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Implication of climate change on rangeland resources from a perspective pastoral community in the Sinnar State- sudan

(Case study Abu Hujar locality)

إنعكاسات التغير المناخي على موارد المراعي من منظور المجتمع الرعوي

(دراسة حالة محلية أبو حجار – ولاية سنار)

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Abstract

Implications of climatic change on rangeland resources from a perspective pastoral community in the Sinnar State-Sudan

The study was conducted in sinner state at Abu Hujar locality ,with aimed to know the effects climate changes on the natural range land in three villages at study area .The study used Synthesis methods approach on rangeland resource-based on land uses and pastoralism interactions. The perception of pastoralists in this study was investigated through the collection of data from the pastoralists, using a questionnaire. The results showed that the pastoralist perceptions of a decrease in animal production could be influenced by their perceptions of the changes in the condition of their rangeland resources. Due to climate change and land use pressure, resulting in degradation and biodiversity loss in rangeland vegetation, some pastoralist move to grazing in forests areas. It was concluded that most herders (around 90%) indicated livestock effected by deterioration of rangeland vegetation. Also 86.7% of the respondents confirmed that climatic changes affected the disappearance of some plant species.This study recommended that the development of natural range land and awareness of pastoral communities about the effects of climate changes on rangeland resources.

المستخلص

انعكاسات التغير المناخي على موارد المراعي من منظورالمجتمع الرعوي

أجريت الدراسة الحالية بمحلية ابوحجار بولاية سنار التي تقع في الجزء الجنوبي الشرقي من البلاد بين خطي عرض 12:5و14:7وخطي طول 32:58شمالاً و35:42شرقاً في وسط الحزام الطيني وهدفت هذة الدراسة لمعرفت **انعكاسات التغير المناخي على موارد المراعي من منظورالمجتمع** الرعوي في منطقة الدرسة لقد تم جمع المعلومات من ثلاثة قرى من مجموع قرى المحلية لمنطقة الدراسة ولقد وجد أن هنالك أثر كبير لتغيرات المناخ على المراعي الطبيعية كما وجد ايضاً اثر على الحيوانات بالمنطقة من حيث تغيير زمن الرعي واختفاء بعض الانواع النباتية وارتفاع درجات الحرارة أيضاً خلال التحليل الاحصائي بواسطة برنامج (SPP) أظهرت النتائج أن هنالك تغيرات للمناخ بالمنطقة خاصةًعلى النباتات والحيوانات أوصت الدراسة بإجراء المزيد من الدراسات في مجال التغيرات المناخ في منطقة الدراسة والمناطق المشابة ،كما أوصت بتنمية وتطوير المراعي الطبيعية وتوعية المجتمعات الرعوية بأثر التغيرات المناخية على الحيوانات والنباتات .

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Chapter One

Introduction

1.1.General:

Sudan is an agricultural country rich in agricultural natural resources, livestock and minerals Sudan is located in the north-eastern part of the continent of Africa and its area is about 448 million feddans of which 170 million feddans are suitable for agriculture, 144 million feddans are natural rang land and 52 million feddans for forests about 3-4 million feddans are cultivated with Meroe. 35-37 million feddans are irrigated from the rich savannah in the south to the desert in the north, forests and natural rang land are considered important resources in addition to the abundant water resources of rain, multiple rivers and underground water reserves. The population is estimated at 42 million people and is divided into 18 states agriculture and the challenges of globalization public Natural pastures are of economic importance in the development of livestock, as they are a less expensive source of fodder than other food sources due to the vast areas they occupy in the world, where information indicates that their area is not less than 40% of the total area of the globe, and there are weeds, herbs and shrubs of various kinds **(Ahmed Suliman Saeed -2013).**

The importance of natural rang land in its contribution to providing fodder materials, as it is considered the main place for raising pastoral herds such as camels, goats, cows, and sheep, as well as its production of many medicinal and aromatic plants, in addition to its role in securing the livelihood of many residents Pastures in developing countries provide multiple services of great economic, social, cultural and biological value locally, nationally and globally Pastures are defined as areas where native plants are often grasses or plants that look like weeds, in addition to some woody plants that animals can eat on **(Bolle .h.l.1995)**

There are a variety of sub-categories under the pastures including steppes, meadows, grasslands, desert lands, shrubs, woodlands, savannahs, forests, tundra and others Natural pastures are distinguished from other grassland lands by the fact that they preserve the original vegetation cover and not what humans have created. In terms of land use, rangelands make up the largest area in the world. **(Marty, 2015).**

This natural resource is primarily used in the production of livestock on a large scale mostly through nomadic system. Grazing can be used as a way to manage pastures, but the persistence

of intense grazing causes a gradual deterioration in the resources of the soil and vegetation cover and this deterioration proceeds without noticing the shepherds because it is usual that the production of the pasture is not measured and in the end the pastoralists are forced to migrate their pastoral activity unless they receive compensation from another source of income climate change on small-scale farmers to ensure they can transition out of poverty and hunger, there are also broader implications for the food security of those living in the region With around 40 percent of the region's overall food supply coming from imports, this region is highly dependent on international markets and is susceptible to the price fluctuations that are likely to arise as agricultural production globally becomes less predictable Of the remaining food supply requirements, 80 percent of this comes from small-scale farmers. Therefore, it will be essential to ensure that they have conducive conditions for crop and livestock production if the food security of the region is to be ensured in the context of these interconnected challenges **(Marty, 2015).**

1.2. Problem justifcan:

The sinner state is considered one of the states in which pastoral societies are characterized by owing large and different numbers of animal revolution which dependmainly on natural rangeland despite this we find that these pastures suffer from many problems related to the deterioration of vegetation cover the disappearance of some plant species and the low services necessary for humans and animals in addition on the extent to which these pastures contribute to improving the standard of living of these communities the important of this study lies in the fact that it deals with the impact of climatic changes on the natural pastures in the state of sinner abuhujjar locality and knowledge the extent of its impact on livestock and pastoral communities the pastoral communities in the study area are also of great importance by relying on raising and caring for livestock independently of natural rang land.

Therefore the importance of the research appears by studying the impact of climate changes on natural range land and seeking to propose solutions and develop strategies for the development of natural rang land and the development of pastoral communities in the study area.

1.3.Objectives:-

1.3.1.General objective:-

To implication of climate change on rangeland resurcrces from a perspective pastoral community in the Sinnar State- sudan

1.3.2. Specific objectives

- To investigate relation to pastoralist's on rangeland condition and vegetation changes
- To understand effect of climate change of pastoralists on vegetation cover

Chapter Two

Literature Review

2.1. Introduction:

Climate changes can affect, directly and indirectly livestock production the effects include Changes in temperature throughout the year that are caused by climate change lead to Exposure of animal wealth to many dangers of diseases, reduced fertility, and a lack of milk production it means heavy material losses to which the livestock sector is exposed drought leads to a decrease in rangeland areas and the amount of fodder available for livestock and grazing Consequently, the rise in temperatures and the low levels of rainfall pose a danger to Livestock, especially animals that depend for their food on grains**(World Bank, 2009).**

Climate changes can lead to an increase in diseases and parasites that affect animals, because Warm winters and early spring may create a suitable environment for parasites and pathogens to live for animals, especially in areas with high levels of precipitation the use of parasitic pesticides and animal medicines may lead to combating animal diseases, To expose food chains to the risk of contamination by these pesticides and the emergence of new generations of pathogens Drug-resistant drug and therapeutics, and the implications for safety and distribution Consumption of livestock**(World Bank, 2009).**

The high level of carbon dioxide in the atmosphere increases the productivity of the range lands It reduces its quality, and this decreases the quality of the fodder obtained by the livestock and thus the need for Livestock to eat more amounts of food to get the appropriate nutritional value climate change also affect economic growth in the livestock sector they cause poverty if the livestock of an area is damaged by disasters, the stocking rates of an area decrease, and the market price of certain types of livestock increases because of lower availability Livestock systems have both positive and negative effects on the natural resource base, public health, social equity, and economic growth they make up 33% of the agricultural gross domestic product, and this share is increasing rapidly**(World Bank, 2009).**

This growth is driven by the rapidly increasing demand for livestock products, while the demand is driven by population growth, urbanization, and increasing incomes in developing countries Climate change will have severely deleterious impacts in many tropical and subtropical zones, even with small increases in average temperatures. This is in contrast to many parts of the temperate zone where agricultural

productivity is likely to increase slightly at mid- to high latitudes, with local mean temperature increases of 1°C–3°C **(World Bank, 2009).**

2.2. The Important of Natural Rangeland:

The area of natural rangeland in Sudan is estimated at about 215 milion fedans natural rangeland provide the main food for livestock and the wild as well it works to preserve the soil from erosion and desertification by providing vegetation cover in areas whose soil is considered marginal light and sandy and the diversity of plants in it improvers soil properties of alawzon of leguminous plants especially aksha trees and others in addition to the organic matter provided by the leaves branches and other plant residues remaining in the soil **(said Mohammad Suleiman) .**

2.3. Rangelands in Sudan:

The rangelands of Sudan contribute to the income and subsistence of a large sector of the population and in addition provide more than 80% of the total feed requirements of the national herd Rangelands also host wildlife and play a vital role in soil and watershed protection, biological diversity, ecological balance and environmental conservation in spite of its importance most quantitative data relating to rangeland productivity in Sudan are based on experts' estimations and rarely based on large-scale surveys Pasture, water and forestry are the most crucial natural resources for pastoralism – which is often defined as a form of land-use system that depends mainly on livestock raising using these interdependent natural resources the sustainability of pastoralism and pastoral production system, therefore, hinges upon the way these resources are managed, used and interact with other components of the rangeland system.

In Sudan, pastoralism is considered a livelihood rather than simply a system of production herding practices dictate customs, habits, relations and patterns of daily living Pastoralism requires access to significant land and must co-exist with other land use systems like smallholder farms and mechanized farming in South Sudan there is less competition with agriculture but instead pastoralism competes with wildlife in certain areas the simultaneous and/or sequential use of land, pasture and water makes the issue of rational use and balanced access to these resources by different users a critical challenge for sustainable natural resources management."

The co-existence and interaction with other land-use systems is considered part of the balance of resource management. For example, grazing animals on crop residue benefits the farmers by

providing manure directly to the fields, removal of crop residues, and balancing herbaceous plant composition through rational grazing. But there are also negative results especially when utilization levels are not balanced or not rational these may include deterioration of resources through over-exploitation or conflicts over sole use that may lead to violence.

For example, herds that enter fields to graze before the crops have been harvested, the exclusion of animals from harvested fields or the cultivation of areas designated as pasture. The simultaneous and/or sequential use of land, pasture and water makes the issue of rational use and balanced access to these resources by different users a critical challenge for sustainable natural resources management. **(HCENR, 2003)**

2.4.Effects of Climate Changes on the World level:

Developing countries are considered more affected by climate changes due to population density weak infrastructure weak insurance policies food shortages and health problems in addition to the dependence of most developing countries on bio energy **(biomas firewood coal).**

2.4.1The Effects of Climate Changes can be Summarized in the Following Points.

-Sea level rise is expected by 15 to 90cm causing floods.

-Global warming by 3.5 to 5 degrees Celsius by the year 2050ad.

-Agricultural production decline the global economy will be seriously affected in the coming years as productivity declines in developing **(biomas firewood coal).**

2.5.Effects of climate changes on the Sudan :

The study carried out by the united nations intergovernmental panel on climate change in 2007 indicated that Sudan's contribution to the global total of greenhouse gas emissions is less than 0.1%deforestation and land use contribute to more than 70%of the total emissions the petroleum sector represents the third source of greenhouse gases with a percentage of 28%and 2%of the activities of other sectors**(SUDAN POPULATION(2020) WORLDOMETER).**

2.6. Rangeland in Sinner state:

It is the main activity of the majority of the state's population as states geographical location helped it to establish many distinguished economic project such as the al Sukiproject and the blue Nile projects which are called irrigated projects also projects were established that depend

on rainwater for irrigation in the areas of aldali and almazmoum and they are called mechanized agriculture projects**(FAO, 2016).**.

The most important crops of Sennar state are mango bananas sun flowers corn soybeans sugar cane and sesame which are pastures after harvesting due to the states enjoyment of vast areas of green pastures it was natural for the livestock trade and care to flourish as the total livestock wealth in the state reached nearly five million heads also there is EL-Dinder natural reserve on the border between Sudan and Ethiopia with an area of more than 10.000square kilometers the reserve contains many wild animals and is used as natural pastures**(FAO, 2016).**

2.7.Rangeland Resources and CLimate Change:

The climate of the Sudan is predominantly tropical and continental The climatic zones range from the arid and semi-arid in the north to the wet monsoon in the extreme south the rainfall ranges from less than 50 mm per year in the north to more than 1200 mm per year in the southern parts of the country rainfall is erratic and the annual variations are very high the mean minimum temperature range between 18oC to 21oC in winter while the mean maximum temperature ranges between 42oC to 44oC in summer **(FAO, 2016).**

The Red Sea area and its highlands are dominated by Mediterranean climate the potential evaporations aspiration is higher than the actual precipitation in most parts of the country.

The country being part of the Sudano-Sahelianregion, has been subjected to recurrent droughts especially during the 1970s and the natural vegetation of the country is a result of the active interaction of climatic, topographic, edaphic and economic factors. It increases in richness from north to south, ranging from desert and semi-desert drought resisting, scanty type of vegetation through woodland savanna in the low and high rainfall areas to high savanna/semi-equatorial forests the mountain types of vegetation are confined to limited isolated sites harrison and Jackson have distinguished the following three main ecological zones**(FAO, 2016).**

2.8.The effects of climate change on vegetation cover:

forest degradation and conversion into other land use is reducing the cover also, there is adepletion in soil moisture that reduces the productivity of major forest species, increases the fire risk, and changes pest and disease patterns. The impacts are more pronounced in the Near East where declining summer rains will lead to severe water shortages that affect for estgrowth **(FAO, 2016).**

While the largest surface areas covered by forests are in Iran and Sudan, the vulnerable forester sources are not confined solely to these areas. The conifer and mixed relic forests in highmountain ranges, such as Iran, Lebanon, and Syria as well as the southern part of the Arabian Peninsula are highly vulnerable. Already-threatened relic forests, trees and shrub species arealso due to be affected. Finally, wetland forests such as the freshwater forest ecosystems in North Africa and the region's coastal forests such as forests in coastal dune systems along theMediterranean coast and the mangrove forests on the Red Sea and southern Iranian coastlineare also vulnerable climate change influences productivity and production in agricultural sectors in a manner that will result primarily in negative socio-economic impacts. One of the main factors limiting agricultural productivity in the region will be the long-term desiccation and drought that is associated with climate variability and the consequent extreme events**(Tolba, M., Najib, 2009).**

Overall, there will be alterations in the agro-climatic conditions. There will be temperature increases during the growing season, increases in the days above threshold temperatures and during key plantdevelopment times, increases in the length of dry seasons in already arid regions, unpredictable rainfall patterns, and salt-water infiltration due to sea-level rise. **(Tolba, M., Najib, 2009).**

All factors considered, climate change will limit agricultural productivity in a region that already maintains a low agricultural productivity level effect of the 2030, 2070 mid, and 2070 high future climates scenarios on predicted pasture production compared with the baseline climate are shown for all sites the Mutdapilly and Barraba sites, the predicted mean annual Dry Matter production increased progressively with each future climate scenario, with atendency for lower simulated spring–early summer growth, but higher pasture growth rates in the other seasons at Mutdapilly, annual average predicted production increased by 3, 10, and 18% over the historical baseline (15.4 t DM/ha)for the 2030, 2070 mid, and 2070 high climate scenarios, respectively at Barraba the predicted production increases were 16, 41, and 52%, respectively, for the same scenarios over the historical baseline in the mixed C3/C4pasture at Barraba, there was also a marked change in the seasonal growth pattern of each species, with a contracted C3species growing season offset by an increased growing season length and a higher summer growth rate for C4 species There was little effect of the future climate scenarios on annual surface runoff at Mutdapilly, where mean runoff was 66–70mmfor all climate scenarios, and a small increase

from 69mm in the baseline to 90mm in the 2070 high scenario at Barraba**(Tolba, M., Najib, 2009).**

2.9.The effects of climate change on pastoralist's livelihood:

The impacts of projected climate change on livestock systems have been covered in recent reviews the impacts on grazing systems include changes in herbage growth (brought about by changes in atmospheric CO2concentrations and rainfall and temperature regimes) and changes in the composition of pastures and in herbage quality**(Van 2012).**

In higher latitudes, future increases in precipitation may not compensate for the declines in forage quality that accompany projected temperature increases, and cattle will experience greater nutritional stress in the future production and productivity, we can be sure that they will have a knock-on effect on incomes and food security in rangelands across the globe. In lower latitudes, in particular, livestock are a critically important risk management asset for hundreds of millions of people, and the impacts of increasing climate variability on downside risk and on the stability of livestock production and human well-being from year to year may be substantia**(Van 2012).**

Some information exists as to how and where the vulnerability of livestock keepers in the rangelands may change in the coming decades; for example, areas that are food insecure and vulnerable to the impacts of future climate change have been identified across the tropics and subtropics (13), and areas of high exposure to climate change were identified using downscaled climate data from the Intergovernmental Panel on Climate Change's Fourth Assessment Some of this Pastoralists, whose herd sizes fluctuate largely in correlation with precipitation patterns, are outside the projected areas that will suffer the most severe precipitation declines**(Van 2012).**.

Most lands experience a precipitation decrease of up to -1.9 mm/month and in some areas there are increases in RCP 8.5. Inland temperature rises in the pastoral lands are projected to be higher) than those experienced on the coast which will have implications for herd health and size Despite this, the livestock breeds that are traditionally kept in these systems are generally well adapted to harsh conditions. However, the traditional management and mobile grazing strategies that enable pastoralists to adapt to fluctuating grazing resources are impeded because of increasingly restricted access to natural resources, the expansion of croplands, population pressure and existing land tenure policies. Pastoralists will be pushed even further to their limits when having to deal with the increased frequency and intensity of heat wavesand droughts.

Therefore, external support is needed to anticipate and build the resilience of pastoralists to adapt to the wide range of shocks **(Van 2012).**

In general, the major climate factors that will affect crop yield stability, pasture productivity and feed quality – and therefore also food and livelihood security for these farmers – areinter-annual and inter-seasonal rainfall variability and temperature extremes. Decreased water supply for irrigation, sea level rise impacts in coastal areas, increased frequency of tropical storms, and rangeland degradation are other climate change induced factors that will impact food availability and therefore food and livelihood security of these farmers small-scale farmers are amongst the most vulnerable groups to the impacts of climate change, because they are dependent on agriculture, which is one of the sectors most directly impacted by climate change. These farmers are also characteristically poor and disconnected from the social protection systems that would increase their resilience to climate change the yields of specific food and cash crops and the productivity of livestock and fisheries used by small-scale farmers will be directly impacted by temperature, CO2 and precipitation changes associated with climate change**(FAO 2017).**

While these general trends exist, it is important to understand the more specific ways in which the various farming systems that cover areas and countries will be affected. Accordingly, all the major farming systems in the region are examined using the CIFS approach that takes data on temperature and precipitation changes and overlays it on data of the major farming Whilethese general trends exist, it is important to understand the more specific ways in which the various farming systems that cover areas and countries will be affected. Accordingly, all the major farming systems in the region are examined using the CIFS approach that takes data on temperature and precipitation changes and overlays it on data of the major farming systems in the region The CIFS maps cover changes in temperature and**(FAO 2017).**

2.10. The Effects of Climate Change on Livestock Production:

Farming is a source of livelihood for one-third of the world's population, and about 60% own livestock. Nearly 800 million livestock owners live on less than $2 a day Food and Agriculture Organization of the United Nations Livestock is a rapidly growing subsector, with 40% of the global agricultural gross domestic product, and it is key to food security in all regions. Meat and milk consumption have increased significantly and are projected to rise in gross terms by 70%–80% over current levels by 2050**(Thornton, 2010).**

Demand for livestock production has increased because of the rise in the world's population. However, climate change affects livestock systems in several ways it impacts livestock production and causes biological changes in livestock, such as fertilization and breeding Extreme weather events cause livestock productivity losses and deaths some animals can survive in hot conditions, but it will limit livestock production. It is generally accepted that an increase in temperature has negative effects on livestock feed intake, reproduction, and performance (Porter et al., 2014). More research is needed on the impacts of climate change on livestock since most of the work to date has focused on crops. The impacts on livestock systems will be measured through reduced feed quantity and quality, changes in pest and disease prevalence, and direct impairment of production caused by physiological stress. Growth and meat, egg, and milk yield and quality decrease as temperatures exceed 30°C because of reduced feed intake **(Thornton, 2010).**

Directs impacts of climate change on livestock production include heat stress, humidity, wind, drought, frost, and floods – leading to a decrease in milk production, meat production, reproduction, animal health, and behavioral performance. Indirect impacts include non-Pastoralists are amongst the most vulnerable groups to the impact of climate change in the region, largely due to their limited adaptive capacity the only notable exception to this exposure may be pastoralists living in mid-latitudes where higher temperatures could lead to richer pastures and increased livestock production (FAO, 2016a). Oman, Libya, Mauritania, Sudan, Qatar and Yemen are in particularly precarious positions, with 70 to 80 percent of livestock population vulnerable to the impacts of climate change. Nevertheless, 30 to 50 percent of livestock populations in other countries in the region are also vulnerable the impacts of climate change on livestock focus on animal productivity, animal health and biodiversity, the quality and amount of feed supply, and the carrying capacity of pastures **(Van and Tibbo, 2012).**

Overall, animal production may decrease indeed; a reduction of 25 percent in animal production is estimated to result solely from reduced feeds and increased heat stress **(World Bank, 2009).**

Higher temperatures could also reduce dairy milk yield in relation to feed in addition to production, productivity of livestock, such as reproductive functions and/ or milk production, may be negatively affected by heat in summer via decreased conception rates, uterus infection, or reduced intake of feed**(World Bank, 2009).**

Climate changes can affect, directly and indirectly, livestock production the effects in clued Changes in temperature throughout the year that are caused by climate change lead to Exposure of animal wealth to many dangers of diseases, reduced fertility, and a lack of milk production it means heavy material losses to which the livestock sector is exposed drought leads to a decrease in rangeland areas and the amount of fodder available for livestock and grazing Consequently, the rise in temperatures and the low levels of rainfall pose a danger to Livestock, especially animals that depend for their food on grains**(World Bank, 2009).**

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2.11.Adaptions Mechanism and Pastoralists Copying Strategies:

Adaptation to climate change is a process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial historically, pastoralists have had relatively high adaptive capacity in inhabiting arid and semi-arid areas Climate variability more strongly stimulates adaptation than changes in climate the high levels of climatic variability that characterize the global rangelands suggest that pastoralists should be well able to adapt to a changing climate, but the current envelope of adaptive practices may not be sufficient. In some contexts, transformational adaptation may be needed Several analyses of pastoralist sensitivity to climatic shocks have indicated entry points by which pastoralist livelihoods can be better supported in response to a changing climate nevertheless, many pastoralists see climate change as just one of many important factors affecting their livelihoods others include human and livestock population growth ,global station, conflict, competition for land, changes inland tenure and land use, intensification of production, voluntary and government-facilitated sedentarisation**(FAO), 2011).**

Chapter Three

Martial and Methods

3.1.Study Area:

The study was conducted in the state of Sinner Abu hujar locality on three villages (Agula-Rowena and Ummjamina).state sinner of the Sudan is located on the south part of the country between latitudes 12:5 and 14:7 and longitudes 32:58 north and 35:42 easts in the middle of the mud belt.- location the state is bordered from the north by Gezira state from the south blue nile state from the east Gedaref state and the borders(Ethiopian Sudanese)while the white nile and upper nile states are bordered by south Sudan from the west and the states capital is the city of Singa 360 kilometers southeast of Khartoum state.

The total area of Sinnar is 40.680 square kilometers it is population is 130.122 people according to 2020 estimates the population in the state is concentrated around the banks of the blue nile and asmall percentage is around agricultural production areas the population distribution in the state is affected by the provision of necessary services aspects of other economic activities climate Sinnar state is located in the Sudanese rainy belt in the rich savannah area it is there fore characterized by a hot rainy summer in which the average temperature is highest in April recording 41 degrees in January .rain begins in march to stop in November recording its high esteaten in august it is 172mm while the annual rate is 512mm **(http://www.sennarstate.gov.sd).**

3.2.Sampling

This study was conducted in Sinner State - Abu Hujar area, it was covered three villages (Ajwala - Umm Jamina - Rowena) that were it represent one the most important pastoral areas in the locality from the total number of 20 villages in this area the total population of villages the two thousand people with 5% to representative study area according to statistical studies.

3.3.Data Collection:

3.3.1. Primary Data:

The primary information relied on conducting a socio-economic survey of the area in order to identify the impact of climatic changes on the natural rangeland, in addition to collecting basic information about the livestock sector in the area, and then designing a questionnaire targeting (60) repetitions. As a purpose sample to fill out the questionnaire at a rate of 20% as a sample of the total number of shepherds in those villages in order to obtain information related to climatic changes in the natural rangeland.

Questionnaire Themes

- Economic and social data for pastoral societies?
- Deterioration of vegetation covers in the area?
- The impact of climatic changes on the vegetation covers in the area?
- How to maintain vegetation cover?
- How animals adapt to climate changes. ?
- Is there a change in the time of animal grazing?
- Is the food in the rangeland suitable for feeding animal?

3.3.2.**Secondary Data:**

Secondary information related to the research war collected from books, reports, the Internet and some research that included information related to this research.

3.4**. Data Analysis:**

After collecting the field information, it was encoded and converted into data using simple statistics to extract the results in the form of tables containing frequencies and percentages to facilitate and discussion for data analyses used SPSS software version .

Chapter Four

Results and Discussion

4.1 Economic and social data for pastoral societies:

4.1.1 The results showed in Table (1) that the respondents were males at a rate of 100%. This is attributed to the basic dependence in the care and breeding of livestock on males, as well as the social customs that do not allow meeting any strange man for women.

Table (1) the types of respondents in the study area.

Type	Frequency	%
Male	60	100
Female	0	0
Total	60	100

4.1.2 The results appear in Table (2) A large proportion of the respondents amounted to 38.3%, their ages ranged between 20 to 40 years, while the older ages of them were 30% and this indicates that those whose ages ranged from 20 to 40 years had the ability to practice grazing, while older ages could help in determining places for grazing and water and conflict resolution.

Table (2) the ages of respondents in the study area.

Ages	Frequency	%
20_____40	23	38.3
40_____60	19	31.7
60 and above	18	30
Total	60	100

4.1.3 The results appeared in the table (3) that a large percentage of the respondents reached 95% of the married, which indicates that they are interested in marrying their children before the age of twenty.

Table (3) the social status of respondents in the study area.

Social status	Frequency	%
Married	57	95
Unmarried	3	5
Absolute	_	0
widower	_	0
Total	60	100

4.1.4 Table (4) sthat a large percentage of the respondents, 86%, were illiterate, 13.3% received basic education only, and this indicates their interest in grazing without education study area.

Table(4) educational level of respondents in the study area.

Educational level	Frequency	%
uneducated	52	86.7
basis	8	13.3
Secondary	_	0
university	_	0
above university e		0
Total	60	100

4.1.5 The results in table (5) that a large percentage of the respondents, amounting to 75%, practice the profession of grazing, and this indicates that they depend on livestock as a main source of income, and that raising livestock is considered a basis for life and a social aspect.

Table(5) source of income of respondents in the study area.

Source of income	Frequency	%
Farming	8	13.3
Grazing	45	75
Trade	_	0
Job	_	0
Other business	7	11.7
Total	60	100

4.1.6 The results in table (6) the absence of funding sources for 66% of the respondents, while there are a very small percentage of government institutions, which amounted to 3.3%, that finance women only and with very small amounts**.**

Table(6) funding sources of respondents in the study area.

Funding sources	Frequency	%
Government institution	2	3.3
Commercial banks	1	1.7
Organizations	17	28.3
Nothing	40	66.7
Total	60	100

4.2 Vegetation Cover Data:

4.2.1 The results showed in table (7) that the most common plants are turmeric, gecko, has kanite and molakhia, with a percentage of 100%. This is attributed to the speed of their growth and their ability to adapt to climatic changes.

Table (7) most popular plants of respondents in the study area.

Most popular plants		Frequency	%
Scientific name	**Local name**		
Boussaad (gafsa)	Albos	60	100
Tribulus terestris	Aldreacia	60	100
Cenchrus ciliaris	Ahscneat	60	100
Corchoru sspp	Almolshea	60	100
Total		60	100

4.2.2 The results in table (8) that tabar, Molkha, Umm Laban and Abu Arida are the most palatable plants, with a percentage of 100%. This is attributed to their content of materials that attract animals, in addition to the value of the food they contain.

Table (8 the most Palatable plants of respondents in the study area.

The most Palatable plants		Frequency	%
Scientific name	Local name		
Ipomoea spp	Altbar	60	100
Corchorus spp	Almolshea	60	100
Euphorbia ssp	Am lban	60	100
Desodium spp	Abo arida	60	100
Total		60	100

4.2.3 The results in table (9) that the most unpalatable plants were hydra and hinted, with percentage of 100%. Thus, they contained animal repellents in addition to substances that made them unpalatable to animals.

Table(9) un Palatable plants of respondents in the study area.

Unpalatable plants		Frequency	%
Scientific name	**Local name**		
Strigahermonthica	Aladar	60	100
Boussaad (gafsa)	Albos	60	100
Ipomoea spp	Alhntot	60	100
Total		60	100

4.2.3 The results in table (10) that the most extinct plants were Al-Nal and Al-Denbayeh, at a rate of 100%. This is attributed to the inability of these plants to adapt to climatic changes, in addition to direct grazing before reaching the stage of waste of these plants.

Table (10) extinct plants of respondents in the study area.

Extinct plants		Frequency	%
Scientific name	**Local name**		
Cammgon nutas	Alnal	60	100
Ipomoea Spp	Alhntot	60	100
Schoenfeldiagraclis	Aldannbaia	60	100
Total		60	100

4.2.4 The results showed in table (11) that the most toxic plants are hydro and oer with a percentage of 100%. Therefore, these plants contain toxic substances, which make the shepherds avoid grazing in places where these plants are abundant.

Table (11) poisonous plants of respondents in the study area.

Poisonous plants		Frequency	%
Scientific name	**Local name**		
Strigahermonthica	Aladar	60	100
	Alaoear	60	100
	Am mahoeara	10	16.7
Tribulusterestris	Aldreacia	50	83.3
Total		60	100

4.2.5 The results in table (12) that the most palatable trees and shrubs are acacia and acacia with a percentage of 100%, which is attributed to their content of high nutrients, followed by more than 95%.

Table (12) palatable trees and shrubs of respondents in the study area.

Palatable trees and shrubs		Frequency	%
Scientific Name	**Local name**		
Acaciamelanoxylon	Altlih	60	100
	Alkter	57	95
Franugulaalnus	Alsder	3	5
Vachellianilotica	Alsnt	60	100
Total		60	100

4.2.6 The results in table (13) that a large percentage of the respondents indicated that there is deterioration in the vegetation cover by a rate of 98.3% due to agriculture and direct grazing at a rate of 100% .

Table(13) deterioration of vegetation cover of respondents in the study area.

Deterioration of vegetation cover	Frequency	%
Yes	59	98.3
No	1	1.7
Total	60	100

4.2.8 The results in table (14) that the respondents indicated that climatic changes affected the disappearance of some plant species with a rate of 86.7%, and this indicates that there are significant changes in the climate in the study area

Table(14) the effect of climate change on the cover of respondents in the study area.

The effect of climate change on the cover	Frequency	%
Plant density	31	51.7
Plant quality	29	48.3
The disappearance of some plant species	52	86.7
Total	60	100

4.2.9 The results in table (15) that a large percentage of the respondents amounted to 96.7%. They explained that there is no way to preserve the vegetation cover and that is the lack of sufficient information to know the preservation of the vegetation cover.

Table(15) how to maintain the cover of respondents in the study area.

How to maintain the cover	Frequency	
Yes	2	3.3
No	58	96.7
Total	60	100

4.3 Animal Information Data:

4.3.1 The results in table (16) showed that most of the animals in the study area are sheep, with a percentage of 55%, followed by goats with a percentage of 45%, then cows with 30%, as camels are few spread in the study area and this is due to the lack of suitable food.

Table(16) the dominant type of animal of respondents in the study area.

The dominant type of animal	Frequency	%
sheep	33	55
Goat	30	45
Camel	-	0
Cattle	18	30
Total	60	100

4.3.2 The results in table (17) that the animals most affected by the deterioration of vegetation cover are camels, at a rate of 100%, followed by wild animals at a rate of 11.7%. This is attributed to the lack of adequate food for camels in addition to the provision of shelters for wild animals.

Table(17) the animals affected by deterioration of vegetation cover of respondents in the study area.

The animals affected by deterioration of vegetation cover	Frequency	%
Camel	53	88.3
Wild animals	7	11.7
Total	60	100

4.3.3 The results in table (18) that the shepherds graze at night at a rate of 100%, and graze inside the ends at a rate of 43.3% in order to avoid high temperatures during daylight hours.

Table(18) the how animals adapt climate change of respondents in the study area.

The how animals adapt climate change	Frequency	%
Grazing at night	60	100
Grazing in forests	26	43.3
Total	60	100

4.3.4 The results in table (19) that a large percentage of the respondents amounted to 90%. They confirmed that there are no permanent pastures for animals, and this in turn leads to many conflicts in the region.

Table(19) the permanent pastures for animals of respondents in the study area.

The permanent pastures for animals	Frequency	%
Yes	6	10
No	54	90
Total	60	100

4.3.5 The results in table (20) that a large percentage of the respondents, amounting to 91.7%, confirmed that there are conflicts in the places of animal grazing, and most of them are with farmers.

Table(20) the disputes in the places of grazing traitors of respondents in the study area.

The disputes in the places of grazing traitors	Frequency	%
Yes	55	91.7
No	5	8.3
Total	60	100

4.3.6 The results in table (21) that a large percentage of the respondents amounted to 65% as there are no conflicts in the places where animals drink, due to the large number of drinking places such as excavations and rivers.

Table(21) the disputes in places where betrayals drink of respondents in the study area.

The disputes in places where betrayals drink	Frequency	%
Yes	21	35
No	39	65
Total	60	100

4.3.7 The results in table (22) that a large percentage of the respondents, 66%, confirmed that they are stable, and that 33% of the respondents confirmed that they are nomads with livestock only in the autumn period, "due to the expansion of farmers on pastures in the autumn period.

Table(22) the migration and movement of animals of respondents in the study area.

The migration and movement of animals	Frequency	%
Stable	40	66.7
Migratory	20	33.3
Total	60	100

4.3.8 The results in table (23) that a large percentage of the respondents reached 100% confirmed that there is a change in the time of animal grazing due to the high temperatures during daylight hours, which were low in previous years, and this indicates that there is a significant change in the climate.

Table(23) the change in animal grazing time of respondents in the study area.

The change in animal grazing time	Frequency	%
Yes	60	100
No	-	0
Total	60	100

4.3.9 The results in table (24) that a large percentage of the respondents, amounting to 93.3%, confirmed that the grazing area in the natural pastures is not sufficient to feed their animals.

Table(24) the both in natural pastures are enough to feed the animals of respondents in the study area.

The both in natural pastures are enough to feed the animals	Frequency	%
Yes	4	6.7
No	56	93.3
Total	60	100

4.3.10 The results in table (25) that a large percentage of the respondents, which amounted to 100%, confirmed that they do not raise their animals in closed pens, and this indicates that they

depend on natural pastures in raising their animals and consider that grazing is the profession of their ancestors and they do not know another profession.

Table(25) the breeding animals closed enclosures of respondents in the study area.

The breeding animals closed enclosures	Frequency	%
Yes	-	0
No	60	100
Total	60	100

Chapter Five

Conclusion and Recommendation

5.1 Conclusion:

- 98.3%of the respondents confirmed that there is deterioration in the vegetation cover in the study area due to direct grazing and agriculture.
- 86.7% of the respondents confirmed that climatic changes affected the disappearance of some plant species.
- 96.7% of the respondents confirmed that there is one way to maintain the vegetation cover.
- 100% of the respondents confirmed that camel is one of the animals most affected by the deterioration of the plant diet.
- 91.7% of the respondents confirmed that there are conflicts in the places where animals are grazing.
- 100% of the respondents confirmed that there is a change in the time of animal grazing due to the great climatic changes that appeared in the study area.
- 93.3% of the respondents confirmed that the grazing in the natural pastures is not sufficient to feed the animals in the study area.

5.2 Recommendation:

- To development of natural rang land and awareness of pastoral communities.
- Establishment of banks to save the seeds of rangeland plants to broadcast when in rains.
- To Activate laws that protect natural pastures from agricultural interventions.
- The need to educate to preserve natural rang land.
- The necessity of educating herders about the climatic changes taking place in the area and its effect on plants and animals.
- To conducting further studies on climate changes in the area and similar areas.
- To increase perception and awareness of local people and pastorals should be increased towards the conservation, protection, and management of the range plants in the study area, and more ecological studies should be carried out in the study.

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Appendix

بسم الله الرحمن الرحيم

جامعة السودان للعلوم والتكنوجيا

كلية علوم الغابات والمراعي

قسم علوم المراعي

إستبيان جمع معلومات لغرض بحث في علوم المراعي

المحور البيانات الاجتماعية والاقتصادية للسكان المحليين:-

1.النوع.

a. ذكر.

b. أنثى .

2.العمر .

a. من 20ـــــــ40سنة

b. من 40ـــــــ60سنة

c. من 60 سنة فما فوق.

1. الحالة الإجتماعية .

a. متزوج.

b. أعزب .

c. مطلق.

d. أرمل.

4. مستوى التعليم .

a. أمي .

b. اساس.

c. ثانوي.

d. جامعي .

e. فوق الجامعي.

5. مصدر الدخل .

a. زراعة.

b. رعي.

c. تجارة.

d. وظيفة.

6. مصادر التمويل للإنتاج الزراعي والحيواني.

a. مؤسسات حكومية .

b. بنوك تجارية.

c. منظمات.

<u>المحور الغطاء النباتات:-</u>

7.ماهي النباتات الأكثر شيوعاً في المنطقة.

a. .....

b. .....

c. .....

d. .....

8. ماهي النباتات الأكثر استساغة للحيوانات.

a. .....

b. .....

c. .....

d. .....

9. ماهي النباتات الغيير مستساغة للحيوانات.

a. .....

b. .....

c. .....

d. .....

10. ماهي النباتات المنقرضة من المنطقة.

a. .....

b. .....

c. .....

d. .....

11.مهي النباتات السامة في المنطقة.

a. .....

b. .....

c. .....

d. .....

12.ماهي الاشجار والشجيرات المستساغة في المنطقة .

a. .....

b. .....

c. .....

d. .....

13. ماهي الاشجار والشجيرات الغيير مستساغة في المنطقة .

a. .....

b. .....

c. .....

d. .....

14. هل هنالك تدهور في الغطاء النباتي في المنطقة (نعم)(لا).

وهل سبب التدهور.

a. زراعة .

b. رعي .

c. حريق .

d. زحف صحراوي.

إستخدامات أخرى.

15. هل أثر التغير المناخي على الغطاء النباتي في المحاور .

a. كثافة النباتات .

b. نوعية النباتات .

c. كمية النباتات .

d. إختفاء بعض ألانواع.

16. كيفية المحافظة على الغطاء النباتي بالمنطقة.

a. .....

b. .....

c. .....

d. .....

<u>محور معلومات الحيوانات:-</u>

17 .نوع الحيوانات السائدة بالمنطقة .

a. ضأن.

b. ماعز.

c. ابل.

d. بقر.

18. ماهي الحيوانات التي تأثرة بتدهور الغطاء النباتي .

a. .....

b. .....

c. .....

19. كيفية طرق تأقلم الحيوانات مع التغيير المناخي .

a. .....

b. .....

c. .....

20 .هل هنالك مراعي دائمة للحيوانات في المنطقة .

a. نعم.

b. لا.

21. هل هنالك نزاعات في اماكن رعي الحيوانات .

a. نعم.

b. لا.

22. هل هنالك نزاعات في اماكن شرب الحيوانات.

a. نعم.

b. لا.

23. هجرة وحركة الحيوانات.

a. مستقر.

b. ترحال.

24. هل هنالك تغيير في زمن رعي الحيوانات واذا كانت الإجابة بنعم لماذاء.

a. نعم .

b. لا.

25. هل الكلا في المرعى الطبيعي كافي لتغذية الحيوانات والإجابة بلا هل السبب.

a. نعم.

b. إذاكانت (لا)هل السبب.

1. كثرة الحيوانات .

2.قلة المرعي.

3. الزراعة .

4. الحرائق.

5. أخرى.

26. هل تقومون بتربية الحيوانات في حظائر مغلقة او شبة مغلقة.

a. نعم.

b. لا.