

# ASSESSMENT OF THE IMPACTS OF MAIZE CROPPING SYSTEMS ON SOIL FERTILITY AND GREENHOUSE GAS EMISSIONS IN THE MARITIME REGION, TOGO

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## ENVIRONMENTAL MANAGEMENT

Land degradation is a pressing global issue with varying degrees, particularly prevalent in Africa. In Togo where agriculture is a major source of income, the lands have been continuously degrading and mainly due to overexploitation of natural resources. Sustainable land management emerged as a measure to reverse the situation and enhance food security. Several techniques are used in Togo notably agroforestry, composting and different cropping systems among which the intercropping. This study therefore, was designed to examine the impacts of the maize-based crop system and land management on soil fertility and on the crop yields. The impacts of such practices on the carbon emissions were also assessed. This was made possible via an experimental trial with a randomized complete block design that was set up in one of the agronomic research centres in the Maritime Region of Togo. Composite soil samples were taken for laboratory analyses. The results revealed significant effects ( $p < 0.001$ ) of the practices on improving the soil parameters, namely the organic carbon, the total nitrogen, the available phosphorus, the exchangeable potassium and the cation exchange capacity. However, such variations were not enough to impact the yields. Moreover, the ex ante analysis revealed that all the treatments of the experiment have the potential to mitigate carbon emissions (ranging from 3 to 14 tCO<sub>2</sub>-e). Finally, the laboratory analysis revealed no significant difference between the soil management practices and the initial soil reference data; however, compared among themselves, the treatments had a significant impact ( $p < 0.001$ ) on the soil respiration. The findings underlie the necessity to continue the practices for the subsequent years to observe significant results on the yields as well as on the carbon emissions.

**Keywords:** Togo, land degradation, sustainable land management, maize cropping systems, soil health, yield, carbon emissions.

# EARTHEN POND MANAGEMENT PRACTICES AND THEIR IMPLICATIONS FOR SURFACE AND GROUNDWATER QUALITY IN IKIRE TOWN, NIGERIA

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The unsustainable management practices in large-scale freshwater aquaculture are known causes of water pollution globally. Little studies have, however, explored the impact of small-scale freshwater aquaculture in headwater regions. This study, therefore, examined the effects of small-scale freshwater aquaculture on surface and groundwater quality in the headwaters of the Koteyemu-Fiditi stream, Ikire, Nigeria.

Six earthen pond sites were randomly selected within the fishing community. Across both the dry and rainy seasons, a total of 24 surface water samples were collected from adjacent streams, while 12 groundwater samples were obtained from wells and a borehole located near the earthen ponds. Floristic composition data were also collected from quadrats placed in study plots. Water samples were tested for the concentrations of formaldehyde, oxytetracycline, phosphorous, sodium chloride, and *E. coli*. Data was analyzed using Pearson correlation statistic and the paired t-test at  $\alpha$  0.05. The floristic diversity indices were computed using PAST3.

In the dry season, 65% of surface water samples contained formaldehyde (at 0.03–0.06 mg/l), while all samples contained oxytetracycline, phosphorous, sodium chloride, and *E. coli* at different concentrations. Concentrations were below the WHO standards for all but phosphorus and *E. coli*. About 33% of groundwater samples contained formaldehyde, while oxytetracycline, phosphorus, and sodium chloride were ubiquitous. In the rainy season, only 16% groundwater sample had 0.06 mg/l formaldehyde and 0.037 ug/l oxytetracycline. Phosphorous (0.023–0.623 mg/l) and sodium chloride (14.23–28.43 mg/l) were also identified in all samples. Despite increased chemical metrics in the rainy season, only phosphorus ( $p < 0.0001$ ) and sodium chloride ( $p < 0.005$ ) showed significant seasonal variations at 95% confidence level.

The study concludes that eutrophication of streams is the greatest environmental risk associated with small-scale freshwater aquaculture. It is recommended that earthen ponds are lined with high-density polyethylene (HDPE) to prevent the infiltration of wastewater into the groundwater table while pollutants from pond wastewater must be filtered in sedimentation tanks before the discharge of pond wastewater into surrounding streams.

**Keywords:** Formaldehyde, Oxytetracycline, Phosphorous, Sodium Chloride, *E. coli*

# **ASSESSMENT OF PASSIVE TREATMENT SYSTEMS FOR THE CONTROL OF ACID MINE DRAINAGES IN THE ABANDONED MINE OF KETTARA, NEAR MARRAKECH, MOROCCO**

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Acid mine drainage (AMD) discharged from the mine has caused severe environmental pollution and human health problems. In Morocco, the abandoned pyrrhotite ore mine in Kettara, pose a threat to public health since 1965. Thus, sparking much research interest. Many studies have investigated AMD treatment and successfully removed significant amounts of sulphate, as well as some chemical elements. However, AMD can also be treated using phosphate limestone waste materials (PLW) in passive system without addition of any other chemicals. This study therefore seeks to evaluate the neutralization capacity of PLW from the phosphate mines in Benguerir, Morocco and mine drainage water from the Kettara mines, the research simulated ex-situ neutralization of AMD. The research further uses both batch and column tests to assess the extent to which it can mitigate its acidity by using continued AMD contact to represent the potential of PLW in neutralizing AMD. In essence the samples were analysed for electrical conductivity, pH of the leachates and effluent composition using Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES). The Scanning Electron Microscopy (SEM), both and X-ray florescence were done on both before and after PLW treatment. The result indicate that Kettara AMD is very acidic with a pH of 2.5, electrical conductivity of 11,8 mS/cm. The ICP-OES analysis showed a high sulphate concentration of 3668,83 mg/L, displaying the existence of some metals notably Mg, Al, and Fe. The neutralization process of Kettara acid mine drainage using PLW was highlighted by the variation of pH from the time mine water was in contact with PLW, for the batch test treatment with PLW. The treated water pH raised from 2.5 to 7 while electrical conductivity decreased from 11,8 to 7.37. This phenomenon was explained by the dissolution and hydrolysis of the oxide components such as CaO. The neutralization process in column test was characterized by raising pH from 2.5 to 5.78 and a decrease in electrical conductivity from 11.8 to 8.24. During treatment of Kettara AMD with PLW the concentration of sulphate was reduced to up to 35% in the effluent. Iron and Aluminium have been significantly removed from Kettara AMD with a percentage of 99% in the leachate. These results therefore indicates that neutralising AMD using the passive treatment is effective and it may serve as a cost-effective mitigation for AMD.

**Key Words:** Acid mine drainage, Phosphate Limestone Waste, Batch tests, Passive treatment.

# **SOCIAL VULNERABILITY TO LANDSLIDES IN NORTHERN ABIDJAN, CÔTE D'IVOIRE**

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Every year, more than 4,000 non-earthquake landslides occur around the world. They cause the death of more than 5,000 people including children. Côte d'Ivoire has experienced dramatic events that have caused the loss of many human lives and destroyed its environment. This study raises the problem of the social vulnerability of communal areas in Northern Abidjan caused by landslides during the rainy season. However, the aim of this work is to study the socio-environmental impact caused by the risk of landslides in Northern Abidjan.

A complete inventory and in-depth survey on the project was carried out. Firstly, a questionnaire was sent out to 384 households and in-depth interviews were conducted in institutions specialising in the study of the environment and civil security. Secondly, processed and analysed Landsat satellite images (Landsat 4 TM, Landsat 7 ETM+ and Landsat 8 OLI/TIR) were obtained from the United States Geological Survey website. Finally, statistical data obtained from the official NASA website was used to evaluate the field survey data, create tables and graphs and calculate certain statistical parameters such as the rate for a better interpretation of the results.

According to the study's findings, there are particular characteristics in the structure of Northern Abidjan that make it more susceptible to the repeated landslides. The elevation variation is significant and ranges from -5 to 140 meters. The monthly temperatures average around 26.22°C, and the amount of rainfall is high (1928.99 mm), making the climatic factors hostile. Social vulnerability to landslides in Northern Abidjan is moderate and high in highly urbanised areas (all communes except Anyama), with occupancy rates of 24.09% and 29.88% of the total surface area respectively. Landslides can occur both naturally and as a result of human action.

The results of this study could help the public and the relevant authorities to become more aware of the impact of landslides on the environment and human life. They will also help us to understand the factors responsible for landslides, so that we can better plan future land use.

**Key Words:** Côte d'Ivoire, Landslides, Social Vulnerability, Northern Abidjan, Socio-Environmental Impact, Land Use

## ABSTRACT

### IMPACT ASSESSMENT OF AN ABANDONED DUMPSITE ON THE SURROUNDING RESIDENTS IN OSOGBO METROPOLIS, NIGERIA

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The study employed both statistical and geospatial techniques to assess the impacts of an abandoned dumpsite on the surrounding residents, within Osogbo metropolis, Nigeria, located between longitude  $7^{\circ}46'35''\text{N}$  -  $7^{\circ}47'45''\text{N}$  and latitude  $4^{\circ}29'14''\text{E}$  -  $4^{\circ}30'28''\text{E}$ . A total of 202 questionnaires were administered, and collection of 19 groundwater samples within the study area, to test for the suitability of drinking water sources of the residents, GPS coordinates of the collection points were also taken and plotted within the ArcGIS environment. Using the simple linear regression statistical analysis, results show that the socio-economic status of the respondents, measured by their income, had a significant relationship to the residents' preferred source of drinking water, as those who earned more, were able to afford sachet and bottled water, while the one-way ANOVA test did not show any similarity between the socio-economic status (measured by level of education), and the respondents' choice of neighborhood. Additionally, the water samples that were collected and tested, were compared against the NSDWQ and WHO water quality standards. Results show that from 50m to 500m of collection, all the water samples fell short of water quality standards, recording consistently levels of *E. coli* contamination in the water samples. Finally, plotting the mean values of *E. coli* against the NSDWQ and WHO standards, the water samples recorded high level contamination, and also did not perfectly decrease with distance from the dumpsite. This may due to the effects in the variety in the frequency and styles of water treatments, as they differ between households. From the interview reports, it was deduced that some houses in closer proximity (50m and 100m) to the dumpsite, treated their water sources than those who were farther away from the dumpsite.

**Keywords:** waste management, water pollution, groundwater quality, landfills, dumpsites, perception and awareness.

# ASSESSING WETLAND HEALTH THROUGH DECOMPOSITION: A CASE STUDY OF LUBIGI AND NAMBIGIRWA WETLANDS, UGANDA

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The assessment of ecological functions, such as the decomposition process, offers a more dependable measure of the health of an ecosystem. Healthy watersheds provide numerous ecosystem services crucial for our social and economic well-being. The study aimed to investigate the decomposition rate in two wetlands of different degree of disturbance to gauge their health and functionality against the physicochemical parameters. Land use/cover maps were created in ArcGIS to identify different land use types around the wetlands and analyse the effect of land use type on the rate of decomposition.

To determine the rates of decomposition, 20g of *Pennisetum purpureum* that had been dried to a constant weight was utilised in litter bag decomposition experiments. Changes in leaf mass as a percentage over time and leaf breakdown rates utilising a single exponential decay mode were determined. The wetlands' physio-chemical characteristics in the waterlogged areas were also measured.

The study findings indicate that in terms of Land Use/cover, the built-up area constituted the largest part of Lubigi (74.47%) and Nambigirwa (40.15%). Lubigi wetland had been encroached upon and cultivated areas (6.96%), and the wetland area decreased by over 8.69%. Mean decomposition rates were significantly different for the land use types observed within the experiment area, demonstrated by one-way ANOVA ( $F_{2, 51} = 33.4$ ,  $P < 0.001$ ) with cultivated areas having faster rates and grazing areas having the lowest rates.

The wetlands significantly differed in the mean decomposition rates ( $P < 0.001$ ), with the degraded wetland having a higher value of  $(0.20 \pm 0.007 \text{ kd}^{-1})$  than the semi-intact one  $(0.015 \pm 0.005 \text{ kd}^{-1})$ . The waterlogged plots of the wetlands had higher  $k$  rates  $(0.021 \pm 0.007 \text{ kd}^{-1})$  than non-waterlogged plots  $(0.013 \pm 0.004 \text{ kd}^{-1})$ . The decomposition rate slightly increased with conductivity, temperature and pH and slightly declined with TDS and dissolved oxygen.

Consequently, land use type is a critical factor that affects leaf litter decomposition in wetlands. The study concluded that litter decomposes more rapidly in degraded wetlands, attributed to human disturbances altering their physical characteristics. Results also highlighted that the wet-dry cycles predominantly controlled the decomposition rates within the wetlands.

**Key Words:** Urban wetlands, land use/cover, decay rate, hydrology, physicochemical parameters, wet-dry cycle

# COOKING EMISSIONS LEVELS, AND ASSOCIATED HEALTH EFFECTS AMONG HOUSEHOLDS IN DODOMA CITY, TANZANIA.

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Biomass use for cooking poses health and environmental risks, despite of the burden there's a few information on cooking emissions in many developing countries. To address a gap, study was conducted to assess cooking emissions levels and associated health effects among households in Dodoma city. The findings from this study improve the evidence base for potential health risks and for implementing public health initiatives regarding energy use for cooking among households.

A cross-sectional study conducted in the peri-urban area of Dodoma City involved 285 households. Data was collected through questionnaires, checklists, and sampling devices. Lung function tests were conducted with the consent of the primary household cooks. Collected data were analyzed using STATA 17 software.

The results from this study showed that the majority 74.7% of participants were using charcoal as cooking energy. About 68.4% of all participants had their kitchens located outdoors in enclosed rooms, semi-enclosed structures or open air. The results also show that there was a statistically significant difference in the concentration of pollutants among different types of fuel ( $P=0.0001$ ). Firewood emitted relatively higher levels of PM and CO. However, during frying the levels of PM in gas were significantly elevated. During the cooking session, the average concentration of CO among firewood, Charcoal-gas, and Charcoal was 6, 5, and 3 folds above the WHO daily average respectively. However, the concentration of gas was below the WHO limits. There was a positive correlation of concentrations between pollutants ( $P$ -value=0.0000).

Charcoal and firewood remain the primary cooking fuels in the study area despite their significant negative impacts. Our findings highlight a lack of awareness among community members regarding the health effects of biomass cooking emissions and insufficient guidance on constructing healthy kitchens. To address this, enforcing building standards, raising health awareness, and ensuring affordable access to modern fuels are crucial steps. These measures are essential for promoting healthier cooking practices and mitigating the adverse effects on households.

**Key words:** Carbon monoxide; Cooking energy; Health effects; Household air pollution; and Particulate matter.