VETIVER SOILTRAPS FOR SLOPE PROTECTION AT GUATEMALA, CENTRAL AMERICA.

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Key Words:

1. Hydraulic Energy: Amount of energy that holds water runoff capable of making severe damage to the slope surface.
2. Hydraulic Gradient: Different hidraulic load applied along a slope surface. Each section of the slope is exposed to different hydraulic load.
3. Soiltrap: Device made out of Vetiver leaves with the main pourpose of aiding to control erosiono n the slope surface.
4. Surface Runoff: Water that runs on the ground surface after the soil infiltration capacity is run ut.

I. INTRODUCTION

In the last decades Vetiver System has gained an important place among the solutions for slope stabilization and erosion control. The reason of its acceptance: due to its multples advantages widly known for slope protection. However, Vetiver System is still vulnerable in certain conditions. When instalation process is just finished the protection level is little and the plants are exposed to runoff. Either planting in dry or rainy season the slope surface suffers main damage. Due to watering in dry season or rain in rainy season. Sediments are transported to the end of the slope or they are taken away by runoff. Both cases are an economic and environmental issue. Therefore an practical, simple and viable solution may be applied.
A solution that make those sediments remain on the slope surface would fix the problem. A phisic barrier laid perpendicular to de slope would trap sediments and these used as a booster for plants grow. Sediments in this conditions are generally poor. However have at least traces of nutrients, so critical in this conditions.
These barriers should gather some characteristics: abundant, low cost, light for easy transportation, and easy instalation.
Finally it was found that Vetiver leaves were the solution. Then these devices was called vetiver soil traps.

When Vetiver is planted it has to be trimed for teehnical reasons. The leaves resultant used to be used for many purposes. This foliage are used now only for making soil traps.

II. MATERIALS AND METHODS

2.1 Materials and Equipment:

For soiltrap manufacturing it is needed the following:

a- Machete
b- Sintetic rope
c- Vetiver foliage

For soiltrap instalation next equipment and materials are needed:

a- Wood or steel stick.
b- Hammer

2.2 Methods and themes:

2.2.1 Justification

At the moment of finishing planting vetiver the surface of the slope is vulnerable to erosion. Even plants may be taken away by runoff in new plantations. That is the reason why an aid should be apply to vetiver at the begining for stopping erosion.
Watering and surface runoff are the reason of the problem. For practical usage from now on when refer to them both the word runoff will be used.

Figure No. 1 Damage made by hydaraulic energy to a recent vetiver plantation. Vetiver Tec. Guatemala.

2.2.2 Analisys Process and Theme:

a- Run off

Amount of water that runs on the surface of the ground after its infiltration capacity is run out. The steeper the slope the more velocity the runoff gains. The same happens with the height of slope. The velocity is what gives the hydraulic energy to the runoff.
The more hydraulic energy of runoff the more damage the slope will suffer.

The amount of soil lost due to runoff depends mainly for hydraulic energy. Then it is necesary to reduce it. In traditional or hard solutions it is used structures for lowering energy of water.
This consists in structures generally made by concrete or other that has the fuction of break down the lenght continued the water has to travel from top to botton. Instead steps along the structure reduce water velocity. Thus stopping or minimizing the hydraulic energy that travels with it. This structures look like stairs since each step will contribute with the cited purposse.

When water reaches the toe of the slope the hydraulic energy is much less compared with water that goes down without this structure. Now it is neccesary understand how to imitate this principle. And apply not only certain spots but along the whole surface of the slope.

In a set of slopes generally these structures are set at certain distance and low the water acumulated at the crown to a safe point. But nothing is done yet at the surface of the slope. If the surface is unprotected it will get eroded and plant may fail before stablished complitely.

Figure No 2. Structure to reduce hydraulic energy. Kindly by Vetiver tec, Guaemala.

b- Hydraulic Gradient, Hydraulic Load And Hydraulic Energy.

The damage caused on the slope surface depends by the hidraulic load exerted to each section of the slope. Each section has different hydraulic load and that is the hydraulic gradient. Upper sections have low hydraulic load then low hydraulic energy is applied. On the other hand the lowest section has the most hidraulic energy excerted and more damage than any section.[1]

Figure 3. Damage caused by hydraulic energy. The image shows the hydraulic load and hydraulic gradient. At the top low hydraulic low is applied. Since the stream goes down the load increaces. Kindly by Vetiver tec, Guatemla.

Gathering all those pronciples comes out the brilliant idea of protecting the surface with the same principle, reducing hidraulic energy on the slope. Now, knowing what to do. What is next? And the answer is a phisical barrier or fence.

These barriers should gather some characteristics: local and abundant resource, low cost, light for easy transportation, and easy instalation.

c- Vetiver Foliage Sources:

At farm vetiver needs some maintenance and the byproduct is vetiver foliage. Also when Vetiver is planted it has to be trimed for tehnical reasons. In both cases vetiver leaves have a low value at farm.

Thus it was found that Vetiver leaves were the solution for making the phisical barrier or fence.

d- Manufacturing fences made out of Vetiver foliage. Soiltraps.

Some leaves were tied with polyethilene rope to form bunches of vetiver leaves.

After theyr efficiency was aproved the idea was expanded. Then these devices was called vetiver soil traps. Vetiver leaves used to be used for many purposes. This foliage are used now only for making soil traps.

e- Caracteristic of a Soil Trap

Dry weigh: 0.5 lb
Green weight: 2.5 lb
Lenght: 1 m.
Diameter: 15-20 cm

Figure No. 3 Vetiver foliage. Soiltraps. Kindly by Vetiver Tec, Guatemala.

f- Instalation Process:

A simple proces is required. To attach the trap to the soil perpendicular to the gradient of steepness.
In fill slopes it is used 1¨ sticks of wood or poles of a mild Steel ¼`
The stick is introduced into de trap and then into the soil.

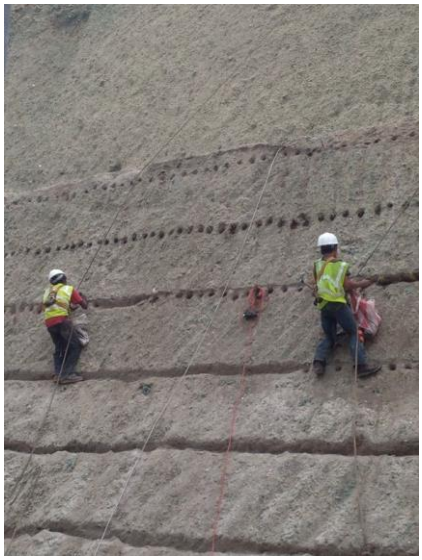

Figure No. 4 Preparing for installation of soiltraps. Kindly by Vetiver tec, Guatemala.

g- Vetiver Soil traps In Action:

Having just installed the soiltraps the first runoff event will bring certain amount of sediments. Gradually sediments will acumulate endless. Provoking a wide variety of benefits.

The sediments are trapped above the trap. These sediments have many benefits listed below:

1. Environmentally: The sediments do not incorporate downstream.
2. Economically: The structure's surface is not damage and less maintenance cost is required.
3. Plant grow: The sediments trapped give better conditions for plant grow. They contain traces of nutrientes, critical in this conditions, keep humidity, and incorporate air to plant crown. These all benefits boost new sprouts yield.

Figure No. 5. Soiltraps working at cut slope. Kindly by Vetiver tec. Guatemala.

Figure No. 6. Soiltraps working at fill slope. Kindly by Vetiver te, Guatemala.

h- Alternatives:

There exists others options to get acomplished de objective. Wich is rediuction en erosion vulneravility of the slope surface. These options are: Silt fence, erosion control roll, and erosion control blankets among others.[2]

Those all are solutions widelly used and well accepted. However there is only one limitation: the cost. It is not a well expanded technology at developing countries and de low demand make these solutions expensive.

III. RESULTS

3.1 After a long process of analysis differents optios for solving a problema a projects a viable solution was found.
3.2 Unexpected but it winded up in the cheapest solution.

V. CONCLUSIONS

4.1 A non valuable source at farm turned onto a very useful source at projects.
4.2 A good amount of soil is saved with the soiltraps aplication.
4.3 Low cost solution for a main issue at project. Maybe the cheapest one.

VI REFERENCES

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BIODATA: Leonel Castro is engineer with knoledge in agriculture, environmental sciences and bioengeneering. CEO at Vetiver Tec where he has specialized on aplication of Vetiver System –VS- and erosion control techniques. He has participated in several conferences on Vetiver System. Nationally and internationally. Has promoted VS untiring. Has work with erosion and sediments themes. Founded Guatemalan Association for Erosion Control and Sediments -AGCES- by its acronym in spanish. Wich has linked tighlly for promoting VS accompanied of erosion and sediments programs. Leonel has conducted several works with creativity for VS aplication in order to discover the most and newest ways to aplly VS to take it to a high level. He was in charge of the finding where a surprising 9.71 m. long-root was extracted. He created the method MERV. By its acronym in spanish. Which meas Efficient Methode for Extraction of Vetiver Roots.