Digital Innovations & Contemporary Research in SCIENCE, ENGINEERING & TECHNOLOGY
Vol. 11. No. 4, December, 2023

Article Citation Format
Ibhafidon-Momodu, G.O. (2023): Gully Reclamation in Agriculture.. Journal of Digital Innovations & Contemporary Research in Science, Engineering & Technology. Vol. 11, No. 4. Pp 79-84. dx.doi.org/10.22624/AIMS/DIGITAL/V11N4P8
www.isteams.net/digitaljournal.

Article Progress Time Stamps

Article Type: Research Article
Manuscript Received: 27th September, 2023
Review Type: Blind Peer
Final Acceptance: 19th December, 2023

Gully Reclamation in Agriculture.

Ibhafidon-Momodu, Gladys Omisi
Department of Civil Engineering Technology
Auchi Polytechnic
Auchi, Edo State, Nigeria
E-mail: justglad11@gmail.com
Phone: +2348034934920; +2348086156882

ABSTRACT

Loses due to gully erosion menace cannot be estimated. The effects have gone beyond local ad-hoc consideration. While some control can be on permanent basic some can be temporary Research on soil conservation is an old practice but its consciousness is slow to arouse in Nigeria. Reclamation of gullies for cultivation and checking gully heads advances call for engineering and non-engineering measure adequate topographical knowledge of the area is very important for effective engineering permanent control leveling determine the difference in heights of positions relatively The use of gabion boxes and mattresses in gully reclamation have proven worth-while. Storm diversion channels designed with adequate capacity to carry peak run off expected from a storm frequency consistent with the hazards involve. Measures aim at producing the waterway and seeding it to adapted species of a grasses to keep Water spread uniformly over wide area A protective mat of vegetation retards soil erosion and resistant cover plant that will stabilize the gully are discussed.

Keyword: Gully, Erosion, Reclamation, Agriculture, Vegetation, Hazards, Soil, Protection

1. INTRODUCTION

Gully erosion is the removal of soil by excessive concentration of running water, resulting in the formation of deep channel. (Michael and Ojha 2005). A gully may be branching or linear, usually dry except after a rainstorm. A wet gully describes a ravine which Roy, AND Misha (1969) says that they are a function of the depth of the rivers and are Confined to the vicinity to the river and their tributaries to adjoining agriculture land. The avoidance of loss is important to combat low agricultural production, food security and rapid increase in the level of poverty (Ehiu et al., 1996). A critical view on the hazards of gully erosion, reveals its destructive tendency. The desire to control the erosion hazard is slow to arouse. The effects have gone beyond local ad-hoc consideration. The preliminary control which have been neglected gave rise to the harmful damages of gully erosion. While some control can be on permanent basis, some can be on ad-hoc control.

Increasing abuse, degradation and exploitation of the vital resources of soil and water have exposed the soil to various erosional hazards of which gully erosion have most profound devastating effects on man and unfortunately his activities. Losses due to gully erosion menace cannot be estimated agricultural land and property. Settlements have been threatened by this monster. Research on soil conservation has already been done for many years in different parts of Nigeria (stamp, 1938). Decreasing fund at the end of oil boom in the 1980s additionally restricted soil conservation scheme.

1.1 Statement of Objectives

The most effective control of gully area into the gullied area and Converting the gully area into forests grass lands. Except in the case of Small drainage area with negligible. Run off, diversion of runoff from above the gully, causing it to flow at a non-erosive velocity to a suitable protected outlet (Michael and Ojha 2005). Specifically, the aim of this work is to design other non-engineering measures of reclamation.

2. TOPOGRAPHICAL SURVEY

Topographical survey shows the difference in heights of point on the earth surface. The effectiveness of a suitable control measure is profoundly based on this knowledge. Through survey, map or plan, the relative positions of physical features both vertically and horizontally are known.

1. Instrument of measurement: The instruments include engineers level, chain, cutlass, ranging pin, ranging pole and leveling staff.
2. Reconnaissance Survey: Involves walking over the area to be surveyed and taking notices of the layout, position of features and shape of the area.
3. Leveling Terms
    a) Benchmark (BM) Predetermined height above datum on earth surface.
    b) Datum: mean sea level in which heights are related.
    c) Back sight (BS): First reading of the engineers level set at station
    d) Foresight (FS): Last reading of the instrument
    e) Intermediate sight (1S) any other reading from the instrument
    f) Reduced Level: Calculate level below or above sea datum.
    g) Height of instrument: Height of columniation above the datum reading are taken.

4. Observation and Heightens: The steps include:
    a) Set instrument at station A
    b) Hold leveling staff behind the instrument (preferably at a known height point, if not available a temporary BM and read the first reading is booked on the record book as back sight (BS)
    c) Transfer from station A the reading could be intermediate sight or foresight reading depending on the sight visibility of the instrument. If the sight is clear it is intermediate sight (IS) but on the contrary is foresight (FS) implying a change point.

The instrument move to station B where a back sight reading will be taken. The last reading on the staff with the instrument set at a station is foresight. Height reduction is achieved through comparative heights the accuracy of the survey is determined by subtracting the summed back sight reading from summed foresight reading. The difference should not be greater than the design permissible error for the instrument. The range of instrument error is greater then the above, the survey have to be replaced.

3. DESIGN STRATEGY

Gully erosion prevails in the presence of high run off velocity resulting to high erosivity power, erodibility of parent mass resulting from its detachability and transportability of run off. The topography of the land contributes more to the accomplishment of gully erosion. Hence a topographical survey become hardy in strategy design. The interest is to lead run off away at a non-erosive velocity control. From the survey plan, nature of slope is determined. Another slope to which the control measure is to be fashioned is determined on the plan Reclamation strategy will include engineering and non- engineering works.

Michael and Ojha (2005) outlined the following steps procedures for gully erosion control including Survey and mapping land capability classification and planning vegetative control of gullies and their catchments, Closure to grazing and other biotic interference in gullies; checking gully heads advancer, gully plugging, stabilization of gully head, reclamation of and narrow gullies.

3.1 Engineering Strategy:

3.1.1 Storm diversion Channel

The capacity of diversion channels should be based on estimates of peak run off for a 10 years recurrence interval (Michael and Ojiha 2005) Discharge is determined from measurement of Stage using the stage discharge relationship for the control section with stable flow depth (stage) versus discharge (volumetric flow rate) relationship (Bos et al., 1984). The diversion channel should be designed to fit the conditions of a particular field and local soil types. The velocity of flow shall be kept as high as will be safe for the planned type of channel.

Types of diversion channel include, vegetated waterways, lined and unlined channels. The factors to be considered in the design-grade, shape and capacity of the channel. Grade must be selected to meet the capacity requirements for the site and the section to be used. Variable grades may be needed to obtain more uniform cross-sessions and best possible alignment. Shape is optional, The most efficient is parabolic but common with from cast challenges during construction. Trapezoidal shape is easier to form and its efficiency is close to the former other are triangular and rectangular shapes channel.

Capacity is significant if peak run from contributing water shed can be carried away protecting agricultural land. Channel capacity must be adequate to carry peak run off expected from a storm frequency consistent with the hazards involved. The discharge (Q) is the product of the cross-sectional area of channel and the velocity of flow through channel (V). This can be computed from manning's and Chezy's formulas. Manning's formula can be written thus:

$$V= R^{2/3} S^{1/2} \quad \text{--(1)}$$

Where
V= Velocity flow in m/sec
R= Hydraulic radius
S=Slope of the land
N=Manning's roughness coefficient

Chezy's Formula is

V=C JRS---(2)

Where
C= Chezy's coefficient
R=Hydraulic radius
S=slope grade

Mathematically representation of the above is thus:

For Manning's
Q=AV
$V = \frac{R^2 S^{1/2}}{n}$

$Q = AR^{2/3} \quad S^{1/2}$

For Chexy's
Q = AV
V = CVRS
Q = AC VRS

A: This the cross sectional area of the channel. The grade of the channel should be selected to meet the velocity and capacity requirement.

B: Gabion boxes and mattresses: water erosion control structure can be permanent or temporary depending on the extent of erosion menace and availability or material for control. In cases, permanent control are used for gully erosion control. A typical example of permanent control work is the Gombe gully reclamation work (1984). It involves the use gabion boxes and mattresses, The gabion boxes and mattresses are made up of wire mesh, interwoven and coated with bitumen lo prevent Corrosion. Mattresses are laid on the channel bed and filled with pieces of rock. The boxes are laid on the sides of the channel and filled with rock pieces. This technology overcomes the challenge of structural failure through cracking. Vegetation can grow easily grow on the channel and side slopes stabilized.

C: Terraces: Are permanent erosion controlling technology. Terrance could be embankment or channel or a combination of both constructed across the slope at suitable spacing and with acceptable grades for (Eze-Ezoamaka 1976). The cross section of Terrance should provide adequate capacity, farming sides slope and must be economical in construction. A typical example is the terraces built in Maku near Udi Nsukka, Enugu state.

4. NON-ENGINEERING STRATEGY (AGRONOMICAL)

The main objective of gully control is the establishment of an erosion resistant Cover plant that will not only stabilized the gully but also produces useful crop for supplementary income. Gullied area are usually the most difficult places to grow plant since the top soil has already be washed away. Diverting runoff water that caused gully erosion from, old path is the beginning of gully reclamation.

Then plants that can grow under poor soil conditions and drought resistant are planted.

a) **Aforestation:** Gully redemption strategy, accomplished by planting suitable three species like prospsis juliflora (hump, side slopes), Acacia Nolitica (side slop) Dendrocolanus stricktus (Gully beds) and constructing gully plugs in the bed of the main and branch gullies.

b) Planting grass species like amulatum can thrive to stabilizes gully heads and sides.
c) Agro forestry: planting of agro forestry species like casuriena, planting crops like cashew nuts, fruit tress like, mango and sapota have been found to be feasible.
d) Horticultural Crops: horticultural crops can be cultivated. in degraded and deluded wastelands to control gully erosion and conserve water. The use of plantation crop have been found to be very important in this occasion, depending on its suitability, adoptability and economic value. Examples citrus, pineapple plantain, bananas etc.
e) Changing gullies into grassed waterways: Small and medium size gullies can often be converted into grassed waterways. It is accomplished by shaping the waterway and seeding it to adapted species of grasses. To keep the water spread uniformly over a wide area the channel cross section should be broad and flat. During filling operations the channel should be fertilized because much of the topsoil may have been preserved. Grasses should produce an elaborate network of root system and close ground covered to serve a good soil stabilizer. Main parameter of, this gully control technology is soil stabilization and it is a function of root spread.

5. CONCLUSION

Neglected preliminary Control gave rise to the harmful damages of gully erosion which ever form erosion may take urgent attention must be given to it effective control. A proper understanding of the contributing water shed would be of immense importance in effective control design, topographical plan/map of the gradient of the land. Erosion effect rain drops that strike soil on sloping land with little vegetation has been appreciated of importance therefore is the restoration of maintenance of such a cover on slopes which have been deforested.Activities of man have contributed greatly to the rapid development of gully erosion.

Indiscriminate bush burning, overgrazing, over cropping, deforestation, exploitation of soil vital resources even on slopes greated than 7% and farming along the slope footpath, along steeply land easily forms channel for gully formation. Particles lossened and shifted by the raindrops are carried sown slope by a very thin sheat of water, which moves along the surface. As raindrops batter and strike the surface, finer particles in the soil may be shifted between larger ones to form an imperious crust in addition to soil compaction by raindrop and impacts. The presence of this crust increases the destructiveness of flood-direct loss of crop producing capacity. Government rush through relevant agencies intensify effort to educate the populace on the danger of violating any of the aforementioned facto.

REFERENCES

Bos, M.G A.J. Replogle and A.J Clemens (1984); flow measuring flumes for open Channel Systems Wiley, New York; 312 PP.
Curtin, W.G. and lane, R.F (1980): Concise practical Surveying. Hodder and Stonghton 2nd Edition. Pp 22-24
Ehui, S.K; Kang, B.T and Spencer, D.S.C (1996); Economic Analysis o soil Erosion Effects in Alley Cropping No Till and Bush Fallow system in south Western Nigeria Agricultural System pp34
Eze-Uzoamaka, O.J. (1976): Soil Erosion and its Control in the Eastern States of Nigeria Proceeding, Nigeria Society of Agricultural Engineer. Volume 3 pp 51.

Hudson, N.W. (1976); Field Engineering for Agricultural Development Low price Edition Oxford University Press.

Michael, A.M. and Ojha, TP. (2005); principles of Agricultural Engineering Vol. 1 4"" Edition Sunil Kunmar Jain Publishing New Dihi pp 756, 742, 746

Roy, K. and Misha, R.P. (1969); Formation of Chambal Ravines Indian Forester Vol. 95 pp 160.

Schwab G.O R.K. Frevert: T.W. Demister and Barnes K.K (1976); Soil and West Conservation Engineering. 2d Edition, John Wiley and sons, New York.

Stramp, L.D (1938); Land utilization and soil erosion in Nigeria Geog. Rev. Vol. 2 f pp 32-45

Town Sens, W.N (1978); Introduction to Scientific Study of Soil, 5h Edition Amola Publishing LTD.

Ude, N.C. (1978): Strategy for Gully Reclamation presented at Agricultural Seminar. School of Agriculture Abubakar Tafawa Balowa College, A