International Journal of Innovative Research in Social Sciences and Strategic Management Techniques
ISSN Hard Print: 2465-728X, ISSN Online: 2467-8155 Vol. 2, No. 1 September, 2015

EFFECTIVE GREEN INFRASTRUCTURE SERVICES TO MANKIND: THE IMPACT OF ENVIRONMENTAL EDUCATION IN NIGERIA

Dipeolu Adedotun Ayodele
Department of Architecture,
College of Engineering and Environmental Studies,
Olabisi Onabanjo University, Ogun State, Nigeria

Abstract
Green infrastructure consists of spatially or functionally connected areas which maintain ecological coherence as an essential condition for healthy ecosystems. Its purpose is not only to reconnect species populations but also to strengthen the functionality of ecosystems for delivering goods and services and as well enhances the quality of life. However, green infrastructure are a part of environmental resources being degraded as a result of human activities for which environmental education should be designed for their effective management and protection. This paper highlights the benefits of environmental education, causes of green infrastructure loss and effects of these losses on mankind. The paper also attributes green infrastructure loss to unsustainable human activities on green spaces which include: urbanization, industrialization, deforestation, high population growth rate and unsustainable agricultural practices. It sees environmental education as a viable tool that can develop in individuals, appropriate knowledge, attitudes, skills, motivation and commitment required to take responsible environmental actions that would lead to the protection, conservation and sustainable management of green infrastructure facilities. The paper concludes that it is through appropriate environmental education that effective green infrastructure services to mankind could be achieved.

Keywords: *Climate Change, Environmental Attitude, Environmental Education, Green Infrastructure*

Background to the Study

Environmental degradation is an important issue globally and locally. In many developing countries, urbanization, industrialization, high population growth rate and unsustainable agricultural practices is a great problem to environment and development (Dunlap et al. 1993; Shah Md, Tom, and Luc, 2010). A major contradiction of the 21st century is the exceptional economic growth and technological advancement which, while benefiting many people have also negatively affected the social and environmental impact on humanity (Sumiani, 2006). In the bid to survive man is rapidly exposing the planet earth to various environmental challenges such as increase emission of greenhouse gases (GHG), deforestation, acid rain, erosion, pollution, climate change and all of these problems together constitutes constraints to sustainable development (Ahern, 2011; Dipeolu and Fadamiro, 2013).

Nigeria is not excluded from the global environmental consequences arising from human anthropogenic activities and this is very evident in the degradation of the ecosystems, loss of bio-diversity and alarming decrease in green infrastructure facilities in Nigeria. The Eastward rapid encroachment of the desert in Northern Nigeria poses threat to sustainable livelihood. In Niger Delta, the cumulative practice of environmental degradation arising from pollution of land, air and water characteristic of oil exploration in Nigeria has made the region constantly susceptible to various environmental injustice (Agbu, 2005, Saka, Salihu and Ali, 2007; Jackson, 2013). Erosion and life consuming floods has constantly threatened environmental sustainability in Southern Eastern Nigeria. The 2012 floods that ravaged nearly 25 states with untold economic, social and political consequences clearly debunk the notion that Nigeria is insulated from such environmental problems (Jackson, 2013).

Green Infrastructure (GI) is a framework of natural and/or artificial facilities that can increase connectivity between existing natural areas and encourage ecological coherence, strengthening the functionality of ecosystems for delivering goods and services. While the strategies of green infrastructure are suppose to be explored for maximum benefits by humans, GI have become part of environmental resources being degraded as a result of human activities for survival. Thus, the economic, social, health and psychological benefits derivable from effective GI management are been wasted due to lack of well designed environmental education on this issue. It is against this background that this paper is designed to look into the contributions of environmental education in ensuring effective green infrastructure services to mankind. This is with a view to promote the fact that green infrastructure management and protection would ensure its effective services to mankind. The specific objectives of the study include the analyses of the

benefits and the need for environmental education in Nigeria.

The study was carried out through the use of library search methods; these include searching for relevant documents and research articles from peer reviewed journals over the internet, gathering and collating relevant information from published and unpublished articles, consulting journals database resources like the Hinari initiatives and others freely available on the internet and personal desktop research. Information gathered were reviewed, discussed and presented descriptively with appropriate recommendations and conclusion.

Literature Review

Historical Background of Environmental Education

Efforts to define environmental education as specific endeavour began in the 1960s. They were given international support at the United Nations conference on the Human Environment held in Stockholm in 1972, where participating government recommended that it be recognised and promoted on an international scale through the United Nations (Palmer, 1998). One of the initial tasks was to develop some consensus on what environmental education could and should become, and to assist governments in implementing relevant programs as soon as practicable. Two major conferences, supported by regional meetings of experts, were hosted by the newly formed UNESCO-UNEP International Environment Education Programme. The purpose of the first "Belgrade 1975" was to draft concepts and vision for environmental education. The second, an Intergovernmental Conference on Environmental Education "Tbilisi 1977" formally approved the scope and action plans put forward from the previous conference. The Conference was convened by UNESCO in co-operation with the United Nations Environment Programme (UNEP) and held in Tbilisi (the Georgian SSR, USSR) from 14 to 26 October 1977. The provisions of the Tbilisi Declaration on the role, objectives and characteristics of environmental education, has remained in wide international use and have sustained their role as a guiding influence over the past two decades (Stohr, 2013). Other major attempts at fostering environmental education are as described in Table 1

Table I: An Overview of Various Attempts at Fostering Environmental Education Globally

S/N	Programme Name	Year	Conference City	Major Emphases
1.	United Nations International conference on the environment.	1972	Stockholm (Sweden)	Emphasis on the 'rights' of the human family to a healthy and productive environment.
2.	Publication of the World Conservation Strategy (WCS) by the International Union for the Conservation of Natural Resources (IUCN)	1980		Requirements for human survival and prosperity, putting forward the conservationist concept of sustainable development.
3.	World Commission on Environment and Development, WCED (*Our Common Future*)	1987	Norway	Emphasized the relationship between the underdeveloped natures of several parts of the world, and existing social and environmental problems. The report is a survey of the planet's health, presenting the problems of atmospheric pollution, desertification, over-population, overconsumption, water shortages, and poverty.
4.	United Nations Conference on Environment and Development, UNCED (*Agenda 21*)	1992	Rio de Janeiro, Brazil	Focused on public education, awareness and training, which confirms the role of education and the importance of positioning environmental education in the perspective of sustainable development (Especially, Chapter 36).

5.	UNESCO Thessaloniki Declaration	1997	Thessaloniki (Greece)	Sustainability as an ethical and moral imperative and the objective to which education should devote itself as an instrument of choice. Education is described as an ongoing process aimed at developing the capability of adapting to rapid changes in the world, but first and foremost as a process of transmitting knowledge and information to make the public understand the problems and to stimulate awareness.
6.	World summit on Sustainable Development	2002	Johannesburg	Need for citizens to become aware of the environmental issues and acquire background knowledge to enable them to make and influence decisions.
7.	High Level Rio +20 Partnership Forum	2012	Rio de Janeiro, Brazil	Environmental education on urban-rural linkages, the elderly and disabled, green urban spaces, climate risks, resource-efficient infrastructure and technology, sustainable behaviour lifestyle and non-motorized transport modes.

Source: Leggett Carter, 2012; Authors compilation, (2015)

Following this trend, many developing countries are beginning to realize the role of environmental education in abating the environmental issues – An example is the African Social and Environmental Studies Programme (ASESP) with its seat in Nairobi, Kenya. This organisation encourages and promotes the creation of environmental awareness and protection in pupils and students and at the same time develops useful activities for the pupils during instruction.

In Nigeria, the concerted effort of the Nigerian Conservation Foundation (NCF) in 1988 motivated the fusion of an environmental education element into the citizenship education curriculum in 1990. Attempts to integrate environmental education into the national curriculum were intensified in the 1991 national curriculum review conference, subsequently followed by a UNESCO sponsored National Workshop on the integration of environmental education elements in the National School Curriculum and the teacher education programme (Adara, 1997).

Defining Environmental Education (EE)

Belgrade 1975 provided a working definition of Environmental Education that it should be an integral part of educational processes, aimed at practical problems of an interdisciplinary character, build a sense of values, and contributes to public well-being. Its focus should reside mainly in the initiative of the learners and their involvement in action and guided by both the immediate and future subjects of concern. According to UNESCO, Tbilisi Declaration 1977, Environmental Education is a process aimed at developing a world population that is aware of and concerned about the total environment, and its associated problems, and has attitudes, motivations, knowledge, commitment and skills to work individually and collectively towards solutions of current problems and the prevention of new ones.

However, Malone (1999) opined that Environmental Education should aim at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to solve these problems, and motivated to work toward their solution. And Smyth (2006) while looking at the concept from sustainability point of view, referred to Environmental Education (EE) as organized efforts to teach about how natural environments function and particularly, how human beings can manage their behaviour and ecosystems in order to live sustainably.

The Concept of Green Infrastructure

The concept of Green Infrastructure has been introduced to upgrade urban green space systems as a coherent planning entity (Sandstrom, 2002). It can be considered to comprise of all natural, semi-natural and artificial networks of multifunctional ecological systems within, around and between urban areas, at all spatial scales. Green infrastructure is defined in different ways by different authors. For example, Benedict and McMahon (2002) defined green infrastructure as an interconnected network of green space that conserves natural ecosystem values and functions and provides associated benefits to human populations. More recently Davis et al. (2012) defined green infrastructure as parts of urban area with a mix of street trees, parks, cultivated land, wetlands, lakes, and streams that are interconnected. Green

infrastructures are very well known to provide environmental, social, and economic benefit to communities (Forest research, 2010). Some green infrastructures are plants and they live many years in perpetuity. Thus provide the environmental, social, and economic benefits not only to present communities but also, with little management cost, to the future generation.

Well planned green infrastructure has also been shown to increase property values and decrease the costs of public infrastructure and public services, including the costs for stormwater management and water treatment systems (Benedict and McMahon, 2006; Otegbulu, 2011). They will provide multiple functions and benefits to the human society as well as the environment. Green infrastructure systems help protect and restore naturally functioning ecosystems and provide a framework for future development (Benedict and McMahon, 2006). In doing so, they provide a diversity of ecological, social, and economic functions and benefits, like enriched habitat and biodiversity; maintenance of natural landscape processes; cleaner air and water; increased recreational opportunities; improved health; and better connection to nature and sense of place. Therefore, green infrastructures ensure sustainability.

Factors Contributing to Green Infrastructure Depletion

High Population Growth

High population growth have high tendency to deplete natural resources and impair the capacity of life supporting ecosystems (Brown 2004). Population growth is the reason why human have changed ecosystems more rapidly and it has been changed extremely over the past 50 years than during any other period. Because, in that period, large number of people than any other period creates more demands for food, fresh water, timber, fibre and fuel (Speidel et al. 2007). And 60% of ecosystem services, the benefits people obtain from ecosystems are being degraded or used unsustainably (Millennium Ecosystem Assessment, 2005).

Urbanization

Urbanization, or the shift of population from rural to urban environments, is typically a transitory process, albeit one that is socially and culturally traumatic. It moves populations from traditional rural environments with informal political and economic institutions to the relative anonymity and more formal institutions of urban settings (Henderson, 2003). Urban growth causes various environmental problems. Presently, urbanization is rapid worldwide and is expected to continue in the coming decades, especially in the developing world where the United Nations Population Fund (UNPF-2007) anticipates 80% of the world's urban communities will be found by 2030 (Beardsley et al., 2009). Thus, in an attempt to respond to challenges of urban growth, green infrastructure facilities depletion has continued unabated in Nigeria and many other parts of the world.

Deforestation

Forest could be seen as plant community, predominantly of trees or other woody vegetation, occupying an extensive area of land. In its natural state, a forest remains in a relatively fixed, self-regulated condition over a long period of time (Aiyeloja and Ajewole, 2006). Deforestation on the other hand, is the deliberate removal of forest and other forms of vegetative covers from a site without replacement. It is the alteration of natural arrangement of trees, a process of depleting without reforestating the flora and fauna within the forest. It is a process whereby trees are felled for several purposes, but without replanting to replace the ones felled (Omofonmwan and Osa-Edoh, 2008; Nzeneri, 2010). Lack of correct monitoring and implication of many government policies are greatly responsible for depletion of many forests which is a major constituent of green infrastructure.

Industrialization

Establishment of industries is also another activity that causes serious environmental threats to the built environment. Effluents, noises and various discharges from these industries constitute pollutions at different levels to the environment. Constant releases of various gases to the atmosphere by these industries are very dangerous to humans, plants and animals in the environment. Concentrations of these dangerous gases impede the growth and thriving of green infrastructure facilities while some of them are depleted on the long run. This consequently poses great challenge to issues of sustainability to the environment.

Unsustainable Agricultural Practices

Agricultural activities such as farming, livestock and monoculture plantation establishment start with forest clearing which results in modification of the original vegetation. This occur in areas with heavy dependence on forest lands for subsistence and shifting agriculture largely found in developing countries like Nigeria (Onyeka and Angela, 2012). Nowadays, agriculture and forestry have intensified the use of more energy, fertilizer and water. When there is shift from extensive agriculture and forest systems to very intensive ones that uses more energy and water, it will result in the reduction of species' richness and undermine the capacity of ecosystems to sustain food production, maintain freshwater, forest resources, and regulate natural green spaces.

Benefits of Environmental Education Programmes

The management of ecosystem involves inventorying and monitoring, applying integrated technologies, methodologies, and interdisciplinary approaches for its conservation. Hence, now it is even more critical than ever before for the human beings to be environmentally literate. To realize this vision, both ecological and Environmental Education must become a fundamental part of the education

system at all levels of education (Stohr, 2013). Environmental Education programme at schools would generate ecological and environmental quality data at regional levels, which helps the local administration in the management of natural resources. Involvement of schools (every year) helps in getting the data updated. The benefits are:

1. Students and local public get sensitized about their local/neighbourhood environment, socio-economic backgrounds and ecological relevance.
2. When carried out periodically, over a period of time a good repository of local environmental information is generated by the high school students for their neighbourhood, which subsequently become a useful tool for the neighbourhood growth and development.
3. With proper documentation, when this content is put online, it virtually reaches almost everyone and the state education department may stand benefited in terms of achieving its goals of enhancing quality (environmental) education.

Implications for Environmental Education in Nigeria

Environmental Education (EE) is a learning process that increases people's knowledge and awareness about the environment and its associated challenges, develops the necessary skills and expertise to address the challenges and fosters attitudes, motivations and commitments to make informed decisions and take responsible actions. According to UNESCO (1986), Environmental Education involves the development of critical thinking about integrated environmental problems and that they can be resolved by participation at the community level. EE goal as declared in Belgrade charter of 1975 and modified and adopted later in Tbilisi Declaration of 1977 is to aid citizens in becoming environmentally knowledgeable and above all, skilled and dedicated human beings, willing to work individually and collectively toward achieving and maintaining a dynamic equilibrium between quality of life and quality of the environment (UNESCO, 1994). The Tbilisi Declaration of 1977 according to UNESCO (1986) and cited in Onyeka and Angela (2012), identified of the objectives of EE to include helping individuals and social groups acquire an awareness of and sensitivity to the total environment and its allied problems as well as to help individuals and social groups acquire basic understanding of the environment, its associated problems and humanity's critically responsible presence and role in it.

In Nigeria presently, depletion of green spaces is growing rapidly due to negative environmental attitudes of most citizens. More forest plantings and biodiversity are been destroyed daily in the bid to cater for human population and development. Commercial activities in the urban centres are gradually taken the place of urban green infrastructure facilities. Apart from this, other ways through which citizens

degrade the natural environment is emission of carbon substances into the atmosphere through constant use of generating plants, constant use of pesticides and herbicides for farming activities. Others include: use of chemical substances for fishing activities, mining activities some of which has resulted into deep gully erosion and various unsustainable agricultural practices. Correct level of Environmental Education on the usefulness of green infrastructure will encourage more citizens to grow, protect and care for urban green infrastructure thereby ensuring effective green infrastructure services and benefits to mankind.

Summary, Conclusions and Recommendations

Green infrastructure is defined as parts of urban area with a mix of street trees, parks, cultivated land, wetlands, lakes, and streams that are interconnected. The economic, social, and environmental benefit of green infrastructures can never be overemphasized. Green infrastructures can be direct source of income and food. They help in cleaning air pollutants, store and sequester carbon dioxide, provide biomass fuel which is renewable, reduce noise pollution, support biodiversity, reduce urban heat island and have general cooling effect, reduce water pollution, and reduce flooding.

Despite all the aforementioned benefits derivable from green infrastructure, lack or inadequate Environmental Education will make the depletion of green infrastructure facilities to continue unabated. It should be noted that Environmental Education is a viable tool that can develop in individuals, appropriate knowledge, attitudes, skills, motivation and commitment required to take responsible environmental actions that would lead to the protection, conservation and sustainable management of green infrastructure facilities.

In order to achieve the objectives of Environmental Education in Nigeria, this study therefore recommend that standard Environmental Education should be designed for Nigerian citizens through the formal (targeting specific students in classroom situation), non-formal (environmental education institutes, camps, non-profit environmental organizations, museums, parks, natural sites, zoos and other environmental groups that aim at educating the public on environmental issues) and informal learning approaches (lifelong education through mass media, parents, friends and personal experience). Also, current issues on the Environment should be built into the academic curriculum at all levels of education. Specific environmental courses should be made compulsory at the higher institution level. At community level, government should embark on awareness campaign for Environmental Education. For example, specific environmental issues should be discussed during Community Development Association meetings and other public fora. Conclusively, if appropriate Environmental Education is put in place then

effective green infrastructure services to mankind could be achieved in Nigeria and other nations of the world.

References

Adara, O.A (1997), "Improving the Quality and Outreach of EE in Nigeria: World Council for Curriculum and instruction." Region 2. Jos. Publishers. P.32.

Agbu, O. (2005), "Oil and Environmental Conflicts", in Salihu, H. A (Edited) Nigeria Under Democratic Rule (1999-2003): Vol. 2, Ibadan University Press.

Ahern, J. (2011), "From fail-safe to safe-to-fail: sustainability and resilience in the New urban world." Journal of Landscape and Urban Planning, (100), 341–343.

Aiyeloja, A. A. & Ajewole, O. I. (2006), "Non-timber Forest Products' Marketing in Nigeria: A Case Study of Osun State." Educational Research and Review, 1(2), 52-58.

Beardsley, K., Thorne, J. H., Roth, N. E., Gao, S. & McCoy, M. C. (2009), "Assessing the Influence of rapid Urban Growth and Regional Policies on Biological Resources." Journal of Landscape and Urban Planning, (93), 172-183.

Benedict, M. A. & McMahon, E. D. (2002), "Green Infrastructure: Smart Conservation for the 21st Century." IN: Renewable Resources Journal, 20(3), 12-17.

Benedict, M. A. & McMahon, E. D. (2006), "Green Infrastructure: Linking Landscapes and Communities." Washington, DC: Island Press.

Brown, L.R. (2004), "Outgoing the Earth: The Food Security Challenge in an Age of Falling Water Tables and Rising Temperatures." W.W. Norton & Company, Inc.

Davis, A. Y., Belaire, J. A., Farfan, M. A., Milz, D., Sweeney, E. R., Loss, S. R. & E. Minor, E. S. (2012), "Green Infrastructure and Bird Diversity Across an Urban Socioeconomic Gradient." Journal of Ecosphere, 3(11),105-112. http://dx.doi.org/10.1890/ES12-00126.1

Dipeolu, A. A. & Fadamiro, J. A. (2013), "Effectiveness of Green Infrastructure on Environmental Sustainability: Perception by selected Stakeholders." International Journal of Research Findings in Engineering, Science and Technology. 1(1), 58-67.

Dunlap, R. E., Gallup, G. H. Jr., & Gallup, A. M. (1993), "Health of the Planet." Princeton, NJ: George Gallup International Institute.

Forest Research (2010), "Benefits of Green Infrastructure." Report by Forest Research. Forest Research, Farnham. Available online at http://www.forestry.gov.uk/pdf/urgp_benefits_of_green_infrastructure.pdf/$FILE/urgp_benefits_of_green_infrastructure.pdf.

Henegar, (2005), "Environmental Education: A look at its purpose, Methods and Effectiveness". ENS Capstone Project.

Henderson, J. V. (2003), "Urbanization, Economic Geography, and Growth." Prepared for Handbook of Economic Growth, Volume 1, P. Aghion and S. Durlauf (eds.), Brown University North Holland.

Jackson, O. R. (2013). "Environmental Education and Sustainable Development in Nigeria: Breaking the Missing Link." International Journal of Education and Research, 1(5), 1-6.

Leggett, J. A. & Carter, N. T. (2012). "CRS Report for Congress." Prepared for Members and Committees of Congress Rio+20: The United Nations Conference on Sustainable Development, June 2012, Congressional Research Service.

Malone, K. (1999), "Environmental Education Researches as Environmental Activist." Journal of Environmental Education Research, 5(2), 163-177.

Millennium Ecosystem Assessment. (2005). "Ecosystem and Human well-being: Synthesis." Washington, DC: Island Press.

Nzeneri, P. U. (2010), "Investigating into the Existing Approaches for Creating Environmental Awareness Among Community Members in Rivers State". M.Ed Thesis, University of Port-Harcourt.

Omfonmwan, S. I. & Osa-Edoh, G. I. (2008), "The challenges of Environmental Problems in Nigeria." Journal of Human Ecology, 23(1), 53-57.

Onyeka, F. M. & Angela, N. U. (2012). "Ensuring Effective Forest Services to Mankind: Implications for Environmental Education in Nigeria." Journal of Education and Practice, 3(3), 1-9.

Otegbulu, A. C. (2011), "Economics of Green Design and Environmental Sustainability." Journal of Sustainable Development, 4(2). Available at www.ccsenet.org/jsd Doi:10.5539/jsd.v4n2p240.

Palmer, J. A. (1998), "Environmental Education in the 21st Century: Theory, Prcatice, Progress and Promise." Routledge.

Saka, L., Salihu, H. A. & Ali, A. A. (2007), "Environmental Degradation, Rising Poverty and Conflicts: Towards an Explanation of the Niger Delta Crisis." Journal of Sustainable Development in Africa. 9(4), 12-21, Fayetteville State University, North Carolina.

Sandstrom, U. F. (2002), "Green Infrastructure planning in urban Sweden." Journal Planning Practice Research 17 (4), 373–385.

Shah Md. A. H., Tom, V. & Luc, H. (2010), "Perception, Environmental Degradation and Family Size Preference: a Context of Developing Countries." Journal of Sustainable Development, 3(4), 101-108.

Smyth, J. C. (2006). "Environment and Education: a view of a changing Scene." Journal of Environmental Education Research, 12(3), 247-264.

Speidel, J.J., Weiss, D., Ethelston.S., & Gilbert, S. (2007). "Family planning and reproductive health: the link to environmental preservation." Journal of Population Environment, 28,247-258.

Stohr, W. (2013), "Colouring a Green Generation: The Law and Policy of Nationally-Mandated Environment Education and Social Value Formation at the Primary and Secondary Academy Levels." The Journal of Law and Education, 42(1),1-11.

Sumiani, Y. (2006), "The Need for Knowledge on Environmental Education for National Development." London: City Publications.

UNESCO (1975), "The Belgrade Charter: A Global Framework for Environmental Education". UNESCO.

UNESCO (1986), "Guidelines for the Development of Non-formal Environmental Education". Environmental Education Series 23. UNESCO.

UNESCO (1994), "A Prototype Environmental Education Curriculum for the Middle School". Environmental Education Series 29. UNESCO.

United Nations Population Fund (UNPF, 2007). "State of World population: unleashing the Potential of Urban growth." From http://www.unfpa.org/swp/.