

STREAM FLOW CHANGES AND THE CHALLENGES OF TRADITIONAL ECOLOGICAL RESPONSES IN THE MOIST-DRY REGION OF OBUDU, CROSS RIVER STATE, NIGERIA

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ABSTRACT

Many streams in Obudu, a moist-dry region in the south eastern flank of Nigeria, are suffering from accretion of sediments, and their eventual modifications from perennial to intermittent and ephemeral channels. Two plausible factors can lead to these problem: climatic and human induced land use changes. Investigations are that climatic variability is an integral part of this environment and no evidence yet of clear cut climate. A strong link has been established by scholars, between human impact on the landscape and sediment yield, and this is the plausible cause of the channel aggradations. Whether the people are aware of the link between this problem and their antecedent and present landscape activities form one of the cruxes of this study. What are their traditional efforts and strategies at sustainable flow formed another issue. Data was generated through the administration of closed-ended questionnaire in addition to participant observations. The data was generated from 200 respondents and statistically analyzed using both descriptive and inferential statistics. Results indicated that more than 80 percent of the respondents had knowledge of the link between the antecedent landscape actions and stream sediment aggradations. Indications were that local efforts at sustainable stream flow existed but interests were fast on the decline because of the issue of territoriality and frontier mentality, for agricultural production (76.5 percent). The negative attitudes of the people towards local codes and conventions were also identified as possible reasons for declining interest in stream protection (74.85 percent). It was established that a knowledge gap does not exist between the various cohorts on the approaches to sustainable stream management (F_1 cal = 2.22; crit = 2.61), but in the actual responses/adaptations, a significant differences existed between the age cohorts (F_2 = 3.47; crit = 2.53). Recommendations were made for adequate mobilization of the people in terms of awareness creation on the importance of watershed conservation practices.

KEYWORDS: Sediments accretion; traditional ecological responses; watershed conservation; territoriality.

1.0 INTRODUCTION

Water is an environmental resource necessary for the sustenance of life, being linked lucidly with civilization. Apart from being a vital resource governing the viability of all ecosystems, it is the basis for the socio-economic development of every society. To this extent its scarcity can truncate development and, in some cases, generate conflict. It is a renewable resource that has been wantonly degraded and not considered by many as valuable for prudent management because of the thinking that it is indefinitely renewable. This is evidenced from the present rate of its consumption and increasing human activities including changing land use, especially around water catchments, without considering the possibility of negative consequences in its deteriorating quantity and quality. This calls for prudent and careful conservation and management of the environment.

In many parts of the rural world; traditional efforts have always been adopted as responses to changing quantity and quality, and to ensure sustainable supply of water from streams. In the moist-dry region of Obudu, such efforts, which once existed are on the verge of being eroded and the resultant effects are the rapid attrition of stream, ponding/accretion, and increasing water scarcity. This study takes a look at these apparent problems in relation to knowledge of the determinants and the resultant traditional responses.

The moist-dry region of Obudu in South Eastern, Nigeria lies between 6°30'N, and 9°28'E and falls under the tropical sub-humid environment, characterized by marked, climatic seasonality and variability. Here water supply is derived from three main sources viz: Rainfall, stream flow and subterranean (ground water) aquifer. Because of the apparent variability in rainfall, which is highly seasonal, the people

depend highly on streams and ground water for all year round requirements. Despite this, ground water yield is highly low and unreliable for most times of the year.

The nature of surface and ground water in this area, as elsewhere, is heavily related to the lithology. This area belongs to the ancient basement (Faniran 1982; Ileoje, 1981; and Ojo 1977) where percolation is marginal and surface water in streams is found mostly in shallow channels with gravelly, stony and sandy floors. Because of the rainfall seasonality many of the streams are equally seasonal and ephemeral, drying up during the dry season, with pockets of water in some that are eagerly sought after during this season.

Plate 1: A typical degraded tributary stream in the wet season

This natural variability in stream water supply has heightened in recent times. A plausible explanation for this is linked to increasing human demand for agricultural land due to the increasing human population and the desire to meet up with anthropogenic demand for settlements. The area under study comprises 16 villages with a projected population figure of 50,910 people in 2005 from 34,444 people in the 1991 census. This characterizes the increasing human activities. Given the area of approximately 480sqkm and a population density of 106 persons per sqkm, pressure on surface water continues to escalate resulting in further stream attrition.. Generally, human activities have been historical, and have already resulted in the widespread changes in landscape. Even the riparian and stream corridors, which hitherto protected the stream channels, have grossly been degraded. The widespread attrition and accretion of streams, most of which have been silted into ponds and choked with debris from over land are clearly evident. There is clear manifestation of

accelerated run-off, particularly as the vegetation has been tampered with and the soils have reduced their infiltration capability.

It must be emphasized here that, because of the importance of water and the apparent seasonality of rainfall in the area, stream water has always been treasured to the extent that traditional methods have been in place to ensure its protection and sustainability. During the dry season for instance, organized labour is employed by community members, mostly the youths and women, for clearing and evacuation of sediments from pools along stream channels, with shades/barricades constructed to protect the pool from reckless exploitation and degradation. This in recent times tends to be one of the cultural attributes that is fast on the decline.

Plate 2: Dry season protection and rehabilitation of the same stream as above in Plate 1

There have also been local byelaws restricting the cutting and clearing of riparian vegetation, including trees at headwaters or supply zones. This practice is equally suffering attrition. Many of cultivable lands currently under natural flood irrigation cultivation, were once wetlands and stream corridors. These have been converted, with the trees harvested for fuel wood or timber. Bamboos that hitherto were in abundance in wetlands have been burnt and the land converted to agricultural land. There is now accelerated scarcity of water and so the call for conservation has become very imperative. There is thus, a need for a re-awakening of interest in traditional knowledge of watershed protection and management of water resources.

The objectives of this study are as follows: To examine the traditional knowledge of the complex nexus between human activities and stream water variability; To identify the various traditional strategies for sustainable stream water supply; To identify the plausible reasons for the erosion of interest in these strategies.

2.0 THE METHOD OF STUDY

Data needed for this study include the knowledge of determinants of catchments degradation and stream accretion, traditional strategies for stream protection and the reasons for increasing death of streams amidst the local

strategies. These data were obtained from field survey via questionnaire and participant observation. This survey instrument was carefully designed and first tested for both content and construct validity before it was finally administered to elicit the required data. The outcome of this resulted in the slight modification of the questionnaire to include issues that were not initially in the questionnaire items. The final questionnaire consisted of 28 items divided into 2 sections. The first section had six items, which sought to gather demographic data. The second section had 22 guided items constructed using the Likert scale of measurement.

The rural communities in this moist-dry region of Obudu, comprises the Bette speaking with about 16 villages and several smaller communities within. It was not possible to carry out a comprehensive survey of all the communities there in. The study was thus restricted to 10 communities, selected through simple random sampling technique. A total of 200 questionnaires administered randomly but based on sex differential and ages (dichotomized into youth (18-35 years) and adults (36 years and above). This was carried out with the collaboration of field assistants who incidentally were indigent. Since the study was to provide answers to both the how and why of the problem, data were summarized and subjected to both descriptive and inferential statistical analysis. The descriptive statistics involved measures of central tendencies including means and percentages, while the inferential statistics used is the Analysis of Variance (ANOVA).

3.0 RESULT AND DISCUSSION

3.1 Demographic Characteristics of the respondents

Out of the 200 questionnaires administered a total of 191 (making 95.5 percent) were completed and returned. As a prelude to the statistical analysis of the result, the data was first Collated and summarized based on socio-economic characteristics, including sex and age brackets of the targeted (sampled) population. Results from here indicated that about 49.7% of the respondents were male and 50.27% were female. The sample, divided into 5 age cohorts, indicated that about 25.84% were between the age of 18 – 35 years; 21.46% between 36 – 40, 20.44% between 41 – 49, 16.23% between 50 – 59 and 6.28% between 60 and above. In addition to this, the identified major economic activities of the various communities were farming accounting for 87.5 percent of the responses.

Table 1: Demographic characteristics of the respondents

	Sex		Age Range					Occupation	
	M	F	18-35	36-40	41-49	50-59	60- above	Farming	Civil service
No. of Respondents	95	96	49	41	39	31	31	167	24
Percentage	49.7	50.27	25.84	21.46	20.44	16.23	16.28	87.5	1.25

3.1 Traditional Knowledge of the Determinants of Stream Aggradations

An examination of the traditional knowledge of the role of human activities on streams degeneration was carried out. The various strategies aimed at stream source protection and restoration efforts inherent in the culture were also identified. A descriptive statistical analysis using percentages was first carried out to establish the level of knowledge of

these linkages and strategies. Results indicated that majority of the respondents (89.5 percent) have knowledge of the increasing seasonality and death of many of their streams, attributing this to land use change and destruction of headwater vegetation, especially forested stream corridors. The only sustainable approach to ensuring sustainable supply and protection of streams is by periodic evacuation of silted

sediments and the construction of shades. The formation of local associations to control wastage and unwholesome extraction was considered an approach to sustainable management and ensuring compliance. On the whole knowledge of the increasing seasonality, death and sedimentation was indicated by an average of 74.3 percent. Local strategies such as stream regeneration, rehabilitation and restoration through periodic evaluation as well as

encouragement of legislative approach through local rules against riparian degradation were 61.03 percent. Despite the fact that 73.3 percent reported that laws are in place, 72.3 percent reported that there are no sustainable and individual/communal efforts at the restoration of degraded watershed through re-vegetation. The results are represented in table 3.1.1 below;

TABLE 2: Local Knowledge of Stream Accretion and Traditional Responses

Variables (items)	Responses (%)
Knowledge of increasing seasonality of streams	89.5
Knowledge of death streams due to sedimentation	80.6
Knowledge of sedimentation through land use change	73.8
Availability of clean water in some dry streams	53.4
Regeneration by evacuation of sediments	70.7
Protection by shade construction	53.9
Protection by associations	52.9
Protection by laws	73.3
Restoration/protection by tree planting	27.7
Knowledge of downstream effects	43.5

The questionnaire were administered to people of different age cohorts. With the intention to examine the attitudinal differences between these groups in terms of ecological knowledge and indigenous conservation, protection and restoration strategies. Result from analysis of Variance (ANOVA) indicated that there was no significant difference

between the various age groupings in their ecological knowledge as well as advocacies for the intensification of protection/restoration efforts/practices. (F cal = 2.22; Fcrit = 2.61) This result as represented in the adaptive ANOVA table below indicates the findings.

TABLE 3: Anova Table of the Differential in Responses Based on Age

Source of variation	Difference of sum of square	DF	Variance estimate
Between sample sum of squares (BSS)	0.8	4	0.2
Within sample squares (WSS)	3.53	40	0.09
Total sum of squares (TSS)	4.33	44	0.29

Calculated F=2.222

Critical F at 0.05 – 2.61

3.2 Responses and Adaptations to Changing Flows.

The traditional conservation technique (TCT) identified, as already noted, was that of periodic evacuation of sediments and silt from stream pools and the construction of shades and barricades around some (plate 2). There seems to be some partial knowledge of the complex relationship between catchments degradation and stream flow. Whereas it was identified that there was traditional ecological knowledge of the relationship between riparian vegetation and stream flow yield, there appeared to be inadequate knowledge of the relationship between activities in the entire catchments and their influence on yield of streams. 72.2 percent were of the

view that clearing and cutting down vegetation, including riparian and wetlands, was necessary to make land available for food cultivation and settlements, with little effects on stream flow elsewhere. They however recognized that within the immediate vicinity of the streams, their past activities such as forest clearing have resulted in the death of their once valuable streams. Though there were laws against degradation of riparian vegetation, observation and oral interview confirm that these have been jettisoned due to the frontier mentality and individualistic attitude. Many of the people view the land as their personal property and there should be no interference from anybody on the way they cut down the trees to create space for cultivation.

In addition, it was reported (69.6 percent) that the conventional end of pipe approach to stream management through periodic maintenance was fast dying off. The reasons for above were ascribed to the attitudes of the youths (73.8 percent) and the current lack of respect for the laws of the land (75.9 percent).

Asked whether the dwindling practices and attitude to water source rehabilitation and the local codes was a factor of the availability of alternative sources of water supply, particularly, from boreholes, 72.3 percent did not view it from this perspective. 63.4% felt these boreholes were not reliable, being always faulty and lacked regular maintenance, whereas 78.8 percent attributed their periodic breakdown to lack of trained local maintenance personnels, as well as government ineptitude and apathy.

TABLE 4: Dwindling traditional responses to Catchments Management

Variables (items)	(%) Responses
No more practice of stream protection	69.6
Boreholes are responsible	27.7
Faulty boreholes	63.4
No trained personnel/regular maintenance	79.6
Attitude of youths	73.8
Lack of respect for law	75.9
Land must be cleared for farming/housing	73.8
More land should be cleared and riparian vegetation degraded to provide cultivable land.	79.1

Analysis of variance (ANOVA) was also carried out to assess differential perception/feeling among the various age cohorts. Results from this analysis indicated that there was a significant difference between the various age groupings in terms of practices and protection activities as well as attitude to land management and exploitation, for improved stream flow ($F_{cal} = 3.47$ $F_{crit} = 2.53$).

TABLE 5: ANOVA Table showing the Differential Feelings and Attitudes among Age Cohorts

Source of variation	Difference of sum of square	DF	Variance estimate
BSS	8.3	4	2.08
WSS	36.23	60	0.60
Total	44.53	64	0.70

Calculated $F = 3.466$

Critical F , at 0.05 = 2.53

DISCUSSIONS

Despite the fact that the Bette people of Obudu view stream water as a valuable resource, and as such highly treasured, fresh water seems to be declining in yield, particularly during the dry season. This is likely to result to what Abramovite (1996) refers to as imperiled water,

impoverished future. There are indications from the various descriptive analyses that there seem to be no culture of sustainable catchments management, particularly restoration of degraded watersheds through re-vegetation. This supports Chiras (1994) that in tropical Africa only 1 out of every 29 trees fell is replaced. Tree planting of any kind is therefore lacking. Rather regeneration is practiced. But because the indigenous trees take very long time to mature, it will take quite some time before the streams can regenerate, if the vegetation is allowed to stay un-tampered

In this part of Nigeria, there are community/indigenous laws with regards to riparian dégradation. In addition, there have been community associations, similar to the situation to the park hill of Kenya (Flauret, 1985) and many other places, formed to take charge of stream management. Despite all of these efforts, findings from this study suggest that stream channel accretion and attrition is still accentuated, hence poor stream flow yield. In other words, indigenous institutions and laws and a tradition of community level decision-making, which are part of the culture of many societies, in this case, have failed to prevent catchments degradation (Gibson and Baker (2000). This can be linked with urban cultural invasion and religious influences, particularly Christianity which has tended to erode the fear of répercussion from deities that were associated with the sacredness of riparian forest and some streams. The intricate cultural systems of the people have therefore been shaped and also have shaped the natural environment. These cultural attributes have also shaped decision-making regarding the exploitation of land and water resources. From the interview, it was confirmed that most of the streams which had fishes that were kept sacred have been degraded and the fishes have disappeared. The stream corridors of such once valuable streams are now lying bare because of human interference.

In addition to the above, the current policy of individualized land ownership among the people have shaped the people's thinking, that they have exclusive right to exploit their land without recourse to community laws or regulations. This is in line with Mwingi (2002) that the land policy in Nigeria prior to the land act of 1978, had traditionally been subject to conflicting system. Traditionally, land had been under collective management, though some communities practice individual ownership, characterized by land fragmentation. The later is the commonest practice among the Bette people today. This individualized ownership to a large extent does not give regard to the communal rules of land management, which restricted exploitation to some areas, particularly, not encroaching into the riparian zones. This has created attitudinal change or has been inherent attitudinal problems, where individual landowners feel the land can be exploited without recourse or regard to the consequences elsewhere and in the future. The associated problem of this frontier thinking results mostly in nutrient/sediment loadings to streams, including chemical invasion. This relates to Hinrichsen et al (1998) that people living in all watershed addresses have tampered with such areas, denuding the vegetation and causing the release of thousands of tons of soil sediments into water courses, causing flooding during the wet season and suffocating aquatic life during the dry season. This inherent frontier mentality that permeates the lives of the people was thus exemplified by the analysis of their feelings in this paper. The people can be considered, based on this analysis, as belonging to a society that is out of synch with natural systems. They are low synergy societies who tend to satisfy their need for food, shelter and other resources by destroying the natural system. This is in line with Chiras, (1994) who sees one of the tenets of frontier ethic as, thinking that "there is always more and it's all for us".

Finally, the increasing interest and demand for land for agriculture and settlement as reported in the analysis could be attributed to increasing population which is widely reported for many rural areas in developing countries (Hinrichsen et al, 1998 Aniah and Utang, 2004) and the consequences are watershed degradation and water shortages.

CONCLUSION AND RECOMMENDATIONS

Many societies have traditional ecological knowledge (TEK) of the complex environment such as catchments degradation and stream flow. This is observed among the Bette people. Based on this, there were laws against stream banks and headwater degradation. These laws do not command enforcement any longer because of the current individualized land ownership/fragmentation. There is increasing demand for land and inadequate knowledge of the effects of their activities and the watershed degradation. Because land is eagerly sought after now, many of the riparians have completely been annihilated. In addition, the current system of individual land ownership has truncated the effectiveness of existing community laws on land management.

It therefore becomes imperative to address the problem from a holistic perspective and this can be achieved by adopting a management approach that involves the mobilization of local communities and individuals (Hall and Walumsley, 1988) and a concerted effort toward environmental awareness and the inculcation of environmental consciousness (Upla and Utang, 2004). Slowing down population through the provision of/and access to family planning is equally a good enough option at least at the long-term.

The move towards more sustainable ethics of conservation and restoration are very important. The adoption of appropriate watershed management practices; particularly through the prevention of reckless land clearing and tree felling, as well as ethno botanical restoration of degraded watershed through the use of exotic and/or indigenous trees species, is particularly imperative (Brush and Stabinsky, 1996; Evarett, 1992). The essence of this ecological approach is to increase infiltration and ground water storage, as well as sustain through flow to the streams. It is also to increase the lag time for surface run-off, which in most cases as expressed above, erodes soils whose particles as well as dissolved materials are later deposited in streams. The growth of trees and cover crops, and the support of natural plant cover thus, minimizes the flow of water from the land phase of the hydrological cycle and at the same time slow and attenuates the delivery of water from the catchments and improving base flow (Chorley, 1979, McDonald and Kay, 1988; Knapp, 1979; and Newson, 1997).

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