

The Role of Inappropriate Agricultural Practices on Soil Degradation in the Eastern Cape: the Case of Farming at Sheshegu Community

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Abstract— This study examines the role inappropriate agricultural activities play in erosion development in the Eastern Cape, using the case study of Sheshegu community, South Africa. A cross-sectional data, collected through a random sampling collection process, from 50 smallholder farmers, form the basis of the study. According to findings, though several anthropogenic variables were mentioned as influencing factors on the Sheshegu soil erosion, agriculture-related activities were perceived higher (47%) in importance, and its level of impact was ranked as high as 90%. This finding was also corroborated by other results, as income from agricultural production (29.4%) contributed the most to farmers' overall income, and free-range animal production system (64%), a system known to be soil erosion-prone, ranked the most out of all farmers' production system. Since livestock farming is the main source of income for farmers in the area, farmers should be supported to establish closed-range lands for their livestock.

Key words— Anthropogenic activities, inappropriate agricultural practices, Eastern Cape, Sheshegu community, Soil erosion.

I. INTRODUCTION

The fact that agricultural activity plays significant roles in soil erosion/degradation has been well acknowledged. One obvious reason is because agriculture provides over 99.7% of all human foods [1], [2], making it the closest activity to the soil. The case is compounded with the current global population growth rate and the overwhelming need to meet the food supply requirements of this growth. Indications are that, 79.3 million people (83 million, according to the World Economic Forum 2017) are added to the world population annually; a figure said to have remained constant for almost a decade [3]. The worry, is that with this growth rate, agricultural production must increase by 70% to be able to meet up with this trend by 2050 [4], [5], [6]. In fact, the current demand for food has been predicted to double by 2050, exerting unimaginable pressures upon natural resources [4]. This is why Nearing et al. [7] and Meijer et al. [8] both emphasize that the increasing global population has led to increased agricultural intensification and land use pressures, resulting in soil and land degradation.

Soil erosion (degradation) is regarded as one of the world's most significant environmental problems due to its impacts on

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both the natural environment and the human society [9]. Soil erosion is commonly regarded as the greatest threat to land productivity, leading to adverse effects on agricultural production, infrastructure and quality of water [10]. It has the capacity to reduce rooting depth, soil fertility, soil organic matter and plant-available water reserves, as well as a global challenge for sustainable agricultural production [11]. Supporting this, Issaka and Ashraf [12] maintain that soil erosion negatively hinders plant growth, farm yields, water quality and recreation. Almost 22% of all global cropland, pasture, forest and woodland have been degraded since the past century; which in financial terms, is approximately an annual loss of US\$28 billion as a result of degradation in global drylands [9].

Indications are that, degradation of the soil is usually a main problem of less developed areas of the world, particularly in places where agriculture is a major source of economic development [5]. This is largely due to factors such as poverty, inadequate technologies and know-hows, and high population growth, which engender improper use of natural resources such as the soil. Degradation is set in motion, often by inappropriate use of land or soil along with extractive farming; a process which feeds on itself in an ever increasing downward spiral [5]. According to Pender and Hazell [13], poverty, low agricultural productivity, and natural resource degradation are very serious interrelated challenges in less-favoured areas such as sub-Saharan Africa. The widespread occurrence of degraded soils in sub-Saharan Africa is a real example of the downward spiral, a problem caused by over exploitation, extractive farming, low external inputs, and poor or improper soil management [5].

Although soil erosion is a natural process, it is however exacerbated by human activities, especially that which relates to clearance of vegetation, such as for agriculture. Thus, the soil is exposed to various agents of denudation. Changes in land use have been widely recognized as having the potential of being able to accelerate the processes of soil erosion [14]. In cropping systems, soil erosion/degradation is propelled by inappropriate management practices which bring about reduction in soil biological, chemical and physical quality, resulting to the inability of the soil to support production and environmental functions [15]. Garland et al. [16] conclude based on evidences, that though South Africa is predisposed to soil erosion due to factors such as the sensitive and fragile nature of its soils, as well as the climate and topography of the area, the most

influential factor however is poor farming and land husbandry by both smallholder and large scale farmers.

Seventy percent of the surface land area of South Africa is said to be affected by varying levels and types of soil erosion [17]. Areas of most degradation are the communal areas of the former homeland, where majority of smallholder farmers dwell [18], [19]. These areas are generally characterized with soil degradation and poverty, part of the consequences of apartheid policies. As it is well known, the former homeland areas were only 13% of total land areas in South Africa, where black people were forced to live during apartheid regimes. As such, apart from the problem of poverty, the competition for usable land due to population density is said to be one reason why such areas are still the most degraded in South Africa. For instance, the Eastern Cape Province, where this study consists, one of the former homeland areas of Ciskei and Transkei, is regarded as one of the three most degraded provinces in South Africa [20], [21]. Also, the province is classified as one of the poorest provinces in South Africa [22], [23]. Based on annual ratings, it was emphasized that the Eastern Cape, KwaZulu-Natal, and Limpopo provinces featured consistently as the three poorest provinces between 2006 and 2015, in South Africa [24].

Further information on the Eastern Cape, Limpopo and KwaZulu-Natal Provinces, indicate that very huge proportions of the land are under severe threat of soil erosion [25]. In fact, when a relative provincial soil loss comparisons were made, the Eastern Cape Province was found to make the most contribution (28%) to soil loss in South Africa; and about one third (16 million ha) or 37% of the entire province is classified as having moderate to extremely high soil loss [25], emphasizing the level of degradation in the province.

The foregoing provides a general overview of pre-existing conditions and reasons for the soil erosion situation of the Eastern Cape. However, this current study seeks to ascertain specific factors, especially as it relates to the study area. Therefore, the goal of this paper is to determine the role inappropriate agricultural practices play in the soil erosion development of the Eastern Cape Province, using the farming situation of Sheshegu community as a case study. In order to achieve this objective, the following specific objectives are specified: (1) to establish the role agricultural activities play in soil erosion development in the study area; (2) to assess farmers' perception on impact of agricultural practices on soil erosion development in the study area; and (3) to determine the basic inappropriate agricultural activities responsible for soil erosion situation of the study area. The expectation is that findings of this study will add to existing literature on causes of soil erosion/degradation in the Eastern Cape, and thus encourage policies to ameliorate the problem.

II. METHODOLOGY

A. Characteristics of Study Area

The study was conducted in Sheshegu community, a rural community, located in Raymond Mhlaba local municipality, Eastern Cape of South Africa. Sheshegu community is located on the south-west of Alice town, along the R345 road to Peddie. It is positioned on longitude $26^{\circ} 44'47".9$ and $26^{\circ} 50' 55".2E$ of

Greenwich, and latitude $32^{\circ} 53' 06".1S$ and $32^{\circ} 56' 36".0S$ of the equator [26], with an elevation of 563m above sea level [27]. The community comprises of the following villages, namely Mpozisa, Skolwoni, Baluia, Lower Sheshegu, Sheshegu Fingo and Komkhalu, respectively. Its lithology is mostly mudstone and sandstone, and its vegetation is part of the Valley Bushveld in the Thicket Biome. The area receives an average rainfall of about 386mm annually, with most of the rainfall experienced during summer [28]. Average daily temperatures in the area range between a minimum of 19°C in June, to a maximum of 28°C in February, respectively. The inhabitants of the area are mainly Xhosa speaking, and their main occupation is livestock farming, as well as small level of crop production [29]. According to Statistics South Africa [30], the main land use type of Sheshegu community is sheep farming, although other animal production systems also occur in the area.

B. Data Collection and Analysis

Data for this paper forms part of a larger study, conducted in 2010. Using the cross-sectional research design method, by a random sampling selection process, data for the study was collected from 50 smallholder farmers in the study area. Collection instrument was a semi-structured questionnaire, through a one-on-one collection process. With the help of the extension department (Department of Agriculture, Forestry and Fisheries [DAFF], Alice) in the study area, farmers' cooperation was solicited to ensure smooth data collection process. Specific variables collected and analysed for this study are: the perceived basic causes of soil erosion in the study area; the perceived role agricultural activities play in soil erosion development in the study area; the relative contribution of various sources of income to overall income of farmers; and farming systems practiced by farmers in the area. Data collected were analysed with the statistical package for the social sciences (SPSS) software package version 19, using basic descriptive statistics such as frequencies, percentages, means, and graph. Table 1 is a tabular presentation of all variables analyzed for the study..

III. RESULTS AND DISCUSSION

A. Socioeconomic Background of the Study

Soil erosion is caused by various natural and human factors [31]. Natural forces are the forces of nature, such as weather conditions (e.g. rainfall/precipitation, temperature, wind, topography of land, and soil structure). Human factors are all human activities conducted on land, especially that relating to the removal of vegetation. Examples are farming; settlement and road construction; and logging activities. Although soil erosion is naturally occurring, human activities however cause it to occur higher than its natural rate, making it devastating. This section therefore provides first, a brief overview of farmer's socioeconomic variables, such as age, education, gender, and annual income. Analysing these variables help to understand the behaviour patterns of people/farmers under study [32]. Also, analyzing these behaviour patterns provide a clue to the behaviour processes of such a population, as well as their production behaviours [33]. Other aspects of this section are the perceived impact of agricultural activities on soil erosion,

and specific inappropriate agricultural activities contributing to soil erosion in the study area.

TABLE I. SPECIFIC VARIABLES ANALYZED FOR THE STUDY

Variables	Description
Perceived causes of soil erosion in the study area	a. Farmers were expected to provide three most important natural causes of soil erosion, as perceived by them b. Farmers were expected to provide three most important human causes of the erosion, as perceived by them
Perceived impact of farming activities on soil erosion in study area	An open-ended question, which was later classified into groups
Relative contribution of various sources to income to overall income of farmers	Percentage ratings by farmers on the relative sources of income on their overall income
Agricultural systems practiced by farmers	Farmers were asked to indicate all types of farming systems practiced in their area

According to the Table 2, the study area exhibits a problem of ageing phenomenon, with relatively low level of formal education, as average farming age in the area is 53 years, only 6% exceeded Grade 12, while as high as about 12% have no formal education. These phenomena is common in many sub-Saharan countries, and the Eastern Cape in particular, which could be a drawback to agricultural development. Although age as a factor in agricultural development is dual and difficult to decide, this result is however consistent with several studies [34], [35], [36], [37], [38], which found that age rather encouraged adoption instead of acting as a drawback. Inadequate education is largely a general problem in the rural areas of the Eastern Cape, as sometimes up to 20% farmers' population still do not have formal education, and only few exceed Grade 12 level of education [39], [38]. Over and above the impact of other socioeconomic variables in agricultural development, education and poverty play significant roles. According to Pender and Hazell [13], poverty and poor education are two main reasons for inappropriate agricultural decisions by farmers.

TABLE II. SOCIOECONOMIC CHARACTERISTICS OF FARMERS

Variables	Statistics	Variables	Statistics
Age of farmers	Average (53 years)	Education levels	No formal education (12%)
Gender of farmers	Male (62%)		Exceeded Grade 12 (6%)
	Female (38%)	Annual income	<R20000 (74%) >R50000 (14%)

Source: Survey research 2010

The study area also consisted of a gender disparity, where male farmers (62%) are more. This finding is inconsistent with some literatures, which suggest that women's contribution to farm production in many developing countries, particularly in sub-Saharan countries, is higher [40]. However, Maka et al. [39] say that the reason for this kind of finding is because of the gender-related economic roles of rural communities in the Eastern Cape, where men are known to engage in farming, while women engage in petty trading. Furthermore, almost three-quarter (74%) of farmers in the study area earn an annual income of R20000 (R1667/month), showing the poverty level of

study area, when compared to the current R3500 minimum wage in South Africa [41].

B. The Role Agricultural Activities Play in Soil Erosion Development

According to the Table 3, in order of preference, rainfall (26%), drought (15%) and wind (13%) were emphasized as main natural causes of erosion in the study area, which is consistent with literature [42], [43], [44], [45], [46], [47], [48]. However, amidst all human activities listed by farmers as cause of the erosion problem in their area, agricultural activities (22%) ranked highest in importance. Although the impact of agricultural activities is already significant in itself, the situation is worse if impact of other agriculture-related activities, such as deforestation (16%) and animal footpath (9%), is included. As such, the overall effect of agriculture and related activities rises up to almost half (47%) of the overall effect of all human activities put together.

The impact of agricultural activities in soil erosion development cannot be overemphasized. This could be in a number of ways: through cropping activities or through any form of livestock rearing. Arguing in support, Mukanov et al. [49] say that anthropogenic activities, particularly that of agriculture have a strong positive relationship with soil condition. Citing an example, it was said, that in Northern Kazakhstan, between 1954-1963, the intense development of pasture lands under the Agricultural Program of the Virgin and Fallow Lands, led to large-scale soil degradation [49]. Similarly, El Jazouli et al. [50] maintain that land-use change patterns as a result of intense agricultural practices and deforestation, coupled with population, increased the rate of fertile land deterioration processes. More so, unrestricted human activities, such as overgrazing, continuous cultivation, and deforestation have been said to be contributing factors for increased soil erosion in Mubi, a town in Nigeria [42].

TABLE III. PERCEIVED NATURAL AND HUMAN REASONS FOR EROSION IN SHESHEGU

Natural causes of erosion	%	Human causes of erosion	%
Climate change/variation	3	Agricultural activities	22
Drought	15	Animal/human footpath	9
Heavy rainfall	26	Building/construction	20
Heavy winds	13	Deforestation	16
Inadequate drainage	1	Trade-medical uses	3
Veld fires/burning	5	Veld fires/burning	12
Nature of the soil	1	Running water	1
Slope/gradient of land	1	Other	17
Bare land	1		
Other	35		

Source: Survey research 2010

C. Specific Farming Activity Contributing to Soil Erosion in Sheshegu Community

As indicated, any human activity which tampers or clears off vegetation cover speeds up the rate of soil erosion. In this regard, Chalise et al. [51] argue that the rate at which land/soil degrades is determined by the rate at which land cover degrades. One main land-use factor that largely tampers with vegetation cover is agriculture. This is because of an ever increasing need to feed an ever increasing population. In order therefore to understand specific aspect of agriculture in the study area

perceived by farmers to be responsible for soil erosion in their area, farmers' perception on their farming systems was sought.



Fig. 1. Systems of farming in Sheshegu community

Findings reveal that three main farming systems (Figure 1) prevail in the study area. In order of importance, the three main farming systems are free-range animal production system (64%), enclosed animal production system (30%), and crop production system (6%), respectively. Finding on free-range animal production system is highly remarkable, suggesting a possible reason for the soil erosion in the study area. According to Chalise et al. [51], livestock grazing increases soil erosion processes, as large groups of animals regularly trample on land, breaking up soil aggregates, thus making it vulnerable. Citing an example, it was said that increased grazing activities, especially in certain areas of Nepal, has drastically degraded its soil conditions, including the water and nutrient holding ability of the soil [51]. Findings here is however consistent with literature on agriculture in the Eastern Cape Province, which suggest that the Eastern Cape is the largest producer of livestock out of all provinces in South Africa. Concuring, Hoffman and Ashwell (undated) maintain that 64% of land in the Eastern Cape is used for livestock rearing, while only 20% of land is used for cropping. The dominant farming activity in the area is livestock rearing [52], [29].

TABLE IV. RELATIVE CONTRIBUTION OF INCOME SOURCES TO OVERALL INCOME OF FARMERS IN SHESHEGU

Contribution of income sources to overall income	Mean (%)
Government employment	13.94
Private company	3.9
Crop farming	1.72
Enclosed animal farming	8.82
Free-range animal farming	18.82
Self-employed(other than farming)	2
Other sources of income	48.76

Source: Survey research 2010

To corroborate findings on specific inappropriate farming activity influencing soil erosion in the study area, two other statistics was collected in the study area. These are farmers' perception on the percentage relative contribution of sources of income to their overall income (Table 4), and impact ratings of the impact of inappropriate farming activities on soil erosion development (Table 5). Sources of income help to reveal main human activity providing livelihoods for people in an area, which also helps to reveal the main activity people engage in their environment, which suggest factors that impact on their environment, in this case, the soil. Based on findings (Table 4), apart from other sources of income (49%), where income from government social welfare grants form the bulk, the relative

contribution of income from free-range animal production (19%) to overall income of farmers in Sheshegu, ranked highest in importance. This corroborates earlier findings on specific farming activity perceived by farmers as basic cause of soil erosion in the study area. Global agriculture today has experienced great advances, as more sustainable methods have been developed. However, the problem of poverty, lack of education, inadequate technology, lack of technical know-how, et-cetera which prevail in many developing countries, especially in sub-Saharan Africa, is the reason why certain degradation-prone agricultural practices, are still being practiced. As a former homeland area in South Africa, farming among smallholder farmers in the Eastern Cape is largely communal, which provides another dimension to this discussion. Due to a lack of access to personal farmland or large piece of land, that can be converted to a rangeland/pastureland, farmers are constrained to using the already known environment-degrading measures such as free-range animal production.

To further buttress farmers' perceived impact of indiscriminate farming activities on soil erosion in the study area, an impact ratings was conducted. This was necessary to provide an understanding of the perceived level of impact, according to farmers. According to findings (Table 5), perceived impact of indiscriminate farming activities on soil erosion development rated as high as 90% of farmers' response. Apart from free-range animal production, which rated higher, other examples of farm practices considered by farmers as impacting on the soil erosion situation in their area includes cropping activities, and tillage practices. According to Le Roux et al. [17], South Africa is susceptible to soil erosion because of inappropriate farm practices, coupled with erodable soils.

TABLE V. PERCEIVED IMPACT RATING OF INAPPROPRIATE FARM ACTIVITIES IN STUDY AREA

Impact of inappropriate farming activities	Frequency	Percent
Highly impacting	45	90
No much impact	3	6
No impact at all	1	2
Other impact	1	2
Total	50	100

Source: Survey research 2010

IV. CONCLUSION AND RECOMMENDATIONS

Although agriculture, and livestock production for that matter is critical for the livelihood of people in the Eastern Cape Province, the problem of soil erosion, largely due to the application of inappropriate farming practices like free-range animal production system, calls for worry. Soil erosion is a naturally occurring phenomenon, but inappropriate human activities however cause it to occur beyond its natural rate, thus making it devastating. This study shows that, though farmers obtain livelihoods from other sources, such as government social welfare grant, livestock (e.g. sheep, cattle and goat) production is the most important source of livelihood for farmers in the study area. However, the production system still prevailing in the study area is the free-range animal production system, which is found to be one of the main agricultural

activities responsible for soil erosion in many parts of the world. This though could be associated with certain socioeconomic challenges found in the study area, such as poverty and inadequate education, as farmers earn far below the minimum wage, and only 6% exceeded Grade 12, while up to about 12% have no formal education.

It is therefore recommended that the problem of farmers' poverty and inadequate education should be addressed by the government. This could be by providing financial support for farmers to establish their own rangelands, and subsidies should be provided for farmers to purchase animal feeds. Also, adequate awareness is required for farmers in the area on the negative impact of free-range animal production and for other inappropriate practices. Similarly, adequate extension education should be increased in the area, and agriculture should be made more appealing, by encouraging youths right from high schools to see opportunities which lie in farming, and providing soft loans for those who show interest.

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