



## Dedication

I dedicate this work

To the soul of my father and brother (Abdalla)

To my dear mother

To my dear brothers and sisters

To my dear limia Aydam Adam

To my sons Nessma , Mohammed and Bessma

With endless love and respect

*Nasreddin*

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## **ABSTRACT**

This study was conducted at Zalingei area, in the period from May 2013 to April 2015. The objectives of this study is to assess woody species and natural regeneration of forest trees in the study area. A reconnaissance survey was conducted on the basis of which the study area was stratified into seven ecological zones namely, contemporary flood plains, lower terraces, upper terraces, clay plains, sedentary plains, lower hill slopes and stony hill slopes. The total surveyed area was 278 ha of natural forests of Zalingei area. Field surveys were conducted, the surveys covered, soil samples collection and analysis, woody vegetation and natural regeneration surveys as well as social surveys. At the various ecological zones, all trees per plot with dbh equal to or greater than seven centimeters were enumerated, the number of trees per ha were calculated, tree height, diameter, crown diameter and volume measurements were calculated. The species composition, the relative dominance, relative abundance, relative frequency, importance value indexes and woody plant diversity were calculated. Regeneration, regeneration type, size of seedlings and survival rates of all seedlings of tree species were counted and recorded four times recurrently, twice in each season. The data were analyzed using various tools including, T Distribution, Regression analysis, Simpson Diversity Index, Sorensen Coefficient of Similarity, and Chi-square test. The Statistical Analysis System (SAS) was also used for data analysis. Results showed that: Twenty nine trees species occur at the surveyed area, results of group discussion indicated that the prevalence of fifty six tree species at the studied area, and this reflects high degree of species richness at the study area. The average number of trees per hectare is was 70 trees whereas natural regeneration was

found to be 389 seedlings per hectare, this makes the ratio of mature trees to seedlings at the study area was approximately 1:6. The dominant woody species were *Faidherbia albida* on contemporary flood plains and lower terraces, *Balanites aegyptiaca* on upper terraces. *Acacia seyal* on clay plains. On sedentary plains *Albizia amara* associated with *Acacia senegal* was dominant, *Albizia amara* also occurs on lower hill slopes. *Boswellia papyrifera* is a dominant tree species on stony hill slopes. The diversity index for the ecological zones ranged between 0.15 - 1. All species have more than one source of natural regeneration, such as *Albizia amara*, *Balanites aegyptiaca*, *Dichrostachys cinerea* which is renewed by seeds, coppices and sprouts, other species have two sources of regenerations; namely seeds and coppices. The average wood volume at the study area is 14.87m<sup>3</sup>/ha and annual deforestation is 1.9 m<sup>3</sup>/h whereas, the vegetation cover is about 17.96%. This abundant natural regeneration needs to be managed; possible scenarios may include the introduction of sustainable forest management approach. Government efforts for the conservation of natural forests would only be materialized if local people have been involved; hence community participation in management of these natural forests is very important. Government may consider the developing of forest regulations, policies and laws that are enforced in local communities. Further research work is needed at the study area in the field of forest management, and natural regeneration taking into account the experience of Sahelian countries.

## المخلص

أجريت هذه الدراسة بمنطقة زالنجي في الفترة من شهر مايو 2013م إلى شهر ابريل 2015 م، بهدف تقويم الغطاء النباتي الشجري والتجديد الطبيعي للأنواع الشجرية في منطقة الدراسة. لقد تم إجراء مسح إستطلاعي وعلي اساسه قسمت منطقة الدراسة الي سبع مناطق بيئية وهي السهول الفيضية المعاصرة و التضاريس السفلي والتضاريس العليا والسهول الطينية والسهول المستقرة و منحدرات التلال والتلال الصخرية ، بلغت جملة المساحة 278 هكتار من مناطق الغطاء النباتي الغابي بمنطقة زالنجي. اجريت مسوحات ميدانية ، هذه المسوحات شملت جمع وتحليل عينات من التربة، مسوحات للغطاء النباتي والتجديد الطبيعي للأنواع الشجرية بالإضافة الي المسوحات الاجتماعية. في مختلف المناطق البيئية تم حصر جميع الأشجار التي قطرها عند مستوي الصدر أكبر من أو يساوي سبعة سنتيمترات. وقد تم حساب عدد الأشجار في الهكتار و دونت إرتفاعاتها وأقطارها وأقطار تيجانها و تم حساب المخزون الخشبي. كما تم حساب تركيبة الأنواع، ووجود الأنواع و الوفرة النسبية و التكرار النسبي للأنواع وحساب مؤشر القيمة، كما تم حساب التجديد الطبيعي ونوع وحجم الشتلات ومعدلات البقاء على قيد الحياة لشتلات كل الأنواع الشجرية، وأجريت هذه القياسات أربع مرات متكررة، مرتين في كل موسم. حللت البيانات بأدوات احصائية مختلفة تضمنت اختبار(ت)، تحليل الانحدار، معامل Sorensen للتشابه، مؤشر Simpson للتنوع ومربع كاي. واستخدم نظام التحليل الإحصائي (SAS) لتحليل البيانات. أظهرت النتائج أن هنالك تسعة وعشرون نوع من الأنواع الشجرية تم تحديدها وتسجيلها في منطقة الدراسة . وقد أشارت المسوحات الاجتماعية إلى وجود ستة وخمسين نوع شجري وهذا يعكس درجة عالية من ثراء الأنواع في المنطقة . كذلك اظهرت النتائج أن هنالك 70 شجرة/هكتار و389 شتلة/هكتار وهذا يجعل نسبة الأشجار الناضجة للشتلات في منطقة الدراسة ما يقارب من 1: 6 . اظهرت النتائج أن الحراز هو النوع الشجري السائد في سهول الفيضانات المعاصرة والتضاريس السفلى، الهجليج هو النوع الشجري السائد على التضاريس العليا . الطلح هو النوع الشجري السائد على السهول الطينية. العرد والهشاب سائدان في السهول المستقرة. العرد هو النوع الشجري السائد على منحدرات التلال. الطرق طرق هو

النوع الشجري السائد على التلال الصخرية. تراوح مؤشر التنوع للمناطق البيئية المختلفة بين 0.15 - 1. جميع الأنواع لديها أكثر من مصدر واحد للتجديد الطبيعي، مثل العرد و الهجليج والكداد التي تتجدد بواسطة البذور والاخلاف والفسائل، أما الأنواع الأخرى لها مصدران للتجديد وهما البذور والاخلاف. حجم المخزون الخشبي 14.8 م<sup>3</sup>/هكتار بمعدل فقد سنوي 1.9 م<sup>3</sup>/هكتار، ونسبة الغطاء النباتي للمنطقة هو 17.96%. التجديد الطبيعي الموجود في المنطقة يحتاج إلى إداره بطريقة سليمة، ومن السيناريوهات المحتمله إدخال نهج الإدارة المستدامة للغابات. يصعب تحقيق جهود الحكومه في الحفاظ على الغابات الطبيعيه دون مشاركة المجتمعات المحلية، وبالتالي المشاركة المجتمعية في إدارة هذه الغابات الطبيعيه مهم للغاية. يوصي بان تضع الحكومه في الاعتبار تطوير وتنظيم السياسات و القوانين التي طبقت علي السكان المحليين في القطر. يوصي بإجراء مزيداً من البحوث في المنطقة في مجال الإدارة الفنية للغابات والتجديد الطبيعي مع الأخذ في الإعتبار الخبرات والتجارب لدول الساحل.

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## List of Abbreviations

Abbreviation	Non Abbreviation
AAB	Absolute abundance
AB	Abundance
ADB	African Development Bank
AFR	Absolute frequency
AFF	African Forest Forum
BA	Absolute dominance
<i>by-x</i>	Regression coefficient
°C	Degree Centigrade
CFT	Contemporary flood plain- Teraje
CPA	Clay plain – Abata
D	Simpson Diversity index
dph	Diameter at breast height
DRC	Danish Refuges Council
EC	European Commission
FAO	Food and Agriculture Organization of the United Nations
F.F	Form Factor
Fig.	Figure
FNC	Forest National Corporation
FR	Frequency
FRA	Forest Resources Assessments
GPS	Geographic Position System
Ha	Is a unit of area. One hectare is equivalent to 10000 square meters (m <sup>2</sup> )
HTS	Hunting Technical Services
IDPs	Internally Displaced persons
IVI	Importance value index
JMRDP	Jebel Marra Rural Development Project
LHA	Lower hill slope – Abata
LHT	Lower hill slope – Teraje
L.S	level of significant
LTA	Lower terraces – Abata
LTZ	Lower terraces – Zalingei
m <sup>2</sup>	Square meters
m <sup>3</sup>	Cubic meters
mm	Millimeter
MS	Moderate spread

Ns	Not spread
NS	Not Significant
RAB	Relative abundance
RBA	Relative dominance
RF	Rarely found
RFR	Relative frequency
S	Sorensen coefficient of similarity
SAS	Statistical Analysis System
SD	Standard deviation
SHT	Stony hill slope- Teraje
SHZ	Stony hill slope- Zalingei
SPA	Sedentary plain –Abata
SR	Survival Rate
<i>ssx</i>	Total sum of squares
UNEP	United Nations Environmental Programs
U of Z	University of Zalingei
UTT	Upper terraces –Teraje
UTZ	Upper terraces – Zalingei
VR	Very rarely found
Wadi	Seasonal water course, usually sand bedded
WS	Wide spread
$\chi^2$	Chi- square
Y1D	Survey in the dry seasons of first year
Y1W	Survey in the rainy seasons of first year
Y2D	Survey in the dry seasons of second year
Y2W	Survey in the rainy seasons of second year