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Think globally, act locally (2): Tree-planting in Nigeria-whose responsibilities

M. C. Anongo

Department of Biological Sciences, Faculty of Sciences, Ahmadu Bello University, Zaria

ABSTRACT

The earth's climate has warmed and cooled for millions of years, long before man appeared on the scene. Currently, the climate is growing warmer, indications that changes are all around the environment. The focus of the 2005 United Nation's Millennium Ecosystem Assessment (MA) on improving ecosystem management and human well being, points to the value of regulating ecosystems locally to function over a long range of environmental conditions. The vulnerability of many communities depends on local ecosystem structure and local biodiversity. The success of the tree-planting strategy adopted in Nigeria could best be achieved with the active and collective participation of every Nigerian stakeholder, thereby correcting the ecological imbalances both at the local and global level. The act of planting non indigenous tree species in a disturbed area with its attendant's effects is directly related to invasion biology and introduced species – the introduction of the non indigenous species which later displace the other indigenous species. This paper specifically highlights how deep-rooted trees use the hydraulic lift principle in a dynamic way that has climatic implications. This paper wishes to question the policies behind tree-planting in Nigeria, and the repercussions of improper implementation and to also highlight the ecological benefits of tree-planting in Nigeria, planting the indigenous ones.

Keywords: Species invasion, cohesion-tension theory, ecophysiological tree model, tree-planting, hydraulic lift principle, lore.

INTRODUCTION

Human-induced climate change has already sounded the death knell for its first victims. The golden toad (*Bufo Periglenes*) and the harlequin frog (*Atelopus varius*) of Costa Rica have disappeared as a direct result of global warming. Species are under threat in more than one way. As climate change wreaks its havoc across the globe, ecosystems could disappear altogether or they may undergo serious and irreversible changes, such as those happening to coral reefs. Some of the most intense climate change-related alterations are those that affect glaciers and ice fields. Rapid temperature changes affect the seasons,

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causing variations in season length. Climatic records put together with long-term records of flowering and nesting times show clear warming trends.^[1]

Climate change has attracted varied worldwide opinions. An article by Science Daily, 2008 titled “Can local actions make a difference in a process principally driven by worldwide trends?” attracted worldwide opinions from the scientific point of view to the policy decision makers. According to the intergovernmental panel on climate change,

the short answer was “no” stating that “we cannot do much locally to lessen the effects of global drivers. Therefore, our local policies must focus on adaptation”. In contrast to that, Charles Perrings, a professor of environmental economics at Arizona State University based his arguments on the findings of the 2005 United Nation’s Millennium Ecosystem Assessment (MA), which focuses on improving ecosystem management and human well-being emphasizing that “The MA points to the value of regulating ecosystems locally to function over a range of environmental conditions”. He further stated that “there is quite a bit to be done to lessen the effects of climate change in our own backyards. The trick is to work locally to diversify our ecosystems to make them more resilient for what is to come”. Perrings remarks that “the vulnerability of many communities depends on local ecosystem structure and local biodiversity”. The challenge now is to deepen our understanding of diversity’s impact on both the supply of valued goods and the severity of harmful events”

Conservation is one of the most significant applications of ecology, chiefly concerned with the use, preservation and proper management of nature’s assets and their protection from man’s destructive influences, misuse, decay, fire or waste. It also involves providing alternative source to replace the depleted or overuse or a specific resource whose discharge cause harm to the environment. It avoids unplanned development which breaks ecological as well as human laws. In third world regions (Northern Asia, Africa, Middle East e.t.c), where a larger percentage of the populations are poverty-stricken, non-provision/or unavailability of alternative source of a nation’s depleted resource would not reduce/eliminate the overexploitation of the already depleted resource. Furthermore, the enactment of laws to protect these threatened or endangered resources have only aggravated exploitation.

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During the rise of Industrial Revolution in the 19th century, little did we think of the repercussions it would impact on the environment? In fact, there have been significant changes in the natural environments due to man’s intervention and his rapid progress in colonization, urbanization, industrialization, agriculture, mining, transportation and technology. Man was so carried away by his discovery of the aesthetic qualities of the environment and subsequent development and comfort without thinking of the subsequent environmental repercussions.^[2]

As average temperature increases and the alarming warnings from scientists and policy makers progressed, individuals and corporate groups in both private and public sectors are working round the clock to proffer immediate solutions like clean up techniques or technology, enactment of laws. e.t.c. Other countries (Korea) have embarked on a project called Biosphere 1 and 2 for species preservation.

A new briefing from the global conservation organization-Stop Climate Change: it is possible, reported initiatives around the world ranging from India to Brazil, which save energy and reduce carbon pollution. In Thailand, a new law encourages the clean production of energy from biofuel plants that will feed into the electricity grid. Elsewhere, major businesses have signed up for WWF’s climate savers programme and are actively reducing their emissions. And in the UK, a new campaign shows that people can unplug their phone chargers to cut stand-by power consumption. In Nigeria, private and public sectors have taken up tree-planting projects.

The questions behind this paper are:

- (1) Are we really planting trees in Nigeria?
- (2) And if we do, is there an active participation of the various professionals in environmental issues or conservation matters like the scientists (botanists, pathologists, plant and animal ecologists, soil scientists e.t.c) and an equal sharing of manpower and resources between policy makers and conservationists?
- (3) And if not, what mitigative measures has the Nigerian government adopted toward the successful implementation of the tree-planting project, being her contribution to climate change issues?

The objective of this paper is to:

- (1) Highlight the hydraulic lift principle of trees and roles of tropical trees in Carbon sequestering,

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and reawakening our simple understanding and implementation of this principle which could help developing nations like Nigeria, involved in tree-planting projects.

(2) Questioned tree-planting strategy in Nigeria, whose responsibility? It also wishes to question the calibre of professionals (Scientists/environmentalists) enlisted or involved in this aspect of environmental conservation. Climate change is a global problem affecting every profession and sector of life, and so every profession and sector of life should also be enlisted in this game of curbing climate change with equitable responsibilities and resources for better results.

(3) Highlight the ecological or environmental problems that may arise concerning tree-planting if the right trees are not planted.

(4) To recommend suggestions toward practicable and implementable measures that could be adopted by the Nigerian government as her contribution to stopping climate change. According to WWF report: Stopping climate change is possible^[3]

2.0. WHAT IS A TREE

Although the concept of a tree as a growth form is useful and generally well understood, it is not possible to provide a precisely delimiting definition of a tree. However, the Encyclopaedia Britannica^[4], defines tree as any tall, woody plant that has a single main stem with branches that extend outward or upward at a distance above the ground. Height is often considered a factor in defining trees with minimum limits of 15 or 20 feet (five to seven metres). The cohesion-tension theory^[5], currently the concept is referred to as the transpiration-cohesion hypothesis and the resistance flow model. Van den Honert^[6], describe a tree as an integrated hydraulic system and predict water potential gradients, water fluxes and leaf water potentials within plants. More recent, physiological tree models integrated water storage pools in an extended, hydraulic system^[7,8,9,10,11] and thus provided better predictions for diurnal patterns of water flow, water potentials and water storage in plants. And more recently, a dynamic ecophysiological tree model developed by Zweifel *et al.*,^[12] which describes a tree as an integrated hydraulic system and predict stomatal aperture values, flow and storage dynamics on a short-term and long-term responses and species-specific patterns. A study involving Pubescent oak and Scots pine observed that oak had an advantage over pine in dry conditions in terms of keeping its stomata open and thus a potential advantage in fixing carbon dioxide with photosynthesis^[12,13]. This further suggested that oak was more efficient in water uptake than

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pine during dry periods. However, further studies in the extreme drought year of 2003 in the dry inner -alpine valley in Switzerland, resulted in the complete cessation of physiological activity by both pine and oak. This thus emphasized the potentially serious consequences of ongoing climate change on both pines and oaks in the study area.

2.1. THE LORE OF TREES:

(1) A fully grown deciduous tree can pull more than a ton of water from the soil each day.

(2) Each year, the average tree takes in about 12 kilograms of carbon dioxide, an amount equivalent to that emitted by a car on a 7,000 kilometer trip.

(3) The tree also releases enough oxygen to keep a family of four breathing for a year.

(4) The oldest, largest and most conspicuous is the bristlecone pine (*Pinus longaeva*) named "Methuselah" is 5,000 years old growing in California: means more than 500 years before the Egyptian pyramids were completed.

(5) The fattest tree is a chestnut (*Castanea*) named the "Tree of One Hundred Horses" which lives on Sicily's Mount Etna: This tree is 58metres around (about 30 students with arms outstretched and touching fingertips to encircle this tree). A 2,000 – year – old tule tree (*Taxodium mucronatum*) near Oaxaca, Mexico, is almost 45metres in circumference. A California redwood (*Sequoia sempervirens*) named the "Mendocino Tree" stands 112metres (367.5 feet) and a weight of approximately 1,600 tons, roughly equivalent to the weight of 10 blue whales.

(6) The most isolated tree in the world is Norwegian Spruce growing in the wasteland of Campbell Island Antarctica. It's nearest arboreal neighbour is over 190 kilometres away in the Auckland Islands.

(7) The California Department of Forestry and Fire Protection estimates that a single tree that lives for 50 years provides about \$200,000(N30,000,000) worth of services to its community. These services include providing oxygen (\$32,000 = N4,800,000), recycling water and regulating humidity (\$37,000 = N5,550,000), producing protein (\$2,500 = N375,000), controlling pollution (\$62,500 = N9,375,000), providing shelter for animals (\$31,000 = N4,650,000) and reducing erosion (\$31,000 = N4,650,000).

Tree-planting in Nigeria, Whose Responsibility**2.2. THE DISTRIBUTION OF TREES**

Trees grow throughout the world, from the extreme cold regions near the Arctic and the Antarctic to the hot tropical regions around the equator. They grow in both good and poor soil, in deserts and swamps, along shores, and at mountain elevations of several thousand feet. Trees are less successful in areas where the time limit between thawing of the ground in spring and its freezing in fall is insufficient. Although trees may grow singly, under natural conditions they more often grow in stands, which consist either of one species or of a mixture of species. A forest is a plant community made up of the trees, shrubs, and herbs that cover an area. Throughout much of North America, forests include only a few species of trees. In tropical forests, however, large numbers of different species can be found in very small areas. A survey of a 1-hectare (2.5-acre) plot in the Brazilian rain forest determined that it contained 476 tree species.

Tree-planting in Nigeria, Whose Responsibility**2.3. ECOLOGICAL ROLES OF TREES**

The most important ecological function of trees is protecting the land against erosion, the wearing away of topsoil due to wind and water. Trees can be considered guardians of soil and water; where they predominate, loss by erosion is compensated by the production of new soil resulting from the weathering of rocks and accumulation of organic herbs. The trunks and branches of trees provide protection from the wind, and tree roots help solidify soil in times of heavy rain.

Trees and forests not only provide shelter (habitat), homes (protection) and food for many animals but also, like all green plants, help to purify the atmosphere by absorbing carbon dioxide and releasing oxygen. Trees and forests store water reserves that act as a buffer for the ecosystems during periods of droughts. Small groups of trees and even single trees have a similar role locally in preventing washouts and in holding stream banks. In regions with extreme climate they serve as windbreaks or as shades against the sun.

Trees bring about local cooling through transpiration. The interior of a forest can be 10⁰ to 15⁰C cooler than the surrounding countryside because of transpiration. Indeed, each large tree of a forest has the cooling capacity of about five air conditioners. In addition trees play an important role in global climate and atmosphere regulation.

2.4. ECONOMIC ROLES OF TREES

Without trees, the world would be bleak, and life as it is known impossible. Man is already acquainted with the vast importance of trees to his survival. Primitive people were dependent on trees for food. Fossilized products of trees like coal (carbonized and fossilized wood) supplies fuel for the energy needs of man. Modern man is no less dependent upon trees particularly the soaring demand for tree products in the manufacture of newsprint and in the manufacture of papers as well as cardboard and similar packaging. Trees also serve as screens to secure privacy, to reduce noise and they provide shade.

The most important products provided by trees include: Lumber is the most widely used material in the building of homes and other structures; pulp and paper, fuel, charcoal and related products like methane, acetic acid and acetone, fabrics and rope, sugar and spice, dyes, drugs, tannins and other chemicals used in the manufacture of inks, wood alcohol etc. Trees and their fruits are a source of many commercial waxes and oils, including olive oil and coconut oil.

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Symbolic and commemorative uses: Each December, about 50 million Christmas trees are chopped down. Many trees have been considered sacred in some cultures. For example, people in the Valley of Mexico prayed to willow trees when they were threatened by storms. In Nigeria, the Yoruba people revered the Ape tree, because it harbours evil spirits; the Oro forest during the Oro festival in Yorubaland is not seen by women.

2.5. THE ROLE OF TROPICAL TREES IN CARBON SEQUESTERING

Trees have long been known to lift water from the soil to great heights using a principle called hydraulic lift, with energy supplied by evaporation of water from leaf openings called stomata^[14]. Twenty years ago, however, some small plants were found to do more than lift water from the soil to the leaves, they also lifted deep water with their tap root and deposited it in shallow soil for use at a later time, and reversed the process during the rainy season to push water into storage deep underground. This so called hydraulic redistribution has been found in some 60

separate deeply rooted plant species. An earlier study on the Amazonian forest by Rafael Oliveira of the Laboratorio de Ecologia Isotopica at the University of Sao Paulo, Brazil (2006) discovered that the Amazonian trees also use hydraulic redistribution to maintain the moisture around their shallow roots during the long dry season. Furthermore, the trees store as much as 10 percent of the annual precipitation as deep as 13metres (43 feet) underground, to be tapped during the dry months. This allows the trees and the forest to sustain water use throughout the dry season. The process is a passive one driven by chemical potential gradients, with tree roots acting like pipes to allow water to shift around much faster than it could otherwise percolate through the soil. In many plants that exhibit hydraulic distribution, the tap roots are like the part of an iceberg below water. In some cases these roots can reach down more than 100 times the height of the plant above ground. In addition to redistributing water during the dry season for use by the plant's shallow roots, keeping the surface soil moist make it easier for the plant to take in nutrients^[14]

In a similar study on the carbon storage of tropical forests spread over 12 sites and three continents, since 1980's, by an international research group led by the Smithsonian Tropical Research Institute and coordinated by Jerome Chave (a CNRS researcher) involving 38 scientists from 15 countries has shown that, tropical forests did indeed act as carbon sinks. Their findings confirmed that carbon storage capacity of tropical forests had increased significantly during the last two decades

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remarking that ancient tropical forests were indeed the major carbon sinks. Also their findings defined two groups of tree species: rapid-growing and slow-growing, with the later having the highest biomass, consequently, the remaining tropical forests will not be able to limit the rapid rise in atmospheric carbon dioxide levels for a long time to come.

In the carbon cycle, photosynthesis by plants and blue-green algae is the only process that removes carbon dioxide from the atmosphere while respiration, decomposition of dead plants and animals and the combustion of fossil fuels add carbon dioxide into the atmosphere. Tropical forests account for nearly two-thirds of terrestrial biodiversity and store more than half of the carbon in the Biosphere^[1].

Trees particularly those with deep roots, contribute to the earth's climate much more than scientists thought. A new study by scientists studying climate change assumed a simple model of plants sucking water out of the soil and spewing water vapour into the atmosphere, and have recognize the importance of vegetation in removing carbon dioxide from the atmosphere and in local cooling through transpiration. The study on the Amazonian forest (the largest forested area on the planet) by biologists and climatologists from the University of California, Berkley ,2006 shows that deep-rooted trees use water in a much more complex way: the tap roots transfer rain water from the surface to the reservoirs deep underground and distribute water upwards after the rain to keep the top layers moist, thereby accentuating both carbon uptake and localized atmospheric cooling during dry periods^[14]. They estimated that this effect increases photosynthesis and the evaporation of water from plants called transpiration by 40 percent in the dry season, when photosynthesis otherwise would be limited. Evapotranspiration stays higher than previously expected during the prolonged dry season because of this private reserve of water banked during the wet season by the tap roots. Just as perspiration cools us off, increased transpiration by trees in June and July explains the drop in temperature in the Amazon. This effect changes the way the atmosphere heats and cools and will change the way rain is distributed. Depending on the extent to which trees elsewhere in the world especially in Africa and other tropical and extratropical areas, redistribute water in the soil, the impact on global climate change would be significant^[14]. According to Dawson and Lee (2006) (Co-authors) "because this has not been considered until now, people have likely underestimated the amount of carbon taken up by

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the Amazon and underestimated the impact of Amazonian deforestation on climate". As the largest forested area on the planet, the Amazon plays a major role in removing carbon dioxide from the atmosphere and thus impacts the climate globally. Another study confirmed that deep-rooted trees (Pubescent oak and Scots pine) continuously supply sufficient water to the tree body to maintain a balance between saving water to avoid cavitation and transpiration of water to cool overheated leaves.^[15, 16]

3. TREE-PLANTING

Literally, the Oxford Advanced Learner's Dictionary 2001, defines a tree as "a tall plant that can live a long time with a thick central wooden stem". In addition to the hydraulic lift principle, characteristics, the ecological and economic roles of trees, tree-planting could simply be the planting of trees that would grow tall, live long and exhibit the basic characteristics (physiological, physical) that makes up a tree. Trees, like all plants, have a fascinating history and lore:

- (1) Planting three or four trees around every American house would save 10% to 50% on air-conditioning bills.
- (2) The fastest growing tree is *Albizia falcate*, a member of the pea family. One tree in Malaysia grew more than 10metres (in height) in only 13months and more than 30metres (in height) in just over 5years.

Laws have also been enacted for offenders – those that cut down trees indiscriminately. For instance, several cities in the United States impose severe penalties for killing a tree. In New York City, anyone who cuts down one of the City's 2million park trees or 700,000 street trees can be fined \$1,000(Naira equivalent N150, 000) and put in jail for 90 days. In New Jersey, anyone found guilty of cutting down a shade tree can be fined up to \$1,500(Naira equivalent N225,000) and pay a "replacement fee" of up to \$27 (Naira equivalent N4,050) per square inch of a tree. This means that someone convicted of cutting down a white oak 75centimetres in diametre and 1.5metres tall would have to pay – in addition to the fine – a replacement fee of \$19,085 (Naira equivalent N2,862,750).

3.1. TREE-PLANTING STRATEGY IN NIGERIA

Tree-planting is one of the options adopted by many nations toward curbing the serious and irreversible changes of climate change.

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Tree-planting have been employed by several environmentalists or scientists to help in the regeneration of forests. In Nigeria, private and public sectors are involved in tree-planting projects. For instance, the Lagos state government in commemoration of the World Environment Day, June 5, 2008, embarked on an annual tree-planting project to plant 1,000,000 trees in 10 years. The inception of 250,000 trees took off on July 14, 2008, which was also declared Lagos State annual tree-planting day. Dignitaries who witnessed the occasion in addition to the governor were Oba of Lagos, members of National Assembly and other prominent citizens of Lagos. Conservationists were not in attendance and the name of the trees planted was unknown^[17]. On individual basis tree-planting projects have been embarked on in the country. For instance, The Nigerian Tree Planters – a private sector initiative aims at promoting afforestation for a sustainable environment and industrial prosperity began 2008. Certain tree seed nurseries have been established in some Forestry Institutes in the country, with the main objective of planting trees in every town and village across all the 36 states of the federation including Abuja. Contributions from experts have also been enlisted and this would go a long way to bring about reafforestation, if the genuine motive is ethical.

Since man is the major, active and direct local predator in terms of habitat destruction for agricultural activities, mining, urbanization e.t.c, they should also be directly and actively involved in correcting the consequences arising from their anthropogenic activities in their localities^[2].

To avoid any future catastrophe on the ecosystems, tree-planting should include:

- (a) Tree-planting should also incorporate a preliminary and feasibility studies involving the enlistment of experts in conservation issues, as well as policy makers. This will ensure effective empowerment and maximum participation of all individuals of that locality in the tree-planting project^[2]. Furthermore, there should be continuous monitoring of the tree-planting projects by the various experts. If tree-planting does not incorporate the planting of indigenous species, biologists call this act invasion biology and introduced species. This is the introduction of nonnative species, which later displace the native species leading to their extinction. Tree-planting should incorporate the planting of indigenous species that will have more beneficial effects on the ecosystem, than planting nonindigenous species that we like or are easily available or affordable.
- (b) Development and establishment of polyculture forests of indigenous trees in every locality.

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This will remove homogeneity, reduce the reaction time and acclimatization time of the indigenous trees, and the soil and its components would easily recognize the tree species since they were previously part of the community before man's intervention.

Tree-planting has tremendous ecological impacts if proper understanding or knowledge is gained. Basic information of the soil conditions should be ascertained before embarking on planting any tree. This is because the present physical, chemical and biological conditions of the soil is completely different from the soils of 50 years ago which were much more stable than now.^[2]

4.0. ECOLOGICAL BENEFITS OF TREE-PLANTING IN NIGERIA

With the exception of humans, all the families in the order Primates are tree-dwelling mammals that live in tropical jungles or dry forests; some live in dry grasslands and still retain their close dependence on trees. However, their numbers are greatly diminishing due to habitat destruction of the tropical forests by human activities (urbanization, agricultural lands and natural resources) on which they depend, and the illegal hunting of gorillas for meat, trophies or subsequent sale of live young. The major threats to birds have been the destruction and modification of their habitats in the 20th century, a time of explosive growth in human populations. Worldwide, the relentless clearing of tropical forests had outweighed even relentless hunting as the cause of the extinction of the famous passenger pigeon.^[18, 19, 20]

Tree-planting strategy has the advantage of preserving the habitat as well as habitat restoration, habitat protection and habitat management through legal protections and control of predators and competitors. It also has the advantage of preserving not only the endangered species but the whole ecological community. Ultimately, humans must decide whether these animals are worth preserving or not.

5.0. THE CONCEPT OF INVASION BIOLOGY AND INTRODUCED SPECIES

This is the introduction of nonnative species which then displace the native species. Humans are the conduits of species invasions because we tend to take plants and animals that we like with us when we settle new areas and also some that aren't as popular, such as micro-organisms on and in our roofs, pets and livestock and stoways such as rodents and insects on ships. Of every 100 species introduced

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about 10 survived in the short term, competing with native species and only one persists to take over a niche. Invasions are more likely to occur in areas that have been disturbed, which suggests a dangerous link to habitat destruction^[21].

A successful invasion can have severe repercussions on an ecosystem. One famous case of species invasion is that of Australian rabbits, in 1859 when wealthy Thomas Austin imported few rabbits in his estate for the fun of hunting. The survivors made more rabbits, spread over the area, ate much of the vegetation and displaced native animals. Another instance in the 1960s is the unintentional invasion of the brown tree snake *Boiga irregularis* on the island of Guam which were apparently eating all the time devouring nearly anything. The snakes feasted on native species as well as introduced species that had been there awhile perished. The population density of the brown tree snake was considerably greater than the birds and lizards, and they were hopelessly outnumbered. Till date, Guam is a long way from recovering its biodiversity. A more recent example of species invasion is occurring in Europe. In the early 1990s, the western corn rootworm (beetle larva) was unintentionally brought into war-torn Yugoslavia on a plane from the United States. By 1995, the root worms had spread to Croatia, Hungary, Bulgaria and Italy. By the time the people observed that their corn crops were disappearing, it was too late to eradicate the pest.

Plant may also be invasive. One example is hydrilla (*Hydrilla verticillata*) one of the non indigenous plant species from Southeast Asia established as an aquarium plant in the U.S ecosystems. The hydrilla choked waterways in Florida, altered nutrient cycles, affected aquatic animals and reduced recreational use of lakes and rivers.

The dangers of introduced species are two-fold:

(i) on ecosystem-by-ecosystem basis: natural selection will favour those species that grow and reproduce the fastest and are generalists.

(ii) Philosophically, introducing species homogenized the biosphere gradually transforming it from a collection of distinctive interacting areas whose species arrived by their own means (birds) to human-directed sameness. In natural ecosystems, the combination of sameness and shrinking habitats may prove devastating to the diversity of life.

At this point we could say that tree-planting is an intentional invasion of nonnative or nonindigenous species in a disturbed area.

CONCLUSION

Although climate change is a global environmental issue, sustainable local initiatives could be adopted. Understanding the value of ecosystem change is one more tile in the global climate change mosaic, one that scientists and policy makers must understand if they are to accurately assess costs and benefits of proposed actions, track ecological assets and develop means of remedying the problem^[22]. The availability and distribution of tree species varies from one locality to the other. Tree-planting without the enlistment and active participation of scientists and policy makers could lead to a phenomenon called species invasion – invasion biology and introduce species. This could have insurmountable and irreversible consequences on the ecosystem functioning. Therefore, protecting the environment is an obligation and not a choice. Our descendants would inherit whatever situation we create and it is up to us to leave it as a fit place to live^[21].

6.1. RECOMMENDATION

Based on the topic of this paper, the following recommendations would bring about the sensitization of the Nigerian populace on the immeasurable significance of Nigerian's natural resources to their development, distribution and survival.

(1) With the recent passage of the climate change bill by the National Climate Change Commission (NCCC) in 2009, the bill should clearly involve the environment as an immediate developmental issue. This is because the environment simply defined by biologists (environmentalists) as “all the biotic and abiotic factors that actually affect an individual organism at any point in its life cycle”, is the haven of resources, where man harvests all his products for his total survival. Environment comprises of water, sun, air, land and their residents, man, plants, animals and micro organisms, which are constantly in a complex network of interactions that determines the development, distribution and survival of every member of the ecosystem. The human-induced activities greatly modifies the environment and the totality of man's survival (economic, social, healthwise, political e.t.c)

(2) The services of Nigerian (local) experts should always be employed. This is because the local experts currently living in the country are more aware of the present issues and the available resources in terms of manpower, facilities, machineries and the scientific and technological know-how and how to tackle those issues than their foreign counterparts.

(3) Incorporation of subjects and courses on environmental issues into the school curriculum. This could imbibe the love of the environment into the minds of Nigerian pupils and students. This would also enhance the development of their intellectual/creative ability toward the development of environmentally friendly products from the food we eat to the materials we fabricate, and the development of other protective measures of preserving the environment. This will go a long way in curbing the menace of climate change on a local and worldwide basis.

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