

# The Role of Range Improvement Practices on Sustaining Rangeland Management in Semi-Arid area of Wad Omer, Central Sudan

Samia Alsmame Babeker Farah <sup>1</sup> Dr. Abdelaziz karamalla Gaiba .Elkheir Mugadam.Salih<sup>2</sup>

1. Corporation research ,E-mail : [samyafarah@yahoo.com](mailto:samyafarah@yahoo.com)
2. Sudan university , E-mail : [Gaiballa@G-mail.com](mailto:Gaiballa@G-mail.com)
3. Sudan university , E-mail : [elkheirsoba@gmail.com](mailto:elkheirsoba@gmail.com)

## ABSTRACT

This study was conducted at Wad Omer area north Omdurman (Kilo 84) near to liveline road, its objective was to study the impact of range improvement practices on sustainable rangeland management in Wad Omer area.

Wad Omer project was conducted within a joint work between the ministry of agriculture and food and agriculture Organization (FAO) with the aim of improving food security through improvement of natural rangeland and agricultural productivity in addition to environmental interventions including sand dune fixation.

Measurements were taken at two selected sites one in the area covered with the project activities and the other in the area not covered. In both sites plots of 1x1 Km were marked and within each plot measurements were taken. Measurements included plant cover, plant composition, frequency and trees densities, along transects of 100m. using quadrat of 1m<sup>2</sup>.The measurements included also seed bank assessment, and soil organic matter, socio economic aspects were also assessed.

The results showed that the parameters identified expressed the difference and impact of these interventions. There were relative differences in the plant composition between the two sites. Species like *Gaw* and *Handal* have dominated in the site covered with the project activities. It is also found that there were 18 types of plants in the site covered with activities. against 14 types in the other site. Organic matter content in the area covered found was higher than that not covered. This also the same

with the soil seed bank, where percentage of soil seed bank was higher than the site not covered.

Interventions has provided green fodder and secured provision of milk and better food security condition.

---

**Key words:** Range improvement, Range measurement, Sustainable rangeland management, Seed bank, Organic matter.

### Introduction

The dry lands in Sudan cover approximately 60% of the country (1.5 million square kilometers) thus, constituting the largest area of dry lands in Africa. One of the most important recently issues' facing Sudan as well as sub-Sahara Africa is the threat of continued drought and desertification that result from destruction of natural resources, agricultural lands and their political and social disturbances. These areas have severely suffered from excessive utilization and environmental problems. Many interventions targeting conservation protection and improvements of resource in these areas were performed. Wad Omer project that was started in 2004 is among these efforts.

The climate is mainly semi-desert. The mean daily temperature is 29.9c° and with mean daily maximum of 45.9c° in May while the minimum is 12.6c° in January. The total annual rainfall is 121.4mm and reaches a maximum of 48.3 mm in August. The highest recorded annual rainfall is 55 mm /y (Ahmed, 2003).The topography of the study area is wavy on nature (high and low) interspersed with rocky hills.

According to (Adel, 2008) the project area is located in semi-desert belt, and according to Harrison and Jackson (1958) the vegetation of this area consist of *Acacia tortilies* (Samr) ,*Maerua crassifolia* (Sareh),*A.trotilis-radiana* (Seyal), *Balanites aegyptiaca* (Higlig), *Ziziphus Spina-christi* (Sidir), and *Capparis decidua* ( Tundub) .Some plants usually appear during the rainy seasons, such as *Tribulus spp* (Deresa), *Aristida adscensionis* (Gaw), *Zeylia pentandera* (Raba), *Corchorus spp* (Khodra) and *Farestia spp* (Dahyaan).The region is currently used for grazing and browsing of plants growing around the village (Sumya, 2008).

Population of wad Omer area is about 805 person, Hassanyia forms about 2008,115 Family ,The Hassanyia ,who are pastoralists , have lost most of their livestock ,and some of them migrated to any places in the Northern state. The people in the study area depend on livestock raising using seasonal grasses, shrubs and some trees in wadies. In addition to that they practice agriculture produce the main crops.

### **Materials and Methods:**

This study was conducted in Khartoum state, in north Omdurman area, around Wad Omer village as a main area covered by the project. The objective of the study was to assess the impact of the project as indicated by rangeland improvement interventions and other environment related activities an rangeland management.

### **Sampling and data collection:**

Sampling was done as relevant to each of the parameters identified, to assess the impact of range improvement activities for range management and related activities. Two range sites were identified, within each site 1x1 Km plot was marked based on the criteria set by (Cottam, 1956).

To represent areas covered by the activities and other areas that not covered, five transects of 100 m. each were randomly located in each site to measure vegetation attributes. Selection of the sites done based on releve' method and minimum area theory. Range measurements including plant cover, plant composition, plant frequency, trees density, organic matter and seed bank were conducted (Matthew and Robert in 1993)

### **Plant Cover:**

Readings were taken using quadrats every 20 meters interval, the most prevalent types of plants within quadrates were identified. Twenty Five readings were taken for plants in the two sites.

### **Plant Composition:**

Plant Composition, bare soil, Litter, rocks were taken at each sites along five transects at 3/4-inch loop hits. The total numbers of hits along each transect was equal 100 hits.

### **Plant Frequency:**

Frequency is the number of times a plant species is present in a given number of quadrats of a particular size or at a given number of sample points. Frequency is usually expressed as a percentage and sometimes called a Frequency Index.

### **Trees Density:**

The nearest individual method was used in each site. Density for trees was determined in each site. A total of 30 points were selected randomly for each site at each point distance to nearest Tree spp measured and the type of Tree reported.

### **Soil organic matter:**

The soil samples were taken randomly to determine organic matter at depths of (0-30 - 30-60 - 60-90 cm). Equipment used included muffle furnace, Balance, Porcelain dish, Spatula, Tongs.

Nine (9) soil samples of 50gm were taken from each of the two sites to determine organic matter at the laboratories of Agricultural Research Corporation for the analysis of soil – Wad Madani. Using procedure the following steps

- The mass of an empty, clean, and dry porcelain dish was determined.
- The part of entire oven-dried test.
- Dish as were placed in muffle furnace. For One day at 105<sup>o</sup>C temperature.
- The porcelain dishes were removed carefully using the tongs, and allowed it to cool to room temperature.
- The dish was emptied and cleaned.

### **Soil seed bank:**

Soil seed bank is a good indicator for assessing accumulative effect of plant establishment along more than one year. To assess seed bank 10 soil samples (10cmx10 cmx5cm depth), were taken within each site randomly, and put in paper

bags. The soil were mixed and sub-samples of 250/gm. each were prepared for washing and extraction.

Soil samples were washed using three sieves of (1.0- 0.5 and 0.25mm) put under each other at the laboratories of the College of Forestry and Range Science (Sudan University of Science and Technology).

Two hundred and fifty gram each sample of soil was placed in the upper sieve and washed using 250 ml of water for 10-15 minutes then put in tray and transferred into 500 ml beaker and stirred. The floating organic matter including dead seeds was filtered, using funnel with filter paper inside it, the funnel placed into one conical flask connected to a vacuum pump to aid filtration.

The filtered residue on the filter paper was transferred into Petri-dish and the organic matter retrieved included mainly dead seeds. Samples remaining residues were washed using 250 ml of calcium chloride (12 gm. /ml) to retrieve dead seeds from sample residues. The floated material after stirring included the live seeds, it is then added to the seeds remained in the flask for 40 minutes. Seen the highest seed solution of calcium chloride and filtered from the suppression of the flask (dead seeds) and left to dry under air.

Seeds of the different species were identified under the microscope MBC Anatomy - 10 by comparing them with a previously prepared colored image of seeds collected from the plants of study sites.

### **Socio economic survey:**

The socio economic survey was conducted to assess the involvement and respond of Wad Omer community to the project activities and their impact in addition to their views for more improvement. Size of 105 households was taken 10%.

A questionnaire was designed to collect the data and information required which covered, plant composition, activities such as agriculture and grazing, inputs of production, types of plants, types of crops, role of women participation, sources of water, irrigation system and vegetation aspects. In addition to the questionnaire a

focused group discussion was conducted using checklist to collect group views and to cross check information provided by households.

### Results and Discussions:

According to table (1) the species dominating composition at the site covered with the interventions were *Aristida adscensionis* (GAW) 13.59%, *Tribulus terrestris* (Diraisa) 8%. It is obvious that *Aristida adscensionis* appeared in the area of the project interventions, but not on the other sites. This indicated the success of seed broadcasting activities with species preferred by animals. This was also confirmed by local people during the focused group discussion.

**Table (1) Plant Composition % at the two sites (covered and not covered) by the project activities:**

Species	Local name	Composition%	
		Site not Covered	Site Covered
<i>Aristida adscensionis</i>	Gaw	-	13.59
<i>Tribulus terrestris</i>	Diraisa	14.32	8
<i>Chrozophora plicata</i>	Tarba	3.51	7.28
<i>Pulicaria crispa</i>	Tagar	6.76	6.3
<i>Zeylia pentendra</i>	Rabaa	8.92	5.58
<i>Stylosanthes flavicans</i>	Sharaia	5.95	5.58
<i>Crotalaria thebaica</i>	Natach	7.27	5.09

Table (2) shows that the frequency of *Aristida adscensionis* was 32% in the site covered and 48% in the site not covered, with activities. Species with high frequency in the site covered with activities were *Aristida adscensionis* 32%, *Pulicaria crispa* 28%, *Tribulus terrestris* 24%, while the spp at the site not covered were *Tribulus terrestris* 52%, *Chrozophora plicata* 48%, *Cenchrus biflorus* 40% and *Citrullus*

*colocynthis* 36%. The results indicated that the frequency percentage of a plant in the area varies depending on plant palatability. It is found that the frequency of *Tribulus terrestris* and *Chrozophora plicata* in the site covered with activities (24% and 16%) relatively higher than the other site.

**Table (2) Plant Frequency Percentage at the two sites (covered and not covered) by the project activities:**

Species	Local name	Sites %	
		Coverd	Not covered
<i>Aristida adscensionis</i>	Gaw	32	-
<i>Tribulus terrestris</i>	Diraisa	24	52
<i>Chrozophora plicata</i>	Turba	16	48
<i>Pulicaria crispa</i>	Tagar	28	12
<i>Zeylia pentendra</i>	Rabaa	20	12
<i>Stylosanthes flavicans</i>	Sharaia	20	24
<i>Crotalaria thebaica</i>	Natach	20	12
<i>Crotalaria senegalensis</i>	Saffary	16	-
<i>Cenchrus biflorus</i>	Haskaneit	16	40
<i>Citrullus colocynthis</i>	Handal	04	36

According to the study results in table (3) total trees density in the site covered with activities was (53 trees) while in the area not covered only (4 trees) reflected big difference in trees density values and indicated that *Salvadora persica* was 17 trees / hectare in the site covered with the activities and none in the site not covered. The other trees at the site covered by activities were *Ziziphuis spina-christi*, (Sidr) *Maerua crassifolia*, *Grewia tenax* and *Acacia radiana*, while in site not covered were *Maerua crassifolia*, *Boscia senegalensis*, *Capparis decidua* and *Acacia radiana*. Very few numbers of trees was observed at the site not covered compared with other site.

The highest tree density was 17 Trees/ha in the site of activities, while on the other site no trees were observed. The area with trees will provide a browsing resource during the summer.

**Table (3) Relative Density of trees T/h at the two sites ( Coverd and not Coverd by the project activities):**

Species	Trees/ha	
	Coverd	Not coverd
<i>Salvadora persica</i>	17	-
<i>Zizuphus spina-christi</i>	15	-
<i>Maerua crassifolia</i>	10	1
<i>Boscia senegalensis</i>	-	1
<i>Capparis decidua</i>	-	1
<i>Grewia tenax</i>	3	-
<i>Acacia radiana</i>	8	1
<b>TOTAL</b>	53	4

According to the result in table (4) there is difference in the organic matter content at the depth 0-30 cm. This is the depth where organic matter expresses the accumulation of organic materials along a number of years. Higher organic matter means more decomposition of organic plant materials produced at the site as a result of high amount of biomass.

**Table (4) Soil organic matter %**

Depth	Two sites	
	Coverd	Not coverd
0-30	0.187	0.055
30-60	0.671	0.154



60-90	0.546	0.049
-------	-------	-------

According to table (5) seeds of fifteen types of plants seeds were detected in the site covered and eleven in the other site. Analyzed soil samples showed differences in the total number of seeds in the seed bank even in the number of live and dead seeds at the depth 10×10×5, at the two sites, where it was found that there was a difference in the percentage of live and dead seeds (Table 4, 5,6, and 7). Generally through the analysis of soil samples it was found that the area covered with activities showed higher proportion of living seed more than in site not covered by activities. The soil seed bank can be affected by many factors in this area (Wad Omer project area) for example environment, human activities, animals, as well all environmental and other factors.

**Table (5) Total soil seed bank at the two sites (coverd and not coverd) by the project activities:**

Sites	Live	Dead	Total
Coverd	9.566	21.380	30.946
Not coverd	8.856	4.589	13.445

**Table (6) Livelihood activities in the project area:**

Activities	Percent
Agriculture	55.0
grazing	20.0
Trading	25
<b>Total</b>	<b>100%</b>

**Table (7) Respondents according to increase in crop production:**

	Increase in crop production (%)	Benefit from irrigation (%)

Increase	55	52.5
Little increase	45	47.5

### Conclusions and Recommendations:

- The study confirmed reliability and apporopriatness of using range health seed bank and soil integrity (organic matter contents) in addition to vegetation attribute including cover, frequency and composition as an indicative parameters to assess impacts of range improvement practice in semi-arid area (Wad Omer area).
- Species like *Aristida adscensionis* existed in areas improved and not in other areas as an indicator of successfull seed broad casting.
- More spp types (richness) was recorded in areas improved compared will other sites (17 to 14 types of plants).
- More average cover percentage reported in areas covered with activities compared with other site (72.8% to 69%) indicating more soil conservation from erosion.
- Soil seed bank (live and dead seeds) were higher in the area improved by percentage of (8%) and for live and about three times dead seeds respectively indicating more potentiality for recovery.
- Soil integrity expressed in organic matter content found to be 0.671 % higher in the site improved compared with site.
- Natural resource constitute the main livelihood assets for the community in the project area confirming the relevance and importance of rangelands improvements for better food security.
- Improvement of agricultural production environment and adoption of green fodder plantation promoted food security and provide summer feeding for livestock.
  - The use of range health parameters include seed bank and organic matter and vegetation attribute to assess the impact of range improvement activities.
  - Adoption of range improvement practices can significantly contribute towards food security in semi-arid areas.
  - More efforts to involve women in range improvement practices are need.

### REFEREENCES

**Adel, M. F. (2008).** Evaluation report of Wad Omer irrigated Scheme north Omdurman, Khartoum State.

**Ahmed, S. E. (2003).** Ecology Coordinator NBSAP-Sudan, HCENR, PhD.

**Cottam, G., and J.T.Curtis.(1956).**The use of distance measures in phytosociological sampling. *Ecology* 37:451-460.

**Matthew, W. F. and Robert, T.F.M. (1993).** Methods for Plant sampling, Restoration in Colorado Desert management Notes, Biology Department Sant Diego state University Sant Diego.

**Sumaya, A. H. (2008).** Annual report of Wad Omer. Ministry of Agriculture, Khartoum, Sudan.