Gully Development in Loess Hilly Area of Gorgan, Northeast of Iran

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Abstract: Gully erosion is one of the most important kinds of soil erosion that causes soil degradation. Also sediment yield of eroded gully causes many problems in downstream areas. Loess is one of the erodible soils that have good distribution in Golestan province. Because of the erodibility of these soils all of kinds of erosion can be seen in loess area. Also because of enough depth of soil gully erosion is common over these soils.

For studying of gully development trend in loess hilly area of Gorgan, Golestan province three typical gully selected with 40 cm—50 cm depth, 90 cm—110 cm width and 300 cm—500 cm length. The slop of area was 12%. Average of annual rainfall is 700 mm. To measure the surface area and changes from cutting back or bank collapse a rectangular grid of erosion pin was set out at an appropriate interval. After each rainfall the dimensions of gully measured again. From 43 rainfall event in one-year study only 6 of them had measurable changes in gullies. In each rainfall event intensity, depth and time of rainfall data was collected from Hashem abad station in 3 km far from study area. The results of this study showed that after each rainfall the amount of degraded soil was between .0.1 m^3 — 0.5 m^3. The total of soil eroded in one-year study was about 0.6 m^3 for each gully. The amount of gully development from head and two sides in one year was 10 and 7 cm respectively. Statistical analysis showed that volume of eroded soil has significant relationship with depth of rainfall.

This survey also showed that depth of gully after each rainfall doesn't increase necessarily and usually because of head cutting and side bank collapse, depth of gully decrease. But after washing and transporting of eroded soil depth of gully increase again. It must be mentioned that depth of rainfall and volume of runoff and also duration of rainfall has important role in cycle of increasing and decreasing of gully depth.

Keywords: gully erosion, erosion measurement, and loess soil

1 Introduction

Gullies are relatively permanent steep-sided watercourse, which experience ephemeral flows during rainstorms. A headcut and various steps or knick-points along their course characterize gullies. (Morgan 1986). Gullies are almost always associated with accelerated erosion and therefore with landscape instability.

Numerous studies record the formation of gullies by pipe or tunnel collapse. Tunnels develop particularly where the clays are of low permeability and sodic.

Loess is one of the most erodible soil that great part of Golestan province.

In hillslope is covered by it.

Surface, rill and gully erosion is different type of erosion in loess hilly area of Golestan provience.

Because of improper land use and also farming operation in downslope direction soil erosion in this area is very high. Gully initiation and development is very typical and must be studied for better management.

So this study carried out for better underestanding of gully erosion processes.

2 Description of study area

The study area located in 36° 46′ 49″ N latitude and 54° 26′ 40″ E longtitude with 160 m high above sea level. This area is located in south of Gorgan, capital of Golestan provience in loess hilly area.

Average slope of this area is 22.12 % and its land use is range whit bad managemet and 50%—60% vegatation cover.

The soil of study area is loess with 61%—74% silt, 14% clay and sand and 15%—25% lime.

Average of annual rainfall is 750mm.

3 Material and method

For monitoring of gully develpoment in loess hilly area 3 typical gully has selected with 40 cm—50 cm depth, 90 cm—110 cm width and 300 cm—500 cm lentgh.

To measure the surface area and chenges from cutting back a rectangular grid of erosion pin was set out at an appropriate grid interval. After each rainfall event the dimensiones of each gully measured again. Six-rainfall event that had runoff and was enough for gully erosion occurred in one year. For each rainfall event depth, intensity and time has recorded. Meteorologocal data has collected from hashemabad synoptic station with 3.5 km distance from study area.

First cross section of each headcut has ploted and after each rainfall event new cross section has ploted.

Figs 1—3 show cross section of each gully for 6 rainfall events. Then with comparison of different cross section the amount of removed soil volume has determined.

Table 1 show volume of removed soil for each gully.

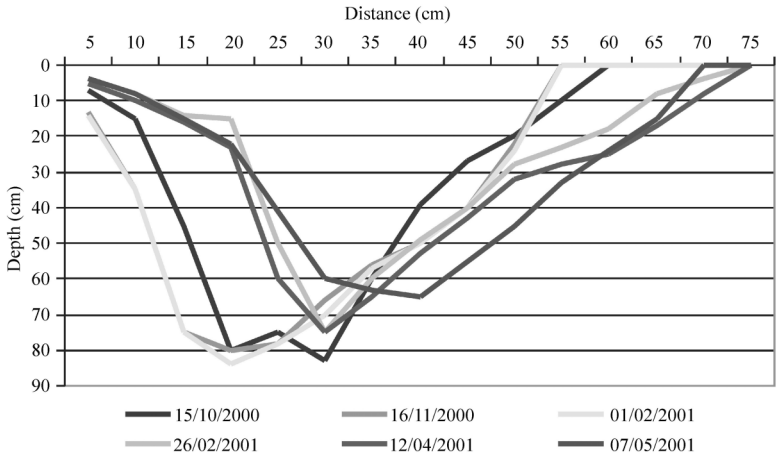

Fig.1 Gully 1 cross section

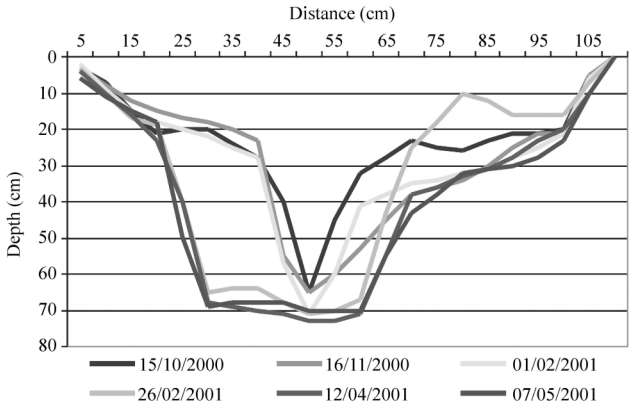

Fig.2 Gully 2 cross section

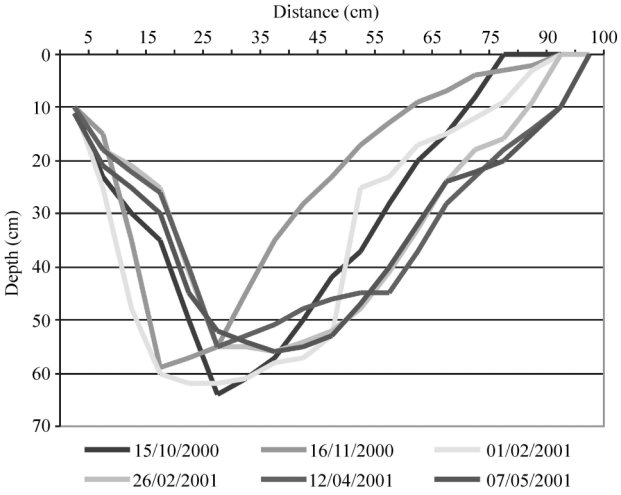

Fig.3 Gully 3 cross section

Table 1 Amount of rainfall and volume of soil removed

		Gully 1	Gully 2	Gully 3
date	Rainfal amount(mm)	Volume diference(m^3)	Volume diference(m^3)	Volume diference(m^3)
16/11/2000	64.4	0.05	0.121	0.037
01/02/2001	14.4	0.123	0.067	0.075
26/02/2001	75.6	0.116	0.118	0.69
12/04/2001	4.85	0.076	0.254	0.44
07/05/2001	65.1	0.004	0.036	0.58

4 Results

Results of this study show that after each rainfal event that has runoff gully has some degredation. In this study the amount of degredade soil was between 1—5 m^3. Statistical analysis shows that volume of eroded soil has significant relationship with amount of rainfal.

This study also shows that depth of gully in each rainfall not only increases necessarily but also usually because of headcutting and side bank collapse decreas. But after washing and transporting of eroded soil depth of gully increase again. It must be mentioned that depth of rainfall and volume of runoff and also duration of rainfall has important role in cycle of increasing and decreasing of gully depth.

This study will continue for 3 years for collection more data.

References

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