Soil Bio & Eco-Engineering Introduction

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Introduction

- Definition
- Advantages
- Disadvantages/Limitations
- Scope and areas of application

Definition of Soil Bio-engineering

• Soil Bioengineering can be defined as the field of engineering in which a combination of live and dead plants and plant parts are used as building materials for erosion & slope protection, which is also useful for rehabilitation of degraded land (Schiechtl, 1980).

• Integrating bioengineering technique with civil engineering structures usually offers effective solution is the Hybrid Eco-Engineering, which is also terms as Eco-DRR.

Definition of Soil Bio & Eco-engineering

- Bio-engineering can be redefined as:
 - Ecological engineering used only plant species;
 - Eco-DRR hybrid or Green-Grey Construction;
 - Nature based Solutions (NbS) or Ecosystem based Adaptation (EbA);
 - Eco-Engineering- Hybrid construction emphasis is given to NbS & co-benefit

• Bio-engineering is popularly use for soil slope protection (e.g. erosion control, shallow landslides, river bank protection, etc.)

Advantages of Soil Bio & Eco-engineering

- Effective in most shallow-seated instabilities and erosion control;
- Low cost technology;
- Environment friendly;
- Use of locally available materials;
- High Skilled manpower not required;
- Work opportunity for local people; &
- Economically beneficial to local farmers.

Conventional Engineering vs Bio & Ecoengineering:



Common roadside slope failures



Common roadside slope failures



Limitations of Soil Bio Eco-engineering

- Not suitable for deep-seated failures;
- May not function properly if adequate care is not given during initial stages;
- Generally cannot provide immediate treatment measures;
- Some construction/plantation techniques may require skilled manpower;
- Proper knowledge of plants, their engineering functions and site suitability is required,

Engineering Functions of plants

- Catch by stem;
- Support base of big trees;
- Anchor Tree roots;
- Reinforce roots of various kinds (root-cohesion);
- Armour ground coverage;
- Drain by planted configuration;
- Improving soil & micro climate & water source;



Scope (Areas) of Application

- Prevention of scour around drain and culvert discharge points;
- Prevention of scour around civil engineering structures, especially at the soil/structure interface;
- Protection against debris blocking side drains;
- Protection against debris coming on to the carriageway of roads;
- Protection of uncompacted spoil



Scope

- Protection of embankments and fill areas;
- Protection of bare cut slopes;
- Protection of bare surfaces on rehabilitated landslides;
- Protection of slope toes from erosion, undercutting;
- Stabilization of gullies;

contd...





Scope

- Rehabilitation of quarries and borrow pits;
- Prevention of shallow planar failures;
- Prevention of shallow slumps;
- Reduction of minor rock falls in weak, shattered rock;
- Reduction of minor debris fall.
- Water resources Conservation

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Role of Vegetation:

Basic Effects:

- Hydrological Effects:
 - Rainfall interception
 - Evapotranspiration
 - Retarding velocity of runoff
 - Creating deep percolation



Role of Vegetation:

Basic Effects:

- Mechanical Effects:
 - Generating subsurface flow
 - Anchoring by tree roots
 - Reinforcement and buttressing of soil by roots
 - Restraint of soil particles/Increase
 Soil Cohesion
 - Surface matting



Techniques of Bio & Eco-Engineering:

- Planted Grass in Lines
- Brush layering
- Fascines
- Palisades
- Wattling / bamboo fencing
- Shrub / Trees / Bamboo Planting
- Vegetated Stone pitching
- Straw Matting
- Jute netting/Geo-nets
- Vetiver grass



Effect of Vegetation on Water Availability

- Vegetation management practices can affect both on-site and off-site water through their effects on vegetation composition & soil surface characteristics;
- The amount & quality of increased soil water depend on the original vegetation, soils & climate;

 Water availability also depends on the range management practice, vegetation, vegetative composition & soil surface characteristics.







