IMPACT OF OIL SPILLAGE ON FLORA AND FAUNA: A CASE STUDY OF SARKIN PAWA AREA, NIGER STATE, NIGERIA

BY

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NSU/NAS/PGD/BCM/009/14/15

PGD, BIODIVERSITY AND CONSERVATION MANAGEMENT

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BIODIVERSITY AND CONSERVATION MANAGEMENT DEPARTMENT OF BIOLOGICAL SCIENCES FACULTY OF NATURAL SCIENCES NASARAWA STATE UNIVERSITY KEFFI NASARAWA STATE, NIGERIA

BEING A PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A POSTGRADUATE DIPLOMA IN BIODIVERSITY AND CONSERVATION MANAGEMENT, NASARAWA STATE UNIVERSITY KEFFI, NASARAWA STATE, NIGERIA.

OCTOBER, 2016

DECLARATION

I hereby declare that this project Impact of Oil Spillage on Flora and Fauna: A Case Study of Sarkin Pawa Area, Niger State, Nigeria. Written by me and it has not been presented elsewhere for the award of any certificate. All quotations are indicated and sources of information specifically acknowledged by means of references.

_____

PIUS MERCY ADA
DATE

CERTIFICATION

This is to certify that this project ‘‘Impact of Oil Spillage on Flora and Fauna: A Case Study of Sarkin Pawa Area, Niger State, Nigeria’’ meets the regulations governing the award of Postgraduate Diploma in Biodiversity and Conservation Management in the Department of Biological Sciences Faculty of Natural and Applied Sciences Nasarawa State University, Keffi.

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DEDICATION

I dedicate this work to God Almighty, for his grace that was enough for me and also my parent Mr. and Mrs. Pius.

ACKNOWLEDGEMENT

My special appreciation goes to the Almighty God the author and the finisher of our faith, the owner of my life for giving me the grace, knowledge, wisdom, and understanding to undergo this study May His name be praise and exalted forever.

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ABSTRACT

This project reviewed the environmental impact study of oil spillage, using the case study of Sarkin Pawa in Niger state north central of Nigeria. It critically analyzed the effect of oil spillage on marine life, environment, flora and fauna; also the effect on human health. The research also involved the use of primary and secondary sources of data collection for methodology. Questionnaires were developed, administered and observations recorded. The research shows that oil spillage in Sarkin Pawa affected 85% of the environment endangering flora, fauna and the health of the community. It was traced mainly due to negligence of duty by the oil company operators in which the oil sprayed within the environment and was ignited by a moving vehicle. The fire it caused affect animals mainly through effects on their habitant, which cause short-term increases in wildlife foods that contribute to the increase in population of some animals. The research shows that 80% of oil spillage was due to negligence. I recommend increased efforts by the oil company in the management of oil installations.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Oil spillage is a release of a liquid petroleum hydrocarbon into the environment such as oceans, lakes and forest due to human activity, or negligence and is a major form of pollution. Petroleum is a collective name for mineral oil and natural gas. The word petroleum originated from the Latin word, ‘‘petro’’ meaning ‘‘rock’’ and ‘‘oleum’’ meaning ‘‘oil’’. It is a naturally occurring oily dark viscous, flammable liquid, or fluid, believed to originate from large deposition of dead and decayed organic (i.e. plants and animals) matter, mainly marine organisms, which have been subjected to high temperature and pressure (Ekekwe, 1981). Unrefined petroleum which was formally called rock oil is now called crude oil (Schelling, 1992). This crude oil is a naturally occurring unrefined petroleum product composed of hydrocarbon deposits and other organic materials. Crude oil can be refined to produce usable products such as Dual Purpose Kerosene (DPK), Premium Motor Spirit (PMS), Automobile Gasoline Oil, (AGO), Diesel Engine Road Vehicle (DERV), and various forms of petrochemicals. Petroleum product make life easier, finding producing, moving, and using them can harm the environment through air and water pollution. Petroleum products give off emission when they are

burned as fuel. Carbon dioxide, Carbon monoxide, Sulfur dioxide and Nitrogen oxide. (volatile organic compound). The term oil spillage often refers to marine oil spills, where oil is released into the ocean or coastal waters. Oil spills include releases of crude oil from tankers, offshore platforms, drilling rigs and wells, as well as spills of refined petroleum products (such as gasoline, diesel) and their by-products, and heavier fuels used by large ships such as bunker fuel, or the spill of any oily white substance refuse or waste oil. Spills may take months or even years to clean up. Oil also enters the marine environment from natural oil seeps. Oil spillage causes a tremendous impact on land and water which leads to the extinction of both flora and fauna because the spilt oil can cause harm to living things due to its poisonous chemical constituent. Oil spills can ignite or explode causes wildfire on forest which leads to deforestation. When deforestation occurs many species lose their natural home and food supplies some indigenous and key stone species are extinct while some animals migrate to other environment for survival. Public attention and regulation has tended to focus most sharply on seagoing oil tankers. Aghalino, (1998).

Oil spillage is one of the greatest environmental problems Nigeria is currently battling with especially in the Niger Delta zone. Oil communities have been at the receiving end of this environmental problem. The problem has generated a lot of concerns within the three tiers of government especially in oil producing states. Anikpe, (1996).

1.2 STATEMENT OF THE PROBLEM

Oil spills always harm wildlife, ecosystem and fragile coastal environments.

Oil spills often result in immediate damage. Some of the environmental damage caused by an oil spill can last for decades after the spill occurs.

Oil spill can damage tankers, pipelines or offshore oil rigs coats everything it touches and becomes an unwelcome but long term part of every ecosystem it enters.

When an oil slick from a large oil spill reaches the beach, the oil coats and clings to every rock and grain of sand. If the oil washes into coastal marshes, mangrove forests or other wet lands, fibrous plants and grasses absorb the oil, which can damage the plant and make the whole area unsuitable as wildlife habitat.

When some of the oil eventually stops floating of the surface of the water and begins to sink into the marine environment, it can have the same kind of damage effects on fragile under water ecosystems, killing or contaminating many fish and smaller organisms that are essential links in the global food chain. Any oil spill in the ocean is a death sentence for sea birds and other aquatic species. Some species off shore birds may escape by relocating if they sense the danger in time but sea birds that swim and dive for their food are sure to be covered in oil. Oil spills also damage nesting grounds, which can have serious long-term

effects on entire species, and those species depend upon the environment for their survival.

Ultimately the severity of environmental damages caused by a particular oil spill depends on many factors, including the amount of the oil spill, the species of wildlife in the area, the timing or breeding cycles and seasonal migrations, and even the weather at sea during and immediately after the oil spill. But one thing never varies oil spills are always bad news for the environment.

1.3 AIM OF STUDY.

The aim of this study was to investigate the causes of oil spillage and its effect on flora and fauna, at Sarkin Pawa area of Niger state Nigeria.

1.4 OBJECTIVES OF STUDY.

The aims of this study were achieved through the following objectives.

i. To determine the causes of oil spillage in Sarkin Pawa community.
ii. To determine the impact of oil spillage on flora.
iii. To determine the impact of oil spillage on fauna.

1.5 STUDY OF HYPOTHESIS

i There is no significant difference on the impact of oil spillage on flora in Sarkin Pawa.

ii There is no significant difference on the impact of oil spillage on fauna in Sarkin Pawa.

1.6 DEFINITION OF TERMS.

Petroleum: A liquid mixture of hydrocarbons which is present in suitable rock strata and can be extracted and refined to produce fuels including gasoline kerosene, and diesel oil..

Crude oil: A substance in its natural unprocessed state, especially, unrefined petroleum.

Pollution: The presence in or introduced into the environment of a substance or thing that has harmful or poisonous effects.

Vandalization: The intentional and malicious destruction of or damage to the property of another.

Refineries: An industrial plant that purify any substance example crude oil into petroleum products. or a place where the unwanted substances in something (such as oil or sugar) are removed. A place where something is refined.

Biodegradation: is the chemical dissolution of materials by bacterial, fungi, or other biological means. Although of conflated, biodegradation is distinct in meaning from compostable. Or is a process by which microbial organism transform or alter (through metabolic or enzymatic action) the structure of chemicals introduced into the environment.

CHAPTER TWO

LITERATURE REVIEW

2.1 Historical Perspective of Oil Spillage.

Nigeria is a major player in the world energy market It is the seventh largest producer of oil in the world. It supplies a fifth of United States oil imports and is at present further becoming an important supplier in the global liquefied natural gas (LNG). Instability in world oil supplies and the critical link of oil to the international economy has made Nigeria and more generally African oil to be more strategic (Ikelegbe, 2005). The Niger Delta region of Nigeria produces over 90 percent of the oil extracted in Nigeria. This analysis is significant to the study because of a few significant factors; first, it was observed by (Awosika, 2008) that, the incident of primary commodity exports and specifically mineral wealth in States has been found to be associated with conflict and occurrence of civil wars. Secondly, according to Reno (2003), the exploitation of natural resources has played a prominent part in conflict in Nigeria. Ever since the discovery of oil in 1956, it is estimated that an oil spill is the release of a liquid petroleum hydrocarbon into the environment, especially marine areas, due to human activity, and is a form of pollution. The term is usually applied to marine oil spills, where oil is released into the ocean or coastal waters, but spills may also occur on land. Oil spills may be due to releases of crude oil from tankers, offshore platforms, drilling rigs and wells, as well as spills of

refined petroleum products (such as gasoline, diesel) and their by-products, heavier fuels used by large ships such as bunker fuel, or the spill of any oily refuse or waste oil. Oil spills penetrate into the structure of the plumage of birds and the fur of mammals, reducing its insulating ability, and making them more vulnerable to temperature fluctuations and much less buoyant in the water. Clean up and recovery from an oil spill is difficult and depends upon many factors, including the type of oil spilled, the temperature of the water (affecting evaporation and biodegradation), and the types of shorelines and beaches involved. Spills may take weeks, months or even years to clean up.

Oil spills can have disastrous consequences for society both economically, environmentally, and socially. As a result of these consequences oil spill accidents can initiate intense media attention and political uproar. Multiple kinds of actors in society can become involved in a political struggle on how government should respond to oil spills and what actions prevent them from happening. Despite substantial national and international policy improvements on preventing oil spills adopted in recent decades, large oil spills keep occurring.

2.2 The Environmental Impact of Oil Spillages

Oil spills have been a common phenomenon in Nigerian oil producing states after the discovery of crude oil in Oloibiri, particularly between 1976 and the 1990s, during which time a total of 4,647 spills leaked about 2,369,470 barrels of oil into the Niger Delta, (Nwilo & Badejo, 2005). The Department of Petroleum Resources (DPR) reported different figures of spills between 1976 and 1996, about 4,835 barrels of oil per year were spilled into the Delta environment (NNPC 2003; NAI, 26/29603). 7,350 barrels spilled per year through the operations of *Shell-BP* into the Ijaw and Delta oil fields between 1989 and 1994.

Since the discovery of oil in Nigeria in the 1950s, the country has been suffering the negative environmental consequences of oil development. The growth of the country's oil industry, combined with a population explosion and a lack of enforcement of environmental regulations has led to substantial damage to Nigeria's environment, especially in the Niger Delta region.

When there is an oil spill on water, spreading immediately takes place. The gaseous and liquid components evaporate. Some get dissolved in water and even oxidize, and yet some undergo bacterial changes and eventually sink to the bottom by gravitational action. The soil is then contaminated with a gross effect upon the terrestrial life. As the evaporation of the volatile lower molecular weight components affect

aerial life, so the dissolution of the less volatile components with the resulting emulsified water, affects aquatic life (Akpofure *et al*, 2000).

2.2.1 Impact of Oil Spills on Fauna

The harmful effects of oil spills on the environment are many. Oil can prove fatal for animal life. The substance is so toxic that it can cause massive loss of species that live in the sea or land. Oil spill penetrates into the plumage and fur of birds, breaks down the insulating capabilities of feather which makes them heavier, disallow them to fly and kill them via poisoning or hypothermia. The animal life that lives in water or near the shore is the ones most affected by spill. In most cases, the oil simply chokes the animals to death. Others that live face a number of other problems. Animals that preen themselves to get rid of the oil accidentally swallow the oil and die due to the toxic effects. In most cases, the animals become blind due to repeated exposure to the oil. Oil settles on beaches and kills organisms that live there; it also settles on ocean floor and kills benthic (bottom-dwelling) organisms such as crabs. Oil endangers fish hatcheries in coastal waters and as well contaminates the flesh of commercially valuable fish. In the Nigerian coastal environment a large areas of the mangrove ecosystem have been destroyed. Oil spillage plays tremendous role in wildlife extinction. Habitat loss, degradation and fragmentation are the leading factors that cause wildlife extinction to occur. Oil spill which contains

both heavy and light oils can explode and ignite wildfire on an environment, this wildfire courses different impact to categories of organisms such as higher, lower, and flying organisms.

Wildfire or wild land fire is an uncontrolled fire in an area of combustible vegetation that occurs in the communities or areas.

Higher animals (elephants, monkeys, etc.) response to fire depends on the species, its habitat, and their mobility and on the uniformity, severity, size, and the duration of the fire (Wright and Bailey 1982). Most animals have the ability to move away from fire if necessary. Land mammals walk and runand also have the ability to escape form wildfire coursed by oil spillage. Most small mammals avoid fire by using underground tunnels, pathways under moist forest litter, stump and root holes, and spaces under rock, talus, and large dead wood (Ford *et al* 1999). Many of these higher animals migrate in search for food, shelter and water. While some are killed because of the thick ground smoke occurs. Singer and Schullery (1989) report that most of the large animals died of smoke inhalation. Some of these animals may be key stone species to the community such as elephant that plays a critical role in the environment because many other animals benefit from it examples are bees, beetles, butterflies etc. all feeds from the elephant feces and these feces also add nutrient to the soil. The migration and extinction of these key organisms in the forest ecosystems, causes lack

of food, clothes, and significantly slow the recovery rate of the community (Boer, 1989).

Lower organisms such as earthworms, snails, snakes, ants, etc. are affected by oil spills and wildfire because their bodies can not withstand the toxic nature of the oil and due to the locomotive and slow movement of some lower organisms they may not be able to escape wildfire as fast as higher organisms. Most small animals seek refuge underground or in sheltered places. Some animals such as Snakes and ants may escape because they are fest and sensitive but can be killed by smoke and heat. The vulnerability of snakes to fire may increase while the are in ecdysis (the process of shedding skin) (Means and Campbell 1981). The vulnerability of insects and other invertebrates to fire depends on their location at the time of fire. While adult forms can burrow or fly to escape injury (Robbins and Myers 1992). The strategies animals have in place to escape the flames do not work, especially for young and small animals. They may not be able to find shelter or run fast enough to escape the flames. “Those few who do survive fires usually have prolific reproduction.

Flying organisms such as birds, flies, insects etc. can easily escape wildfire faster than other organisms due to their ability to fly high the birds can be an indicator species in that they indicate an event in a particular environment. Some indicate a climate change i.e. raining and

dry season and some indicate danger in an environment. These flying organisms can be endangered when oil spills on their feathers impairing their flight and making them more vulnerable to cold. This can course extinction to those species of birds. Fire caused bird mortality depends on the season, uniformity, and severity of burning (Kruse and Piehi 1986). Many birds leave burning areas to avoid injury. Most birds and mammals that immigrate in response to fire are attracted by food resources.

The biggest effect wildfire has on wildlife habitat is by altering the three things animals needs most: food, water and shelter. Plants and shrubs that provide food are lost and this lost often results in wildlife moving away to areas where food, water and shelter are more readily available. And also the effect fire has on wildlife is the change in their habitats. Wildlife habitats, like forests are not static, the evolve and respond to disturbances as do other natural systems. Fire changes the proportion, arrangement and characteristic of habitats across the land scape.

Wildfires are also a risk to human health as the release of hazardous chemicals from the burning of wildland fuels significantly impacts health in humans. Wildfire smoke is compose the primarily of carbon dioxide and water vapor other common smoke components present in lower concentration are carbon monoxide, formaldehyde, acrolein

polyaromatic hydrocarbons & benzene. Small particulate suspended in air which come in solid form or in liquid droplets are also present in smoke. Carbon dioxides have light concentration in smoke; it poses low health risk due to its low toxicity. Keeley (1995).

Carbon monoxide & fine particulate matter, particularly 2.5um in diameter & smaller, have been identified as the major health threats. The degree of wildfire smoke exposure to an individual is dependent on the length, severity, duration, & proximity of the fire. People are exposed directly to smoke via the respiratory tract through inhalation of air pollutants. Indirectly, communities are exposed to wildfire debris that can contaminate soil & water supplies. Bravo, (2009).

Residents in communities surrounding wildfires are exposed to lower concentration of chemicals, but they are at a greater risk for indirect exposure through water or soil contamination. Exposure to residents is greatly dependent on individual susceptibility. Vulnerable persons such as children (ages 0-4), the elderly (ages 65 and older), smokers, & pregnant women are at an increased risk due to already compromised body systems, even when the exposure are present at low chemicals concentrations & for relatively short exposure periods. The U.S Environmental Protection Agency (EPA) development the Air Quality Index (AQI) a public resource that provides national air quality standard concentrations for common air pollutants. The public can use

this index as a tool to determine their exposure to hazardous air pollutants based on visibility range. Additionally, there is evidence of an increase in material stress, thus affecting birth out comes. The inhalation of smoke from a wildfire can be a health hazard because wildfire smoke is primarily composes of carbon dioxide, water vapor, particulate matter, organic chemicals, nitrogen oxides and other compounds. The health concern is the inhalation of particulate matter and carbon monoxide. Particulate matter (PM) is a type air pollution made up of particles of dust and liquid droplets. Douglass (2008) carbon monoxide in smoke can be inhaled in to the lungs where it is absorbed into the blood stream and reduces oxygen delivery to the body's vital organs. At high concentration it can cause headache, weakness, dizziness, confusion, nausea, disorientation, visual impairment, coma and even death.

In many villages near oil installations, even when there has been no recent spill, an oily sheen can be seen on the water, which in fresh water areas is usually the same water that the people living there use for drinking and On several occasions, people interviewed by Human Rights Watch said that spills in their area had made people sick who drank the water, especially children. The heath implications of oil spills are many. Generally, people in the affected areas complain about

health issues including breathing problems and skin lesions. Many have lost basic human rights such as health, access to food, clean water, and an ability to work (Anderson and LaBelle, 2000).

2.2.2 Impact of Oil Spillage on Flora

Oil spillage kills plants, poison algae, disrupts major food chains and decreases the yield of edible crustaceans. In the Nigerian coastal environment a large areas of the mangrove ecosystem have been destroyed. The mangrove was once a source of both fuel woods for the indigenous people and a habitat for the area's biodiversity, but is now unable to survive the oil toxicity of its habitat.

Some indigenous plant species may no longer survive due to high rate of toxicity on land. The lost of plant result to the high risk of land erosion, soil degradation.

Oil spills ignite wildfire on forest and vegetation altering the three things plants needs most such as water, manure and nutrient. Some flora such as trees, shrubs and grass varies greatly in wildfire survival and this is influenced by size, structure, age, health and many other factors.

Trees survival depends on the nature of the trees that grows on that area high intensive fire might just cause a big tree to lost the current fruit and leaves, some part of the trees partly dies and takes a longer time to recover. Even if they are not killed by fire, trees generally take

a longer time to recover to pre-fire levels of structure and dominance relative to smaller, faster growing shrubs and grasses. Fire may wound or scar trees, providing entry points for pathogens (e.g. fungi, insects) that could lead to delayed impacts or mortality as a result of fire. Some tree species exhibit adaptive traits such as thick bark, ability to heal fire scars, resprouting capability and seed adaptations. The roots of atree are deep into the ground which enables it tostand fame and reach for deeper water that has not be contaminated by oil spills in order to survive. Many tree species have the ability to resprout after being burned, either from the root stock or the stem (Agee, 1993).

Grasses can not survive the toxic nature of the soil due to oil spills and wildfire can easily wipe its existents. Gasses do not have longer roots spared inside the ground, they are smaller then tress and can not withstand the effect of fire, these grasses may no longer grow or may take longer years to grow at that environment. New stand of grass springs up from surviving root systems and many graminoids (e.g. grasses, sedges) are fire tolerant and appear to be good candidates for burning. Most species respond better during dormant burns and when soil conditions are moist or wet, so that roots rhizomes, and organic soils are less likely to be damaged.

Shrub is a woody plant which is smaller than trees and generally has a rounded shape. Shrub has several main stems growing from ground

level, rather than one trunk. It varies in size from ground cover right up to huge bushes. Woody shrubs may be lumped with trees in certain respects, in that they look similar and may be perceived as fire sensitive. Shrubs are usually top-killed by fire, but many sprout vigorously from below ground parts and recover quickly from fire. And also dense shrub thickets can create fire hazards and carry fire to unwanted areas. Shrub can not survive oil spills and wildfire which leads to their extinction. Oil spills leads to the destruction of large forest land, vegetation and farm land disturbing flora habitation (Orubu *et al*, 2002).

In forests areas where fire is not a natural disturbance, it can have devastating impacts on forest vertebrates and invertebrates – not only killing them directly, but also leading to longer-term indirect effects such as stress and loss of habitat, territories, shelter and food. The loss of key organisms in forest ecosystems, such as invertebrates, pollinators and decomposers, can significantly slow the recovery rate of the forest (Boer 1989).

2.3 Oil Spill Incidents in Nigeria

Oil spill incidents have occurred in various parts and at different times along our coast. Some major spills in the coastal zone are the GOCON's Escravos spill in 1978 of about 300,000 barrels, SPDC's Forcados Terminal tank failure in 1978 of about 580,000 barrels and

Texaco Funiwa-5 blow out in 1980 of about 400,000 barrels. Other oil spill incidents are those of the Abudu pipe line in 1982 of about 18,818 barrels, The Jesse Fire Incident which claimed about a thousand lives and the Idoho Oil pill of January 1998, of about 40,000 barrels. The most publicized of all oil spills in Nigeria occurred on January 17 1980 when a total of 37.0 million litres of crude oil got spilled into the environment. This spill occurred as a result of a blow out at Funiwa 5 offshore station. Nigeria's largest spill was an offshore well-blow out in January 1980 when an estimated 200,000 barrels of oil (8.4million US gallons) spilled into the Atlantic Ocean from an oil industry facility and that damaged 340 hectares of mangrove (Nwilo and Badejo, 2005).

According to the Department of Petroleum Resources (DPR), between 1976 and 1996 a total of 4647 incidents resulted in the spill of approximately 2,369,470 barrels of oil into the environment. Of this quantity, an estimated 1,820,410.5 barrels (77%) were lost to the environment. A total of 549,060 barrels of oil representing 23.17% of the total oil spilt into the environment was recovered. The heaviest recorded spill so far occurred in 1979 and 1980

With a net volume of 694,117.13 barrels and 600,511.02 barrels respectively. Available records for the period of 1976 to 1996 indicate that approximately 6%, 25%, and 69% respectively, of total oil spilled in the Niger Delta area, were in land, swamp and offshore

environments. Also, between 1997 and 2001, Nigeria recorded a total number of 2,097 oil spill incidents.

Thousands of barrels of oil have been spilt in to the environment through our oil pipelines and tanks in the country. This spillage is as a result of our lack of regular maintenance of the pipelines and storage tanks. Some of these facilities have been in use for decades without replacement. About 40,000 barrels of oil spilled into the environment through the offshore pipeline in Idoho. Sabotage is another major cause of oil spillage in the country. Some of the citizens of this country in collaboration with people from other countries engage in oil bunkering. They damage and destroy oil pipelines in their effort to steal oil from them. SPDC claimed in 1996 that sabotage accounted for more than 60 percent of all oil spilled at its facilities in Nigeria, stating that the percentage has increased over the years both because the number of sabotage incidents has increased and because spills due to corrosion have decreased with programs to replace oil pipelines (SPDC, 1996). Pirates are stealing Nigeria's crude oil at a phenomenal rate, funneling nearly 300,000 barrels per day from our oil and selling it illegally on the international trade market. Nigeria lost about N7.7 billion in 2002 as a result of vandalization of pipelines carrying petroleum products. The amount, according to the PPMC, a subsidiary of NNPC, represents the estimated value of the products lost in the process. Illegal fuel

siphoning as a result of the thriving black market for fuel products has increased the number of oil pipeline explosions in recent years. In July 2000, a pipeline explosion outside the city of Warri caused the death of 250 people. An explosion in Lagos in December 2000 killed at least 60 people. The NNPC reported 800 cases of pipeline vandalization from January through October 2000. In January 2001, Nigeria lost about $4 billion in oil revenues in 2000 due to the activities of vandals on our oil installations. The government estimates that as much as 300,000 bbl/d of Nigerian crude is illegally bunkered (freighted) out of the country. In Nigeria, fifty percent (50%) of oil spills is due to corrosion, twenty eight percent (28%) to sabotage and twenty one percent (21%) to oil production operations. One percent (1%) of oil spills is due to engineering drills, inability to effectively control oil wells, failure of machines, and inadequate care in loading and unloading oil vessels.

2.4 Sources of Oil Spills in Nigeria

Oil spills may occur for numerous reasons such as equipment failure, disasters, deliberate acts, or human error (Anderson and LaBelle, 2000). Shows the percentage each subcategory has contributed to the total number of oil spills in Nigeria in the past five years (Shekwolo, 2005). Crude oils are exclusively natural products, most of which are produced from artificial wells. Natural seepage of crude oils occurs in various parts of the world, not only on land, but also on the seabed.

Seeps emerge through fractures in the crests of folds in rock formations beneath the sea floor that contain oil and gas deposits. Oil and gas tend to rise and become trapped in anticlinal folds in subsea rock strata. Seepage occurs through fracture zones where the folds are truncated at the sea floor. Seeps may emanate from a single point or as many as 3 x 104 individual seepage signals may be merged onto a high resolution profile record (Clark *et al.*, 2000).

2.5 Causes of Oil Spillage in Nigeria

Oil spills are a common event in Nigeria and occur due to a number of causes, including: corrosion of pipelines and tankers (accounting for 50% of all spills), sabotage (36%), and oil production operations (6.5%), with 1% of the spills being accounted for by inadequate or non-functional production equipment. The largest contributor to the oil spill total, corrosion of pipes and tanks, is the rupturing or leaking of production infrastructures that are described as, "very old and lack regular inspection and maintenance. A reason that corrosion accounts for such a high percentage of all spills is that as a result of the small size of the oil fields in the Niger Delta, there is an extensive network of pipelines between the fields, as well as numerous small networks of flow lines the narrow diameter pipes that carry oil from wellheads to flow stations allowing many opportunities for leaks.

In onshore areas most pipelines and flow lines are laid above ground. Pipelines, which have an estimate life span of about fifteen years, are old and susceptible to corrosion. Many of the pipelines are as old as twenty to twenty-five years even Shell admits that "most of the facilities were constructed between the 1960s and early 1980s to the then prevailing standards. SPDC [Shell Petroleum and Development Company] would not build them that way today." Sabotage is performed primarily through what is known as "bunkering", whereby the saboteur attempts to tap the pipeline. In the process of extraction sometimes the pipeline is damaged or destroyed. Oil extracted in this manner can often be sold. Sabotage and theft through oil siphoning has become a major issue in the Niger River Delta states as well, contributing to further environmental degradation.

Damaged lines may go unnoticed for days, and repair of the damaged pipes takes even longer. Oil siphoning has become a big business, with the stolen oil quickly making its way onto the black market. While the popularity of selling stolen oil increases, the numbers of deaths are increasing. In late December 2006 more than 200 people were killed in the Lagos region of Nigeria in an oil line explosion Nigerian regulations of the oil industry are weak and rarely enforced allowing, in essence, the industry to self- regulate. An operation in the Delta, as the environment is growing increasingly uninhabitable. People in the

affected areas complain about health issues including breathing problems and skin lesions many have lost basic human rights such as health, access to food, clean water, and an ability to work. Also some of the major causes for the consistent oil spills in the Ijaw environment or elsewhere in Nigeria include blowout, pipeline corrosion, equipment failure and sabotage (Aaron, 1996). Other minor causes of oil spills also include accidental spills, overflow of tanks, valve failure, over pressure, sand cut through erosion, and engineering error. Bruce (2003) suggests that the obsolete leaking and rusting of oil pipelines had become a major cause for the Ijaw people, as in the case of the blowouts at Jesse Creek and Botem village in Ijaw and Ogoni land in the 1990s, with devastating effects on the courses that supplied them with drinking water (Jike, 2004; Saro-Wiwa, 1992). Blowout as a major factor responsible for spills occurs when there is too much pressure on the pipeline transporting oil to the terminal station, as in Bonny or Port Harcourt. Leaking and rusting pipelines led to the contamination of water and soil in the area. An offshore blowout of January 12, 1980 saw about 20,000 barrels of oil (8.4 million US gallon) spilled into the Atlantic, damaging about 340 hectares of the Delta mangrove (Nwilo, 2005).

2.6 Control and Management of Oil SpillageinNigeria

The Federal Government, oil companies and non-governmental agencies have made several efforts to manage oil spill disaster along our coastline. These efforts are discussed in the following sections Nigerian Government Action:

To reduce the rate of oil incidents along the Nigerian Coast particularly as a result of vandalization, the Federal Government through an act of the National Assembly created the Niger Delta Development Commission (NDDC). Part of the responsibilities of the Commission is to develop a master plan for the development of the Niger Delta, provide infrastructure and create an enabling environment for industrialization and employment. There are also several other laws dealing with issues related to oil pollution in the environment. Furthermore, standards for the development of the environmental sensitivity index maps for the coast of Nigeria have been developed by the Environmental Systems Research Institute (ESRI). These standards are to be used by all the oil companies to prepare ESI maps for their areas of operations in Nigeria. A number of Federal and state agencies deal with the problems of oil spill in Nigeria. The agencies include: the Department of Petroleum Resources (DPR), the Federal Ministry of Environment, the State Ministries of Environment and the National Maritime Authority. A National Oil Spill Detection and Response

Agency (NOSDRA) has been formed and approved by the Federal Executive Council of Nigeria. The Ministry of environment, which initiated the Agency, has also forwarded to the federal executive council for approval, the reviewed draft National Oil Spill Contingency Plan (NOSCP) which the Agency would manage (Alexandra Gas and Oil Connections, 2006).

The establishment of the contingency plan and the agency was in compliance with the International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC90) to which Nigeria is a signatory. According to the ministry's sources, the draft bill on the NOSDRA was being put together and would be forwarded to the National Assembly to be enacted into law (Alexandra Gas and Oil Connections, 2006). Apart from intensifying efforts towards compliance monitoring and enforcement of oil and gas regulations and standards, the ministry is also mounting pressure on the oil and gas operators for a gas flare-out. Effort is also being made, according to the sources, to ensure the use of environmental-friendly drilling fluid and mud systems (Alexandra Gas and Oil Connections, 2006).

There is a need to create serious awareness among the populace on the implications of oil spill incidents on the environment. Governments must assist the rural communities in claiming their rights on oil spills and ensure that digital ESI maps are readily available for managing oil

spill maps. Government should have strict rules for local oil tankers that would ply our coastal and inland waters as a result of the new Cabot age law that is just being passed into law in the country (Nwilo & Badejo, 2005).

CHAPTER THREE

MATERIALS AND METHODS

3.1 STUDY AREA.

Sarkin Pawa is located in the region of Niger state. Niger's capital Minna is approximately 77km/48mi away from Sarkin Pawa. The distance from Sarkin Pawa to Nigeria's capital Abuja is approximately 115km/71mi. Sarkin Pawa lies between the latitude of 3.20' east and longitude 8 and 11.3' north. It is bordered to the North by Izom, and 30km South by Kazai and 20km East by Gwada. Kaduna and Federal Capital Territory bordered the state by both North-East and South-East respectively.

Sarkin Pawa area lies within the basement complex region of northern Nigeria. Danbatta *et al,* (2002) discussed the different basement rock types found in the study area, which include migmatites, gneisses, met sediments and older granites.

The soil in Sarkin Pawa is the flood plain type and is characterized by considerable variations. The soil is of two main types which could be used for agriculture and are rich in minerals for the manufacture of various products. The two types of soil are:

(a) The Ku-soil which has little hazards and

(b) The Ya-soil which has a better water holding capacity.

Sarkin Pawa experiences distinct dry and wet seasons with annual rainfall varying from 1,100mm in the Northern part of the State to 1,600 mm in the southern parts. The maximum temperature is recorded between March and June, while the minimum is usually between December and January. Generally, the climate soil and hydrology of the State permit the cultivation of most of Nigeria's staple crops and still allows sufficient opportunities for grazing, fresh water fishing and forestry development.

About 65% of the Study areas are farmers, while the remaining 35% are engaged in other vocations such as, manufacturing, business, production of crafts and arts. The Study area is very richly and abundantly endowed naturally with fertile land. Added to this is the even climate of the geographical area which is characterized by very rich annual rainfall. To crown it all, a wide variety of mineral and material resources are known to be available in the area. Therefore, whether the interest is agriculture or industry, the study area has the capacity to sustain it.

According to National population census (2006) the total population of the study area stood at 594,508. Which comprises of male, female and children.

3.2 Research Design.

The research method employed in this study was the descriptive survey approach aimed at examining and describing the major situation associated with oil spillage in the study area. The study area of Sarkin Pawa were randomly picked within male and female of different age bracket, and a well design questionnaire, in this research both primary and secondary data have been used. The primary data was organized from the study area which are data collection such as administering of questionnaire, observation, personal interviews, discussion with indigenes of the communities in the study area and the oil company operators. While Secondary source of data were gathered from a wide range which involves Articles, textbooks, web database, internet, publish books, and related literatures on how oil spillage had affected the flora, fauna and biodegradation on the land.

3.3 Sampling Techniques.

3.3.1 Visual Observation

Several observation of the study area was made during the field visit. A distinct difference was found in the land condition, where there are oil spills. The trees and grass were wiped by wildfire which was ignite by a moving truck. This results to the extinction of both fauna and flora and also causes environmental pollution.

3.3.2 Administration of Questionnaire.

The data was collected from 40 respondents through convenient sampling technique. 25 respondents where randomly selected from the age of 25-35. While 15 respondents from the age of 36-45.

A structured questionnaire was developed in English and translated in a lay mans language (simple English). The data was collected randomly within the community of Sarkin Pawa. Data was collected through survey method from the respondents. Responses were measured by using scale that showed the level of agreement and disagreement of respondents in the statements of YES or NO.

3.4 Statistical Analysis

Responses of the respondents were coded for analysis using SPSS software. Simple descriptive statistics (frequencies and percentages) is used to analyze the results of the study.

CHAPTER FOUR

RESULTS

4.1 Demographic Characteristic of Study Population.

Table 1 shows the categories of the respondents in the study area of Sarkin Pawa which include: Age, Gender, Education, Occupations and Residence. The table gives a description of the attributes of the participants. There are 40 respondents and the profile demonstrates the demographic characteristics of the study population. The respondent from the ages of 24-35 are 25 (62.5%) while the ages of 36-45 are 15 (37.5%). The majority of the respondents were males 32 (80.0%) while female are 8 (20.0%) and about 39 (97.5%) are all resident in the area while 1 (2.5%) is not a resident of the area. Table 1 shows the education qualification of the respondent, about 31 (77.5%) are primary school holder, about 8 (80.0%) are secondary school holder while 1 (2.5%) hold tertiary institution certificate. The table shows that at of 40 respondent 23 (57.5%) are farmers/ fishers while 17 (42.5%) are trader/ business.

Table 1 Demographic Characteristics of Study Population.

Character	Variables	Number of Responses (N=40)	%
Age	25-35	25	62.5
	36-45	15	37.5
Gender	Male	32	80.0
	Female	8	20.0
Education	Primary	31	77.5
	Secondary	8	20.0
	Tertiary	1	2.5
Occupation	Farming/Fishing	23	57.5
	Trading/Business	17	42.5
Residence in	Yes	39	97.5
Sarkin Pawa	No	1	2.5

4.2 Causes of Oil Spillage in Sarkin Pawa.

This study shows the causes of oil spillage in Sarkin Pawa Area, Niger state, Nigeria.

Table 2 shows the response of respondents on the causes of oil spillage in Sarkin Pawa base on Age group. The ages from 25-35 (n=25) while ages from 36-45 (n=15).

Table 2, 84.0% from the ages of 25-35 and 93.3% from the ages of 36-45 have good knowledge of oil spillage. 60.0% from the ages of 25-35 and 86.7% from the ages of 36-45 indicated that they have experience of oil spillage. 24.0% from the ages of 25-35 and 33.3% from the ages of 36-45 indicated that oil spillage was due to maintainers error. About 40.0% from the ages of 25-35 and 53.3% from the ages 36-45 indicated that oil spillage was due to vandalisation. While 80.0% from the ages 25-35 and 80.0% from the ages 36-40 also indicated that oil spillage was due to negligence.

Table 2 Responses on Causes of Oil Spillage Base on Age Group

Causes	Age Group					
	25-35 (n=25)	%	36-45 (n=15)	%	Total	%
Knowledge of oil spillage	21	84.0	14	93.3	35	87.5
Oil spillage experience	15	60.0	13	86.7	28	70.0
Spillage due to maintenance error	6	24.0	5	33.3	11	27.0
Spillage due to vandalization	10	40.0	8	53.3	18	45.0
Spillage due to negligence	20	80.0	12	80.0	32	80.0

Table 3 also shows the response of respondents on causes of oil spillage base on gender. Male (n=32) Female (n=8).

The table shows that 87.5% of male and 87.5% of female's respondents has good knowledge of oil spillage. 71.9% of male and 62.5% of female respondents has experience of oil spillage. 31.3% of male and 12.5% of female respondents indicates that oil spillage was due to maintains error 46.9% of male and 37.5% of female respondents indicated that oil spillage was due to vandalization. While 75.0% of male and 100% of female respondents highly indicates that oil spillage was due to negligence.

Table 3 Response on Causes of Oil Spillage Base on Gender.

Items	Gender					
	Male (n=32)	%	Female (n=8)	%	Total (n=40)	%
Knowledge of oil spillage	28	87.5	7	87.5	35	87.5
Oil spillage due to experience	23	71.9	5	62.5	28	70.0
Oil spillage due to maintenance error	10	31.3	1	12.5	11	27.5
Oil spillage due to vandalization	15	46.9	3	37.5	18	45.0
spillage due to negligence	24	75.0	8	100	32	80.0

Where P=0.05

Table 2 and 3 shows there is no significant difference in causes of oil spillage in both Age group and Gender.

4.3 Effect of Oil Spillage in Sarkin Pawa.

This study investigated the effect of oil spillage in Sarkin Pawa Area, Niger state. Five effects were examined in the area.

Table 4 shows the response of respondents on the effect of oil spillage base on age group. Ages from 25-35 (n=25) and from 36-45 (n=15).

The table shows that 100% from the ages 25-35 and 100% from the ages of 36-45 respondents highly indicated that oil spillage have effects on flora. 76.0% from the ages 25-35 and 80.0% from the ages of 36-45 respondents indicated that oil spillage have effect on fauna. 92.0% from the ages of 25-35 and 93.3% from the ages of 36-45 respondents indicated that there are effect of fire due to oil spillage. 84.0% from the ages of 25-35 and 86.7% from the ages of 36-45 responded that there are great effect of oil spillage on the environment. While about 40.0% from the ages of 25-35 and 40.0% from the ages of 36-45 responded that there are oil spillage effects on health.

Table 4. Response on Effect of Oil Spillage on Age Group.

Effects	Age Group					
	25-35 (n=25)	%	36-45 (n=15)	%	Total (n=40)	%
Effect of oil spillage on flora	25	100	15	100	40	100
Effect of oil spillage on fauna	19	76.0	12	80.0	31	77.5
Effect of fire due to oil spillage	23	92.0	14	93.3	37	92.5
Effect of oil spillage on environment	21	84.0	13	86.7	34	85.0
Effect of oil spillage on health	11	40.0	6	40.0	17	42.5

Table 5 shows the response of respondents on the effect of oil spillage base on gender. Male (n=32) female (n=8).

Table 5 shows that 100% of male and 100% of female responded that oil spillage has great effect on flora. 78.1% of male and 75.0% of female responded that there are effects of oil spillage on fauna. 90.6% of male and 100% of female responded that there are effects of fire due to oil spillage. 81.3% of male and 100% of female responded that oil spillage has high effect on environment. While 43.8% of male and 37.5% of female indicated that oil spillage have effect on health

Table 5.. Responses on Effect of Oil Spillage Base on Gender.

Item	Gender					
	Male (n=32)	%	Female (n=8)	%	Total (n=40)	%
Effect of oil spillage on flora	32	100	8	100	40	100
Effect of oil spillage on fauna	25	78.1	6	75.0	31	77.5
Effect of fire due to oil spillage	29	90.6	8	100	37	92.5
Effect of oil spillage on environment	26	81.3	8	100	34	85.5
Effect of oil spillage on health	14	43.8	3	37.5	17	42.5

Where P=0.05

Table 4 and 5 shows there is no significant difference in effects of oil spillage in both Age group and Gender.

Plate1: Clean up and Remediation of crude Spill site at Sarkin Pawa.

Plate 2: Area burnt by fire due to Oil Spills

Plate 3: Clean up and Remediation of crude Spill Site at Sarkin Pawa.

Plate 4: PPMC Pipes for various Crude oil Products at Sarkin Pawa Pump Station

Plate 5: Sarkin Pawa PPMC –NNPC Pump Station

Plate 6: PPMC – NNPC Pipes for transferring of various Crude oil Products

Plate 7: Storage Tanks were various Crude oil Products were stored at Sarkin Pawa

Plate 8: Loading bay were Tankers load different products for sale and delivery at Sarkin Pawa Station

Plate 9: Damaged fauna within the study area due to oil spills

Plate 10: Damaged soil flora within the study area due to oil spill

CHAPTER FIVE

Discussion, Recommendations and Conclusions

5.1 Discussion

The study shows the demographic characteristic of the study area are of different categories such as Age, Gender, Education, Occupation and residences. The study area are more of male than female and they are all resident in the area their educational background are more of primary school than secondary while 1% hold tertiary institution certificate. The occupations of the respondents are farming, fishing, trading and business.

The study shows that an underground high pressure PPMC pipeline that was conveying crude oil from Escravos, near Warri, to Sarkin Pawa pump station to Kaduna Refinery. The tanks in Sarkin Pawa pump station got filled up and the oil spilled all over the area. It

resulted into the spillage of unknown quantity of crude oil which polluted the environment. Thereafter a moving vehicle ignited fire in the area, damaging the soil, farmlands, vegetation, aquatic life and microorganisms.

The result shows respondents opinion regarding the causes of oil spillage within the community of Sarkin Pawa and its environs.

Vandalisation and Maintenance error as a cause of oil spillage, few of the respondents responded yes while most of the respondents

responded No to the statement. Negligence as the cause of oil spillage almost all the respondents responded yes while minute respondents responded No to the statement.

This can be compare to Osueke (2014), findings that negligence is the major causes of oil spillage in Izombe, with 70.0% responses.

The result shows the respondents opinion regarding the effect of oil spillage.

Habitant loss, migration and extinction of flora and fauna as a result of oil spillage, almost all the respondents responded yes to the statement while few of the respondents responded no to the statement.

The damage and decrease in agricultural land and vegetation by fire as an effect of oil spillage, almost all the respondents responded yes while minute respondents responded no to the statement.

Environmental degradation, devastation, pollution and other form of ecological disasters as a result of oil spillage, most of the respondents responded yes while few respondents responded no to the statement.

Health hazard as an effect of oil spillage, few of the respondents responded yes while most of the respondents responded no to the statement.

These can be compared to Osueke (2014), findings on the impact of oil spillage on Izombe that environmental degradation and pollution, damage and decrease in agricultural land and vegetation, loss and

extinction of flora and fauna and health hazard are the major effect of oil spillage.

5.2 Conclusion

5.2.1 Causes of Oil Spillage in Sarkin Pawa

The study clearly shows the negative impact of oil spillage within the environment in the community of Sarkin Pawa in Niger state. Findings showed that negligence of duty from the oil company operator's are the main cause of oil spillage in the area with the percentage of 80.0% while vandalization of pipe lines has a percentage of 45.0% and maintenance errors have the lowest percentage of 27.5%. From the results the findings shows that there is no significant difference in cause of oil spillage, where P= 0.05.

5.2.2 Effect of Oil Spillage in Sarkin Pawa

Findings of the study in respect to effect of oil spillage in Sarkin Pawa shows that habitant loss, migration and extinction of flora and fauna are the main effect of oil spillage with the percentage of 100%. While damage and decrease in agricultural land and vegetation by fire have the percentage of 92.5%. Environmental degradation, devastation, pollution and other form of ecological disasters have the percentage of 85.0% and health hazard as an effect have the lowest percentage of 42.5%. From the result the findings shows that there is no significant different in the effect of oil spillage, where P= 0.05.

5.3 Recommendations

5.3.1 Causes of Oil Spillage

i. Similar studies should be carried out at regular interval on oil spillage and how it causes damage on flora, fauna and environment.

ii. To control the rate of oil spillage within affected areas, federal and state governments should make an in-depth analysis of the causes of oil-spills, in order to find a lasting solution to the problem within the areas.

iii. The oil companies should give orientation on danger of maintenance error and negligence of duty to the companies' operators.

iv. The oil company operators should be trained/upgraded on modern technics of loading to avoid future occurrences

v. The federal government should not allocate oil company pump station close to farm lands and villages

5.3.2 Effect of Oil Spillage

i. Because environmental devastation is inevitable as long as oil exploitation continues, both the Government of the federation and oil-producing companies should be involved in taking precautionary and remedial measures that can minimize the negative effects of oil-spills within the areas of pipeline installations to avoid further and frequent oil spillage within the areas.

ii.

iii. The agencies that are responsible and saddle with various policies relating to environmental management should wake up to their assigned responsibilities towards curbing the oil spillage within the affected areas and communities across the country.

iv. There should be a law enactment at both the state and national assemblies that will aid and guide individuals to forestall the act of pipeline line vandalism and other human activities that lead to oil spillage within the affected areas in the country.

v. Studies should be carried out at regular interval on the effect of oil spillage and how it can be prevented.

vi. Community heads should educate their populace on the effects of oil spillage e.g. drinking polluted water and farming on the affected lands

vii. The community should include their vigilantes on surveillance on oil pipeline to avoid lager/wider spillage.

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APPENDIX I:

QUESTIONNAIRE

TOPIC: IMPACT OF OIL SPILLAGE ON FLORA AND FAUNA IN SARKIN PAWA AREA.

SECTION A: ABOUT YOU (please tick all that apply to you)

1. Are you ? Female [ ] Male [ ]
2. Age? 25-35 [ ] 36-45 [ ]
3. Do you reside in Sarkin Pawa? Yes [ ] No [ ]
4. Which work do you do? Farming/Fishing [ ] Trading/Business [ ]
5. Education Qualification? Primary [ ] Secondary [ ] Tertiary [ ]

SECTION B: AWARENESS. (please tick only the box that most apply)

1. Do you know about oil spillage? Yes [ ] No [ ]
2. Have you experienced an oil spillage incident? Yes [ ] No [ ]

SECTION C: CAUSES OF OIL SPILLAGE (please tick the box that most apply)

1. Do you consider maintains error to be the cause of oil spillage?
   Yes [ ] No [ ]
2. Do you consider vandalization to be the cause of oil spillage?
   Yes [ ] No [ ]
3. Do you consider negligence to be the cause of oil spillage?
   Yes [ ] No [ ]

SECTION D: EFFECT OF OIL SPILLAGE (please tick the box most apply)

1. Was there any spillage effect on grasses, shrubs and trees? Yes [ ] No [ ]
2. Was there any spillage effect on animals (running, creeping and flying)
   Yes [ ] No [ ]
3. Was there any fire blow out due to oil spillage? Yes [ ] No [ ]
4. Have oil spillage affected you through the environment? Yes [ ] No [ ]
5. Have oil spillage affected you through health (illness)? Yes [ ] No [ ]