

**SOIL SEEDBANK DYNAMICS AND REGENERATION OF VEGETATION ON OIL
SPILLED SITES IN BARUWA COMMUNITY, ALIMOSHO LOCAL
GOVERNMENT AREA OF LAGOS STATE.**

Adeola AdenikeADEGBITE

B. FWM (FUNAAB)

**A THESIS SUBMITTED TO THE INSTITUTE OF ECOLOGY AND
ENVIRONMENTAL STUDIES IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF
SCIENCE (M. Sc.) IN ENVIRONMENTAL CONTROL AND MANAGEMENT OF
THE OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA.**

2015

CERTIFICATION

This is to certify that this research was carried out by Adeola Adenike ADEGBITE (Registration Number SCP12/13/H/0073) of the Institute of Ecology and Environmental studies, Faculty of Science, as part of the requirements for the award of the degree Master of Science (M.Sc.) in Environmental Control and Management, of the Obafemi Awolowo University, Ile-Ife, Nigeria.

Prof. O. O. Awotoye

Supervisor

Signature

Date

Prof. O. O. Awotoye

Director, Institute of Ecology Signature Date

DEDICATION

This work is dedicated to the most high GOD, my alpha and omega and also to my father,
Late Prince Adegbite Adegboye Ademuyiwa.

ACKNOWLEDGEMENTS

My profound gratitude goes to the Ancient of days, for his divine support, provision, strength, favour and courage through the course of this study. Through it all, I have learnt to trust in you alone. I sincerely appreciate my supervisor Prof. O. O. Awotoye for his fatherly advice, patience, thorough supervision, constant monitoring and drive at every stage of this research. Your positive impacts in the successful completion of this research work is highly immeasurable, God bless you sir.

I will also like to say a big thanks to all the members of staff (both academic and non – academic), Institute of Ecology and Environmental studies, you all took care of me like your biological daughter and sister, starting from Dr. M. B. Adewole, Pastor A. A. Ojo and Miss Tope Audu, for your assistance and guidance throughout the course of this research work, may the good Lord bless you real good.

My gratitude also goes to Dr. O. E. Eludoyin (Department of Geography) and Dr. O. A. Titilayo (Department of Statistics and Demography) for your warm and brotherly assistance and encouragements, may the good Lord continue to guide you in all your endeavours in life in Jesus name.

What would have become of this research without the back up of my wonderful mother, my sister and my confidant, Mrs Adegbite Olusola Anike, Pharmacist Adegbite Adedolapo Oluwamayowa and Captain Fasola Samson respectively. Thanks for your support in all ramifications, may you live to eat the fruits of your labour in Jesus name. My sincere appreciation also goes to a great people, CEDAR family, especially my wonderful father in the Lord, Prof. Ayobami Salami (DVC. Academics, Obafemi Awolowo University, Ile- Ife), Pastor Paul and his darling wife Sis Joyce, as well as the entire church as a whole for their care throughout my stay in this reputable Institution. My immeasurable gratitude goes to

Mummy Adekunle and her family as well as the Fasola family, for their continuous encouragements and prayers.

Finally to my brother from another mother and my dear friends respectively, Abayomi, Happiness, Eguono, Emmanuella, Ireti, Yetunde, Ibukun, Tosin, Olatunji (Department of Botany) and Wumi (Department of Botany), I really appreciate your continuous encouragements during the course of this research, most especially when I was discouraged to move on, may you all find favour always in Jesus name.

TABLE OF CONTENTS

Title	Page
Certification	i
Dedication	ii
Acknowledgements	iii
Table of Content	v
List of Tables	ix
List of Plates	x
List of Appendices	xi
List of Abbreviations	xii
Abstract	xiii
 CHAPTER ONE: INTRODUCTION	
1.1 Background to the Study	1
1.1.1 Causes of Oil Spillage	2
1.1.2 Effects of Oil Spillage on the Environment.	4
1.1.3 Effects of Oil Spillage on Vegetation, Land use and Seedbanks	4
1.1.4 Soil Seedbanks	5
1.1.5 Importance of Seedbanks in Regeneration of Vegetation	6
1.2 Justification of the Study	7
1.3 Objectives of the Study	9

1.4 Contribution to Knowledge

9

CHAPTER TWO: LITERATURE REVIEW

2.1. Oil Spillage as an Environmental Problem

10

2.1.1 Examples or Cases of Oil Spill in the World and their Effects

11

2.1.2 Effects of Oil Spill on the Environment

15

2.1.3 Effects of Oil Spill on Vegetation

15

2.1.4 Effects of Oil Spill on Soil

16

2.1.5 Effects of Oil Spill on Human

17

2.1.6 Effects of Oil Spill on Water

18

2.1.7 Oil Spill in Nigeria and Effects on the Environment

18

2.2 Soil Seedbank

21

2.2.1 Uses of Seedbanks in Vegetation Research

26

2.2.2 Characteristics of Seedbank as an Effective Indicator of Plant Regeneration

27

2.2.3 Soil Seedbank and Disturbance

28

2.2.4 Depth of Seed Burial and Seedbank

29

2.2.5 Physiognomy and Seedbank

31

2.2.6 Seasonal Variations and Seedbank

31

CHAPTER THREE: MATERIALS AND METHODS

3.1	Study Area	33
3.1.1	Topography	33
3.1.2	Climate	34
3.2.	Sampling Procedure	34
3.2.1.	Selection of Sample Plot	34
3.2.2	Plant Enumeration	35
3.2.3	Determination of Soil Seedbank	36
3.2.4	Seedling Emergence Test	36
3.3	Soil Analysis	37
3.4	Statistical Analysis	38

CHAPTER FOUR: RESULTS

4.1	The Vegetation of the Selected Plots	39
4.1.1	Species Composition of the Standing Vegetation	39
4.2	Structural Characteristics of the Study Area	46
4.3	Seedling Emergence	48

4.3.1	Seedling Emergence in Soil Collected at 0 – 15 cm depth for both Drying and Raining Seasons	48
4.3.2	Seedling Emergence in Soil Collected at 15 – 30cm depth for both Drying and Raining Seasons	51
4.4	Soil Seedbank Variation at Different Depths	53
4.5	Standing Vegetation and Seedbank	55
4.6	Soil Properties	55
4.6.1	Heavy Metals Concentration in the Soil across the Plots	57
4.6.2	Hydrocarbon Concentration in the Soil across the Plots	57
4.6.3	Soil pH	57
4.6.4	Total Nitrogen and Phosphorus	59
4.6.5	Potassium, Calcium and Sodium	60
4.6.6	Organic Matter	60
CHAPTER FIVE: DISCUSSION		
5.1	Species Composition of the Standing Vegetation	62
5.2	Species Composition of the Seedbank	64
5.3	Extant Vegetation and Soil Seedbank	65
5.4	Seasonal Dynamics of Soil Seedbank	66

5.5 Soil Seedbank and Soil Depths
67

5.6 Soil Seedbank and Soil Properties
68

CHAPTER SIX: CONCLUSION AND RECOMMENDATION

72REFERENCES

74

APPENDICES 94

OBAFEMI AWOLOWO UNIVERSITY

LIST OF TABLES

Table	Title	Page
1.1	Cases of oil spill in the world and its effects	13
4.1	Frequency of herbaceous species across the plots	41
4.2	Frequency of tree species, mean height and range height (m) across the plots	42
4.3	Frequency of Grasses found across the Plots	43
4.4	Frequency of Shrub, Creepers and Sedges across the Plots	44
4.5	Summary of Species Composition of the Study Area	45
4.6	Vegetation Parameters across the Plots	47
4.7	Mean Density (seed/m ²) and Percentage Contribution of each Species in the Seedbank of Selected Study Site in both Dry and Raining Seasons at 0 – 15 cm depth	50
4.8	Mean Density (seed/m ²) and Percentage Contribution of each Species in the Seedbank of Selected Study Site in both Dry and Raining Seasons at 15 – 30cm	52
4.9	Summary of Mean Density of Seed/m ² at Different Depths in both Seasons in the Site	54
4.10	The Herbaceous Species found in both the Standing Vegetation and the Seedbank	56
4.11	Mean Values of Heavy Metals Concentration at 0 – 15cm and 15 – 30 cm Soil Depth in the Study Site across the Plots	58

4.12 Mean Values of Soil Properties at 0 – 15 cm and 15 – 30 cm Soil Depth in the Study
Site across the Plots.

61

OBAFEMI AWOLOWO UNIVERSITY

LIST OF PLATES

Plate	Title	Page
1 89	Plate showing oil spilled area under study in Baruwa community	
2 90	Plate showing soil samples from the same depth being pooled together	
3 91	Plate showing labelled composite sample for each of the depth.	
4 92	Plate showing soil samples at the laboratory of Institute of Ecology and Environmental Studies for air drying	
5 house	Plate showing seedling emergence at the seedling identification at the screen	93

LIST OF APPENDICES

Appendix	Title	Page
1	Schematic arrangement of each main sample plots, sub plots and quadrants for the five plots.	94
2	Descriptive analysis for the comparison between seedbank and standing vegetation	95

LIST OF ABBREVIATIONS

AAS	Atomic Absorption Spectrometer
ATSDR	Agency for toxic substance and disease registry
<i>et al.,</i>	and others
UNDP	United Nations Development Programmes
US	United State
%	Percentage

ABSTRACT

The study determined the floristic composition of the standing vegetation and soil seedbank around oil spilled site, examined the relationship between standing vegetation and the soil seedbank as well as determined the effects of petroleum hydrocarbon pollutant on soil around the oil spilled site. This was with a view to determining the effects of oil spill on above and below-ground vegetation in oil polluted area.

Sampling was carried out in five plots of 25 m x 25 m using purposive sampling techniques. Five plots were selected based on their physical characteristics such as severely burnt (Plot 1), burnt with scanty re-growth of grasses (Plot 2), burnt but dominated by grasses (Plot 3), burnt but dominated by herbs (Plot 4) and partially burnt with herbaceous plants (Plot 5). In each sample plot, plant species were identified in the field and those of unknown identity were collected and pressed for later identification at the IFE Herbarium, Department of Botany, Obafemi Awolowo University, Ile - Ife. The species were classified into grasses (annual or perennial), trees, herbs, shrubs, creepers and sedges. Individual plants were counted to determine the abundance of each species. The composition of trees and shrubs > 1 m height and their density was recorded. Species richness, diversity and dominance for each of the plot were determined. Soil samples for the soil seedbank were collected at two different seasons (raining and dry) at the same locations. Five quadrants of 5 m x 5 m were marked out in each 25 m x 25 m plot. Twenty five soil samples were collected at random in each sampling site at two soil depths (0 – 15 cm and 15 – 30 cm) and were pooled together, to form one composite sample for each of the two depths in each of the sampling sites. Germinated seeds were observed and

counted till six months when no further seed germination was confirmed. The composite soil samples were analyzed for petroleum hydrocarbon and heavy metals (Lead, Iron, Copper and Cadmium) using standard procedures. Data collected was subjected to analysis of variance to compare the relationships between the soil seedbank and the floristic composition of the vegetation.

The results showed that the frequency of occurrence of the vegetation were 917 herbaceous plants, 624 grasses, 186 creepers, 11 Sedges and 83 shrubs. Two (2) tree species were recorded in the oil spilled area. The total number of families recorded in the oil spilled area was sixteen (16). Shannon – Weiner index showed that species found in the burnt but dominated by herbs, were more diverse in their composition compared to other plots. Herbaceous species had the highest percentage contribution to the total seedbank density in both dry and raining seasons and at different depths, followed by grasses. No tree species emerged from the soil seedbank of the oil spilled area in both seasons. Sorenson index of similarity showed low similarity between the above-ground and below-ground vegetation of the oil spilled area. There was variation in the seedbank density in relation to soil depths in the oil spilled area in both seasons. The seedbank density was higher in the dry than the raining seasons at both soil depths. The seed density decreased with increase in soil depth by 14.5% during raining season and 32.1% during the dry season. The heavy metals (Lead, Cadmium, Iron and Copper) as well as the petroleum hydrocarbon in the soil of the oil spilled area were higher than the recommended level by Federal Ministry of Environment.

The study concluded that oil spill impacted the species composition of the above and below-ground vegetation of the oil spilled areas.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The exploration and exploitation of petroleum hydro-carbons have been with Nigerians for decades and their concomitant effects on the oil producing communities have been quite problematic. These activities, though developmental, have elicited all kinds of impact, ranging from the barely tolerable ones to utterly disastrous effects. For instance, the activities are known to have decimated terrestrial and aquatic biota, which constitute the peoples' major source of livelihood.

Similarly, soil fertility still remains one of the inextricable effects that have received insufficient attention (Osuji, Adesiyani and Obonte, 2004). Oil spill, which is the release of a liquid hydrocarbon into the environment due to either conscious or unconscious exposure of the hydrocarbons into the environment, is one of the major problems facing the environment and its major components (soil, water, vegetation and even humans). Oil spillage often pollute the immediate environment, including the ocean, land or soil, where they cause habitat disruptions, deaths of organisms, and they often bio accumulate in the ecosystem, where they cause salient but significant damage especially as they become interchanged within the food web (Omodanisi, 2011). The severity of oil spills is influenced by many factors including the quantity of oil, and the effects of the oil spill.

Oil spills have been known to destroy farmlands, terrestrial and marine communities, contaminate ground water, kill natural vegetation and disrupted the food chain (Omodanisi, 2011). The rainforest vegetation, a characteristic feature of most part of southwest Nigeria and mangrove forest of the coastal areas has been affected by oil spill and the diversity as well as the

abundance of the biological communities have been greatly affected (Omodanisi, 2011). Every aspect of oil exploration and exploitation has deleterious effects on ecosystem stability and local bio - diversity which the peoples' livelihoods depend upon (Zabbey, 2005). However, to protect our environment and biodiversity, proper understanding of the impact of oil pollution on health of vegetation should be given serious attention.

1.1.1 Causes of Oil Spillage

Oil Spill has various causes, but the most common cause is as a result of anthropogenic activities, such as: Storage, handling, offshore drilling, routine maintenance activity, intentional oil discharge, vandalization

Storage: oil and oil products may be stored in a variety of ways including underground and above storage tanks. Such containers may develop leaks over time.

Handling: This happens during transfer operations and various uses.

Transport: Big oil spills (up to million and hundreds of million gallons of water or land through accidental rupture of big transporting vessels (e.g. tanker, ships or tanker trucks). For example, Exxon Valdez spill was a massive oil spill off the Alaskan shoreline due to ship failure which happened in late 1980s.

Offshore drilling: There is current experience of massive oil spill in the Gulf of Mexico with its hard to predict consequences on environment, marine life and humans as the spill continues since April 22, 2010 and it may take a while until a solution is found.

Routine Maintenance activities: This involves cleaning of ships which may release oil into navigable waters. This may seem insignificant, however due to the large number of ships even

few gallons spilled per ship maintenance could build up to a substantial number when all ships are considered.

Road Run off: Oily road run off add up especially on crowded roads. With many precipitation events, the original small amounts of oil from regular traffic would get moved around and may build upon the environment.

Intentional oil discharge: Such as those thorough drains or in the sewer system. This includes any regular activities such as changing car oil if the replaced oil is simply discharged in a drain or sewer system.

Vandalization of oil pipelines: Failures of petroleum pipelines are known to have caused environmental pollution and deaths of plants, animals and humans. Almost all the reported cases of pipeline explosions recorded in Nigeria were attributed to deliberate rupture by oil thieves or saboteurs (White, 1983; Baskin and Baskin 2004; Ferrandiset *al.*, 1996). An example of the effects of pipeline vandalization was the fire disaster of 26th December 2006, which killed more than 256 people and significantly degraded the ecological system of the Ilado- Odo Community in Lagos State, Nigeria. According to Torulagha (2001), pipeline explosions take place due to the following reasons:

- (a) During drilling activity at new site.
- (b) Following an accidental bursting of pipeline work is taking place around the pipeline.
- (c) An old pipeline that has not been checked for maintenance.
- (d) Vandalization by angry youth and members of the host communities.

1.1.2 Effects of Oil Spillage on the Environm