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

EFFECTIVENESS 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

Leary, Ryan J.; Ebertowski, Peter. 2010. Effectiveness monitoring for streams and riparian areas: sampling protocol for vegetation parameters. Unpublished paper on file at: http://www.fs.fed.us/biology/fishecology/emp.

For Information about PIBO Effectiveness Monitoring,
contact Eric Archer, telephone: (435) 755-3565.

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). A debt of gratitude is owed to Marc Coles-Ritchie for the initial development and testing of this protocol; your work is greatly appreciated. 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 and Alison Kelly. Since 2003, over 70 field technicians have provided valuable feedback about the methods through use of this protocol.

Cover Photo: North Fork Dupuyer Creek, Lewis and Clark National Forest, Montana
(Site Name: 240-12-I)

TABLE OF CONTENTS

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 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. Figure 1 shows an example of a reach layout with greenline and riparian cross-section quadrats.

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 M) 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 (usually 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.

Data Collection Tasks

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

1. species and percent cover in and over quadrats.

Riparian Cross-Section Data
Collect data at channel transects 1, 5, 10, 15, and 20 (or last transect for reach if there are fewer than 20 transects), which includes:

1. species and percent cover in and over quadrats.

Specimen Collection
Collect specimens for unknown and dominant plant species at every reach. All unknowns and the four most dominant plant species are collected at every reach.

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 typically includes 42-50 greenline quadrats, 30 cross-section quadrats, 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 all data collection for the reach by drawing the reach map, operating the data logger or holding the tape or stadia rod. Ask the stream technicians how you can help. See Appendix K for how to draw a reach map.

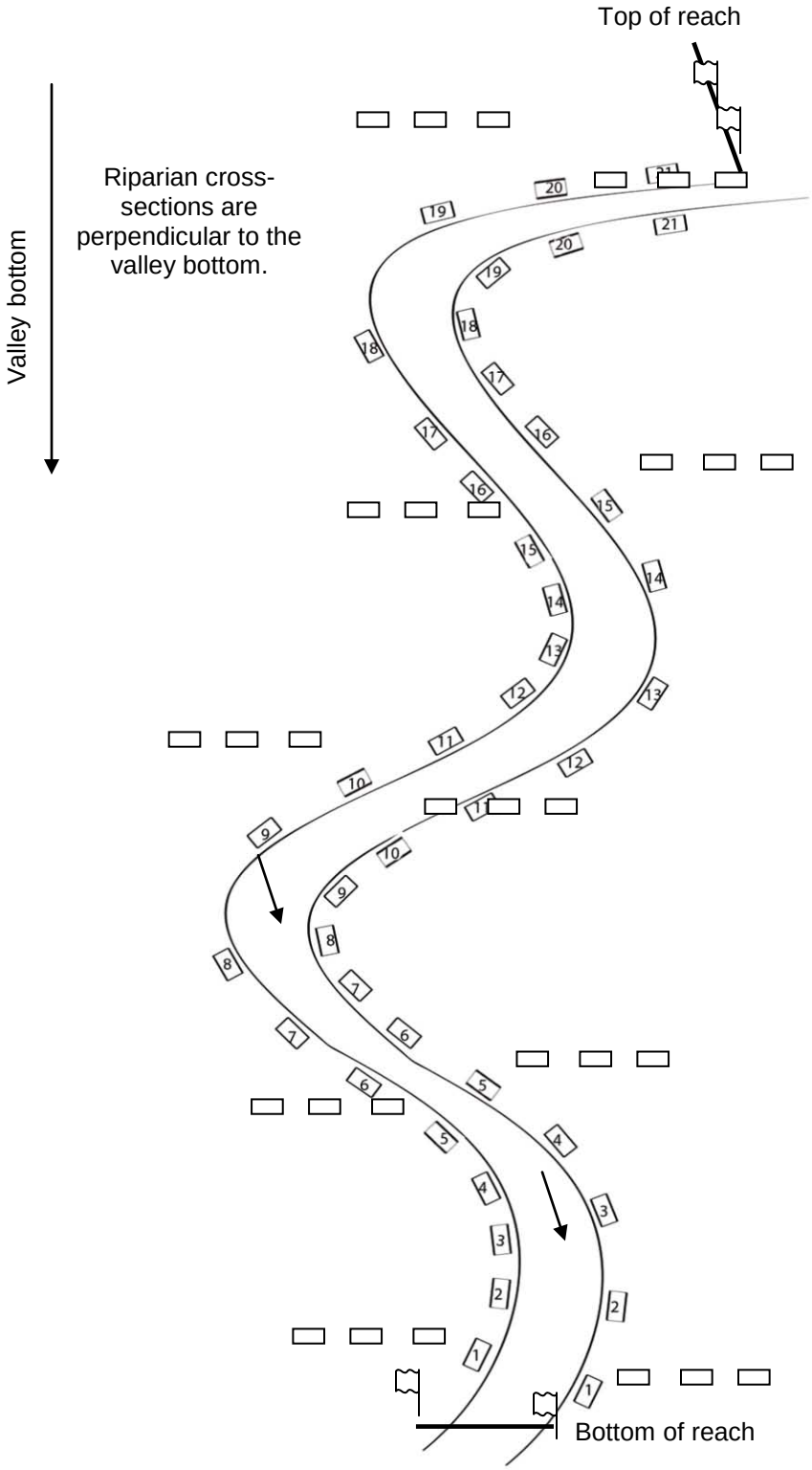


Figure 1 – Layout of greenline and riparian cross-section quadrats at a reach (quadrat size is exaggerated).

ESTIMATING COVER IN QUADRATS

A 50 cm x 20 cm Daubenmire (1959) quadrat frame (figure 2) 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 if it overhangs the quadrat and is rooted in the streambed.

To Determine Cover

Cover data is collected in two different layers: ≤1 m (lower layer) and >1 m (upper layer).

1. Lower layer: 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 (see Determining the Greenline for exception).
2. Upper layer: Look straight up (directly overhead, not a 90 degree angle from the quadrat) to determine percent cover of each woody species above 1 m over the quadrat. When looking up, only consider woody species vegetation visible from the quadrat from a height of 1 m; do not move around to see more and do not move live woody vegetation above 1 m to see obscured woody vegetation: for example, trees over shrubs. However, if herbaceous vegetation is obscuring woody vegetation above 1 m then move the herbaceous vegetation to estimate the woody cover.

The total percent cover for each layer should be ~100% (the sum of the cover class midpoints may slightly exceed or be below 100%).

Record percent cover for each species in a quadrat using the cover classes in Table 1. 5% cover is equal to 7 cm X 7cm.

The painted areas on the quadrat frame (figure 2) are to help in assigning cover classes (table 1). The painted areas correspond to 5%, 25%, 50%, 75%, and 95% of the quadrat.

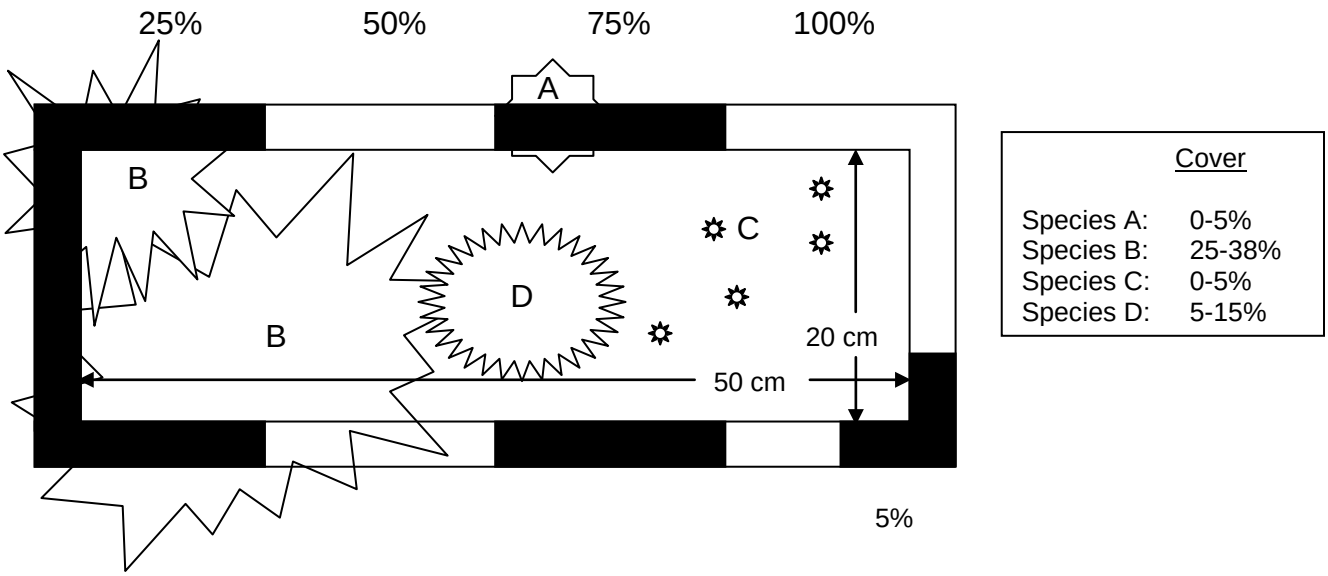


Figure 2 – The Daubenmire quadrat frame used to define the area where species cover will be estimated. 5% cover is 7 cm x 7cm.

Table 1 – Cover classes and range of cover.

Cover class	Range of cover (%)	Cover class midpoints
1	0 to <5	2.5
2	≥5 to 15	10
3	≥15 to 25	20
4	≥25 to 38	31.5
5	≥38 to 50	44
6	≥50 to 75	62.5
7	≥75 to 95	85
8	≥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 and ground cover adjacent or nearest 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.
2. When looking from 1 m and below (do not use these categories when looking >1 m) record the appropriate "not veg" category for a quadrat:
    a. not veg: bare (paved road, soil, sand, and rock <2.5 cm)
    b. not veg: litter/moss = downed organic matter ("cow pies", leaves, needles, and branches <10 cm). Branches <10 cm connected to a log are litter.
    c. not veg: log or stump ≥10 cm (measured along the diameter). Log has to be on the ground or on top of other logs that are on the ground.
    d. not veg: massive rock feature (defined in determining the greenline)
    e. not veg: rock ≥2.5 cm

    If any portion of a quadrat is water then record what the substrate is or what is underneath the water.
3. When looking above 1 m, if any portion of a quadrat is not live vegetation record 'not veg: not live veg'.

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 3).
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 (figure 3). 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 the greenline 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 4). 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 4).

7. Sinuous streams:
   a. If there is no transect flag do not collect greenline or riparian cross-section data for that transect on that bank but make a comment in the PDA as to why there is no data.
   b. Transects may not always be placed in numerical order (e.g. 1, 2, 4, 3, 5…).

   The stream techs will let you know when either of these situations occur.

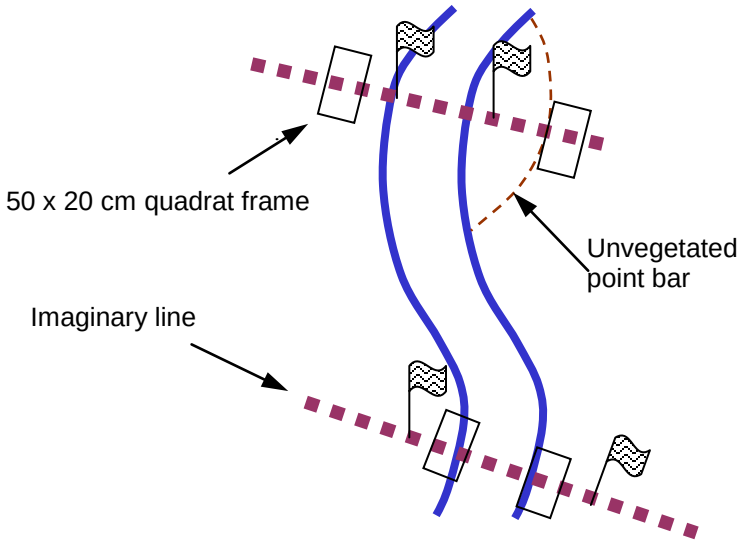


Figure 3 – The relationship of channel transect flags (wavy lines) and greenline quadrats on the imaginary line.

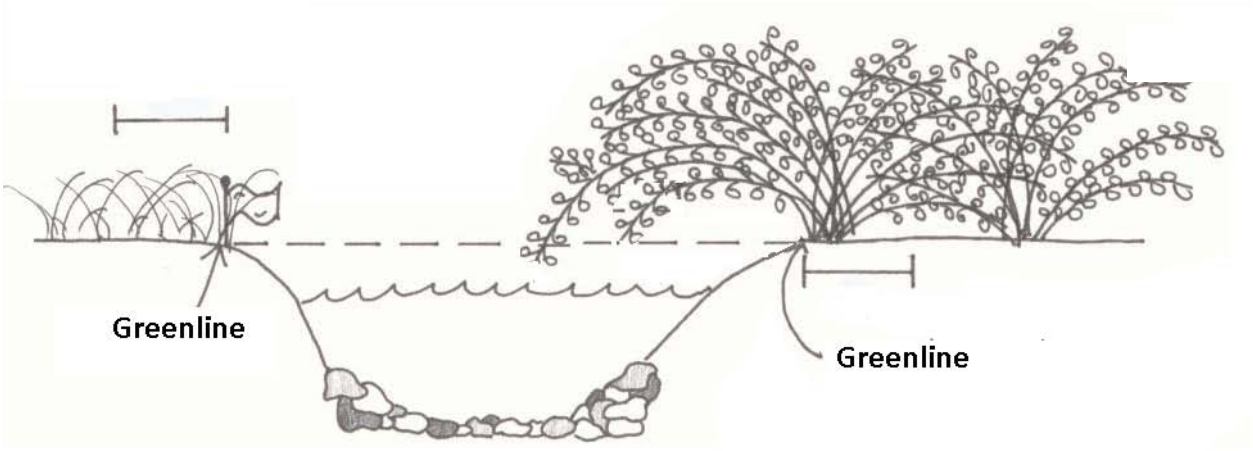


Figure 4 – Greenline location at the rooted point of vegetation, not necessarily at the canopy of woody vegetation (right).

Determining the Greenline

The greenline is the vegetation closest to the stream that meets the following criteria:

- At least 25% cover of live, perennial, vascular species rooted in the quadrat.
    1. Cover can be from one species or a combination of species.
    2. 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.
    3. Annuals, biennials, and species that are sometimes annuals, are not used to define the greenline, but are recorded in a qualifying greenline quadrat. See Appendix F for a list of species not used to determine the greenline.
    4. 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. Before moving oscuring vegetation, if 25% “greenline” vegetation can be seen within the quadrat, do not move obscuring vegetation to see vegetation below -- record what is seen from 1 m (100% cover for quadrat).
    5. If a greenline can only be established by moving obscuring vegetation less than 1 m and not rooted in the quadrat then record both the cover of rooted vegetation that was used to define the greenline and the vegetation that was obscuring the greenline. This is the only situation where a quadrat could have over 100% cover for a layer .

    See Appendix L for points 4 and 5

- Greenline Lower Limit (Figures 5-9)
  The greenline will never extend below where the streambed meets the streambank (this is especially important on dry streams and when vegetation extends into the water). The location where the streambed and streambank meet can be identified by:
    1. Break in the relatively steep streambank slope to a more gently sloping streambed.
    2. Rapid fining of particles from relatively coarse streambed particles to the finer streambank particles.
    3. Streambank material is usually consolidated versus the streambed material which is unconsolidated.
    4. Normally (but not always) below the current water level.
    5. The streambed almost always has <50% terrestrial vegetation cover.

- Greenline Upper Limit (Figures 5-9)
  The upper limit for greenline placement is:
    1. the first flat, floodplain-like/depositional feature located at or above bankfull, going no higher than 50 cm above bankfull; or,
    2. 50 cm above bankfull if there is no flat, floodplain-like/depositional feature.

  If there are questions regarding bankfull elevations please consult with the stream technicains.

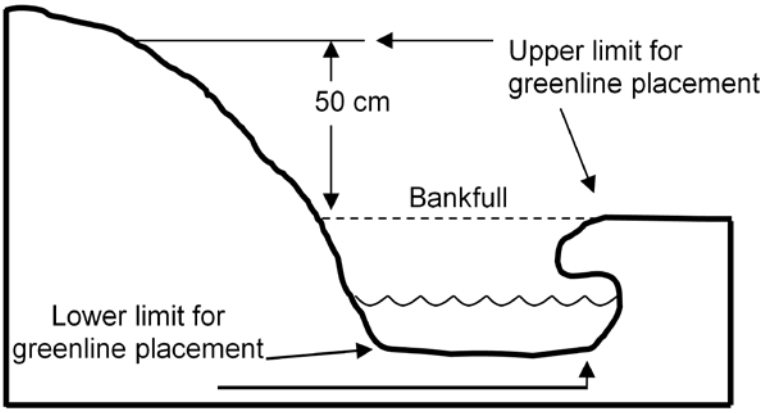


Figure 5 – Upper and lower limits for greenline placement.

- No Qualifying Greenline within Upper and Lower Limits (Figure 6)
    1. If there is no qualifying greenline within the lower and upper limit then data collection takes place at:
        a) the first flat floodplain-like/depositional feature at or above bankfull; or
        b) bankfull, if first flat feature is not present or outside the upper limit.
    2. Record the appropriate “not veg” category and any vegetation cover.

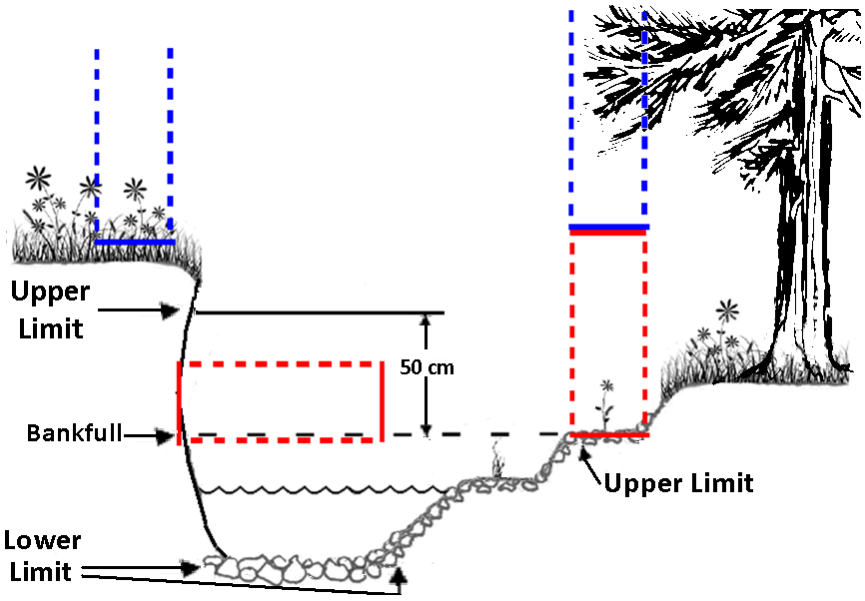


Figure 6 – Upper and lower limits and greenline placement. No qualifying greenline within upper and lower limits (left side), greenline quadrat placed at bankfull with no vegetation. Do not record herbaceous cover above 1 m. No qualifying greenline, greenline quadrat placed at the first flat floodplain-like/depositional feature at or above bankfull (right side). Red quadrat equals greenline placement with dashed line extending 1 m at a 90 degree angle from quadrat. Blue quadrat equals looking directly above the red quadrat above 1 m.

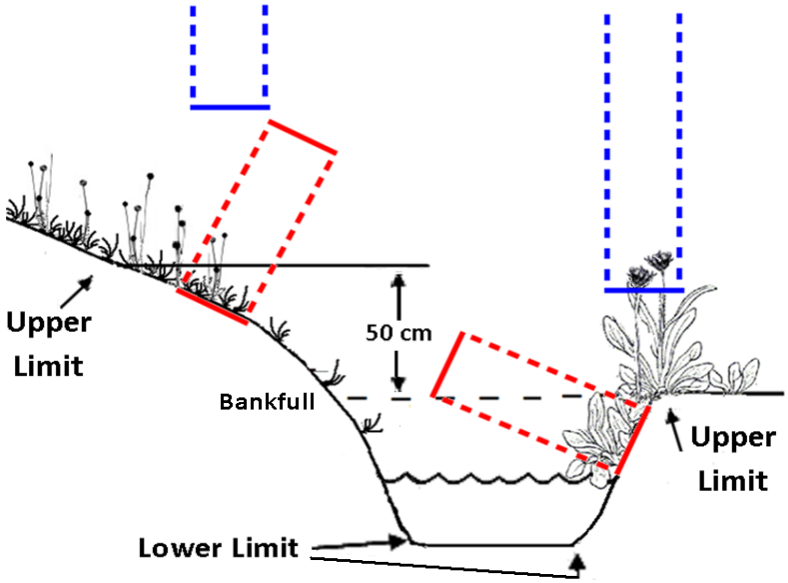


Figure 7 – Upper and lower limits and greenline placement. Herbaceous cover does not get recorded above 1 m (right side). Red quadrat equals greenline placement with dashed line extending 1 m at a 90 degree angle from quadrat. Blue quadrat equals looking directly above the red quadrat above 1 m.

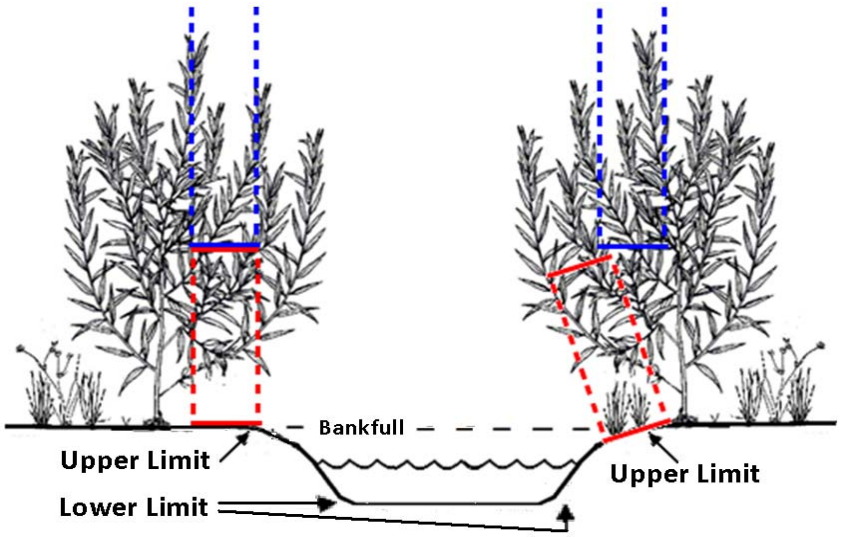


Figure 8 – Upper and lower limits and greenline placement. Red quadrat equals greenline placement with dashed line extending 1 m at a 90 degree angle from quadrat. Blue quadrat equals looking directly above the red quadrat above 1 m.

- <u>The greenline may be in the water</u> at high flows or when bank building is occurring (right side figure 9), 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 riparian side of where streambed and streambank meet. Do not over-estimate percent cover of vegetation that is bent over by flowing water.

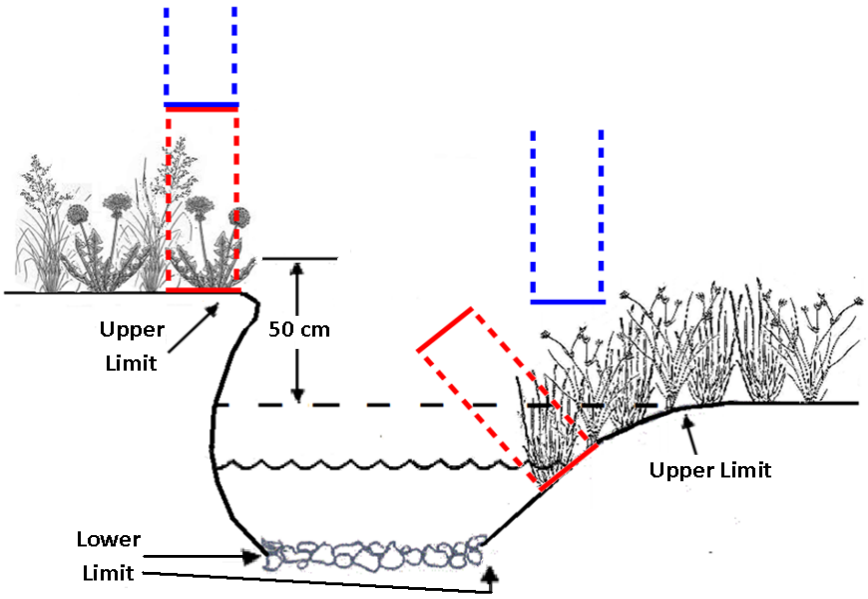


Figure 9 – Greenline placement, upper and lower layers and vegetation growing in water. Red quadrat equals greenline placement with dashed line extending 1 m at a 90 degree angle from quadrat. Blue quadrat equals looking directly above the red quadrat above 1 m.

- 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.
- Aquatic species:
    1. Free floating, totally submersed, or bottom rooted and floating aquatic species (middle four plants of figure 10) are NOT 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. (Keep in mind streambed vs. streambank)
    2. Totally emergent aquatic species are used to define the greenline (left and right side of figure 10). Emergent aquatic species are typically grasses and grass-likes that include: *Carex aquatilis*, *Scirpus microcarpus*, *Glyceria grandis*, *Typha latifolia*, and *Eleocharis palustris*.

Figure 10 – 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 streambank. Consider the slump block unattached if only gravity / friction is keeping it in place.
- When a large rock is part of the bank and at the upper limit for greenline placement or there is a massive rock feature record:
    1. “not veg: rock >70 cm” – for a rock that is >70 cm along any axis.
    2. ”not veg: massive rock feature” – for a talus slope or a cliff, which includes:
        a. talus – a sloping mass of loose rock and/or sediment that is part of the hillslope (record any vegetation cover if present); or
        b. cliff – a high, steep face of rock 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. (Do not record any vegetation cover for cliffs)
- Wood, logs, root wads, or stumps:
    1. 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 part of the bank or lying on the bank and at the upper limit for greenline placement record “not veg: log >70 cm”.
    2. A log with a qualifying greenline suspended over the stream or ground is not the greenline. When a log is on the ground, part of the bank, and has a qualifying greenline on top of the log then it can be the greenline.

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 11). Hillslope/uplands will almost always be on a slope.
2. Species cover: record species cover data for each quadrat. A riparian cross-section quadrat is never moved, even if it has <25% total cover of live vegetation.
3. When looking from 1m and below (do not use these categories when looking >1 m) record the appropriate "not veg" category for a quadrat:
    a. not veg: bare (paved road, soil, sand, and rock <2.5 cm)
    b. not veg: litter/moss = downed organic matter ("cow pies", leaves, needles, and branches <10 cm)
    c. not veg: log or stump >10 cm (measured along the diameter) Log has to be on the ground or on top of other logs that are on the ground.
    d. not veg: massive rock feature (defined in determining the greenline)
    e. not veg: rock ≥2.5 cm

    If any portion of a quadrat is water then record what the substrate is or what is underneath the water.
4. When looking above 1 m, if any portion of a quadrat is not live vegetation record 'not veg: not live veg'.

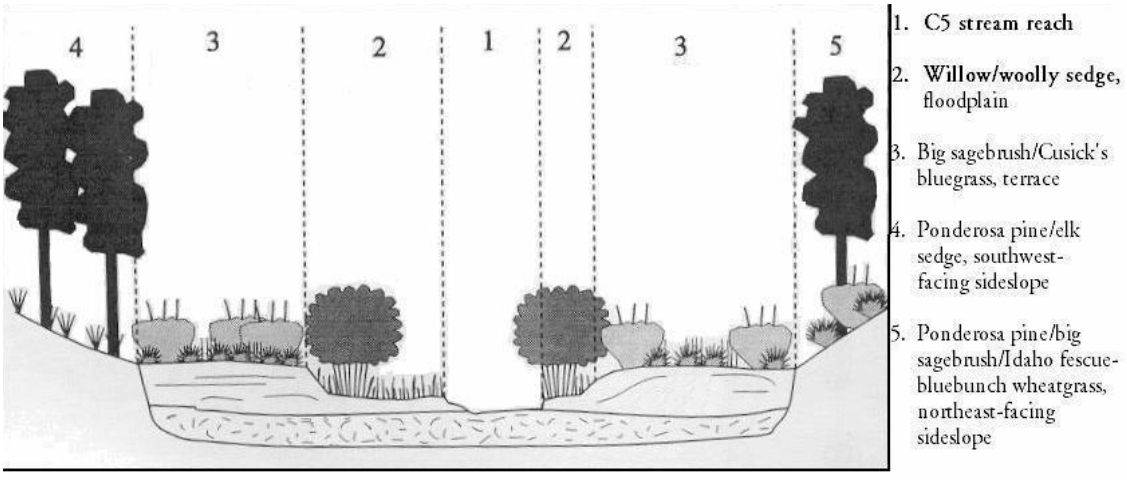


Figure 11 – Diagram showing changes in topography that correspond to different communities and the distinction between valley bottom (numbers 1, 2, and 3) and hillslope/upland (numbers 4, and 5) (from Crowe and Clausnitzer 1997, used with permission).

Where to Collect Data

1. Channel transect numbers 1, 5, 10, 15, and 20 (or last transect for reach if there are fewer than 20 transects).
2. Riparian cross-sections begin at the greenline quadrat pivot point and extend into the riparian area or hillside perpendicular to the direction of the valley bottom, not necessarily perpendicular to the stream (figure 1).
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 pivot point 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.

Unique Riparian Cross-Section Circumstances

- Sinuous Streams
    1. If a stream is sinuous, a riparian cross-section may intersect the stream. When measuring the riparian cross-section distance do not measure areas within the streambed or on islands (figure 12). Never collect data within the streambed or on islands.
    2. Riparian cross-section quadrats can be on the greenline if the stream is parallel to the cross-section bearing (figure 12).
    3. Riparian cross-sections may be close together, or even along the same line, but should not cross since they use the same bearing and are therefore parallel (figure 12).
- Inaccessible Quadrats
    1. 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 species cover as best as possible from a distance.
    2. 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. Do your best to collect or estimate data.
- 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:
    1. talus – collect data in the talus field, if it can be done safely, using "not veg" categories and any species data present; or
    2. cliff – use "not veg: massive rock feature" and no vegetation data is collected.

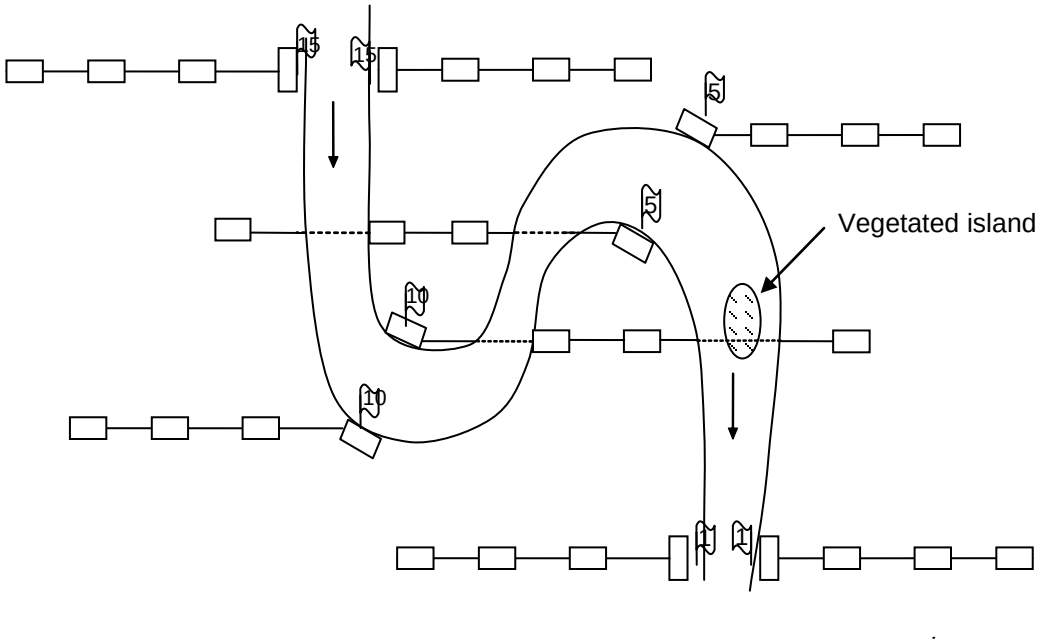


Figure 12 – Riparian cross-sections that intersect the channel on a sinuous stream.

UNKNOWN SPECIES

When an unknown species is encountered in a quadrat, do the following:

1. Key it out using *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.**

COLLECTING SPECIMENS

When to Collect Plant Specimens

Unknown Specimens
Collect a specimen of all unknown plants in a quadrat. Collect a specimen only once for that species at a reach. **Always collect a species even if it is identified later in the day.**

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. If a species has already been collected as an unknown then do not collect it as a dominant. All four dominants should be plant species that were identified, not unknowns.

Second Guessed Species
Treat identified species that you later second guess and are unsure of its correct identification as unknowns and collect them. Circle 'Unknown' on the specimen label as reason collected.

Threatened and Endangered Species
When a threatened or endangered plant species is encountered 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 Specimen form of the PDA, and in the Comment field, say that there weren't enough individuals (not collected). For unknowns, enter the genus, if known, or the life form (grass, shrub, forb, etc.) if genus is unknown, in the Genus or Comment fields.
2. Collect all unknown specimens from a quadrat, while at that quadrat. Do not wait to collect them. If you later see additional plants of a collected species that are better for identification (e.g., more mature flowers), include them in that specimen collection.
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 as much dirt and sediment from the roots as possible.
    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 plant label. 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. Cut folded newspaper to 9 x 12 inches. 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. Keep plant presses in a dry area with ventilation, ensuring specimens can air out and 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 and dominants) in the "Specimen" table in the PDA and in your field notebook.
10. At the end of the hitch put newspaper around all the specimens for each 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 provided plant labels 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.). Be sure to make notes on uncollected parts.
4. Under greenline or cross-section circle bank L or R, fill in transect number, and circle meter 3, 6, or 9 (cross-section only). Greenline or cross-section location information should be filled out as to where the unknown was first encountered.

- 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.

NOTEBOOK

In your notebook, record some basic information for each reach:

1. Group, Order, Reach Type, Reach ID, and Stream Name
2. Date and Crew
3. List of specimens collected (all unknowns and dominants)
    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.)
    b. Note where the species was first encountered (which GL or XS quadrat.)
4. Comments about reach (e.g. 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).**

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 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 of 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 upstream of the site 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.

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).

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 usually be 21 channel transects set up at 6 m intervals, regardless of the average channel bankfull width.

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 the last transect of the reach.

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.

Appendix C: 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.

When at a beaver impacted reach follow normal sampling procedures. Some beaver situations may be difficult, do the best that you can under these circumstances and make detailed notes as to what specifically was difficult, why sampling was difficult and why data could not be collected.

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

If two vegetation technicians are collecting data at the same reach 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 riparian cross-section data. Only one technician should enter specimen data into their 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.

Appendix E: Equipment List

PDA
PDA charger auto adapter
PDA secure digital (SD) memory cards
PDA lithium ion battery (2)
PDA clear protective box (space maker pencil box)
Binocular Harness
Compass
Lumbar pack
Hand lens with Lanyard (2)
Field Rite-in-the-Rain notebook (pocket size) (1)
Pencils/Pens
Sharpies
Plant digger
Small field plant press
Plant labels
Standard plant press with cardboard and felt (you need to get newspaper)
Dissecting probes
Protocol
Quadrat frame
Screwdriver
Titanium Scissors
Ruler
Forceps
Field vest
Pencil Case
Folder with handouts and plastic sleeves
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 1973)
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 F: Species Not Used to Determine the Greenline

Species that are not strictly 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	Veronica anagallis-aquatica
Datura stramonium	Melilotus alba	Viola nephrophylla
Daucus carota	Melilotus officinalis	Vulpia microstachys Xanthium spinosum

Appendix G: 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 touchscreen is not working, you can perform the soft reset using only the power button: hold the power button down (up to 30 seconds) until the screen goes dark and the green LED lights up.
- If the device won't turn on, first experiment holding the power button down for up to 30 seconds. If this fails to turn on the PDA, 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 perform a backup of the PDA and 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). To do the hard reset, 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. Release the power button, and simultaneously hold down the **home**, **up direction** on the central button, and **context** (far right) buttons until an image appears on the screen. You'll need to go through the setup steps [if it doesn't ask you to go through a setup, you probably only did a soft reset, so try again], and then use File Explorer (explained below) 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 all the 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 make checks of the basic PDA settings and may need to reenter the name of your handheld as the correct Device ID.:

Enter your Device ID/user name (Settings-System-About-Device ID)	A1, A2 ... A18 (Correct ID is Important!)
Power – turn off if not used (Settings-System-Power-Advanced)	Battery – 2 min, External – 5 min
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. If that doesn't help, you can disable error reporting.

If you get an error message relating to a Forms file, worded something like "Error parsing file..." a forms data file has been corrupted, and you will have to perform a hard reset. Do a backup of data (you may have to do a soft reset first). Document the problem 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 H: Forms Data Backup using Sprite Backup (Archer Handheld)

Overview: You will use the application Sprite Backup to save a backup file to the SD card. You will name the file with the date and time the backup was done, and save it to the correct hitch folder. The handheld will reset twice during the backup process, then report to you that it has finished.

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.13). **Tap on the Backup Icon** [selecting Next is the same as selecting Backup].

The next screen ("Backup Data Selection", Fig. 14) 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. 15)
In the Name field, **Enter a new name with the correct Date and Time in the following format: 3Jul9AM.** The correct date is necessary; the time can be rounded to the hour.
Using the Location and Folder fields, you will save the file to a folder for the current hitch on the SD card.
Select the following fields, or check that they are correct:

The **Location** should be **\SD Card**.

The **Folder** should be the named folder for the current hitch (for example, "H1Jun9-16').

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 application do its thing. 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!

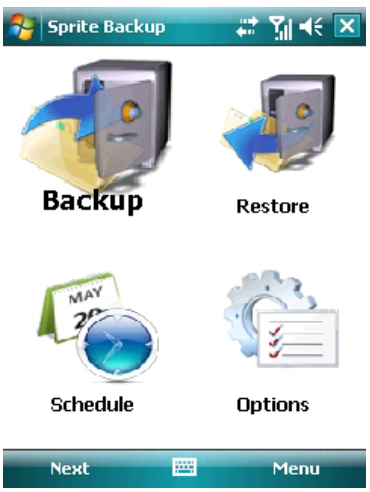


Fig. 13

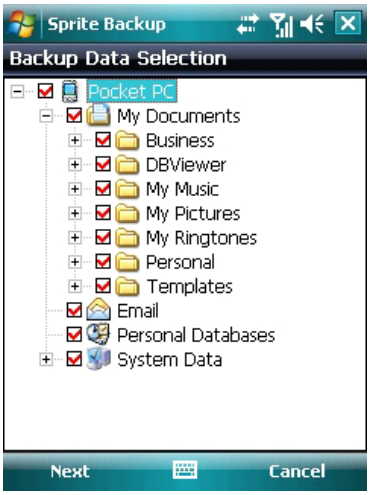


Fig. 14

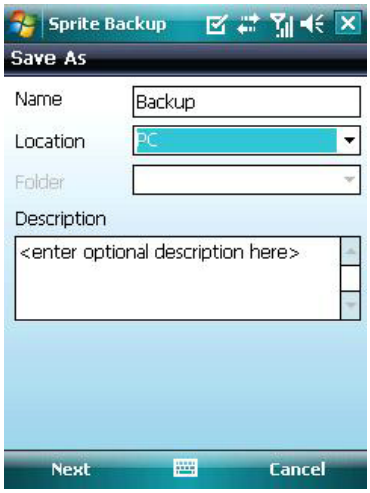


Fig. 15

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. Select the folder for the current hitch to view its contents. Your new backup data file should be listed for that folder. If it is not, it may have been saved elsewhere on the SD card, or in "Storage" or "My Documents" in internal memory. If you find it in any of these places, leave it there, and be sure to save future backup files to the correct location.

Appendix I: Determining Bankfull

Objective: Examine bankfull indicators throughout the reach and determine dominant bankfull height

Bankfull Indicators: Recognize that all six indicators are rarely present at every site.

1. **Examine streambanks for an active floodplain.** This is a relatively flat, depositional area that is commonly vegetated and above the current water level unless there is a large amount of spring runoff or there has been a substantial rain event (i.e. stream running at bankfull stage).
2. **Examine depositional features such as point bars.** The highest elevation of a point bar usually indicates the lowest possible elevation for bankfull stage. However, depositional features can form both above and below the bankfull elevation when unusual flows occur during years preceding the survey. Large floods can form bars that extend above bankfull whereas several years of low flows can result in bars forming below bankfull elevation.
3. **A break in slope of the banks and/or change in the particle size distribution** from coarser bed load particles to finer particles deposited during bank overflow conditions.
4. **Define an elevation where mature key riparian woody vegetation exists**. The lowest elevation of birch, alder, and dogwood can be useful, whereas willows are often found below the bankfull elevation.
5. **Examine the ceiling of undercut banks.** This elevation is normally below the bankfull elevation.
6. **Stream channels actively attempt to reform bankfull features such as floodplains after shifts or down cutting in the channel.** Be careful not to confuse old floodplains and terraces with the present indicators.

Measuring Bankfull Height

- After you identify bankfull, measure the vertical distance from the water's surface to the dominant bankfull elevation measured throughout the reach.
- This vertical distance can be used when bankfull indicators are not present at a particular point along the streambank.

Appendix J: Miscellaneous Tips and Notes

- Communicate with the stream techs to ensure consistency with streambed vs. streambank determinations and bankfull locations.
- Make comments in the PDA for **each** quadrat where data is missing or was not collected. Also, make comments in the PDA where transect number or bank is entered incorrectly for each individual quadrat.
- There should **always** be an entry in the PDA for 30 cross-section quadrats and twice as many greenline quadrats as transects.
- If a quadrat is difficult to reach, an estimate is better than not collecting any information.
- Collect unknown plant specimens as you sample; **do not** wait until the end to make collections.
- Call Peter (435-760-1212 or 435-755-3562) if there are questions regarding PDA problems.
- Call Peter, Ryan or the Hotline if there are questions regarding the protocol. If you do not get an answer make note of the problem and be sure to bring the issue up at the end of a hitch.

Appendix K: Reach Map

At times the vegetation technician may need to assist the stream technicians to complete all data collection for a reach. Drawing the reach map can be a very helpful way to assist the stream technicians. The reach map should be drawn on Form 2; which the stream techs will have. The reach map is drawn to describe the reach and help relocate the site in the future. Draw the reach map to scale (relatively) and strive for clean and simple drawings. Show the stream channel extending at least 10 m above and below the reach boundaries; locations of shrubs and trees, large wood, bars, islands, pools, site markers and beaver ponds; location of hill slopes, roads, fences, side channels, tributaries, etc. In addition, show any distinct feature that will help in relocating the site.

Commonly Used Symbols for Reach Maps

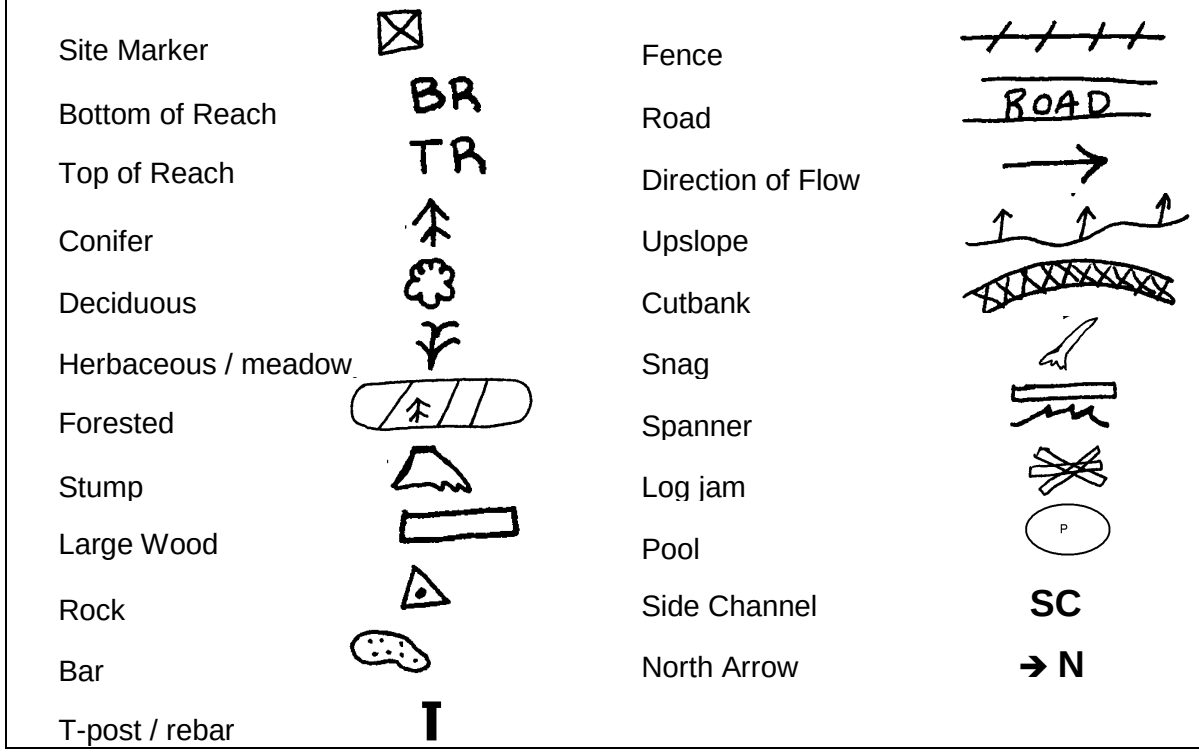


Table 2. Commonly used symbols for reach maps.

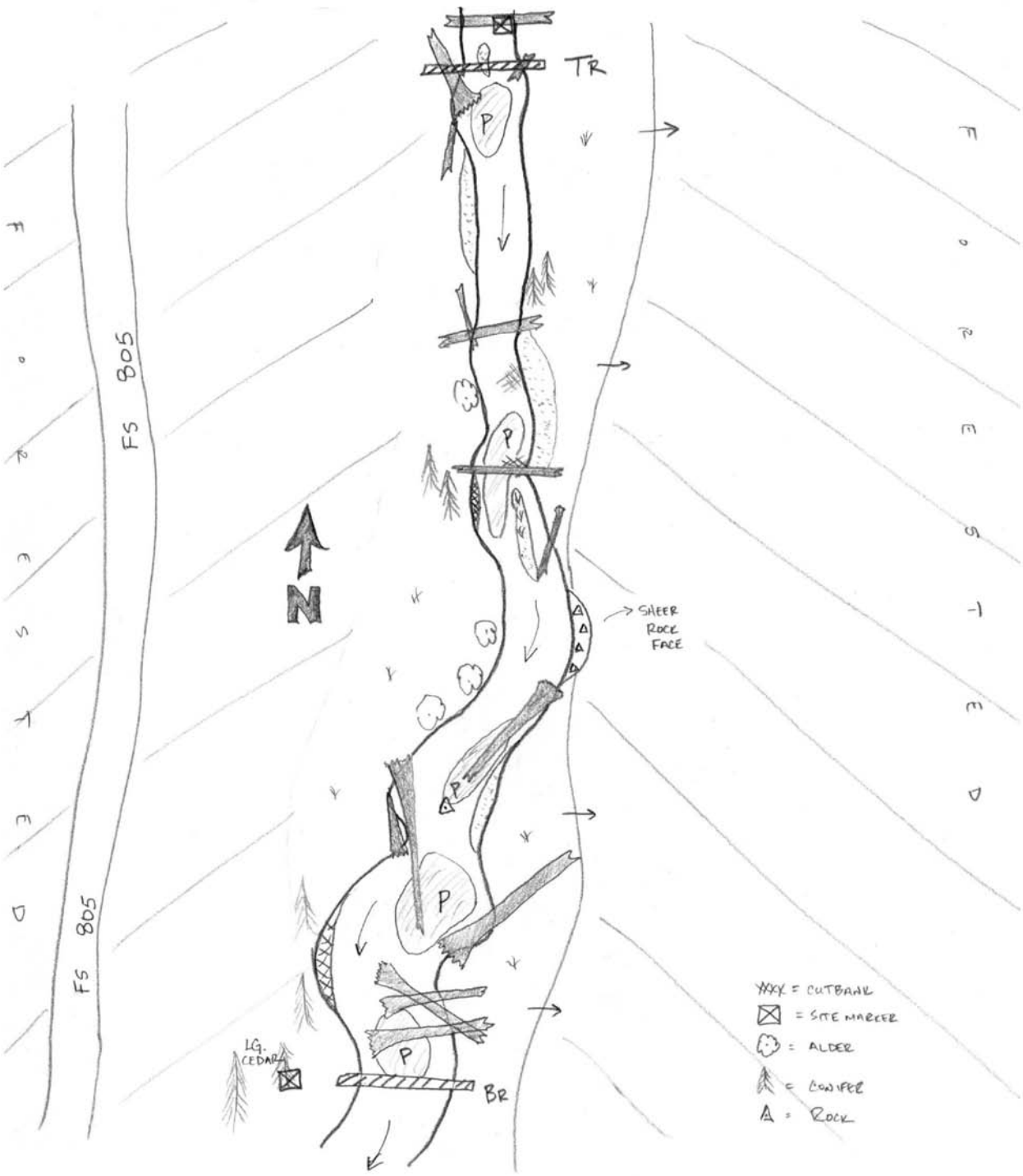
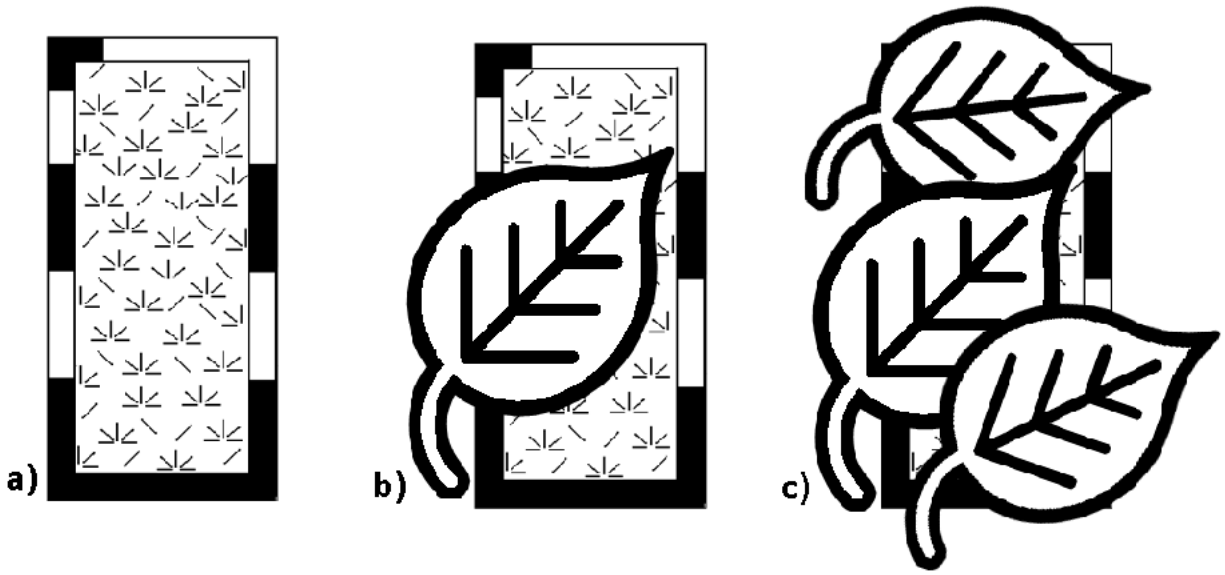


Figure 16 – Example of a well drawn reach map.

Appendix L: Exception to Estimating Cover (>100% for Greenline)



This figure assumes all three quadrats (a, b, c) are on top of 100% rooted, live, <1 m vegetation (species A). The overhanging vegetation is not rooted in the quadrat and is less than 1 m tall (species B). Note that quadrat 'c' has over 100% cover for the greenline.

Greenline
a) 95-100% species A
b) 50-75% species A and 38-50% species B
c) 95-100% species A and 75-95% species B

Cross-section
a) 95-100% species A
b) 50-75% species A and 38-50% species B
c) 5-15% species A and 75-95% species B

Appendix M: Data Sheets/Forms

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

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

Reason Collected: UNKNOWN DOMINANT

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

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

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

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

Habit/Comment:____

Greenline
Bank: L R
Channel Transect #:__________

OR

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