Mimulus guttatus
Alyssum desertorum	Draba verna	Mimulus suksdorfii
Anthriscus sylvestris	Echium vulgare	Montia fontana
Arctium lappa	Epilobium brachycarpum	Montia linearis
Arctium minus	Epilobium minutum	Muhlenbergia filiformis
Bromus briziformis	Epilobium torreyi	Myosotis discolor
Bromus carinatus	Erigeron flagellaris	Myosotis laxa
Bromus commutatus	Erigeron strigosus	Nemophila breviflora
Bromus hordeaceus	Eriogonum vimineum	Nemophila parviflora
Bromus japonicus	Erodium cicutarium	Nemophila pedunculata
Bromus secalinus	Galium aparine	Onopordum acanthium
Bromus sterilis	Galium bifolium	Panicum miliaceum
Bromus tectorum	Galium parisiense	Phlox gracilis
Capsella bursa-pastoris	Galium tricornutum	Plantago lanceolata
Cardamine oligosperma	Geranium bicknellii	Poa annua
Cardamine pensylvanica	Geranium robertianum	Polemonium micranthum
Cenchrus longispinus	Geranium viscosissimum	Polygonum douglasii
Centaurea diffusa	Grindelia squarrosa	Portulaca oleracea
Centaurea solstitialis	Hackelia deflexa	Potentilla norvegica
Cerastium glomeratum	Helianthus annuus	Ranunculus pensylvanicus
Cerastium nutans	Hordeum murinum	Ranunculus sceleratus
Chenopodium album	Hypericum anagalloides	Ranunculus uncinatus
Chenopodium fremontii	Impatiens ecalcarata	Rorippa curvisiliqua
Cirsium vulgare	Juncus bufonius	Sisymbrium altissimum
Clarkia rhomboidea	Lactuca biennis	Sonchus asper
Claytonia perfoliata	Lactuca serriola	Stellaria calycantha
Claytonia sibirica	Lapsana communis	Stellaria media
Collinsia grandiflora	Lepidium campestre	Taeniatherum caput-medusae
Collinsia parviflora	Lepidium perfoliatum	Thlaspi arvense
Collomia grandiflora	Linanthus harknessii	Tragopogon dubius
Collomia heterophylla	Lolium perenne	Tragopogon pratensis
Collomia linearis	Machaeranthera canescens	Tribulus terrestris
Conium maculatum	Madia exigua	Trifolium cyathiferum
Conyza bonariensis	Madia glomerata	Trifolium dubium
Conyza Canadensis	Madia gracilis	Trifolium microcephalum
Corydalis aurea	Malva neglecta	Trifolium variegatum
Crepis tectorum	Medicago lupulina	Verbascum thapsus
Cynoglossum officinale	Medicago sativa	Viola nephrophylla
Datura stramonium	Melilotus alba	Vulpia microstachys
Daucus carota	Melilotus officinalis	Xanthium spinosum

Appendix F: Archer PDA Troubleshooting

When you're having a problem with the Archer handheld

- If the main Windows screen is displayed, check that the device is not locked.
- If you are in the middle of an application, hit the Applications Manager (leftmost) button, and try closing all applications. Relaunch the desired application. (If you were in the middle of entering a record, you may have to return to it and edit or delete it.)
- If the problem persists, try a soft reset. To do this, hold the power button down until the Power Button screen appears. Select "Reset". [No data will be lost with a soft reset, but if you were in the middle of entering a record, you may have to return to it and edit or delete it.]
- If the device won't turn on, first experiment holding the power button down. Second, you can try removing and reinserting the battery (This also should work if the unit is on and will not respond to buttons being pressed). Finally, replace the battery to see if the battery was too low to power up the device. When it powers up, it will have performed a soft reset, so if you were in the middle of entering a record, you may have to return to it and edit or delete it.

HARD RESET AND RESTORE INSTRUCTIONS: as a last resort, you can perform a hard reset. Before resetting the device, you should write in your field notebook information about when you performed the hard reset- date, time, and if you have begun a reach, where you are in your sampling (i.e., what you've sampled so far, and whether any of this was backed up). Perform a backup of the PDA, if possible. Hold the power button down, and when the power button screen appears, continue holding the power button until the screen goes dark, The green LED to the right of the buttons should come on. Hold down the **home**, **up direction** on the central button, and **context** buttons until the device starts to reset. You'll need to go through the setup steps, and then use File Explorer to open the PIBO_Restore file on the SD card.

Launch File Explorer. You'll need to close/exit any open applications or screens. In the main Windows screen of the PDA, select Start, then Programs, then File Explorer. The main heading for the File Explorer screen is, appropriately, File Explorer. Directly below that is the display of where you are exploring/ navigating. The main locations are My Device, Storage (in My Device), and SD Card; these are always listed for convenience. The downturned triangle to the right of the name points down to the list of files and folders contained within. **Select the SD Card, then select the PIBO_Restore file.** Opening this self-extracting file will launch Sprite Backup.

The screen for Sprite Backup should have the heading Restore Data Selection. This allows you to select what you want to restore. A check in the box means selected for restoration. The check in the Pocket PC box means everything on the handheld (that was backed up in this file) will be restored. This is what you want, so **select Next** in the lower left part of the screen to continue**.**

When the Device Reset Required screen appears, **Select Next to continue**. Now, be patient while the restore proceeds. The handheld will reset. After performing the restore, the handheld will reset a second time. When it is finished, it will allow you to look at a report. The Restore has been completed.

To confirm this, find and open the Forms 5.1 application and check that the eight forms are listed. Also, check that Sprite Backup is present on either the Start menu or the Programs page of the PDA. At this point, you will need to reenter the name of your handheld as the correct Device ID, and make checks of the basic PDA settings:

Enter your Device ID/user name (Settings-System-About-Device ID)	A1, A2 ... A16 (Correct ID is Important!)
Power – turn off if not used (Settings-System-Power-Advanced)	Battery – 1 min, External – 5 m
Backlight – turn off if not used (Settings-System-Backlight)	Battery – 1 min
Brightness level (Settings-System-Brightness)	
Battery: Keypad - Off, Screen Backlight – Medium High	
Date and Time (Settings-System-Clock&Alarms or Today/Home screen)	**Correct Date is Important!!!**

Error messages: If you get an error message where it asks you if you want to send in a report, you can click "don't send". If you keep getting the message, you can try a soft reset. I if that doesn't help, you can disable error reporting. You may get another type of error message relating to Forms files. If these messages continue after a soft reset (with no option of disabling error reporting, you may have to perform a hard reset. Document the problem and perform a backup of data if possible before doing the hard reset. At the end of the hitch tell your area supervisor that you had to perform a hard reset and note it on the End of Hitch form. If you are able to use the PDA to enter Forms data, the data should be secure.

Appendix G: Forms Data Backup using Sprite Backup (Archer Handheld)

Instructions
Launch Sprite Backup. Select the Start menu, (then Programs, if necessary,) then Sprite Backup. To get to the Start Menu, you can use the Start button on the handheld, or go to the main screen for Windows. The main screen for Sprite Backup has the Backup, Restore, Schedule, and Options icons (Fig.1). **Tap on the Backup Icon** [selecting Next is the same as selecting Backup].

The next screen ("Backup Data Selection", Fig. 2) allows you to select what you want to back up. A check in the box means selected for backup. The default setting is that everything on the PDA is selected for backup (the box for the Pocket PC is checked gray, and the folders and files on it are checked red.) We will go with this setting, so **confirm that the Pocket PC box is checked, and select Next** in the lower left part of the screen to continue.

On the new screen titled "Save As" (Fig. 3)
In the Name field, **Enter a new name with the correct Date and Time** in the following format: 3Jul9AM. Because there will be multiple backup files on the card, it's important to know which is the latest.
Select the following fields, or check that they are correct:
The **Location** should be **\SD Card**.
The **Folder** should be **None**.
In the lower left part of the screen, **select Next** to continue.

If the Device Reset Required screen appears, select Next to continue. Now, relax and let the magic happen. The handheld will reset. After performing the backup, the handheld will reset a second time. When it is finished it will tell you that the backup is completed and allow you to look at a report. The data backup is complete!

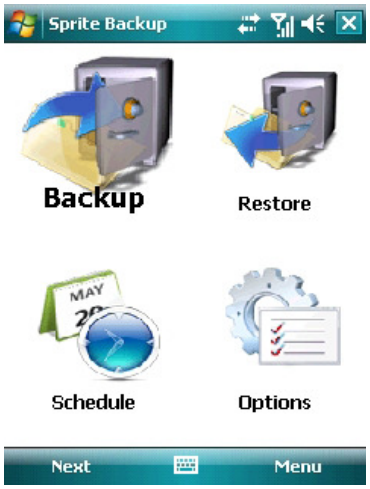

Fig. 1

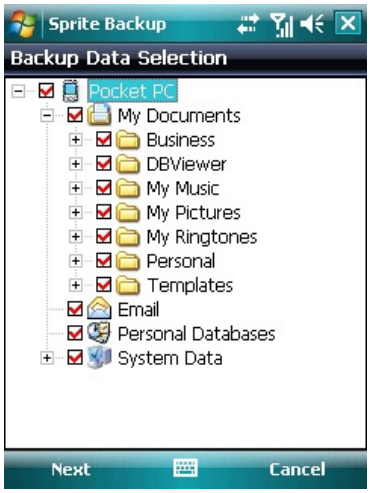

Fig. 2

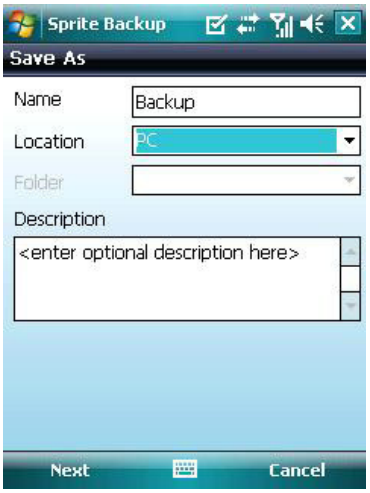

Fig. 3

You can use File Explorer to confirm that the backup file is on the SD card as you expect. To do this, go to the Start menu (then Programs, if necessary) and select File Explorer. In the File Explorer window, select SD Card to view the files and folders on the card. If you do not see "SD Card" listed, select the icon directly below the Windows Start icon and "SD Card" should appear as an option. Your new backup data file should be listed on the SD Card. If it is not, it may have been saved in "Storage" or "My Documents". If you find it in either of these two places, leave it there, be sure to save future backup files to the correct location, and at the end of the hitch, tell the bunkhouse supervisor about the wayward file.

Appendix H: Sampling Sites with Beaver Activity

Safety First!! Please be careful walking around beaver impacted areas!!

Why do beaver impacted reaches matter? PIBO-EM is attempting to assess changes in riparian and aquatic habitats due to land management. Beavers also influence riparian and aquatic habitats; therefore we want to sample reaches that have beaver activity.

A scout or the stream techs will determine whether or not to sample in a beaver impacted reach. When there are inactive beaver dams, sample the reach using normal sampling procedures. When there are active beaver dams there are two sampling scenarios:

1. If >50% of the total reach length is beaver impacted and/or there is not >80m of continuous un-impacted channel there will be no transects set up and no vegetation data will be collected. Please help the stream techs with their data collection.
2. When ≤50% of the total reach length has been impacted by beaver and there is ≥80m continuous length of un-impacted channel a subset of the old reach will be sampled. The stream technicians will determine the bottom of reach (BR), set up as many transects as possible, and determine the top of reach (TR). Follow normal sampling procedures for transects that are established.

Appendix I: Sampling with Two PDA's at a Reach

If two vegetation technicians are collecting data at the same reach for the day then indicate it on the "Reach" form. Be sure to enter the same group, order, reach type, and reach ID in each PDA. One PDA will be used to collect all greenline data and the second PDA will be used to collect all cross-section and tree belt-transect data. One technician should enter Specimen data in his/her PDA. Both technicians must use the same unknown numbers in both PDA's for all unknowns. At the start of the reach work through several (3-5) transects together to get a "feel" for the vegetation and to ensure that both technicians are identifying unknowns consistently. When any new unknowns are encountered be sure to communicate with the other vegetation technician as to what the unknown plant looks like and the unknown number associated with that unknown.