Sudan University of Science and Technology

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Impact of Rangelands' Use Patterns on Rangelands Health and Sustainable Management, North Kordofan State

(أثرانماط الاستخدام علي سلامةالمراعي والإدارة المستدامة – شمال كردفان)

By

Alsammani Ali Mohammed Ali

B. Sc. (honor) Natural Resources and Environmental Studies, University of Kordofan

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Main Supervisor: Prof. AbdelazizKaramallaGaiballa

Co Supervisor:

Dr. Hala Mohamed Alhasan

Faculty of Forestry and Range Science

University of Sudan

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Dedication

To my parents whom put me in this life

To my brothers and sisters

To my lovely family involved

My wife Sara Ali

My son Mohammed and Daughter Maal

To all people concern about rangelands in whole the world

For above I gift my simple effort

Acknowledgement

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استهلال

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

سَبِّحِ اسْمَ رَبِّكَ الْأَعْلَى (1) الَّذِي خَلَقَ فَسَوَّى (2) وَالَّذِي قَدَّرَ فَهَدَى (3) وَالَّذِي أَخْرَجَ الْمَرْعَى (4) فَجَعَلَهُ غُثَاءً أَحْوَى(5)

صدق الله العظيم سورة الاعلى الاية(1-5).

List of abbreviations

Bs	Bare soil
CBS	Central Bureau of Statistics
CC	Carrying Capacity
DM	Dry Matter
DAAD	DeutscherAkademischerAustaushDienst
FAO	Food and Agriculture Organization
Fig	Figure
GIS	Geographic Information System
Ha	Hectare equivalent 10000m^2
IFAD	International Fund for Agricultural Development
L	Litters
MA	Mass of Ashes
MD	Mass of Dry Matter
MO	Mass of Organic matter
MPDS	Mass of Porcelain and Dry soil
MPDS	Mass of Porcelain and Dry Soil
NRCS	National Resources Conservation Service
OM	Organic Matter
PUF	Proper Use Factor
Rs	Rocks
RPA	Range and Pasture Administration
SRM	Society of Range Management

Abstract

This study was conducted in Elobied North Kordofan at Am Kass rainy season grazing area *(Makhraf),* located about 25Km from Elobied town. The objective was to study impacts of rangeland use patterns on Rangeland health and Sustainability. The sampling assessing rangeland health (vegetation attributes, soil seed bank and organic matter) for the study was based on identifying the main rangeland sites based on soil type (sandy and gardud soil). Data collected included vegetation attributes for herbaceous and trees (Frequency, Biomass production and densities at each site using transect sample methods. Soil samples were taken to determine soil organic matter and to assess soil seed bank for rangeland health assessment. Socio-economic information was collected from pastoralists using questionnaires. According to main findings nomads are about 78.4 % the nomads stated that soil is deteriorated due to intensive using of rangelands at $P \leq (0.000)$ and this found accompany low value for soil organic matter 0.36%, 0.32% at Sandy and Gardud[1] soil and has there were variations between the two sites in soil seed bank which was higher in gardud site compared with sand, the live seeds and dead densities were (2067 seed/m^2, 1728 seed/$m^{2/}$5 respectively) whereas found low at sandy site ,the live seed and dead densities were 610seed/m^2, 676seed/m^2 respectively. In addition to this sandy site had the higher plant composition48%, whereas it was lowest at Gardud site 46%, bare soil and lowest plant litters compared to the sand site. Nevertheless the two sites recorded low plant cover, low biomass production which might be a result of the low seed bank in the area. Sandy site was dominated by unpalatable species like: *Zornia glochidiata* while Gardud site was dominated by *Abutilon figrianum.*This is also reflected in the low trees density such as *Acacia mellifera*, *Boscia senegalensis* was 40 and 15 plant

[1] *Soil of clay nature with hard surface of low water permeability*

/Ha respectively. On other hand the pastoralists stated that there is change in the range use pattern in term of time of entrance, exist and duration of stay at the grazing season areas. Rainy and summer season.

The nomads and sedentary respondents confirmed occurrence invasive species in the area and disappearance of more palatable species such as *Blepharislinarifolia* and *Andropogongayanus*. According to the results the study recommended that the rangelands management process should be based on sites characteristics and conditions when applying different rangelands management approaches beside Proper setting livestock routes and summer domains. The plant cover in the sand site should be increased and gardud site needs soil erosion measure particularly water erosion. The study recommended that to concern the variation of soil seed bank and different soil types in rangelands management strategies.

الخلاصة :

أجريت هذه الدراسة في منطقة الابيض شمال كردفان بمخرف منطفة أم كاس الواقع علي بعد 25 كلم من مدينة الابيض ، وكان الهدف دراسة اثار انماط استخدام المراعي علي سلامة المراعي واستدامتها .اعتمدت عملية اخذالعينات لتقييم سلامة المراعي سمات نباتية (سمات النباتات،المخزون البذري للتربة والمادة العضوية)بتحديد مواقع المرعي علي اساس نوع التربة (التربة الرملية والقردودية). شملت البيانات التي تم جمعها سمات النباتات للاعشاب والشجيرات (التردد والكتلة الحية والكثافات النباتية لكل موقع باستخدام طرق العينات الخطية وقد اخذت عينات من التربة لتحديد المادة العضوية في التربة ولتقييم محتوي التربة من البذور لتقييم سلامة المرعي. تم جمع المعلومات الاجتماعية الاقتصادية من الرعاة باستخدام الاستبيانات.وحسب النتايج الريسية فان البدو والرحل هم حوالي 47% هم من البدو وزكرو ان التربة تدهورت بسبب الاستخدام المكثف للرعي عند مستوي معنوية 0.000 وهذا صاحبه انخفاض في القيمة للمادة العضوية للتربة 0.36 و0.32 في التربة الرملية والقردودية وكانت هنلك اختلافات بين الموقعين في المخزون البذري وكانت اعلي قيمة قي موقع القردود مقارنة بالرمل وكانت البذور الحية والميتة 2067 بذرة للمتر المربع و1728 بذرة للمتر المربع علي التوالي بينما وجدت منخفضة في موقع الرمل وكانت البذور الحية والميتة 676 بذرة للمتر المربع و610 بذرة للمتر المربع علي التوالي .بالاضافة الي هذا الموقع كان اعلي قيمة في التركيب النوعي 48% بينما كان اقل في موقع القردود 46% والتربة الجرداء والبقايا مقارنة مع موقع الرمل ومع ذلك سجل الموقعان تغطية اقل للنباتات وهذا الانخفاض في الكتلة الحية قد يكون نتيجة لانخفاض البذور في التربة في المنطقة تسود في موقع الرمل انواع غير مستساغة مثل الشيلني *Zornia glochidiata*بينما تسود في موقع القردود النيادة*Abutilon figrianum*ينعكس ايضا في انخفاض كثافة الاشجار مثل السنط والكرسان حيث كان 40 و15 نبات في الهكتار علي التوالي .ومن ناحية اخري ذكر الرعاة ان هناك تغييرا في نمط استخدام من حيث مدة الخول وان هناك تغيرا في نمط مدة البقاء في مناطق موسم الرعيو (موسم الصيف). واكد البدو الرحل والمستقرين حدوث صراعات في المنطقة واختفاء النباتات الاكثر استساغة مثل الضحيان*Faristia longisliqua*وابو الرخيص*Andropogan gayanus*ووفقا للنتايج اوصت الدراسة بان تعتمد عملية ادارة المراعي علي خصائص المواقع وحالة المرعي عند تطبيق نهج إدارة المراعي المختلفة إلى جانب تحديد طرق الماشية والمصايف علي نحو سليم ويجب زيادة الغطاء النباتي في مواقع الرمال ويتعرض الموقع إلى انجراف بواسطة المياه واوصت الدراسة تتناول تنوع المخزون البذري ومختلف انواع الترب في استراتيجيات إدارة المراعي.

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CHAPTERONE

INTRODUCTION

1.1 Background:

Rangelands in Sudan are variable and extend over ecological zones: desert, semi-desert, low rainfall savanna on sand, low rainfall on clay. These variations support diversity of vegetation and production systems; also range lands are feed sources for more than 80% of livestock in Sudan (Ali and Suleiman, 1988, and Abu Suwar, 2007). Kordofan region is considered among the leading regions of Sudan in terms of animal and range resources, where more than 24.2 million heads of cattle, sheep, goats and camels are present. This amount constitutes more than 17.6% of the country livestock population. North Kordofan lies between latitudes 11°:15/ and 16°:30/ N and longitudes 27° and 32° E at an altitude of 560 meters above sea level. Maximum temperatures range between 30 and 35°C, with peaks of above 40°C during the months of April, May and June prior to the rainy season. The minimum temperatures could reach to 18-22^{o} C during the winter season, which extend from November to February (Technoserve, 1987). The temperatures are modified by precipitation. The rainy season extends from July to October with the greatest monthly rainfall in August. The long term average annual rainfall is about 280 mm. The study area can be categorized into two major soil groups, sandy and sandy loamy soils (locally called *Gardud* soil).The dominant tree species in the study area are composed of *Acacia senegal, Acacia mellifera, Adansoniadigitata, Leptadeniapyrotechnica, Maeruacrassifolia, Boscia senegalensis and Grewiatenax.* The vegetation grasses and herbs are dominated by *Sesamum alatum, Cenchrusbiflorus, Zornia glochidiata, Aristida mutablis,Cassiaobusiflora, C.*

occidentals. Ipomoea kotschyana and Farsetialongisiliqua(Khatir and Jadalla, 2014).

North Kordofan is divided into four ecological zones according to isohyets and soil types: arid, semi-arid and low rainfall savanna on sand and low rain fall savanna on clay (Harrison and Jackson, 1958, Khatir, 2012).

Most crops are grown on Gardud while sands are used as rangeland with some cropping. Rain water is harvested into Hafirs, earth dams, seasonal pools and water yards for irrigation, human and livestock consumption. Boreholes, hand pumps and open wells are drilled to use up underground water (Etezaz, 2013).

More than 80% of North Kordofan people depend on animal husbandry keeping cattle, sheep, desert goats and camels. Rain fed agriculture is practiced on Goz slopes and depressions. Main crops grown are millet, sorghum, watermelon and groundnut. *Acacia senegal* is conserved for Gum Arabic production. The climate change mitigation innovations project, a state and UN sponsored activity, provides many services including agricultural extension, animal husbandry, water harvesting, health and education (Jadalla, 2012). Although there are a number of problems associated with applying the term "health" to natural ecosystems (Wicklum and Davies 1995).Range land health provides a third way to assess ecological sites. Qualitative assessments of rangeland health provide land managers and technical specialist with a good communication tool for evaluating ecological processes and can assist to identify potential areas at risk of degradation. According to Foggin and Smith,(2008). It is important to understand the utilization of rangelands by pastoral system and the potential effects of rangeland utilization on biodiversity, if efforts are to be made to ensure that such resources are managed sustainably. However, data on rangeland utilization and local biodiversity are often lacking, and it is not always clear how such data (when available) should be used to inform management decisions. Animal production in Kordofanis mainly

practiced under traditional extensive system, depending on natural rangelands (Fadlalla and Cook, 1985).

1.2 Problem statement:

Rangeland has Economic, environmental, and social importance in the Sudan. Rangeland in Sudan is shrinking and deteriorating. This leads to negative impact on provision of feed for livestock. Shrinkage of rangeland in addition to expansion of farming on expense of rangelands and impact of climate change have led to difficulties in mobility and shrinkage of rangeland this situation greatly altered the pattern of rangeland use. North Kordofan has large animal population and has vast areas of natural grazing and browsing resources. Demand has raised on the rangeland resources resulting in degradation and depletion of vegetation (Ahmed *et al.*, 2006). The growing negative impacts on rangelands have influenced the way rangeland resources are used. In addition to this the imposed means of range lands use also remarkably affect rangelands resources. This study is aiming at studying the prevailing rangeland uses and how they interact with range health and condition.

Despite the importance of the range land in Sudan and the availability of the herders in the study area. North Kordofan state rangeland uses have their different impacts on vegetation cover which grazed by their animals. Moreover, there are a lack of investigative studies carried out in the study area; so the study focus on the impact of the rangeland use patterns on the rangeland health and sustainable range management.

1.3 Objectives:

The general objective is to study the impact of rangelands use patterns on range land health and Sustainable Rangelands Management in North Kordofan.

Specific objectives:

1- To study vegetation and rangeland health attributes in relation to rangeland use patterns in the study area.
2- To study herding practices and their impacts on rangeland management.
3- To recommend on best options for sustainable management.

CHAPTER TWO

LITRETURE REVIEW

2.1 Introduction:

Rangelands are threatened by urban development and conversion to agricultural crops (Cameron *et al*. 2014, DeLonge *etal.,* 2014.The Range lands it suffering from heavy grazing and periodic droughts, rangeland still makes an important contribution to the country's economy as well as playing an important role in environmental protection and food security according to Azimi *etal*.,(2013) . Rangelands make up an estimated 47% of the earth's terrestrial surface (Roselle *et al*., 2011). This large extent and the value they provide to people makes rangelands economically, socially, and environmentally important. These lands support numerous and diverse plant and animal species and provide natural resources such as water and soil. Rangelands also provide livestock forage, recreation opportunity, open space, and natural beauty. In California alone, rangelands make up over 40% of the land area and include grasslands, deserts, oak savannas, riparian areas, and wetlands (Brown *et al.,* 2004). These practices were initially designed to minimize livestock impacts based on the assumption that they were the key variable influencing rangeland controlling livestock equated to controlling ecosystems. In addition, the economic benefits that fencing and predator control provided by reducing labor costs for herders may have also reinforced "management by practice (Sayre, 2015). Consequently, the need for management to control rangeland exploitation, support agency authority, and produce economic value directly contributed to the development of range science not the other way around (Sayre, 2017).

2.2 Range management:

As we know need for management to control rangeland exploitation, support agency authority, and produce economic value directly contributed to the development of range science other way around (Sayre, 2017). Utilization guidelines are derived from two types of studies stocking rate studies and clipping studies. The stocking rate studies are generally aimed at the effects of different stocking rates on vegetation, soils, and animal performance. Clipping studies are aimed at evaluating the effects of utilization levels on individual plant productivity, reproduction, or longevity. Many of the concepts of proper use when applied to key forage plants are based on clipping studies. For example, the rule of thumb of take half–leave half" probably derives initially from the clipping studies of (Crider, 1958).

2.3 Practices in rangelands management:

Rangelands require information about the current condition and capacity of the land, intended use, and land owner objectives. The first priority is typically managing vegetation in a more sustainable manner. This should take into account grazing periods, rest, animal impact, and level of use that will bring about desired changes in the plant community. Second, it is necessary to implement the desired planned grazing system. These practices influence the movement of livestock and may include fencing, salting, stock trails, and herding. Other considerations in developing management plans include riparian areas, adjacent land use, recreation and cultural uses(Fraser *etal.*, 2006).

2.4 Challenges in rangeland management today and tomorrow:

Both ranchers (livestock owners) and land managers alike benefit from minimizing duplicating efforts, bureaucracy and cross-agency bottlenecks. Some of the key issues and challenges to address include:

Different socio-political contexts in different countries that influence rangeland management policies and practices also Managing multiple uses and values on rangelands to provide the outputs individuals and communities need to prosper, while maintaining sustainability for future generations, working within our various cultural systems to figure out how to facilitate people working together to manage rangelands for sustainable use moreover building and managing partnerships government, non-government ,private, tribal, and other communities (Bruynooghe*etal.*,2008).

2.5 Range health:

Rangeland health is the degree to which the integrity of the soil, vegetation, water and air as well as the ecological processes of the rangeland ecosystem are balanced and sustained. Integrity is defined as the maintenance of the functional attributes characteristic of a locale, including normal variability. Although there are a number of problems associated with applying the term “health “ to natural ecosystems (Wicklum and Davies 1995).Range land health provides a third way to assess ecological sites. Qualitative assessments of rangeland health provide land managers and technical specialist with a good communication tool for evaluating ecological processes and can assist to identify potential areas at risk of degradation. Conservation planning assistance to rangeland owners and managers includes the following: Trend assessments (rangeland trend or planned trend) will be made provided the appropriate plant communities are known and described in the

ecological site descriptions, on the predominant rangeland ecological sites and key areas within their operating unit.

2.5.1 Range health benefits:

Range health have more benefits such as producing forage, preventing soil erosion, cycling nutrients' and plant diversity.

2.5.2 Indicators of Rangelands health:

The protocol of rangelands health assessment measure five indicators of rangelands health since there are ecological differences between type of range this indicators are follows:

Integrity and ecological status, Plant community structure, Hydrologic function and nutrient cycling, Site stability, Presence of noxious weeds. Similarity index to the historic climax plant community or desired plant community will be determined. If appropriate rangeland health ecological attributes evaluations will also be made. Professional judgment, based on experience and knowledge of the rangeland ecosystems, will be required to decide which rating techniques should be used on an individual rangeland unit.

Trend is a rating of the direction of change that may be occurring on a site. The plant community and the associated components of the ecosystem may be either moving toward or away from the historic climax plant community or some other desired plant community or vegetation state (rangeland trend or planned trend). At times, it can be difficult to determine the direction of change. The kind of trend (rangeland trend or planned trend) being evaluated must be determined. This rating indicates the direction of change in the plant community on a site. It provides information necessary for the operational level of management to ensure that the direction of change will enhance the site and meet the objectives of the manager.

The present plant community is a result of a sustained trend over a period of time. Trend is an important and required part of a rangeland resource inventory in the NRCS planning process. It is significant when planning the use, management, and treatment needed to maintain or improve the resource. The trend should be considered when making adjustments in grazing management (Fraser *etal.,* 2006).

2.6 Range condition assessment:

Range condition is the level of specific indicators such as vegetation cover, production soil erosion at particular location is compared with the assumed potential for that attributes within that vegetation type or other location. Factors determining range condition include vegetation composition, vegetation cover, vegetation density, plant vigor, plant litter, and bare soil (erosion hazard). Also range condition classified into four classes according to the vegetation cover, species composition as follows (El-hag *etal.,* 2011) 75-100% Excellent range condition ,50-75% good range condition, 25-50% fair range condition and 0-25% poor range condition.

2.7 Vegetation attributes:

Vegetation attributes are quantitative features or characteristics of vegetation that describe how many, how much, or what kind of plant species is present. The most commonly used attributes are:

A-Cover

In general, cover is the amount of a given area covered by one or all plant species in a plot. However, cover can be presented in multiple forms. Foliar cover is the area of ground covered by vertical projection of the aerial parts of plants, whereas basal cover is the area of ground surface occupied by the basal portion of the plants. Foliar cover is more sensitive to climatic variations and current-year

grazing. Ground cover is the most stable since it is less responsive to current year grazing and variations in climate, however measurements of basal cover require more time and labor, especially in herbaceous plant communities, than foliar cover.

B-Density

Density refers to the number of individual plants in a given area. Density is therefore an indicator of proximity among individuals and can be interpreted with resource availability. Differences in individual size (e.g., seedling vs. mature tree), reproductive methods and structure (multi or single –stemmed) can make interpretation of results more difficult. (Still water Sciences, 2011).

C-Production

Production refers to the amount of plant biomass produced in a given time period. Most frequently, only annual above-ground production is measured and in herbaceous communities. In such cases peak standing crop, the greatest amount of plant biomass present above ground during a given year is typically used to estimate above-ground production. Peak standing crop generallyoccurs towards the end of the growing season, but different plant species peak at different times. Total forage is the total amount of herbaceous and woody palatable plant biomass available to herbivores. Variation in standing crop is introduced by climatic variability, grazing, insect, trampling, and time of sampling. (Still water Sciences, 2011).

D-Composition

Composition refers to the different plant species in a given area and the relative proportion of space (canopy or basal cover) and/or biomass that they comprise. Composition is measured using species-specific cover or frequency data collection methods. (Still Water Sciences, 2011).

2.7.1 Positive effects:

Trampling accentuates:

-The dissemination of numerous plants by fragmentation of root stocks or rhizomes;

- Seed germination (by breaking the integuments of hard seeds);

- Incorporation of organic matter in the soil by fragmentation.

2.7.2 Negative effects:

Trampling reduces:

- Standing crops by breaking up dried stubble, thus increasing the area of denuded soil and encouraging erosion;

- Photosynthesis in plants by tearing and crushing leaf tissue;

- The soil's seed stocks by pulverizing seeds.

The impact of trampling on the soil results in large part from the repeated passage of animals over the same area (livestock trails, for instance). In some mixed tropical highland systems, for example, animals reach the pasture by travelling along paths between cultivated fields. Because of the animals' repeated passage, these paths represent primary run-off channels at times of heavy rainfall, leading to major soil erosion.

2.8 Direct indicators:

The main direct indicators are:

Biological if they relate to the vegetation; in rangelands areas, it is these biological indicators that determine the relationships between biological environment and livestock production, physical if they relate to soil, water and, to some degree, the atmosphere.

2.9 Biological environmental indicator:

2.9.1 Plant cover:

This will be assessed in terms of either the percentage of soil surface covered in vegetation in any given area or, conversely, the percentage of bare soil. Such data can be interpreted, provided comparable diachronic sequences are available (same area, same season), thus providing information on changes in plant cover.

Plant cover gives an overall estimate of the vegetation's condition and of its growth characteristics, making it possible to monitor modifications to its structure (opening up of the environment, contraction of plant associations).

Some factors cause changes in the plant cover: vagaries of climate (e.g. droughts), for instance, animal pressure, land clearance and over-use of wood. Because of the diversity of elements that affect it, plant cover is a far from sensitive indicator for livestock production. It is also an element used in diagnosing soil conditions in relation to wind erosion and water erosion (bare soil).

2.9.2 Plant biomass:

"Plant biomass" refers to the quantity of plant matter present at the moment of measurement. The total quantity produced in a year is the annual primary production, which consists of two fractions: above- and underground production. Primary production is an adequate indicator to assess biological activity in an environment. Herbage available to livestock can be measured simply by assessing the forage quantity the animals can use.

2.10 Botanical composition of the woody layer:

Woody plants, made up of perennial species, are sensitive to long-term ecological change: the structure and composition of such vegetation are relevant medium-

term indicators. Stock browsing on the leaves and young plants of certain species has a direct effect on this vegetation and plays a major part in seed dispersal. Given the considerable direct and indirect influence that livestock production can exert on the preservation and regeneration of woody plants on rangelands, this is an indicator of major importance. The changes observed, however, have other causes, associated with human activity or natural or climatic processes. The impact of livestock production activities on the composition of the woody layer can only be demonstrated if one has a sound knowledge of the circumstances surrounding these changes.

2.10.1 Botanical composition of the herbaceous layer:

Herbaceous vegetation consists of annual and perennial species whose presence is influenced by external events, even of a short-term nature. Its botanical composition can change rapidly. This vegetation is the basic food of herbivores. Animal pressure and grazing time are among the main direct causes of change. Its floristic composition is, however, the product of complex mechanisms, and the consequences of grazing can thus be seen in both positive and negative terms. Plant cover and biomass are compound criteria that explain very little. Floristic composition offers more information useful in analyzing the responsibility of livestock production for the changes noted.

2.11 Domestic animal numbers and pressure of grazing on the environment:

A– Animal density:

The number of domestic animals in a given area is the historical consequence of stock breeding activities. It is limited by forage or food resources, by the livestock's access to water and by competition with other activities and speculative

enterprises, i.e. agriculture, as far as labour and means of production, for instance, are concerned. The animals' environmental impact depends on their species and is a direct function of livestock numbers.

Animal density in a region, administrative division or country is calculated by determining the relationship between head of livestock and the size of the area concerned.

B– Herd composition by species:

Livestock composition by species is information of major importance. Each species has its own diet and exerts its own particular pressure on the environment. Cattle, for instance, are essentially grazing animals and grass-eaters, whereas goats are primarily browsing animals most of whose food consists of the leaves and fruit of shrubs and trees. The distance explored between watering points or grazing areas also differ from one species to another.

Changes in livestock composition in a region are linked to changes in forage resources occurring there and are an example of changes affecting the environment. The increased aridity of the Sahel has thus made camel breeding important there. Such changes also depend on farmers' wealth. A herd of cattle represents a capital that takes much longer to accumulate and is slower to mobilize than a flock of sheep; its growth results from a capacity to accumulate.

2.12 Relationship between actual stocking rate and carrying capacity:

Carrying capacity is the maximum number of animals that a grazing area is reputed to be able to sustain without deterioration (FAO, 1988). This is a very controversial idea as it is impossible to determine exactly the limit beyond which there is a risk of degradation, but it is nonetheless a convenient unit of measurement. It is

expressed in head of livestock or standard animal units per unit of area. The actual stocking rate/carrying capacity ratio provides a good indication of the intensity of use of grazing lands this is a useful indicator, although only an indicative one. It can be used to assess the proportion of forage production consumed by livestock and hence the "grazing pressure" on the environment. It is specific to livestock production and without interference from other factors (Islam *etal.*,2018).

The movement of forage resources, from one season to another, makes it necessary for the animals to journey to the appropriate locations at the appropriate times, these being, however, almost impossible to predict. There are three main types of stock mobility: nomads, migratory herding and free grazing. Nomads is practiced in the most arid regions, where the rainfall needed for grazing plants to grow is so random that forecasting is impossible. Provided water is available for them, the herds or flocks are taken to these transitory grazing areas as soon as they become available, and remain there only long enough to exhaust them completely. This happens on the fringes of the Sahara.

Migratory herding is the seasonal movement of herds on a regular basis, between two or more plant communities, each of which has a forage value worth exploiting at a particular time of the year. Free grazing is very widespread among small farmers in regions where there is an abundance of communal pastoral resources. Owners usually keep stock away from cultivated fields, but may leave the animals completely untended in commonly-owned or risk-free areas. They then graze freely as instinct dictates and only return in the evening. This is a very common practice with small humid-zone ruminants and camels.

2.13 Attributes related to animal impact:

Utilization: Utilization is the proportion or degree of current year's forage production that is consumed or destroyed by animals(including insects).Seasonal utilization" is the percentage of the forage produced in the current growing season up to the date of measurement that is removed by grazing (Smith et al. 2007). The impact of grazing on individual plants is considered related to the percentage weight removed, and the percentage of the forage by weight in a vegetation type is related to the animal unit months of grazing that has occurred. Thus, utilization is based on percentage of the dry weight of plant production rather than height or cover. Results reveal that the organic matter contents of coarse-textured, slightly alkaline soil of the study site were in the range of 9.4 - 17.6 g kg-1 soil and showed a strong positive correlation with aboveground vegetation biomass. The biomass of plants was 56.5% and 33% greater at controlled than uncontrolled grazing site in 2015 and 2016 respectively and plant cover was also higher at controlled than uncontrolled grazing site in both years. Islam *etal*, 2018)

2.14 Uses/Interpretations:

Utilization is a check on the intensity of grazing by livestock and/or wildlife at the end of a grazing season. When combined with other information, utilization can indicate the need for adjusting stocking rates, especially when measured over a period of years Grazing patterns can be identified by mapping utilization patterns over the entire management unit, or plotting observed utilization at a number of locations scattered over the unit. True utilization (based on total year's forage production) and seasonal utilization are both attributes that can be mapped or plotted and used to support decision making. The landscape appearance method is recommended for use pattern mapping since it can be used in almost any vegetation type and allows for rapid assessment over large areas. Where

utilization is mainly being judged on perennial grasses other methods (e.g. height-weight, stubble height, percent grazed or grazed class) may be used for training or as checks on visual estimates(Smith,2007).

2.15 Impact of grazing during the growing season:

grazing impact during the growing season in humid grasslands in South Africa has revealed that grazing animals can have a severe negative impact on both the vigor (short term) and proportional species composition (long term) of the grass layer (Kirkman 2002, Also Kirkman (1999) found that the vigor of preferred (palatable) grasses declined during the season following grazing, while vigor of un preferred (unpalatable) grasses increased during the following season, probably due to reduced competition from the regularly defoliated preferred grasses.

2.16 Direct impacts of herbivores on fauna:

According to (Landsberg *et al.*, 1997; Ludwig *et al.*, 1997), animals have had well documented effects on the vegetation of arid zone ,these effects include a general reduction in vegetation cover, an increase in the amount of bare ground, changes in the composition of perennial and annual vegetation selecting against palatable species loss of soil nutrients (Sparrow *et al.,* 2003), changes in the density and composition of the seed bank (Landsberg *et al*,. 1997; Kinloch and Friedel ,2005), decreased seed production (Letnic, 2004).

2.17 Indirect impacts of pastoralist:

The impacts of livestock are not only on the landscape and fauna associated with pastoralist. Pastoral enterprises require the establishment of infrastructure including watering points and fences, the manipulation and control of fire regimes, and the control of species that are perceived to be pests. The changes in landscape structure and function associated with these features of pastoral land use have had

an impact on the fauna of the arid zone in addition to the impacts of livestock grazing like artificial waters have allowed species to use and persist in areas where they were less likely to have occurred previously. The increase in the availability of watering points has resulted in an increasing species (Reid and Fleming, 1992).

2.18 Impacts of utilization of rangeland:

Effect of Utilization on Aboveground Biomass in Mongolian Rangeland it is well known that intensity of grazing matters when it comes to health and sustainability of rangelands (Liang *et al.,* 2009). It is obvious that grazing intensity is important when it comes to utilization and sustainability issues. However, timing of grazing is also an important factor that strongly influences the biomass production. This study shows that rangeland production is easily disturbed due to utilization but rangeland recovery is slow in Mongolian dry condition. Grazing by large herbivores is a key determinant of soil spatial heterogeneity in grasslands (Liu C. *et al.,* 2015).

2.19 Impacts of grazing on ecosystems:

Grazing animals have several direct and indirect impacts that can improve or degrade rangelands depending on the timing and intensity of grazing. Foraging animals affect rangelands by removing vegetation, roughing up and compacting soil through hoof action, and depositing minerals and nutrients in the form of urine, feces, or the animal's carcass. Appropriate and well-managed grazing can favor desirable plants, improve habitat for wildlife, reduce weed invasion, reseed areas for restoration, reduce mulch accumulation, increase soil organic matter, and reduce fuel loads that promote wildfire. Overgrazing and prolonged poorly managed grazing can remove desirable plants, decrease water infiltration into soil, increase soil erosion, reduce water quality, increase weed invasion, and alter the

plant community composition to a less desirable state. Therefore, the impacts of grazing depend on when and how it occurs.

Vegetation attributes most sensitive to grazing impacts include above ground biomass(harvesting), basal cover, percent bare ground, and rooted frequency (Coles Ritchie *et al*., 2004). Basal vegetation cover and rooted frequency are well correlated to production rates and somewhat less time-consuming. Other non vegetation effects associated with grazing can include soil compaction, water quality impacts, and surface erosion. Several excellent sources with detailed information on measuring forage production and other grazing impacts include (Herrick *et al*., 2005).

2.20 Sustainability:

Objectives of rangeland management are to achieve and maintain plant communities that will protect the potential productivity of the soil and to provide desired benefits (livestock forage, wildlife habitat, "ecological services," etc) on a sustainable basis. Therefore, the final test of whether the goal of sustainability is being met rests in assessing the general direction of vegetation dynamics as moving toward or away from a desired plant community description that will meet both ecological and resource output goals. That is what rangeland assessment and monitoring should primarily address (Smith *etal.* 2012).

2.21 Drought impact on rangeland management:

Drought impacts rangeland conditions, both ecologically and socio-economically, in many ways. In the short term, it decreases forage availability for wildlife and livestock. Over extended periods, droughts can cause native plants to die out, soil to erode, and water supplies to dry up. Drought indices, alone, do not provide managers with adequate information needed to make decisions. Some of the SRR

indicators that may be sensitive to drought include “Change in the Area of Bare Ground, “Changes in Groundwater Systems, “Change in Stream No-flow Periods, “Condition of Riparian Systems and Wetlands,” “Value of Forage Harvested,” Employment Diversity, Sources and Amounts of Community Income, and “Return on Rangeland Investments (Mitchell, 2010).

2.22 Livestock production systems:

The livestock production systems in the Sudan generally fall under five major systems: Pastoralist system nomadic and transhumant, sedentary and semi sedentary.

A. Traditional system:

(i) Pastoralist nomadic

Pastoralists depend on rangelands and move animals where feed and water are available, in specific geographical zones (camel) and cattle owners in Kordofan and Darfur). These groups own 80- 90% of the total number of cattle, 100% of camels, 80% of sheep and 60% of the goats of the country. The herd sizes in the system vary, averaging 200, 70, 90 and 200 for cattle, sheep, camels and goats, respectively. The system is the main source of meat for the local demand and for export.

(ii) Transhumance system

This is practiced in the Southern part of the country where herdsmen move away during the flood time and to it when recedes. The herds are kept in enclosure. The seasonal movement is short for distances as compared to the nomadic system. Herd sizes are small and are mainly cattle, which represent the pivot for the economic and social life of the people.

(iii) The sedentary and semi-sedentary system

This includes livestock owners who practice rain fed agriculture and also sends their animals with the nomads to feed on agricultural by- products in the area. The system also includes farmers in the irrigated schemes who raise small ruminants for supplementary financial support. Owners keep milking animals and send dry ones with the pastoralist nomads. The system supplies milk to towns and urban areas, and is characterized by low technology (Sudan Fourth report, 2009).

B-Distribution livestock use over the rangeland:

Livestock are creatures of habitat and will not typically distribute themselves uniformly over the range, even if topography is not an issue. Bull's-eye grazing patterns are typical on most range areas, with water sources, flat terrain and shaded areas receiving disproportional use. These are referred to as primary range. Unless effort is taken to distribute use through water development, strategic fencing, herding and the use of attractants, these areas of primary range tend to be overgrazed and overused Range managers in the Caribou - have successfully used the attractant crystalyx1 to get better distribution of cattle and use of pine grass. Managers in West world-Monte Hills Range Units are achieving better cattle distribution using range riders.

C-Level of use:

In the past, 50% of annual forage production was seen as the safe level of use. Recent analysis has shown that this is a poor rule of thumb. On average, late-seral range should be used at no more than40% of production, mid-seral at 30% and early-seral at 17-25%. Some domestic forage can be used at a higher level because they are adapted to grazing and usually have growing points that are low to the ground and not easily removed by the grazing animal. We have also learned the importance of leaving (Duag, 2013).

2.23 Grazing system:

The grasses, forbs, and shrubs that grow on rangelands are important sources of forage for grazing animals. Rangeland plants photosynthesize and use energy from the sun to turn carbon dioxide, water, and nutrients into organic compounds such as carbohydrates and proteins. When herbivores consume plant material, these compounds are digested and provide energy and nutrients for herbivores. Grazing is a natural ecological process that occurs on all rangelands (Roselle, 2011). Grazing distribution patterns of large herbivores are affected by biotic factors such as slope and distance to water and by biotic factors such as the quantity and quality of forage. Biotic factors are the primary determinants of large-scale distribution patterns and act as constraints within which mechanisms involving biotic factors operate. Usually, there is a proportional relationship between the time that large herbivores spend in a plant community and the available quantity and quality of forage (Bailey *et al.,* 199).Grazing systems fall into 4 main categories as fallow:

1. Continuous grazing systems:

Livestock are kept on one area of land, on which they are allowed to freely move and graze, through the placement of salt blocks and mineral licks and opening and closing of stock tanks, boreholes and other water supplies.

Continuous grazing in the absence of proper planning frequently leads to problems of overgrazing (F folliot, 1995).

2. Seasonal grazing systems:

Livestock are confined to one area in the dry season and to another area in the wet season. A feature of these systems is that one area of land is grazed at the same time each year. Rangelands that typically suffer misuse are those which are grazed regularly in the wet season. Therefore, seasonal grazing system is acceptable only

when the wet-season grazing area is large in relation to the size of the dry-season grazing area and number of livestock (F folliot, 1995).

3. Rotational grazing systems:

The total area to be grazed is divided in to number of blocks in rotational grazing system. These blocks are grazed separately in the order that seems appropriate. However, unless the systems are monitored, some of the block can be overused and other wasted.

4. Deferred grazing systems:

In balanced rotational grazing system a period of deferment is applied to each block, with successive grazing periods in a block deferred so that grazing take place at different times of the year. Each block is grazed for an equal period during the growing season, which normally 12 months on grazing lands regions.

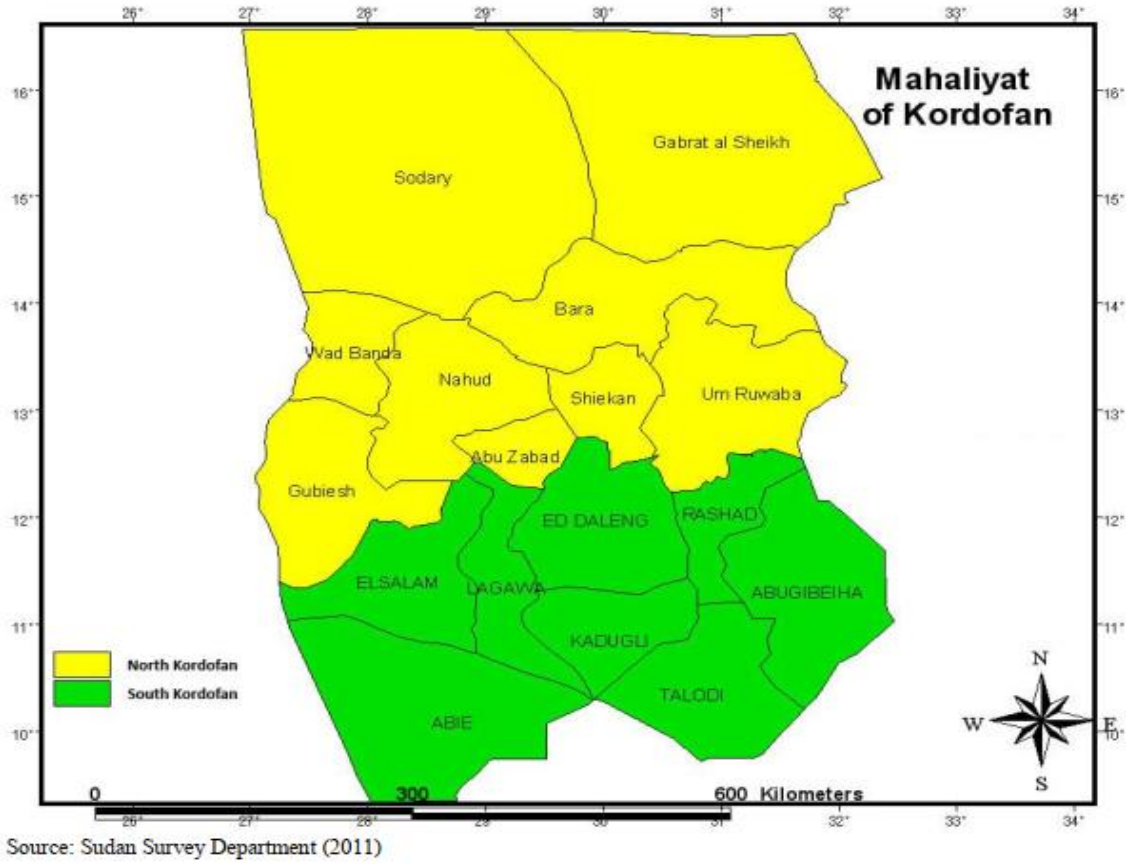
CHAPTER THREE

MATERIAL AND METHODS

3.1 Description of Study Area:

The study was carried out in Um Kass Makhraf Southern Elobied town, which is located in North Kordofan State between latitudes 9° 30' and 16° 24' N and longitudes 27° to 32° E. Kordofan, which lies largely within the arid zone, covers an area of about 244,700 km2 and has a total population of 2.9 million persons (CBS,2008) showed in map 1 50% rural, 34% urban and 16% nomads with an annual growth rate of 1.45%. Administratively the state consists of nine localities, and many of them are frequently affected by drought.

Map 1-2 North and South Kordofan localities and main towns:



Source: Sudan Survey Department (2011)

Map1: of North Kordofan State and localities (CBS, 2008).

Table2: Average rain falls in Sheikan Locality for the period 2014-2018

Season	Average of rainfall (mm)
2014	279.3
2015	332.0
2016	491.0
2017	500.6
2018	224.0

* Source: Survey of Ministry of Agriculture, Animal Resources and Irrigation (MAARI), North Kordofan State (2007).

Study methods:

Secondary data was collected from previous studies, while the primary data and information were collected along the following study components:

1-Rangehealth assessment:

A-Vegetation assessment:

Two rangeland sites representing rangelands of the area were selected based on the *Releve*[2] method one is Sandy soil site and the other is Gardud soil sites. (Barbour *etal.,* 1987).

At each site, data were collected during the month of November in 2017. The sampling area of 1 km^2 was marked in each site within each site four transects of 100m. Length were used each site, quadrates of (1 m^2) placed along each transect line systematically to determine biomass production and plant cover for (grasses and herbs) in each site.

Plant composition:

Plant composition as a total plants plant types observed from total number of hits; while the relative plants composition refer to the contribution of each individual

[2]* Releve Method: French methods for selecting site of rangelands

plant species in the total plants percent (Parker, 1951). Parker loop method (Parker & Harris, 1959) was used. A total of 100 hits per transect were taken, then distribution of the species, litters, bare soil and rocks along each transect were identified. The total hits of each parameter were calculated. The following equations were used to calculate percentages of parameters such as (Plants composition%, relative plants species composition%, litter%, bare soil% and rocks %).

Plant cover percentage:

Plant cover percentage was estimated as visual percentage of the quadrate covered by plant material (Bonham, 1989) usually estimated by locating 1x1 m quadrates at each site along each transect.

$$\text{Plants coverpercentage} = \frac{\text{Total estimations}}{\text{Total number of quadrats}} \times 100 \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Biomass production:

Biomass is the weight of vegetation at a point in time (Holecheck *et al.*, 1989).

Biomass was determined using comparative yield method. equipment were included quadrate(1x1 m), was placed at each site Bonham,(1989) plant species in each quadrates were clipped at level 3cm above the ground level and dried by oven at 105c to get dry matter content until weight is obtained. Biomass value was subsequently converted to a kilograms / hectare.

$$\text{Biomass production gm/m}^2 = \frac{\text{Total weight of dry matter of plants}}{\text{Total number of Quadrats}} \ldots\ldots\ldots\ldots\ldots (4)$$

$$\text{Biomass production ton/ha} = \frac{\text{Biomass gm/m}^2 \times 10000}{1000 \times 1000\text{gm}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

(Gaiballa.,*etal*,2003)

Available forage production = Biomass production ton/ha × 0.5

0.5 = Proper Use Factor.

Carrying Capacity:

The carrying capacity was calculated on basis of total biomass production and amount of the feed requirements per animal unit. Carrying capacity is usually determined using proper use factor (PUF), of 50% in which only half biomass produced is considered available for grazing, livestock requires daily dry matter (DM) intake equivalent to 2.5 – 3% of their body weight.

Thus Tropical Livestock Unit (TLU) of 250 Kg body weight consumes 2.5 – 3% of their body weight the daily Animal Unit (AU) requirements is equivalent to 6.25 – 7.5Kg dry matter per day (Darag and Suliman, 1988). The following equations were used to calculate Carrying Capacity.

Requirements of AU/day = 3× 250 ÷ 100 = 7.5 kg

Requirements of AU/month = 7.5 × 30 = 225 kg

Requirements of AU/year = 7.5 × 30 ×12 = 2700 kg

$$CarryingCapacity = \frac{Available\ forage\ production}{Total\ animal\ unit\ consumption\ (AU/Year)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

(Gaiballa.,*etal*,2003)

Where: Available forage production is the biomass production at the study area in ton/hectare.

AU: Animal Unit.

Measurement tools used included the following:

Measuring tape (100-meter),Parker loop (3/4" diameter),Recording sheet, Pair of scissors, Quadrate ($1m^2$),Paper bags, Ranging rode, Sensitive balance and Compass.

Trees and shrubs density:

Density in vegetation measurement refers to the number of individuals per unit area. Density for trees and shrubs was determined by using the Nearest Individual Method Barbour *e t al.*, (1987) in which 30 points were taken at each site), at each point the distance to the nearest individual tree of any species (shrub or tree) was measured; the species were identified and recorded. Only one measurement from each point was taken. All distances for all species were summed and divided by their numbers to yield one average distance to calculate density per hectare ($10000m^2$) for all trees. The following equations were used to calculate trees density and relative trees density.

$$\text{Trees density} = \frac{10000}{2(\text{Average distances in meter})^2} \ldots\ldots\ldots (7)$$

$$\text{Relative trees density} = \frac{\text{Number of species encountred}}{\text{Number of all trees}} \text{trees density} \ldots\ldots\ldots\ldots\ldots (8)$$

(Barbour *e t al.*,1987).

B- Soil seed bank:

To investigate the density of soil seed bank Forty (40) soil samples were taken randomly in each site (20 samples at each site) in 10x10cm at 5cm depth, according to Chield and Goodall,(1973)who reported that the first 2cm accumulate most of the seed bank in arid environment. The samples were mixed probably, and sub- samples of 250g prepared for seeds extraction.

Preliminary washing of the soil samples using sieves of 1.0, 0.5, and 0.25mm pore size. The technique comprised initial washing of the soil, floatation, and then separation of live seeds based on their density using Ca Cl_2 solution.

Each soil sample (250g) were placed and filtered through three sieves of mesh sizes 1.0, 0.5, and 0.25mm and wash for 20min. The residuals in the three sieves washed by about 250ml of water, then transferred into 500ml beaker and stirred. About 250ml of $CaCl_2$ (1.5g/ml of water) were added to the same sample residues, and let each sample residues for 40 min into a beaker. The floated material after stirring included mainly live seeds (Ramadan, 2001). The washing of samples was done at plant sciences laboratory of University of Sudan, College of Forestry and Range Science.

Extracted seeds were identified through comparison with reference samples of seeds collected from plants growing in the study area, using a microscope and lenses. The identified seeds in each sample where recorded and counted (Ramadan, 2001).

To calculate seed composition by counted the number of dead seed and live seeds of each species in soil samples, then express as number per square meter at designated soil depth

$$\textbf{Percent of live seeds} = \frac{\text{Total live seeds}}{\text{Total of all seeds (live \&}dead)} \text{----------(1)}$$

$$\textbf{Percent of dead seeds} = \frac{\textbf{Total dead seeds}}{\textbf{Total of all seeds (live\&}dead)} \times 100\text{-----(2)}$$

Plate (1) Samples techniques

C- Soil organic matter:

Ten soil samples of one Kg weight and at about 20 cm depth were randomly taken and merged in one mixed sample representing for each site. Soil organic carbon (SOC) was determined using Walkley and Black methods (1934) are simple by methods only 77% of total oxidizable organic carbon is oxidized.

Total organic carbon was find out by O.C. % *1.3

2. Socio-economic aspect:

This cover (using patterns, community livelihood, herding practices)Tools used include questionnaire (annex) and check lists for field observation, focal group discussion. Socio – economic aspects in this study included to two categories (group discussion and Questionnaire) distributed on breeders.

The questionnaires were distributed for 150 respondents cover nomads and sedentary herders in three villages around the study area people were selected and that equivalent 10% of families for both respondents. 75 for nomadic and 75 questionnaires for settled. The information which collected from them included the information about the land uses, rangelands utilization and management methods (indigenous knowledge), the conflicts between them, rangelands status, and livestock and rangelands improvement methods.

3.5 Statistical Analysis:

The vegetation attributes were analyzed using standard range land assessment equations as stated earlier while Statistical Packages for Social Sciences (SPSS) was used for analyzing the socio-economic data.

1.3 Theoretical frame work

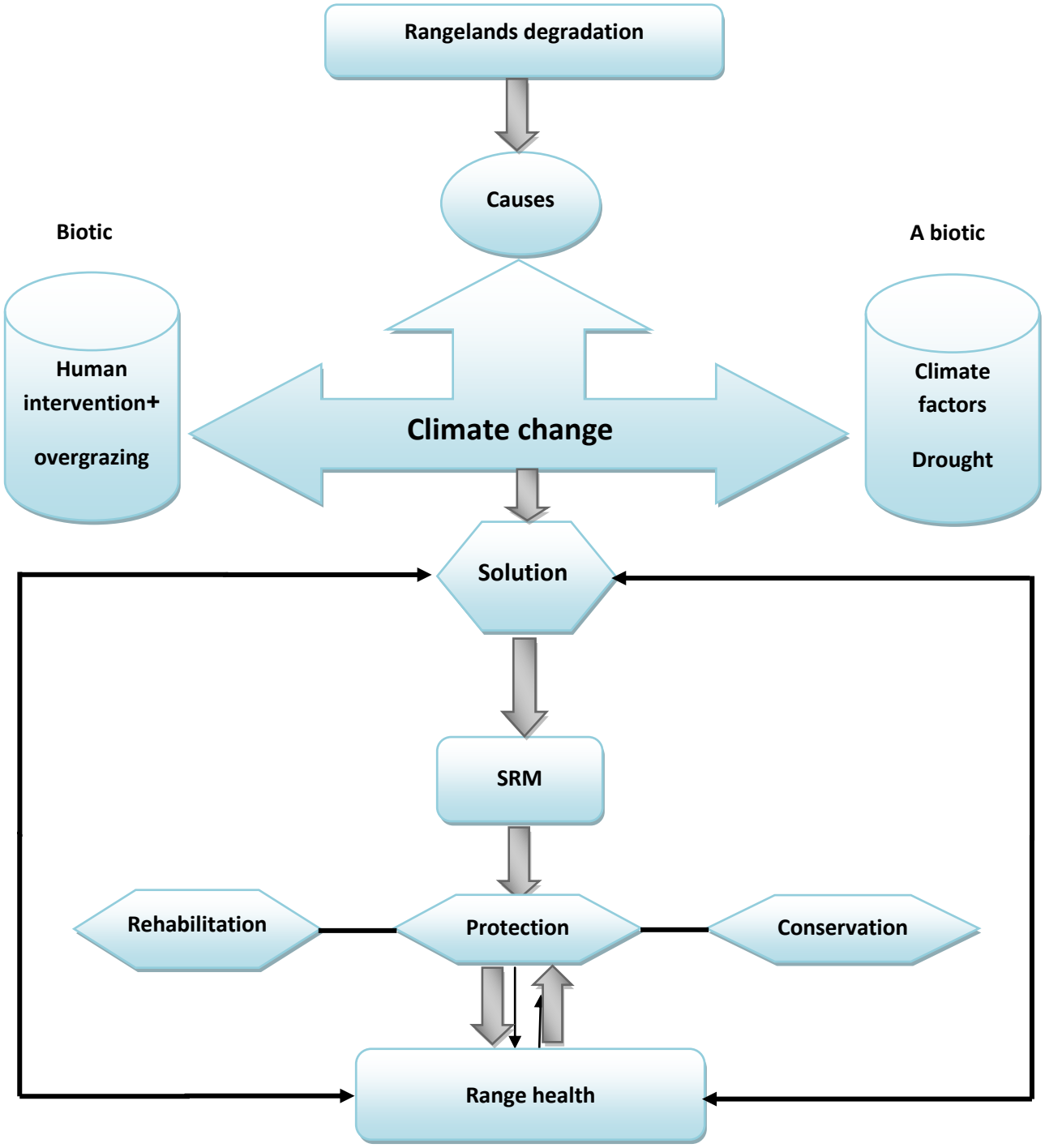


Figure 1: Theoretical Frame work

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Vegetation measurements

4.1. Ground cover:

According to table (4.1) sandy sites showed higher score of Plant composition 48%, litters%13 and bare soil 38 % compared with 46% ,15 and 34% respectively, for Gardud site. This is attributed to the reason that sandy soil usually grazed earlier in the season, compared with Gardud site. Yates *etal., (*2000) stated that there is usually low plant composition due to variability of soil properties and intensive uses. The spatial differences between sites in plant composition may be due to variable soil properties (soil nutrient and moisture contents) and grazing intensity. Management practices should improve the vegetation composition in Gardud soil. This can be done by grazing management (Stocking rate, and appropriate species).

4.2 litter and bare soil:

The result in table 4.1) shows that litter percentages was very low at the Sandy site, 13% 15% respectively. This litter percentages may be due to low rainfall characterizing the semi-arid areas, which resulted in low vegetation cover. Coleman, (1992) reported that litter in a pasture is a function of forage growth, senescence, harvest and decomposition. It may be also due to both the continuous grazing of the available sparse vegetation and the redistribution of litter by wind and water.

Table 4-1: Vegetation parameters at the Sandy and Gardud rangeland sites

Parameter measured (%)	Range site	
	Sandy soil	Gardud soil
Plant composition	48	46.75
Bare soil (B.S)	38.25	34.25
Litter (L)	13	15
Rock(R)	0.75	4
Total	100	100

Source: field data

Table 4.2: Dry matter at the two sitesg/m^2

NO	Site sand Dry matter	Site Gardud Dry matter
1	138	35
2	25	31
3	33	190.9
4	39	29.9
5	30	25.9
6	35	42.2
7	79	65.7
8	44	53.8
9	100	31.7
10	119	42.2
11	30	29.1
12	42.4	27.7
13	49.1	28.7
14	41	28.1
15	36.6	131.6
16	43.8	27.1
17	87.7	27.6
18	0.0	77.9
19	30.9	76.6
20	39.2	182
TOTAL	**1042.7**	**894.7**
Average	**54.8**	**44.7**

Source: field data

Biomass production and vegetation cover at study area:

According to the study result in table (4.3) the vegetation cover was high at Gardud site (33%) compared with the sandy site (27%). Abdelsalam *etal.,* 2012 stated that vegetation cover is poor in Sandy soil. Both sites did not reach the standard percentage of plant cover needed to protect soil and reduce the erosion in the study area, the percentage of plant cover in the study area ranging from27% – 33%. Connolly *et al*., (1997) reported that when the percent of vegetation cover is less than 30% – 40%, run-off and soil loss dramatically increase.

Biomass productivity in table (4.3), showed high value at Sand soil whereas at Gardud soil was lower. This result agree with line Abdelrahim and Abdalla,(2015) they reported that biomass productivity vary according to growth condition including soil features and rainfall amount and distribution Ellis, (1995) and Scoones,(1995) reported that the amount and temporal distribution of precipitation, more than any other factor, determines plant growth in semi-arid regions.

Table 4.3: Vegetation cover and Biomass productivity Ton/ha

Parameter measured (%)	Range site	
	Sandy soil	Gardud soil
Biomass production ton/Ha	2.74	2.23
Vegetation cover%	27.5	33.7

Source: field data

4.1.3 Relative Plant density:

Results of the relative plant density for the two sites at Study area were demonstrated in Table (4.4). The density values 23 plant / m^2 and 42 plant / m^2 were scored in the Sand and the Gardud sites respectively. Plant density was low3, 2plant / m^2 in the sand and gardud site respectively. This reduction may be due to heavy grazing in these areas. The plant was showed high relative density were(30.3,23.3 and 12.7) *Cypprus rotundus* , *Abutilon figrianum* and *Solanum dubium* in

Sandy site where the plant of *Abutilon figrianum*, *Acanthus sp* and *Eragrostis termula* do the same in Gardud soil(41.6,16.3 and 8.4) may be related to over grazing.

Table 4.4: Relative plant density Plant/m^2

Species	Sandy %	Relative density	Grdoud%	Relative density
Abutilon figrianum	75	23.3	138	41.6
Faristia longisliqua	7	2.1	9	2.7
Eragrostis termula	12	3.7	28	8.4
Fimbristilis dichotma	6	1.8	4	1.2
Heliotropuim supinum	1	0.3	7	2.1
Acanthus sp.	15	4.6	54	16.3
Zornia glochidiata	10	3.1	27	8.1
Seteria verticillata	2	0.6	0	0.0
Cassia sena	2	0.6	4	1.2
Triblus tresters	5	1.5	6	1.8
Cenchrus biflorus	6	1.8	7	2.1
Solanum dubium	41	12.7	27	8.1
Amaranthus vridis	27	8.4	0	0.0
Chorchrus olitorius	1	0.3	2	0.6
Datura stramonium	1	0.3	0	0.0
Zaleya pentandra	2	0.6	4	1.2
Euphorbia aegyptiaca	1	0.3	0	0.0
Schenfeldi agracilis	9	2.8	0	0.0
Cassia tora	1	0.3	0	0.0
Cypprus rotundus	97	30.2	5	1.5
Alyscarpus monilifera	1	0.3	1	0.3
Aristida funiculate	0	0.0	3	0.9
Sesbania sesban	0	0.0	1	0.3
Cleome monophylla	0	0.0	1	0.3
Ipomea kordofana	0	0.0	2	0.2

Source: field data

4.1.4 Trees and shrub densities:

The study showed that the total density of trees at Sandy soil was 27 trees /Ha. Whereas at Gardud soil was 12 trees/Ha. The results indicated that the two sites are

have different trees density. Relative density at Sandy site is dominated with *Boscia senegalensis*(40 shrub/ha) ,while the Gardud site was dominated by *Acacia nilotica* (6) shrub/ha Table 4-5.This variation of trees and shrubs at the two sites may be due to topography, soil types and rainfall characterization. The species *Boscia senegalensis* considered as dominant species at the sand but does not preferred by most animals particularly for this reason animals avoid eating it.

Table 4-5: Density of woody tree species Trees/Ha in Study area

Species	Relative density in sand	Site sand	Site Gardud	Relative density
Acacia nilotica	5	3	4	6
Boscia senegalensis	39	15	3	5
Ziziphus spinachristi	11	4	1	2
Acacia nubica	18	7	2	4
Caltropis procera	0.0	0	2	4

Source: field data

4.2.1. Soil organic matter:

The study showed that soil organic matter percentages were demonstrated in Fig (3). It was generally low if compared with rangeland in semi arid. Burke, (1989) in semiarid and arid region showed a significant topographic influence on soil organic matter accumulation these patterns have been interpreted as being the result of two simultaneous processes. The Sand and Gardud sites scored the low value 0.36%,0.32% respectively. This finding in study area was low organic matter it consider very low. Low organic matter is a natural feature of arid and semi arid. It is related to rates of carbon addition to the soil. Burke *et al*., (1997) and Epstein et al., (1998) declared that soil organic matter of grassland is significantly related soil texture, and land use history.

The spatial variation in soil organic matter may be induced by the spatial vegetation pattern which was affected by rainfall and topographic variation. Sala et*al.*, (1988) stated that soil organic matter was related to patterns of precipitation and land use. Grazing was also response of variable soil organic matter. Lassina *etal.*,(2018) stated that heavy grazing cause reduction in soil nutrients.

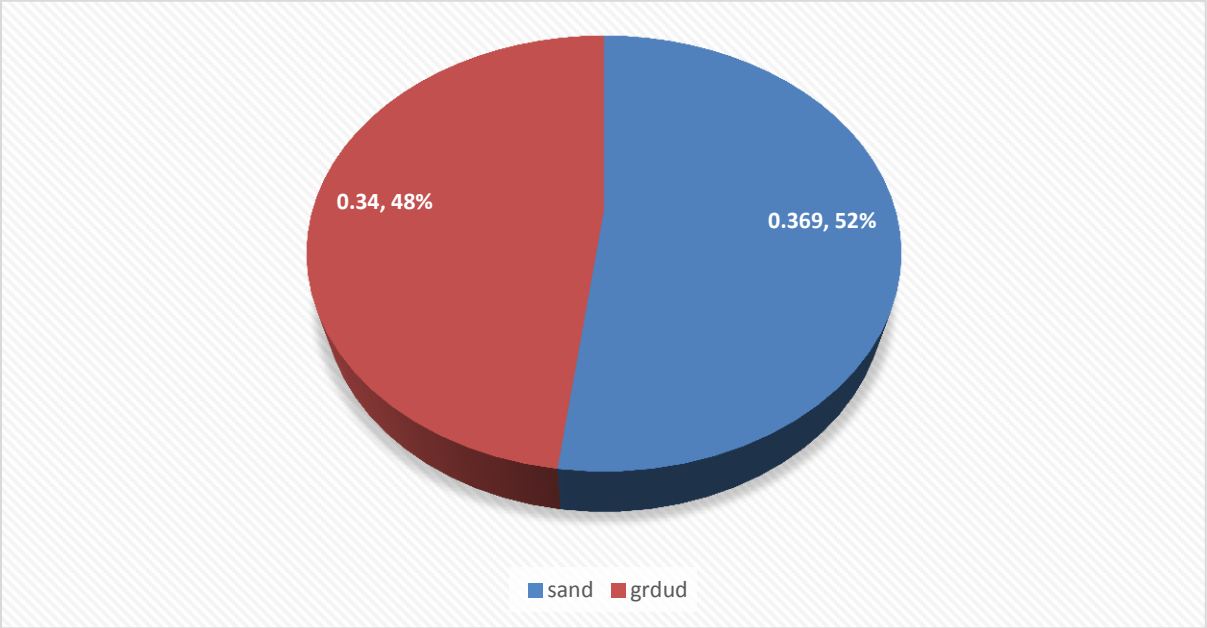


Figure2: Soil organic matter

4.2.1. Soil seed bank:

Generally soil seed bank was higher in Gardud site compared with Sandy site, the live seeds and dead densities were (2067 seed/m^2,1728 seed/$m^{2/}$5 respectively) whereas low at sandy site,the live seed and dead densities were (610seed/m^2),676seed/m^2 respectively. This seed density was reported by Fumanal *etal*. (2007) with 536 +/- 194 to 4477 +/- 717seeds/m^2.Tree seeds density ranged from 828.6 to

1052.6 seeds m^2in the top 5 cm soil depth, whereas(Karrer *etal.*,2016) also stated that the soil seed densities found only in the upper soil layer (0-10 cm) (Karrer *et al.*, (2016)with 467.9 and 146.22 seeds / m^2.Fg(1).

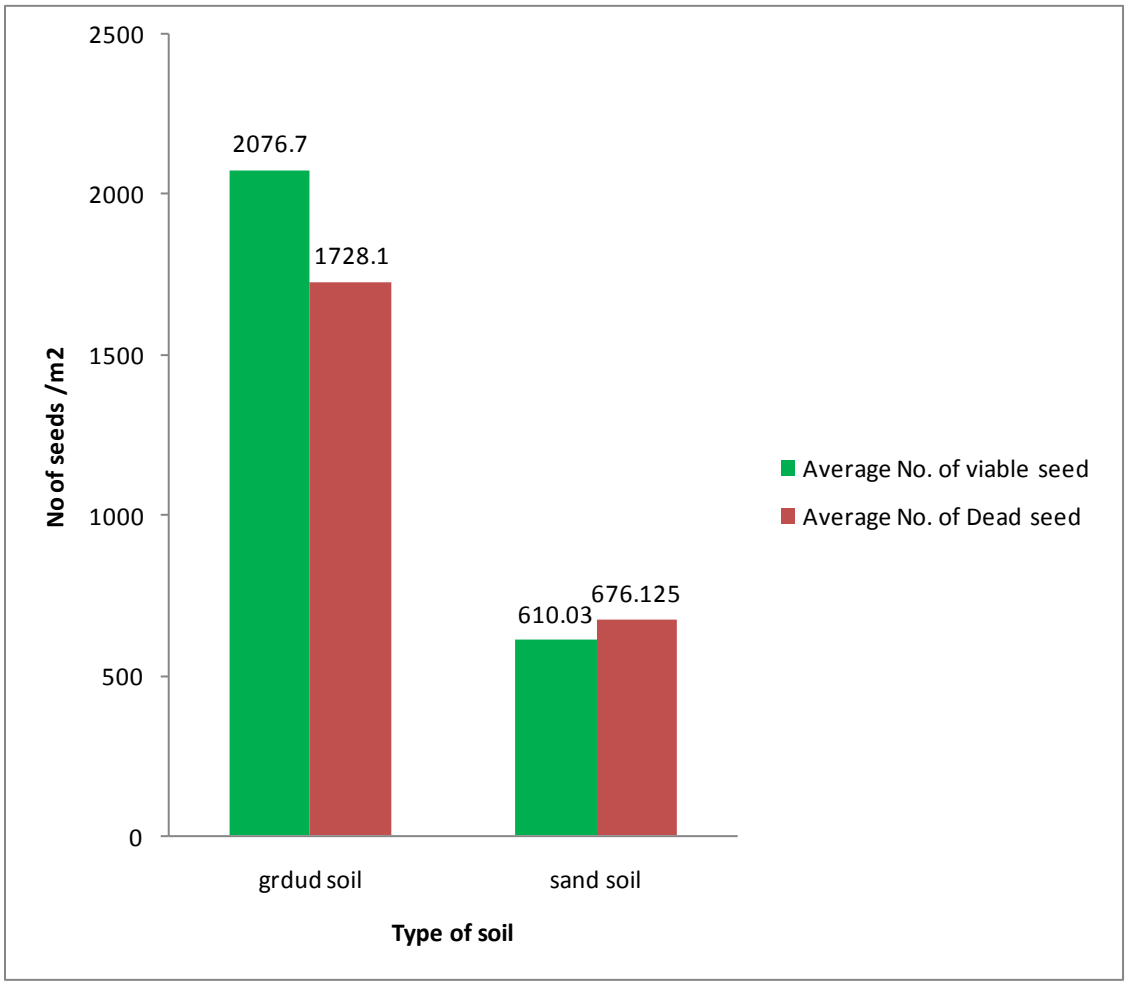


Figure 3: Average indicates live and dead seed/m^2.

Table 4-6 indicated that the total dead seeds were higher than the total viable seeds in both sites at study area. The high density of dead seeds may either seed persistency was low and/or the rainy season was not favorable for growth for some species due to poor survival (Hacker, 1989), pre-dispersal seed predation (feeding on flowers, seeds), post-dispersal seed predation (consume seeds when they

matured), trampling, un-controlled agricultural practices and it may be due to short term persistent. *Abutilon anagolensis,Echinocloa clona*, scored high densities in Gardud site viable seeds, while *Echinocloa clonum* was high at the sand site.

Table 4-6: Dominant density of viable seeds /m^2

Species	Soil seed density /m^2	
	Sand	**Gardud**
Abutilon anagolensis	4389	4990
Echinocloacolonum	2048	2661
Abutilon figrianum	1170	1996
Zaleyapentandra	1170	1330
Sesamumalatum	877	998

Source: field data

This result in table 4-7indicates that early grazing leads to soil erosion and in the area will be dominated by less preferred plants. Grazing management can improve the species composition by decreasing the pressure on the species that disappeared with heavy grazing such as *Cenchrus biflorus.* The results in table 4-7shows the main five dominant species density /m^2 of the dead seed at gardud site. In table 4-7 the high dead seeds were recorded by *Echinocloa colonua*, followed by this result agree with Ali and Ahmed, (2012) as found that species recorded high score at clay soil.

Table 4-7: Seed bank densities of dead seed /m^2

Species	Soil seed density /m^2	
	Sand	**Gardud**
Abutilon figrianum	4096	1996
Echinocloa colona	2340	2495
Abutilon anagolensis	1755	-
Zaleya pentandra	-	1996
Sesamum alatum	877	-
Ocimum basilicum	877	2328
Cenchrus biflorus	-	2994

Source: field data

Live and dead seeds species at Gardud site:

According to table 4-8 26 species were identified at Sandy site as live seeds whereas 28 species were identified from the dead seeds. The most dominant species identified as live seeds included,*Abutilonanagolensis, Echinociloaclona, Abutilonfigrianum, Zaleyapentandra,Sesamumalatum*. The most dominant species identified from dead seeds included: *Abutilon figrianum, Echinocloa colona, Abutilon anagolensis, Ocimum basilicum* due to different factors affect the viability of seed bank in the soil. Grazing and cutting intensity affect the seed bank, through effects on the seeds return.O'Connor *et al*. (1991) studied the seed bank of *Aristida bipartia* and other spp. in savanna grassland and reported that the seed bank was dominated by less preferred species in areas subjected to heavy grazing.

Table 4-8: Average live and dead seeds densities of species in the two sites at the study area

Scientific name	Habit	Sites			
		Sandy		Gardud	
		Live	Dead	Live	Dead
Zaleyapentandra	Forbs	4	2	6	6
Zorniaglochidiata	Forbs	0.0	1	0.0	0.0
Echinochloacolonum	Grass	7	8	8	75
Dactylocteniumaegyptium	Grass	1	1	3	1
Abutilon figrianum	Grass	4	14	4	0.0
Sesemum alatum	Forbs	3	1	3	1
Cenchrusbiflorus	Grass	0.0	9	0.0	9
Xanthium brasilicum	Forbs	0.0	1	0.0	1
Acanthospermum hispidum	Forbs	0.0	2	0.0	0.0
Sida cordofolia	Forbs	0.0	0.0	15	6
Ocimum basilicum	Forbs	1	3	2	7
Total		35	42	41	105
Total seeds/m^2		610	676	2076	1728

Source: field data

Table 4-8 shows viable seeds in the study area at the two sites. Gardud site recorded highest seed density for both seeds (lives and dead seeds), that is could be due to palatability of species which found in the vegetation cover in this site. Sandy site recoded lowest seed density in both live and dead seeds, that is might be due to heavy density, low vegetation cover and palatability of species in the site. Okin *etal.*,(2001) stated that heavy grazing often results in a remarkable decline of plant seed production and seed number in soil (Coffin and Lauenroth, 1989; Bertiller, 1996).Management plan should be reseeding with the dominant specie in the vegetation in the different sites. *Echinocloa clonum,Gisekia pharnaceoides*.

4.2 Socio-economic aspects of rangeland use:

4.2.1 Community characteristics:

Age groups for nomads and sedentary groups:

The result in table 4-9shows high significant differences at P< (0.000) according to age between sedentary in the study area where (56.9%) their age is within the range (20-30 year) young boys may be due to role of them look after live stock herder, Nomads groups also showed significant differences at P< (0.015) according to their age 46% of them more than 40 year, most people among the sedentary group their age above 50year,

Table 4-9: Age groups for nomads and sedentary groups

Ages groups	Nomads		Sedentary	
	Frequency	**Percentage**	**Frequency**	**Percentage**
20-30 year	16	20.2	29	56.9
31-40 year	26	32.9	14	27.5
More than 40	37	46.8	8	14.6
total	79	100	51	100
X^2	8.3		33.4	
Sig	0.015		0.000	

Source: field data

Education levels for nomads and sedentary group:

According to educational levels among the nomads in table 4-10 about 69% of them were illiterate, 15% were educated at primary and secondary, there with high significant differences at P<(0.000)(Table 4-10). Sedentary group also showed high significant differences at P< (0.000) in education levels 43% of them at primary educated, 35% at secondary level, 21% illiterate. The high illiteracy among the nomads (69%) can be attributed to the limited numbers of school in the places where they are living or the school timing contradicts with their life pattern, but illiteracy among sedentary families was not high. This may be due to staying at one place and availability of schools surrounding their villages compared with nomads. Education level will have an impact on extension activities to be adopted, as it interferes with message designing and means of communication.

Table 4-10: Education levels among nomads and sedentary groups

Education levels	Nomads		Sedentary	
	Frequency	Percentage	Nomads	Sedentary
Illiterate	55	69.6	11	21.5
Primary	12	15.2	22	43.1
Secondary	12	15.2	18	35.4
Total	79	100.0	51	100
$\chi 2$	8.33		26.3	
Prob.	0.001		0.000	

Source: field data

Grazing patterns:

According to grazing practices in the study area 39.2% of the nomads stated that they practice transhumant system, 60.8% semi transhumant. Most of the nomads in the area are moving either for a long or short distance most of them move in the different directions table 4-11 very high significant differences at P≤ (0.001).

4.2.2 Land use patterns:

Table 4-11: Grazing pattern practice by the nomads

Freq	Nomads		Sedentary	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Transhumant	31	39.2	44	86.2
Semi transhumant	48	60.8	6	11.8
Total	79	100	51	100
χ^2	3.6		67	
Prob.	0.056		0.000	

Source: field data

Duration of use:

About 73.5 % of sedentary groups use the rangeland of North Kordofan all year round for animals, while about 26.5% of them have reported that they use the range for a limited time. Table 4-12shows significant differences p≤ (0.000) for the period of using the rangeland had negatively affected rangelands plants due to heavy use of rangeland. This is in agreement with Lyons and Hanselka (2001) reported that disturbed rangeland is due to heavy animal grazing. Duration of use indicates the level of range plants consumption under existing grazing intensity, time of use may interfere with the factor of improper time of grazing or browsing. Odo*et al.* (2001) stated that grazing pressure may increase the number of less preferred plant species at the expense of the preferred species.

Table 4-12: Respondents according to duration of using rangeland.

Period /Month	Nomads		Sedentary	
	Frequency	**Percentage**	**Frequency**	**Percentage**
1-3	68	26.5	39	26.5
More 6	32	73.5	12	73.5
Total	100	100	51	100
X^2	10.6		16.2	
Sig	.001		.000	

Source: field data

4.2.3 Agricultural practices:

Agricultural practices in the area are practiced by nomads and sedentary groups, 53.8 and 46.2 % respectively. They stated that it is practiced through the year there were very high significant differences at P ≤ (0.000) table 4-13. Farming into the nomads grazing areas. Salih (2001) stated that most of the nomads do not use the traditional routes, which had been determined by government, so they search about the pure grazing areas anywhere and this lead to damage the settler's farms and finally causes the conflicts between them.

Table 4-13: Agricultural practices

Landholding	Nomads		Sedentary	
	Frequency	Percentage	Frequency	Percentage
Small	55	69.6	2	3.9
Large	24	30.4	49	96.1
Total	79	100	51	100
X^2	12.6		43	
Sig	.000		0.000	

Source: field data

* Small (less than5 Feddan),Large (more than 5fedan).

4.2.3.1 Impact of grazing at study area:

The study showed in table 4-15 Nomads and sedentary groups considered some species were disappeared from grazing areas (87% and 96%) respectively *Zorniaglochidiata,Triblustrestris*and*Aristida funculata*. Most of them are palatable for the livestock in the area. Decreasing of more palatable species could be due to intensive grazing and absence of rangelands improvement programs in the area. The invader species included *Xanthium brasilicum, Abutilon figrianum*and, *Datura stramanium.*Thisresults suggest that current grazing practiced have negative impacts on the vegetation surrounding the study area according to Sanou and Zida,.2018).

Table 4-14: Decreasing rangelands

Respondents	Nomads		Sedentary	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Disappearance	69	87.3	49	96.1
Not disappearance	10	12.7	2	3.9
Total	79	100	51	100
X^2	1		79	
Sig	.000		.000	

Source: field data

Rangelands Condition:

From the result of range condition in the study area most of the nomads and sedentary groups 51.9 and 86.3 % respectively they stated that the rangelands was deteriorated and (48.1 ,7.8) had not deteriorated there were very high significant differences at P≤ (0.000), they said that the deterioration of rangelands may be due to lack of grass, appearance of unpalatable species, conflicts.

Conflicts among pastoralists:

Conflicts are common between the nomads and sedentary groups in the study area. 85% of the nomads have conflicts compared to 15% do not have conflicts. 77% of sedentary have conflicts.

According to the reasons of conflicts as stated by the nomads that 52.2% due to narrow routes, resulting from expansion of agriculture into grazing areas, 17.7% Table 4-16 were very high significant 2differences P≤ (0.000) from these results the expansion of agriculture considered the main causes of conflicts in the area. Garcia (1981) stated that main problem of Africa in rangeland is expansion of agriculture.

Table 4-15: Conflicts and causes among nomads and settled group

Degree of conflicts	Nomads%	Sedentary%
High	60.8	39.2
Moderate	25.3	51.0
Nil	13.9	9.8
Cause of conflicts at study area		
Cause	%	
Route change	52.9	
Lack of water	19.6	
Fire	9.8	
Agricultural expansion	17.7	
X^2	28.2	21
Sig	0.000	.000

Source: field data

Livestock routes:

The study showed that the pastoralist stated that conflict between farmers led to route changed .This result confirm by Salih (2001) stated that most of the nomads do not use the traditional routes, which had been determined by government, so they search about the pure grazing areas anywhere and this lead to damage the settler's farms and finally causes the conflicts between them.

Deterioration of soil:

According to nomads in study area about 78.4 % they stated that soil deteriorated by animal due to intensive using of rangelands with very high significant differences at $P \leq (0.000)$.

Participation of pastoralist in rangelands improvement:

According to the results the majority of pastoralists 86% did not participated in range improvement activities with very high significant differences at $P \leq (0.000)$. This could be due to the reason that they are not stable one place and for this lack of extension services. There is a need for extension activities.

CHAPTER FIVE

CONCLUSIONS AND RECOMENDATION

Conclusions:

According to the study results the prevailing pattern of rangeland use has led to shrinkage in rangeland areas resulted from farming encroachment and urban expansion.

-Shrinkage of rangeland Altered main features of rangeland use including

Routes demarcation (length and Width). In addition to time of entrance and exit to and from rainy season and dry season domains will need to reserved.

- Longer period of use at specific site especially rainy season has led to decrease in organic matter, soil seed bank and vegetation composition along time.
- Low organic matter and poor seed bank express intensive use of rangeland and low decomposed plant biomass. This is also reflected in the low trees density.
- Sandy rangeland sites are more affected as it is usually used early in the season compared with Gardud range site.

Recommendation:

Based on the study results it is clear that integrated measures are needed to address impacts of herding practice. The focus should be on addressing the causes behind change in pattern and not only symptoms but the factor behind reasons such as corridors, rainy season and dry season suitability and special adequacy through addressing causes of impact as following:

- Proper setting of livestock routes and summer domains.
- Promote the full participation of pastoral communities in rangeland management conservation planning and activities.

Restoring of deteriorated area through:

- Reseeding to re-vegetate the depleted areas and for improving the vegetation composition of the potential sites and hence range health.
- Raising the local awareness about the negative impact of the un-controlled agricultural practices and the illicit cutting.

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appendix (1)

Recording sheet (Loop reading Form)

Sudan University of Science &Technology

College of Graduate Studies

College of Forestry &Range Sciences, Range Science Department

Transect Number ( ) Quadrate No (Location)……Date.....

Collector's Name……

1	L									
2		Bs								
3				Bs						
4										
5			L							P
6						R				
7		P								Bs
8										
9					P			Bs		
10										L

Where: L =litters, R = Rocks, P = Plant (recorded name of plant) and Bs = Bare soil (source, surveyor, 2017)

Appendix NO (2)

Species of soil seed banks

Botanical name	**Site**			
	Sand		**Gardud**	
	Dead	**Viable**	**Dead**	**Viable**

Appendix (3)

Biomass production Form

Sudan University of Science &Technology

College of Graduate Studies

College of Forestry &Range Sciences, Range Science Department

Location (Site)…….Date..... ……Collector's Name…….

Transect NO	Quadrate NO										Total biomass production	
	1	2	3	4	5	6	7	8	9	10	Gram/m^2	Ton/ha
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

Appendix (4)

SEED BANK ON SAND SOIL/Sample

M^2	عدد مرات الظهور ميتة	M^2	عدد مرات الظهور الحية	الاسم العلمي	اسم النبات
4096	14	1170	4	*1-Abutilon spp*	النيادة
1755	6	4389	15	*2-Abutilon angulatum*	مكشاشة
877	3	292	1	3-	ريحان
292	1	00	0	*4-Zornia glochidiata*	شيليني
877	3	877	3	*5-Sesamum alatum*	سمسم الجمال
585	2	1170	4	*6-Zaleya pentandra*	الربعة
2340	8	2048	7	*7-Echinochloa colona*	الدفرة
292	1	00	0	8-xanthium bracilicum	رامتوك
585	2	00	0	9-Acanthospermum hispidium	حراب هوسا
292	1	00	0	*10-Cenchrus biflorus*	حسكنيت ناعم
292	1	292	1	*11-Dactyloctenium aegyptium*	ابواصابع
	42		**35**	**11 species**	**المجموع**

Appendix (5)

SEED BANK ON Gardud SOIL/Sample

M^2	عدد مرات الظور ميتة	M^2	عدد مرات الظهور الحية	latin name	Common name
00	0	1330	4	*Abutilon 11-figrianum*	النيادة
1996	6	4990	15	*2-Abutilon anagolensis*	مكشاشة
2328	7	665	2	3-	ريحان
00	0	00	0	*4-Zornia glochidiata*	شيليني
332	1	998	3	5-	سمسم الجمال
1996	6	1996	6	*6-Zaleya pentandra*	الربعة
24951	75	2661	8	*7-Echinocloa colonum*	الدفرة
332	1	00	0	8-	رامتوك
00	0	00	0	9-Acanspermum hespedum	حراب هوسا
2994	9	00	0	10-	حسكنيت ناعم
00	0	998	3	*11-Dactyloctenium aegyptium*	ابواصابع
	105		**41**	**11 species**	**المجموع**

Appendix (6)

Values of Chi squire Nomads and Sedentary group

Group	Nomads		Sedentary	
Parameter	**Chi squire**	**Sig**	**Chi squire**	**Sig**
Age groups for nomads and sedentary groups	8.3	0.015		
Education levels among nomads and sedentary groups	8.3	0.001	26.3	0.000
Grazing pattern practice by the nomads	3.6	0.056	67	0.000
Duration of use	19.8	0.000		
Respondents according to duration of using rangeland.	10.6	0.001	16.2	0.000
Agricultural practices	12.6	0.000	43	0.000
Decreasing rangelands	79	0.000	1	0.000
Rangelands Condition	33.3	0.000	1	0.000
Conflict among pastoralist	28.2	0.000	2	0.000
Deterioration of soil	16.4	0.000	1	0.000
Participation of pastoralist inrangelands improvement	41.3	0.000	1	0.000

Appendix (7)

جامعة السودان للعلوم والتكنولوجيا

كلية الدراسات العليا

استبيان حول أنماط استخدام المرعي وتأثيره علي إدارة المرعى

Impact of Rangelands Uses patterns on Range health and Sustainable Management in North Kordofan State

المجموعات المترحلة

المعلومات العامة

ذكر ( ) أنثى ( )

العمر: 1- أقل من 20 . 2- من 20-40 . 3- من 40-60 . 4- أكثر من 60 سنة

مستوى التعليم : 1- أمي 2- خلوة 3- ابتدائي 4- متوسط 5- ثانوي 6- جامعي

المصدر الرئيسي للدخل : 1- تربية حيوان 2- زراعة 3- تجارة 4- مرتب 5- أخري

المصدر الثانوي للدخل : 1- تربية حيوان 2- زراعة 3- تجارة 4- مرتب 5- أخري

نمط الاستخدام

نوع الحيوان المتواجد ؟ ابل ( ) اغنام ( )ابقار ( )

هل أنت : 1- مستقر 2- شبة مستقر 3- مترحل

طرق استخدام المرعي :

1- استخدام طول العام 2- استخدام لفترة محددة (حدد الفترة)..... 3/ إذا كانت الإجابة باستخدام المرعي لفترة محددة لماذا هذه الفترة؟

.....

ماهي فترة الخروج من المرعى ؟

مبكرا ( ) متأخرا ( )

هل تفضل ان تبقى مستقرا ؟ 1- نعم ( ) 2- لا ( )

هل تترحلون بالحيوانات إلى مناطق أخري؟ 1- نعم ( ) 2- لا ( )

إذا كانت الإجابة بنعم هل سبب الترحال؟ 1- قلة الماء 2- قلة المرعى 3- تفادى الأمراض 4- أخري

هل تترحلون بكامل الأسرة ؟

نعم ( ) لا ( )

هل تترحلون بجزء من القطيع ؟

نعم ( ) لا ( )

هل توجدا شجار ترعي لمدة طويلة ؟ نعم ( ) لا ( )

هل للرعي الشديد اثر علي التربة ؟ ( )نعم لا ( )

هل للمرأة دور في إدارة الحيوان والعملية الإنتاجية : 1- نعم ( ) 2- لا ( )

إذا كانت الإجابة بنعم ما هو الدور؟.....

من وجهة نظرك ايهما أفضل من ناحية الصحة والإنتاج :

1- الحيوانات التي ترعى حول القرية 2- الحيوانات التي ترعى لمسافات بعيدة من القرية

هل ترعى كل أنواع الحيوانات :

1- في منطقة واحدة من المرعى 2- تقسم الحيوانات بأنواعها في المرعى على حسب النباتات الموجودة.

هل توجد نباتات (مخلفات محاصيل ، مراعي طبيعية ، محاصيل زراعية) تحفظ في الصيف كعلف للحيوانات ؟ 1- نعم ( ) 2- لا ( )

إذا كانت الإجابة بنعم ما هي تلك النباتات؟

.....

1/ استخدام المرعي:

2/ ما هي الاشجار الجيدة والأكثر استساغة للحيوان؟

.....

3/ ما هي الاشجار غير الجيدة وغير مستساغة للحيوان؟

هل تعتقد ان هذا المرعي كثيف ويكفي للحيوان ؟ نعم ( ) لا ( )

.....

4/ ما هي النباتات الموجودة سابقا وغير موجودة حاليا؟

.....

5/ هل توجد نباتات ضارة بالمرعى؟ 1- نعم ( ) 2- لا ( )

6/ إذا كانت الإجابة بنعم ماهى ؟.....

هل تعتبر هذه النباتات معوق لاستخدام المرعي ؟ نعم ( ) لا ( )

7/ ما هي الشجيرات الجيدة والأكثر استساغة للحيوان؟

.....

8/ ما هي الشجيرات غير الجيدة وغير المستساغة للحيوان؟

.....

9/ ما هي الشجيرات الموجودة سابقا وغير موجودة حاليا؟

.....

10/ هل توجد شجيرات سامة بالمرعى؟ 1- نعم ( ) 2- لا ( )

11/ إذا كانت الإجابة بنعم ماهى ؟.....

12/ايهما أفضل : 1- المرعي سابقا 2- المرعي الحالي

13/ ولماذا.....

14/ هل الرعي في المرعي المفتوح يكفي لتغذية الحيوانات؟ 1- نعم ( ) 2- لا ( )

15/ إذا كانت الإجابة بلا هل السبب:

1- قلة المرعي 2- كثرة الحيوانات 3- الزراعة 4- أخري.....

16/ هل تعطى الحيوانات التي ترعى على المرعى المفتوح غذاء اضافى ؟ 1- نعم ( ) 2- لا ( )

17/ إذا كانت الإجابة بنعم ماذا تضيف وما هي الكمية.....

18/هل تعتقد ان كمية المياة داخل المرعي كافية ؟ نعم ( ) لا ( )

19/هل تمارس الزراعة ؟ 1- نعم ( ) 2- لا ( )

المساحة ( ) 5-10 ( ) 10-20 ( ) اكثر

20/ماهي المحاصيل المزروعة ؟

سمسم ( ) فول ( ) ذرة ( )اكثر من محصول ( )

21/من هم الاشخاص المشاركين في الزراعة ؟ اعضاء الاسرة ( ) المربين اخرى ( )

22/هل لديكم مشكلة حشائش ؟ نعم ( ) لا ( )

23/ماهي الانواع التي تعتبر حشائش ----------

درجة استغلال المرعي ؟ماهي

غير مستغل ( ) ( )مستغل

24/هل تفضل ان تبقي الحيوانات داخل الغابة ؟ نعم ( ) لا ( )

25/هل المرعي متوفر طول العام ؟ نعم ( ) لا ( )

26/ماهي افضل فترة رعي في العام ؟ فى بداية الموسم ( ) وسط الموسم ( ) أخر الموسم ( )

27/ماهي مدة البقاء داخل المرعي ؟ ----------

28/ماهو الزمن الوقت المناسب للخروج من الغابات الي المراعي الطبيعية ؟----------

29/هل توجد مزارع رعوية لسد النقص في الأعلاف؟ نعم ( ) لا ( )

30/هل مصادر المياه كافية داخل المراعى ؟ نعم ( ) لا ( )

31/ماهي أسباب الحرائق في المراعي ؟

32/ماهي معوقات استغلال المراعي ؟ قلة المياه ( ) النيران ( ) صعوبة الحركة ( )

33/الصراعات الموجودة بين المزارعين ؟

موجودة ( ) غير موجودة ( )

34/ماهي اسباب الصراع ؟----------

35/دور الادارة المحلية في صيانة المراعي وفض النزاعات ؟

دور ايجابي ( ) سلبي ( )

36/هل لادارة المراعي أي دور في حماية المراعي ؟نعم ( ) لا ( )

37/اذا كانت الإجابة نعم ماهو الدور؟ حماية المراعي ( ) الارشاد الزراعي ( ) تنمية المراعي ( )

38/هل شاركت في تطوير المراعي ؟ نعم ( ) لا ( )

39/هل لديكم انشطة اخري بجانب الرعي في فترات الرعي ؟ نعم ( ) لا ( )

40/هل المزارعون والرعاة يشاركون في أعمار المراعي ؟ نعم ( ) لا ( )

Appendix (8)

جامعة السودان للعلوم والتكنولوجيا

كليه الدراسات العليا

الاستبيان الخاص بالرعاة المستقرين

الرعاة المستقرين :

-1العمر: 20-30 30-40 اكثر من 40

-2المستوى التعليمي: امي ( ) خلوة ( ) اساس ( ) ثانوي ( )

المصدر الرئيسي للدخل : 1- تربية حيوان 2- زراعة 3- تجارة 4- مرتب 5- أخري

المصدر الثانوي للدخل : 1- تربية حيوان 2- زراعة 3- تجارة 4- مرتب 5- أخري

3حالة الاستقرار: لفترة طويلة ( ) لفترة قصيرة ( )

مكان رعى الحيوانات ؟

هل تتحرك بالحيوانات بعيدا عن القرية ؟

نعم ( ) لا ( )

المسافة التي تتحرك فيها ؟

كيلو ( ) أكثر من كيلو ( ) ميل ( )

هل التحرك بالحيوان وحده أم بالأسرة بأكملها ؟

	حول المسافة القريبة من القرية	مسافات بعيدة من القرية	الاثنين معا
الخريف			
الصيف			
الشتاء			

استخدام المرعى

نوع الاستخدام ؟

رعي ( ) زراعة ( ) جمع منتجات غير خشبية ( ) السياحة ( ) الصيد ( )

1/نوع الحيوان المتواجد ؟ ابل ( ) اغنام ( )ابقار ( )

2/ ما هي الاشجار الجيدة والأكثر استساغة للحيوان؟

.....

3/هل تعتقد ان هذا المرعي كثيف ويكفي للحيوان ؟ نعم ( ) لا ( )

.....

4/ ما هي النباتات الموجودة سابقا وغير موجودة حاليا؟

.....

5/ هل توجد نباتات ضارة بالمرعى؟ 1- نعم ( ) 2- لا ( )

6/ إذا كانت الإجابة بنعم ماهى ؟.....

هل تعتبرهذه النباتات معوق لاستخدام المرعي ؟ نعم ( ) لا ( )

7/ ما هي الشجيرات غير الجيدة وغير المستساغة للحيوان؟

.....

8/ ما هي الشجيرات الموجودة سابقا وغير موجودة حاليا؟

.....

9/ هل توجد شجيرات سامة بالمرعى؟ 1- نعم ( ) 2- لا ( )

10/ إذا كانت الإجابة بنعم ماهى ؟.....

11/ايهما أفضل : 1- المرعي سابقا 2- المرعي الحالي

12/هل تمارس الزراعة إثناء الرعي: نعم ( ) لا( )

13/اذا كانت الاجابة بنعم المساحة صغيرة ( ) كبيرة ( )

14/هل تفضل الزراعة بجانب الرعي نعم ( ) لا ( )

15/فترة الاستقرار بالحيوان ؟شهر – ثلاثة( ) أكثر من 6 شهر ( )

16/هل يوجد ارشاد رعوية بالمنطقة ؟ نعم ( ) لا ( )

17/هل توجد قوانين خاصة تنظم استغلال المرعى ؟ نعم ( ) لا ( )

18/الصراعات الناجمة عن الزراعة والرعي مستمرة( ) خفيفة( ) لاتزكر ( )

19/حالة منطقة الرعي ؟ جيدة ( ) غير جيدة ( )

20/هل يوجد اختفاء لبعض النباتات من المرعى ؟ نعم ( ) لا ( )

20/هل توجد محميات رعوية ؟ نعم ( ) لا ( )

21/امكانية الوصول الي مصادر المياة ؟ سهلة ( ) صعبة ( )

22/نوع مصادر المياه ؟ دوانكي ( ) حفاير( )

23/ هل يوجد استزراع للمناطق الرعوية ؟ نعم ( ) لا ( )

24/ما طبيعة هي الاستزراع؟ شعبي ( ) حكومي ( )

25/ماهو اثر التدخلات ؟ اقتصادية وليس اجتماعية ( ) اقتصادية واجتماعية ( )

26/اعداد الحيوانات في منطقة الرعي ؟ زيادة ( ) نقصان ( )

27/هل تري ضرورة تدخل السلطات لمنع الصراعات داخل المراعي ؟ نعم ( )لا ( )

28/ماهي التحديات التي تواجة الاستغلال الامثل المرعى ؟ ----------

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