Landscape Degradation and Restoration

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ABSTRACT

In this relatively short time, the changes to the ecology of the landscape have been dramatic. Some of this change has been necessary for agriculture, however, pushing the country too hard can result in degradation that impacts on both the lands productive capability and conservation values. Sometimes, land can degrade to a point where rehabilitation or restoration action is required to maintain or improve the productive and/or environmental values of the land. Restoration of an ecosystem is less desirable than the prevention of degradation. Restoration can rarely reproduce the condition of the former landscape, as severe or large-scale degradation may result in the permanent loss of species or genetic material from a local area. Vegetation is the key to restoration of degraded landscapes and its management will be the single most important consideration in any restoration project. Vegetation is vital for stabilizing soil, reducing water tables or maintaining habitat and biodiversity. Most degraded tropical landscapes are a mosaic of land uses and may include patches of intact residual forest and productive agricultural lands as well as degraded lands. It is rarely possible to reforest the whole landscape, especially if it is also occupied by many small farms. Under these circumstances forest restoration is usually done by concentrating on particular sites. These might be riparian areas, buffer zones around residual forest patches, corridors between forest areas, eroding areas on steep hills, etc. however, the effectiveness of conserving biodiversity and restoring key ecological functions that operate at landscapes scales depends on these separately restored sites complementing others in the landscape mosaic. Forests have paid a high price for the growing human need for food, feed, fuel and timber. More than three quarters of the world's forests have been cleared, fragmented or degraded while almost half have disappeared completely. Just one fifth remains undisturbed in tract that is large enough to maintain all their natural functions. The consequences are immense. Degradation harms local livelihoods. Loss of ecosystem services causes local poverty and downstream disasters.

Keyword: Stabilization, Contour Furrowing, Eroded Landscape, Mulching, Revegetation, etc.

1. INTRODUCTION

Vegetation is the key to restoration of degraded landscapes and its management will be the single most important consideration in any restoration project. Vegetation is vital for stabilizing soil,

reducing water tables or maintaining habitat and biodiversity. For most restoration projects, the objective will be to return the land to as near natural condition as possible. To achieve this it stands to reason that restoring the lost vegetation will be the main focus.

2. LANDSCAPE DEGRADATION

Degradation will generally occur in two ways. Firstly, a single or series of discrete "catastrophic" events can result in change, such as severe overgrazing, clearing, drought, rabbit plague or a combination of these factors. Secondly, degradation may occur slowly over time such as through grazing pressure selectively removing sensitive plant series from a paddock and allowing invasion by undesirable plants. Rising water tables and the resulting salinity problems from clearing and irrigation are another example of a relatively slow degradation process. Rabbit infestations also tend to be higher in the sandy soils and this adds to the total grazing pressure in such areas. As a result, vegetation communities that occur on light textured soils including Black Blue bush or Cypress-pine. Mixed woodlands tend to be more degraded. Fences and watering points should be situated so that they do not increase grazing pressure on these vulnerable soil landscapes. Large scale death of mature plants is significant as saltbush seed remains viable in the soil for only 3 to 5 years. If the seed does not have suitable conditions for germination and establishment in this time, the saltbush will be depleted or lost from the area. Once removed it is likely to be replaced with less desirable species such as Poverty Bush and Dillon Bush. Woodlands suffer from degradation on a large scale as they are highly fragmented from clearing. Grazing pressure within woodland remnants tends to remove the under storey shrubs and suppress regrowth of trees. This will often result in woodland that lacks structural diversity and does not have any young trees to replace those that age and die.

3. LANDSCAPE RESTORATION

Left alone for long enough, degraded land may recover to an extent, but it rarely recovers to its original condition. More often, degradation will get worse before it gets better and restoration action is required to reverse the trend. There are four key aspects to a restoration project:

3.1 ***Recognizing Cause and Effect – Target the cause:*** For every effect or symptom of degradation there is an underlying cause. To restore degraded land the cause of the degradation must be identified and addressed. Land is unstable if degrading influences are still active, as the condition of the land will continue to decline. For example, fencing off and planting trees in a dieback affected Black Box depression will not ultimately restore the health of the vegetation if the tree death is resulting from salinity or a lack of flooding.

3.2 ***Site stabilization:*** Removing the degrading influences will usually reduce the rate of decline in condition at the site, and it can also initiate immediate improvement. Stabilization is the minimum level of restoration that should be undertaken in any degrading landscape to prevent the situation from becoming worse.

3.3 ***Environmental reconstruction:*** Following, stabilization and the removal of degrading influences, works can be undertaken to restore the land to the desired condition. This is the environmental reconstruction stage. The extent and nature of the reconstruction works will depend on what you are trying to achieve for the site. Most restoration projects will aim to achieve one of the following objectives.

- Agricultural production
- A natural environment or ecosystem
- Partial restoration for a mix of production and environmental benefits.

The extent of restoration will also depend on the resources available to commit to the project.

3.4 ***Monitoring:*** For any restoration it is important that monitoring is undertaken to ensure that the site is stabilized and improving in condition and that no new degradation is occurring.

4. RESTORATION TECHNIQUES

4.1 Saline Landscapes

It is generally not possible to fully restore saline land to natural condition. However, it can be rehabilitated to a point where some production and environmental benefits may be realized.

4.1.1 ***Recharge stabilization:*** For saline land restoration, the first step is to determine the source of the recharge. If this can be identified, action should be taken to reduce the leakage of water into the ground. Where irrigation is casing the recharge, options include:

- Improved crop water use efficiency;
- Improved irrigation layout;
- Improved surface drainage and recycling;
- Sub-surface drainage such as tile drains, etc.

4.1.2 ***Reconstruction of Saline Land:*** With measures in place to stabilize recharge, restoration of the discharge site can commence. Restoration measures can include the following:

a) Fencing: Stock will often preferentially graze or camp on saline areas. Fencing out a saline area allows grazing to be better managed without affecting the entire paddock. Stock exclusion will allow natural regeneration of ground cover to occur. Saline sites should only be grazed when plants are established and the ground is dry.

b) Retain Remnant Vegetation: Protect and retain existing vegetation to ensure a source a seed for regeneration. Retain dead trees for habitat.

c) *Revegetation:* Revegetation works through tree; shrub or grass planting will accelerate the restoration process and enable the reintroduction of species that may be lost from the site.

d) *Cultivation:* Cross ripping or cultivation of bare ground can improve salt leaching and trap windblown seed.

e) *Ground water pumping:* Bores, spear points and evaporation basins can be used to lower water tables. These options do not address the cause of the problem, but are quite effective stabilization measures.

4.2 Eroded Soil Landscapes

Soil erosion is initiated when there is low vegetation cover on the soil surface.

4.2.1 Stabilization: Stabilization options for erosion generally rely on a combination of structural works, grazing management and vegetation management. Structural works for water erosion control are site specific and require specialist design, survey and construction. Such works include dams, banks, waterways and flumes. While structural works may stabilize the erosion, they generally do not address the cause of the problem. On cultivated soils, stabilization can be through:

- Wind breaks
- Alley farming
- Retention of stubble
- Conservation farming techniques
- Minimizing stock and machinery traffic
- Agronomic practices that improve soil structure, water holding capacity and maximize ground cover.
- A ground cover of at least 50% is required to minimize wind erosion, and 70% to minimize water erosion. Appropriate management of total grazing pressure and revegetation in the paddock or catchment is a key step in maintaining ground cover.

4.2.2 Reconstruction: Following stabilization works, restoration of eroded land is mainly through fencing to exclude stock and promote natural regeneration of vegetation with revegetation works as required. Where soil erosion is caused by a change in catchment hydrology, grazing management and revegetation or changed cropping practice in the catchment can rectify this situation. Scalds are extensive bare areas where topsoil has been eroded leaving a clayey subsoil that is often saline and relatively impermeable to water. Scalded reclamation options include the following:

- ***Waterponding:*** Surveyed banks in either horseshoe or circle configurations can be constructed that pond water over the surface of the scald. The water infiltrates, leaching out salts as well as cracking the surface, thereby improving soil conditions for plant establishment and growth. This is the most successful form of scald reclamation.
- ***Contour Furrowing:*** On slopes greater that 2%, one option is to rip furrows along the contour. The furrows trap water, soil and seed and provide favorable sites for plant growth and establishment. Best suited to areas of low slope.
- ***Revegetation:*** Revegetation works should be targeted at the re-introduction of chenopod shrubs, generally Bladder Saltbush, Black Blue bush or Old Man Saltbush. Early deep ripping with follow up direct seeding into the rip lines can be effective.
- ***Checkerboard or Cross Ripping:*** As with furrowing, rip lines can be used to trap windblown seed and soil and provide suitable sites for plant establishment.
- ***Fencing and Grazing Management:*** It is generally impractical to fence out smaller scalds, however, grazing management is important and fencing will help. Paddocks with scalds should be periodically spelled and rabbits controlled to increase regeneration. This should be done in conjunction with other mechanical techniques.
- ***Farm Infrastructure:*** Situate watering points away from sensitive landscapes to avoid scalding. Ensure that paddock fencing does not isolate sensitive landscapes near fence lines, especially the south west of paddocks.
- ***Mulching:*** Spreading lambs' tails on the scald will add organic matter, trap windblown soil and seed, and increase soil water retention. Mulching with stem trash and seed heads will have a similar effect.
- ***Animal Impact:*** Feeding mobs of stock on a clay pan will disturb the soil, break the soil crust and add organic matter, seed and nutrients through dung and residual feed.

4.3 FRAGMENTED LANDSCAPES AND VEGETATION DIEBACK

A fragmented landscape is where vegetation only occurs as remnant patches. There are two steps in the restoration of a fragmented landscape:

1. Enhancing the condition and quality of remnant vegetation.
2. Increasing the area and connectivity of native vegetation through strategic revegetation and regeneration.

To enhance the condition of remnant vegetation and stabilize the decline, the first step is to remove the degrading influences of the "edge effects". Depending upon the cause of the degradation, restoration measures for erosion include:

- Removal and control of willows.
- Release of native fish into waterways.
- Fencing to exclude stock.

- Adoption of off-stream watering points.
- Revegetation with aquatic and terrestrial plants.
- Weed control.
- Develop a love of fishing and a taste for carp.

4.3.1 Derived landscapes: Derived landscapes are essentially vegetation communities that have changed in composition and character from their original form. The original vegetation has been replaced by a community that may be stable and biological diverse, but does not represent the original vegetation that was present prior to a degrading, or change inducing influence. This change is called succession, and can be induced by management, particularly grazing. Reconstructing prior vegetation communities can prove difficult, and even impossible. However, where the process is actively occurring it is possible to stabilize the situation and reverse the trend. The restoration of these areas is dependent on several factors:

- Sound grazing management.
- Appropriately situated farm infrastructure.
- Reinstating an appropriate fire regime for woody weeds.

4.3.2 Cropped landscapes: Land that is subject to dry land or irrigated cropping can suffer degradation. However, restoration is generally not an option as the land is managed for production

4.3.3 Intact Landscapes: Landscapes and ecosystems that are in good condition and are not degrading to require restoration. However, they do require protection and monitoring to ensure that they do not start to decline.

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