Standard Operating Procedure (SOP) 4.9.0

VEGETATION MONITORING PROCEDURE

Riparian vegetation provides critical food, shelter, and nesting/denning resources for many species of wildlife in California. Riparian vegetation also provides important nutrients to the stream's invertebrate populations and provides cooling shade to moderate water temperature in streams. Little information currently exists on the condition of riparian trees, shrubs and herbs.

A field team comprised of a minimum of three volunteers establishes the boundaries of a "belt transect" at a previously determined study location. The transect is 10 meters in width and extends perpendicular to the creek from the outer edge of riparian vegetation on one bank to the outer edge of vegetation on the other bank. Within this "belt", all trees over 4 cm in diameter are measured and identified. A metric tape measure is extended through the middle of the transect longitudinally to measure the extent and type of understory vegetation. Canopy cover (percent canopy closure) is measured above the wetted channel at four locations within the transect.

Although this protocol was developed using a 10 meter wide transect every 500 meters along a stream course, other transect widths could be used to increase sample population size. Steep eroded banks are difficult to access and frequently encountered. Vegetation data in such cases can only be estimated.

Vegetation teams can periodically be joined by local botanists from horticultural societies or the California Native Plant Society. The team and the botanist can collect replicate data and review results after data collection is complete. The team can be evaluated on skill and familiarity with the field equipment, adherence to protocol and skill and accuracy in vegetation identification.

The information gathered by this team will help describe the important vegetational components of the riparian habitat on each creek. Correlations can be made between various vegetation parameters and wildlife observations. Vegetation also contributes to changes in stream flow patterns and provides important instream habitat for amphibians and fish.

Equipment and Materials
Tape Measures:
100-Meter Tape
50-Meter Tape
Diameter at Breast Height Tape
Clinometer
Compass
Rangefinder
Stadia Rod (Staff Gauge)

Transect Marking Equipment
Rebar (Four lengths of 2')
Hammer
10 Meter Rope
Data Sheets
Clipboards
Plant ID Book
Pencils

Establishing the transect boundaries
The first task the survey team must undertake is establishing the boundaries of the transect using the survey marker in place on the stream bank. The marker is an orange "tassel" attached to the top of a stake driven level with the ground surface. A large number is written on the top of the stake, which corresponds to the number appearing on the stream map.

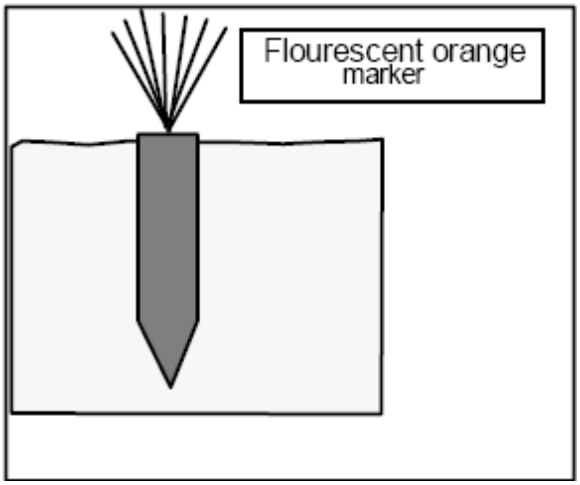


Figure 1. Marker stake

The following process will establish the boundaries of the **belt transect**.

1. Stretch out the measured 10 meter rope (or the meter tape) **perpendicular** to the creek with the orange mark (or 5 meter mark) on top of the stake. At one end of the rope, pound or push a "marker," (flags, rebar, stake etc.). Stretch the rope taut and pound in the marker, being sure to keep the 5 meter point centered on the survey stake.
2. Send two members of the team to the top of the opposite bank with markers, a measuring rope, hammer, and a compass.
3. Standing at either the "0" or "10" marker, align the compass along the length of the meter tape and set the bezel on the compass to match the line on the mirror. Rotate 90º toward the opposite bank and sighting along the line of the compass, align the team member (or orange PVC pipe) on the opposite bank.
4. Once aligned, the team member will place a stake. The opposite bank team member will then repeat the process of marking the other corner of the transect and the transect is marked.

As the opposite bank team members begins coming back across the stream, they should tie small lengths of survey tape to tree branches or vegetation, marking the outside boundary of the transect. This will make it easier to determine if a particular tree is in or outside the transect. **All markers, stakes and tape should be removed after the data gathering is finished.**

Once the outside boundaries of the transect have been established, the team needs to determine how far the transect will extend past the top of the bank on either side of the stream. **We will only count trees, which are associated with the riparian corridor**. In rural areas, it may be more difficult to determine where the influences of the stream begin to diminish. Teams must use their best judgment to determine the extent of the riparian corridor. Draw maps and take notes to document decisions/discussions of the group. Once the boundaries of the corridor have been determined you can begin taking data. **Note:** Trees at the edge of the transect boundary which are leaning out of the transect should be counted as long as they are rooted inside. Trees which lean into the transect but are rooted outside the transect should not be counted.

Tree Measurements

For the purposes of this study, a tree is defined as any woody vegetation over 3 meters high and having a diameter of 4 cm or more. Young willows, alders or other tree species growing near the low flow channel frequently are below the limits listed above. **Sapling and seeding trees which do not meet the 4 cm/3 m criteria should be counted and noted on the data sheet.** Separate counts should be made for low, mid, and upper slope.

For multi-trunked trees, such as buckeyes and bays, each trunk is considered a separate tree as long as it is at least 4 cm in diameter and branches from another trunk at or within 1 meter of the base (see figure below).

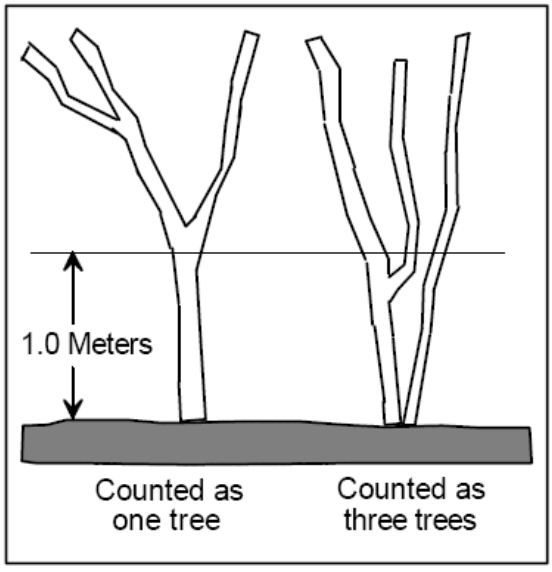


Figure 2. Individual tree determination.

The information we will be gathering on trees is as follows:

Species
Diameter (in centimeters)
Height (in meters)
Location on bank
Whether the tree was planted or volunteer (subjective determination)
Tree Species

Use the common name of the tree on the data sheet. Write legibly.

If you cannot confidently identify the species by using the field guides provided, (e.g., red willow vs. yellow willow) note the family (e.g., willow) and collect a sample of the plant following the instructions at "1.0 Meters Counted as one tree, Counted as three trees". On the data sheet under "Species" enter "Unidentified Sample #1,"

Place the sample into a large Ziploc bag with a label indicating the stream point #, the date, and the collector's name, location of tree where sample was obtained, and the sample #. Whenever possible, include a sample of any flower or fruit present. On the back of the data sheet describe the trunk characteristics (e.g., smooth, deeply grooved) and the branching pattern (branching near the base, central trunk, branching near the top). The more information you take on any unknown tree, the better the chance are that we will be able to identify it.

Diameter (Diameter at Breast Height, DBH)

Using the metric diameter tape, wrap the tape around the trunk of the tree, take a reading, and record the measurement in the "Diameter" column on the data sheet. Diameter measurements should be taken at approximately **1.2 meters** from the base of the tree (average chest height). In the case of trees whose trunks are not vertical, simply measure 1.2 meters up trunk from the base and take the diameter reading there, regardless of the height from the ground. **Note that there are two scales on the tape**. Make sure you use the scale marked "Diameter in centimetres and millimetres" (European spelling) with all black markings. The other side of the tape (with red meter numbers) is a standard metric tape which cannot be used for the diameter measurement.

Height

Tree height measurements are obtained in one of two ways. If the tree is 3 to 7 meters tall, the stadia rod can be used to take a direct height measurement. One member of the team will place the rod as close to the base as possible and extend the rod sections up through the center of the tree canopy until the top of the rod reaches the top the canopy. Another member of the team should stand approximately 10 meters away from the tree to insure that the rod has actually reached the top of the tree. Read the number framed in an opening at the top of the first unextended section of the rod to get your measurement. Direct height measurements should be recorded in the "Direct" column of the data sheet.

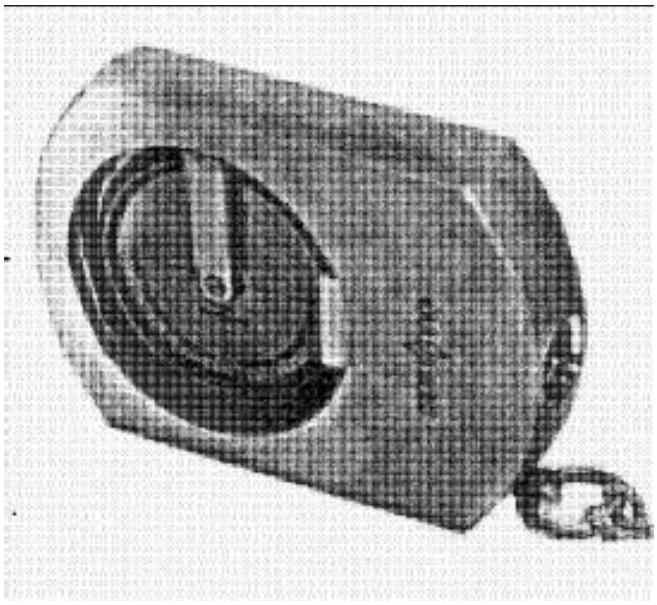


Figure 3. Clinometer.

If the tree is over 7 meters tall or if the vegetation is so dense that the stadia rod cannot be raised to the top of the tree or cannot be read by the observer, then tree height is determined through the use of the "Clinometer" pictured below. This instrument measures inclination relative to a predetermined distance from the base of the tree. There are a number of steps involved in using this instrument.

1. Using the 50 Meter tape measure, measure a distance **beginning at the point directly below the highest point of the tree visible** (this distance must be either 10, 15 or 20 meters measured horizontally from the tree). The further this distance, the more accurate the reading. See diagram next page. Record this distance in the "Distance" column on the data sheet.

Figure 4.Viewing through a clinometer.

2. Holding the clinometer to one eye, sight to the top of the tree. In order to locate the top of the tree you must have both eyes open and alternately focus on the top the tree and through the instrument.

3. As you look through the meter, you will notice two scales and a horizontal line. The horizontal line should be lined up with the top of the tree. If your distance to the tree is either **10 or 20** meters, use the **left** scale to take your readings. If your horizontal distance is **15** meters use the **right** scale. Record the number indicated by the clinometer in the column marked "Ht.". Record which scale you used (left or right) in the "Scale" column.

4. Repeat the above process for the base of the tree (or the area directly below the highest visible point of the tree, if different) and record your value in the column marked "Base". In cases where the top of the tree and the base point of measurement cannot be seen simultaneously, the stadia rod can be used to get a measurement from base point to area visible with clinometer. Do not attempt to calculate the actual height of the tree. Such calculations are done at the data analysis stage.

5. Next, record whether you are standing upslope, downslope or level with the base of the tree and record in the "Upslope or downslope" column.

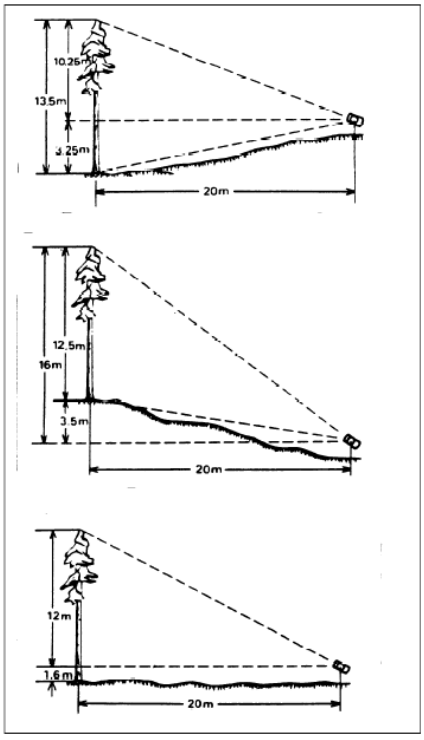


Figure 5. Determining height

Location on Bank

Bank sides (right or left) are determined by facing **downstream**. Refer to the diagram above to determine the appropriate contour features to record in the "Location on Bank"

column. Also note whether the tree is located on the "upper" (above the top of bank), "mid", or "lower" (below the toe) of the slope.

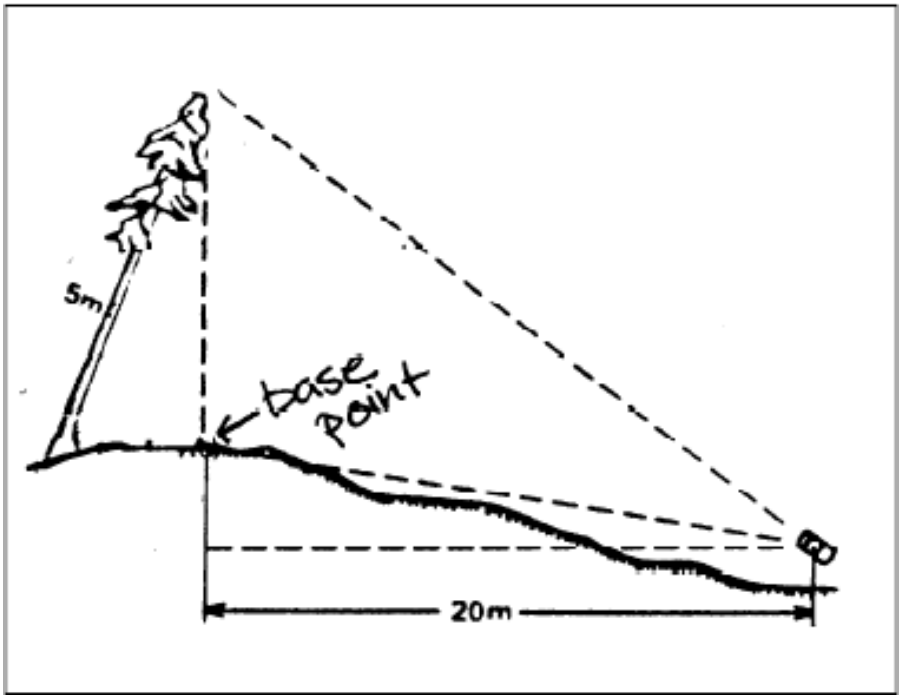


Figure 6. Where tree is leaning or misshapen, it is critical to measure from directly below the highest visible point of the tree, rather than from the base of the tree itself.

Planted or Natural/Volunteer
Determine if possible whether the trees are planted or naturally occurring. In some cases it is obvious that restoration or landscaping has occurred. Unless the tree is clearly planted indicate "natural."

Sapling and Seedling Trees
Young/small trees which do not meet the 4 centimeter diameter/3 meter height requirements to be measured shall be identified by species and location, and counted according to their position in the channel (upper, mid, lower slope) and whether they are clumped in one area or dispersed loosely around the site. If it is clear whether the young trees are seedlings (sprouted from seed) or saplings (sprouted from the roots, base, stump or trunk of an established tree) please cite in the notes. Give exact number of trees up to 50, then give categories of 25 (i.e. 50-75, 75-100) for numbers of trees above 50.

Understory and Setback Measurements
The understory, or vegetation growing underneath the taller trees, is important habitat for wildlife and provides additional shading to keep water temperatures within a range necessary to support native fish populations. To characterize and measure this important component of the riparian ecosystem we will be using a technique known as the "line intercept" method. In order to maximize the team's time, the line intercept is extended

past the riparian corridor on each side to include the "setback," or area of unused land (if any) between the outer edge of the riparian corridor and the first active land use.

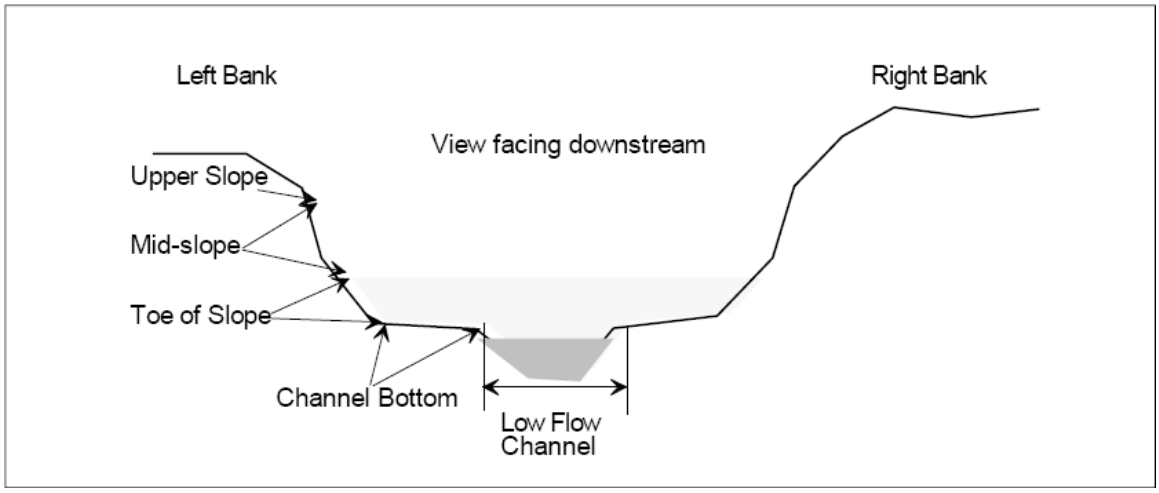
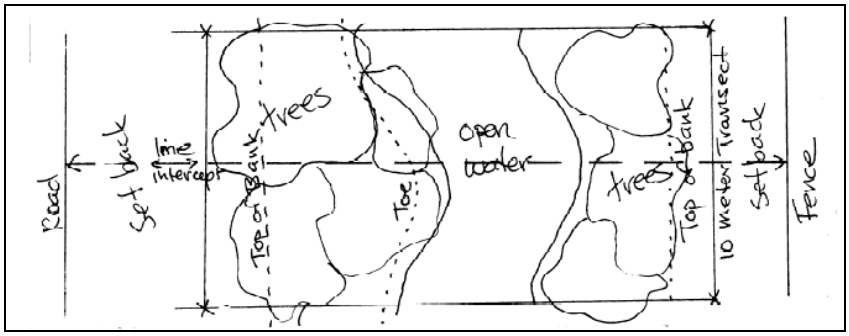


Figure 7. Setback measurements

1. Use the compass to set the 100 meter tape strait across the stream from one land use to the other centered down the middle of the belt transect. The tape should cross the location of the survey marker. Make certain the tape lies on or near the ground.

Sapling/Seedling Species	Location on Bank R/L	Up	Mid	Low	Clumped	Notes
Fremont Cottonwood	R	128	9	0	yes	All originating from downed tree
Fremont Cottonwood	L	19	2	1	no	Scattered along gravel bar

2. Beginning at "0" note the structure/impact at which you have begun, then the length of the setback. Upon reaching the outer dripline of the riparian area, determine the dominant and subdominant vegetation types or if the ground is bare or covered with leaf litter. Move along the length of the tape until the major component of the understory changes for a distance of greater than 0.5 meter. On the data sheet mark the corresponding meter mark as the end of that understory component. See the example above.



3. Continue the process until you work across the creek to the top of the bank on the opposite side. Do not include small patches of different vegetation. Minimum patch size is 0.5 meters. Again, if you cannot determine what the dominant understory vegetation is, collect a sample and label it "Unident. understory #1" and put it in a Ziploc bag with a label indicating Point #, date sample #, and collector. (Use the sampling protocol attached at end of this document). Note the far dripline, and then give the distance of the setback and the structure /impact ending it.

4. Indicate the extent of water or, if the channel is dry, streambed on the data sheet also.

Canopy Cover

The last task before moving on to the next point is a determination of the percent of canopy cover at the site. This information is extremely valuable since it determines, to a great extent, the amount of shading of the channel and the temperature of the water. Canopy cover is measured with an apparatus known as a "spherical densiometer". This is a rather fancy name for a convex mirror with a grid on the surface. Our densiometers have 50 equally spaced dots on the surface as a grid. Hold the mirror about 6 cm from the middle of your chest; your head should just fit in the small box at the bottom of the mirror. Simply count the number of dots covered by vegetation, **multiply by two**, and record that number. There are 4 boxes on the data sheet for 4 separate canopy cover measurements. These four measurements should be taken along the line intercept at regular intervals from the bottom of the toe of one bank slope to the bottom of the toe of the other. Calculate where to stand using the line intercept -- figure out the width between toes, divide by three, and move that distance along the tape for each reading. Always face the nearest bank.

> Notes: Anything unusual that is seen during the course of your survey work should be noted in this section. We are particularly interested in signs of nesting or breeding animals, indications of pollution or other impacts, presence of invasive nonnative plants near the study site. Before you leave the study area, review the data sheets. Look for missing data and check all the decimal points for completeness and accuracy. Make sure all information is recorded on the data sheets and that they are collated if extra pages are necessary. Turn in all data sheets promptly to the Team Leader. It is the Team Leader's responsibility to screen the data sheets prior to submitting them to the Vegetation Survey Coordinator. Should the Vegetation Survey Coordinator have questions on any of the data, the Team Leader will be responsible for contacting survey participants if necessary.

Example of a Tree Inventory Data Form

Creek Name
Survey Point
Date
Time Start: Finish:
Page of

Participants:	
	(recorder)

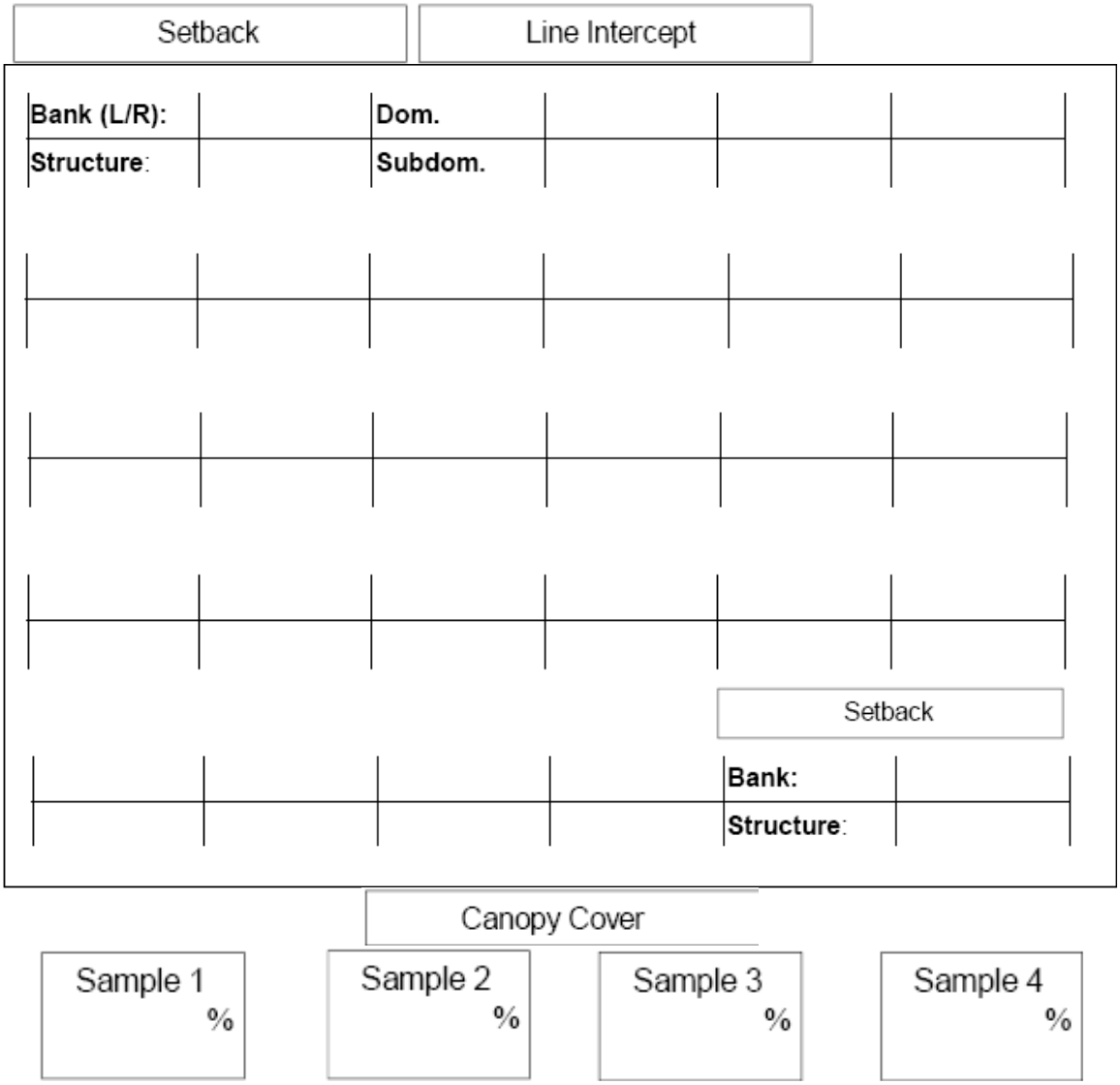
	Height												
Tree Species	Dead?	Direct	Dist. to Base	Clin. Scale (L/R)	Ht.	Base (+/-)	Upslope Downslope or Level	Diam.	Loc. on Bank Bilt. or Tape	L/R	U/M/L	Plant. vol.

Sapling/Seedling Species	R/L	Location on Bank Up	Mid	Low	Clumped	Notes

Example of an Understory and Canopy Data Form

Creek Name		
Survey Point		
Date	Time Start	Finish
Page	of	

Participants:	
	(recorder)



Record number of dots "touched" by the reflection of banks, vegetation, etc. **multiplied by two** to determine percentage. Also note **left/right** sides.