THE ROLE OF INDIGENOUS KNOWLEDGE IN FORESTED WATERSHED PROTECTION AND COMMUNITY DEVELOPMENT

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INTRODUCTION

Forested watersheds are now recognized as one of the world's most productive and most crucial ecosystems which through their functions provide goods and services for the health, safety and welfare of human population and the environment in which they occur. The functions which furnish forested watersheds with this important status include the conservation of soil, flood control, water quality improvement, sediment trapping, protection of biodiversity, including fisheries and wildlife. Only forest watersheds posses these characteristics and their destruction means the loss of these values forever.

However, forested watersheds, although highly productive are among the most threatened ecosystems on the globe. Threats facing the world's forested watersheds range from logging, bush burning, erosion, flooding, pollution, the intensification of farming activities, urban developments and engineering constructions. All these arise out of man's constant need to satisfy the basic necessities of life e.g. food, fuel, fibre and shelter.

Whenever and wherever the activities of man leads to the destruction of forests, there is always an accompanying disruption of the balance existing between the forested section of the watershed and its unforested neighbourhood with its farmlands, buildings, bare surfaces and secondary vegetation. The unforested or deforested sections of the watershed are usually prone to accelerated erosion, flooding, and changes in microclimate, silting-up of streams and general land degradation. All these go to show that a watershed that is stripped of its forests is exposed to environ-mental crises whereas the one that has its forest intact is protected against ecological problems.

The rest of this paper is divided into five sections dealing with the nature of watershed ecosystems, the need for watershed protection, the role of indigenous knowledge systems, watersheds and community development, and practical strategies for the protection of forested watersheds.

THE NATURE OF WATERSHED ECOSYSTEMS

The term watershed is sometimes used synonymously in the literature to refer to the drainage basin, river basin, catchment of drainage divide. At a larger scale, the drainage basin is in truth a watershed. This is because the drainage basin is the land area drained by a major river and its main tributaries in its journey from the source to the mouth or outlet which could be a sea or a major lake (Olayide, et al. 1979). Indeed, one of the major break through in geohydyrologic research is the recognition of the river basin as a basic unit or system within which scientific information can be collected, organized and analysed. What provided the basis of interest in the river basin as a "physiographic atom" was the topographic, hydraulic and hydrological unity of the basin as soil, water and vegetation seems to be related from one section of the basin to the other. The concept of the drainage divide as a

fundamental hydrological and environmental unit dates back to the works of Horton (1945), Strahler (1952), Chorley (1969), Gregory and Walling (1973) and a host of other contemporary scholars who have thrown more light on the river basin as a basic unit of study, research and planning. Today, the river basin can be readily traced on maps or aerial photographs and as Davis (1899) puts it: "One may fairly extend the river allover its basin and up to the divides. Ordinarily treated, the river is like the veins of a leaf; broadly viewed, it is like the entire leaf" (Quoted from Faniran, 1972). The river basin is therefore a unit of landform that is limited, convenient, unambiguous and clearly defined in a nested hierarchy of sizes on the basis of stream ordering.

At a smaller scale, the watershed can be viewed simply as a section or an organic part of the drainage basin. Brooks (1992) defines the watershed as a topographically delineated area that is drained by a stream system or just the total land area above some point on a steam or river that drains past that point. Simply put, a watershed is an area of land with a common drainage (Gregersen, 1989). In most studies of water as a natural resource, the watershed has a unifying factor which shows the natural relationship of interaction between the physical and socio-economic variables operating within the watershed.

From the above, it can be seen that the most important attribute of the watershed is that it is an open physical system with interconnections and with inputs and outputs. Its outputs include rainfall, solar radiation and debris supply. The outputs are evapotranspiration, runoff, percolation losses, loss of debris and nutrients out of the system. The characteristics of the input and output mechanism is greatly conditioned by the structures on the watershed most especially the forests. For example, the inputs of precipitation is usually intercepted by forest leaves and aerial parts before reaching the ground. In this regard, the erosive potency or power of raindrops are usually reduced or completely neutralized. However, if the watershed is deforested, such raindrops would impact directly on the soil surface causing first splash erosion and then rill, runoff and gully erosion in that progressive order.

Forest clearing in watersheds therefore sends shocks throughout the entire river basin in terms of erosion, sediment load and flow regime as the watershed is a natural open system. The watershed ecosystem is therefore highly sensitive to deforestation, land use, mechanical construction, etc.

FOREST AND WATERSHED PROTECTION

Watershed protection has been accorded low priority in developing countries like Nigeria because the environmental benefits are not immediate or are hard to measure. However, with the present upsurge of interest on environmental issues, attention seems to have been drawn to especially forested catchments and the need for their protection. Watershed protection involves the process of guiding and organizing the use of the land, water, forests and other resources within the watershed to provide desired goods and services without harming the soil and water resources respectively. It involves wise use and the recognition of the interrelationships between land use, vegetation, soil and water and the linkages between the upstream and downstream sections. Watershed protection therefore include the conservation of forests, the protection of the soil and water systems. It incorporates the proper management of the natural resources of the watershed to produce food, fibre, forage, etc. and the rehabilitation of even degraded lands and enhancement of water quality and quantity (Black, 1990; Brooks, 1992).

Forested watersheds need protection because they serve as both economic and environmental resources (World Bank, 1978). Economically, forests within watersheds provide a source for wood products (fuelwood, timber, stakes, etc), food, animal and other products like medicinal herbs which are consumed by human beings. As an environmental resource, the forests in watersheds function as:

i) natural habitats for biodiversity and wildlife;
ii) regulate the micro-climate of the catchment;
iii) reduce the direct impact of raindrops rendering it ineffective in causing erosion;
iv) regulate streamflow (especially flood) to the extent of confining the stream water to its channel;
v) stabilizes the soil through its roots system which act as anchors;
vi) prevent the silting up of streams
vii) frictionally resists surface water flow except in open places in the forest such as rock outcrops and water;
viii) assist in infiltration of water by loosening the ground surface and sub-surface;
ix) generate root passages and improvements of soil structure;
x) provide scenic beauty or aesthetics.

All these indicate that forested watersheds act as a "buffer" or "shock absorber" of the entire drainage basin as it plays a key role in temperature regulation, evapotranspiration, soil protection, recharging of ground water and the regulation of surface drainage.

THE ROLE OF INDIGENOUS KNOWLEDGE SYSTEMS

The indigenous knowledge system (IKS) of those who inhabit forested watersheds is very crucial in watershed protection and management. An indigenous knowledge systems (IKS) encompasses knowledge itself and the various means and processes by which knowledge is used or transformed within the system (Howes and Chambers, 1980; Yoder, 1990). Epistemologically, indigenous knowledge is cultural knowledge which is specific to a given group within a society. It represents the successful ways in which people have dealt with their environment (Warren, 1989). It reflects the unique experiences, values, preferences and perceptions that guide daily activities and decision making. It is thus, a dynamic source of creativity, action and innovation.

Within a forested watershed, the activities of individuals, most especially farmers, is guided by experience and the practical results of farmers' annual experimentation. This we often over look. Yet, it is the practical results of the farmers' experience and experiment that guide his behaviour within the environment.

The knowledge of indigenous people about indigenous tree species found in the area, their uses, values and consequences of disappearance constitute an environmental resource that must be recognized, respected and given prominence. The extensive deep and rich local knowledge, especially of the elders, would help use to understand the underlying socio-cultural structures which control indigenous rights, obligations and access to the forest/watershed.

Historically and traditionally, African societies have their own indigenous knowledge systems. African communities have always treated nature (their natural environment) as an integral part of their day to day existence. We Africans have an organic conception of nature in which the animate (biotic) and inanimate (abiotic) world were inextricably interwoven. Both the biotic and abiotic forms of existence were regarded as sacred and were to be maintained and harnessed mutually and symbiotically to

ensure continuity. Such traditional societies made no distinction between spiritual and physical concerns in relation to forest and agricultural levels. Certain days were set aside for firewood collection and people were rarely allowed to chop down trees as mostly only dead branches were collected. Some sacred forest/community forest were protected and could only be entered in times of need and by special individuals especially for sacrifices. Wanton destruction of the forest was unknown and so was environmental degradation resulting from deforestation. There was wise use of the forest.

We need to invoke the indigenous knowledge concept to ensure adequate protection of the forest around catchments. It is our sensibility to the indigenous knowledge systems (IKS) that will enable us to understand and change the widely held opinion among farmers in Cross River State that forest land is a major source of fertile land or even to deeply understand the attitude of the people. For instance, Bisong (1994) recorded that the benefits derived from the forest as listed by an all women's group in Bendeghe Ekiem as follows:

"A lot of things are gathered from the forest for food and cash and these include bush mango, mushroom, palm kernels and monkey kola. Also timber is extracted from the forest and other building materials. Cane ropes for making baskets and staking materials for yams are obtained from the forest. Medicinal herbs for infertility and child birth are obtained from the forest".

The above list of benefits derivable from the forest as presented by the all women's group in Bendeghe Ekiem is clearly sourced from the indigenous classical knowledge of especially the female group concerning the values of the forest. The list of benefits carefully avoided the conversion of forest to farmlands, not because it does not occur, but because the women were interested more in presenting their use interests. Any discussion of forest and catchment protection that does not recognize or pay explicit attention on IKS may likely fail.

. Four major facts about IKS make it attractive for a project like watershed protection. First, indigenous knowledge is practical knowledge. Second, indigenous knowledge reflects generations of experience. Third, indigenous knowledge is dynamic, innovative, flexible and adaptive. And finally, there are lessons to be learned from indigenous knowledge that can be applied to other situations. Starting with indigenous knowledge is like starting from the scratch and leaving no gaps. It is the opposite of transfer of technology or knowledge from an advance society to a less advance one. It is thus invaluable in forest and watershed protection.

It may well appear as if science has started reaping the benefits of indigenous knowledge especially within the Cross River Basin as Professor Obot, an Ethnobotanist has recently observed. According to Obot (1997), of well over four thousand (4000) plant species identified in the Cross River rainforest, 12 per cent are endemic and 7 percent are found to be useful to human communities around the Cross River National Park (Okwango Division). It is interesting to note that the approach adopted in obtaining information about the medicinal herbs was through the indigenous knowledge of the people who inhabit the villages around the Okwango National Park.

The indigenous knowledge of the people of this country can therefore be harnessed to protect our watersheds. This classical knowledge if clearly identified and applied will save the forested catchment from disappearance, siltation and general pollution.

COMMUNITY DEVELOPMENT AND FORESTED WATERSHED PROTECTION

The forest within watersheds bring both economic and environmental or ecological benefits to communities around the catchment. Timber harvesting and extraction of non-timber forest products are among the most common economic returns whereas the environmental gains are priceless and include soil protection and improvement in streamflow and water quality not to mention the regulation of climate all of which aid community development. Indeed, if we take community development to include:

i) changing the structure of the community economy for the better;
ii) increasing per capita production through the multiplication of public goods and service;
iii) increasing per capita income and consumption of welfare goods; and
iv) the growth in human welfare and standard of living etc. then community development occurs only when majority of the people enjoy not only increases in per capita income but participate fully in the production and sharing of the wealth of the community.

Thus, if only a few people protect the forest within the catchment and enjoy the benefits therefrom, then community development has not occurred. It is for this reason that the process of development is associated with the mobilization of people for the challenge of survival in comfort, peace and tranquillity, individually and as a group in their own environment, on their own terms, according to their own culture, transformed, modified or modernized by informal and formal education (Ntukidem, 1990). Forest protection within watersheds must therefore enjoy the support of the local people who will also share in the benefits of such programmes.

Within predominantly rural communities, forested watershed protection constitutes a strategy for not only rural economic betterment but a veritable tool for sustainable development. This is because forest protection within catchments recognises the inter-relationships between the forest, soil, water and land use. As the forest protects the soil from eroding or regulates the micro-climate or reduces sedimentation of streams or preserves biodiversity, site production is maintained, agriculture is enhanced, the supply of forest products are ensured continuously and even good quality water that is essential for increased food production and real incomes becomes realizable. And this also saves the world from health-threatening pollution, global climate change and loss of biodiversity. In addition to all these, there is the avoidance of flooding and flood damages, greater use of the floodplains, increases in hydropower potential, increases in fish harvest, greater erosion control and mass movement.

We shall however highlight three major physical benefits of forested watershed protection:

1. ***Soil Erosion Control and protection of surface and Ground Water Resources.***

Trees can use rainfall in the most manageable and least wasteful means for production purposes (Gregerson, 1989). The crowns of trees and forest undergrowth and litter layer break the power of raindrops so that splash erosion, the primary phase of the process of erosion by water, is placed under check. The organic litter layer especially acts as a sponge absorbing the impact of raindrops harmlessly hence causing minimum movement. On the other hand, the forest promotes rapid movement of water into the soil, that is, high infiltration hence reducing runoff, sheet erosion, gullying and flashfloods. The surplus water flows into the stream channel and sub-surface or ground water system in a

more stable manner, forming more sustainable water regimes.

2. ***Regulation of Micro-Climate***

Forests plays a key role in regulation of temperature, evapotranspiration and relative humidity such that the removal of forest brings about immediate and drastic increases in the amount of global and micro-scale radiation reaching the ground (Richards, 1966). Even with the development of alternative covers apart from the forest (e.g. farmlands or natural regrowth) the low light transmission of the initial vegetation is in most cases never equaled. This has been attributed to changes in reflectivity, absorptivity, and transmissivity (Lawson, 1986). Evapotranspiration is also usually much higher partly because of the large surface roughness characteristic s of the forest and the consequent higher degree of turbulent mixing and transportation of water vapour (Thompson and Pinker, 1975). Moreover, interception of rainfall by forest canopies also enhances evapotranspiration. In all, air and soil temperatures are moderate under forest cover and increase following forest removal.

3. ***Prevention of silting-up of drainage, dams and canals***

The lowest erosion and sedimentation rates are usually associated with forested watersheds in natural conditions (Brooks et al, 1991). This is because of the role of the forest in inhibiting overland flow and sediment delivery into streams. When the forest is removed, the soil looses not only their natural protection, but also their natural water retention capacity. This produces disturbances of the water balance leading to alternating droughts and flash floods as well as inadequate input into the ground-water and large scale transportation of the fertile top soil by water to block stream channels (Herb, 1983). In other words, deforestation opens the land to runoff erosion, soil and nutrient losses which pollute streams to the extent of silting them up. There is thus a direct link between deforestation and the drying up or disappearance of most streams in our communities.

It is for the above reasons that even flooding is attributed to forest removal. Indeed, most flood occurrences in Lagos State has been attributed to increased forest removal in the Ogun watershed. The Ogunpa flood disaster in (1973, 1978, 1980) was also attributed largely to the clearance of forest along the banks the rivers and streams. In Ekureku, a rice producing community in Abi LGA of the Cross River State, flooding has become an annual occurrence ever since the Villagers wiped out the rain forest completely from the area in 1987 through deliberate destruction of the high forest. Deforestation of catchments therefore leads to land degradation, poverty, misery and underdevelopment. Within Ikom LGA, it might surprise us to hear that the Agbokum waterfall might be a thing of the past if the forest resources are unprotected or completely depleted. At present, there are signs that Agbokim waterfall is no more what it use to be.

PRACTICAL STRATEGIES FOR FOREST AND WATERSHED PROTECTION

The following practical strategies can be adopted to protect forested watersheds especially within the Cross River Basin Basin:

- The Forest zones very close to stream channels should be preserved, maintained and declared a no-go-area as they constitute the "buffer zone" of the watershed ecosystem;
- Selective logging and tree planting must go hand in hand. Unwise and misguided felling of trees must be outlawed by the different communities involved;

- The protection of forests within the watersheds must be done over a long period of time to particularly conserve the soil and understory vegetation which are critical in erosion and flood control.
- There is need for research into the peculiar characteristics of the watershed in terms of topography, surface drainage, ground water, micro-climate characteristics, land use and indigenous knowledge systems of border communities. This will form the information base or data bank for effective management and protection of the catchment and its forest resources.
- The local people must be involved as they are both agents and victims of catchment deforestation. Men, women and children should be the centre of attention and not just the forest trees; the people should be mobilized to protect forest trees from being hacked down and from fire.
- Forest protection brigades if not already in place should be set up to assist in the conservation of the remaining high forest.
- The seemingly irrational behaviour on the part of the rural farmer within a forested watershed must be viewed in the context of the indigenous knowledge systems. Okali (1993) is of the opinion that forest management and preservation fail because of the abandonment of the traditional conservationists attitude and practices.
- There is also need to educate the local people on the consequences of devegetating forested watersheds. A vigorous environmental education will create public awareness and concern for action.
- In addition, incentives should be given to the rural poor, the landless and under-privileged to keep them away from the forests.
- Finally, we need to avail ourselves of the technical expertise of scholars on environmental issues. The environment is multidisciplinary in nature. The Universities, the Polytechnics, Colleges of Agriculture and Forestry Departments offer a large number of specialists on the environment whose services might be of assistance from time to time.

CONCLUSION

Forests protect watersheds and contribute tremendously to the development of communities within catchments. Our current methods of conservation of the forests are based on Western cultures, values, pure scientific and economic models. Perhaps, that is why they have not been effective. There is need for us to focus attention on the existing indigenous knowledge systems to protect, defend, and control exploitation and regenerate the forest along water courses.

REFERENCES

Bisong, F. E. (1994). ***Farming systems, human ecology and biodiversity conservation in the cross river state rainforest of nigeria.*** An unpublished Ph.D Dissertation submitted to the University of Port Harcourt, Nigeria.

Black, P. E. (1990).***Watershed hydrology.*** Englewood Cliffs. N. J. Prentice hall.

Brooks, K. N. Gregerson, H. M., Efolliott, P. F.& Tejwani, K. G (1992). Watershed management: A key to Sustainability ***in*** N.P. Shama (Ed.) . ***Management world's forest: looking for balance between conservation and development.***

Chorley, R. J (ed (1969): The Drainage Basin as A Fundamental geomorphic unit in ***Water, earth and man*** (R. J. Chorley, Ed.). London: Methuen, I, pp. 77-99

Davis, M. W. (1999). The Geographical cycle " ***Geog. Journal*** 14, 481-504.

Faniran, A. (1972). River basins as planning units in ***Planning for Nigeria*** (K. M. Barbour, Ed.).

Gregerson, H. Draper, S. & Elz, D. (Eds.) (1989). ***People and trees: The role of social forestry in sustainable development***, Edl seminar series, . 11-36

Gregory, K. J. & Walling, D. E (1973): ***Drainage basin form and process*** Arnold.

Herbs, J. (1983). Energy from small hydropower plants – A contribution to the solution of energy problems in developing countries in ***Applied geography and development***, 21, 65-74.

Horton, R. E (1945). Erosional I development of streams, their drainage basins: A hydrophysical approach to quantitative geomorphology. ***Bull. geo. soc. & America,*** 56, 27-370.

Howes, M. & Chambers, R. (1980). Indigenous technical knoweldges: analysis, implications and issues" ***In indigenous knowledge systems and development*** (Brokensha, et al) ed. Lanhan, M. D University press of America.

Lawson, T. L., R. Lal & K. Oduro-Afriyo (1986). Rainfall redistribution and micro-climate change over a cleared watershed in Lal, et al (Eds.). ***Tropical agricultural hydiology.*** John Wiley & sons, pp. 141-151.

Ntukidem, A. E (1992). ***Geography, regional development planning, development and underdevelopment.***. A prepared for a departmental seminar in the department of geography and regional planning, University of Calabar, July2, 1992.

Okali, D. U. U. (1993). Conservation in development: the art of eating your cake and having it. ***NEST forum 2, (3)*** , 6-10

Olayide, S. O., Olayemi, J. K.& Eweka, J. A (1979). ***Perspectives in Benin-Owena river basin development***, U. I. Ibadan:LARD

Richards, P. W. (1966). ***The tropical rainforest***. Cambridge university press.

Strahler, A. N. (1952). Dynamic basis for geomorphology, ***Bull. geo. soc. of America***, 63, 933-938

Thompson, O. E. & Pinker (1975). ***The*** energy balance of a tropical evergreen forest ***JAM 19*** (12), 1341 – 1356).

Warren, D. M. (1989). Editor's notes. ***CIKARDS news***! 1, 5.

World Bank (1978). ***Forestry sector policy paper***. Washington, D. C World Bank.

Yoder, R. L (1990). ***Amish agricultural in Iowa: indigenous knowledge for sustainable small-farm systems.*** Studies in technology and social change. No. 15, Ames, Iowa, 1009.