

Agronomic Engineering And Bio Engineering

Practices For Soil Erosion

Preventing And Managing Erosion

Programs to control erosion in Queensland began in the 1950s and have been very successful.

The 3 main principles to control erosion are to:

- use land according to its capability
- protect the soil surface with some form of cover
- control runoff before it develops into an erosive force.

1.Land capability

Soil erosion can be avoided by using land within its capability.

The land's position, soil type and slope determine how vulnerable it will be to erosion. It may not be suitable for agriculture, or suitable only for an activity which limits erosion.

There are a number of resources to help determine how land should be used to avoid erosion:

- for cropping lands—land management field manuals map and describe the land types in many districts and provide advice on land use and management for each soil type. Go to our library catalogue and search for **land management field manuals** to view manuals available in your region.
- for grazing lands—maps of soils and land types are available for most areas. These give graziers an indication of what soils their property may have and are a useful planning tool. Search for soils maps and reports in your region.

2.Surface cover and runoff

Surface cover is a major factor to control erosion because it reduces the impact of raindrops falling on bare soils and wind removing soil particles. It also reduces the speed of water flowing over the land.

Erosion risk is significantly reduced when there is more than 30% soil cover. Total cover is achievable for many grazing and cropping systems.

Runoff concentrates as it flows downslope. By the time rivers draining large catchments reach the coast, they are usually just a few hundred meters wide. Even though surface cover encourages runoff to spread, runoff concentration is inevitable.

Coordination across the catchment is important when implementing runoff control measures. Runoff may pass through several properties and cross several roads (sometimes railway lines) as it passes from the most remote part of a catchment to a major drainage line or creek.

3. Using trees to control erosion

Trees are often considered to be the universal answer to control soil erosion. Tree roots help prevent landslides on steep slopes and stream bank erosion but they don't stop erosion on moderately sloping hillslopes.

In forests, the soil surface is usually protected by a layer of mulch from decaying vegetation as well as a variety of surface growing plants. If the soil is bare under the tree canopy from over grazing, vehicles or pedestrians, soil erosion will still occur.

Erosion control in cropping lands

Tillage

Conservation cropping practices that maintain cover on soils include minimum and zero tillage practices. Nowadays during the fallow period, farmers use tillage implements that kill weeds without burying stubble and herbicides to minimise the frequency of tillage.

Contour banks and strip cropping

Runoff concentration is managed by structural measures such as contour banks in upland areas, or strip cropping on floodplains. These systems involve a total change in the way a farm is managed.

Runoff systems must be carefully planned. Flow between properties and across roads and railway lines must be coordinated and suit those affected by the changes.

When runoff water can impact neighbouring properties or infrastructure, land owners are encouraged to discuss with their neighbours and seek professional advice.

Approximately 80% of soil lost as a result of poor cover can be trapped in the paddock by contour banks. The banks channel the runoff at low speed into grassed waterways. Good surface cover between contour banks and in waterways will ensure their stability and dramatically reduce the amount of soil deposited in waterways.

On flood plains, strip cropping is used to spread flood flows rather than allowing it to concentrate.

Green cane harvesting

Another measure that maintains soil cover is green cane harvesting or 'trash blanketing'. When a cane crop is harvested, the leaves and tops of the cane are left on the ground as a 'trash blanket'. This protects the soil from erosion by raindrop impact. This practice has been widely adopted in many Queensland cane growing districts.

Erosion control in grazing lands

Surface cover

Surface cover is the key to erosion control in grazing lands. It prevents erosion by maintaining the soil so it can absorb rainfall.

A well-managed pasture with good cover will ensure that runoff spreads rather than concentrates. Bore drains, tracks, roads, cattle pads and fences concentrate runoff, so careful planning is required to ensure that property improvements are located where they will not contribute to erosion.

The critical level of cover for pastures in tussock grasslands is about 40% cover and 1000 kilograms per hectare of dry grass. Ideally, this level of cover will exist at the beginning of the summer storm season.

The ideal stocking rate is flexible, and stock numbers should match available feed. Regular monitoring of pastures is necessary to achieve this. Long-term weather forecasting, using predictive tools such as the Southern Oscillation Index (SOI), has improved the options available for predicting droughts.

Fire

Fire is useful for controlling woody weeds but it needs to be managed carefully. Regular burning of pastures will further reduce ground cover and promote runoff and erosion.

Managing Erosion In Urban Areas

Queensland's rapidly increasing population and continued economic development require numerous construction projects and activities that expose soils to erosion.

The following approaches will help reduce erosion on development sites:

- disturb minimal area when excavating
- where possible, divert upslope stormwater around the work site and other disturbed areas
- install sediment barriers (e.g. sediment fences or turf buffer strips) downslope of the building site to filter coarse sediments
- restrict vehicle access to one entry point where possible. Graveling the access point will allow all weather access and minimise erosion.
- connect a temporary or permanent downpipe to a stormwater system before laying the roof
- place all stockpiles on the construction site and behind a sediment barrier
- landscape all bare areas as soon as possible after construction is completed.

Measures for Soil Erosion Conservation:

Engineering Practices

This article throws light upon the top five engineering measures to help control soil erosion.

The engineering measures are:

- 1. Bunding**
- 2. Terracing**
- 3. Trenching**
- 4. Basin-Listing**
- 5. Sub soiling.**

Engineering Measures # 1.

Bunding:

Bund is an earthen embankment constructed to control runoff and minimizes soil erosion by reducing the length of slope.

(a) Contour Bunding:

(i) Contour bunding is most popular mechanical measure to control soil erosion and conserve moisture in arid and semi-arid areas with high infiltration and permeability.

(ii) This practice consists in making a comparatively narrow-based embankment at intervals across the slope of the land on a level that is along the contour.

(iii) It is commonly adopted on agricultural land up to a slope of about 6 per cent and in areas where average annual rainfall is < 600 mm.

(b) Graded Bunding/Channel Terraces:

(i) In graded bunding water flows in graded channels constructed on upstream side of bunds and leads to safe outlet on grassed water ways.

(ii) Graded bunds may be narrow-based or broad-based. A broad-based graded terrace consists of a wide-low embankment constructed on the lower edge of the channel from which the soil is excavated. The channel is excavated at suitable intervals on a falling contour with a suitable longitudinal grade.

(iii) It is adopted at about 2-10 per cent land slope and in areas where average annual rainfall is > 600 mm.

Grassed Waterways:

(i) Grass waterways are natural or constructed watercourses covered with erosion resistant grasses and are used to dispose surface water from the crop land. They are constructed along the slope of the land.

(ii) Grassed waterways are associated with channel terraces for the safe disposal of concentrated runoff, thereby protecting the land against rills and gullies.

(iii) Grass waterways are also used to handle natural runoff or to carry the discharge from contour furrows, diversion channels or to serve as emergency spillway in farm ponds.

(iv) The suitability of a grass was based on the cover it gave, the ease with which it was established and the forage yield obtained from it.

(v) Panicum repens was the best suited grass, followed by Brachiara mutica, Cynodon plectostachyus, Cynodon dactylon and Paspalum notatum.

Soil Erosion Conservation: Engineering Measures # 2.

Terracing:

A terracing is a combination of ridge and channels built across the slope. This is generally practiced in steep hill slope.

(a) Bench Terracing:

(i) Bench terrace consists of construction of step like fields along the contour by half cutting and half filling. Original slope of the land is converted into level fields and thus all hazards of erosion are eliminated.

(ii) The vertical drop may vary from 60 to 180 cm, depending upon the slope and soil conditions, as also on the economic width required for easy cultural operations.

(iii) The material excavated from the upper part of the terrace is used in filling the lower part.

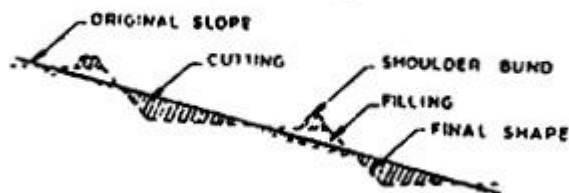
(iv) A small 'shoulder' bund of about 30 cm in height is also constructed along the outer edge of the terrace.

(v) It is generally practiced on steep sloping (16-33 per cent) and undulated land.

(vi) It helps to bring sloping land into different level strips to enable cultivation.

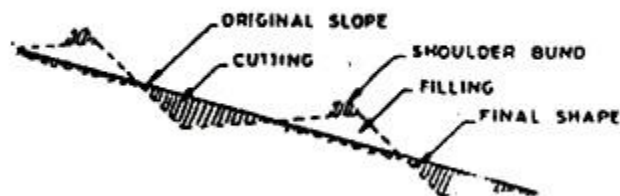
(vii) Bench terraces may be 'table top' or sloping outward or inward with or without a slight longitudinal grade, according to the rainfall of the tract – medium, poor or heavy, and the soil and the subsoil are fairly absorptive or poorly permeable.

(i) **Table top (level):** adopted in medium rainfall (750 mm) areas, permeable soils and ideal where irrigation facility is available.

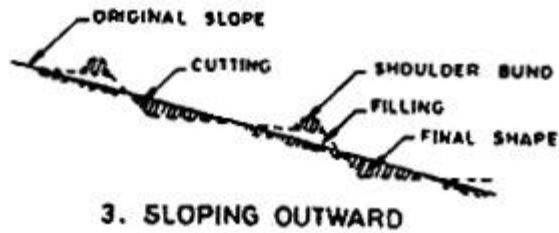


1. LEVEL AND TABLE TOP

(ii) **Sloping inward:** adopted in heavy rainfall (>750 mm) areas



2. SLOPING INWARD



(b) Zing Terracing:

- (i) Zing terracing is adopted in 3-10 per cent land slope.
- (ii) It is constructed in medium to deep soils in high rainfall areas.
- (iii) The aims of constructing zing terracing is:
 - (iv) To cut down the length of slope
 - (v) To harvest the runoff from upper areas for the benefits of crops grown in lower areas.

*Soil Erosion Conservation:
Engineering Measures # 3.*

Trenching:

Trenching is made along the contour for soil & moisture conservation and afforestation purpose.

- (i) The size of trenches – 60cm x 48cm
- (ii) Spacing of trenches -10-30 meter
- (iii) Trenches are half refilled with excavated materials and remaining half of the soil forms the spoil bank.
- (iv) The remaining water in the trenches helps in conserving the moisture and provides benefits for sowing and planting.

*Soil Erosion Conservation:
Engineering Measures # 4.*

Basin-Listing:

Basin-listing consists in making of small interrupted basins along the counter with a special implement, called a basin lister. Basin-listing helps to retain rainwater as it falls and is specially effective on retentive soils having mild slopes.

Soil Erosion Conservation: Engineering Measures # 5.

Sub soiling:

This method consists of breaking the hard and impermeable subsoil with a subsoiler to conserve more rainwater by improving the physical conditions of a soil. This operation, which does not involve soil inversion and promotes greater moisture penetration into the soil, reduces both runoff and soil erosion.

The subsoiler is worked through the soil at a depth of 30-60 cm at a spacing of 90-180 cm. Subsoiling by tractor drawn chisel plough at 2 m horizontal interval is the most effective in situ soil and water conservation practice for early establishment and improving the pasture. It will also increase the efficiency of work and a large area can be covered in a few cost and limited time.

Agronomic Practices For Soil Erosion

Erosion control measures that are natural or organic based are efforts to protect the earth's surface through materials that come from the earth. These materials can be **plant** based, **water** based, or **rock** based.

There is an abundant amount of plant based erosion control measures.

Buffer Strip

Buffer strips are similar to **bioswales** (see below) as both control running water and contain loose sediment. Buffer strips are usually found on farmland and are made up of permanent plants (which means a farmer will not strip the plants and grow new vegetation in their place) -- bioswales, on the other hand, are entrenched into the land.

Alternatively, there is an erosion control measure called **windbreak**. Windbreaks have the same purpose as buffer strips but are made up of bushes and trees rather plants.

Crop Rotation

Crop rotation is growing a new type of crop in a field each year to help fight soil erosion

Mulching

To mulch is to place either natural or human-made material on soil. Mulching helps kill weeds, trap water, and protect soil from wind and water erosion. Natural mulch may be leaves, straw, or wood chips

(to list a few) while human-made mulch could be a plastic sheet (the use of such mulch is called **plasticulture**)

Reforestation

Reforestation means to replant trees in an area where they have been cut down. Not only does growing new trees help fight erosion, but trees also provide us with fresh air.

Seeding

There are two types of seeding (**temporary** and **permanent**) and a seeding method (**hydroseeding**) that help control erosion. The purpose of these two types of seeding is to grow plants that will help protect the soil from erosion. Seeding is much like mulch, which can be used in conjunction with seeding.

1. Temporary Seeding. This is seeding that is used during quick construction jobs or until permanent seeding is able to be planted. The time of year may prevent permanent seeding.

2. Permanent Seeding. This is seeding that occurs after construction and is done in order to provide the land with lasting protection against erosion.

3. Hydroseeding. Hydroseeding is a method of seeding and can be used for either temporary or permanent seeding. It is employed when the land is difficult to access (a steep slope, for example). With hydroseeding, seeds are sprayed onto the ground either through the use of a truck or helicopter.

A similar concept to **seeding** is **cover crops** which are crops made up of strong plants compacted together to help prevent the soil from eroding.

THE END