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Big News in Environmental & Ecology Studies

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Abstract

Soil and water conservation vegetation can effectively conserve soil and water, relief of destruction caused by sandstorms and haze weather, and the improvement of ecological environment. But along with plant growth and root development rain intercepted by canopies and water use by plant increased which caused serious soil drying. Soil drying sometime development into serious drying, which eventually result in soil degradation, vegetation decline and agriculture failure in water-limited regions. In order to solve these problems When the soil moisture resources in the maximum infiltration depth equal Soil Moisture Resources Use Limit by Plant , the relationship between soil water and plant growth has to be regulated on the Soil Moisture Carrying Capacity for Vegetation to ensure sustainable use of Soil Water Resources, forest sustainable development and the sustainable produce of crop to meet the people's increasing need of forest products and agricultural produce and better environment.

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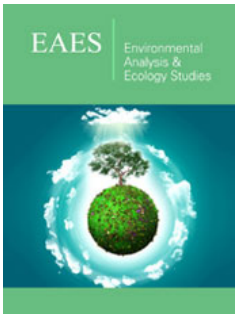

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Introduction

In recent decades, agricultural production has been intensified to meet the food demand of a growing population. Worldwide, the intensificaon of agricultural activity coexisted negative environmental influence. Such as in the loess plateau of China, in order to meet food demand, original vegetation has been destroyed, forest and grass land changed into farmland to plant corn wheat or millet and so on, and original forest and vegetation is scarcity, and the loss of soil and water in the Loess Plateau had become a serious environmental problem.

The loss of soil and water eroded fertile surface soil and led to soil fertility and crop productivity reduced, which influence quality of human life. In order to conserve soil and water loss, relief of destruction caused by sandstorms and haze weather, and the improvement of ecological environment, Chinese government has been taking many measures since 1950. In particular, with the implementation of Three-North Shelter Forest Program sponsored in 1978 for 50 years and Grain for Forest and Grass Program for 3 year from 2000 to 2003, large-scale afforestation and fruit trees has been carried out on the Loess Plateau. As a result of these efforts, great achievements have been made. The forest coverage fast increased and annual sediment discharge on the Loess plateau has been reduced from 1.6 billion tonnes in the 1970s to 0.31 billion tonnes in recent years, and the runoff has been halved.

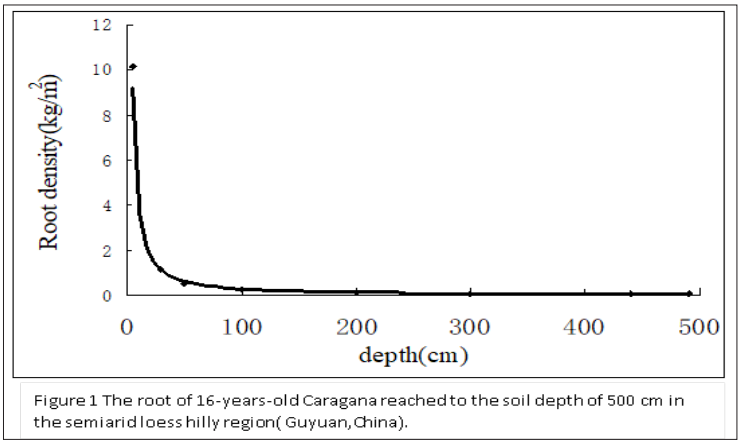

Figure 1 The root of 16-years-old Caragana reached to the soil depth of 500 cm in the semiarid loess hilly region(Guyuan, China).

Figure 1: The root of 16-years-old Caragana reached to the soil depth of 500cm in the semiarid loess hilly region (Guyuan, China).

In the process of vegetation restoration, Tree or plant species or crops, selected for their capacity of extending roots deep (Figure 1 & 2) and growing fast, have been initially densely planted in order to cover the ground quickly, or get higher production and benefit, and thereby to quickly realize ecological, economic and social benefits during vegetation restoration. With the growth of the forest and plant, the roots develop, and the soil depth at which Dried Soil Layers (DSL) occurred and thickness of DSL increased, soil drying becomes gradually serious with times going by. Consequently, the combination of increased rain intercepted by canopies and water use by plants and low infiltration capacity and soil water recharge rates has led to widespread soil drying on the Loess Plateau. Soil drying sometime development into serious drying, which eventually result in soil degradation, vegetation decline and agriculture failure because soil water mainly from rain in these regions.

Figure 2: Corn growth under serious water stress in the semiarid loess hilly region (Guyuan, China).

Conclusion

In order to solve these problems, the relationship between the soil water and plant growth have to be regulated. The theoretical foundation is Soil Water Resources Use Limit by Plant (SWRULP) and Soil Water Carrying Capacity for Vegetation (SWCCV) in the key regulation period.

SWRULP is the soil moisture storage in the Maximum Infiltration Depth (MID) in which soil water content equals wilting coefficient. Wilting coefficient is expressed by the wilting coefficient of indicator plant in a plant community. Indicator plant is constructive species for natural vegetation and principal or purpose species of trees or grasses for plantation [1,2].

Maximum infiltration depth can be determined by the two-curve method

The infiltration depth for one rain event equals the distance from the surface to the crossover point between the two respective soil water distribution curves of soil water with soil depth before and after the rain event (Figure 3). The MID will occur after a continuous heavy rainfall event and a long-term cumulative infiltration process and can be determined by a series of two-curve methods (Figure 4) [3,4].

Soil Water Carrying Capacity for Vegetation (SWCCV) is the highest density (relative index)or population quantity (absolute index) of indicator plant in a plant community when soil water consumption is equal to soil water supply in the root-zone soil layers in a given time scale (Key regulation period, minimum death days) [3-6].

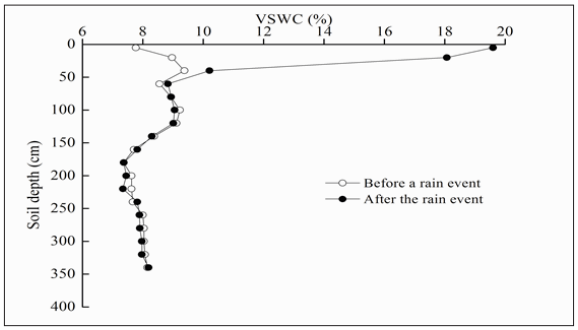

Figure 3: Infiltration depth and soil water supply for a rain event in Caragana shrubland of the semiarid loess hilly region(Guyuan,China).

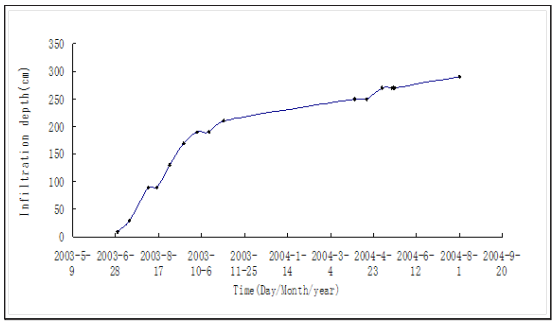

Figure 4: A long-term cumulative infiltration process and maximum infiltration depth in Caragana shrubland of the semiarid loess hilly region (Guyuan, China).

When the soil moisture resources in the maximum infiltration depth equal Soil Water Resources Use Limit by Plant (SWRULP) , the relationship between soil water and plant growth has to be regulated on the Soil Water Carrying Capacity for Vegetation to ensure sustainable use of soil water resources, forest sustainable development and the sustainable produce of crop to meet the people's need of increasing forest products and agricultural produce, and better environment and realize the sustainable development [7].

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