

# *Dedication*

*To the soul of my father*

*To my mother*

*My grand mother*

*My sons*

*To My colleagues and friends*

*To my supervisors*

*To all those*

*I dedicate this humble work.*

## **Declaration**

The study presented in this thesis was completed by the author whilst he was a postgraduate student at the College of Graduate Studies and Scientific Research, Sudan University of Science and Technology.

I hereby affirm that the content of this thesis is original research conducted by the author. All views and conclusion are the sole responsibility of the author. All references to previous work are included at the end of the thesis.

I certify that the content of this thesis has not already been submitted for any degree and is not being currently submitted for any other degree.

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## ABSTRACT

This study was conducted at El- khuwei Locality, North Kordofan State, Sudan. Two sites were selected El-Rosa enclosure and a control in the open area nearby. The overall objective was to provide information that contributes to a better understanding of the plant- animal interactions, and thereby develop a more resilient and sustainable livestock production system based on natural rangelands.

Materials and methods of this study included a taxonomic study on range plants which was based on fresh plants specimens collected from the rangelands. These specimens were prepared, examined, identified, described and documented. Range vegetation measurements were then conducted and botanical composition of the diet selected by sheep was determined using the bite count technique. Moreover, voluntary feed intake was assessed using the product of the quantity of faeces collected over a specific period of time and in vitro digestion coefficient of forage plants selected by sheep. Chemical composition of the biomass, the diet selected and of some plants of interest was performed. The perception of pastoralists and their impact on the use of rangelands was investigated through the collection of data from the livestock raisers, using a questionnaire and group discussions.

The taxonomic study of range plants revealed 74 species, belonging to 68 genera and 38 families. The three species that had high percentage in botanical composition in the enclosure range were *Cenchrus biflorus* (27.6%), *Ipomea eriocarpa* (20.2%) and *Eragrostis tremula* (19.2%). At seed set stage the dominant species were *Acanthus spp.* (18.5%), *Cenchrus biflorus* (15.0%) and *Merremia omarginata* (7%). On the open range *Cenchrus biflorus* was dominant (24.0%) followed by *Echniochloa colonum* (13%) and *Sida alba* (6.5%). The Percent vegetation cover, bare land and litter in the enclosure range were

71.5%, 15.5 and 11.5 respectively. That of open range site was 57.0%, 32.2% and 10.0 respectively.

These results indicate that the range productivity was enhanced by the application of fencing compared with open range. In this study the carrying capacity, based on the flowering stage calculations, was 3.4 ha/TLU/year in enclosure range and 1.8 ha/TLU/year in the open range.

In the flowering season plants with highest relative preference index (RPI) at the in the enclosure range were *Zornia spp.* (12.9), *Merremia spp.* (12.6) and *Desmodium spp.* (2.0). In the open range the plants with highest (RPI) were *Desmodium spp.* (15.9), *Ipomea eriocapa* (15.7) and *Echinochloa colonum* (5.1). The most important plants selected by sheep at the seed set stage in the enclosure range as indicated by RPI were *Ceratotherca spp.* (22.4), *Zornia spp.* (2.1) *Desmodium spp.* and *Eragrostis tremula* (1.7) each. In the open range the plants with highest RPI were *Desmodium spp.* (10.4), *Zornia spp.* (6.5) and *Ipomea eriocapa* (2.5).

The crude protein (CP %) of biomass vegetation at flowering stage in enclosure range was 10.9%. That of the simulated diet at the same time was 15.3%. In the open range CP% of biomass vegetation was 10 %. That of the simulated diet at the same time was 11.9%. Individual herbaceous plants found to contain high % CP were *Acanthus spp.* (18.4%), *Zornia spp.* (16.6%) and *Desmodium spp.* (16.6%).

The study on rangeland management and pastoralists' perceptions on rangeland resources and utilization were meant to improve our understanding of the interactions between the human and livestock population and the environment from the pastoralists' standpoint. This should give a validation of the scientific methods we adopted at least in

part. Many of the plants that had high RPI were also reported by pastoralists as preferred plants.

It was concluded that sheep can select a diet superior to the average quality of the biomass vegetation. It was also concluded that the most preferred plants by sheep in this study were *Desmodium dichotomum*, *Zornia spp.*, and *Ceratotherca spp.*

It is recommended that these findings should be considered as a basis for an informed management system in the El-Khuwei Locality which will be invaluable in developing sustainable management strategies for use by pastoralists.

## ملخص الأطروحة

أجريت هذه الدراسة فى محلية الخوى ، ولاية شمال كردفان بالسودان. و قد تم اختيار موقعين لنماذج رعوية شملت محمية الروزا كمرعى محمى والآخر هو السيطرة

في منطقة مفتوحة مجاورة كمرعى مفتوح. كان الهدف الرئيسي من هذه الدراسة هو توفير المعلومات التي تسهم في فهم أفضل للتفاعلات الحيوانية النباتية وبالتالي لتطوير الإنتاج الحيواني واستدامة نظام قائم على المراعي الطبيعية.

وشملت مواد وأساليب هذه الدراسة، دراسة تصنيفية على نباتات المراعي التي قامت على أساس العينات النباتية من النباتات الطازجة التي تم جمعها من المراعي. وقد أعدت هذه العينات وتم اختبارها وتعريفها ووصفها وتوثيقها. ثم أجريت قياسات الغطاء النباتي و من تم تحديد النباتات التي اختارها الضان عن طريق حساب عدد القضبات بالملاحظة المباشرة.، وعلاوة على ذلك تم تحديد كمية العلف (النباتات المختارة) المتناول من جانب الضأن بأستخدام العلاقة بين كمية الروث المنتج ومعامل الهضم المعملى للنباتات المختارة من الضأن تم تحديد القيمة الغذائية للمرعى للكتلة الحيوية، من النباتات المختارة وبعض النباتات ذات الاهتمام بواسطة التحليل الكيميائي لنباتات المرعى، وكان التدقيق في تصور الرعاة وأثرها على استخدام أراضي المراعي من خلال جمع البيانات من مربي الماشية باستخدام استبيان ومجموعات النقاش.

كشفت الدراسة التصنيفية للنباتات المراعي 74 نوعا، تنتمي إلى 68 جنسا و 38 عائلة. وكانت أعلى تركيبة نباتية لثلاثة في نطاق المحمية هي *Cenchrus* 16.5 (*Ipomea eriocarpa* (% 21.5 *biflorus* (% و 15.5 *Eragrostis tremula* (%. في مرحلة طرد البذور والأنواع السائدة هي (% 18.5 *Acanthus spp s* (% 16.5 *Cenchrus bifloru* (% و 7.5 *Eragrostis tremula* (%. على المرعى المفتوح الأنواع السائدة هي (% 24.0 *Cenchrus biflorus* (%، و يليه *Echniochloa* (% 13.5 *colonum* (%، و 6.5 *Sida alba* (%).

وكانت النسبة المئوية للغطاء النباتي والارض العارضة وبقايا النبات في نطاق المحمية 70.5 %، 15.5 و 11.5 على التوالي، و على المرعى المفتوح 57.0 %، 32.2 % و 10.0 على التوالي. أظهرت نتائج إنتاجية المرعى تحسين بين المرعى المحمي والمفتوح في موسم الإزهار وموسم إنتاج البذور. وكانت الحمولة الرعوية استنادا على موسم الإزهار هي 3.4 هكتار / TLU / سنة في المحمية و 1.8 هكتار / TLU / سنة في المرعى المفتوح.

كانت أفضل النباتات المختارة من جانب الضأن استنادا على مؤشر التفضيل النسبي في موسم الإزهار في المرعى المحمي هي *Merremia spp* (12.9) ، *Zornia spp* (12.6) و *Desmodium spp* (2.0). على المرعى المفتوح ، *Desmodium* (15.9) ، *Ipomea* (15.7) و *Echinochloa colonum* 5.1). في مرحلة طرد البذور المحمية على النحو المبين من قبل *Desmodium sp* (2.1) ، *Zornia sp* (22.4) ، *Ceratotheca sp* (1.7) و *Eragrostis* (10.4) ، *Desmodium sp* (6.5) و *Ipomea eriocapa* (2.5).

كان البروتين الخام (CP %) من النباتات لكتلة الحيوية في مرحلة الإزهار في نطاق المحمية 10.9%. وكان ذلك في النباتات المختارة في الوقت نفسه 15.3%. وفي المرعى المفتوح كان CP % من الكتلة الحيوية النباتية 10%. كان ذلك في النباتات المختارة في الوقت نفسه 11.9%. تم إيجاد CP % لبعض نباتات المرعى الفردية هي *Zornia spp* (16.6%) ، *Acanthus spp* (18.4%) و *Desmodium* (16.6%).

كانت نتائج الدراسة حول نظرة الرعاة لإدارة المرعى واستخدامها لتحسين فهمنا لتفاعلات بين السكان والثروة الحيوانية والبيئة من الرعاة. هذا يجب أن تعطي المصادقة على الأساليب العلمية اعتمدنا على الأقل جزئياً منها. وأفيد أيضاً عن العديد من النباتات التي كانت عالية في مؤشر التفضيل النسبي هي نفس النباتات المفضلة للرعاة.

وخلصت الدراسة أن النباتات المختارة من جانب الضأن متفوقة على متوسط جودة النباتات للكتلة الحيوية. وخلصت أيضاً إلى أن معظم النباتات التي يفضلها الضأن في هذه الدراسة هي *Zornia spp* ، *Desmodium spp* ، و *Ceratotheca sp*.

توصى الدراسة أنه ينبغي اعتبار هذه النتائج كأساس لنظام إدارة المرعى غى محلية الخوى التي لا تقدر بثمن في وضع استراتيجيات للإدارة المستدامة للاستخدام من قبل الرعاة.