ABSTRACT:
Observations were presented on the natural regeneration of woody species at the study area. The main objectives of this study were to examine: survival of newly recruited seedlings and saplings of woody species. Growth and survival of established plants. Populations of new seedlings were monitored throughout the study area. A total of 42 plots, with 10x10 m each, were studied. Natural regeneration of 10 woody species at the study area was recorded, with density ranging between 286–464 seedlings/ha. The natural rates of regeneration have been very slow due to intense biotic pressure (agricultural management practices, overgrazing, fuel wood and fodder). The most dominant regenerating species were Acacia tortilis subsp.spirocarpa and Acacia tortilis subsp.raddiana. The other woody species with poor regeneration were Balanites aegyptiaca, Acacia orefota, A.mellifera, Capparis decidua, A.seyal var. seyal, and Maerua crassifolia.

KEY WORDS: Acacia tortilis, Natural regeneration, Saplings, density, woody species.
INTRODUCTION

Natural regeneration is the process by which old trees and shrubs replace themselves without human intervention, Steward (2004). It usually refers to the process by which native species return to area of land that has been degraded. Natural regeneration arises from seeds and sprouting from shrubs or roots. Natural regeneration should occur as long as there is sufficient existing native biodiversity in the area. Certain pioneer species are most suited for a particular habitat. As time passes, the habitat will change and other species may replace the earlier pioneers. Kirkpatrick et al., (2000) reported that advantages of natural regeneration include good root development by native seedlings, less disturbance to soil ecology and reduced risk of soil erosion, low cost establishment, less labour and equipment and no problem of geographical origin of seeds. The disadvantages are: less control over initial stocking and spacing, generally lower commercial yield, no genetic improvement or the introduction of disease resistant stock, possible delays in regeneration due to drought or inadequate seeds and the possible need for precommercial thinning to ensure good growth. Many bush species regenerate primarily from resprouting rather than seeds.

Kirkpatrick et al (2000) counted the advantages of natural regeneration as: it occurs from plant material that is already present so it will be best suited to the environment and it will help to protect the genetic make-up of the bush on one's property and that it is effective in re-establishing or rehabilitating the bush on your property, particularly on large areas.

According to Kirkpatrick et al (2000) the causes of poor natural regeneration of woody species are: competition from grasses and other native species, heavy grazing, soil compaction by animals, and predation. The seeds of most forest trees germinate soon after reaching the ground and resulting in many seedlings.

Seydack et al (2000) defined the regeneration individuals as plants between 50cm and 1.5m. in height. Seedlings were identified as those individuals without any connection with an adult.

According to Mustafa (1997) rainfall plays a vital role in natural regeneration in the Sudan and that the density and occurrence of the trees
decreased northwards similar to pattern of rainfall. He also reported that the natural regeneration from seeds is successful on cleared forest sites and fallow land where the rainfall exceeds 600mm. It is difficult on sites that receive less than 600mm unless the seeds were ingested by animals or placed on-flow sites. There are some activities, such as cultivation, that may promote the natural regeneration of *Acacia seyal* dormant seeds in the top layers of the soil (Mustafa, 1997). Population growth of the rural communities and their search for subsistence income has led to massive deforestation. This is a problem and a threat to natural regeneration of the woody species in a rangeland area. This resulting in a very poor natural regeneration. The aim of this study is to assess the natural regeneration of woody species in a rangeland area.

**MATERIALS AND METHODS**

**MATERIALS:** Woody species of Um Rimmitta area, White Nile State, Sudan were identified and their regeneration was studied during the period (2003-2006).

**METHODS:**

Natural regeneration was determined at the three sites (A, B and C) at the study area. A number of 14 quadrats (10 x 10m.) for each site were studied. The woody species on six transects were identified and 42 (10 x 10 m) systematic quadrats along each transect were studied. The new seedlings of natural regeneration were counted for all the species/area. The inventory was done by using global positioning system (GPS) and 10x10m. quadrats to assess the wild seedlings/ha., based on Krebs, (1989). The species regeneration (R.S) was calculated as follows:

\[
R.S = \frac{\text{Number of saplings x ha}}{\text{Number of quadrats x quadrat area (m}^2)}
\]

**RESULTS AND DISCUSSION**

The results were presented in table (1) and the natural regeneration of the whole area was determined.

Table (1): Total number of seedlings at three sites (A, B and C) at the study area:
Total number of seedlings at site (A):
Natural regeneration was calculated as follows:

\[
\text{Total Number of seedlings} = \frac{\text{N.of quadrats \times area/m}^2}{1400} = 0.0464286 \text{ seedlings/m}^2
\]

\[
\text{S. /ha} = 0.0464286 \times 10000 = 464.3 \text{ seedlings/ha}.
\]

Total number of seedlings at site (B):

\[
\text{N.S. /m}^2 = \frac{40}{1400} = 0.0285714 \text{ seedlings/m}^2
\]

\[
\text{N.S. /ha} = 0.0285714 \times 1000 = 285.7 \text{ seedlings/ha}.
\]

Total number of seedlings at site (C):

\[
\text{N.S./m}^2 = \frac{72}{1400} = 0.0514285 \text{ seedlings/m}^2
\]

\[
\text{N.S./ha} = 0.0514285 \times 10000 = 514.3 \text{ seedlings/ha}.
\]

The natural regeneration of the whole study area =

\[
\frac{1264}{3} = 421 \text{ seedlings/ha}
\]
Fig. (14) Histogram showing natural regeneration of woody species at the study area.

**Where:**
A: *Acacia tortilis* subsp. *spirocarpa*.
B: *A. tortilis* subsp. *raddiana*.
C: *A. orefota*.
D: *Ziziphus spina-christi*
E: *Balanites aegyptiaca*.
F: *Leptadenia pyrotechnica*.
G: *Acacia nilotica* subsp. *nilotica*.
H: *A. seyal* var. *seyal*.
I: *A. mellifera*.
J: *Maerua crassifolia*

The results of natural regeneration showed that the most dominant naturally regenerating species were: *Acacia tortilis* subsp. *spirocarpa* and *Acacia tortilis* subsp. *raddiana*. These species have very large numbers of wild seedlings which indicates that they have high adaptability to site and adverse environmental conditions, besides tolerance to over-grazing. The other species e.g *Ziziphus spina-christi*, *Balanites aegyptiaca*, *Acacia orefota*, *Acacia mellifera*, *Capparis decidua*, *Acacia seyal* var. *seyal* and *Maerua crassifolia* showed small numbers of wild seedlings. This may be attributed to the small number of viable seeds and lack of resistance of these species to predators, adverse conditions and over-grazing. The present study
has found an average of 421 seedlings/ha for the woody species in the sites of the study area.
The autecology of *Acacia tortilis* subsp. *spirocarpa* and *Acacia tortilis* subsp. *raddiana* is generally similar, although *Acacia tortilis* subsp. *Spirocarpa* seems to be more tolerant to lack of moisture in the soil than *Acacia tortilis* subsp. *Spirocarpa*. It is found that the best growth of *Acacia tortilis* subsp. *spirocarpa* and *Acacia tortilis* subsp. *raddiana* occurs on khors, wadis and water courses.

**CONCLUSION:**

The advantages of the natural regeneration processes and applying a few silvicultural measures will lower conservation forestry costs (e.g. soil preparation, direct sowing and beating up).

**RECOMMENDATION**

It is recommended that further studies should be carried out for better understanding of the ecological processes within *Acacias* stands such as seed dispersal, predation and seedlings establishment, the influence of browsing and the effects of management practices.

**REFERENCES**


