Revegetation

EROSION CONTROL TECHNIQUE

Revegetation	✓	Temperate Climates	✓	Short-term	[1]
Non Vegetation		Wet Tropics	✓	Long-term	
Weed Control		Semi-Arid Zones	✓	Permanent	✓

[1] Temporary revegetation can be an effective form of erosion control, but it usually needs to incorporate *Light Mulching* in order to provide sufficient protection from raindrop impact erosion.

Symbol

Photo 1 – Turfing

Photo 2 – Fertiliser spreader and chisel plough

Key principles

1. Test the soils, and where required, adjust the soils before planting
2. The primary function of "temporary" vegetation, in association with mulching, is to achieve effective short-term erosion control through coverage of the soil surface, thus the effective percentage surface cover is the key performance measure.
3. Vegetative-based erosion control is primarily achieved through coverage of the soil. Root stabilisation of the soil structure is generally of secondary importance. However, the function of the roots becomes increasingly important as the surface slope increases.
4. The initial coverage of annual grasses in the weeks following seeding may not provide adequate erosion protection against raindrop impact because these grasses primarily grow vertically, thus providing only limited coverage of the soil surface. In such cases, mowing can increase the effective soil cover.

Design Information

Selecting the most suitable plant establishment techniques, appropriate species, seeding rates, planting densities, fertiliser types, watering rates, and maintenance techniques, requires the guidance of experts such as soil scientists, revegetation specialists, local bushland groups, and government extension officers.

Each of the various forms of soil erosion, whether initiated by wind, rain, or flowing water, are best controlled by different forms and/or combinations of vegetation. Table 1 outlines the types of vegetation most likely to be effective in the control of the various forms of soil erosion. Of course there are always exceptions to such generalisation.

Table 1 – Plant selection for the control of soil erosion

Erosion form	Primary vegetation	Secondary vegetation	Comments
Water induced:			
Raindrop impact	Ground covers, grasses, and living or dead organic matter	Trees, shrubs	• Ground covers need to quickly cover the soil surface (i.e. not just straight, vertical shoots—which is often the early growth characteristic of many annuals). • In this context, "grasses" includes living, dormant and dead grasses. • Trees contribute by suppling leaf and bark litter (mulch).
Sheet erosion	Ground covers, grasses		• Non-clumping, continuous ground cover is required.
Rill erosion	Ground covers, grasses		• Non-clumping, continuous ground cover is required.
Gully erosion	Ground covers, vetiver grass	Trees, shrubs, woody debris	• Vetiver grass can be used to form a vegetative sediment barrier. • Trees and shrubs may be required for bank stability.
Tunnel erosion			• Stabilisation of soil and control of water pathways are of primary importance. • Avoid deep-rooted or short-lived plants on water impoundment embankments.
Wave erosion	Reeds	Mangroves	• Critical locations include coastlines, rivers, lakes and dams. • Mangroves can struggle to deal with significant wave attack.
Gravity induced:			
Mass movement	Trees, vetiver grass	Shrubs	• Use of deep-rooted plants is critical.
Wind induced:			
Wind erosion	Ground covers	Tree, shrubs, mulches	• Trees can form windbreaks. • Aided by increased surface roughness.
Watercourse erosion:			
Refer to the *Instream Erosion Control* fact sheet, and Tables I14 to I15 (p. I.32 to I.34) in Appendix I – *Instream works*.			

ESTIMATING GROUND COVER

(i) Quadrat method

Materials:

- 50m tape measure
- $1m^2$ quadrat (a "quadrat" for these purposes being a 1m x 1m rectangular viewing grid)
- visual cover estimation template (Figure 1, otherwise refer to McDonald et al., 1990)
- notebook and pens

Procedure:

1. Locate sampling points at four evenly spaced points along a 50m transect.
2. Place the $1m^2$ quadrat on the ground with the nominated point at the centre. Identify all species rooted **within** the quadrat (if required), and estimate and record the percentage cover. Where required, record the percentage cover of each plant species. For the purpose of species identification, do not record plants rooted outside, but branching across, the quadrat. For purposes of total cover estimation, record all matter, plant (living or dead) and mulch, whether rooted inside or outside the quadrat.

(McDonald, R.C., Isbell, R.F., Speight, J.C., Walker, J. and Hopkins, M.S. 1990, *Australian Soils and Land Survey Field Handbook*, Inkata press, Melbourne)

(ii) Ellenbank Pasture Meter

The Ellenbank Pasture Meter consists of a weighted plate that compresses pasture, then measures the height of the compressed vegetation. Even though this procedure provides a good estimate of pasture density (for stock feed), it does **not** necessarily provide a good estimate of cover. It is noted that the bulk of the pasture may consist of tall, near-vertical stalks that provide limited protection against raindrop impact in comparison to shorter, near-horizontal dead or living stalks.

ESTIMATION OF TREE AND SHRUB DENSITY

Materials:

- 2 x 50m tape measures
- star pickets
- notebook and pens

Procedure:

At each sample site, mark the western end of a 50m transect with a star picket. Measure the tree and shrub densities using the Point-Centred Quarter method (Barbour et al. 1987), as described below.

1. Locate sampling points at the 0m, 25m and 50m points on the transect.
2. At each sample point, align two axes centred on the sample point. The axes follow the line of the transect, and a line perpendicular to the transect.
3. Within each quadrant formed by the axes, identify the closest tree and shrub. If the tree or shrub exceeds a distance of 50m, do not record it.
4. Measure the distance in metres to the closest tree, and to the closest shrub.
5. Record the species and estimate its height.
6. For each transect, average the distance measurements for trees (D_{ave}).
7. Calculate the average tree density (stems per hectare), $T_d = 10{,}000 / (2 \times (D_{ave})^2)$
8. Calculate the relative density of species, X =

   (Number trees of species, X) / (Total number of trees x average tree density)
9. Repeat Steps 6 to 8 for shrub species. Record the adopted classification of shrubs (e.g. all woody plants less than 6m tall, including tree saplings).

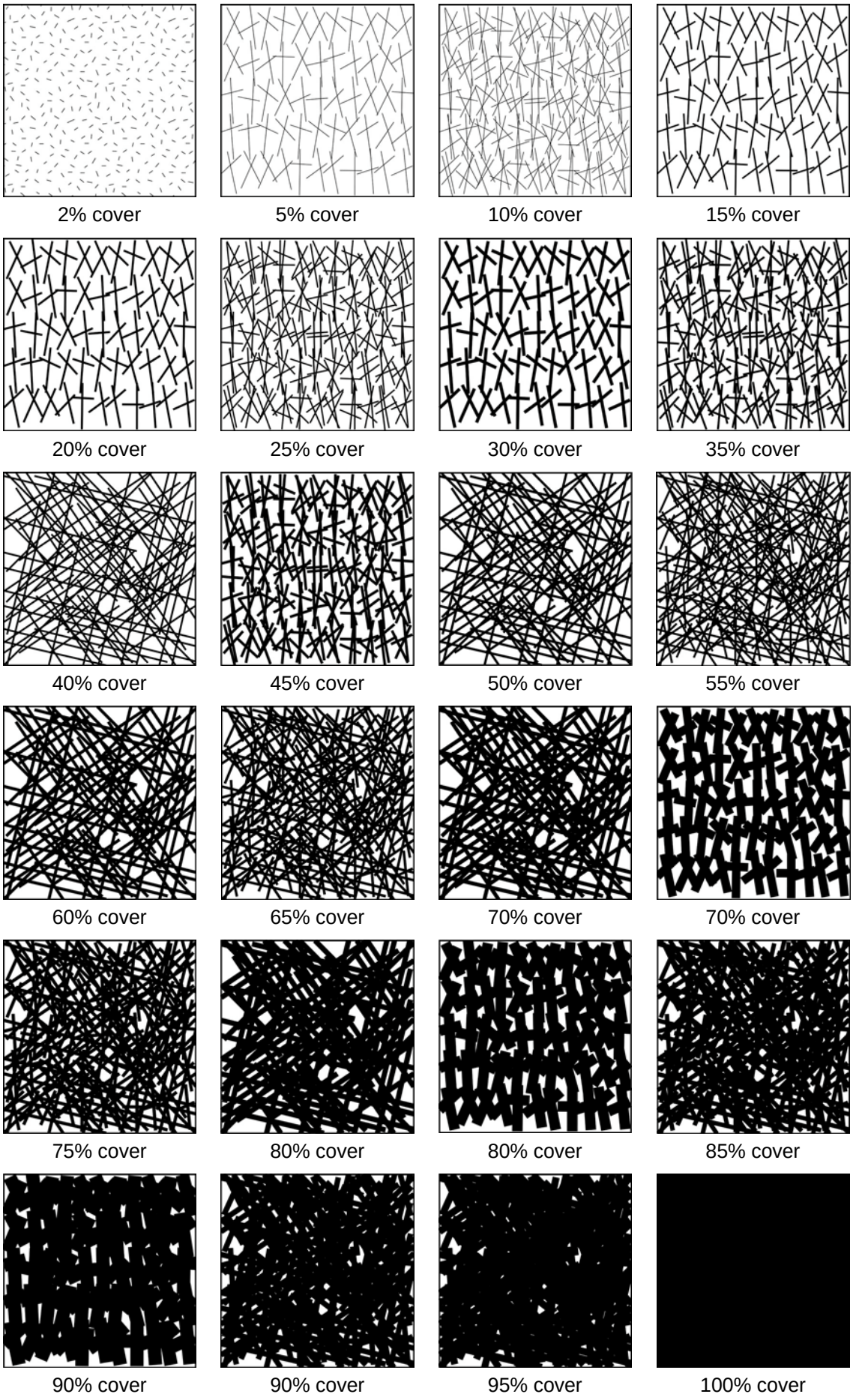

Figure 1 – Visual cover estimation template

Description

Establishment of temporary or permanent vegetation over exposed soil surfaces.

"Temporary seeding" is a process of providing a temporary grass cover during construction delays, or when final further soil disturbance is expected within a given area and short-term erosion control measures are deemed necessary.

Purpose

Site revegetation is performed for a number of reasons, including:

- Improve aesthetics
- Erosion control
- General ecological reasons including habitat, food source & shelter
- Stabilisation of shallow land slips
- Increase stormwater infiltration and reduce the volume of runoff
- Reduce rainfall impact energy
- Increase organic content of the soil
- Established vegetated buffer zones
- Reduce dust problems
- Filter sediment from sheet flow

Limitations

There are limits to the role vegetation alone can play in controlling erosion. Both soil strength and vegetation cover (including root system) can take years to develop to the required condition.

Usually not suitable in heavy traffic areas or on long slopes steeper than 2:1(H:V).

Advantages

In terms of ecologically sustainable soil protection, vegetation is the best long-term solution to wind and water induced erosion.

Most forms of vegetation are self-regenerating and to some degree, self maintaining.

Well-landscaped works are aesthetic and usually well received by the public.

Disadvantages

Long establishment time for most forms of vegetation, except turfing.

Subject to damage in heavy traffic areas.

Conflicts can exist between the choice of native and exotic species.

In some rural and semi-arid areas, watering costs can be high.

Usually requires a long maintenance period.

Common Problems

Poor site drainage can damage plant seeds and remove mulch cover.

Poor soil preparation can significantly limit the establishment, growth and erosion benefits of vegetation.

Many problems can initiate from inadequate soil testing and soil amendment.

Special Requirements

Usually requires guidance from local experts, such as local agronomists.

At least 70% ground cover (combined plant and mulch) is considered necessary to provide a satisfactory level of erosion control.

A mulch cover layer is usually required to control short-term erosion and provide good growing conditions. The mulching of exposed soils is generally recommended on all seeded areas, especially when the area contains: high clay content soils, dispersive soils, exposed subsoils, or during hot, dry weather (to limit soil moisture loss).

Requires suitable soil and soil conditioning.

Plant establishment requires a reliable water supply.

On some open grassed areas, slashing is recommended to reduce the excessive growth of the primary cover and also to remove immature seed heads. This is particularly important for summer plantings as regrowth can compete strongly for light and water with the secondary and tertiary cover species.

Long-term maintenance needs are usually inversely proportional to the degree of planning and quality of site preparation.

Site Inspection

Check effective percentage cover.

Check for damage to protective fencing.

Seed, seedlings and mulch may need re-application if the vegetation does not establish in the required time.

Look for displacement of mulch by wind or water.

Specifications for site revegetation vary considerably from site to site. Site supervisors should obtain site specific planting specifications.

Installation

1. Refer to approved plans for location, extent, and application details. If there are questions or problems with the location, extent, or method of application contact the engineer, landscape architect or responsible on-site officer for assistance.
2. Apply soil conditioners and fertiliser as specified on the approved plans. Rip the soil to a depth of 100 to 150mm to mix the components into the soil and to loosen and roughen the soil surface before seeding.
3. There should be sufficient soil depth to provide an adequate root zone. The depth to rock or impermeable layers such as hardpans should be 300mm or more, except on slopes steeper than 2:1(H:V) where such soil depth may not be feasible.
4. Ensure the soil pH is within the specified range.
5. Apply seed uniformly by hand or with a fertiliser spreader, drill-seeder, hydro-seeder, or other suitable equipment as specified.
6. When using broadcast-seeding methods, subdivide the area into workable sections and apply one-half the specified quantity of seed while moving back and forth across the area, making a uniform pattern. Then apply the second half in the same way, but moving at right angles to the first pass. Cover broadcast seed by raking or chain dragging; then firm the surface with a roller to provide good seed to soil contact.
7. Apply seed at the recommended rate, and disc or otherwise mechanically treat the surface to bring the seed into contact with the soil.
8. The seeded area should be mulched as specified in the approved plan.

Maintenance

1. During the construction phase, inspect the treated area fortnightly and after runoff-producing rainfall. Make repairs as needed.
2. Watering the vegetation periodically is essential, especially in the first 7 days after establishment. Use low-pressure sprays because high-pressure jets can wash away the seed and mulch cover.
3. Watering should start immediately after planting. Watering should comply with specifications provided with the approved plans. Generally watering should vary according to weather and soil conditions. A typical watering schedule may consist of the following:
   - 25 mm every second day for the first three waterings;
   - 25 mm twice a week for the next three weeks; and
   - 25 mm once weekly for a further two weeks.
4. Monitor site revegetation, particularly after rainfall, and appropriate maintenance and/or amendment to ensure that the revegetation is controlling erosion and stabilising soil slopes as required.
5. Where practicable, fill in, or level out, any rill erosion between plants. If excessive erosion occurs, then consider increasing the planting density, applying appropriate erosion control measures, or introducing alternative, non-clumping plant species.
6. Areas must be re-seeded and mulched if the vegetation fails to establish or is damaged by runoff or construction activities.
7. If the temporary vegetation cover or erosion control measure (e.g. mulch cover) should fail for any reason before establishment of the permanent vegetation cover, then it must be replaced with an appropriate type of cover sufficient to control soil erosion.
8. If the permanent vegetation should fail to establish or to adequately restrain erosion for any reason during the construction or maintenance period, the area should be revegetated or protected with other erosion control measures as appropriate.
9. In areas where the obtained vegetation cover is considered inadequate for erosion control, the affected area should be over-seeded and fertilised using half the originally specified rates, or as directed.

10. Maintain grass blade length at a minimum 50mm height within medium to high velocity drainage areas, and 20 to 50mm within low velocity flow paths.
11. Where necessary, or as directed by the site supervisor, slash the temporary crop/grass cover to allow the successful growth of the underlying permanent vegetation cover.
12. Control weed growth within 1m of immature trees for 6 to 12 months for fast growing species, and 18 to 20 months for slower growing species, or until the end of the specified maintenance period.
13. Where mulch is used to control weed growth, inspect and where necessary, renew at maintenance periods not exceeding 4 to 6 months.
14. Apply additional seed, mulch and/or soil conditioning as required. Mulches usually need to be maintained or renewed (as necessary) 2 to 3 times a year.
15. Inspect and where necessary repair protective fencing at maintenance periods not exceeding 1 month.
16. Re-firm plants loosened by wind-rock, livestock or wildlife.
17. Replace dead or severely retarded plants.
18. Prune any plants of dead or diseased parts. Cut off all damaged tree limbs above the tree collar at the trunk or main branch. Use several cuts including undercutting to avoid peeling bark from the healthy areas of the tree.
19. Dispose of cleared vegetation in an appropriate manner such as chipping or mulching, on-site burial, or off-site disposal. Cleared vegetation should not be dumped near a watercourse or on a floodplain where is could be removed by floodwaters. Vegetation should not be burnt on-site without specific approval from the local authority.
20. Repair damaged tree roots by cutting off the damaged areas and sealing them with an approved product. Spread moist topsoil over exposed roots.