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Biodiversity

Standard Operating Procedure

Establishing Vegetation Transects

SOP No:6.2

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Significant Native Species and Ecological Communities – Resource Condition Monitoring Project

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Table of Contents

Appendix A
Photo plates 1 & 2 depicting transect measuring

1 Purpose

This protocol details the method to monitor vegetation (primarily shrubs, herbs and graminoids) through transect sampling, in Western Australia. The method has been used extensively in temperate regions and has been utilised across all bioregions in Western Australia. The methods described here will be used to conduct monitoring in a standardised manner so that where appropriate, comparisons between sites can be made. This method is to be adapted to suit the vegetation type and bioregion in which the vegetation is to be sampled. Generally, in the more diverse vegetation communities transects should be sampled at more frequent intervals to gain a representative sample and in sparsely vegetated communities a longer transect may be required.

2 Scope

This standard operating procedure applies to staff wishing to establish vegetation monitoring transects. Botanists will be familiar with the use and establishment of transects and will find this SOP in line with current published literature.

The SOP details the procedure for both point and line intercept transects and for plots used along a transect.

3 Equipment and Materials Required

Equipment:

- field data sheets (or a hand held PDA for data recording)
- pointer (intercept device) at least 1 m in length (eg. extendable car aerial or metre rule)
- hammer
- permanent yellow, pink or orange spray paint
- metal stakes (stakes, fence dropper, tent pegs) to permanently mark transect
- two 100 metre tapes (or other length suitable to project)
- compass
- pre-constructed quadrat (1x1 m or other) (if required)
- GPS (preferably differential)

4 Procedure

Determine Your Monitoring Question

The monitoring question being asked will largely determine the design (arrangement, placement, and replication) of the monitoring transects and whether a line or point intercept sampling is appropriate.

Select the Appropriate Transect Sampling Method

Transects can be used in a number of ways for monitoring including but not limited to:

- line intercept;
- point intercept; or
- quadrats placed along a transect line.

The use and considerations associated with each method are described:

Line Intercept Method

Canopy cover, or the vertical projection of the vegetative part of the plant over the ground, is measured along a line intercept transect by noting the point along the tape where the canopy begins and the point at which it ends. When these intercepts are added, and then divided by the total line length, the result is a percentage cover for that species along the transect (Elzinga 2001). Cover measured by line intercept is less prone to observer variability than visual estimates in quadrats. Due to overlap of plants of different heights along the transect, it is possible that total species cover using line intercept can be greater than 100%.

This method is particularly suitable when accurately quantified vegetation data are required, for

example when measuring the effectiveness of weed control in reducing weed cover, or in measuring change in cover of native species in response to a specified burning regime.

When using this method, it is useful to establish a photo point and to take both general view and close-up photographs that will be replicated in subsequent monitoring events.

This method is best suited to plants with boundaries that are easily distinguished such as with shrubs and matted plants with dense unbroken canopies (e.g. cushion plants) and particularly those under 1.5 metres. It is less suited for use with sparse or spreading plants, trees, grasses and some thin leaved herbs.

Considerations:

- when selecting key areas for setting up transects, be sure the site is located within a single plant community and within a single ecological site[1];
- for overhead vegetation, a pole can be used to determine canopy cover;
- it is best to conduct this type of study on a windless or low wind day;
- ensure that you are aware of any other work/management that may be occurring within your site and how this may influence results;
- the length of transects is determined by the homogeneity and density of the vegetation. Longer transects are recommended if vegetation is sparse. Transects can vary anywhere between 5 -100 metres in length so refer to an experienced botanist/ecologist for advice if required;
- be sure to permanently mark the study site (a differential GPS location of the start and end points is also useful); and
- be sure to adequately document information on your data recording form and make sure your methods are also well documented.

Collecting Data

- place marker stake to establish the transect start (a steel tag can be used to identify the transect number/identifier);
- determine the bearing of your study area and place a stake at the other end;
- run the measuring tape between the two transect marker stakes, preferably along the ground or as close to ground level as possible;
- there should be several transects created at each study site;
- transects should run about 15 meters in length for dense cover to 50 meters in length or more for areas of sparse vegetation;
- since variation of cover can be high, it is important to take as many readings along the transect as possible;
- proceed down the line-transect (tape) stretched along your study area and identify and measure the horizontal linear length of each plant (for canopy or basal cover) that intercepts the line (remember to look up and include canopies that are above the transect line);
- measure grasses and grass-like plants at ground level;
- for herbs, shrubs, and trees, measure the vertical projections of the foliar cover intercepting one side of the tape;
- record data on a standardised data collection form for transects; and
- Sites need to be carefully selected to ensure that replicates are in the same vegetation community in order to assess the variables of interest.

Analysing Data
From data recorded on the data collection form (e.g. Line Intercept Form)

Cover: Calculate the percent cover of each plant species by totalling the intercept measurements for all individuals of that species along the transect line and convert this total to a percent of total cover. Calculate total cover measured by adding the cover percentages for all plant species. The total distance for each species is then divided by the distance of the tape for the percent cover for that species. Canopies of multiple species that overlapped one another are measured separately,

[1] Unless the transect is established specifically for assessing factors across vegetation boundaries.

potentially resulting in total percent shrub cover for the entire transect to exceed 100%. Standing dead canopies should not be recorded; and cover is calculated by adding all intercept distances and expressing this total as a proportion of the tape length (Elzinga *et al.* 2001).

You can also calculate species composition using this method by totalling the percent cover for each species.

Point Intercept Method

The Point Intercept Method is one of the most common approaches to estimating cover. It is undertaken by placing a 'pin' or other point intercept device along the transect at regular intervals and determining the proportion of points that "hit" (or intercept) vegetation **(Plates 1 & 2, Appendix A)**. Canopy cover is measured by point intercept based on the number of 'hits' on the target species (or general taxa present) out of the total number of points measured. Because at each point the only decision is whether the point intersects the species, measuring cover by points is considered the least biased and most objective of the three basic cover measures (Bonham 1989) as point intercepts are not subject to observer variability from canopy gaps or visual cover estimations.

Additionally, this method is useful for most vegetation types, especially when less than 1.5 meters in height. Plant height (shrubs) higher than 1.5 meters can make reading the pin difficult. Also, if multiple intercepts of varying canopy heights are to be recorded, this is no longer a measure of canopy but rather an index of biomass or composition (Elzinga *et al.* 2001). Using this method, total cover can be calculated as the percentage of hits, relative to the total number of points sampled. Cover of individual species can also be estimated by recording the plant species when intercepted by a point.

It is again useful to have a complete photo record of the site taking both general view and close-up photos.

Considerations:

- sites should be located within a single plant community and within a single ecological site[1];
- It is important to permanently mark each study location (and record start and finish points with a DGPS) and adequately describe the site on a transect data recording form;
- Be sure to establish a detailed photo record of the site;
- To ensure that all installed transects are independent (do not overlap), spacing between transects should be greater than the average diameter of the largest plants likely to be encountered; and
- Sites need to be carefully selected to ensure that replicates are in the same vegetation community, in order to assess the variables of interest.

Collecting Data

- At each pre-determined interval along the transect (regardless of layout), place the point intercept device on the ground; and
- Record the plant species that directly intercept the pin on your transect data form:
    - Cover includes vegetation (can be identified by plant species or simply as vegetation), litter, gravel, stone, or bare ground.
    - You may simply record the presence or absence of vegetation, although it is more effective to record the actual type of ground cover if vegetation is not present.

Analysing Data

Calculate the percent cover for each transect by totalling the "hits" for each cover component (vegetation, litter, gravel, stone, or bare ground), dividing by the total number of hits for the transect, and multiplying by 100.

You can also calculate the percentage of each individual plant species (species composition) by totalling the number of "hits" for that species, dividing that number by the total number of hits along the transect, and multiplying by 100.

[2] Unless the transect is established specifically for assessing factors across vegetation boundaries (see footnote 1).

Transects with plots

Canopy cover in plots (quadrats) is usually determined from visual estimates of cover classes (e.g. Braun-Blanquet (1965)). If small plots are to be placed along a transect line enough distance must occur between the quadrats for them to be considered independent sampling units, meaning that they are not correlated. Correlated sampling units result in an underestimation of the standard error and questionable results (Elzinga 2001).

This method is useful for monitoring recruitment/mortality events of a particular species; or the densities of herbaceous plants. For perennial species a permanent quadrat will be more useful, while annual species, whose distribution is not necessarily correlated from year to year, may suit random, non-permanent sampling.

Select the Location and Placement of Survey Transects

The entire length of the transect needs to be wholly contained in the vegetation unit being sampled. If a particular species is being targeted in the monitoring, then the transect should be wholly contained within the known parameters of the population. Within the vegetation unit the transect should be placed randomly either by the use of random number or by preselecting an angle (0-360˚) to run the transect along from a randomly selected point. If quadrats are to be used in conjunction with the transect they should be placed where they are likely to include the target species as good sensitivity to change in quadrats is obtained for frequency values between 30 to 70%.

An exception to the placement of a transects wholly within a vegetation unit includes for example, if transects are being used specifically to measure vegetation across vegetation boundaries.

5 Safety Considerations

It is recommended that a job safety analysis is undertaken prior to undertaking monitoring using transects at your site. This safety analysis should include the following considerations:

- exposure to sun (UV);
- potential trip or fall injury;
- venomous snakes, ticks, insect bites;
- driving (4wd or light vehicle);
- dehydration; and
- disorientation.

6 Further Reading

The following SOPs have been mentioned in the advice regarding “Establishing Vegetation Transects”. It is recommended that the following SOPs are also consulted when proposing to undertake monitoring using transects:

SOP Collection of Herbarium Specimens (in draft)

7 References

Bonham C. D. 1989 *Measurements for terrestrial vegetation*. John Wiley & Sons, New York, USA.

Braun-Blanquet J. 1965. *Plant sociology: the study of plant communities*. Hafner, London, UK.

Elzinga C. L., Salzer D.W., Willoughby J.W., Gibbs J.P. 2001 *Monitoring Plant and Animal Populations*. Blackwell Science Ltd, USA.

8 Appendices

Appendix A

Plate 1 Using a point intercept device to record species intercepting the transect line.

Plate 2 Noting the occurrence of canopy that overhangs the transect line.

Photos: C. Harding DEC (2008)