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Full Length Research Paper

Ecological implication of market gardenning in the old Ogoja zone of Nigeria

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Man's attempt to improve his income and also supplement his food especially during dry season in the old Ogoja zone has led him to develop dry season farming along watershed. Man's farming activities mainly for market gardening has impacted in no small way on the environment which has resulted in the reduction of rainfall volume, increase temperature, biodiversity depletion and soil fertility loss. In this research which spans a period of five years, the activities of these market gardeners were critically assessed; we collected data from the field in three folds, temperature data by measuring temperature on the farm site twice every year. During the rainy season and during the dry season. We also collected rainfall data for the same period under study. We went further to collect soil moisture data. We used simple analysis to compare the temperature and rainfall data from 2005 to 2009 when the research was initiated. It was discovered from the research that the market gardening activities as carried out in the area have potentially impacted on the environment. We concluded that if nothing is done to reduce this trend, it will lead to global climate problems. We proffered some suggestions as to reduce this trend in the study area through the use of water from a reservoir or hand dug well and also such farms should be cultivated away from watershed and water courses. We equally suggested that the use of inorganic artificial fertilizer should be replaced with the use of organic manure like composting and farm yard manure from the leaf litters and the grasses removed from land clearance in the farm.

Key words: Market gardening, eutrophication, enthrophication, ecological change, global impact, inorganic and organic manure and watershed depletion.

INTRODUCTION

Man's quest for the improvement of his income for his daily sustenance and the reduction of poverty has seen man in various ways struggling helplessly to get something from the environment irrespective of the climatic, ecological, social and cultural implication of his action. In recent times, there has been increasing discussion about the link between conservation, poverty reduction and human livelihoods, gaining momentum since the Rio Earth Summit in 1992. The International Union for the Conservation of Nature (IUCN) has intensified its efforts to address questions of ethics, poverty and human livelihoods in its conservation efforts (Pretty, 2000).

Despite the size of its workforce, agricultural production accounts for less than five percent of the gross world product (an aggregate of all gross domestic products) (Gordon et al., 2007).

Poverty is the root cause of most environmental problems. This is because poor people have problems with meeting their daily needs; food, shelter, health and resort to for their survival is the land or the environment

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Abbreviations: IUCN, International Union for the Conservation of Nature; **SSI,** semi-structured interviews.

where they look at the resources within it as their ancestral inheritance. They also see this as their community resources where they can always fall back to for complimenting their sources of livelihoods. This is because the activities of man have increasingly impacted on the environment and its resources. This has also affected biodiversity and other species within the ecosystem. Man's activities on the ecosystem has altered the ecological balance and functioning of the entire ecosystem. The sum total of these effects is specie extinction including specie loss, endangerment, disappearance and ecological problems like shortage in rainfall, climate change, flooding, increased heat, fertility loss and food insecurity.

Chrispeels and Sadava (1994) saw the action of man in the environment as acting without making recompense to the environment and the future generations. Pretty (2000) observed that man has so impacted on the environment that he does not even think well about the influence of his activities on the environment. To Darlong (2004) poverty is the reason behind this action since he must satisfy his basic needs. These needs according to Maslow (1963) are arranged in an order, and once a particular need is met, the next need on this hierarchy of human needs surfaces automatically. Maslow (1963) listed human basic needs to include, physiological needs (food, shelter, clothing etc.), safety need (security, consciousness and identification among a crowd of people), love (acceptance, love and belonging), self esteem (human worth and respect, self integrity, self pride and honor) and self actualization (the sense of fulfillment and arrival in the social strata in any society, class formation and attainment).

To Sol (2003) the major causes of environmental problems are from the following causes: habitat decimation and destruction, urbanization, pollution and natural disaster. Eneji et al. (2009) included faulty agricultural practices as another cause of environmental problems. In their submission, they looked at the major problems of the environment to include deforestation for whatever reason, agriculture, urbanization, infrastructural development, poor agricultural practices, peasant agriculture, rotational bush fallowing, shifting cultivation, mechanized agriculture with the concomitant indiscriminate and unregulated use of agrochemicals (herbicides, insecticides, pesticides, inorganic fertilizer), habitat decimation, pollution from both domestic, industrial and commercial production and consumption processes. Other forms of waste, from industrial, domestic and commercial activities all contributes in no small way to environmental degradation (Expedito et al., 1996; Alakali et al., 2006; Borger, 2008).

The activities of humans in the study area to increase their sources of income and also improve their meal have contributed in no small dimension to destroying the ecosystem leading to an increase in the deterioration of the climatic conditions of the area. Basically in these study areas, agriculture is still at the traditional level, with the use of local farm implements like hoe and cutlasses for clearing and cultivation of land for agriculture, bush burning is another method of clearing land for farming activities. In some communities, stumping is also done where there appear to have too many shrubs on the farm land. Besides the major staple food crops cultivated for family consumptions like yams, cassava, maize , banana, guinea corn, millet, long beans, potato, rice etc., most women and young people have resorted to cultivate rice, and some vegetables during the dry season to improve their income basically and to contribute occasionally to their feeding. In villages like Ugboro, Ukpah, Otukuru, Gabu, Akurinyi, Ukpada and a pocket of other communities, they now cultivate rice twice on the same portion of land a year. The idea in itself is not bad, but the process and methods of cultivation with low agricultural inputs rather depending on the natural fertility of the soil for better yield has become worrisome of late. Young women and men now cultivate vegetables like the green vegetables along watershed. This type of market gardening practices and short period agricultural activities according to Torreggiani (1993) destroys the ecosystem and the ecobalance leading to leaching of fertile soil, destruction of watershed and destruction of soil fertility fixing micro organism. A watershed is any area drain by any body of water or a stream. The choice of cultivating along watershed is to have access to water close to their farm where they could do manual irrigation of the crops directly from the streams or rivers. This therefore means that as they engage in this type of dry season agriculture for market gardening, their choice of land is along water courses which are the main watershed of the area (Eneji, 2006). During land preparation, they deforest the land with machetes and cutlasses; burn the grasses, then till the land. In the process of clearing and cultivating, they destroy the watershed. This has some ecological and climatic implications to the global and local climate regimes of the communities (Borger, 2008). This activities of local market gardeners in the area has contributed in time past to destroying the watershed and also exposing the top soil to direct effect of sun light and heat. The burning of these grasses has also generated a lot of heat on the soil, thereby killing some micro organisms responsible for soil fertility replenishment and other nutrient recycling in the farm site under study (Silveira et al., 1996; Akatugba, 2004; Field, 1997; World Bank, 1995).

In a similar research on the effect of tillage method on soil microclimate and yield of fluted pumpkin (*telfairia occidentalis hook. f*), looking at the effect of tillage on ground cover. Ojugo (2009) observed that ground cover influenced surface runoff, the dynamics of soil moisture, and played an important role in soil and water conservation. Baker et al. (2000) also observed further that ground cover mainly refers to living land surface cover, non-decomposed and semi-decomposed plant

litters mulched on the soil surface, once these ground cover are destroyed, the living part of the earth has been destroyed (Yaqub, 2007). In this study, they used *Paspalum notatum* and its litter to study the effects of ground cover on distribution of soil moisture along a slope.

These agricultural practices of slash and burn have both negative and positive consequences. The positive consequences which local farmers always capitalize upon are that the fire burns off all insects and crop pest which would have ordinarily affected or attacked their crops (Pretty, 1994).

Other usefulness of burning farm sites includes easy way of discarding the thick grasses and packing them from the farmland. Another agricultural benefit of burning is that in an acidic soil, the ash from the burnt grasses is very rich in alkalinity, so it helps to reduce the soil acidity hence allowing the neutralization of the acidic soil content and improving crop productivity. But the point always forgotten even at that is that how did they test the soil to ascertain whether the soil is basic or acidic in nature so as to know whether it needs neutralization or improvement on the soil acidity (Pretty, 1994). Another negative effect of bush burning for agricultural purpose by our local and peasant farmers is the killing of soil micro organism responsible for soil fertility improvement and decomposition of leaf litters and other living things amongst which are nitrosomonas, (nitrogen fixing bacterial in the stem and leave nodules of rhizomes and cover crops, azocotbacter, fungus, bacteria). Another is the reduction of soil water or moisture content by evaporation as a result of the heat from the burning. Most often when this type of crop production is practiced, the local farmers use all kinds of inorganic fertilizers to boast their crop productivity especially market gardening. In the studied areas, the use of inorganic chemical fertilizers like NPK 15:15:15, NPK 20:10:10, NPK 12:12:17:2, ammonium nitrates popularly called urea are ignorantly applied to the soil and water without knowing the chemical composition and implication for both the soil, water and humans that will consume such crops or vegetables (Schneider, 1989). The farmers within the study sites also use obnoxious chemical to kill their grass and bushes around, some of these herbicides are those that have been ban from usage in other part of the world, but are now being used in Nigeria and the study sites (Brady and Weil, 2002; Schneider, 1989; Gordon et al., 2007).

Micro climatic conditions and variations in ecological systems within the region have generated very complex weather and climatic conditions. Five unique sites for this traditional gardening practice were selected to analyze perceptions of communities practicing these in relation to their experience with eco-climate change. The mean annual rainfall varies from 2000-4000 mm with most rainfall concentrated from May to September. Synthetic nitrogen, along with mined rock phosphate, pesticides and herbicides have greatly increased crop yields in the early 20th century (Suman and Chakesang, 2008; Eborge, 2002; Schneider, 1989; UNESCO, 2008).

SOME MARKET GARDENING PRACTICES

Slash and burn

This is also called land clearing and burning. A process where the vegetation cover of the top soil is removed without replacement to enable tilling. This process exposes the top soil to direct sun light and heat, while the burning also kills soil micro organism which are responsible for soil nutrient recycling and decomposition of dead materials (Azotobacter and nitrosomonas and denitrifying bacteria).

Soil tillage

This is the ploughing of the top soil in preparation for planting or for the addition of nutrient, herbicides and pesticides. Soil tillage varies in intensity from zero to complete traditional tilling. Though this method may improve crop productivity through the warming of the soil, introduction of fertilizer and through weed and pest control, but the unintended effect leads to rendering the soil more exposed to ecological and climatic conditions such as erosion, it catalyses the decay or decomposition of soil organic matter releasing CO_2, and reduces the abundance and diversity of soil organisms while also increasing the average temperature of the area (Lester, 2008).

Soil fertility management

This includes nutrient inputs for improved crop productivity. Fertility inputs could be inorganic chemical fertilizers, or organic green manure, farm yard or compost and phosphate minerals from rocks. Manure is applied by spreading either dry or in liquid form on cropland or farm sites where crops and vegetables are cultivated. Most often the commonest type of manure is the inorganic compound manure like NPK and Urea.

Soil moisture and water management

This is the practice of trying to manage soil moisture content and water by manually irrigating the land from the river or stream where such gardening is done along watershed. Here this practice is done during the dry season where market gardening is carried out. The practice includes mulching, irrigation and regular watering of crops especially vegetables (Suman and Chakesang,

2008).

This study is therefore initiated to ascertain whether these farming activities are capable of causing some ecological change and weather modification within the study sites. The study also seeks to establish if the farming practice can affect local climate modification and affects environmental change.

METHODOLOGY

The study area was located in Bekwarra and Ogoja local government areas of Cross River State, Nigeria**.** Uduo River, Unwaodaa stream in Otukpuru village, Illa stream in Gakem village, Junction spring in Abuochiche, Ityem River in Ukpah and Ugboro in Bekwarra local government area and Kwarikwata swamp in Igoli, Ogoja local government area. These villages and farm sites for market gardening were purposefully selected because they have been engaged in market gardening activities over the years. They cultivate such vegetables like green vegetables (*Amarantus spinosus*), fluted pumpkin (*Telfairia occidentalis* Hook. F), okra, (*Habiscus esculantus*), water leaf, (*Talinum triangulere*), maize, (*Zea mays*) garden egg, (*Solanum, melongena* var., *esculentum*, *Solanum*, *integrifolium*), pepper (*Capsicum annuum*) scent leaves, *(Cymbopogon Winterianus*, *Geranium Pelargonium*), curry leaves, (*Murraya koenigii*), onions (*Allium*, *stellatum*, *Alum selpa*), ginger (*Zingiber officinale Roscoe*) among others. The study area according to the 2006 national population census has an aggregate population of more than 350, 000 persons; with a gender ratio of 1:3 (male: female ratio), their major occupation is predominantly peasant farming for feeding their immediate family with very little for market. Though the study areas has a reasonable population who are both civil and public servants. The area is bounded by Vandeikya of Benue state in the north, Obudu and Boki in the east, Okuku in Yala Local Government Area of Cross River State in the west, while in the south the area is bounded by Ikom all in Cross River State, Nigeria.

The study was carried out under a five years period. Using participatory research methodology involving semi-structured interviews (SSI) of focal groups of farmers, data was generated on agricultural land use pattern in these study areas. First, we designed a key informant interview and administered to the people involved in the cultivation of market gardening, to ascertain if they have noticed any change in the environment from the farming activities which they are engage for years and also to some people living around the areas where these farming practice is being carried out to equally ascertain if they have noticed any change in the environment : water, river dry up, forest depletion, watershed destruction, increase in temperature among other variables conceived to be associated with these farming practices. A total of 50 persons were interviewed and discussed with informally. During this five years period, we collected soil samples from the farming sites during the farming season for five years and weighed the soil samples in a scale, and exposed the soil samples to two types of treatments. We weighed the soil samples immediately there are collected from the farm sites, then expose the sample to the sun for some period and then weigh again to check for weight loss as a result of evaporation. We also heat some of the soil samples using a Bunsen burner in the laboratory to determine the rate of evaporation and to ascertain if the soil moisture is lost during burning and exposure to heat from direct sun light since the vegetation cover is regularly removed during the dry season. We took the temperature of the farm sites for both dry and rainy season for a period of five years using stationed thermometers and also the amount of rainfall within the study period using a graduated rain gauge. During the same period of study, we also collected data from the meteorological station at Ogoja for temperature and rainfall. The yearly average for temperature and rainfall and also the average for every six months dividing the seasons into when they cultivate these market crops and when they don't, though we were not oblivion of the fact that temperature increases during dry season. We interviewed residents who have lived in the area for onwards of ten years and above to compare what they see now in the area as compared to what they had seen before these farming activities became prominent in the area. Results from the field sample study are as shown in Tables 1, 2 and 3.

RESULTS

From Figure 1, there is a marked increase in temperature as a result of the farming activities practiced in the area and this has contributed in the rise in temperature over the study.

There is thus a steady increase in the mean annual temperature figures over the years increasing from 2005 at 43.4 to 54.8°C in 2009 during the dry season when they engage in market gardening, while there is also an increase in the mean annual temperature in the study areas during the rainy season from 40.7°C in 2005 to 50.2°C in 2009. When the variance is calculated within these study periods, there is a marked increase in temperature. From this analysis, it therefore means that the farming activities carried out during this period contribute to a change in temperature within the area under study.

Figure 2 also shows that there is reasonable reduction in rainfall due to deforestation, bush burning and direct exposure of the soil to heat from the sun. This is as a result of the land clearing and subsequent destruction of the watershed along the water courses where they cultivate these farms during dry season. From the graph below, the rainfall values shows a reduction of -264.8 cm^3 within the study period. This is so because the soil moisture content evaporates at a rate higher than the normal. The second reason is that the watersheds are usually destroyed leading to the reduction in rainfall volume and frequency. This farming activity therefore has significant impact on the rainfall pattern and frequency.

From Figures 1 and 2, it is observed that there is a reduction in the soil moisture content, this shows a marked difference in temperature which was attributed to the exposure of the soil to direct heat from bush burning and solar radiation as a result of, deforestation over a period of 5 years. The mean variance in temperature between the years 2005 and 2009 shows an increase temperature of +17.2°C, this shows an annual increment of 3.9°C.

The result is that there is an increment in temperature and a reduction in rainfall and soil moisture content in the area under study. From our personal interviews and observation, the main reason for people engaging in these farming activities is to improve their income and also supplement their food during times of want. The people also observed that there is well established change in the

Table 1. Showing temperature variation in the farm sites and from the meteorological station ogoja.

Temp. variations	Specific days	Ityem River Ugboro/Ukpah (℃)		Uduo River / Ungwaodaa Otukpuru (℃)		Illa stream Gakem (℃)		Junction Spring, Abuochiche (℃)		Kwarikwata Igoli, Ogoja. (℃)		Mean Temp. Dry season (℃)	Mean temp. Rainy season(℃)	Mean Temp. at weather station(℃)
		Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy	Dry	Rainy			
Year 2005	01/12/2005	44.9	42.2	44.6	40.1	40.3	40.1	41.9	39.9	45.1	41.0	43.4	40.7	41.0
Year 2006	01/12/2006	44.7	42.6	45.9	43.0	45.0	47.3	42.0	41.0	44.2	40.1	44.4	42.8	41.9
Year 2007	01/12/2007	49.3	40.1	47.9	41.9	46.1	46.6	44.9	41.0	43.9	42.2	46.4	42.4	45.1
Year 2008	01/12/2008	52.9	44.9	50.3	48.9	48.3	43.1	48.0	45.1	49.1	47.0	49.7	45.8	52.1
Year 2009	01/12/2009	55.9	50.0	53.2	47.9	53.2	49.9	55.5	51.1	56.0	52.0	54.8	50.2	58.2
Annual mean temp.	2005-2009	47.7	44.0	48.3	44.4	46.6	45.6	46.5	44.0	47.7	45.6	47.4	44.7	47.7
Variance of means.	2005-2009 (Five Years)	7.8	2.0	3.8	4.3	6.3	5.5	4.6	4.1	2.6	4.6	11.4	4.0	17.2

*Data generated from the farm sites over a five years period 2005-2009.
*There is significant difference in temperature of the farm sites within the five years period.

Table 2. Mean annual rainfall in the study sites from 2005-2009.

Rainfall variations	Specific days (Measured rainfall)	Ityem River (Amount of rainfall in mm^3)	Uduo River / Ungwaodaa Otukpuru	Illa stream Gakem	Junction Spring, Abuochiche	Kwarikwata Igoli, Ogoja	Mean annual rainfall in all sites (mm^3)	Rainfall Data From Weather Station Ogoja (mm^3)
2005	25/06/2005	977	992	987	988	979	984.6	1080
2006	25/06/2006	962	971	978	981	972	974.2	998
2006	25/06/2006	891	901	899	902	911	900.8	901
2006	25/06/2006	791	801	796	896	809	818.6	861
2006	25/06/2006	675	771	699	712	742	719.8	811
Mean annual rainfall	2005 -2009	859.2	887.2	871.8	895.8	882.6	879.6	930.2
Variance in rainfall 2005-2009		-302	-221	-288	- 276	-237	- 264.8	- 269

*From the data collected from the farm sites, the mean variance between 2005-2009 shows that there is a significant difference of -264.8., *This figure is less 269 from the mean average of all the community in 2009.

environment, especially as the amount of heat observed these days is quite different and higher than what was the case some years ago. The respondents also complaint about the amount of rainfall which has also reduced as compared to what use to be the case in these areas. They attributed the cause of all these to bush burning and deforestation as being carried out in the area. Some informed people called the observed problem desertification.

DISCUSSION OF FINDING

From the graphs and tables, the results shows that there is a marked difference in temperature, rainfall and soil moisture content and above all,

Table 3. Soil sample moisture content availability before and after exposure to treatment in the farm five sites in old Ogoja zone.

Farming sites	Weight of soil												
	2005		2006		2007		2008		2009		Mean average per site (g)		Diff in weight loss
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After	
Ityem river (Ugboro/ Ukpah)	2000	1521	2000	1579	2000	1679	2000	1788	2000	1901	10000	8468	1532
Uduo River/ Ungwaodaa Otukpuru	2000	1611	2000	1522	2000	1669	2000	1705	2000	1822	10000	8329	1671
Illa stream (Gakem)	2000	1672	2000	1611	2000	1707	2000	1677	2000	1851	10000	8518	1482
Junction Spring, Abuochiche	2000	1593	2000	1613	2000	1671	2000	1771	2000	1875	10000	8523	1477
Kwarikwata(Igoli, Ogoja)	2000	1757	2000	1615	2000	1647	2000	1697	2000	1878	10000	8594	1406
Summation of weights	10000	8154	10000	7940	10000	8373	10000	8638	10000	9327	50000	42432	7568
Differences in weight loss is moisture content		1846		2060		1627		1362		673			
Variance in weight loss of moisture content							2005-2009= -1173						

*From the table above it shows that there is soil moisture content loss between 2005-2009, 2005 = 1846 g and 2009 = 673 g, this show a mean variance of -1173 g less than the first year.
*It also means that for every year, there is a soil moisture loss of 234.6 g/volume of soil sample used.

observed changes in environmental and climatic conditions in the study areas. It was clear from our discussions that traditional practices in agriculture are overloaded with eco-climatic problems ranging from siltation, soil moisture content loss, reduction in rainfall, increase in temperature, increase in atmospheric carbon, soil fertility loss and biodiversity depletion and in some cases, extinctions. Because the practice of this farming pattern and system is to provide for immediate food shortage and to also carter for the urgent financial needs of those who become engaged in market gardening. This is buttressed by the findings of Oamen (2004). This local innovation requires minimum supply of water and is practiced after the rainfall when water becomes scarce. They now depend on water from the streams and rivers, and farming along watershed, hence the destruction of watershed reducing rainfall in the farm area. Due to reduced rainfall and moisture in the soil, most land is becoming desertified. This phenomenon is rated as one of the major ten ecological problems in recent times. Desertification does adversely affect the socioeconomic development of any society. Desertification does not only cause serious harm to ecosystem, but also has adverse effects on many aspects of socioeconomic and cultural development of the entire region (World Bank, 1995). Desertification has some adverse ecological implications in the country and the world over. Some of the problems associated with desertification as a result of reduced moisture availability in the soil which includes: Reduced soil quality and arable land size, reducing the quality of soil for crop productivity. Soil desertification from reduced moisture content and rainfall diminished biodiversity and bio-productivity. In this case, desertification has extremely serious ecological consequences. With this type of farming activities, it leads to soil moisture content loss which causes high soil and water loss, with some soil deposition in rivers and lakes; this worsens the whole ecological environment (World Bank, 1995). This also increases poverty and reduction of economic benefits. Because desertification destroys land and water balance, it also aggravates poverty. Constraints to socio-economic development, and ecological restoration desertification leads to deterioration of the ecological environment, damages economic development, and in the zone today, seriously restricts economic and social progress. The deterioration of the ecological environment aggravates the contradiction between man and nature, making it difficult to establish a harmonious relationship among society, nature and ecological civilization (Yu, 2002).

The activities carried out by these farmers' causes serious threats to the eco-climatic regime of the local people and this contribute in no small

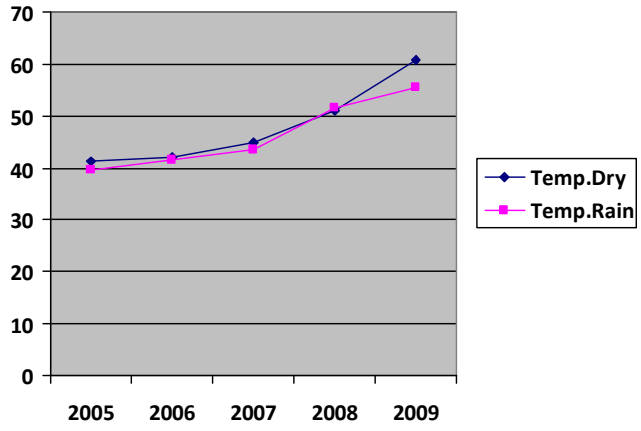

Figure 1. Showing temperature variations between dry and rainy season during the study period (℃).

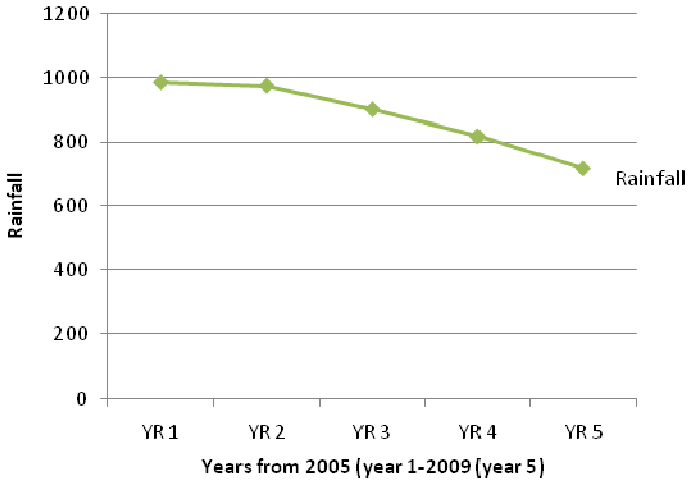

Figure 2. Mean annual rainfall variation within the study periods in the farm sites.

way in modifying the local climate of the environment. Some of the eco-logical implication of market gardening as practiced by these people include but not limited to these listed here. Agriculture imposes external costs upon society through pesticides, nutrient runoff, excessive water usage, and assorted other problems.

Land transformation, the use of land to yield goods and services, is the most substantial way humans alter the Earth's ecosystems, and is considered the driving force in the loss of biodiversity. Estimates of the amount of land transformed by humans vary from 39–50%. Land degradation, the long-term decline in ecosystem function and productivity, is estimated to be occurring on 24% of land worldwide, with cropland over represented. The UN-FAO report cites land management as the driving factor behind degradation and reports that 1.5 billion people rely upon the degrading land. Degradation can be deforestation, desertification, soil erosion, mineral depletion, or chemical degradation (acidification and salinization).

Eutrophication, excessive nutrients in aquatic eco-systems resulting in algal blooms and anoxia, leads to fish kills, loss of biodiversity, and renders water unfit for drinking and other industrial uses. Excessive fertilization and manure application to cropland, as well as high livestock stocking densities cause nutrient (mainly nitrogen and phosphorus) runoff and leaching from agricultural land. These nutrients are major nonpoint pollutants contributing to eutrophication of aquatic ecosystems. This finding affirmed conclusions of Arnold (1992) and Ogar (2005) observe that inorganic chemical fertilizers contribute an unintended outcome of over fertilizing water bodies which increases the growth of water hyacinth and also increase the carbon content of the water on the top preventing oxygen from going under for plants and animals to live on, here eutrophication arises.

Climate change can potentially affect agriculture through changes in temperature, rainfall (timing and quantity), CO_2, solar radiation and the interaction of these elements. It has been established beyond all reasonable doubt that the gardening activities as carried out by these local farmers have contributed in no small way to negative modification of local climate and this can also result to climate change, reduction in water supply as a result of watershed destruction, water pollution, eutrophication and species extinction and endangerment, increased atmospheric carbon, temperature increase and reduction in rainfall and salinization of rivers and other water bodies.

CONCLUSION

These farming activities also cause erosion and slope formation along cultivated area and along the water shed where they cultivate the rich forest soil for water availability assurance and fertility. Above all there is the destruction of the watershed which guarantees our steady supply of water, hence most water bodies in the area have completely become shrunken or dried up. Most of the forest areas have been depleted and some places have been completely laid bare as a result of these farming activities of market gardening. This had led to most land becoming dry and empty, with just minor shrubs here and there in the farm land. This situation of climatic and weather change is noticed within Uduo river and Unwaodaa in Otukpuru, Junction spring in Abuochiche, Illa in Gakem, Ityem in Ukpah and Ugboro and Kwarikwata in Igoli, Ogoja. The case is becoming so critical that it has become a case for concern of late because this practice is detrimental to the environment.

The complex trade-offs between increased agricultural production and declines in other ecosystem services as caused by agricultural changes to the hydrological cycle have been reviewed by the Millennium Ecosystem Assessment and the Comprehensive Assessment of Water Management in Agriculture. This review research

revealed that knowledge of these trade-offs is prolific and increasing, this also shows that we lack an integrated understanding of how agricultural modifications of the hydrological cycle regulate the prevalence and severity of weather and eco-climatic change in ecosystems (Gordon et al., 2007).

In view of the foregoing, it is clear that the farming activities carried out by these groups of farmers have potentially contributed in no small way to environmental deterioration and degradation in the area under study. It is necessary to mention here that though the time frame of five years was scientifically too short to record any reasonable climate change, but with careful observation and analysis followed by independent studies, we drew the conclusion that there is observed local climate modification and change in this area.

RECOMMENDATIONS

From the findings in the field, we came up with the following suggestions:

- There should be the introduction of the use of water from a reservoir or hand dug well to replace farming along water course.
- Such farms should be cultivated away from watershed and water courses.
- The use of inorganic artificial fertilizer should be replaced with the use of organic manure like composting and farm yard manure from the leaf litters and the grasses removed from land clearance in the farm.
- Government should design a well articulated poverty reduction strategy that will reduce undue pressure on the environment.

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