

# Effects of **PLANT** on **GRAVITY EROSION** on the Gully Sidewall under the Intense Rainfall

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# Contents

1

Introduction

2

Methods and material

3

Results and discussion

4

Conclusions

# 1 Introduction



**VERY POPULAR**  
and **VERY**  
**SERIOUS** on the  
Loess Plateau of  
China



- Random
- Burst
- Difficult to be separated from other forms of erosion



**Its mechanism is different to other erosions**



- Present a **new way** to observe the gravity erosion
- Observe the **mass failures** on the planted slopes

# 2 Methods & material

## Methods

### Experiments

Models VL & BL

### Devices

- Sidewall model
- Topography meter
- Rainfall simulator

### Conditions

- In a same flume
- Simulated rainfall and initial slope are same

### Material

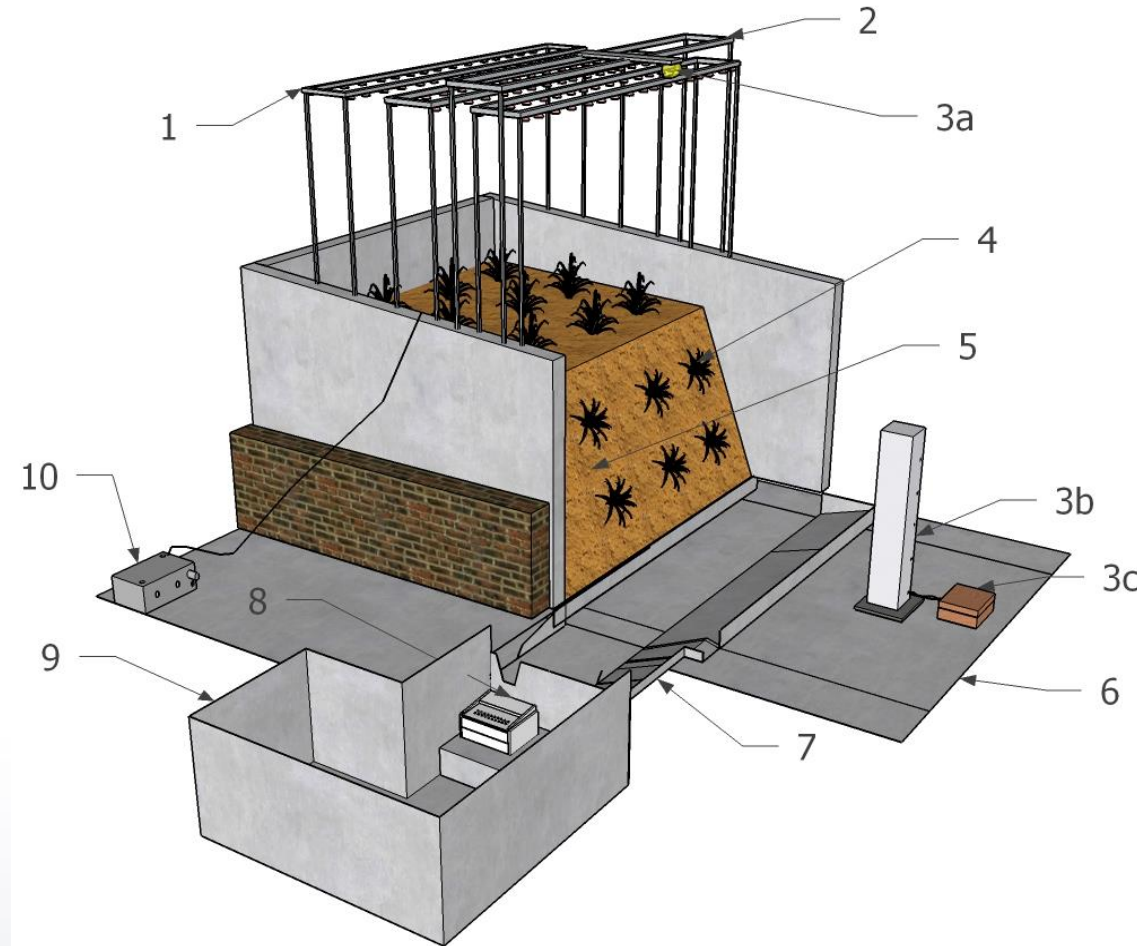
Gentle slope:  $3^\circ$ ; steep slope:  $70^\circ$

Projected area:  $250 \times 300 \text{ cm}^2$

Rainfall:  $0.8 \text{ mm/min} \times 60 \text{ min}$

Kerria: 2%

## Experimental setup



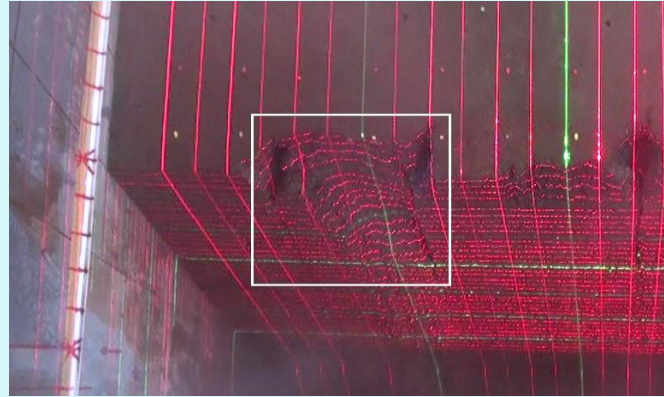
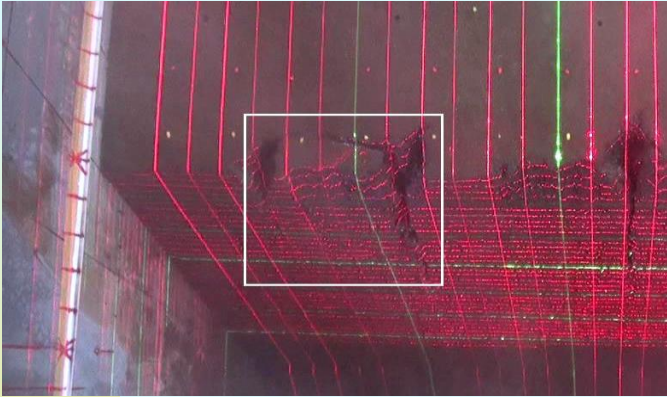
1. Rainfall simulator, 2. Camera holder, 3 Topography meter, 4 plant, 5 model slope



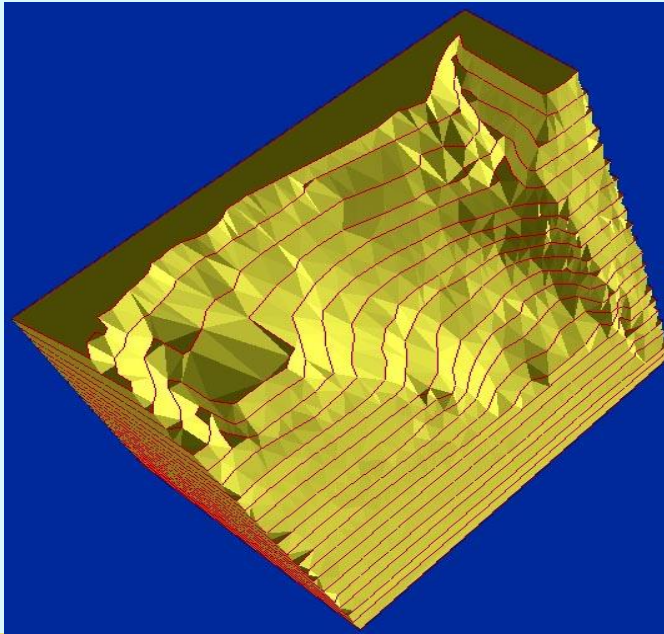
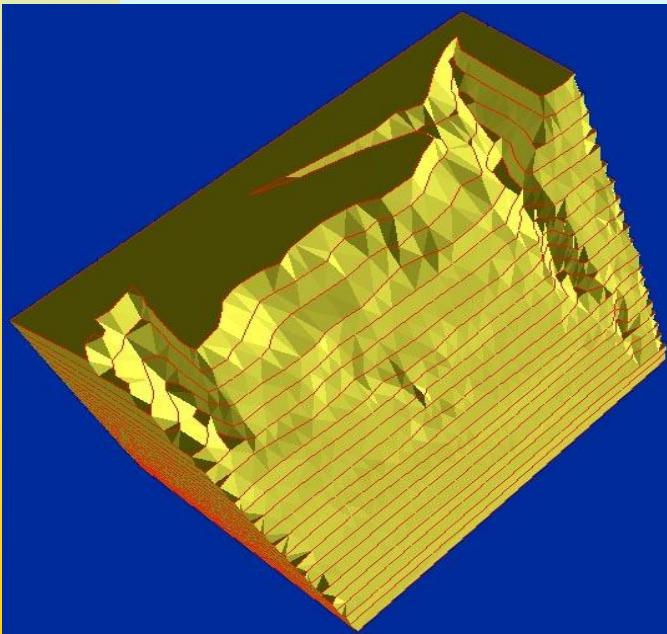




# Volume of the failure mass



The relative errors among the volumes observed by the Topography Meter and those of the conventional instruments were all within 10 %



Landform after 21'25" rainfall

Landform after 21'27" rainfall

# 3 Results & Discussion

3.1 Influence of the vegetation on the total amount of gravity erosion : **ignored**

**Control**

Plant roots may reinforce the soil

**Promote**

- Self-gravity of the plant
- Increase of the permeability

**Model BL:**  $626.5 \times 10^3 \text{ cm}^3$  ↑

**Model VL:**  $552.6 \times 10^3 \text{ cm}^3$  **12%**

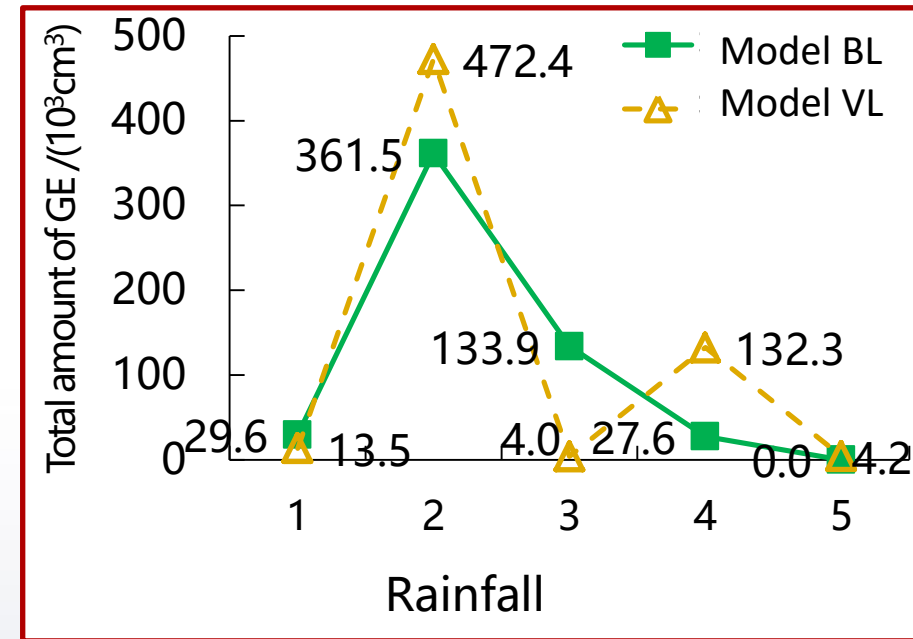
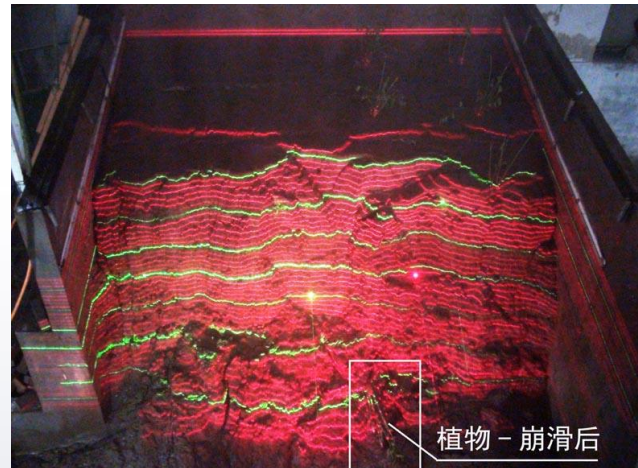
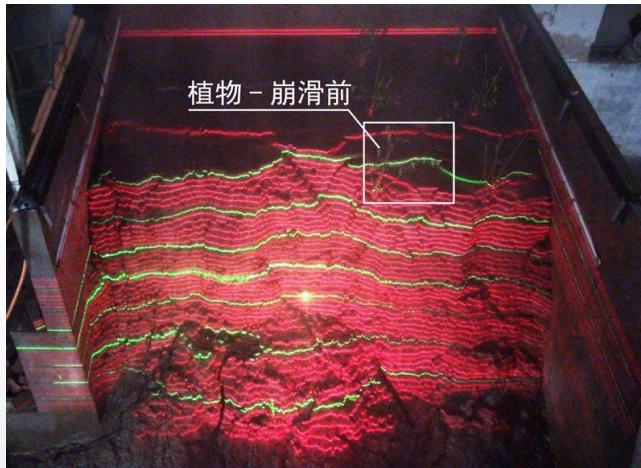


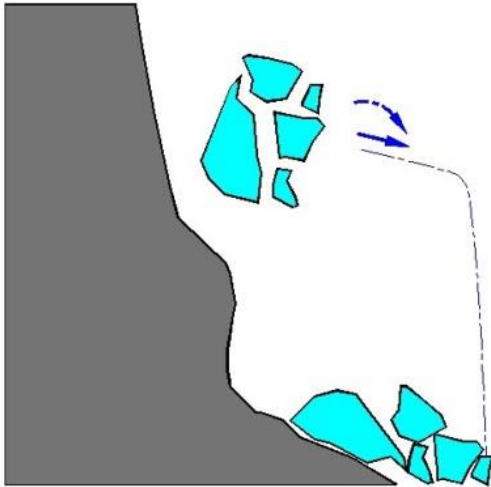
Fig. 3 A tree is sliding down together with the mass failure

# 3 Results & Discussion

## 3.2 Effects of vegetation on different types of gravity erosions

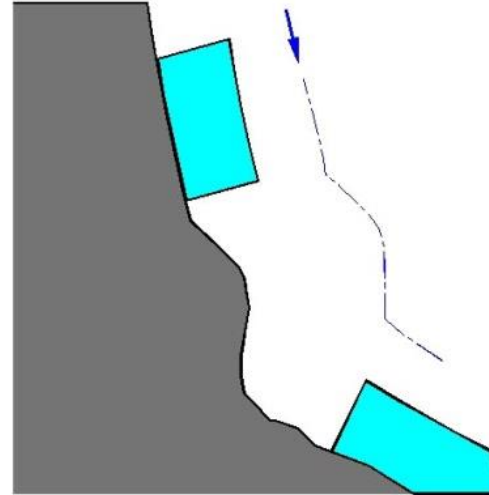
### Definition

#### *Avalanche*



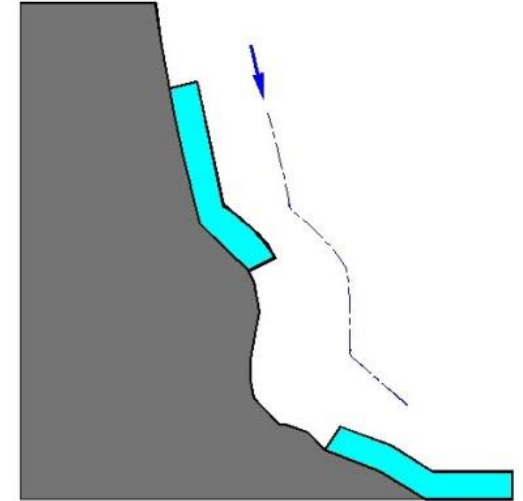
The phenomenon that soil suddenly topples, fragments and rolls down fully apart from a sloped face

#### *Landslide*



The phenomenon that soil on the slope slips down as a whole along a certain weak belt

#### *Mudslide*



The failure occurring with distorting shape and involving full saturation



# 3 Results & Discussion

## 3.2 Effects of vegetation on different types of gravity erosions

Vegetated vs. bared land models after 5 rainfalls

Type	Total amount of gravity erosion			Maximum amount in a rainfall		
	Vegetated Land Model /(10 <sup>3</sup> cm <sup>3</sup> )	Bare Land Model /(10 <sup>3</sup> cm <sup>3</sup> )	Increase in the Planted Model	Vegetated Land Model /(10 <sup>3</sup> cm <sup>3</sup> )	Bare Land Model /(10 <sup>3</sup> cm <sup>3</sup> )	Increase in the Planted Model
Avalanche	138.2	488.0	-72%	26.9	224.1	-88%
Landslides	411.2					
Mudslides	3.1	10.2	-69%	0.7	3.0	-78%

The plants may control the avalanches and mudslides, while the plants may aggravate the landslides on the loess side wall.

CONCLUSION

# 4 Conclusions

## Effects of plant

1

A method has been presented that could quantitatively measure the time-variable gravity erosion in the whole process of a rainfall event, and the **Topography Meter** has completed a precise and rapid measurement of slope behavior

2

The influence of the vegetation on the total amount of gravity erosion may be ignored.

3

The vegetation on the gully sidewall had different influences on the varied types of gravity erosion. The total amounts of avalanche, landslide and mudslide on the vegetated sidewalls in a rainfall have been increased – 72%、 220%、 –69% of those on the bare land, respectively.