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School Tree Planting with Terminalia Mantaly H. Perrier in Lunda Sul, Angola: Survival of 336 Individuals in 8 Schools and Contribution to the 30% Target of the Un 3-30-300 Rule.

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Abstract
Introduction: School afforestation in Miombo phytogeographic domain is strategic for environmental health and 30% canopy target of UN 3-30-300 rule (Konijnendijk, 2023). Terminalia mantaly H. Perrier is widely planted in Saurimo. Objective: To assess survival of 354 Terminalia mantaly in 8 public schools Lunda Sul, Angola, 2025. Methods: Retrospective observational study, planting 23/01/2025 and 13/12/2025. Survival=(alive/planted)x100, mortality=(dead/planted)x100. Results: 354 planted, 336 alive=94.92% global survival, 5.08% global mortality. Special School: 16 planted, 14 alive, 2 dead=87.5% survival, 12.5% mortality. Total deaths=14. Of these 14.7 (50.0%) due to accidental cutting during weeding due to lack of gardener. Mature canopy projection 12,936 m² (1.29 ha) for 336 trees, reaching 38.5% cover in 5,000 m² schoolyards with 50 trees >30% target. Conclusion: Schools effective refuges in Miombo >90% survival, contributing to 30% target of 3-30-300 rule.

Summary

Introduction: School tree planting in the Miombo phytogeographic domain is strategic for environmental health and for the 30% tree cover target of the United Nations (UN) 3-30-300 rule (Konijnendijk, 2023). The exotic species Terminalia mantaly H. Perrier, with a stratified crown, is widely used in Cassengo, Lunda Sul, due to its adaptation to the climate and aesthetic value. **Objective:** To evaluate the survival rate of 324 Terminalia mantaly individuals planted in 8 public schools in Lunda Sul, Angola, in 2025, and to estimate their contribution to the 30% target of the 3-30-300 rule. **Methods:** Retrospective observational study. Planting took place between January 23, 2025, and December 13, 2025, in 8 public schools in Cassengo. The seedlings were produced by the author and planted with a spacing of 10 m. The survival rate was calculated by (N alive / N planted) x100. The loss rate per school was calculated by (N lost / N planted) x100. The causes of mortality were determined by direct observation. The current and projected coverage at maturity (7 m diameter canopy, 38.5 m²/tree) was estimated. **Results:** 354 individuals were planted, of which 336 were alive in the September 2026 inventory, corresponding to 94.92% overall survival and 5.08% overall mortality. By school: Daniel José Saquinda Kawazanga School 100% (29/29, 0 losses, 0% mortality), Special School 87.5% (14/16, 2 losses, 12.5% school mortality), Mulombe School 100% (5/5, 0 losses), INE - Magistério Nº1 Amor do Povo School 100% (100/100, 0 losses), Caimbo Kambuanji Sameneca School Complex 94.7% (90/95, 5 losses, 5.3% mortality), Caminhoto College (Maria de Lurdes) 82.7% (24/29, 5 losses, 17.2% mortality), João Quimbanda School Complex 96.0% (48/50, 2 losses, 4.0% mortality), 4 de Abril School 86.7% (26/30, 4 losses, 13.3% mortality) (mortality). The total losses across the 8 schools was 18 individuals. Of these 18 losses, 7 (38.9%) were due to accidental cutting during grass cutting due to the absence of a gardener, 4 (22.2%) due to lack of maintenance, 2 (11.11%) due to school construction, and 1 (7.1%) unidentified. The Special School contributed 2 losses due to accidental cutting, representing 11.11% of the 18 total losses. The projected coverage at maturity is 12,936 m² (1.29 ha) for 336 trees, allowing for 38.5% coverage in schoolyards of 5,000 m² with 50 trees, exceeding the 30% target. **Conclusion:** Schools constitute effective refuges for T. mantaly in Miombo, with survival rates exceeding 90%, directly contributing to the 30% target of the 3-30-300 rule, mitigating heat islands, and promoting school environmental health. The absence of a gardener is the main modifiable risk factor. Hiring a gardener, marking seedlings, and watering during the dry season are recommended.

Summary

Introduction: School afforestation in Miombo strategic to target 30% UN 3-30-300 regulation. Objective: Evaluate survival of 354 Terminalia mantaly in 8 schools Lunda Sul 2025. Methods:

Retrospective, planting 01/23/2025 and 12/13/2025. Results: 354 planted, 336 alive = 94.92% survival. Special School: 16 planted, 14 alive, 2 dead = 87.5% survival, 12.5% mortality. Total deaths=18. Of these, 4 (22.22%) were due to accidental cutting due to a yard fault. Conclusion: Efficient Miombo refuge schools >90% survive, exceeding 30% target.

I. Introduction

The province of Lunda Sul is located in the Miombo phytogeographic domain, characterized by a prolonged dry season from May to August, ferralitic soils, and wooded savanna vegetation. The city of Saurimo, the provincial capital, faces environmental health challenges associated with alluvial diamond mining dust, heat islands, and low school tree cover, impacting the well-being and cognitive performance of students (Chiteculo et al., 2023; De Cauwer et al., 2024). The 3-30-300 rule proposed by Konijnendijk (2023) establishes that each citizen should see 3 trees from their home, live in a neighborhood with 30% tree cover, and be within 300 m of a quality green space. For schools in Lunda Sul, the 30% coverage target is particularly relevant for reducing radiant heat, filtering dust, and improving school performance, as recommended by the World Health Organization (WHO, 2023) and FAO (2024). Terminalia mantaly H. Perrier (Combretaceae) is an exotic species from Madagascar

widely planted in Angola due to its horizontally tiered canopy, rapid growth, drought tolerance, and ornamental value. Despite being exotic, it shows good adaptation to Miombo and is accepted by school communities, being an alternative to slow-growing native species. However, survival data in school settings in Angolan Miombo are lacking. This study, developed within the scope of the Master's Program in Public Health with a Specialization in Environmental Health at FUNIBER / Universidad Iberoamericana del Atlántico, presents a retrospective inventory of 356 individuals planted in 8 public schools in Saurimo in 2025, with the objective of evaluating survival and estimating contribution to the 30% target of the 3-30-300 rule.

II. Materials and Methods

2.1 Study Area: 8 public schools in the municipality of Cassengo, Lunda Sul, Angola (9°39'S, 20°23'E), located within the Miombo phytogeographic domain. Humid tropical climate with a marked dry season. Ferralitic soil. The schools are: Daniel José Saquinda Kawazanga, Escola Especial, Escola do Mulombe, INE - Amor do Povo, Caimbo Kambuanji Sameneca, Caminhoto, João Quimbanda and Escola de Abril. 2.2 Design: Retrospective observational study of planting inventory, based on primary records of the author between 23/01/2025 and 13/12/2025. 2.3 Planting: Between 23/01/2025 and 13/12/2025, 354 individuals of T. mantaly, produced by the author in a local nursery in Cassengo, with an average height of 20-50 cm at the time of planting, were planted. Planting holes measuring 40x40x40 cm, spaced 10 m apart, without chemical fertilization. Manual watering after planting, then dependent on rainfall. All expenses were borne by the author, without external funding. 2.4 Survey: In September 2026, a survival census (alive/lost) was carried out with direct counting. Cause of mortality by direct observation on site. Observations were recorded regarding the absence of a gardener, ongoing works, and grass cutting.

2.5 Analysis: Overall survival rate and per school: (N alive / N planted) x100. Loss rate per school: (N lost / N planted) x100. Distribution of causes of mortality over total losses: (n cause / total losses) x100. Current coverage estimated by $\pi*(d/2)^2$, with d=1.2 m current (1.13 m²/tree) ed=7 m at maturity (38.5 m²/tree) according to Mbalmay et al. (2024). 2.6 Ethical aspects: Authorization from the management of the 8 schools. No sensitive human data.

III. Results

In 2025, 354 Terminalia mantaly plants were planted in 8 public schools in Lunda Sul. In the September 2026 inventory, 336 plants were still alive, corresponding to a 94.92% overall survival rate and a 5.8% overall mortality rate (18 losses).

Table 1. Planting and survival of Terminalia mantaly in 8 public schools in Lunda Sul, Angola (2025).

anting date	School	Planting	ong live	Losses	Survival	School loss
23/01/2025	Daniel José Saquinda Kawazanga	29	29	0	100% (29/29)	0% (0/29)
30/09/2025	Special School	16	14	2	87.5% (14/16)	12.5% (2/16) - construction, without gardener
25/10/2025	Mulombe School	5	5	0	100% (5/5)	0%
08/11/2025	INE Love of the People	100	100	0	100% (100/100)	0%
15/11/2025	Caimbo Kambuanji	95	90	5	94.7% (90/95)	5.3% (5/95)
20/11/2025	Caminhoto	29	24	5	82.7% (24/29)	17.2% (5/29)
22/11/2025	John Quimbanda	50	48	2	96.0% (48/50)	4.0% (2/50)
13/12/2025	April 4th School	30	26	4	86.7% (26/30)	13.3% (4/30)
TOTAL	8 Schools	354	336	18	94.92% (336/354)	5.08% (18/354)

Source: The author, research data, Cassengo 2025

Table 2. Causes of mortality out of a total of 18 deaths across 8 schools.

Causes loss	n losses	% on 18 losses	Schools / factor
accidental grass cutting	7	50.0% (7/14)	Special 2 + Caimbo 2 + Caminhoto 3 - gardener absent
Gardener/maintenance needed.	4	28.6% (4/14)	Special + Caimbo
Work/construction	2	14.3% (2/14)	Special School
Not identified	1	7.1% (1/14)	John Quimbanda
Accidental burning of school waste	4	13.3% (4/30)	School $ of April
TOTAL	18	100%	8 schools

Source: The author, research data, Cassengo 2025

Table 3. Estimated tree cover and contribution to the 30% target of the UN 3-30-300 rule.

Parameter	ırrent value 2025-2026	Value at crown maturity 7 m
N living trees	336	336 = 38.5 m²/tree
Total area of the canopy	~350 m²	12,936 m²=1.29 ha (12,936 m² with 336)
School with 5,000 m² and 50 trees.	1.1% coverage	38.5% coverage > target 30% UN

Source: The author, research data, Cassengo 2025

IV. Discussion

The overall survival rate of 94.92% (336/354) in 8 schools is higher than the average reported for urban tree planting in Africa (70-85%) (FAO, 2024; De Cauwer et al., 2024) and for *T. mantaly* in Madagascar (88%) and Cameroon (85%) (Razanajatovo et al., 2022; Mbalmay et al., 2024). This confirms that schools are effective refuges in the Miombo forest, with initial watering and social

monitoring, even without external funding, with all expenses borne by the author. The Special School illustrates the importance of methodological clarity: 16 planted, 14 alive, 2 losses = 87.5% survival and 12.5% mortality of the school (2/18). These 2 losses represent 11.11% of the 18 total losses in the study (2/18). The 50.0% refers to the distribution of causes: 7 losses due to accidental cutting during grass cutting out of 18 total losses (7/18), distributed by Special School (2), Caimbo
(2) and Caminhoto (3), April 4th School (4). The main cause of mortality was accidental cutting during grass cutting (22.22% of the 18 losses), associated with the absence of a gardener, a factor already described in Mozambique and Zambia (Dewees et al., 2021). The Special School, under construction, without a gardener, with tall grass, had small seedlings accidentally cut. The April 4th School had losses of approximately 13.3% (4/30), due to the burning of school waste. The hiring or designation of a responsible person, at low cost, and the marking of seedlings with colored stakes, as well as the controlled burning of waste, are measures recommended by the FAO (2024) and can prevent 50% of the losses. The projected canopy coverage of 1.29 ha at maturity for 336 trees (12,936 m² for 336) demonstrates that the 30% target of the 3-30-300 rule is achievable in a school context. A school with a 5,000 m² courtyard and 50 trees with 7 m canopies achieves 38.5% coverage, exceeding the 30% target, with benefits for mental health, a 2-4°C reduction in radiant temperature, retention of diamond mining dust, and improved school well-being, aligned with SDGs 3, 11, and 15 (WHO, 2023; Pereira et al., 2022).

V. Conclusion

In 2025, 356 Terminalia mantaly specimens were planted in 8 schools in Lunda Sul, with 336 surviving specimens, corresponding to a 94.92% overall survival rate and a 5.08% overall mortality rate. The Special School had 16 planted specimens, 14 surviving specimens, and 2 losses, corresponding to an 87.5% survival rate and a 12.5% loss rate; the total losses in the 8 schools was 18 specimens, with 7 (50.0%) due to accidental cutting during grass cutting due to the absence of a gardener. The schools constitute effective refuges for T. mantaly in Miombo, contributing significantly to the 30% target of the 3-30-300 rule, achieving 38.5% coverage in 5,000 m² courtyards with 50 trees; it is recommended to hire or designate a gardener, mark the seedlings with colored stakes, water them weekly during the dry season, and properly manage school waste.

Statements

Financing: The production of seedlings and their planting took place without any funding; all expenses were borne by the author.

Conflict of interest: The author declares no conflict of interest.

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Attachments

Fig. 1 Seedling production grounds



Fig. 2 Planting on school



Source: The author, research data, Cassengo 2025

Fig. 3 Student participation in the irrigation process



Fig. 4 Protective barrier created by students



Fig. 5 Growing specimen



Fig. 6 Specimen planted on the same day (+ 3 m)
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Source: The author, research data, Cassengo 2025