



## Environmental Factors that Limit Sustainable Commercial Agriculture in Developing Economies and Control Measures

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### ABSTRACT

This research study is intended to examine environmental factors limiting commercial agriculture in developing economies. Man's desire to produce food on large scale for sale, distribution and export has been hindered by some problems such as poverty, international market, inaccessibility to advanced technologies and environmental changes. The environmental changes are inevitable outcomes of economic growth and development which qualitatively transformed the physical environment. The environmental impact on agriculture in this study is understood in the context of wider environmental problems, which stemmed from unsustainable practices associated with low productivity and agricultural practices by subsistence farmers. In this study, the problems that tend to limit commercial agriculture in developing economies have been reviewed. Various environmental challenges critically examined and major control measures explored to ensure sustainable agriculture in developing economies of the world.

**Key words:** Environmental factors, commercial, agriculture, economies, control and measures.

### INTRODUCTION

Prior to the first agricultural revolution, people relied on hunting and gathering to obtain food supplies. The agricultural revolution began as the individuals in the society began to cultivate soil, plant seeds, and use plows and animals to assist with the cultivation of soil (Korvenoja, (1993)). This development changed from hunting and gathering occurred simultaneously around the world (Santra, 2001). Commercial agriculture came into existence during the second agricultural revolution in the 17<sup>th</sup> century, when individuals started shifting from hard labour to machine farming(). It is a type of farming in which the role of the farm has moved from the centre piece of agricultural production into only one part of the system of production. This process includes, harvest, storage, processing, marketing and selling of food and cash crops in large quantity due to the rapid change in technology that is a major force of contemporary commercial agriculture. Stemming from man's quest for increase in food production for the ever increasing production and hunger for technological breakthrough in sustainable extensive agriculture guised as commercial agriculture, much pressure had been brought upon the environment in alarming proportion. This pressure has led to various challenges faced by commercial agricultural practices. These challenges could be briefly classified as follows: availability of fewer varieties of food, excess production/supplies, limitation of farmers to access some agricultural facilities, international market, instability of standard economics, desire for high productivity and profitability, employment, welfare and safety of workers and environmental changes.

Environmental change is an inevitable outcome of economic growth and development. Economic activity such as commercial agricultural production, qualitatively transforms the physical environment within which it takes place. The amount of harm it does to the environment depends on upon the technology and the value one attaches to different aspects



of the environment. When assessing the environmental impact of commercial agriculture, we need to take into consideration the term “commercial” in the context of total damage caused by commercial agriculture that may warranted the need to eliminate damage elsewhere by allowing agricultural output to be produced on a smaller area of land. Environmental impact on commercial agriculture needs to be understood in the context of wider environmental problems relating to agriculture, most of which stem from the unsustainable practices associated with low-productivity, subsistence agriculture practiced by peasant farmers and livestock producers. Reardon *et al*, (1998) pointed out that the main environmental problems in developing economy related to population pressure on natural resources include:

- Poverty
- Soil erosion and loss of soil fertility as smallholders seek to intensify production by adding labour to existing agricultural land without corresponding increase in chemical input, organic matter, equipments, land conservation.
- loss of biodiversity and damage of natural ecosystem due to smallholder’s desire to increase agricultural production by clearing forests and expand into fragile ecosystem.
- lack of product quality and safety of workers.
- Global warming.
- Acidification.

To have quality control of the above environmental challenges, first and foremost, assessment of the environmental impacts of the farm on both the landscape and operational levels, road and transport associated with production and processing facilities should be carried out. This assessment must cover impacts on soil, water, air, biodiversity and people.

## CHALLENGES OF COMMERCIAL AGRICULTURE:

The hunger of man to produce products large enough for sale to meet his ever increasing financial stresses led to a lot of problems to the environment. Since the advent of commercial agriculture, during the second agricultural revolution, man has had to face the realities associated with mechanization and technological advancement in agricultural practices under the guise of challenges. These challenges include: consumer preferences, excess production, poor harvest of varieties of food, limitation to the use of modern tools (farm), desire for high productivity and profitability, workers’ welfare and safety, economy, international market and environmental changes.

### Consumer’s preference:

Historically, farmer’s main objective was to keep up with the food demand generated by growing population. However, over time, the population not only requires basic energy requirements one met but demanded better access to a wider variety of nutritious foods. Today, consumers are very concern about the nutritional characteristics of food as well as the safety of the food. With the increasing number of people in labour, therefore, there is an emphasis on developing new products that not only meet the nutritional value and safety requirement, but also increase the ease and speed of preparation.



### **Excess production:**

Excess production or supplies has had negative impact on both small and commercial farmers, as it reduces their income and increase spoilage due to lack of storage facilities.

This challenge can be controlled by government policies through;

- Payment of farmers not to grow cash crops, which perhaps have negative impact on the economy in future.
- Provision of price support for products that are sold cheap
- Buying surplus products and storing them in silos.
- Donating or destroying it.
- Provision of adequate storage facilities to farmers.

### **Poor varieties of crops:**

With the global spread of commercial agriculture, fewer varieties of crops are being planted in shrinking areas of arable land. Varieties of rice, corn and wheat and new farms of livestock breeding have displaced local varieties of crops and animal breeds. The United Nations food and agricultural organization (FAO) has estimated that more than 75% of agricultural crop varieties and more than 5% of domestic livestock breeds have disappeared over the past century because of modern agriculture and the introduction of new varieties of crop through the adoption of biotechnology. (FAO,).

### **Limited access to facilities:**

In developing economy, commercial and technological know-how are not widely seen. This can be attributed to the following:

- > Small land holdings, scattered plots and poor rural infrastructure.
- > Low income levels and the availability of cheap household labour discourage household from either purchasing or renting machinery to engage in extensive agriculture.
- > Rapid spread of commercial agriculture market barriers, and privatization of knowledge that has accompanied advances in biotechnology, patenting of live pose a direct threat to livelihood of farmers.
- > Lack of government policies such as finance subsidies, high interest rate loans for purchase of farm machinery, lack of tax exemption, fuel to operate machinery etc.

### **Desire for high productivity and profitability:**

According to Weight and Kelly, (1999), commercial agriculture requires a combination of agro-ecological practices (e.g no-till, cover crops, rotation and agro-forestry) and increased use of chemical fertilizers. Fertilizers are recommended as the primary nutrient inputs and organic matter are recommended as amendment to fertilizer. This is because large quantities of organic materials are required to deliver a nutrient load equivalent to fertilizers. It is difficult for farmers to obtain such large quantities due to competition from non-agricultural uses (fuel, folders and construction), hence they resort to chemical fertilizers.

- Fertilizers reduce biodiversity, pollute streams, rivers and underground water, degrades soil fertility.



- The decrease cost of synthetic fertilizer inputs, along with the higher price that consumers pay for organic products, contribute to increased profits.

### **Welfare and safety of workers:**

Commercial agriculture requires large work force right from cultivation to processing and production stage. Workers are involved in both planting, processing and production. They are required to be protected from hazards, motivated through promotion and salary enhancement, training and retraining, and safety of workers. Unfortunate enough, the above privileges seem to be lacking in small holdings. For commercial agriculture to be seen as sustainable, the following measures must be taken.

- Health and safety of workers must be taken serious.
- The pay and conditions of all workers must meet national and international guidelines of labour organization
- Child labour should be discouraged.
- Health insurance should be provided for all workers.

### **Economic value:**

Although the scope of economics is broad, agricultural economics tends to focus on maximizing yields and efficiency at farm level. Economics takes an anthropocentric approach to the value of the natural world: biodiversity for instance is considered beneficial only when it is valued by people and increased profits. Increased in the following result economic loss.

- Soil erosion.
- Increases in carbon emission.
- Damage to biodiversity and ecosystem.

Commercial agriculture is thus capital intensive requiring more energy, money and manufactured inputs

### **Global market:**

In the global market, many of the crops are characterized by:

Finding new ways to deliver them to foreign consumers in the form in which they want to buy.

Developing more alternative crops and more specially crops.

Marketing value added products.

Because of the size of global market, globalization is one of the fundamental factors affecting the well-being of farmers in developing economies. We live in a global market and a global society. This creates tremendous opportunities for the farmers to draw upon genetic materials and new crops from other countries to engage in commercial agriculture. However, these opportunities seem to be lacking in developing economies.

### **Environmental Challenges**

The third major trend of the 1990s is the growing concern for the environment. One of the goals is to provide commercial agriculture with the best available, most environmentally friendly irrigation, prevention of soil erosion, control of pests, sustainability of soil fertility,



maintenance of biodiversity and ecosystem, concern for the health and safety of workers and animals and use of chemicals (fertilizers and pesticides), however, man's quest for profitability has drawn him to various environment abuses that have led to the following:

- Soil erosion and soil fertility as smallholders seek to identify production by adding labour to existing agriculture land without corresponding increase in capital (chemical inputs, organic matter, land conservation and infrastructure).
- Loss of biodiversity and damage of natural ecosystem as farmers intensify agriculture by clearing forest, logging and expanding into fragile ecosystem (Semgalawe, 1998)
- Product quality, safety and health of animals and workers.
- Global warming.
- Acidification of the soil
- Waste management and water conservation.

## POVERTY

Poverty is the main cause of current patterns of environmental degradation in the rural parts of developing economies (Kitting, 2003). To escape from poverty, the rural poor face two options: Either they must find remunerative livelihood outside agriculture or adopt technologies that would allow them intensify agriculture in a sustainable way. While income generated by employment in the rural non-farm economy might help finance necessary investment in inputs, the linkages between agriculture and the rural non-farm economy usually means poor performance and low income in the farmer translate into equally poor performance and low income in the latter. Excessive focus on cash crops has forced subsistence smallholders to farm marginal land with little access to input, this leads to soil erosion and declining soil fertilities (Korvenor, 1993).

## ENVIRONMENTAL QUALITY CONTROL MEASURES

The ultimate goals of commercial agriculture is to produce crops large enough to be sold either locally or internationally that would be safe and nutritious for consumers. Besides, the practice must be environmentally friendly. Unfortunately, commercial agriculture practices in developing economies have left leave much to desire as a result of the environmental abuses associated therein. These abuses If not checked early would have dangerous effects on the existence of biotic and non-biotic entities on earth. In this paper, several control measures have been put in place to assist farmers in various forms of commercial agriculture. There are therefore opened to windows of application.

## CONTROL MEASURES

### Soil erosion/fertility

Simply put, soil erosion is the washing away of the top soil. It is caused by a number factors ranging from destruction of natural forest by clearing and cutting trees to bush burning this reduces soil fertility as farmers strive to identify production by adding labour to existing agriculture. These problems can be controlled by:

- Avoiding bush burning to prevent soil exposure and stem global warming.
- Maintenance of riparian reserves to stop soil run-off.
- Planting of legume cover (e.g Fabaceal family)



- Construction of retention ponds, silt taps, terraces and platforms.
- Production of intercropping (with wider spacing).
- Application organic manure and natural occurring form of potash to provide potassium.
- Avoid heavy logging and wood cultivation. Plant new trees whenever a tree is fell.
- Avoid dotting the farm with petroleum products or other oils during cultivation and processing of crops.

### **Biodiversity and Ecosystem:**

This is one of the most dangerous problems associated with commercial agriculture. Biodiversity describes the number, variety and variability of living things in terms of gene, species and ecosystem, corresponding to the three fundamental levels of biological organization. It is the result of two opposite action: The processes that produce new genotypes, new varieties and new species and processes that eliminate mutation, variants and species from the system.

Farmers often seek to intensify agriculture by clearing first, logging and expanding into the fragile ecosystem by introducing new genotypes through mutation, recombination and related genetic phenomena, hunting, and other accidental causatives. Biomass is altered in the process. These environmental abuses are not checked, they may lead to losing resources to resistance to pests, diseases and climatic stress, resulting in crop failure in future. These environmental challenges can be mitigated by:

-By having knowledge of the species including rare, threatened and endangered species and where there are, this can be used as basis for planning.

-Carry out zero burning to pave way for cleaner environment, soil organic matter, physical properties and fertility should also be enhanced.

-Ensure maximum conservation of soil by carrying out appropriate land preparation techniques for road construction, terracing and construction of silt-pits and bunds.

-Maintenance of natural vegetation riparian along rivers.

-Crop diversification through the planting of agro forestry species in forested reserves, steep or lateritic land, commercial trees like tea and bamboo can be planted around and within cultivated fields.

-Enhancement of soil biodiversity by planting creeping leguminous cover such as *Mucuna bracteata* and beneficial rhizobium interactions.

-Planting of beneficial plants like *Euphorbia heterophylla* to suppress leaf pests.

-Use barn owl as the primary means of rat control e.g in oil palm cultivation to reduce the use of rodenticides.

-Maintain water catchment areas and water bodies.

>Developing economies should accept cost of conservation be it by foregoing some economically more attractive development or tolerating crops damaged by pests.

>All developing economies should agree to levying a biodiversity conservation cess on (a) all products of biodiversity based on enterprise. (b) polluting industries responsible for depletion of biodiversity.



### Use of chemicals:

Needless to say the intensification of production through increase use of inorganic fertilizer and other agrochemicals can come with its set of environmental problem such as:

- > Reduction of biodiversity.
- > Pollution of streams and underground water due to run off from the field(Witte *et al*,1993).
- > They are harmful to the health of farmers and agricultural workers
- > Degradation of the soil fertility ,e.g over use of inorganic fertilizer
- > They alter microbial balance that converts organic matter and dissolved minerals in the soil to form that plants(rice) can use.
- > They reduce the ability of soil absorb chemical inputs(Clay,2003)

These challenges above can be overcome by the following control measures:

- > Minimize the use of chemical fertilizers and pesticides. If synthetic chemicals are used, the following information must be provided.
  - (i) Details of why and when they are to be used.
  - (ii) The potential negative effect and how to prevent it
  - (iii) Decision process for deciding where they are necessary to apply.
  - (iv) Appropriate personal protective clothing and emergency plan
- > Encourage the use of organic clothing.
- > Encourage crop rotation, green manure, compost and biological pest control.
- > Apply biological pesticides such as pyrethrum, rotenone, copper, sulphur and bacterial toxin
- > Encourage crop protection using physical barriers such as row covers and crop diversification through companion planting.
- > There should be provision for beneficial organisms such as minute pirate bugs, praying mantis and parasitoid wasps
  - Apply naturally derived insecticides like *Bacillus thuringiensis*(bacterial toxin),neemleaf(green insecticides).
  - Use of caprylic acid(natural fatty acid in milk and coconut fruit) for pest control.
  - Application of a mixture of  $\text{Cu}(\text{OH})_2$  and  $\text{NaHCO}_3$  for fungi.

### Weeds:

Weeds posed serious environmental threat to commercial agriculture in developing economies, as they compete with crops for nutrients in the soils. Weeds can be controlled by:

- Introduction of weed suppressing cover crops and crops with dissimilar life cycles to discourage weeds associated with a particular crop.
- Application of tillage method(i.e turning soils between crop to incorporate crop residues and soil amendment)
- Disturbs the soil after seedling.
- Mowing/cutting (i.e removing top growth of weeds).
- Use of heat to kill the weeds.



- Blocking weed emergence with organic materials, plastic film or landscape fabric (mulching).
- Application of naturally sourced chemicals like acetic acid, corn gluten meal and essential oils.

### **GLOBAL WARMING:**

Global warming is one of the environmental challenges that has ravaged earth surface. It is caused by rise in CO<sub>2</sub> on earth surface, which induces corresponding temperature increase. Natural phenomena such as volcanic eruption and decomposition of forest litters, and anthropogenic activities like burning of fossil fuels and changing of land use pattern contribute considerable amount of CO<sub>2</sub> emission processes. Global warming affects species in two ways:

- It makes plants not to tolerate new conditions because of their physiology.
- It affects plants' changing interactions with predators, parasites, competitors and mutualists (Santra, 2001).
- Global warming can alter photosynthetic rate, plants productivity, survival and distribution of species.

Global warming can controlled by planting palm trees in the farms alongside crops, as they are more efficient carbon sink than a tropical rainforest (Bhatia,) and helps to absorb greenhouse gases.

### **Acidification:**

The main causes of natural acidification are long-term leaching, microbial respiration by acid formed from rain water(carbonic acid), decomposition of organic matter(fulvic acid and humic acid) which stimulate leaching by dissociation into H<sup>+</sup> ions.), plant growth and nitrification.

The anthropogenic causes of acidification are land use pattern such as needle leaf afforestation, excessive use of inorganic nitrogen fertilizers, land damage and acid deposition. Needle leaf trees produces litters that are acidic and causes damage to crops through stress.

This environmental challenge can be controlled by the following measures:

- Liming of the soil.
- Slowing of organic matter turnover.
- Introduction of poor modulation in some legumes, calcium, molybdenum deficiency, manganese and aluminum toxicity. The liming materials commonly used are limestone, chalk, based slag, quicklime, and slake lime.

### **Soil and water conservation:**

Management of water is a very important and aspect in commercial agriculture. Deficit supplies of water could create stress to commercial agriculture and affect yield of crops. During planting several measures are taken to prevent soil infertility. Silt pits helps reduce the length of slop, while trapping soil and plant nutrients, pruned fronds placed a long the slope minimize soil erosion .

Leguminous cover crops fix nitrogen in soil, recycle organic matter, improve soil texture, keep out weeds, reduce compactors and erosion and promote rainfall acceptance.In





coastal plantings, emphasis should be placed on proper drainage and water management. This would prevent over draining and deterioration of fragile acid sulphate and peat soil.

## CONCLUSION:

The ultimate goals of commercial agriculture is to produce crops large enough to the nutritional and safety of man locally and internationally. Unfortunately, these goals have been dwarfed in developing economies of the world by several environmental factors that tend to limit intensification and sustainability of agriculture. These environmental factors range from poverty to soil erosion/fertility, destruction of biodiversity, use of chemicals to increase soil fertility and control of pests, weeds, global warming, and acidification. These challenges can be surmounted, assessment of the environmental impacts of the farm on both landscape and operational levels, road and transport associated with processing and production facilities be carried out first. The assessment should cover impacts on air, soil, water and people.

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## ABSTRACT

Our life styles are among the determining factors and precursors for the pattern of development in vogue in contemporary civilization. The younger generation, future leaders and decision-makers may opt for changes in the life styles that may certainly be some determining factors in the renewal of development expected with respect to the products and demands of all types of industries and agriculture. This would require the provision of sound environmental education at all levels of education, during which participants form and reform their philosophy that would serve them as a content for their decision and actions in their active life and work. This study is therefore intended to review the goals and objectives of environmental education, examine strategies for E.E development and explore models for future environmental education development system.

## INTRODUCTION/LITERATURE

Environmental education dated back to the 18<sup>th</sup> century when Jean Jacques Rousseau stressed the importance of education that focused on the environment in *Emili* or on *Education* several decade later Lous Agassiz, a swiss-born naturalist, echoed Rousseu's philosophy by encouraging students to "study nature, not book". These two scholars opened the gate way for a concrete environmental education programme, which is today known as nature study that took place in the 19<sup>th</sup> and early 20<sup>th</sup> centuries. Thereafter, was an emergence of a new type of environmental education ascribed as conservation education due to great depression and dust Bowl in 1920s and 1930s. This type of environmental education focused on scientific training rather than natural history.

The modern environment education movement which gained significant momentum in the late 1960s and early 1990s was berthed when governments at the highest level came together to take stock of what mankind had done to the environment (United Nations, 1972).

As more people began to fear the radiation fall-out, chemical pesticides and significant amount of air pollution and waste, the concern for the health and that of the environment led to a unifying concept known as environmentalism(Santra,2012).



United Nations Education scientific and cultural organization (UNESCO) and United Nations Environmental programme (UNEP) created three major declarations that have directed the course of environmental education, the declaration were:

-Stockholm declaration of 5-16<sup>th</sup> June, 1990s, whose mandate was to inspire and guide the people of the world, and enhancement of the human environment.

-Belgrade Charter of October 13-22, 1975, whose duty was to formulate goals, objectives and guiding principles of environmental education programme. It defined the audience for environmental education.

-Tbilisi declaration of October 14-26, 1977 that noted the significant role of environmental education in the preservation and improvement of the world's environment and included new goals, objectives, characteristics and guiding principles of environmental educator

Several definitions of environment have emerged, however, the most comprehensive definition of environment came out in the work of the intergovernmental conference of Environmental Education, Tbilisi (1977). In this context, the environment is considered to consist of a "whole set of natural and social system in which man and other organisms live and from which they draw their sustenance. This concept embraces the natural and man-made resources and products whereby man needs are satisfied.

The definition of the environment is adopted to facilities and handle environmental issues and problems, and formulating needed environmental legislation at all levels. knowledge in the above context produced my scientific studies and research needs to be translated into appropriate message through environmental education for various target groups, hence the need for environment education.

## STATEMENT OF THE PROBLEM

It is a well known fact that environmental education is a dynamic, every change on content, characterized by highly complex interrelationships, priority problem, causes, impact and solutions. knowledge-base of the environmental as made difficult to understand because human race often simply cannot understand environmental issues or their potential resolutions in any definitive or permanent sense because "one man's solution may be another's catastrophe". Also, a number different ideologies or perspectives on the root causes of environmental problems gives rise to various implications for education (problems relating to content and ideologies are in conflict with current educational practices).

To match the complexities of environmental education with intricacies and demands of formal education curriculum, principles and process of learning, models for teaching and learning, environmental education models become apt and timely, hence the study.

## AIM AND OBJECTIVES OF THE STUDY

The main aim of the study was the imperatives of future models for environmental education development system.

The specific objectives were as follows:

- To review environmental education goals and objectives.
- To examine strategies for it development.



-To explore models for the effective teaching and learning of environmental education in schools

### SIGNIFICANCE OF THE STUDY:

- > It would contribute to the body of knowledge.
- > The study would provide substantial changes in the thinking and practices that may be applied not only to environmental situations but education itself.
- > It would enable curriculum formulator to build upon prior knowledge and formative experience by setting locally appropriate goals, and most importantly by planning coverage of all the core component of environmental teaching and learning.
- > The study would provide useful components of the models that could help form a critical link between the three fold frame work of environmental education and dimensions of learning.
- > It would help learners to realize the complex nature of the environment.

### GOALS OF ENVIRONMENTAL EDUCATION

The goal of environmental education formulated and adopted at the Tbilisi conference (UNESCO/UNEP, 1977) were;

- To provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment.
- To foster clear awareness of and concern about economic, social, political and ecological interdependent in Urban and rural areas.
- To create new partners of behaviour of individuals, groups and society as a whole towards the environment.

#### Objectives of Environmental Education:

The objectives endorsed at the Tbilisi Conference of UNESCO-UNEP, 1977 were as follows:

- **Awareness:** To help social groups and individuals acquire an awareness of and sensitivity to the total environment and its allied problem.
- **Knowledge:** To help groups and individuals gain a variety of experience in and acquire a basic understanding of the environment and its associated problem.
- **Attitudes:** To help groups or individual to acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.
- **Participation:** To give people opportunity to actively involve at all levels, working towards resolution of environmental problems.



## STRATEGIES FOR ENVIRONMENTAL EDUCATION DEVELOPMENT

### Authorization:

To incorporate environmental education into education process, it is pertinent to establish the needed mandatory authorization and responsibility for educational institutions to abide with. Anything short of these would make E.E staff as a peripheral subject or activity and may never establish the needed part of the core of education curriculum for students and teachers. The formulation of the mandatory and guidelines for environmentalization of education can be advanced by a high education committee assigned by the decision makers at the highest level.

### Curriculum renewal:

This required a committee consisting of curriculum experts, experience teachers, environmental science experts and representatives of the communities. Their ultimate responsibilities are thus:

- Examination of curriculum of the primary and secondary schools and identify the environmental education concepts covered to serve as the basis upon which environmentalization of school curriculum could be based.
- To formula E.E objectives for education
- To identify local environmental problems, additional environmental education contents required appropriate activities, time needed for different subjects and topic, instructional methodological, appropriate instructional materials.

**Renewal of Teachers' Training:** It is the teacher that makes a curriculum function. If teachers are trained in environmental education, they can help in the formulation and development of suitable curriculum and teaching materials. The involvement of teacher in curriculum and materials renewal leads to teachers' commitment and responsibility for the effective implementation of curriculum and teaching materials

- The curriculum renewal with respect to environmental education should include teacher education renewal.
- Pre-serve teacher education should be based on the courses and elements of the environmental education dimension of the curriculum for schools with due consideration to their needs in the cognitive, effective and psychomotor domains

### Teaching methods:

The teaching methods that could be applied in environmental education are lecture, demonstration, discussion, field trips, projects, games simulations, debates, case study, competition and laboratory work.

Environmental Education requires the use of environment as a living laboratory in the teaching and learning process at all levels of education to ensure that learning by doing is considered as a teaching method and strategy.

Learning by doing can be achieved by undertaking experiment at micro and/or macro levels with air, water, soil, plants, animals and their interactions. If the activities are well planned learner would understand environment better and can initiate research thinking, techniques, activities and become acquainted with problem-solving approach.



Learning can be facilitated, made well appealing and more permanent when it is achieved through research and experimentation in indoor and outdoor environment requiring problem identification, observation, exploration, data collection, interpretation, proffering solutions and reaching conclusions.

### **Evaluation:**

Evaluation is the process of finding out if environmental education objectives in context of teaching/learning have been fulfilled. Results of an evaluation are feed back mechanisms indicating the achievement and weakness of students and the productivity of the effort of teachers.

The evaluation of knowledge and skills may be done satisfactorily through essays, objective tests, true and false questions, short answer questions, project assessment laboratory work, report, survey, case studies etc.

Evaluation instruments in education can be revised and renewed to accommodate educational questions based on the objectives and contents of environmental education that have been incorporated in education.

The main task in teaching of environmental education is to inculcate sound environmental attitudes and ethical responsibilities conducive to sound civic actions. Therefore, there is immediate need to develop effective instruments for evaluation to capture this type of achievement.

### **MODELS FOR FUTURE ENVIRONMENTAL EDUCATION SYSTEM:**

Environmental education is not all about saving the wale or saving the world. It is also about the development of an appreciation of the wonders and beauty of the world and a sense of wanting to save it (development of ecological thinking or of an environmental ethics).

The basic curriculum essential "elements" are empirical, ethical and aesthetic. These component of the model help to make critical links between the three-fold frame work of environmental education, (about, for and in) and diminishment of learning.

Any curriculum review should consider whether the essential elements are adequately covered by asking the questions below:

- Do students have many opportunities for empirical investigation in the environment; for observation, measuring, regarding interpreting and discussing what has been observed? ("in the environment" experience).
- Are students above aware of the complex nature of the environment or do they realize the inter-relationships and complexities within and among issues, the inseparable nature of the various components of the environment?.
- Is there a focus on aesthetic dimensions and qualitative study?
- Does the programme contain ethical dimensions; encouraging learners to ask if the criteria of proposal actions are based on morally justifiable values?

The basic models that attempt to proffer solutions to the above questions include:

- The static model
- Merger and overlap model



- Feeder foundation model

### Static model:

The static model shows the three elements of teaching and learning as primarily located within one of the three approaches to teaching and learning (Education about, in and for the environment), but the surface elements could not rotate and blend with each other. Thus model should the component of planning task. Education about the environment is grounded inscientific domain towards, education for the environment focuses exclusively on a particular issue as an organizing principle and it draws on knowledge opportunistically instead of systematically, while education in the environment addresses the essential foundation for formative influence of the personal, aesthetic kind. This model presupposes that all these aspects of environmental education frame work have a significant role to play alongside inter-linking each other in the learning processes and curriculum development

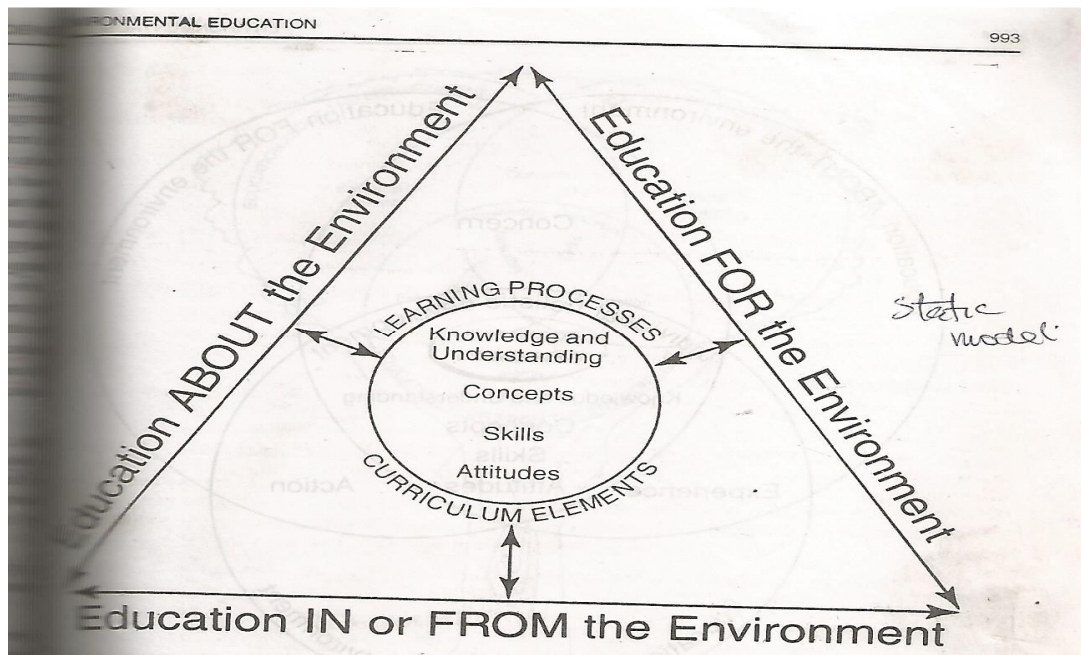


Fig. 1 Static model for teaching and learning in environmental education (components of the planning task).

### Merger and Overlap Model:

This model addresses the limitation of the two dimensional representation and addresses the issue of wealth of formative influences or significant life experiences that individuals bring to their educational programmes in the development of environmental education, understanding and concern. The core or centre of the diagram should contain the formative influences upon which all further learning depends and which most educational programmes and practice seem to ignore. It shows merger and overlapping of the three environmental education frame work to achieve successful teaching and learning tasks, with emphasis on



the formative stage taking the central place. From this formative influences and formal education programmes, hopefully, individual could acquire range of knowledge and understanding, skill, attitude and values that foster personal concern and enable the ability to act in pro- environmental ways.

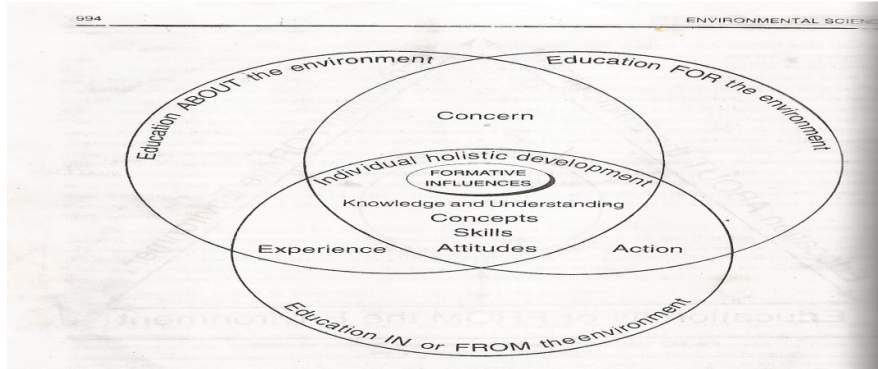


Fig 2.0 Diagram of the merger and overlapping model.

In this model, the “core” of formative influences is considered to be pre-supposed and cannot be planned for like other components. However, is considered to be independent of yet inter-related with the experiences of planned programmed, thus regarded as a “foundation” that continue to feed into and nurture other experiences (figure 3).

- There is need for institution to establish adequate mechanisms for review and review for policy and practice.
- There is need for going research in the field and for the outcomes of research studies to be accessible to all concerned with environmental educator -policy makers, curriculum developer and educators alike

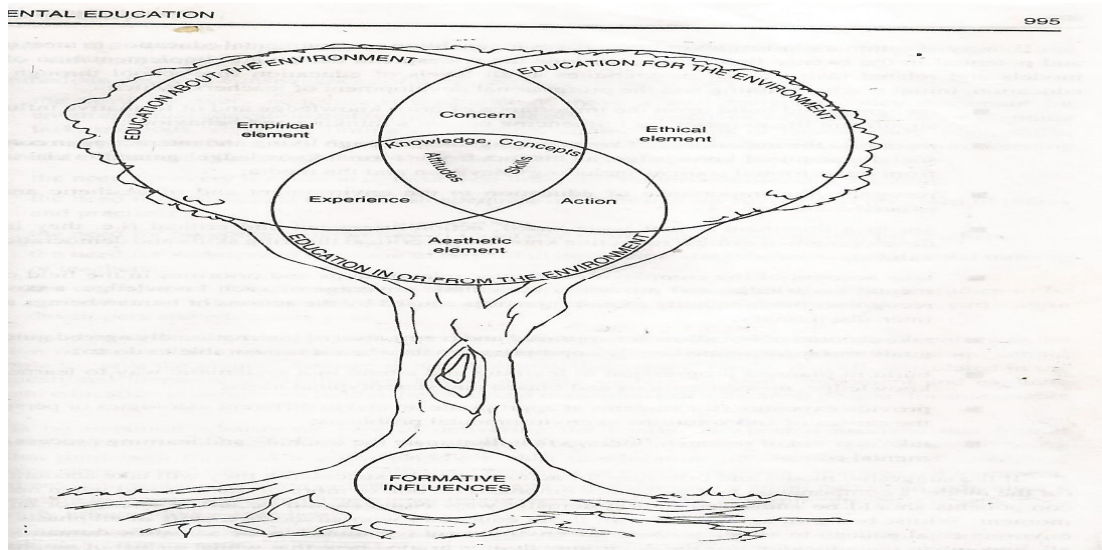


Fig. 3.0 Diagram Showing the feeder foundation model





## CONCLUSION

Environmental education is about “employment” and development as a source of ‘ownership’, improving the capacity for people to address environment and development issue in their own community, touching people’s beliefs and attitudes, support these beliefs attitudes and values and providing information appropriate action to be taken to enabling environmental education to meet its promises and potential in the 21<sup>st</sup> century, include the wide spread design and implantation of planning models and related instructional porgrammes all levels of education which recognize and build upon the importance of prior knowledge and of formative influences and significant life experiences influencing people’s thinking and behaviour; build in planned progression in learning and attend in a systematic way to learners’ gaps in knowledge, misconceptions and biased and stereotypical ideas; provide exposure to different ideologies or perspectives or the causes and solutions to environmental problems etc.

## RECOMMENDATIONS

For the suggested models and priorities for action to be successful, the following recommendations need to be taken seriously.

- There is need for every educational institution to have a well-designed policy document for environmental education that includes details of aims, objectives, components of the planning tasks, methods, styles and timing of teaching, content, resources and organization of resource assessment, record-keeping and evaluation (Palmer and Neal, 1994).
- The need for wide spread attention to the paid to environment education in the initial training of teachers.

## REFERENCES