Research on Humanities and Social Sciences
ISSN (Paper)2224-5766 ISSN (Online)2225-0484 (Online)
Vol.4, No.11, 2014 

# Sociology of Landscape: Agricultural, Soil and Water Conservation in Calabar, Cross River State

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**Abstract**
The magnitude of challenges created on the human environment in different parts of the earth surface today, is alarming. This has resulted to various environmental threats across the universe which are quite visible and have a roused the concern of sociologists-worldwide. This is seen in the scale of wildlife destruction, soil erosion, deforestation, air, water, and land pollution, increased temperature levels among others. Globally, we are confronted with massive human starvation, extinction of plants and animal species, dwindling biodiversity, drought and desertification, global warming, emission of carbon dioxide from burning of fossil fuels, depletion of the protective ozone layer by lethal chemicals and concomitant bombardment of the earth's environment by cancer-causing ultra violent radiation. Man's attempt to convert the environment for his development had produced the highlighted and if mans activities on the environment are not controlled it would seriously rendered the world landscape uninhabitable. This paper seeks to explore the various ways in which man's activities in the environment pose a threat to Agricultural soil and water conservation. It also highlights strategies to achieve sustainable environmental landscape balance.

## INTRODUCTION

There are many challenges, problem and opportunities associated with the living environment today. Our only one earth and its beautiful landscape is experiencing a siege from all aspects of human activities. Misuse, abuse and degradation of the environment have become so easily spotted, with disruptions and livelihood practices are changing fast as a consequence of the realization that people have power to extract resources around them thereby defacing the natural landscape.

To face up to the future with vigor and optimism, would depend to some extent on how we are able to set the stage for handling the problem of defacing the environment. At the front burner of development are environmental issues. In Nigeria for instance, there is both cultural diversity, and ecological diversity which holds sewage to how landscape is handle within a given environment.

The measure of change created on the human environment in different parts of the world is quite visible and has aroused great concern to sociologists whose focus is on landscape and Agricultural, soil and water conservation. Research has revealed that the imprint created on the environment is principally a fall out of man's development activities and are attributable to limited efficiency of conversion mechanism. Limited efficiency results in the production of excessive waste which adds to the already over labored environment. Man's conversion of the environment for his development programmes has caused disorganization, which is bound to affect him negatively on the long run in terms of his health and welfare. It therefore follows that if man's activities on the environment are uncontrolled, his very existence on planet earth will be threatened.

At different spatial and time scales, vegetation cover helps in protecting the soil from harsh climatic conditions mostly soil erosion. The presence of dense vegetation affords the soil adequate cover thereby reducing the loss in macro and micro nutrients that are essential for plants growth and energy fluxes.

Iwara (2011), maintained that, the continuous conversion of vegetal areas to non-vegetal surfaces reduces soil productivity as a result of increased soil erosion and changes in moisture content. Indeed, the concentration of nutrient in the soil is depleted when vegetation is destroyed through numerous anthropogenic activities such as deforestation and land preparation for agricultural production, and road construction among others (Elliots 2003; Thornely and Cannely, 2000). The change in forest cover such as plantation and grassland result in the tremendous modification of canopy cover; thereby making the area affected susceptible to soil erosion; this affect the stock of Soil Organic Carbon (SOC). The conversion of forest ecosystem to other forms of land cover may decrease the stick to Soil Organic Carbon (SOC) due to changes in soil moisture and temperature requires and succession of plant species with differences in quantity and quality of biomass returned to the soil (Offiong and Iwara, 2012). Indeed, changes in land use cover have significant effect on the amount and diversity of biomass returned to the soil. It is perhaps a known fact that soil erosion intensity and amount of nutrient element loss varies depending on the vegetation type at a particular place and time. This is so because, the rate of nutrient element loss in both dissolved and sediment bound forms will depend on the ability of vegetation canopy to effectively intercept the direct impact of raindrops that strike the soil surface (Iwara, 2011). If the canopy is not dense enough or well developed, low quantity of nutrients will be returned to the soil as well as large quantities of nutrient will be removed from the soil surface during periods of heavy rainstorm when the

 

soil is saturated. Earlier studies have emphasized the negative effect of land use/cover-change on soil properties. For example, Agoume and Birang (2009) examined the impact of land-use system on some physical and chemical soil properties of an oxisol in soil the humid forest zone of southern Cameroon. Result showed that land-use system significantly affected the day, the silt and the sand fractions. Sand and silt decreased with the soil depth whereas clay increased with it.

Soil pH, total nitrogen, organic carbon available phosphorus, exchangeable calcium, exchangeable Al, sum bases, ECEC and Al toxicity chromolaena odorata fallows presented relatives higher soil fertility, secondary forests and cocoa plantations the lower. Lal (1996) noted that land use change in tropical ecosystem could cause significant modification in soil properties. In stressing the effect of this phenomenon on the ecosystem, Sclipper and Sparling (2000) posited that land use change modifications are biologically and chemically more rapid than physically, as forest ecosystem are important both ecologically and economically forest soils are one of the major sequesters of carbon on earth due to their high organic matters status (Dixon et al, 1994), as such any land development efforts or landscaping activities such as what is obtainable in the study area must mimic the characteristics of forest ecosystem. It is only through such healthy practice that the ecological component such as soil can be enhanced and sustained.

Furthermore, Gol (2009) investigated the effects of land use change on soil properties and organic carbon at Dagdami river catchments in turkey. Result indicated that saturated hydraulic conductivity ($K_{sat}$), bulk density (BD), water stable aggregates (WSA), soil organic matter (SOM), soil organic carbon (SOC) and total nitrogen significantly changed with land use type and aspect.

In addition, the study reported significantly higher values of saturated hydraulic conductivity ($K_{sat}$) in natural forest top soil (82.4$cm^3$ h-1 on average) and hazelnut garden soils (11.5$cm^3$ h-1) and corn field soils (30.0$cm^3$ h-1) WSA was greater in the pasture and forest soils than in cultivated soils.

In addition, $K_{sat}$ had the highest value in the forest soils at all aspects while, SOM and SOC of forest soils were higher than other land use types.

Furthermore, the amount of SOM and SOC is soils of grassland hazelnut garden and corn field were low level and close to each other. Offiong et al (2009) compared soil properties in undisturbed secondary forest and soil adjoining the road in Tinapa, area of Cross River State. Result indicated that the level of organic matter, total nitrogen and cation exchange capacity were substantially higher in soils of the undisturbed secondary forest than in soil adjoining the road. Zhao et al (2008) studied the effect of land cover change on soil phosphorus fractions in southern Horqin sandy land, Northern China. Results showed that organic P dominated and was the principal source of availability P. the degradation of elm savanna to grassland significantly reduced soil pH and resulted in an overall reduction in soil fertility although slightly increased labile inorganic P grassland afforestation, had no significant influence on soil pH, organic carbon, and total N but significantly reduced total P. impacts of grassland afforestation on soil p. fractions depends on tree species. Natural elm savanna had higher soil p. conserving ability than artificial plantations. The study suggested the planting of tress with low nutrient demand (particularly p) and efficient nutrient cycling as being more suitable for ecosystem restoration.

The above studies reveal that change in land use/cover can cause significant variation in soil properties, terrestrial cycles and reduction in soil output.

**Conception of environment**

The concept “environment” can be seen from many perspectives. Such perceptive can give birth to several competing definitions and descriptions. It is what we see and find as land, water and air. It is an embodiment of the entire stock of plants, animals and human beings and indeed the complex ecosystems and life forms between and among these. The environment is the earth and all its fullness – the physical features, its structure and crust, space and fine as well as culture that also produces the built up environment and the entire human development. The environment may be seen as the living earth, the only place where life is known to be found and sustained. It is here that human exert extensive influence and control over the forces of nature. The living environment is the combination of solid, liquid and gas, sound, vibration, radiation, heat and their combination in varying degrees to influence the growth and development of organisms. The minerals in the bowels of the earth and the mountains, hills, valleys, rocks, forests, and woodlands and the fluffy and scenery vegetation cover. The economic and cultural space formed by human also constitutes the environment. It also refers to all natural resources joint property of man of which one man’s right of use must not adversely affect the right of use of other joint owners (Offiong, 2003, Verla 2003, Eni 2005; Obong, 2007 b). The current global awareness of the environment and has pivoted role to human endeavors and survival as stated in the mounting of the 1972 United Nation’s World conference on Human Environment.

As identified by Eni (2005), human beings have characteristically lived in two worlds. The first is the natural world of nature consisting of plants, animals soils, air, and water that preludes the existence of man by hundreds of millions years of which man is an integral and inescapable part, the second is the world of social institutions and artifacts (built world) that man deliberately creates for himself using science, technology, culture,

 

political organization and so forth.

**Landscape Sociology**

Landscape Sociology encompasses social and ecological systems associated with public open space, urban agriculture, the urban and peri-urban fringe, regional towns and rural landscape. Landscapes make visible the biophysical and social links between nature and culture, especially between natural resource management, conservation (biodiversity) and agricultural food systems. Landscape is a vernacular scene, the product of everyday practice. Landscape sociologists believe that the landscape is not neutral but constructed, and that from this theoretical position research is possible to understand the social practices that have contributed to how the landscape is now and how it might be different in the future. Following on from this, the communities who are responsible for the landscape they inhabit, research, or make policies about, are able to be active in understanding and changing them. For landscape sociologists landscape are both subject and object and a part of an environmental narrative.

Landscape Sociology focuses on the interaction of society and the environment in a landscape. This obviously includes all land managers, farmers and community groups such as land care. Less obvious, but no less important, are government employees who are responsible for policy and the delivery of services to the community. Landscape sociology offers insight into how each of these communities of practice', including those in the public service, pursue their own interests in the landscape. A significant context for this research is the moved away from productivity as the dominant mode of conceiving agricultural landscape' worth, towards complexity science, social and ecological systems and resilience. Making this change in policy work will require different social groups to collaborate and share their practices in new and unconventional ways.

The Landscape sociology group has developed research practice capacities in: social theory, social ecological systems, resilience studies, rural sociology, complexity science, interdisciplinary, landscape policy and planning, anthropology and natural resource management. Our methodological approaches include case study research, discourse analysis, qualitative analysis and survey methods. As a group, researchers have grappled with the construction of social ecological knowledge in placed-based communities and scientific knowledge in government agencies, the socio economic drives of land use change, social ecological resilience, risk communication and policy and the social (mal) adaptation to drought. Landscape sociology is an exciting area of research that is opening up original research space and ecological realities. Associate Professor Ruth Berlin leads the Landscape sociology group within the Melbourne School of Land and Environment.

However, there is an attitudinal dimension of the sociological approach to the study of landscape which requires the carrying capacity of the earth and change our attitude towards the non-human world and inculcate in people valuable actions and concern for nature.

What is however, important to sociology concerning the natural global landscape is how man sustains its beauty without defacing it to instinction. Sustainable landscape in society is the society itself, which pays attention to evidential improvement in the quality of human life, through acceptable conservation practices. This creates a goodness-of-fit between the economy and the ecology in mutually supportive way. Sociology of landscape therefore is a rational attempt to go beyond gambling for the survival of public open spaces in the ecosystem.

In order to maintain perfect landscape sustainability every body needs to be mobilized and carried along in the steam boat of the ecological balance. To succeed no country is expected to be left out from a sustainable ecological balance and nobody should be found standing aloof. There is a need for global alliances and sociological landscape cooperation which is capable of ensuring a universal equity relating to environmental conditions and the social integration of all users of the environment.

**Methodology of the Study**

**Study Area**

This study was conducted in Calabar, Cross River State which lies between latitude 50.251E and longitude 250.001E. The study area falls within the rain forest zone of CRS where they rainy season lasts for about months 10-11 months with the dry months having less than 60mm of rainfall in the south. It has temperature with average daily maximum of $35^0$c. The rainy season has a short dry period called "August Break" or short dry season which last between 2 to 4 weeks.

The topography of the area is inculcating with gradual rise and fall. The area is well drained such that run off water disappears 30 minutes after a typical rainstorm (Eze, 2008). The highest elevation is about 300meters and lowest of about 50meters above sea level. The soils in Calabar are generally deep, porons, weakly structural, well drained with low to moderate status and where vegetation cover is removed due to human activities, the soil is vulnerable to active sheet and gully erosion. The area serves as a corridor of development to complement the tourism development initiatives of the state. The area is currently undergoing rapid development and changes in vegetation cover as a result of the influx of people into the state and the increasing need for

 

housing. Presently, people prefer residing in the area as a result of its low social vices and serene environment.

**Sampling procedure**

This study evaluated the effects of vegetation cover on soil properties by comparing the properties of soils of road side vegetation and a secondary forest.

The roadside vegetation comprises a stretch of land dominated by grasses with few trees stands, while the secondary forest plot is characterized by a dense vegetation (tall trees/shorts) with numerous undergrowth, which is less than 3km from the roadside vegetation. The study sites have similar soil parent materials topography and climate field survey and soil sampling was carried out using the quadrant approach. In each identified and delineated land use cover, five plots of 5m by 5m were established after which soil samples were randomly collected from the 0-10cm layer of the soil using a soil anger, in all 15 soil samples covering collected.

**Land use cover in Calabar CRS**

In Calabar, Cross River State, just like in other parts of the state, change in land use cover is an emerging phenomenon as a result of the state government's drive to making the state the ideal tourism destination in Nigeria.

In this regard, a lot of landscaping works has been embarked upon by the government like the planting of grasses along road verges as a way of beautifying the state and to control soil erosion among other ecological services.

The landscaping activities are characterized by the introduction of sand in degraded areas to ease the planting exercise. In some areas, trees are felled to make way for grasses; such a practice could be ecologically unwise in terms of its ability to suppress soil erosion.

Different studies have examined the effects of land use. Cover change on soil physicochemical properties (Lal, 1996; Bosshyt et al; 1999, Eneji et al, 2003 Everndileka et a; 2004, Igne, 2007, Emadi et al 2008, Zhao et al, 2008; Agonme and Birang, 2009, Gol 2009; Offiong et al 2009). The studies nevertheless characterized changes in soil properties in relations to emerging land use/cover change in their respective ecosystem on this note, more studies are indeed to understand the effect of emerging land sustainability.

According to Gol (2009), land management practices provide essential information for assessing sustainability and monitoring environmental impacts. In Calabar, with the current changing patterns of land use cover, mostly the introduction of grass planting, there seems to be paucity of literature on the ecological implication of this emerging phenomenon on the soil. It therefore becomes perturbing to investigate the impact of this current land management practice on soil fertility in order to suggest possible ways through which the inherent land use system can be ecologically sustainable.

**Laboratory Analysis**

The soils were stored in zip-10c bags and placed in a cooler to keep the sample at moderate temperature. They were than taken to the laboratory for analysis of soil physical and chemical properties. Particle size composition was determined using the hydrometer method by applying Stoke's law for particle settlement in hydraulic medium. (Bouyoulos, 1926); organic carbon by the Walkey-Black method (1934); total nitrogen by the Kjeldahl method (Bremmer and Mulvaney 1982); available phosphorus was determined by the method of Bray and Kurtz (1945). The soil were leached with IM neutral ammonium acetate to obtain leachates used to determine exchangeable base and a soil cation exchange capacity, while pH values were determine using a glass electrode tectonic digital pH meter with a soil water ratio of 1:2.

**Data Analysis**

The obtained soil data were analyzed using tables averages Pearson correlation and one way analysis of variance. The one way analysis of variance was performed to determine if the properties of soil varied significantly among the various land covers, while Pearson's correlation was employed to determine the nature of association between the soil variables in order to understand the possible factors that affect their build up in the soil.

**Result and Discussion**

**Physical Properties of Soils**

The particle size composition of soil in the three land covers are depicted, the soils are principally sandy, with sand accounting for more than 75% of the inorganic mineral fragment in the soil. The proportion of sand was higher in the secondary forest and roadside soil.

This is so as the sandy area is a part of the coastal plain of southern Nigeria which is characterized by sandy soils over wide expanses of land (Awston and Eneruvbe, 2010). There was significant variation in sand content under soils of different land cover ($p<0.01$), the amount of silt and clay in the three soil comities was small compared to the value obtained for sand; silt contents were higher in the secondary forest soil and a 16-

 

years old plantation soil with mean values of 8.22% and 8.20% respectively but in roadside soil the mean value was 4.6%. The increase in silt content in the secondary forest and 16 year old plantation soils is attributed to the development of dense cover which helps to suppress soil erosion, soil content varied significantly under soils of different land cover at ($p < 0.05$). Clay content was much higher in the roadside soil than in the other land covers with mean value of 16.80%. The high amount of clay in the roadside soil is attributed to road construction and landscaping activities, during which soil with probably large amount of clay is introduced. There was significant variation in clay content under soil of different land cover ($p < 0.05$). However, the particular size composition of soils in the different land cover is insignificant; as soil in the area are texturally similar, being loamy sand having been derived from the same parent materials (granite) under the same climate and topography.

**Table 1:** Physical properties of the soils: a soil properties
Secondary forest soil
Rubber soil
Roadside soil
F –values

| **Sand (%)** | **Silt (%)** | **Clay (%)** |
|---|---|---|
| 85.80 ± 0.80 | 8.22 ± 0.49 | 5.78 ± 1.01 |
| 86.80 ± 0.20 | 8.20 ± 0.49 | 5.00 ± 0.49 |
| 78.60 ± 1.41 | 4.60 ± 0.80 | 16.80 ± 2.06 |
| 22.4ψ | 11.57± | 23.27± |

Field survey data analysis. Where;
a = value are means ± standard errors
ψ - difference between means is significant at 1% alpha level
+- difference between means is significant at 5% alpha level

**Chemical properties of soils**

The chemical properties of soils under different land cover are shown in table 1 below:

The social of the area are acidic with a pH range of 4.06 to 5.20. The acidic nature of the studied soil is attributed to the high rainfall resulting in the leaching of some basic cations especially calcium from the surface horizons of the soils (Foth 2006, Abua et al, 2010; Iwara et al, 2011). The pH value obtained in this study agrees with the findings of Agbnede (2008) that the pH in Nigeria derived savanna and forest soils falls within the range of 4.5-7.5. The contents of organic carbon (OC) and total nitrogen (TN) were high in the secondary forest soil, and low in roadside soil with mean values of 1.93% and 0.46% as well as 0.97% and 0.24% respectively.

The mean OC contents of the studied soils ranged from 0.97% - 1.92% and were rated as low (below 2%) $C^{O}$ Clude et al, (2011), Reid and Dirou, (2004). While, TN content of the soils ranged from 0.24 to 0.46% (table 2); this range of value was rated as medium when compared to the medium range of 0.10 to 0.45% recommended by Holland et al (1989).

This range is however, consistent with the works of Ukaegbu and Akmigbo (2005) who reported average total percentage of 0.08 in soils of the Cross River crastal plain sands. The increase in contents of OC and TN in the secondary forest soils is attributed to the increase in plant density and cover which provides large amount of biomass that decomposes to form nutrient in the soil. The proportion of OC and TN varied significantly under soils of different land covers.

**Table 2: chemical properties of the soils: a soil properties**
Secondary forest soil
Rubber soil
Roadside soil
F –values

| **pH** | **OC** | **TN** | **AV. P (mg/kg)** |
|---|---|---|---|
| 4.07 ± 0.16 | 1.93 ± 0.28 | 0.46 ± 0.07 | 8.65 ± 0.99 |
| 4.06 ± 0.02 | 1.04 ± 0.19 | 0.025 ± 0.05 | 21.90 ± 6.31 |
| 5.02 ± 0.39 | 0.97 ± 0.05 | 0.24 ± 0.01 | 48.85 ± 1.68 |
| 8.80ψ | 7.31ψ | 5.31+ | 28.85ψ |

Field Survey Data Analysis 2003

| **CEC (Cmol/kg)** | **Ca (cmol/kg)** | **Mg (cmol/kg)** | **Na (cmol/kg)** | **K (cmol/kg)** |
|---|---|---|---|---|
| 4.45 ± 0.27 | 0.77 ± 0.05 | 0.23 ± 0.02 | 0.39 ± 0.02 | 0.08 ± 0.01 |
| 4.96 ± 0.22 | 0.38 ± 0.05 | 0.16 ± 0.01 | 0.72 ± 0.02 | 0.07 ± 0.00 |
| 7.47 ± 1.53 | 1.43 ± 0.09 | 0.75 ± 0.02 | 0.10 ± 0.01 | 0.49 ± 1.33 |
| 3.94 ns | 63.84 ψ | 4.47 ± 91ψ | 448.86ψ | 1.15ns |

 

Field Survey data analysis 2003

a - values are means ± standards errors
ψ – difference between means is significant at 1% alpha level
+ - difference between means is significant at 5% alpha level $3.5^0$
Ns - not significant at 5% alpha level.

The content of cation exchange capacity (ECE) happened to the higher in the roadside soil with a mean value of 7.47cmol/kg in other land cover soils. The high content of CEC in roadside may be attributed to road construction and landscaping activities resulting in the introduction of soil with high clay content. Reid Dirou, (2004) opined that both clay and organic matter serves as potential; matter have higher exchange capacities than sandy soils, which are usually low in organic matter.

**Summary**

In summation therefore, one may conclude that landscape issues need also to be mainstreamed into our developmental policies and schools in all areas of programme and curriculum implementation everybody as a stakeholder of landscape must be mobilized to participate in its protection for a sustainable living.

Sociology of landscape is therefore inevitable, as it helps man to examine human capabilities, exertion of creative knowledge and application of skills to attain greater freedom and enjoy higher level of well being in a sustained natural landscape as to meet the needs of man at the moment without destroying the environment as to affect its future needs and use.

The attempt to control the landscape can be on a sociological dimension, the processes, style and product which may be inappropriate and incapable of coping with long term ecological demands. Essentially therefore, sociological approach landscape sustainability is practically inevitable to achieve ecological balance.

**Conclusion and Recommendations**

As we create wealth from the environment for our economic boom, we must not credit waste to it for an ecological doom. We must deliberately attempt to consider most especially he landscape in order to keep it on a balance, otherwise it will boomerang back, so, in order to forestall this danger, we need to live in consonance with natural rules. We must as a matter of priority maintain, sustain and continue to have habitable communities. We need to protect the environment and the people who live in it. Our social institutions must change and be strengthened to protect the living environment and its beautiful natural landscape.

It is apparent from the study that changes in land use cover have significant impact on the availability of nutrient in the soil. This is evident as areas with sparse vegetation cover are susceptible to soil erosion process resulting in the loss of organic matter and other essential nutrients from the soil layer. This is observe in the roadside soil with low vegetation and spares cover resulting in the low OC and TN contents.

However, it is equally important to note that human are utilizing all the world's major renewable natural resources agricultural soil, forest trees range grasses and ocean fishes at rates exceeding the natural ability to renew themselves and the high contents of CEC, available phosphorus, Ca, Mg, and K in the roadside soil are attributed to road construction and landscaping activities resulting in the introduction of sand with high clay content. The high quantities of OC and TN in the secondary forest soil ecosystem have significant effect on the build up of nutrients in the soil; this is because dense canopy cover helps in nutrient accretion in the soil by minimizing the loss of nutrients through soil erosion and leaching. It also enhance the production of more litter as well as provide the needed temperature for bacteria, fungi, micro-fanna and other soil microbes with a high level composition, that helps in facilitating organic matter decomposition, thereby facilitating carbon sequestration in the soil. However, to maintain the stock of soil organic carbon in soil in line with changing landscape, trees whose height are controllable should be planted along with grasses, instead of grasses alone as could be seen in major routes in Calabar. The planting of trees with controllable height will help in carbon sequestration and the maintenance of nutrient in the soil for continuous energy fluxes. It is therefore recommended that:

- Tree planting perhaps should be the major priority, proper afforestation of land according to Lal (2005) can reverse some of the degradation process and cause enhancement or sequestration of SOC stock and nutrient in the soil.
- Furthermore, residues from the cleaning of grasses undergrowth should be used to cover the soil surface in order to minimize the effects of erosion in relation to the addition of nutrients in the soil.
- The so called civilized and westernized life styles and consumption should be reviewed with a reversal to the traditional and natural compatible ways of doing things, since there is the lack of technological know how to cope with the westernized life style.
- Sociologists should develop an ecological system associated with public open space both for urban and rural agricultural development.

 

- Landscape sociologists should develop research practice capacities in landscape policies and planning in Nigeria via the world.
- Sociologists in collaboration with the world environmental summit should design research programmes targeted at man's interactions with his landscape, either for shelter, farming, mining, beautifications irrigation, fishing and the likes.
- Government of each country should be more interested on the fraudulent use of her landscape, by enacting policies that are geared towards the preservation of their ecosystem for a sustainable balance.

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