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RESEARCH ARTICLE

GREENBELTS IN CITY GROWTH AND DEVELOPMENT IN NIGERIA

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ABSTRACT

Greenbelts within and around cities are sites retained to discourage human habitation and hence forestall population density and encroachment into some areas. Biological gardens, tracks of open spaces as well as forests play invaluable roles in ecological stability, urban beautification and preservation of species. This study examines the significance, infringement and management of greenbelts. A3-stage stratified random sampling technique combined with physical field observations and reference to relevant literature were used to derive information for the study. Over 87%of the sampled population agreed to a changing ecological characteristic of the area arising from transformation of ecosystems and monotony of infrastructural development with implications. In order to avoid a society devoid of naturalness or habitat inversion, and ensure quality environment, 168 respondents solicited for joint management of green areas. The study revealed that ex-situ conservation promotes city beautification, air purification, preservation of species, maintenance of ecological stability as well as scientific and recreational up liftment. Protect and maintain ex-situ conservation schemes, greenbelts not necessarily continuous in nature as well as explore other areas for designation as in-situ sites.

INTRODUCTION

Maintaining vegetation in urban settlements is vital to in-situ conservation and sustainable management of natural ecosystems. The faunal and floral components of ecosystems are fundamental in environmental dynamics. Sub-urban green area systems form transition strips between communities-urban and rural. Its vegetation serves as sink for carbon dioxide (CO_2), water catchments and wildlife habitat, and diminishes immediately around the city. The existing vegetation including plants within settlements also performs these functions. Thus, the urban and peri-urban areas accommodate systems such as greenbelts made up of watersheds, tracks of open spaces, biological gardens, recreational parks, riparian forests and plantations which provide environmental services. These green elements that also include sacred grooves and golf courses, according to **NEST (1991)**, are purposely retained, set aside or left undeveloped to meet future demand. Urban forests are invaluable resources offering protection against floods, wind landslides, gully erosion and rise in temperature. The frequency of some of these disasters in many Nigerian cities led to the emergence of the concept of urban forestry and city beautification. Hitherto, the growing of trees and reservation of urban forests have been practiced since colonial era, when government offices, residential quarters, government reservation areas and major streets were adorned with trees and ornamentals (**Dada, 1993**). In the Federal Capital Territory (FCT), squatter settlements in satellite towns have taken the place of open spaces and industrial areas to the detriment of the overall planned development of the capital. The squalid dwellings become prominent in virtually every urban centre with structures located on illegal sites. Such settlements become focal points, which radiate growth to other areas where transformation of ecosystems for subsistence agriculture, wood extraction, hunting as well as encroachment into forest reserves, watershed degradation and surface water pollution, exacerbate conservation problems (**Okali 1990**).

Ezeh (1990) puts it that the establishment and maintenance of biological systems improve aesthetics, restore and preserve deteriorating soils, watersheds and provide energy, fruits and fodder for the human and animal components of communities. The systems ameliorate ecological disasters and reduce the frequency and severity of floods and wind. Some cities like Benin City, Enugu, Ibadan, Lagos, Onitsha, Kano, Kaduna and Port-Harcourt, lack adequate green areas. The general scenario is that of continuously built-up landscapes. According to **NEST (1991)** and **Oguntala (1993)**, only 4.18% is retained for recreation or set aside as green areas in Lagos and Ibadan combined. Abuja, the Federal Capital Territory- an envisioned model- has less than 5% of its 25,000ha land area under greenbelts. Deficiencies of this kind provoke disasters and may

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lead to inordinate growth of settlements beyond thresholds where facilities and services become overloaded. These require considerable attention to safeguard the wellbeing of the society. The phenomenal surge in population and urbanization in the FCT is capable of inducing ecosystems transformation with the attendant adversities, elicited the need for this study. This study examines greenbelts in cities with bias to the Federal Capital Territory. It evaluates opinions, the need and significance of green areas in planned infrastructural development. The objectives of the study are to:

- assess the provision and significance of green areas
- determine the effects of infringement on the sites
- examine the effectiveness of management measures and
- make recommendations for proper management.

MATERIALS AND METHODS

Discription of study area

The study was carried out in the Federal Capital Territory (FCT) in the Guinea Savanna Zone. It lies between latitudes 8^0 25'N and 9^0 20'N and longitudes 6^0 45'E and 7^0 39'E.It is bounded by four (4) of the thirty-six states that make up the Federal Republic of Nigeria, These include Kaduna state to the north, Nasara wastate to the east and southeast, Kogi to the south and Niger to the west. The area receives normal annual rainfall of about 1,383.4mm.Its mean monthly temperature is as high as 38.1^0C. Relative Humidity (RH) is generally high with a-ten-yearly average of 65% and50% in the morning and afternoon respectively. The soils are sandy and stony with generally acidic reaction. This supports a combination of savanna and rain forest ecosystems that has ensured rich biodiversity at the levels of habitats, species and genes.

Data collection

A social survey using structured questionnaires was used to obtain information for the study. The study was carried out in the six administrative area councils that make up the study area. A 3-stage stratified random sampling design was used for data collection. Settlements with human population of 1000 persons and above were identified in each area council. Twenty per cent (20%) of these settlements were randomly selected and each was divided into strata of 100 households for administrative convenience. Out of these, 10%of the total number 100 households was randomly selected from each settlement for data collection.

The heads of families were identified and interviewed using questionnaires. In addition, respondents were drawn from the management of some government institutions and Non-governmental Organisations (NGOs) within the stakeholder sectors in the study area. One hundred and twenty questionnaires were administered with 109 daily completed and retrieved. Questionnaires totalling 320 were administered. Two hundred and eighty nine (289) questionnaires constituting 90.3% were duly completed and retrieved during the survey. Besides the use of questionnaires and field observations, data were also obtained from available literature, publications and other documents on the subject.

Data obtained from the questionnaire survey were analyzed using techniques that involved classification of respondents' disposition and computation of simple means and percentages.

RESULTS AND DISCUSSION

Greenbelts: city ecological safeguards

Growth of human population, advancement in technology and urbanization induce transformation in ecosystems with little regard for the ecological consequences. Ecosystems transformation is a common feature in the study area. The greater the magnitude of forest devastation and ecosystems conversion, the more it becomes imperative to consider likely ecological impacts. Ignoring safeguards may lead to disasters that unleashed hardship and death on humans. Land-use planning reduces uncertain adverse environmental effects. During the questionnaire survey, over 200 persons responded to the question on what constitute green areas. About 47% of the respondents see green areas as recreational parks, gardens, woodlots and sacred groves. Riparian forests, river valleys, watersheds, and floodplains combined provide suitable habitats for the protection of aquatic biota. **Adeyoju (1977)** had expressed that to avoid habitat inversion and to maintain quality environment, woody vegetation in the study area may be delineated green areas. Woody vegetation abounds in national parks, watersheds, inviolate plots, forest reserves, urban plantations and biological gardens. **Furthermore, Mabogunje (1977)** had as well recommended retaining and preserving natural vegetation in slopes and valleys of major streams that criss-cross the territory.

Apart from limiting over-urbanization, growth of squalor, differentiating settlements and ensuring land reservation in agreement with **Thomas (1970)** and **Culling worth (1978)**, the respondents elicited other values of greenbelts. As shown in table 1, recreation, urban ventilation, ecological stability, nature and biodiversity conservation values combined, represent 93.3% of the total frequency distribution. The potential values constitute some of the most significant benefits of green areas. However, the concept of biological diversity is new and despite its growing recognition as being pivotal to sustainable development, not many people are conversant with the terminology and its application to safe and healthy urbanisation (**Dudley, 1992**).

Table 1. Significance of greenbelts in human settlements

Potential values	Frequency of responses	Relative frequency (%)
Recreation	41	19.4
Urban Ventilation	39	18.5
Ecological Stability	47	22.3
Urban Beautification	45	21.3
Nature and Biodiversity Conservation	25	11.8
Shade	9	4.5
Food, medicines and raw materials	5	2.4
Total	211	100

The significance of the belts notwithstanding, 109 respondents decried the deplorable status of the systems in the territory (Figures 1 and 2).

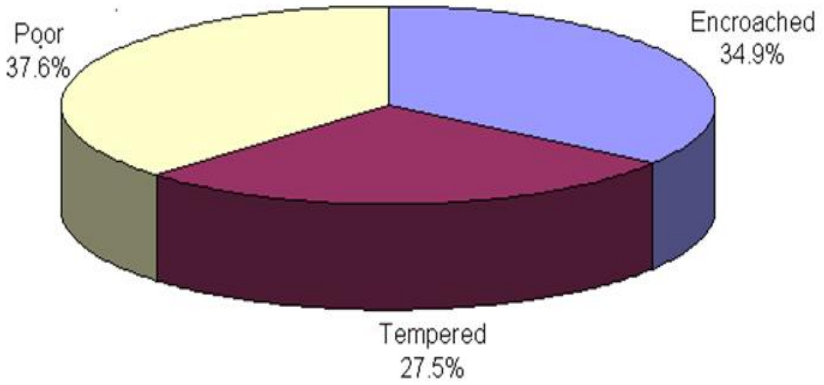

Fig.1. Status of greenbelt protection in the FCT

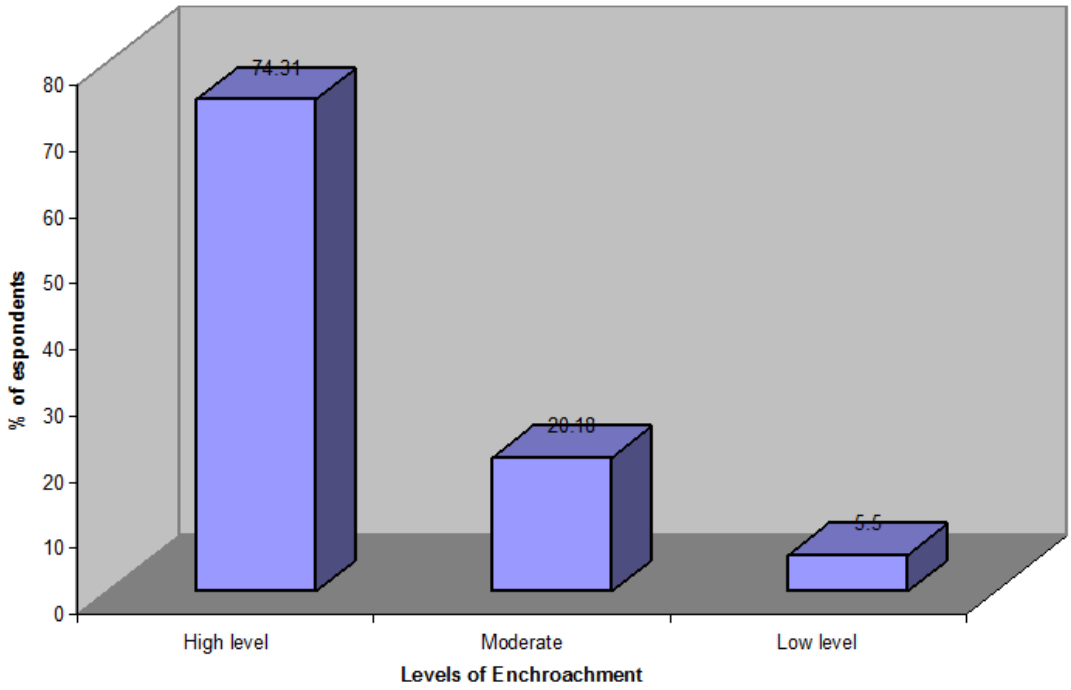

Fig.2. Opinion on level of encroachment into green areas in FCT

The picture portrayed by the figures, support field observations indicating encroachment into the sites and where they are not, the schemes are improperly managed. It is indeed disheartening to note that greenbelts envisioned as long-term ecological features provided for in Abuja master plan were converted to corner shops, office and religious infrastructures as well as residential buildings. Some of these structures are located near riverbanks and on flood plains. According to **Ugolo (1998)**, all these infringements require effective regulations and a revisit to the planning laws. In addition, some respondents interviewed during the study, strongly advocated compliance monitoring and enforcement of existing regulations. As an enforceable measure to discourage incursions, 38.8% support prosecuting violators irrespective of status in the society. The measures suggested to correct violations include demolition of structures and revocation of inappropriately allocated lands. Public enlightenment and solicited participation of members of the public in management would enhance the status of green areas and greenness in the study area and elsewhere.

The sampled population also expressed opinion on the effects of infringement on green areas. As shown in Table 2, 85% agreed to the statement: *"The destruction of greenbelts in Abuja is inimical to the future well-being of urban inhabitants"*. This impressive response is an indication that majority are aware of cushioning effects of green area systems and the inherent implications when such sites are non-existent and devastated where they exist. Furthermore, based on discussions with individuals, field

Table 2. Effects of infringement on greenbelts

Statement	Respondents' Opinion	
	Agree	Disagree
The destruction of green belt is inimical to the future well-being of the urban inhabitants.	85 %	15.0 %

Observations and the views of the sample population, it can be inferred that encroachment, re-designation and destruction of green areas are harmful activities whose negative effects would

manifest in the future. These are likely to be similar to effects that arise from degradation of watersheds and occupation of flood plains, river valleys, swamps and fragile areas. However, 77.1% of respondents in featured comments generally expressed that infringement under city expansion and physical infrastructure development invite impacts that include (i) greater percentage of concrete jungle; (ii) impairment of hydrological balance; (iii) absence of recreational facilities; (iv) erosion of biological diversity; and (v) vulnerability to ecological disasters. The adverse elements confirm the views of **Boateng (1990) and UNEP (1988)**. These authors opined that infringement on biological gardens parks, tracks of open spaces and conservationists and amenities that form part of the milieu of human existence, have associated risks. The risks manifest from haphazard, ill planned and unmanaged activities which ignore limitations and constraints on the environment.

Absence of green areas in cities and urban centres create room for high concentration of facilities, congestion, incompatible land use practices, decay, exposure of city residents and generations to seemingly natural disasters like flooding, erosion and excessive heat. Habitats for rodents, reptiles and birds that are important in ecological relationship may become lacking. These are the views of 20% of the respondents. However, it is worthy of pointing out that a few respondents opined that violation of schemes constitute no significant threats. This view may have arisen from the fact that the sites have been accorded little consideration in many Nigerian cities, and because the implications of such lapses are insidious but only unleash repercussion years later when least expected.

Biological gardens: city greeningtool

Biological gardens collectively hold a diverse collection of plant and animal genetic materials. And across the world, particularly in developing countries, there is a growing concern of the detrimental effects of human activities on the environment. The changing nature of the ecology of biological species in the FCT resulting from on-going activities was evaluated. About 87.3% of the respondents attested to the question posed on changing ecological systems. In addition, physical field observations showed that infrastructure development alter the characteristics of the ecology. Higher levels of consumption are associated with concentration of humans and economic activities. These put pressure on renewable resources and ecosystems. Wild faunal and floral species thus face increasing array of threats, and conservationists must deploy techniques that will conserve the diversity of habitats, species, populations and genes.

During the study, 96.1% of the respondents expressed the view that living biotic collections in biological and zoological gardens are of immense value to the city and its dwellers. It suggests that biological gardens are imperative for the conservation as well as preservation of species and ecosystems. Monotony of infrastructures has far-reaching implications. These include stress, absence of habitats for birds, small ruminants and insects, high atmospheric concentration of CO_2, monotony of life, loss of species and decline in soil fertility. The gardens form excellent centres for the protection of sites and species of conservation interest. And the millions of people that visit gardens for recreation provide unique opportunity for the centres to influence public attitude towards species conservation and protection of the environment. For socio-cultural advancement, scientific development, recreation and enhanced public awareness therefore, the establishment of zoological and botanical gardens become worthwhile activities in the transformation of ecosystems as in the territory under study. Table 3 tabulates the respondents' disposition to the values of these schemes in a city and urbanizing environment. According to **Bada (1995)**, the schemes provide opportunities for recreation, education, research, conservation of genes and information on the ecology and distribution of species. Indeed, establishment of parks and biological gardens constitute some of the veritable tools for sustainable management and species conservation.

Table 3. Importance of botanical gardens

Value of botanical gardens	Frequency of responses	Relative frequency (%)
Conservation of biodiversity	52	14.6
City beautification	55	15.5
Air purification	19	5.3
Recreation	59	16.6
Preservation of endangered species	46	12.9
Tourist attraction	17	4.8
Gene pool conservation	14	3.9
Habitat for birds	9	2.5
Maintenance of ecological stability	27	7.6
Education/Scientific Research	58	16.3
TOTAL	356	100

Forests and vegetation belts function in air purification and cleansing, particularly in carbon sequestration. Ex-situ conservation schemes, a common feature in city green facilities, ensure ecological stability and provide habitats for a variety of small ruminants, insects and birds. These notable attributes as investment in botanical gardens (inspite of eliciting low relative frequencies of 7.6% and 2.5% respectively), incorporate abiotic features and conditions suitable for the survival of biotic communities. Indeed, biological gardens as green areas find valuable expression in the preservation, and multiplication of samples of rare and endangered species for re-introduction into the wild.

The UN Convention on Biological Diversity (CBD) provides for ex-situ conservation to compliment in-situ schemes. Article 9 (d) of the Convention requests contracting parties to manage collections of biological resources from natural habitats for ex-situ conservation. In conformity with this provision, many biological gardens abound in the FCT. The ex-situ sites identified by 56.2% of respondents who have knowledge of the gardens include Abuja Gardens, FCT Plant Nursery, the National Arboretum, Abuja Zoological Gardens and Nigerian Institute of Pharmaceutical Research Garden.

Green areas in urban beautification

Landscaping architecture seeks to beautify a transformed region. Introduction of plants add biological and physical value to the environment as demonstrated by indoor plants, pathway and avenue planting. Significance of aesthetic engenders support for tree planting, ornamentation and horticultural practices. Thus, during the survey, 65.3% of the respondents

attested to this concept of beautification. The practices vary between the Area Councils strata. It was more pronounced in the Municipal Area Council, where the capital city resides. Indication of higher acceptance of horticultural practices in the Municipal Area Council is ascribed to concentration of government facilities trailed by dense population and greater awareness of the need to beautify a transformed environment. Exotic ornamentals as the study shows, have been widely used to bring the desired beauty. But **Okali (1990)**, had strongly expressed that indigenous species can, however be used to achieve the same adornment. Thus, naturally occurring deep rooted tree species like *Khayasenegalenses, Daniellaoliveri*, *Parkiabiglobosa, Anogeisusleocarpus*etc, are encouraged to avoid total removal of forest trees and extirpation of likely endemic species in the on-going physical development. Over 76% of the respondents of the sampled population participate in horticulture practices. This exemplifies the significance of plants as elements of survival of city life, urban beautification and sustainable ecological services.

Commercial and government-operated nurseries, according to the respondents, form the major sources of seedlings and propagules. The two sources form 33.7% and 29.4% of respondents' view respectively. Commercial nurseries represent 63.1%. Apart from the FCT established nurseries, other government agencies run nurseries. Federal Ministry of Environment, Pharmaceutical Research Institute and Agricultural Development Projects (ADP), for instance, operate forest, ornamental and ethno-botanical nurseries that provide seedlings for planting. While privately-run nurseries are also operated for personal uses, commercial nursery business booms in the territory particularly in the Municipal Area Council where infrastructures, facilities and people are concentrated. Population density, government and non-governmental activities are at low levels in other strata. The need to ventilate and purify air, control erosion, replace part of lost vegetation and meet ethno-botanical requirements, endeared widespread participation in horticultural and ornamental practices. The cultivation of trees, ornamental species and the management of forests and vegetation contribute to the psychological and socio-economic well-being of a society (**Gray and Frederick 1986**). Indeed, areas planted up have attracted and will continue to attract insects, small birds and bats particularly when the trees flower, a development that uphold ecological functions.

The on-going development, transform the territory into a "man-scape" in which humans beings and urban infrastructure assume the centre stage. Field survey indicates that the re-configuration reshapes and impoverishes a mix of savannah and tropical rain forest ecosystems. Impoverishment is a consequence of adverse impacts of an expanding heterogeneous population with its activities involving continuous harvest of fruits, nuts, seeds and wood as well as small-holder agricultural expansion, bush burning and grazing. Monotonous scenes of houses become unappealing and uninviting for modern urban living except green resources are introduced for beautification (**Gray and Frederick, 1986**). Indeed, landscaping becomes preponderant because, apart from soil protection and promoting pollution-free environment, it beautifies and creates a congenial atmosphere for relaxation, recreation and habitats for other creatures important in ecosystems functioning. In restoring parts of lost vegetation and rehabilitating a changing ecology, establishment of urban forests and the use of plants, ameliorate degradation as well as bring aesthetics into the city environment.

Management of green areas

Deforestation, de-reservation and encroachment into retained green and critical areas trail on-going development in Abuja. It is observed that the green areas are unmanaged because the sites were improperly constituted and adequately delineated. A total of 168 respondents agreed that both government and non-governmental institutions concerned with conservation of natural resources and protection of the environment be vested with the responsibility of managing city green sites. As table 4 shows, 54.2% support NGOs while 45.8% align with corporate bodies such as

Table 4. Responsibility for the management of green areas

Managers of greenbelts	Number of respondents				Total number of respondents
	YES	%	NO	%	
Non-Governmental Organizations	74	44.0	17	10.1	91(54.2%)
Corporate bodies (MDAs)	65	38.7	12	7.1	77(45.8%)
TOTAL	139	82.7	29	17.3	168

Ministries, Departments and Agencies (MDAs) for adequate protection and sustainable management.Furthermore, 54.2% of 139 respondents itemized the following reasons amongst others in support of environmental NGOs:

- Have fundamental objective in the protection of the environment and conservation of biological diversity;
- Enhance and compliment government efforts;
- Efficiency in mass mobilization and community involvement;
- Capacity to develop strategic initiatives;
- Create greater awareness and source external funding for efficient management; and
- Have minimal bureaucracy in decision-making and project execution.

Similarly, 45.8% which support corporate entities that include government and its agencies opined that these organizations have: (i) stable financial disposition; (ii) greater capacity to generate revenue; (iii) greater investment capacity in environmental management; (iv) provision of expert views (v) adequate legal backing in cases of violations; and (vi) greater capacity to support research.

However, about 17.3% of the sampled population did not support any of the bodies managing greenbelts. Indeed, over 58.6% noted that the NGO's lack statutory mandate or ability to enforce regulations or halt infringements. This is contrary to what was observed during the survey to the effect that some formidable NGO's have the where with-all to sensitize the public on land use issues as in the need to protect tracks of open spaces, greenbelts as well as riparian and fragile areas. Abuja Horticultural Society (AHS), a leading NGO in the study area, for instance, promotes environmental awareness

campaigns, biodiversity conservation and sustainable management of natural resources. This NGO has in many cases successfully prevailed on government and members of the public on issues bordering on the environment. One of such interventions culminated in the establishment of the Abuja Zoological Garden on a site hitherto used for purposes inimical to conservation interest. While local management outfits evolve as demonstrated by the proliferation of NGO's and Community Based Organisations(CBO's), it is expedient that governments provide necessary framework conditions to enable these organizations operate and address environmental issues (**Anon, 2001**).

Generally, it is expressed that for proper utilisation, better management and control of green areas in cities and burgeoning urban centres, collaboration between NGO's, MDAs and individuals is paramount. Such a coalition would introduce sanity into public infrastructure development, as land is seldom used for purposes for which it is best suited.

Conclusion

Greenbelts are invaluable in urban recreation, ventilation, ecological stability, nature and biodiversity conservation. The significance of the greenbelts notwithstanding, it is disheartening to observe the deplorable state of the sites, because a good number have been infringed. Infringements have implications as conversion has repercussions similitude to those associated with devastation of watersheds and occupation of flood plains, river valleys, swamps and fragile areas. Thus, the benefits of maintaining green areas become eroded in urban expansion and infrastructure development. The unforeseen adverse effects include preponderance of concrete structures, impairment of hydrological balance, absence of recreational facilities, erosion of biodiversity and prevalence of ecological disasters. In addition to concentrating facilities leading to congestion, incompatible land use practices and urban decay and inadequate greenery, expose generations to hazards.

Ex-Situ conservation schemes such as parks, botanical and zoological gardens have potentials for environmental protection, preservation and rehabilitation of endangered species. The schemes are critical in processes involving transforming the environment, which over time influence the characteristic of species and ecosystems functioning. Over 87.5% of the sampled population attested to changing ecological characteristics of the FCT. Monotony of infrastructures has implications that include stress, concentration of carbon dioxide in the atmosphere, loss of species and threat to habitats for birds, small ruminants, bats and insects. Physical observation and views of the respondents indicate role played by the schemes to include conservation of biological diversity, city beautification, preservation and rehabilitation of threatened species. The study also showed green belts are important in air purification, scientific research and education, maintenance of ecological stability, and as habitats for rodents, reptiles, birds and other organisms.

Increasingly, activities of ethnically diverse population, complex social infrastructure and reconfiguration of ecosystems with little consideration for ecological principles, place the resources and biological diversity in jeopardy. An improperly coordinated physical development led to the spread of chequered land use patterns involving devastation of forest reserves, sacred groves, wildlife habitats, wetlands, water bodies and green areas provided for in the development master plans. Therefore, certain implementable measures are recommended for the protection and maintenance of greenbelts in cities. These recommendations are broad and as such are of general application in urban growth and development. The redeemable measures are:

- Protect and maintain designated greenbelts and shelterbelts which might not necessary be continuous stretches and ensure wise usage, control and proper management of ecologically fragile areas in cities and urban areas.
- Promote the development of parks and biological gardens to ensure adequate natural green areas within human settlements for ecological balance.
- Encourage joint management in enforcing extant regulations on the development of parks, biological gardens and other recreational facilities to ensure proper maintenance.
- Establish and protect existing ex-situ conservation schemes as tools for sustainable development of sites of special scientific interest, urban recreation, conservation of biological diversity and preservation of species for the future generations.
- Explore areas that can be acquired, designated and developed as in-situ conservation sites.
- Assess the status of the existing forest reserves and other sites of conservation interest consequent upon infringement and put in place machinery for participatory management.

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