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**Vegetation and Environmental
Conservation Laboratory**

The role of vegetation in the environment

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Outline



- The history of vegetation engineering in Taiwan
- Definitions and Subjects of Vegetation
- Conservation Functions of Vegetation
 - ◆ Environmental Adaptation Functions of vegetation
 - ◆ Soil and Water Conservation Functions of Vegetation

The history of vegetation engineering in Taiwan



In early years:

Taiwan's soil and water conservation and vegetation works are scattered in **pit and trench stability and landslide site remediation projects**, with the utilization of **germination stake nailing or staking and burying branch method** to stabilize slope surface.

In the 1960s:

The main work focus that **agricultural land soil and water conservation, vegetation coverage and grass cultivation**, etc.

In the 1970s:

when constructing Zhongshan Highway, **a lot of foreign vegetation equipment, information, materials, and construction operational methods** were introduced to carry out **roadside slope stability** with vegetation engineering.

The history of vegetation engineering in Taiwan



After 1983:

Vegetation technologies for special areas including **red soil, mudstone and limestone mining areas**, etc. were respectively experienced and explored.



The history of vegetation engineering in Taiwan



In 1984:

The Greening Implementation Team was established by the Taiwan Provincial Government at that time to promote environmental greening of roads, school campuses, factories and home environments.

After 921 Earthquake in 1999:

In response to the greening and revegetation needs of wide areas of the country, **ecology-based and safety-oriented ecological engineering** as well as soil and water conservation vegetation works were confirmed as development direction to promote **national land disaster prevention and revegetation task**.

The history of vegetation engineering in Taiwan



In recent years :

Due to the disasters and the impacts brought on by climate change, soil and water conservation work has promoted rural green vegetation resource and environment survey, encouraged extensive planting of trees, and constructed green belts with ecological and buffering functions as performing direction.



Definitions and Subjects of Vegetation

- Vegetation refers to the total aggregation of plants grown in an area, especially the grasses, ferns, and higher plants such as shrubs and trees, etc. grown on the ground surface.
- The vegetation of soil and water conservation field focuses more on the artificial importation of vegetation materials or artificial assistance of vegetation succession, as well as accelerating the establishment of vegetational structures that have slope disaster prevention, environment conservation and sustainability functions. It consists of five parts:
 - ◆ Water conservation, ground erosion prevention
 - ◆ Shallow layer collapse prevention
 - ◆ Flood reduction
 - ◆ Air purification
 - ◆ Environment beautification



Definitions and Subjects of Vegetation Engineering

Vegetation engineering refers to the engineering methods and technologies designed for the purpose of vegetation through selecting vegetation materials suitable for growth, coordinating with the constructive foundation and protective engineering, and then carrying out with vegetative introduction construction and operation.

The scope of vegetation work includes as:

- ◆ Vegetation preparing operation (vegetation base work)
- ◆ Vegetation introducing operation (vegetation practices)
- ◆ Vegetation maintenance and management, etc.

These three parts are the core scopes of vegetation engineering.

Conservation Functions of Vegetation



1.Environmental adaptation functions of vegetation

◆ Microclimate adjustment

- ◆ Air purification
- ◆ Noise control
- ◆ Traffic guidance
- ◆ Water purification
- ◆ Biological habitat creation

- The vegetation structure can influence the sun's radiation effect on the ground.
- Plants can block direct sunlight and reflected light, reduce wind speed, adjust summer atmospheric temperature through evapotranspiration and energy consumption, and then adjust the microclimate and alleviate the ground temperature difference.
- In addition, the temperature changes inside and outside the forest can even promote better airflow and create a more comfortable environment.

Conservation Functions of Vegetation



1.Environmental adaptation functions of vegetation

◆ Microclimate adjustment

◆ Air purification

◆ Noise control

◆ Traffic guidance

◆ Water purification

◆ Biological habitat creation

- When plants breathe, they can absorb part of polluted gases into leaves, and then return them to the land via fallen leaves.
- So vegetation has air purification functions of oxygen supplementation, filtration, deodorization, absorption, and suction, etc.

Conservation Functions of Vegetation



1.Environmental adaptation functions of vegetation

- ◆ Microclimate adjustment
- ◆ Air purification
- ◆ **Noise control**
- ◆ Traffic guidance
- ◆ Water purification
- ◆ Biological habitat creation

- Plants have the effects of absorption, reflection, refraction, and deflection on noises, so they can effectively reduce the noise pollution of the environment.
- In particular, the establishment of green buffer strips or buffering belts around the development base can effectively control noise.

Conservation Functions of Vegetation



1.Environmental adaptation functions of vegetation

- ◆ Microclimate adjustment
- ◆ Air purification
- ◆ Noise control
- ◆ Traffic guidance
- ◆ Water purification
- ◆ Biological habitat creation

- The application of vegetative green belts, green fences, or the planting of forest belts can effectively reduce glare interference.
- Design should avoid vegetation plants prone to cause glare, and provides passersby with a comfortable traffic environment.
- The street trees on the road and the green belt on the refuge island can also reduce the wind speed to adjust the microclimate and maintain the driving safety.

Conservation Functions of Vegetation



1.Environmental adaptation functions of vegetation

- ◆ Microclimate adjustment
- ◆ Air purification
- ◆ Noise control
- ◆ Traffic guidance
- ◆ **Water purification**
- ◆ Biological habitat creation

- The vegetation protection green belts set on the edges of natural rivers, stream areas, agricultural ponds or wetlands have the functions of stabilizing the waterfront, filtering sediment, and filtering pollutants in water purification.
- The construction of good forest form and vegetation cover in the water resource protection zone stabilizes and provides excellent water quality.

Conservation Functions of Vegetation



1.Environmental adaptation functions of vegetation

- ◆ Microclimate adjustment
- ◆ Air purification
- ◆ Noise control
- ◆ Traffic guidance
- ◆ Water purification

➤ The plant community having multi-layer canopy covers can provide plenty of foods, supply material energy circulation and create habitats for wild animals, and also provide places for people to relax or play.

- ◆ **Biological habitat creation**

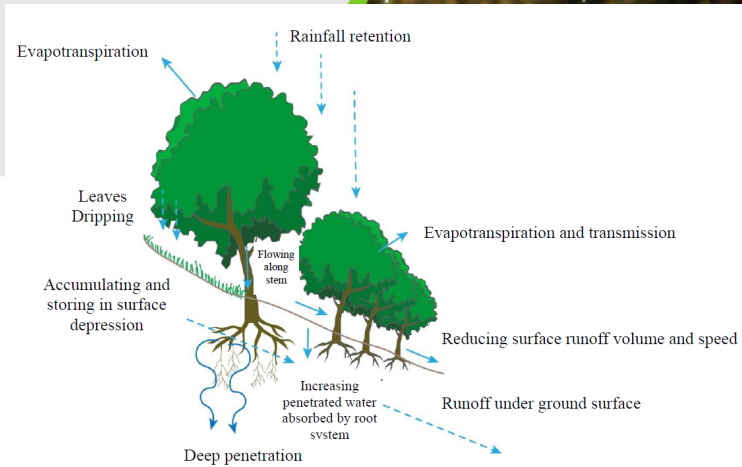
Conservation Functions of Vegetation

2. Soil and Water Conservation Functions of Vegetation

◆ Water conservation function of vegetation

(1) The interception effect of crown canopy

The crown canopy of trees can intercept rainfall and reduce the volume and rate of rainfall reaching the ground surface. In areas with better forest vegetation coverage, about 30% of the annual rainfall can be intercepted. For a single rainfall, the canopy interception rate can reach 100% when the rainfall is small. When the rainfall is heavy, it can reach about 25%. (Lin Xinhui, 2004). The canopy interception volume or rate is affected by tree species, tree age, degree of crown closeness, branch shape, bark roughness, and leaf shape characteristics.



Conservation Functions of Vegetation



2. Soil and Water Conservation Functions of Vegetation

◆ Water conservation function of vegetation

(2)Ground surface protection

Vegetation cover can **prevent soil separation and loss due to raindrop impact**. Through the protection of vegetation, surface hardening can be effectively prevented, and soil aggregate stability and infiltration rate can be increased. In general, plant coverage rate will affect the degree of resistance to the impact of rainfall. **In the regions with the vegetation coverage rate of less than 70%, the runoff rate and erosion amount will rapidly increase due to the reduction of vegetation coverage.** (Lin Xinhui, 2004).

Conservation Functions of Vegetation



2. Soil and Water Conservation Functions of Vegetation

◆ Water conservation function of vegetation

(3) Increase of infiltration effect

- A. The presence of horizontal root system and its above-ground backbone of plant's root base protruding from ground and dead branches, can **increase ground surface roughness**, and can **extend the retention time of rainwater** on the surface and **increase the infiltration volume**.
- B. The topsoil forms **a lower bulk density and a better aggregate structure**, which can increase soil water preserving ability.
- C. **The crown canopy layer and the litter layer of plant can delay the time** when the rain falls to ground surface, which can effectively increase the infiltration amount.

Conservation Functions of Vegetation



2. Soil and Water Conservation Functions of Vegetation

◆ Water conservation function of vegetation

(4)Runoff mitigation

- A. Plant canopy intercepts rainwater and reduces rainfall in the forest.
- B. The litter layer and the ground cover plants have the function of absorbing rainfall moisture.
- C. The soil under the litter layer is beneficial to **the infiltration of runoff water into the soil** due to the increase of humus and the aggregate structure and the residual pores of the corroded root group.
- D. Plant roots** can improve the properties of deep soils and increase soil water preserving and infiltration abilities.
- E. The root systems of vegetation cover are **particularly intertwined**, reducing the development of surface erosion and gully.



Thanks for your attention.