



Field Survey Procedure – Line Intercept Riparian Survey

Restoration Monitoring Guidance
















31 July 2024

Document details	An overview of a riparian vegetation transect approach, including a 1-page field method (Appendix A) and a field data form (Appendix B), for the purpose of monitoring changes in riparian areas associated with fish habitat restoration projects.
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Resource Commitments

2 people	Low cost	Plant ID experience	Low field time	Low processing time
				
 3 - 5				
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1. OVERVIEW

This protocol collects information regarding riparian vegetation type, cover, cover height, and overhanging vegetation. Derived metrics include canopy cover by height class and distance from stream, horizontal extent of hydrophilic vegetation, species composition, invasive vegetation, and vertical vegetation structure.

Line intercept methods minimise among-observer variation (e.g., Palmquist et al 2019) and capture variation associated with distance from the stream or water body, reflecting the influence of hydrological processes on riparian habitat. In addition to more general riparian monitoring, this protocol is considered suitable for floodplain reconnection and process-based restoration monitoring.

This protocol is recommended for use at systematically established transects (e.g., existing channel cross-sectional transects) within a reach or study area that is characterised by a particular vegetation type and land use. This protocol does not survey aquatic or island vegetation, but can be easily adapted.

Considerations for this protocol include the time of year and weather conditions. It is generally recommended that the survey is conducted during summer low flows. This is, in part, due to the assumption that an objective of riparian restoration involves moderating water temperatures when most vulnerable to solar heating, but is also because we anticipate maximum vegetative cover being present at this time. If other objectives necessitate observations at other times of the year (e.g., relating to wetland plant maximum cover), then it will be necessary to consider the influence of the variation in timing associated with the cover of deciduous and non-perennial plants. At certain times of year, a delay of a week between surveying a restoration and a control site may be sufficient to bias the cover metrics, including omitting plant species entirely based on their time and rate of emergence.

This survey should be conducted during dry weather conditions. As the survey is typically conducted at a time when deciduous trees are fully leafed-out, rainfall can influence cover metrics by weighing down leafed branches, altering the extent of the transect on which they are present. Heavy rainfall often also causes limbs to break in summer, presenting a safety hazard.

Conducting this protocol during summer low flows and dry weather, it can also correspond to measurements of canopy cover taken with a spherical densiometer or similar. This facilitates exploration of causal relationships among restoration actions (e.g., riparian planting), riparian composition and structure (this protocol), stream shading (see protocol Stream Canopy Cover), and stream temperature.

A summary of the required equipment for this line intercept survey is provided in Table 1.

Table 1: Equipment Checklist – Line Intercept Riparian Survey

Item	
Field forms (waterproof) / Tablet	<input type="checkbox"/>
Camera	<input type="checkbox"/>
GPS	<input type="checkbox"/>
Flagging tape / pins	<input type="checkbox"/>
Measuring Tape	<input type="checkbox"/>

Note: This list includes only equipment necessary for performing the survey and does not include items required for remote work, wildlife safety, or equipment cleaning/decontamination.

2. LINE INTERCEPT RIPARIAN SURVEY PROCEDURE

Please refer to ‘APPENDIX A: Line Intercept Riparian Survey 1-Pager’ for a concise step-by-step field method, intended for quick-reference in the field. The main body of this document provides further context and some relevant background.

This protocol applies to both left and right banks.

1. Identify the Reach Transect or establish a new transect perpendicular to stream flow. Measurements can be taken at established transects, e.g. where cross-sectional stream measurements are conducted. We recommend transects spaced at 2 x bankfull width, or at 15 m intervals if the bankfull width is < 7.5 m. You should initially walk the reach and take several ‘representative’ measurements of bankfull to establish the transect spacing
2. With 0 m at the bankfull mark, extend the tape perpendicularly away from the channel for the predetermined survey distance.
 - a. Where obstacles are encountered along the transect (e.g., trunks, dense blackberry thickets), assume the transect passes through the obstacle, noting the obstacle and recording the distance it occupies, before resetting the transect beyond the obstacle.
3. Plant encounters along the transect are to be recorded based on species (or lowest known taxonomic unit) and height class. Encounter means that part of the plant is present either directly above or directly below the tape.
 - a. Overlapping or contiguous occurrences of the same plant species present in the same height class are to be considered one encounter, but if the same plant is present in multiple height classes it can have up to three overlapping occurrences (i.e., one per height class).
 - b. Include cover that is present directly above/below the current transect, even if the plant is rooted on the opposite bank or on vegetated islands. Add a note for these encounters.
4. Starting from 0 m on the transect, record the following as encountered:
 - a. The species (or otherwise lowest known taxonomic unit). Include trees, shrubs, and herbs.
 - b. The height class as low (<1.5 m), mid (1.5 to 5 m), or canopy (>5m), based on the greatest height of that plant’s canopy that is present along the transect.
 - i. If there are multiple individual plants of a species within a contiguous or overlapping cluster/stand, with individuals of the species reaching to different height classes, these should be recorded as individual encounters with separate rows for species by height class.
 - ii. The above height class categories are intended to capture notable canopy structure elements for restoring riparian forest (e.g., 1.5 m to 5 m mid-layer functionally shades common invasive plants, >5m canopy height reflects trees becoming established, higher canopy category absent due to multidecadal timescales involved). These height classes should be used unless deemed inappropriate for the target habitat (if finer-scale distinctions are required on grasslands, for comparisons to old-growth structure etc.). If different height class categories are used, the classes should be clearly stated and consistently applied.
 - c. The start and end measurements on the tape for each contiguous or overlapping stand/cluster of that species and by height class.

See Figure 1 and the appended datasheet for clarification.

Additional Guidance

- Vegetation that is rooted above the bankfull mark but is **overhanging the channel within 1 m height of the bankfull elevation** shall be recorded as a negative distance value measured from bankfull mark (e.g., LB -0.8 to LB 4.6 is interpreted as a 5.4 m cover that overhangs bankfull by 0.8 m).
 - Vegetation qualifies as within 1 m height of the bankfull elevation if any part of the plant encountered at the transect descends to within 1 m.
 - Overhanging vegetation that is not within 1 m of the bankfull elevation at any point is not recorded. However, if any cover extends across the channel and above the opposite bank it will be recorded as an encounter on that bank.
 - The following features and their start and end locations (if within transect) should also be recorded if they span more than 0.3 m of the transect:
 - bare soil/sand, gravel, cobble, boulder/bedrock, moss cover (where moss is the dominant/defining vegetative cover), woody debris, anthropogenic items (concrete, riprap, garbage, berms), standing water, saturated soils.
 - any feature that prevents completion of the predetermined length of the transect such as near-vertical valley walls;
 - notable depressions, hummocks, or hollows that are marked by a change in vegetation, including whether the feature is isolated (e.g., fallen tree hollow, rootwad) or linear (scoured overflow channel, berm);
 - Pay particular attention to obligate hydrophytic (wetland) and obligate terrestrial (upland) plants, e.g., differentiating grasses from sedges, even if not known to species level.
 - Gaps or occurrences of cover within any layer of canopy that are <0.15 m along the transect can be ignored.
 - If plants are present but do not qualify as an encounter (e.g., recently emerging, small/rare plants that do not meet 0.15 m minimum criteria, frequently adjacent to but not intersected by the transect), record the species in the notes (no measurement necessary).
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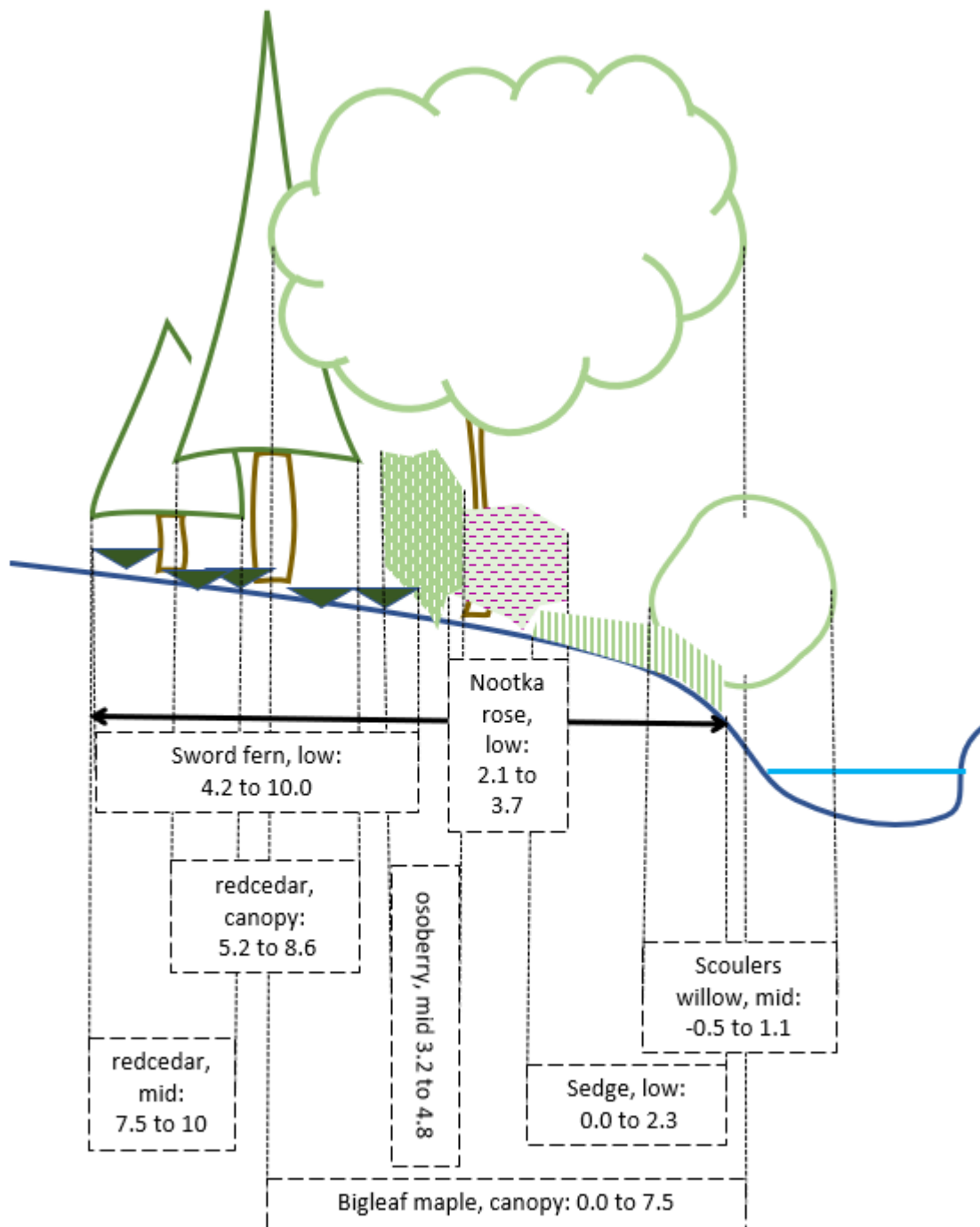


Figure 1: Sketch of line-intercept transect method for riparian/floodplain vegetation. Plants encountered along the transect are recorded by species and height class, with the start and end locations of their cover presence (in m) directly above or below the transect tape. Note that plant species occurrences within the same height class are combined if no gaps in cover greater than 0.15 m occur. In the sketch, Scoulers willow overhangs within 1 m of the bankfull elevation and the overhang distance is recorded as a negative value. No overhang distance is recorded for bigleaf maple, as it is not within 1 m elevation of bankfull.

3. REFERENCES

Palmquist, E.C., Sterner, S.A., and Ralston, B.E. 2019. A Comparison of Riparian Vegetation Sampling Methods Along a Large, Regulated River. *River Research and Applications*, 35(6), pp.759-767

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APPENDIX A: LINE INTERCEPT RIPARIAN SURVEY 1-PAGER

Both left and right banks are surveyed to a predetermined distance from bankfull mark. This protocol does not survey aquatic or island vegetation, but can be easily adapted to do so.

1. **Identify the transect:** Conduct at reach transects where established, or establish new transects. We recommend transect spacing at 2 x bankfull width, or 15 m if bankfull width is <7.5 m.
2. With **0.0 m at bankfull mark**, extend the tape perpendicularly away from the channel for the predetermined survey distance.
 - a. Where obstacles are encountered along the transect (e.g., trunks, dense blackberry thickets), assume the transect passes through the obstacle, noting the obstacle and recording the distance it occupies, before resetting the transect beyond the obstacle
3. **Record plant encounters by height class**, starting from 0.0 m on the transect:
 - a. Encounter means that part of the plant is present either directly above or directly below the tape. *Overlapping or contiguous occurrences of the same species present in the same height class are to be considered one encounter*, but if the same species is present as different individuals in multiple height classes (e.g. saplings beneath canopy tree) it will have separate occurrences that overlap.
 - b. Record the following:
 - i. The **species** (or otherwise lowest known taxonomic unit). Include trees, shrubs, and herbs.
 - ii. The height class as **low (<1.5 m)**, **mid (1.5 to 5 m)**, or **canopy (>5m)**, based on the greatest height of that plant's canopy that is present along the transect.
 - iii. The **start and end distance measurements** (m, 1dp, from bankfull mark) on the tape for each contiguous or overlapping stand/cluster of that species and by height class.
 - c. **Overhanging vegetation** within 1 m of bankfull elevation is recorded as a negative value.
 - d. Record **notable features that span 0.3 m or more** along the tape:
 - i. Bare soil/gravel, moss (if dominant/defining vegetative cover), anthropogenic items, valley walls, notable hummocks or hollows with distinct vegetation etc.
 - e. **Gaps or occurrences of cover less than 0.15 m** along the transect within any layer of canopy can be ignored.
 - f. Pay particular attention to obligate hydrophytic (wetland) and obligate terrestrial (upland) plants, e.g., **differentiating grasses from sedges**, even if not known to species level
4. **Repeat Steps 2 and 3** for the remaining bank, then **repeat at every reach transect** or until a predetermined number of transects have been completed.

APPENDIX B: LINE INTERCEPT RIPARIAN SURVEY FIELD FORM

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Line Intercept Riparian Survey

Study Ref			Stream Name			Date
Transect ID			Transect length beyond bank / m			Staff
Transect Waypoint/GPS						
L/R bank	Species (or lowest known taxonomic unit; or notable feature)	Height class / L-M-C	Start location / m (1dp)	End location / m (1dp)	Plant / Feature Notes	
Transect / General Notes						