RCMOS – Multidisciplinary Scientific Journal The Knowledge.
ISSN: 2675-9128. São Paulo-SP.

**Year V, v.2 2025 | Submission: 01/11/2025 | Accepted: 03/11/2025 | Publication: 05/11/2025**

**What is the reason for the disappearance of cashew trees in Soyo?**

*What is the reason for the disappearance of cashew trees in Soyo?*

**João Zombo -** PhD candidate in Education at Genesys International Higher Education/USA. Master's degree in Geological and Mineralogical Sciences. Bachelor's degree in Engineering Hydrogeology from the Azerbaijan State University. University Professor at the Soyo Higher Polytechnic Institute, teaching Mathematical Analysis, General Mathematics, and Elementary Mathematics. Contact phone number: 924410018, Soyo Higher Polytechnic Institute

Email: joaozombo8@gmail.com

**Mpiangu António Marciano -** PhD candidate in Education at Genesys International Higher Education/USA. Master's degree in Educational Sciences from the IBRO-American University Foundation; Bachelor's degree in Educational Sciences with a specialization in Mathematics from the Higher Institute of Educational Sciences of Uíge; University Professor at the Higher Polytechnic Institute of Soyo, teaching General Mathematics and Mathematical Methodology; Telephone contact: 924426083. Higher Polytechnic Institute of Soyo

Email: mpiangum20111@gmail.com

**Summary**

This study analyzes the causes of cashew tree disappearance in Soyo, pointing to oil pollution – resulting from oil spills and toxic emissions from exploration companies – as the main factor. This pollution compromises soil fertility and drastically reduces productivity, with losses of up to 80% in some coastal areas. Climatic factors, such as long periods of drought, water stress, and the end of the productive cycle of old plantations, exacerbate the decline of the trees, hindering the formation of flowers and fruits. The research was based on interviews with affected farmers, environmentalists, and local authorities, as well as the analysis of agricultural production data and soil contamination tests. Added to this picture are the lack of systematic renewal of cultivated areas, urban expansion that fragments properties, desertification of rural areas, and insufficient technical and financial support provided to producers, which limits access to improved seedlings and sustainable management practices. To reverse this process, it is recommended to decontaminate the soil using phytoremediation techniques and chemical washes, introduce seedlings genetically adapted to stress conditions, implement agroecological management programs, and create lines of credit and technical assistance dedicated to cashew farming. Public incentive policies and partnerships between the government, the oil sector, research institutes, and farmers' cooperatives are fundamental to restoring productivity, recovering degraded areas, and ensuring the sustainability of cashew farming in Soyo. The success of these initiatives will depend on continuous monitoring, as well as raising awareness among the communities.

**Keywords:** Oil pollution, Water stress, Production cycle, Crop renewal, Incentive policies

**Abstract**

This study examines the causes behind the disappearance of cashew trees in Soyo, identifying petroleum pollution—stemming from oil spills and toxic emissions by exploration companies—as the primary factor. This contamination undermines soil fertility and drastically reduces productivity, with losses reaching up to 80% in some coastal areas. Climatic stresses, such as prolonged droughts, water scarcity, and the end of the productive cycle of older orchards, further exacerbate tree decline by hampering flower and fruit development. The research is based on interviews with affected farmers, environmentalists, and local authorities, as well as on analyzes of agricultural production data and soil contamination tests. This situation is compounded by the lack of systematic renewal of cultivation areas, urban expansion that fragments landholdings, the desertification of rural zones, and insufficient technical and financial support for producers, which limits their access to improved seedlings and sustainable management practices. To reverse this trend, it is recommended to

RCMOS – Multidisciplinary Scientific Journal The Knowledge.
ISSN: 2675-9128. São Paulo-SP.

**Year V, v.2 2025 | Submission: 01/11/2025 | Accepted: 03/11/2025 | Publication: 05/11/2025**
decontaminate soils using phytoremediation techniques and chemical flushing, introduce genetically adapted seeds tolerant to stress conditions, implement agroecological management programs, and establish dedicated credit lines and technical assistance for cashew cultivation. Public incentive policies and partnerships among government bodies, the petroleum sector, research institutes, and farmer cooperatives are essential to restore productivity, rehabilitate degraded areas, and ensure the sustainability of cashew farming in Soyo. The success of these initiatives will depend on continuous monitoring and community engagement.

**Keywords:** Petroleum pollution; water stress; Production cycle; Cultivation renewal; incentive policies.

## Introduction

The cashew tree (Anacardium occidentale L.) plays a central role in the rural economy of numerous In tropical regions, providing income and food for thousands of small producers. In Soyo, Angolan municipality traditionally associated with cashew cultivation, the once abundant presence of these The trees have been suffering an alarming decline. Despite the socioeconomic importance of the cashew tree to the The local community shows clear signs of a decline in planted areas, a phenomenon that has been little explored by... Literature to date.

This imbalance draws attention to potential threats to cultivation and ways of life. dependent on it. Empirical records point to the impacts of oil spills and toxic emissions. the impact of the oil industry on soil quality, compounded by prolonged periods of drought and depletion of the vigor of old orchards. Concomitantly, accelerated urbanization and lack of Technical and financial support exacerbates the sector's fragility, highlighting gaps in planning and in... environmental management.

This article aims to fill this gap by identifying and quantifying the main... Factors that explain the disappearance of cashew trees in Soyo. Based on data collection. agricultural studies, soil contamination tests, and interviews with farmers, environmentalists, and managers. In the public sphere, we seek to understand the interactions between pollution, climate, and management practices.

Finally, we will discuss strategies for recovering cashew farming, combining techniques of Soil remediation, seedling renewal, and public incentive policies. The expectation is to offer subsidies for the formulation of integrated actions that ensure the restoration of productivity and Environmental sustainability in Soyo.

## Theoretical Framework

### Oil pollution and soil contamination

The literature on contamination of agricultural ecosystems demonstrates that hydrocarbons Contaminants resulting from spills and toxic emissions alter the physical and chemical structure of the soil, reducing its... Porosity, water retention capacity, and nutrient availability. In the cashew orchards of Soyo, this... Pollution acts as a chronic stressor, generating an accumulation of toxic compounds that inhibit processes.

RCMOS – Multidisciplinary Scientific Journal The Knowledge.
ISSN: 2675-9128. São Paulo-SP.

**Year V, v.2 2025 | Submission: 01/11/2025 | Accepted: 03/11/2025 | Publication: 05/11/2025**

They disrupt basic nutrient cycling and hinder root development.

**1. Phytoremediation as a recovery strategy**

Phytoremediation is based on the ability of certain plants and microorganisms to metabolize, stabilize, or extract pollutants from the soil. Studies indicate that species adapted to tropical regions can be used to degrade petroleum compounds at depths of up to 50 cm, promoting the gradual restoration of fertility and enabling the replanting of sensitive crops, such as cashew trees.

**2. Water stress and cashew tree physiology**

The cashew tree (Anacardium occidentale L.) requires well-defined rainfall patterns — ideally 800–1,500 mm/year distributed over 5–7 months — and soils with good water retention capacity and efficient drainage [8 ]. Under conditions of prolonged drought, leaf loss, reduced photosynthesis and interruption of the reproductive cycle occur, factors which, added to pollution, intensify the decline of orchards.

**3. Production cycle, senescence and crop renewal**

Every sustainable agricultural system must consider the natural senescence phase of plants. The common cashew tree begins flowering only at 3–5 years of age and stabilizes production after 8 years, while early-maturing dwarf varieties flower as early as 18 months. The absence of planned seedling renewal accelerates the aging of the orchard and exacerbates the decline in productivity.

**4. Land use fragmentation and urbanization**

Landscape and land use theories indicate that urban expansion fragments agricultural areas, reducing ecological corridors and exacerbating adverse microclimates. In Soyo, the conversion of cashew plantation areas into residential or industrial zones contributes to the loss of soil connectivity and hinders the adoption of integrated management practices.

**5. Technical and financial support and rural extension**

Models for the diffusion of innovations in agriculture emphasize the role of extension services in strengthening production systems. The lack of rural credit, continuous technical assistance, and training occupies a central position in the literature on the abandonment of perennial crops in tropical regions, as it limits access to quality seedlings, adequate inputs, and conservation practices.

**6. Integrated approach to sustainability**

The paradigm of agroecological sustainability proposes the articulation between environmental remediation, adaptive management, and public policies of incentive. In this context, the restoration of cashew plantations in Soyo demands a holistic vision that combines soil recovery technologies, genetic renewal, climate monitoring, and institutional strengthening to ensure long-term productivity and resilience.

## 1. Materials and Methods

### 1. Study area

The study was conducted in the municipality of Soyo (6°06ÿS, 12°23ÿE), in the province of Zaire, Angola, encompassing coastal and inland areas where the largest cashew orchards have historically been concentrated. The climate is humid tropical, with an average annual rainfall between 800 and 1200 mm, and a dry season from May to October.

### 2. Collection of environmental and agricultural data

Soil sampling: composite samples were collected in each of the five main cashew-growing regions of Soyo.

**Year V, v.2 2025 | Submission: 01/11/2025 | Accepted: 03/11/2025 | Publication: 05/11/2025**

From 0–20 cm and 20–40 cm deep, in triplicate, under productive, senescent or dead trees.

Contamination analyses: samples were subjected to gas chromatography coupled with mass spectrometry (GC-MS) for quantification of total petroleum hydrocarbons (TPH) and polycyclic aromatic compounds (PAHs).

Soil fertility: determination of pH, organic matter, total nitrogen, available phosphorus and cation exchange capacity, according to the methods of Johnson & Ulrich (1959).

**3. Collection of socioeconomic information**

Semi-structured interviews: with 45 farmers selected by purposive sampling (15 from each orchard situation – productive, declining, abandoned), in addition to 10 public managers and 5 environmentalists.
The interviews focused on perceptions regarding soil quality, management practices, technical support, and the history of oil spills.
–Secondary data: annual cashew nut production, years of planting and seedling reapplication, obtained from the Municipal Department of Agriculture (2018–2023).

**4. Spatial analysis**

Geotechnologies: Landsat 8 images (2013–2023) were processed in QGIS to map land use changes and fragmentation of cashew plantations; calculation of vegetation indices (NDVI) allowed for the evaluation of the vigor of tree formations.

**5. Data processing and analysis**

Descriptive and inferential statistics: using R 4.2.0, Pearson correlations between contaminant levels and yield were tested; ANOVA compared soil attributes between orchard categories.
– Qualitative analysis: the interviews were transcribed and coded in NVivo 12, using a thematic content analysis approach to identify perceived factors of decline.

**6. Ethical aspects**

The study received approval from the Local Agricultural Research Council, and all participants signed a free and informed consent form, guaranteeing anonymity and confidentiality.

## Results and discussion

## 4. Results

### 4.1 Soil contamination

GC-MS findings revealed average total hydrocarbon concentrations of oil (HTP) of 2,300 mg·kg$^{-1}$ at the 0–20 cm horizon and 1,150 mg·kg$^{-1}$ at 20–40 cm, values 11–23 times higher than the safety limit recommended by the FAO (100 mg·kg$^{-1}$). Compounds Polycyclic aromatic hydrocarbons (PAHs) totaled an average of 320 µg·kg$^{-1}$ in the first horizon, indicating Chronic pollution and relative penetration along the soil profile.

### 4.2 Decline in productivity

Municipal production data indicates that the average chestnut productivity has fallen from 650 kg·ha$^{-1}$ in 2018 to 120 kg·ha$^{-1}$ in 2023 – a decrease of 81.5%. The correlation analysis of

RCMOS – Multidisciplinary Scientific Journal The Knowledge.
ISSN: 2675-9128. São Paulo-SP.

**Year V, v.2 2025 | Submission: 01/11/2025 | Accepted: 03/11/2025 | Publication: 05/11/2025**

Pearson showed a strong negative association between HTP levels and performance ($r = -0.76$; $p < 0.01$). corroborating the toxic effect of polluted soil on the productive capacity of cashew trees.

### 4.3 Vegetation and land use indices

NDVI mappings extracted from Landsat 8 images between 2013 and 2023 indicated a reduction. The average plant vigor decreased from 0.68 to 0.34 (a 50% decline). Land use classification revealed... that 42% of the area originally occupied by cashew orchards has been converted into urban or industrial zones. during the same period.

### 4.4 Perception and support for producers

Of the 45 interviews, 87% of farmers reported productivity losses linked to spills. oil spills; 74% cited long periods of drought as an aggravating factor. Only 18% renewed their oil. orchards in the last five years, while only 26% reported having received technical assistance. or suitable lines of credit.

## Discussion

### 5.1 Roles of pollution and water stress

The sharp decline in productivity correlated with high HTP confirms the central role of Oil pollution contributes to soil degradation and the blockage of nutrient absorption, intensified by... prolonged water stress conditions. The combination of these factors creates a double stress that This prevents the cashew tree from producing fruit normally.

### 5.2 Aging orchards and lack of renewal

The scarce practice of agricultural renewal (only 18% of producers) intensifies the effect of Senescence of the oldest cashew trees. Without systematic replanting, the exhausted plantations will not... They resist environmental stress, exacerbating the collapse of local cashew farming.

### 5.3 Fragmentation and institutional support

The conversion of 42% of the cashew plantation area to urban/industrial use not only reduces the extent Continuous orchard management alters the microclimate and hinders integrated management programs. Insufficient technical and financial assistance limits access to improved seedlings and practices. phytoremediation, creating a cycle of low resilience.

RCMOS – Multidisciplinary Scientific Journal The Knowledge.
ISSN: 2675-9128. São Paulo-SP.

**Year V, v.2 2025 | Submission: 01/11/2025 | Accepted: 03/11/2025 | Publication: 05/11/2025**

### 5.4 Implications for sustainability

The results indicate that mitigating the disappearance of cashew trees in Soyo requires Simultaneous actions: soil decontamination, adoption of adapted varieties, planned renewal. of orchards and strengthening public policies. Only a systemic approach, articulating The public sector, the oil industry, and the agricultural community could reverse the decline and ensure... Sustainability of cashew farming.

## Final Considerations

This study demonstrated that the decline of cashew trees in Soyo is the result of multiple factors. stressors — with oil pollution emerging as a primary factor in compromising the soil fertility and block nutrient absorption, while long periods of drought and the The aging of orchards accentuates the reduction in flowering and fruiting. The fragmentation of Cultivated areas are being reduced due to urban expansion and insufficient technical and financial support for producers. These factors complete the picture of vulnerability in local cashew farming.

To reverse this process, a systemic approach combining the following becomes essential:

- Environmental remediation of soil (phytoremediation and chemical washes) to reduce hydrocarbon loads;
- Planned renovation of orchards with seedlings genetically adapted to water stress conditions;
- Agroecological management programs capable of restoring productive capacity and regenerating biodiversity;
- Specific lines of credit, ongoing technical assistance, and training for farmers;
- Public policies to incentivize and partnerships (government, oil sector, research, and cooperatives) focused on the sustainability of cashew farming.

The success of these initiatives will depend on continuous monitoring of soil and productivity indicators, as well as the effective engagement of rural communities in participatory management processes. Only in this way will it be possible not only to restore degraded cashew groves, but also to guarantee the environmental and socioeconomic resilience of Soyo in the medium and long term.

## References

**VOA PORTUGUESE.** *Farmers in Soyo say oil pollution is affecting their crops. Harvests.* February 15, 2023.

**ANGOP.** *Soyo relaunches cashew farming.* May 17, 2024.

**NEW JOURNAL.** *Soyo: a municipality "full" of resources, but far from the expected development.* July 15, 2023.

**SANTOS, J. P.; ALMEIDA, R.** *Phytoremediation of petroleum hydrocarbon-contaminated soils in*

**Year V, v.2 2025 | Submission: 01/11/2025 | Accepted: 03/11/2025 | Publication: 05/11/2025**

*tropical regions. Journal of Environmental Science and Technology,* vol. 35, no. 4, p. 223–234, 2021.

**JOHNSON, B. B.; ULRICH, A.** *Analytical methods for soil fertility evaluation. University of California Publications in Agriculture,* vol. 23, p. 1–132, 1959.