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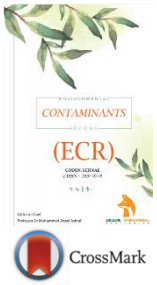

RESEARCH ARTICLE

A REVIEW ON SOIL CONSERVATION PRACTICES IN NEPAL

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ABSTRACT

Land degradation and soil erosion are the major problem in the world. The world loses 24 billion tons of fertile land and dry land degradation reduces National domestic product in developing countries by up to eight percent per year which indicates the vulnerable threat to millions of people in the world. About 87 tonnes of top soil per hectare per year eroded in Nepal. The fragile geology, farming practices, Increasing population etc are the reason which exceeding erosion in Nepal. Soil conservation practices include erosion control and fertility maintenance as well. Agro-forestry system using *Pectona grandis*, *Acacia nilotica*, *Dalbergia sissoo* etc play an important role in soil conservation. Cowpea, Velvet bean, sesbania, blackgram etc as a cover crop intercept the splash effect of raindrops, Improve infiltration of soil and also to reduce deleterious effects of global warming. Conservation tillage was found effective against both soil and wind erosion. Mulching, contour farming and terracing are also found effective in the hilly mountaineous region. It was also found effective in Nepalese condition as well. In this paper bird's eye view on soil erosion issue, reason and major conservation practices in Nepal and world as well.

KEYWORDS

Soil erosion, Nepalese context, Conservation practices.

1. INTRODUCTION

Land degradation and Soil erosion are the major global problem (Guerra et al., 2017). The United Nations report shows that every year the world loses 24 billion tons of fertile land and dry land degradation reduces National domestic product in developing countries by up to eight percent (UN, 2019). It is the most vulnerable threats affecting millions of people worldwide. Previously, also mention about land degradation by accelerated erosion as a serious problem, especially in developing countries of tropics and subtropics (Lal, 2001). About 87 tonnes of top soil per hectare per year on sloping terraces are found as eroded in Nepal. In Nepal due to fragile geology from almost 2/3 of the total area, soil erosion is exceedingly high (Kaini, 2019). Land degradation and soil erosion in Nepal are due to geographical and social diversity, Intense cultivation, Increasing population, lack of governmental plan etc (Karkee, 2004; Gardner and Gerrad, 2003).

Table 1: Some data regarding soil erosion in Nepal

Location	Erosion Rate(ton/ha/yr)	References
Khajuri catchment (Siwalik Hill)	64 (about 21000m^3)	(Ghimire et al., 2013)
Aringale Khola watershed	11.17	(Chalise et al., 2018)
Koshi basin	22	(Uddin et al., 2016)

So, in order to reduce and decline the rate of land degradation and soil erosion in Nepal, we must follow the various management approaches. This paper focuses mainly on possible and practices approaches against soil erosion in world.

2. CONSERVATION PRACTICES

In the Present day, new terms and approach are arises in conservation of environment. In this context, Soil Conservation includes both erosion control as well as fertility maintenance. Similarly, on the prevention of soil loss title 'Soil conservation' is replace with positive concept of 'land husbandry' or 'conservation farming' (Stocking, 1985). Single or Multiple adoptable combinations of conservational tools targeted to achieve permanent productivity of the soil (Bennett et al., 1951).

2.1 Agroforestry

Agro-forestry control erosion of soil by checking runoff, grass strip, ditch and bank structure (Young, 1989). There are no rules and principles for selection of species under agroforestry system. Popular species under cultivation are *Pectona grandis*, *Acacia nilotica*, *Dalbergia sissoo* etc raised in different part of world (Dwivedi, 1992). Forest has role in soil conservation and provide nutrient.

2.2 Cover crop

Cover crop also called as green manure crops. It is not for market purpose and grown, incorporate into the soil (Fageria et al., 2005). Cover crops play a dramatic role in soil conservation. The best cover crops sequenced are as Cowpea followed by other legumes such as velvet beans, sun hemp and black gram (Tejwani et al., 1975). It improves soil physical and chemical properties followed by other legumes Velvet beans, Sun hemp, dhaincha (sesbania), green gram. Furthermore, Deep rooted cover crop such as

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Pigeon pea, Stylo and Velvet beans improve Infiltration rate of soil within 1 to 2 years (Lal et al., 1979). Cover crops intercept the splash effect of raindrops and thus reduced the Kinetic energy of raindrops (Stallings, 1957). It has advantages of weeds suppression, upgrade nutrient retention, decreasing disease and increasing crop yield as well as productivity (Creamer and Baldwin, 2000; Dinnes et al., 2002; Triplett et al., 1996). So that it is called nutrient management tools (Ruffo and Bollero, 2003). Cover crop is of leguminous and non leguminous. it was found that cover crops reduces soil erosion by one hundredth times than of bare soil (Cunningham, 1963). Cover crops increased C and N storage in soil through various management practices as a result increased in sequestration of CO_2 and N in atmosphere (Sainju et al., 2002). So that we can conclude that it helps to reduce deleterious effects of global warming.

3. Mulching

Mulch is effective against direct splash effect of rain, maintains pore space %, increase in infiltration rate, overall crop growth and development (Srivastava, 2011).

4. Water Harvesting and Runoff Cycling

Process of collection of water, store and using reduces the free runoff over the ground. It can be achieved by In-situ and Ex-situ harvesting. The recommended practices of roof-top harvesting are done in high rainfall area (Srivastava, 2011). Flood water harvesting is different from rain water harvesting. Flood water harvesting performs only by small scale silt traps (Jean, 1992). Around 1990s in Nepal, Silt traps are found effective to filter debris from gullies and river flows thereby which are still in practices results in creation of new possible land (Gill, 1991).

5. Tillage

Any tillage practice that maintains surface cover at least 30% is Soil conservation (Consevation Tillage Information Centre, 1988). Conventional tillage doesn't meet minimum residue cover requirement (Hill, 1990). Change in tillage operation results in change in pore characteristics which is determinate by compaction, fragmentation in the tillage zone. Changes in organic matter contain alter the pore characteristic in a comparative longer period of time (Kay and Vandenbygaart, 2001). Under conservation tillage water erosion rates are reduced by 1 to 2 orders of magnitude than that of conventional tillage systems (Leys et al., 2010). Moreover, Plot studies on effectiveness of conservation tillage also showed that if the slope length increases, the effectiveness of conservation also increase (Leys et al., 2010). Conservation tillage reduced wind erosion also by increasing shear strength (Govers et al., 2017). Combination of modified tillage techniques and crop rotations reduced wind and water erosion to acceptable level (Sterk, 2003).

Cultural practices such as sown date & time, use of balanced fertilizer, optimum plant population, practices of irrigation that make optimum crop growth as well as reducing losses caused by runoff and erosion (Vasudevaiah et al., 1965). To reduce the percentage of wind erosion, wind break should be established. Wind breaks effects are seen up to 10 times than their actual height (Srivastava, 2011). According to decades of work done at central Arid Zone Research Institute, Jodhpur, The three row shelter belts combination (Cassia siamea, Albizia lebbeck & Cassia siame) when put across wind direction were found best in reduction of wind as well as soil erosion (Faroda and Joshi, 1998). Soil organic matter influenced primarily on physical characteristics associated with soil structure, soil aggreration and aggregate stability (Six et al., 1999). Primary Soil paticles bind physically and chemically that results in aggregates stability and limitation of breaking down during wetting process (Emerson, 1997).

5.1 Contour Farming

Contour lines is farming practices in contour lines instead of traditional straight lines practices. Strip cropping practices in combination with contour farming makes more uniform distribution of water instead of normal practices. It was founds that even smaller percentages of slopes highly affect the farming (Srivastava, 2011).

5.2 Terracing

Terraced slopes are practices for both aesthetic and productive purposes (Khanal and Watanabe, 2006). Several building typologies are used in slope reshaping that was carried out manually (Reij, 1991). An effective but rudimentary technique of stone lines is found on Ader Doutchi Maggia of Niger which has been mentioned (Reij, 1991). Also, Stone bunding practices are found in middle mountain of Nepal (Tamang, 1991).

Table 2: Some Practices followed in Nepal againstSoil Erosion and deterioration

Practices	Study Area	Results	References
Reduced Tillage	Kathmandu University	Reduced tillage decreased the loss of SOM, K and C by 62, 1.4 and 7 kg ha-2 respectively	(Atreya et al., 2006).
Cover crop	Pipaltar, Nuwakot district	Napier as a cover crop restored soil fertilityand recovered catchment	
Mulching	Kathmandu University	Rice as straw mulching reduced runoff by 18%	(Atreya et al., 2008).
Strip planting	Palpa district	Maize and legumes as strip planting as sieve-barrier effect	
Hedgerows	Godavari	soil loss reduction ny 90%	
Check dams	Bagmati river basin	reduction of stream banks cutting	(Dhital and Tang, 2015).

6. Conclusion

In this way Agro-forestry, Cover crop, mulching, tillage, terracing etc are found effective in the global scenario. So that, we want to recommend to government and concern sectors to follow it in order to reduce soil erosion and land degradation.

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