Journal of Research in Forestry, Wildlife & Environment Vol. 16(2) June, 2024
E-mail: jrfwe2019@gmail.com; jfewr@yahoo.com
http://www.ajol.info/index.php/jrfwe

ISBN: 2141 – 1778
Lawal et al., 2024

DOES FOREST COVER TYPE AFFECT THE REGENERATION POTENTIAL OF TREE SPECIES? A CASE STUDY OF *Triplochiton scleroxylon* IN AKURE FOREST RESERVE

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ABSTRACT

This study assessed the successional status of Triplochiton scleroxylon using three selected land-cover types in Akure Forest Reserve. The study was carried out in Queen's plot, enrichment forest, and disturbed forest areas in Akure Forest Reserve, Ondo State. A systematic line transect was used for data collection. Two line transects at 150m apart were laid for each forest cover type. On each transect, four 50 m by 50 m plots were laid in an alternate direction. Eight plots were laid in each forest cover type. All the overstory trees, wildlings, and seedlings in each plot were counted and recorded. The findings showed that Queen's plot had good regeneration potential (seedlings > wildlings > overstory), enrichment forest had fair regeneration potential (seedlings > wildlings < overstory), while regeneration potential was poor in disturbed forest areas (seedling = 0, wildlings < overstory). Queen's plot presents a promising environment for regeneration, with numerous seedlings suggesting a thriving population. Satisfactory regeneration potential exists in the enrichment forest, whereas the disturbed forest area presents a situation of poor regeneration, highlighting the need for conservation measures.

Keywords: Enrichment Forest, Disturbed Forest, Regeneration Process, Indigenous Tree

Correct Citation of this Publication

Lawal, A., Adeyemi, O. and Jimoh, B. (2024). Does forest cover type affect the regeneration potential of tree species? A case study of *Triplochiton scleroxylon* in Akure forest reserve. *Journal of Research in Forestry, Wildlife & Environment*, 16(1): 62 - 67

INTRODUCTION

The fundamental prerequisite for ensuring the long-term survival of forests depends on an understanding of the regeneration process (Malik *et al*., 2016), and the ability of a plant community to regenerate in response to various environmental factors, such as climate, soil properties, disturbance patterns, and seed bank composition, is critical determinant of its sustainability. The significance of restoring and preserving species and ecosystems cannot be overstated, as the type and intensity of land use have a profound impact on the number of species present in different habitats, including arable land, forests, and plantations, all of which are affected by human activities (Chirwa and Adeyemi, 2019). Land use change is one of the most significant global drivers of biodiversity loss, as noted by Chapin *et al.* (2000). These land conversions are more intense in some countries than in others. For example, in Nigeria, the forest belt is heavily exploited, with vegetation degraded and reserved for agricultural use, industrial purposes, and urban development. According to Mansourian and Berrahmouni (2021), Nigeria has approximately 20,000 ha of primary forests and less than 10% forest cover. The decline in forest coverage is characterised by illegal logging of forest timber and inefficient government measures. Additionally, increased human activity contributes to a high rate of deforestation and forest degradation in the primary forests. This situation threatens the survival of the majority of significant tree species

due to the cutting of timber, the expansion of farming onto forestland, and the establishment of tree crop plantations (Olajuyigbe and Adaja, 2014). Additionally, many native tree species are adversely affected by illegal activities.

Triplochiton scleroxylon, also known as "Obeche or Arere" in Yoruba, Nigeria, is a significant African tropical tree both environmentally and economically, with approximately 38,000 m^3 traded annually, as reported by the International Tropical Timber Organization (ITTO, 2015). Veenendaal *et al.* (1996) reported that the pioneer species *T. scleroxylon* is usually found in secondary forests, woodlands, and farmlands. This tree is known for its unpredictable fruiting and flowering, as described by Newton *et al*. (1998). Seed germination for pioneer species such as *T. scleroxylon* occurs in the openings in the canopies of the forest and open forest regions, whereas non-pioneer species primarily benefit from the shade provided by the forest. Although *T. scleroxylon* populations do not decline rapidly once forest vegetation has taken hold, they are adaptable to colonising secondary forests and degraded areas (Hall and Bada, 1979). The tree can easily colonise open spaces and regenerate for a while in early successional forests, but it frequently fails to do so when disturbed by humans in both logged and unlogged forests, as noted by Karsenty and Gourlet-Fleury (2006).

Triplochiton scleroxylon faces growing threats from various human sources. It is listed as an endangered species in the International Union for Conservation of Nature (IUCN) catalogue of threatened species in Nigeria (Oni, 2018). This plant species is commercially utilised for construction, panelling, carvings, mouldings, block boards, furniture components, and shoe heels (Wunder, 2003). The increasing demand for durable wood species has led to a surge in illegal exploitation of protected area, which has contributed to the decline in the population of Obeche in the Akure forest reserve. The aim of this study was to determine the successional status of *Triplochiton scleroxylon* k. Schum in selected land cover types in Akure forest reserve, Ondo State, Nigeria. This will help to examine the regeneration potential of *T. scleroxylon* in the reserve and similar reserves.

MATERIALS AND METHODS

The Queen's Plot, a strict nature reserve established in 1948, spans 32 ha in Akure Forest Reserve within Ondo State. Located between longitudes 5°1'48"E and 5°3'42"E and latitudes 7°13'47"N and 7°17'45.6"N, the terrain is mildly undulating with an elevation of 229 m above sea level. Ferric luvisol soils, prevalent in southwestern Nigeria, are also present in the Queen's plot. The climate is characterised by humid and tropical weather, with seasonal variations. August is the driest period, while the mean annual rainfall is approximately 4000 mm, peaking in July and September. The dry season lasts from December to February, with January and February being the driest months. July and September have the lowest relative humidity readings at about 81% and 44%, respectively. The temperature ranges between 20.6ºC and 33.5ºC, allowing for the growth of tropical rainforests due to the area's favourable climate.

The Enrichment Forest, covering 5 ha, is situated within Akure forest reserve at N07º.26'45" latitude and E0050.036'75" longitude (see Figure 1). This area was once impacted by human activities such as timber logging and illegal felling. In 2004, a portion of the forest reserve was set aside for regeneration purposes. The Enrichment Forest Initiative, overseen by the Federal Government of Nigeria, aimed to restore the forest by planting regenerative trees. The Forestry Research Institute of Nigeria has been responsible for forest care and protection since its launch. The disturbed portion of Akure Forest Reserve, measuring 39,963 ha, is located at latitude N07º.265'11" and longitude E0050.039'17" (see Figure 1). Anthropogenic activities, such as farming, tree harvesting, fuelwood collection, and hunting for wild animals have been previously carried out in this area.

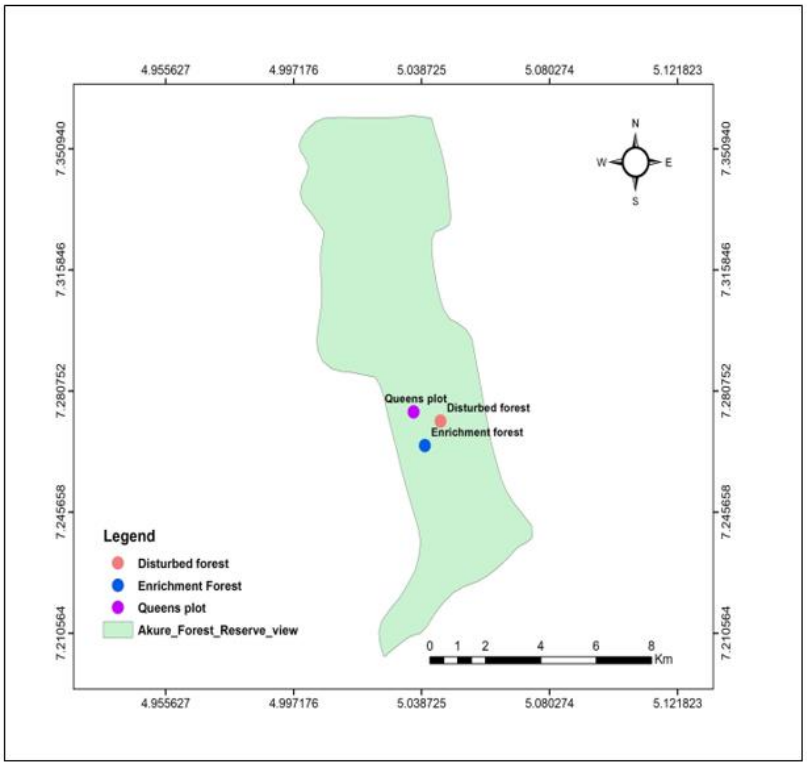

Fig. 1. Map of Akure Forest Reserve showing the sample sites

A systematic line-transect method was employed to gather the required data. To ensure comprehensive coverage, two line transects were set up in each type of forest cover, with a distance of 150 m between them. On each transect, four plots measuring 50 m by 50 m were established, spaced 100 m apart from one another in alternating directions. This resulted in eight plots per forest cover type. Within each plot, every Obeche tree with a diameter at breast height (Dbh) equal to or greater than 10 cm was carefully measured and documented. Additionally, the number of wildlings (with a Dbh between 5 and 10 cm) and seedlings (with a Dbh less than 5 cm) were counted and recorded.

RESULTS

Successional status of *Triplochiton scleroxylon* in Queen's plot: *Triplochiton scleroxylon*, also known as the African whitewood, possesses a favourable successional status. This was demonstrated by the higher occurrence of seedlings compared to wildlings and the overstory, as shown in Figure 3. The frequency of young plants emerging from seeds was higher, indicating a promising trend for the continued growth and development of this species.

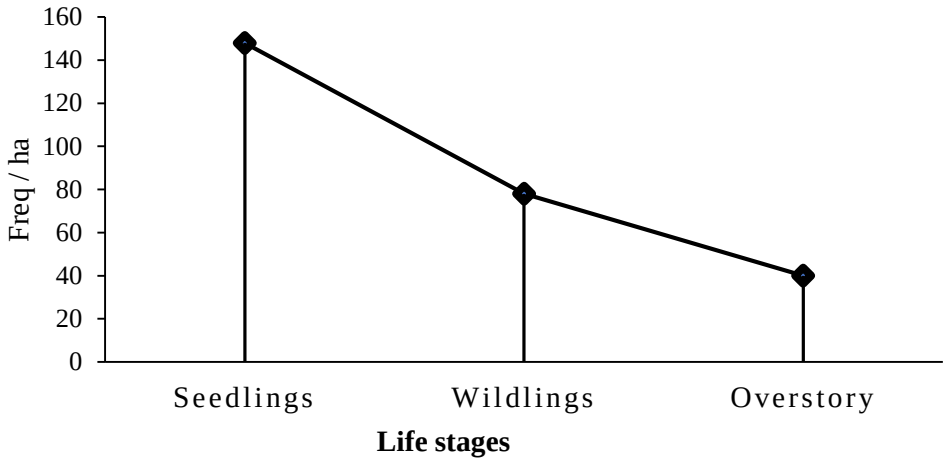

Figure 1: Successional status for *Triplochiton scleroxylon* in Queen's plot, Akure forest reserve

Successional status of *Triplochiton scleroxylon* in the enrichment forest area: *T. scleroxylon* exhibits a promising ability to regenerate naturally. This is evident from the fact that the number of seedlings produced surpasses that of wildlings, which are trees of the same species that grow in the wild. Interestingly, in the enrichment forest, when comparing the two groups, it became apparent that the frequency of mature trees in the canopy layer, known as the overstory, was higher among the wildlings (Figure 4).

Successional status of *Triplochiton scleroxylon* in disturbed forest area: This species has been observed to endure solely in the form of wildlings and during the overstory stages within the disturbed forest area of the Akure forest reserve, as depicted in Figure 5.

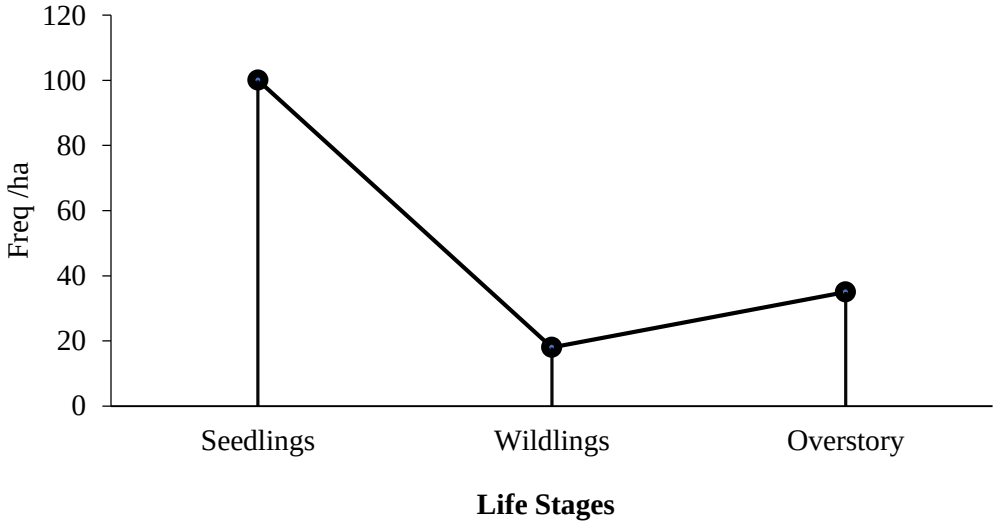

Figure 2: Successional status for *Triplochiton scleroxylon* in enrichment forest, Akure forest reserve.

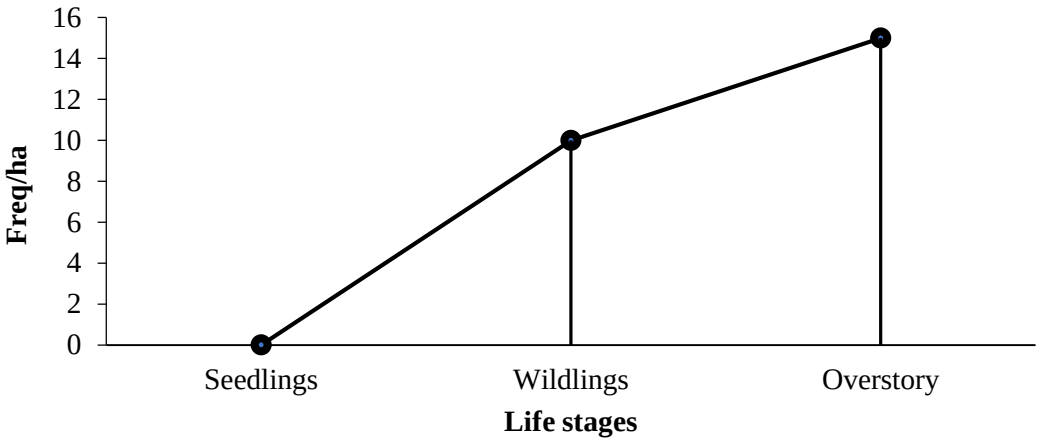

Figure 3: Successional status for *Triplochiton scleroxylon* in the disturbed forest area

DISCUSSION

Forest regeneration is a vital process that involves the growth and renewal of forests. Two primary methods are used to achieve this goal: natural and artificial regeneration. Natural regeneration is often preferred, because it has the ability to regenerate on its own, with a significant number of seedlings taking root. Some of these seedlings eventually developed into mature trees, which helped establish a young forest. The process of natural regeneration takes several years and is influenced by a range of factors, including the environment and human activities. The survival of a plant community depends largely on its ability to regenerate under different environmental conditions, such as climate, soil characteristics, disturbance patterns, and seed bank composition. Successful forest regeneration is critical for the long-term health and sustainability of ecosystems. To evaluate regeneration status, we examined the populations of seedlings, saplings, and mature trees. Bhuyan *et al.* (2003) provided guidelines for assessing regeneration, which can be further classified as follows.

i. Good regeneration indicates a healthy state with an abundance of seedlings, followed by wildlings, and finally overstory trees.
ii. Fair regeneration: suggests a moderate state with an adequate number of seedlings, either greater than or equal to the number of wildlings and adults.
iii. Poor regeneration: This indicates a challenging situation where the species only survives as saplings, with no seedlings present (although wildlings may be equal to or greater than adult trees).
iv. Not regenerating: denotes a state in which the species is only found in its adult stage, showing no signs of successful regeneration.

By considering these classifications, we can gain insights into the health and potential sustainability of a species within a given forest. In this study, *T. scleroxylon* was found to possess good regeneration potential in Queen's plot, which can be attributed to the area being a Strict Nature Reserve (SNR). This conclusion is supported by the findings of Adekunle *et al*. (2013), who emphasised the importance of SNRs in the in situ conservation of biodiversity not only in Nigeria but also globally. The fair regeneration potential observed in the enriched forest land can be attributed to the type of forest, as it is called an enrichment forest, which means that the area was previously depleted of trees due to human activities before being converted back into an enrichment forest. In contrast, the poor regeneration potential in the disturbed forest area could be due to the absence of seedlings, which could be attributed to human activities in the forest. This observation aligns with previous research, which stated that the regeneration of various species in undisturbed forest estates is generally richer and faster than that in disturbed forest estates (Kimaro and Lualandala, 2013).

CONCLUSION

This study provides foundational information about the succession status of *Triplochiton scleroxylon* in Queen's plot, enrichment forest, and the disturbed portion of Akure forest reserve. The capacity of *T. scleroxylon* to regenerate varied significantly across different forest cover types within the reserve. Queen's plots have emerged as a promising environment for regeneration, with a large number of seedlings indicating a thriving population. In the enrichment forest, the regeneration potential was deemed satisfactory, whereas the disturbed forest area presented a worrying scenario with poor regeneration, suggesting the need for conservation measures.

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