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SOCIOECONOMIC, INSTITUTIONAL AND TECHNICAL ISSUES INURBAN FORESTRY

Ajewole, Opeyemi Isaac
Department of Forest Resources Management
University of Ibadan

Introduction Urban Forestry and Green Economy Nexus

Green economy has been defined by UNEP (2010) as an economy that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. In its simplest expression, a green economy is low-carbon, resource efficient, and socially inclusive. According to UNEP (2011), green cities are defined as cities that are environmentally friendly. Indicators measuring environmental friendliness or performance can include: levels of pollution and carbon emission, energy and water consumption, water quality, energy mix, waste volumes and recycling rates, green-space ratios, primary forests, and agricultural land loss.

Rapid urban growth and activities in cities occasioned by lifestyles and standard of living have been of major concern in green economy discourses. For example, it has been established that 50% of the global population was living in urban areas in 2007, and will reach 69 per cent by 2050 (UN Population Division, 2006 and 2010). Rapid urban growth tends to overwhelm cities where the struggle to develop infrastructure, mobilise and manage resources has negative consequences for the environment.

Furthermore, as cities become more prosperous, with wider and deeper patterns of consumption and production, their environmental impacts are increasingly felt at the global level. Urban areas in prosperous economies concentrate wealth creation as well as resource consumption and CO2 emissions. For instance, with a global population share of just above 50% and less than 2% occupation of the earth's surface, urban areas concentrate 80% of economic output, between 60 and 80% of energy consumption, and approximately 75 per cent of CO_2 emissions (Kamal-Chaoui and Robert 2009; UN Population Division 2010). Furthermore, buildings, transport, and industry – which are constituent components of cities and urban areas, contribute 25%, 22% and 22%, respectively of global energy-related GHG emissions. From the foregoing, it is apparent that cities have a lion share of economic output, energy consumption, carbon dioxide and GHG emissions; and by extension, a lion share of environmental pollution.

Urban forestry has very great potential to facilitate and expedite the achievement of the objectives of increased environmental quality, resource use efficiency and social inclusiveness which are the main thrusts of green economy. Urban forestry can reuse municipal wastewater and solid wastes, reduce transportation costs, preserve biodiversity

and wetlands, and make productive use of green belts. Kuo *et al.* (1998) observed that the more trees and greenery form part of inner-city public spaces, the more these spaces are used by residents. The study also found that, compared with residents living near barren spaces, those closer to greenery enjoy more social activities, have more visitors, know more of their neighbours, and have stronger feelings of belonging. Wells and Evans (2003) also found out that children with nature near their homes are more resistant to stress; have lower incidence of behavioural disorders, anxiety, and depression; and have a higher measure of self-worth. Green space also stimulates social interaction among children.

Urban greenery provides a unique opportunity to improve air quality. In Chicago, urban trees provided a service for air cleansing that is equivalent to US$ 9.2 million dollars and their long-term benefits are estimated to be more than twice their costs (McPherson et al. 1994). There is a broader set of public health issues around healthier lifestyles in cities. It is estimated that physical inactivity accounts for 3.3 per cent of all deaths globally and for 19 million disability-adjusted life-years (Bull et al. 2004). Green urban transport is a unique opportunity to link physical activity and emissions reduction by promoting walking and cycling.

Urban greenery and vegetation represent a range of ecosystem services with significant wider welfare effects (TEEB 2010). A study of Toronto's Green Belt estimated the value of its ecosystem services at CA$ 2.6 billion annually, an average of around CA$ 3,500 per hectare (Wilson 2008). Ecosystem services further play a critical role in risk reduction measures. Tropical cities such as Jakarta have dramatically increased their risk exposure to flooding as a consequence of local deforestation. The city's most recent floods in 2007 affected 60 per cent of the city region, killed 80 persons and forced more than 400,000 residents to leave their homes (Steinberg 2007).

Restoration of urban ecosystems is part of the city greening effort, which can reduce the impact of freak weather conditions. Coastal regions in particular can benefit both in terms of lives and money. Mangrove replanting in Vietnam, for example, saves US$ 7.3 million annually on dike maintenance while it costs only US$ 1.1 million (International Federation of the Red Cross and Red Crescent Societies, 2002). More generally, an increase in the amount of green cover in urban areas not only increases a city's ability to reabsorb CO_2 but also ameliorates the urban heat island effect (McPherson et al. 1994). Safeguarding natural ecosystems in cities' hinterlands is also important in reducing their exposure to risk. This is of particular relevance to fresh water supply and food security. As they have expanded, many cities have exhausted local fresh water sources and rely on importing water from their wider region. Such requirement to import water is already associated with enormous costs for places such as Mexico City and São Paulo. In New York City, the protection of its fresh water supply has allowed the city to avoid paying US$ 5 to US$ 7 billion for an additional filtration plant (TEEB, 2010).

Parks, protected green space and gardens, street trees and landscaping provide vital ecosystem services, acting as green lungs, absorbing and filtering air pollution or as acting

as filters for waste water (TEEB Ibid). They also provide a habitat for wildlife and offer recreational benefits to city dwellers. As noted above, a study of Toronto's Greenbelt identified its wetland and forests as one of its most valuable assets in terms of ecosystem services, including carbon storage, habitat, water regulation and filtration, flood control, waste treatment and recreation (Wilson 2008). In addition, the presence of green landscaped areas helps regulate natural processes, including the mitigation of local temperature extremes: a ten per cent increase in tree cover reduces cooling and heating energy use by between five per cent and ten per cent (McPherson et al. 1994). Vegetation and soft open space also play a role in decreasing storm water volumes, thus helping cities to manage the consequences of heavy rainfall, and are effective in helping flood protection in coastal cities. New design strategies have pioneered the use of green roofs and facades on buildings, to add to the quantity of natural (as opposed to man-made) surfaces in cities and to reduce cooling energy demand. For example, Itabashi City in Tokyo is promoting climbing plants as "green curtains" around public buildings and private homes to avoid buildings overheating in summer and to reduce the use of air conditioning (ICLEI, 2009).

1. Technical Issues in Sustainable Urban Forestry Development

Basic technical issues of interest to sustainable urban forestry development comprise the evaluation of the site conditions and the tree species' suitability for amenity planting in urban areas. A number of them are outlined below:

1.1. Site Evaluation

The nature of urban site condition is highly complex and constitutes great challenges for tree cultivation and growth. Therefore, proper site evaluation has to be carried out in order to achieve sustainable urban forestry development. Gilman and Sadowski (2007) and USDA (2005) summarized the factors to consider for detailed assessment of potential planting sites to include the following:

1.1.1. Light patterns and exposure

Consider the amount of sunlight, shade, and artificial light at the site, including the duration and directness of sunlight. How often is the tree in full sunlight or shade? Are there buildings or other trees shading the site? Are there artificial lights shining on the tree all night? Is there reflective light from buildings, streets and other structures? Light patterns can even change the dormancy and growth patterns of a tree. Sunlight reflected from glass or a wall on buildings can increase the heat load on a tree planted near a building. Drought-tolerant trees that grow in full sun are best suited for this kind of site. In addition, providing a large area of soil for roots to explore often helps trees withstand reflected light because the trees have access to more soil from which to absorb water. Irrigation helps these trees as well. Visiting the site at different times of the day and season will help determine the light patterns and help in choosing a species appropriate to those conditions.

1.1.2. Wind patterns

Strong winds may blow down trees and snap trunks and limbs. Constant winds increase the trees' need for water because of increased transpiration. Therefore, in areas exposed to

higher winds (e.g. near the beach), consider choosing only drought-tolerant trees. Otherwise, special provisions should be made to increase the availability of irrigation or to protect the site from direct wind. If the site has poorly drained soil, trees will need to be both wet and drought-tolerant. Furthermore, buildings in downtown areas can create a wind-tunnel effect and increase the wind speed in those locations. Hence sites exposed to strong winds should have adequate soil volume for good root development, and the tree species should have a structure and branch attachment that can tolerate windy conditions.

1.1.3. Temperature extremes

It is important to know if a species can survive the temperature extremes at the planting site. Urban areas are usually warmer than rural ones because of the "heat island" effect, but site-specific factors can cause even greater extremes. For example, trees planted next to a black asphalt road will have much hotter conditions and will probably need more water than those planted in the middle of a park or yard.

1.1.4. Air quality

Air quality problems vary depending on the location of the site, the size of the urban area, the kind of local industry, and the climate and weather patterns. Air pollution may damage foliage and impair photosynthesis and at the same time, some trees are capable of filtering pollutants from the air. Hence if the planting site is near a major road with large quantities of exhaust fumes or around or within industrial area or estate, species that can better tolerate or even absorb specific pollutants should be considered.

1.1.5. Other Trees

Young trees that tend to develop broad canopies and that require full or at least partial sun (mahoganies etc.) often bend toward the sunlight and develop a one-sided canopy when they are planted under a canopy of established trees. Trees planted between existing established trees may grow slowly or not at all due to root competition and lack of water and shade.

1.1.6. Buildings

Trees are most stable in the ground when they develop a uniform root system with straight roots distributed more or less evenly around the tree. If a tree is close to a building, the root system can become one-sided and unbalanced. Unbalanced root systems result in tree failure in strong winds. Trees that grow large should be planted at least 15 feet from a building while a tree with a narrow canopy may be a good choice within 10 feet of a building, although tree canopies can adapt by growing more on the side away from the building. If shade is desired, consider planting several small-stature trees to create a closed canopy.

1.1.7. Signs

Signs and trees frequently conflict with each other due to poor planning. To help prevent this, large trees should be planted near low signs and small trees near tall signs. Large-maturing trees could be in the way of a low sign for several years after planting, but if the

tree is grown with a single trunk, lower limbs can be reduced and eventually removed so the sign remains visible.

1.1.8. Site Location

The site location offers clues on potential stresses that may impact tree health and maintenance. Sites near a street, sidewalk or paved area as well as those where pedestrian and vehicular traffic is high can create challenges for tree development. Tree roots may have conflicts with asphalt and cement pavement thereby causing the pavement to crack and buckle and trees may also suffer from vandals and sometimes may be damaged by vehicles in such sites. Thus tree species with drooping branches (which will require frequent pruning) and thorns or prickly foliage or soft, messy fruit should be avoided on the sites with heavy pedestrian and vehicular traffic.

Furthermore, root barriers and root training can be used to avoid root-pavement conflict. Root barriers are designed to physically deflect the roots away from the pavement. Although, in some cases they do prevent root growth near sidewalks, but they may also limit tree growth. Root training is an option that uses chemical and physical barriers, deep fertilization, and irrigation or aeration structures to improve the soil conditions in the deeper soil horizons. If the barriers are successful, the roots will grow deeper, avoiding surface problems such as cracked sidewalks.

1.1.9. Utility lines

Utility lines for water, sewer, phone, electric, or cable may cause problems for trees. When selecting a site, one needs to check for underground or above-ground lines that might interfere with the future growth of the tree. If the site has above-ground utility lines, select a small species that will top out at least 5 feet below the wire, or select a species with a narrow crown and place it so it will not grow into the utility line. In the case of below-ground utility lines, the planting site should be located at least 12 feet from a major underground utility line for large trees. A common misconception about tree roots is that they actively grow into sewer and water lines. Roots will follow a path of least resistance and only grow into sewer and water lines that are broken. It is advisable to contact the local utility company to find out how to have all underground utility lines marked on the site.

1.1.10. Site activities

The type of activities, past, current, and future, on the site can help determine if this is a good planting site. If for instance construction has previously occurred on the site it may have changed the soil conditions. Thus there is need to check for safety concerns such as personal welfare and property damage, need for tree protection from compaction, vandalism and injuries and legal restrictions on how the property is used. This type of information can usually be determined by visiting the site and talking with people who are familiar with it. The owners of the site or the local planning department are good resources for finding out about future plans.

1.1.11. *Existing Vegetation*

The existing vegetation at a site may reveal the current condition of the site. The condition of the site can be inferred from the physiognomy and health of existing vegetation, species composition and competition, signs of pest and diseases etc. For instance, if the roots of the existing trees are visible above ground, it suggests that the soil is likely compacted or eroded. In addition, existing natural vegetation also suggests species suitability, especially if native plants are being considered for planting.

1.1.12. *Edaphic factors*

Urban soils are often compacted and poorly drained; even sandy soil can compact. These soils contain little oxygen—a gas that tree roots need to survive and grow. Only species and cultivars tolerant of wet or swampy sites can survive in such difficult soils. In this case, care has to be taken in the use of trees with aggressive root systems because of large surface roots which can disrupt lawn mowing operations and can damage curbs, sidewalks, pavement, and other nearby structures. Large shade trees can fall over during turbulent winds because inhospitable soil prevented their establishing deep, stabilizing root systems, therefore, small- to medium sized trees (less than 40 feet tall at maturity) are recommended to minimize windthrow in such sites.

Soil pH governs availability of nutrients to plants and also affects activity of soil microorganisms. A pH test should be conducted in several areas of the site, wherever soil color or texture appear different. Site pH may vary too much to plant the same species across the entire job. Most trees can grow in soils with a pH between 4.8 and 7.2. If the soil is less than 4.8, select trees tolerant of acidic soils. If the soil is greater than 7.2, select trees tolerant of alkaline soils. Few trees grow well in soils with a pH above 9.0. Small to medium-sized trees should be planted if bedrock comes close to the surface or if there is little soil. Large-maturing trees in soil less than two feet deep could topple over in storms as they grow older because they lack deep roots.

1.2. *Tree Species' Evaluation for Urban Planting*

Evaluation of tree species for urban planting involves the identification of attributes of the trees and matching of those attributes with desirable and undesirable traits for trees considered for planting in different parts of urban area. Some tree attributes as well as the desirable and undesirable traits of importance are presented in Table 1. Table 2 presents the empirical use of this evaluation model in the assessment of 12 tree species enumerated in the premises of public hospitals in Ibadan metropolis (Ajewole and Oladipupo, 2012).

Table 1: Tree Attributes and Traits Considered for Urban Planting

Attributes	Characteristics	Traits	Characteristics
NATURE/TYPE OF TREES	Deciduous	DESIRABLE TRAITS	Fine or interesting leaves
	Evergreen		Foliage colour or colour change
	Palm		Showy flowers
FINAL HEIGHT	< 8m (Short)		Interesting tree form
	8-16m (Medium)		Good shading effect
	17-24m (Tall)		Hardiness or longevity
	> 24m (very tall)		Nitrogen – fixation
FINAL CROWN SPREAD	< 4m (Narrow)		Noise Mitigation
	4-8m (Medium)		Low crown base
	> 8m (Wide)		Fragile or brittle branches
GROWTH RATE (Annual Growth Increment)	< 0.3m (Low)		Top prone to wind throw,
	0.3-0.6m (Medium)	UNDESIRABLE TRAITS	Formation of buttress root
	> 0.6m (High)		Shallow roots,
ENVIRONMENTAL TOLERANCE	Poorly drained soil		Aggressive searching roots
	Infertile/skeletal soil		Non-erect or leaning bole
	Drought		
	Shading		
	Strong wind		
	Salt spray		
	Air pollution		
SUITABLE HABITATS	Pavement and roadside		
	Garden and open space		
	Hill slope		
	Parks/school grounds		
	Coastal		
	Sandy Beach		

Source: Adapted from Jim C.V (1990): Evaluation of Tree Species for Amenity Planting in Hong Kong

Table 2: Attributes and Traits of Identified Tree Species in Selected Hospital Premises in Ibadan Metropolis

S/N	SPECIES	NATURE OF TREE	FINAL HEIGHT	FINAL SPREAD	GROWTH RATE	DESIRABLE TRAITS	UNDESIRABLE TRAITS	ENVIRONMENTAL TOLERANCE	SUITABLE HABITATS
1	*Delonix regia*	D/E	C	C	C	A,B,C,D,E,G	B,D,E	A, B	A,B,D
2	*Mangifera indica*	E	C	C	C	A, D, E, F,	-	A, E	B,D
3	*Plumeria rubra*	D	A	A	A	A, B, C	A, B	D	A, B
4	*Polyalthia longifolia*	E	C	A	C	A,B, C, D E,H	-	F	A, B
5	*Roystonea regia*	P	D	B	A	A, D, G	-	A,C, F	A,B,D
6	*Terminalia catappa*	E	C	C	C	A,B, E, F	D, E	C,F	B, D, E

7	*Pinus caribea*	E	D	A	C	A, D, F	-	C	A,B
8	*Elaeis guineensis*	P	D	C	A	A, D, E, F	-	C, E	A, B
9	*Tectona grandis*	D	D	B	C	A,B,C,E	E	B	A
10	*Dacryodes edulis*	E	B	B	B	A,B, C, D	A	E	B
11	*Gliricidium sepium*	E	B	B	C	G		B	B
12	*Samanea saman*	E	C	C	C	A, B, E, F G	E	B,E	D

Source: Ajewole and Oladiupo (2012): Evaluation and Users' View of Amenity Trees in the Premises of Selected Public Hospitals in Ibadan Metropolis

LEGEND FOR THE TREE ATTRIBUTES AND TRAITS PRESENTED IN TABLE 2

I. NATURE/TYPE OF TREES: D=> Deciduous, E=> Evergreen, P =>Palm

II. FINAL HEIGHT: A => Less than 8m (Short), B => 8-16m (Medium), C=>17-24m (Tall), D => Greater than 24m (very tall)

III. FINAL CROWN SPREAD: A => Less than 4m (Narrow), B => 4-8m (Medium), C => Greater than 8m (Wide)

IV. GROWTH RATE: A => Less than 0.3m (Low); B => 0.3-0.6m (Medium); C => Greater than 0.6m (High)

V. DESIRABLE TRAITS: A => Fine or interesting leaves, B => Foliage colour or colour change, C => Showy flowers, D =>Interesting tree form, E => Good shading effect, F => Hardiness or longevity, G => Nitrogen – fixation, H => Noise Mitigation.

VI. UNDESIRABLE TRAITS: A => Low crown base, B => Fragile or brittle branches, C => Top prone to wind throw, D => Formation of buttress root, E => Shallow roots, F => Aggressive searching roots, G => Non-erect or leaning bole, H => Thorns or sharp protrusions.

VII. ENVIRONMENTAL TOLERANCE: A=> poorly drained soil, B=> Infertile and skeletal soil, C => Drought, D => Shading, E => Strong wind, F => Salt spray, G => Air pollution

VIII. SUITABLE HABITATS: A => Pavement and roadside, B => Garden and open space, C => Hill slope, D => Parks and school grounds, E => Coastal, F => Sandy Beach

2. Institutional Issues in Sustainable Urban Forestry Development

The urban forest is influenced and managed by public policies set at many levels of government. Public policy is a broad term and difficult to define. However, it can generally be defined as some actions taken by government to manage/resolve issues of public concern. Many of these policies may not mention urban forestry specifically but they can still affect trees in a community. Managing the urban forest involves knowing about these public policies and how they work. It also requires working with groups and making

decisions about issues that cut across governmental, community, and ownership boundaries. There are public policies at all levels of government (Federal, State and local) that can impact the urban forest. Examples of different forms of public policy include legislation, regulations, resolutions, programmes, appropriations, administrative practices and court decisions.

2.1. Urban Forest Policy Stakeholders

USDA (Ibid.) identified some of the key public policy stakeholders capable of influencing urban forestry development to include:

2.1.1. Federal Government

The Federal government can directly influence urban forestry by means of financial support and technical assistance, such as the ecological fund in Nigeria. The Federal government indirectly impacts State and Local governments through decisions made by Federal courts and by Federal regulations.

2.1.2. State Government

State government also influences urban forestry by means of financial support, technical assistance, and legislation. Examples of financial support include allocated funds for urban forestry development. Technical assistance refers to a State agency's ability to help local governments, communities, organizations, or citizens in their efforts to improve and maintain the urban forest. A legislative example is enabling legislation that gives local governments the authority to pass local laws and ordinances. Within the State government there are departments, agencies, divisions, or commissions that may have policies related to urban forestry.

3.1.3. *Environmental Protection Agency*

The Environmental Protection Agency or related department has regulatory authority to protect water and air quality. This may include policies that address erosion control, non-point source pollution, buffers, rivers, and tree protection. Sometimes the environmental protection responsibilities will be under a natural resources department.

3.1.4. *Natural Resources Department/Unit*

This department usually oversees issues related to natural resources in the State. It may also deal with natural resource planning on regional scales and oversee public open space. In some States, environmental protection, State forestry agencies, and mining and reclamation are within the natural resources department.

3.1.5. *Fish and Wildlife Department/Unit*

Fish and wildlife departments typically are responsible for managing, protecting, and improving habitat for fish and wildlife in the State. They may also be involved in managing urban wildlife.

3.1.6. *Forestry Department/Unit*

State forestry agencies protect and manage the State's forest resources and provide assistance related to forestry, forest health, fire protection, urban forestry, and conservation education; they also may encourage voluntary implementation of forestry "best management" practices. They often formulate policy on forest-related issues.

3.1.7. *Transportation Department/Unit*

Transportation departments plan and oversee road building and maintenance. They may also establish regulations related to tree plantings and maintenance along highways and near billboards on State and Federal roads. The State transportation department may have policy that impacts trees in a community.

3.1.8. *Community Development Department/Unit*

The community development departments oversee a variety of issues that may include community planning and development, tourism, emergency management and historical sites. Urban forestry is often involved in many activities related to community development.

3.1.9. *Local Government*

Local government generally refers to cities, towns, counties, or parishes. Local governments enact laws to protect the health, safety, and general welfare of the community. While the local government may not have the broad influence that the Federal and State governments have, it does significantly affect policy related to urban forestry. Local governments traditionally have principal responsibility for managing and conserving urban forests and public open spaces. This responsibility may include planning, generation of revenue, staffing, implementation and enforcement of ordinances, and responding to the needs of the public. Asides the statutory roles of the above public institutions, Carter (1994) further collated diverse players with potential to influence urban forestry development (Table 3).
Furthermore, a range of public policy tools that can be used to meet the vision, goals, and objectives of the community's urban forest include: Comprehensive plan, Land-use plan, Ordinances, Variances, Subdivision regulations, Land-development permits, Performance standards or controls, Urban growth boundaries, Transfer of development rights, Acquisition of open space, Conservation easements, Conversions and Landowner tax incentives. Understanding these tools is important because their application impacts the community's forest and can be used to maximize the benefits and minimize the costs of the urban forest.

Table 3: Players with Potential to Contribute to Urban Forestry Development

State political administration	Politicians
State departments	Forestry
	Horticulture
	Agriculture
	Highways/roads
	Irrigation
	Utilities

Municipal Councils	Parks and Gardens
	Town planners
	Landscape architects
	Legal advisers
Environmental NGOs	International
	Local
Donor agencies	Bi-lateral (government to government)
	Multi-lateral
Corporate Business	Multi-national
	National
	Local
Academic institutions	Universities
	Other research bodies
Local groups of residents (organized or loosely knit)	Associated with the local school
	Associated with the local church/temple
	Environmental groups
	Harvesters of tree products
Individuals	Owners/managers of private tree nurseries
	Private tree growers
	Tree Wardens
	Harvesters of tree products, etc.

Source: Carter (1994): The Potential of Urban Forestry in Developing Countries: A Concept Paper

2.2. Urban Forestry Legal Environment

Another major institutional factor of importance is the legal framework for sustainable urban forestry development. Sustainable urban forestry development calls for deployment of one or two legal instruments. According to Grey (1996), the general legal environment in which urban forestry operates has three primary components; ordinances, regulations and liability considerations. It is important to examine each of them to assess their peculiar use in urban forestry development.

2.2.1. Ordinances

Urban forestry ordinances are city or local government codes concerning trees and related organisms within the urban set up. Ordinances are of two general types: those providing for management, and those concerning tree protection and landscape matters.

2.2.1.1. *Management Ordinances*

Management ordinances give authority, define responsibility and set forth minimum standards for safety and convenience. The effect is to charter city forestry programme and provide a legal structure for operations. Management ordinances generally have eleven basic elements:

i. Definition, ii. Designation and responsibility of city (urban) forester, iii. Establishment of a tree board/commission (composition, terms of office, duties, procedures), iv. Responsibility for trees on public property, v. Planting regulations (permits, official species, spacing, location), vi.

Maintenance standards, vii. Removal requirements and standards, viii. Catastrophic authority on private property (condemnation and treatment), ix. Requirements for private contractors, x. Prohibitions of interference and xi. Violations and penalties. It is important to note that legal requirements concerning trees may also be found in ordinances concerning other departments of city governments.

3.2.1.2. Tree Protection and Landscape Ordinances

Tree protection and landscape ordinances relate generally to special trees and groves, development and construction, and special landscape needs. Responsibilities of urban forest managers in these situations may include identification and classification of special trees, review of site and landscape plans, and design and enforcement of specification for tree protection during development. Special trees and unique groves are often protected by ordinance. Protection may be because of size, species, scarcity, and historical or cultural significance, position in the landscape or environmental contribution. Often referred to as tree preservation ordinances, such laws establish criterion for special trees and groves, allow them to be set aside, and authorize maintenance.

Ordinances relating to development and construction concern the maintenance of tree cover and the protection of trees. Tree cover requirements vary and may be expressed as a percentage of total land area, stems per unit of land area, and crown cover. Critical drainage areas, wetlands and other special ecosystems may also be included. Ordinances concerning special landscape matters are generally of two types; those that require tree planting and other landscaping for new development and those that relate to reduction in economic value, enjoyment of views, and general beneficial use because of location and establishment, growth or maintenance of trees.

2.2.2. Regulations

Regulations concerning urban forestry have the weight of law and might properly be considered as ordinances. They are considered separately, however, because of their purposes and origins. Regulations may be classified as those concerning homeowners such as subdivision regulations, those concerning program administration, and those based on state or federal legislation.

2.2.2.1. Subdivision Regulations

Most modern subdivisions have regulations for the "common good." Many properties also have deed restrictions that influence trees and other vegetation. Based on concern for maintenance of property values, public safety, environment and other factors, sub-division regulations encumber developers and subsequent property owners. Regulations concerning vegetation may include species selection, planting location, insect and disease control, and maintenance. Sub-divisions commonly have homeowners associations, with approval and enforcement authority vested in a board of directors or landscape committees.

2.2.2.2. Administrative Regulations

Administrative regulations on the other hand are requirements of city (state) government that facilitate or influence urban forestry operations. Included are registration and licensing requirements for arborists/horticulturists and other landscape operators, business permits and regulations concerning use and disposal of wood and other vegetative materials.

2.2.3. State and Federal Legislations

State and Federal Legislations in their own case are often reflected in city ordinances. State and federal laws have strong influence on urban forestry. Such laws concern both the natural and work environment and involve: Rare, threatened or endangered species, Wetlands or other critical habitats, Point and non point source pollution, Pesticides, Work place safety and Workers' rights.

2.2.4. Liability

Trees often pose threats to life and property. Entire tree may topple, branches may fall, leaves and fruit may create slippery surfaces, foliage and trunks may obscure views, and roots may heave sidewalks. Resulting accidents often leave property owners and those responsible for tree care liable for damages. Liability is based on the tort law principle of prudent and reasonable care. Thus, property owners and their agents have a responsibility to exercise such care. To city forestry departments, this responsibility translates into effective and on-going tree hazard management programme.

The Lagos State Government has taken a giant and emulative stride in laying the foundation for sustainable urban forestry development in the state and by extension in Nigeria by promulgating the Lagos State Parks and Gardens Law No 13 of 2011 which established the Lagos State Parks and Garden Agency. The goal of the law is to create a sustainable beautiful, safe and healthy State through the establishment of functional parks, gardens and recreational centres in line with international standards and best practices (LASG 2011).

3. Socioeconomic Issues in Sustainable Urban Forestry Development

Socioeconomic aspect of sustainable urban forestry development entails the incorporation of the interests and concerns of all the sections of the urban community into the overall planning of the urban forest. Thus the needs, perceptions and preferences of the various socioeconomic groups in the urban area have to be incorporated into the planning and management of the urban forest. This is essential because for instance attitudes and desired benefits from urban forest might vary with income groups, residential neighbourhoods, gender, educational levels, age, religion, culture etc.

The advantages of participatory urban forestry development include: engendering project's appropriateness, effectiveness and sustainability; reconciliation of conflicts arising from different socioeconomic background of urban dwellers; encouragement of the participation of urban dwellers in urban forestry development volunteer schemes; and reconciliation of different perspectives on the choice of species to be planted (Ajewole, 2008).

Incorporating people's needs, perceptions and preferences as well as the elicitation of participation in urban forestry development can be achieved through participatory planning. Planning techniques such as participatory planning and participatory evaluation can be used to design new integrated policy plans and implementation systems that achieve project sustainability more effectively. *Participatory planning* consists of including stakeholders in the project design, in various collaborative capacities, from identifying critical problems, to setting priorities and deciding on which strategies to adopt. On the other hand, *participatory evaluation* is a partnership approach to program evaluation in which stakeholders, who have the most at stake in the program, are actively engaged in developing and implementing the evaluation process. This consists of an inclusive process of knowledge sharing and capacity building to foster evaluation skills (*Avigya 2012*).

Urban forest managers and practitioners play a significant role in catalyzing stakeholder engagement in urban forest management. Practitioners can provide many different types of opportunities for stakeholders to learn about and become involved in urban tree planting and stewardship. Moskell et al. (2010) identified how some urban forestry practitioners provided good platforms for members of the public to participate in urban forestry development in United States. For example, Friends of the Urban Forest in San Francisco, California and Friends of Trees in Portland, Oregon offer a suite of educational opportunities for stakeholders who wish to gain knowledge or hands-on skills related to tree planting and tree care. The opportunities for involvement are diverse, ranging from events or programs that last a few hours, such as volunteer tree planting events, to longer training programs on skills related to urban forest stewardship. One example of an urban forestry training program is the —Citizen Pruner course offered by the non-profit organization TreesNY in New York City. Program participants take a four-week course to earn certification to legally prune street trees in the city. TreesNY and similar program models also train participants in street tree identification. Many municipal agencies, such as the New York City Department of Parks and Recreation, have recruited volunteers to assist city arborists in conducting street-tree inventories because properly trained volunteers can be equally proficient as professional arborists in tree identification.

Moskell et al. (Ibid.) also collated benefits attributable to public participation in urban forestry, from a number of studies to include: individuals' personal sense of satisfaction from planting trees and from taking action that improves their community; social interactions that occur between participants of tree planting events that are held within their neighborhood; long-term survival of urban trees and lower rates of tree mortality.

Ajewole (2002) identified four models by which urban dwellers can participate in urban forestry development. Process participatory model is the planning role whereby the public is involved in the process of decision making. Cognitive participatory model is the promotional role whereby an urbanite identifies with urban forestry project, but not necessarily participating in it physically. Interactive participatory model is an educational role that involves educating, motivating, organizing, guiding and preparing people for a particular task in urban forestry project. Lastly, material participatory model is the implementation role in which the public

actually contributes time, money, labour or other resources for implementing the programme. Furthermore, levels of participation range from passive (urbanites informed by unilateral announcements by administration and or management), to informed and active (urbanites are given information, are consulted and may play some active role), through to interactive and decision-making (urbanites play a major role or even lead an initiative).

Ajewole (Ibid.) discovered a great potential for participatory urban forestry development in Ibadan wherein it was revealed that 64% of the respondents were willing to contribute funds and participate in other ways in urban forestry project in Ibadan, while 77% was willing to join an environmental NGO to spearhead urban forestry initiative in the metropolis. Furthermore, Ajewole (2002b) also found out that 77% of respondents were willing to pay between ₦50 and ₦500 monthly for the rehabilitation of Ibadan metropolitan forest reserves. The study also observed that proximity of respondents' residence to the reserves had significant influence on their willingness to pay for the rehabilitation of the reserves.

In another study, Ajewole (2011) found out that being a house owner, being a pensioner, being a student and living in high class neighbourhood, have significant and positive influence on the willingness of Lagos metropolitan residents' willingness to support financially urban forestry development in the metropolis.

Conclusion

Urban forestry no doubt has a critical role to play in the attainment of the objectives of the green economy. However, for urban forestry to contribute optimally to the achievement of the green economy, adequate attention must be given to the technical, institutional and socioeconomic issues germane to sustainable development of urban forestry.

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