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Landslide Occurrences in Kittony Area, Elgeyo Marakwet County, Kenya

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Abstract: *Landslides and other forms of ground failure affect communities all across the nation. Despite advances in science and technology, these events continue to result in human suffering, billions of dollars in property losses, and environmental degradation. As the population increases and the society becomes ever more complex, the economic and societal costs of landslides and other mass wasting processes will continue to rise. The objective of the study was to establish the types of landslides prevalent in Kittony area, Elgeyo Marakwet County, Kenya. The study population comprised of 2000 residents of Kittony Area in Elgeyo Marakwet County. Five members of the local administration, and a County Geologist. The sample size consisted of the following respondents: two hundred and forty six residents of Kittony area, the local chief of Kittony area and a County Geologist. This study adopted a descriptive survey research design and utilized a qualitative research methodology. The systems theory was used to underpin the study and a conceptual framework showing the interrelationship between the dependent and independent variables was used to guide and conceptualize the study. The findings of the study included the types of landslides that exist in the area.*
Keywords: *Landslides, effects, environmental degradation*

I. Introduction

Landslide is a geological phenomenon that includes a wide range of ground movements, such as rock falls, deep failure of slopes and shallow debris flows. They are influenced by action of gravity and land use changes that affects original slope stability. They can occur in offshore, coastal and onshore environments. Natural causes of landslides include; groundwater (pore water) pressure acting to destabilize the slope; loss or absence of vertical vegetative structure, soil nutrients, and soil structure; erosion of the toe of a slope by rivers or ocean waves; weakening of a slope through saturation by snow melt, glaciers melting, or heavy rains; earthquakes adding loads to barely stable slope; earthquake-caused liquefaction, destabilizing slopes and volcanic eruptions (Le Bas, 2007).

Landslides are aggravated by human activities, such as; deforestation, cultivation and construction, which destabilize the already fragile slopes; vibrations from machinery or traffic blasting; earthwork which alters the shape of a slope, or which imposes new loads on an existing slope; in shallow soils, the removal of deep-rooted vegetation that binds colluvium to bedrock; Construction, agricultural or forestry activities (logging) which change the amount of water which infiltrates the soil (Easterbrook, 1999).

Kenya has witnessed numerous rainfall triggered landslides (Karanja & Mutua, 2000). During the 1997-1998 El Nino events, most parts of the country received 2 to 12 times the monthly long-term mean rainfall amount that resulted in floods and landslides in various parts of the country (Ngecu & Mathu, 1999). The estimated loss incurred by the agricultural sector during this period was estimated to be about USD 236 million (Karanja & Mutua, 2000), constituting one-tenth of the gross domestic Product. Landslides represented about 5% of all natural disasters worldwide, between 1990 and 2005 (Kanungo *et al.,* 2006).

1.1. Statement of the Problem

Landslide occurrence as a consequence to land use changes is an area that still need thorough investigation as its effects are disastrous. A case at hand is landslides that hit Kittony area in 2014 killing 15 people and injuring several others (Bii, 2014). This calls for government and other agencies to develop viable solutions of mitigation and adaptation to landslides and its effects. In order to develop effective adaptation and mitigation strategies, it is important to understand the types of landslides that occur in a given geographic location, hence the objective that this study sought to achieve.

1.2. Objectives of the Study

This study sought to establish the types of landslides prevalent in Kittony area of Elgeyo Marakwet County, Kenya

1.3. Conceptual Framework

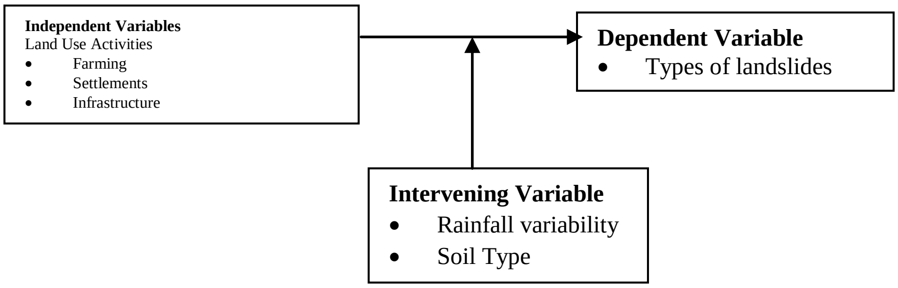

Figure 1.1 shows the interaction between land use activities and resultant landslides. Rainfall variability and soil type acts as intervening variable.

II. Materials And Methods

2.1 Research Design

The study adopted a descriptive survey research design. The design was selected because it is very convenient in collecting substantial amount of views from respondents over a wide area using limited resources (Kombo and Tromp, 2006). The variables were studied were at their natural occurrence and not manipulated by the researcher. The survey method was appropriate because it is a self-report study, which required the collection of quantifiable information from the sample. This involved collection of both quantitative and qualitative data. This study was concerned with the investigation on the occurrence of landslides in Kittony Area of Elgeyo Marakwet County.

2.2 Data collection procedures

The study used questionnaires and interviews as main instruments of data collection. The instruments contained questions dealing with land use activities and types of landslides in Kittony area of Elgeyo Marakwet County, Kenya.

2.3 Data analysis

Based on the data evaluation instruments, quantitative and qualitative data analytical techniques were utilized. Data from questionnaires were analyzed in frequencies, means and percentages using the Statistical Package for Social Sciences (SPSS). Qualitative data from the interviews were analyzed in themes and categories identifying similarities and differences that emerge. Descriptive statistical method was used and adopted to calculate the percentages and means.

III. Results And Discussions

The study established the following types of landslides in Kittony Area:

3.1 Earth flows

Plate 3.1: Earth Flow in Kittony Area

Earth flows are down slope, viscous flows of saturated, fine-grained materials, which move at any speed from slow to fast. Typically, they can move at speeds from 0.17 to 20 km/h (0.1 to 12.4 mph). Though they are a lot like mudflows, overall they are slower moving and are covered with solid material carried along by flow from within. They are different from fluid flows because they are more rapid. Clay, fine sand and silt, and fine-grained, pyroclastic material are all susceptible to earth flows. The velocity of the earth flow is all dependent on how much water content is in the flow itself: if there is more water content in the flow, the higher the velocity will be. These flows usually begin when the pore pressures in a fine-grained mass increase until enough of the weight of the material is supported by pore water to significantly decrease the internal shearing strength of the material. This thereby creates a bulging lobe which advances with a slow, rolling motion. As these lobes spread out, drainage of the mass increases and the margins dry out, thereby lowering the overall velocity of the flow. This process causes the flow to thicken. The bulbous variety of earthflows is not that spectacular, but they are much more common than their rapid counterparts. They develop sag at their heads and are usually derived from the slumping at the source.

Earth flows occur much more during periods of high precipitation, which saturates the ground and adds water to the slope content. Fissures develop during the movement of clay-like material which creates the intrusion of water into the earth flows. Water then increases the pore-water pressure and reduces the shearing strength of the material.

3.2 Mudflows

Plate 3.2: Mudflow in Kittony Area

A mudflow is an earth flow consisting of material that is wet enough to flow rapidly and that contains at least 50 percent sand, silt, and clay sized particles (Linuzela 2006). This occurred in Kerio Valley, Kittony village where the mud killed 11 people and covered thousands of animals and structures on March 2011. In 2012, 16 people, among them three children, died in Kocholwo, Simit, Kapsokom, Kaptarkom and Toroplongon areas of the Elgeyo escarpment after heavy rains pounded the region. The tragedy preceded another in Marakwet East where 14 people in Kittony village were killed by massive landslides in 2010. Reports in the area indicate that more than 60 people have been killed due to landslides since the 1997 El Nino rains, with geologists declaring the Elgeyo Escarpment unfit for human settlement.

3.3 Rock Fall

Rock Falls are abrupt movements of masses of geologic materials, such as rocks and boulders that become detached from steep slopes or cliffs. Along the road in Kittony, Separation occurred along joints, and bedding planes. The movement was by free-fall and rolling for 15m blocking the highway. They are influenced by gravity, mechanical weathering, and the presence of interstitial water. It also occurred in Chesikaki area on the slope of Mt Elgon in 1997 where 100m^2 boulders hit the ground and swept an area of 36000m^2 after heavy precipitation (Masibo, 1998).

Plate 3.3: Rock fall in Kittony Area

3.4 Soil Creeping

Soil creeping is a slow, superficial and predominantly seasonal form of land sliding (Alexander, 1993). However, many of the other forms of landslides can undergo creeping, and gradually do serious damage. Soil creeping was observed in Kittony area near river catchments.

Plate 3.4: Soil creep in Kittony Area

3.5 Debris Flow

A debris flow is a form of rapid mass movement in which a combination of loose soil, rock, organic matter, air, and water mobilizes as a slurry that flows downslope. Debris flows include <50% fines. Debris flows are commonly caused by intense surface-water flow, due to heavy precipitation that erodes and mobilizes loose soil or rock on steep slopes. Debris flows also commonly mobilize from other types of landslides that occur on steep slopes, are nearly saturated, and consist of a large proportion of silt- and sand-sized material. Debris-flow source areas are often associated with steep gullies, and debris-flow deposits are usually indicated by the presence of debris fans at the mouths of gullies. Fires that denude slopes of vegetation intensify the susceptibility of slopes to debris flows.

Plate 3.5: Debris flow in Kittony Area

IV. Conclusions

The types of landslides that exist in the area are earth flows, mud flow, down soil creeping, rock fall and debris flow. The heavy rains, poor loose volcanic soils and the rugged topography in the area were the geological and topographical factors that caused and triggered landslides in the area

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BIO-DATA

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