Characterisation of Urban Forest Nurseries: A Case Study of Harare Suburbs in Zimbabwe

Silas Mufambi Mudyiwa*, Tendayi Nyamugure, Tendai Chitagu, Alfred Kundhlande

Department of Environmental Science, Bindura University of Science Education, Bindura, Zimbabwe

Abstract

The study aimed to characterise urban forest nurseries with respect to nine Harare suburbs. Dzivarasekwa, Epworth and Kambuzuma represented high density suburbs, while the medium density was represented by Mabelreign, Waterfalls and Warren Park with Highlands, Chisipiti, and Mandara representing low density suburbs. Stratified random sampling was used to select the study sites. Data collection was carried out using structured and unstructured questionnaires, key informant interviews and observations. Data were analyzed using statistical package for social sciences (SPSS) version 16 through one way Analysis Of Variance (ANOVA). A total of 40 nurseries were identified within the suburbs and the key players in the business were individuals (83 %), non-governmental organisations and public organisations. There was a significant difference between the number of nurseries located in the high and medium density suburbs and those in the low density suburbs. Males dominated the trade (85 %) than women. Most nurseries (65 %) were compliant in terms of registration though few could not meet the registration requirements. Nursery operators were constrained by finance, limited operational space, theft and irrigation water. It is recommended that training be done in nursery management. Associations can also be helpful in gaining recognition by City Council and EMA and this can harness opportunities for thriving business.

1. Introduction

Plants are a very important component in urban areas (Arnold, 1993). They play major environmental, aesthetic and social roles (King and Davis, 2007; Nowak *et al.*, 2006; Tyrvainen *et al.*, 2005; Maco and McPherson, 2003; Akbari *et al.*, 2001; Becket *et al.*, 2000; McPherson *et al.*, 1997) hence the need for their presence both inside and outside living areas (Ajewole, 2001; Joshi, 1999; Olutayo and Loto, 1990). As the urban areas expand, the demand for residential land and fuel wood increases leading to decimation of greenbelts (Rotshetko *et al.*, 2008). To mitigate this urban forestry should be strengthened through plantings from nurseries and wildings.

Urban forestry is the management of trees and their contribution to the physiological, sociological, and economic well-being of urban society (FAO, 2009). It is multifaceted and includes a great variety of habitats which are not limited to streets, parks and derelict corners where trees bestow a great variety of benefits and problems. Most of the planting stock is established in nurseries which are either privately or publicly owned.

Nurseries can contribute substantially to the development of a country's economy (Keith, 1990; Tonne, 1963). They are an

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* Corresponding author

E-mail address: silasmudyiwa@gmail.com (S. M. Mudyiwa)

economic activity which can create viable employment for a number of families in a country (Bota, 2008) and provide invaluable service to the fast growing landscape and floricultural industries. This has seen sprouting of nurseries along major roads, streets and private homes in a bid to avert the prevailing economic hardships and unemployment situation in Zimbabwe.

Public environmental concerns will make the nursery business in cities continue to create demand for ornamentals (Babalola and Agbeja, 2006), however, there is limited information on the activities of the urban forest nursery enterprises in Zimbabwe. It is against this backdrop that this study was initiated to provide useful information on environment, management and practices so that operators can be better supported. This will also help to identify sound

strategies to harness available opportunities to address the problems on the ground and stimulate more interest in the enterprise.

2. Materials and Methods

2.1. Study Area

The study was carried out in Harare which is located in the Northern side of the country and lies between longitudes 31˚01' East and latitudes 17˚51' South (Fig 1). It experiences wet summers from October to mid-April. Mean annual rainfall is above 1000 mm. The average maximum and minimum temperatures are 24˚C and 17.9˚C respectively. Temperature is highest in October and lowest in June. The climate supports a natural vegetation of the open woodlands.
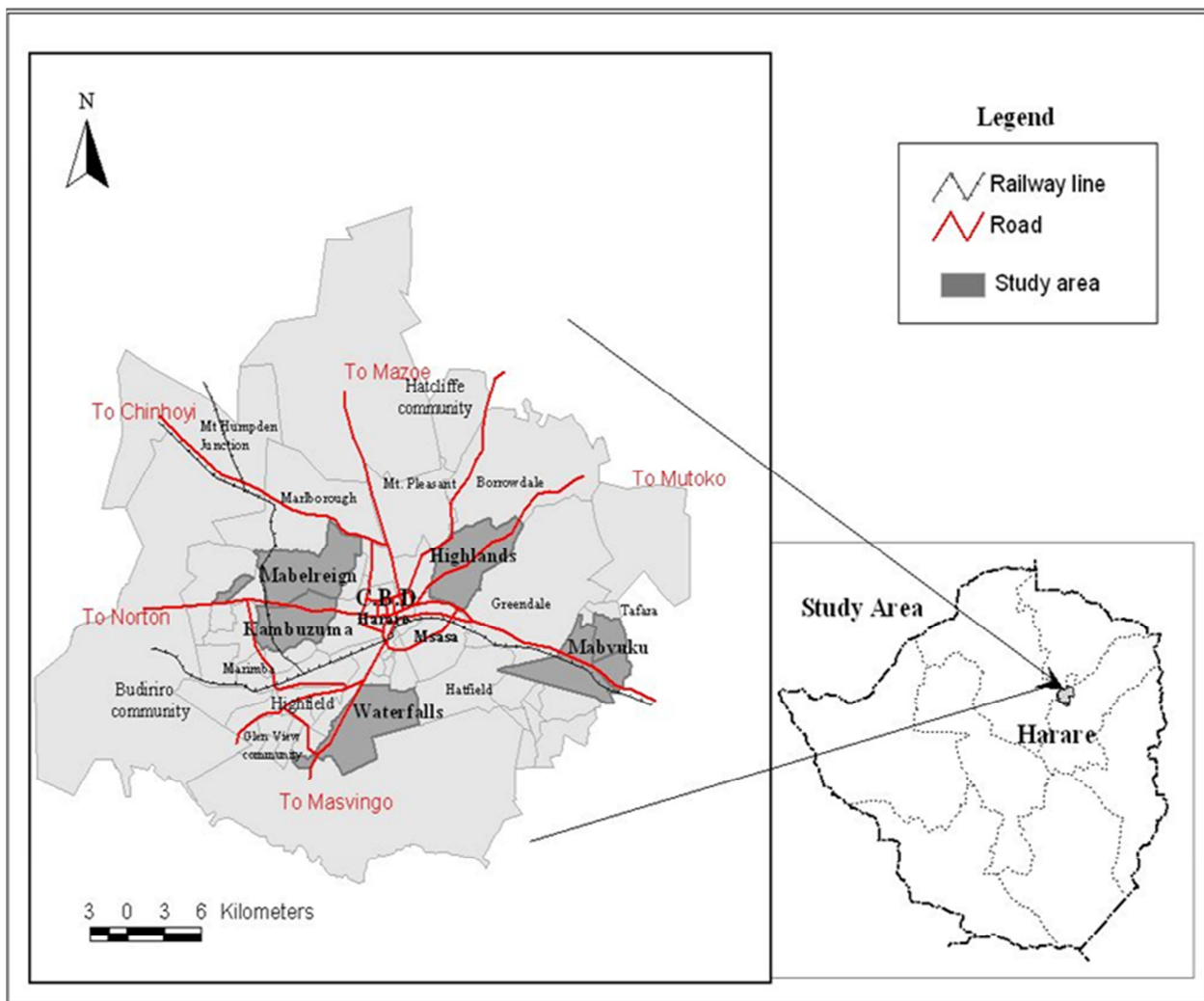

Figure 1. Map of Harare showing selected residential suburbs.

Data collection was conducted in three high density suburbs (Dzivarasekwa, Epworth and Kambuzuma), three medium density suburbs (Mabelreign, Waterfalls and Warren Park) and three low density suburbs (Highlands, Chisipiti, and

Mandara).

2.2. Research Design

Harare residential map was used to identify different density

suburbs and the suburbs which fall under each density category of suburbs thus, high, medium and low. Stratified random sampling design was employed for this study. A sampling intensity of 40% was used for the study. Stratified random sampling was used because there was assurance of total representation of the small minority.

2.3. Sampling Technique

Stratified random sampling was used to select the urban density suburbs. Firstly, Harare suburbs were divided according to their respective grouping thus, high, medium and low density suburbs because these suburbs have different characteristics. Randomisation was done using computer generated random numbers to select suburbs in each category, and it was done for each strata. This was done to come up with a manageable sampling unit. In each category, suburbs were selected as shown on Table 1. In the high density suburbs Dzivarasekwa, Epworth and Kambuzuma were selected. The medium density was represented by Mabelreign, Waterfalls and Warren Park, whilst Highlands, Chisipiti, and Mandara represented the low density suburbs.

Table 1. Number of sampled suburbs per each category.

Site Description	Number of sampled suburbs
Site 1(High density suburbs)	3
Site 2(Medium density suburbs)	3
Site 3 (Low density suburbs)	3

3. Data Collection

3.1. Key Informant Interviews

The key informant interviews were done with a Forestry Commission Extension officer based in Harare, City of Harare officer and urban forest nursery owners. Snowball sampling was used to locate other forest nurseries within the selected suburbs under study.

3.2. Questionnaires

A pretested questionnaire containing both closed and open ended questions was administered to nursery operators. Observations were done also to verify some of the information like species grown, type of materials used and size of nurseries.

3.3. Data Analysis

Aside from the use of standard descriptive statistics, the study analysed data using statistical package for social sciences (SPSS) version 16 and one way Analysis Of Variance (ANOVA) was used for data analysis (Baily, 2008).

4. Results

4.1. Distribution of Nurseries

A total of 40 nurseries were found in the study area. The high density suburbs had 7 nurseries, 10 nurseries in the medium density suburbs and 23 nurseries in the low density suburbs. There was no significant difference ($p > 0.05$) between the number of nurseries found in high and medium density suburbs. However, there was a significant difference ($p < 0.05$) in numbers of nurseries found between low density and high and medium density suburbs (Table 2).

Table 2. Location of Nurseries.

Location of suburb	Total no. of respondents	Mean no. of nurseries (±SD)
High density suburb	7	2.33±1.16[a]
Medium density	10	3.33±1.53[a]
Low density	23	7.67±1.53[b]
Total	40	

[ab] Means within the same column with different superscripts are significantly different at $p < 0.05$

There were fewer nurseries in high density suburbs as compared to low density suburbs because there is low business in high density suburbs. People who live in low density suburbs have more appreciation for trees as they use trees and flowers for landscaping at their homes. They have also more yard space which they can utilize for trees, shrubs and gardening than in the high density suburbs which do not have such yard space for that. However, Poincelot (2004) noted that the best location for nurseries is in areas experiencing major construction activities irrespective of land value and that already built up areas offer less promise. Basweti et al. (2000) coined that these nurseries also contribute a lot to the ecology of a city as they are located along the roads with diverse tree species and thus contribute to the green 'look' of the city.

4.2. Players in the Forest Nurseries Business

The key players in the nursery business were individuals (83 %), non-governmental organisations (NGOs) (10 %) and the public organisations (Forestry Commission and Harare City Council) (7 %).

Individuals were into the business as entrepreneurs and this was their sole source of income. Most of the seedlings (93 %) they raised were mainly for sale, 5 % for own use and 2 % for free distribution. They ventured into nurseries because of the high rate of unemployment in the country. The issue of indigenisation also influenced many people to start their own business ventures. This is contrary to Mason (2004) who saw nursery business as a business used to provide supplementary income to the family budget.

Nurseries also serve as an important source of employment and provide support for both skilled and unskilled labour, married and single urban dwellers (Fakayode et al., 2008). Some nursery operators (individuals) were contracted by funeral service providers to propagate trees for them. The funeral service providers plant a tree after every burial they do and they call themselves 'Friends of the Environment'.

NGO's main aim of establishing nurseries is to support reforestation and afforestation programmes to augment government efforts. Of the seedlings they produce, 75 % is for their own use in community projects, 23 % free distribution and 2 % for sell.

Public organisations mostly produced seedlings for their internal use (60 %), for sale (20 %) and free distribution (20 %).The Harare City Council nurseries provide plants for the aesthetic (beautification) value of the city in the form of different trees and flowers which they plant along the roads and in pavements although they sell some of their seedlings to individuals and other organisations. The Forest Commission raises plants for sale and for its reforestation programmes which are commemorated on the first Saturday of December every year known as the National Tree Planting Day.

The dominant group of individual operators were in the age group 31-40 years constituting 42.5 %. The age group 20-30 years constituted 35 % with those in age group 41-50 years constituting 7.5 % and those above 50 years twice as much (15 %).There were more males (85 %) involved in the urban forest nurseries than females. The high percentage of males engaged in the nursery business conforms to similar findings by Fakayode et al. (2008), who found out that males dominated nursery business in Nigeria. The low percentage of women is worrisome given the level of women empowerment in Zimbabwe.

4.3. Land Ownership and Nursery Size

A significant proportion of the operators (63 %) leased land from the City of Harare, whilst 15 % owned the land they were operating on, 12 % were operating on open spaces (illegal makeshifts on City Council land or servitudes) and 10 % were operating on inherited lands. Generally operators had small pieces of land for nursery production (Fig. 2) with the majority (40 %) having between 400 and 700m^2. A small proportion (10 %) had more than 1000m^2 and 15 % between 700-1000m^2. The small sizes of nursery indicates limited land and scarcity in the city which concurs with Fakayode et al. (2008) who found small retail nurseries ranging between 2.4m^2 and 123.6 m^2 though Diver and Greer (2008) defines a small nursery as a nursery with fewer than 500 m^2 of container production or fewer than 1500 m^2 of field production.

4.4. Operation of Nurseries

A small proportion (35 %) of nursery operators had no management or seedling production training while the majority (65 %) of operators had gained their knowledge from attending formal training. Those who had formal nursery management courses were running public, NGO's or registered nurseries. Those who had no nursery management courses had obtained their knowledge from their former employers. They would have once been employed on other famous nurseries and this had influenced them to start their own nurseries. Some operators would also get short training courses on nursery management from other operators (Basweti et al., 2000) who use their nurseries also as educational centres for primary and secondary school pupils at surrounding schools.

Some nurseries were operating illegally (45 %) because they were not registered whilst a significant percentage (55 %) of the nurseries were registered and recognised. Nurseries in Zimbabwe have a regulation that governs their establishment and operation. Some operators were not registered because they were failing to meet inspection requirements and some were failing to raise registration fees. Some even showed ignorance of the requirement. Failure to get registered contributed to the harassment they received from the Environmental Management Agency (EMA) who in some cases apparently could not recognise their business permits offered by the City Council.
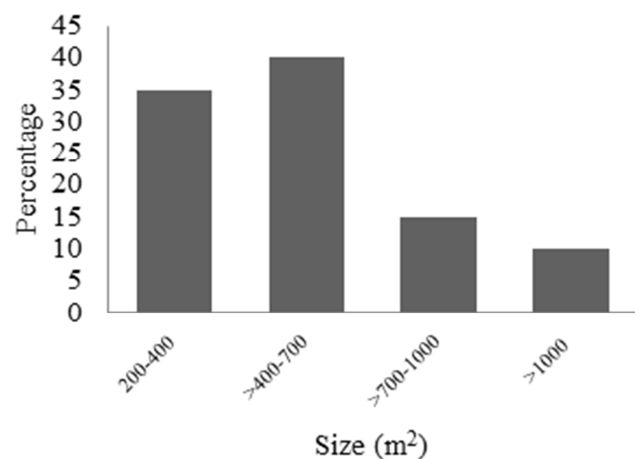

Figure 2. Sizes of nurseries.

4.5. Germplasm Source and Propagation Equipment

All nurseries whose plants were propagated from seed (22.5 %) used seed collected from various locations. Most operators (50 %) purchased seed from The National Seed Centre at the Forestry Commission Head Office or from reputable private dealers and the remainder collected from various locations. Those who collected seeds on their own

reported that the germination percentages and performance of their seed was satisfactory. The practice of seed collection is detrimental to the genetic quality of the resulting seedlings. Ideally, germplasm should be collected from selected superior mother trees that are growing far from each other to ensure high genetic quality and to promote high genetic diversity of seedlings (Mulawarman et al., 2003). In Ghana nursery operators preferred buying seed from a certified source where they can obtain certified planting materials (Asiedu et al., 2012).

The bulk of operators (60 %) raised their seedlings in seedbeds and pots, (20 %) in seedbeds, trays and pots while (15 %) in trays and pots and only (5 %) in pots only. Seedbeds and pots were mostly used because they regarded them as easy to manage. This was also caused by financial constraints as using seedbeds was cheap for them. In their investigation Diver and Greer (2008) found out that container growing was the most popular form of nursery production and that it was used to raise about 80 % of plants produced in a nursery.

4.6. Species Grown in Urban Forest Nurseries

Urban forest nurseries were producing a number of varieties of species and the most species propagated were *Eucalyptus grandis, Acacia karoo, Croton megalocarpus, Mangifera indica* and *Moringa oleifera*. Most of the tree species were propagated from seed while some few fruit trees were vegetatively propagated through grafting.

Table 3. Species propagated in the nurseries.

Suburb category	Species	Number of nurseries
High density	*Eucalyptus grandis*	7
	Acacia karoo	7
	Mangifera indica	6
	Persia americana	7
	Moringa oleifera	5
	Croton megalocarpus	7
Medium density		
	Brachystegia spiciformis	5
	Eucalyptus grandis	10
	Mangifera indica	10
	Psidium guajava	8
Low density		
	Pinus patula	22
	Croton megalocarpus	23
	Eucalyptus grandis	20
	Acacia karoo	14
	Moringa oleifera	20
	Psidium guajava	18
	Brachystegia spiciformis	15

5. Challenges Faced by Urban Nursery Operators

Urban forest nurseries optimal operations were restricted by various problems. The challenges identified by respondents were:

5.1. Lack of Financial Support

The urban forest nurseries were having financial problems thus, they were failing to meet their different targets for production outputs due to lack of money to buy polybags, seeds and to pay their employees. Finance was the major challenge nursery operators were facing, so they were failing to produce the seedlings they want because it required lots of money. Fakayode et al. (2008) similarly identified inadequate funding as a major constraint to ornamental plant production.

5.2. Unreliable Source of Irrigation Water

Water was a problem affecting nursery production. Water scarcity is a perennial problem in Harare suburbs and has led urban forest nurseries to reduce the number of trees they used to produce because of water shortages. Seedlings were dying due to lack of water.

5.3. Soil Supply and Nutrition

Potting soil was a problem in their nursery business. Due to increase in urban agriculture and high deforestation rates, the gwashas where they used to collect potting soil had disappeared. Soil supply and nutrition has an impact on the production of urban forest nurseries because legislation does not allow for soil excavation within the nursery locality and this was a challenge to urban nursery operators.

5.4. Failure to Meet Operational Standards and Regulations

Operators were often raided by EMA and the City Council for inspections and compliance to standards and regulations. Failure to produce required working documents would result in harassment especially with the City Council. Indigenous tree seedlings were taken away by EMA if operators were not in possession of a licence which permits them to sell indigenous trees and they would not be able recover them.

5.5. Land Ownership

Most of the nurseries were on lease (63 %) so they wanted permanent places to establish permanent nurseries. Some would use the servitude areas which would always result in them being raided and harassed by the City council as they would be operating illegally on forbidden land.

5.6. High Competition Among Harare Urban Forest Nurseries

High demand of trees for landscaping, mining reclamation and also from tobacco growers had led to high competition on prices and quality of seedlings produced in these nurseries especially for eucalypts and this affected newly established urban forest nursery operators who had just joined the nursery industry.

5.7. Theft Cases

Most of the urban forest nurseries were located along the roads. Theft cases are many because some nursery operators cannot afford to have security guards to look after their seedling over the night.

5.8. Distribution of Free Seedling by other Players

Private nursery operators were having some problems with organisations which provided seedlings for free. It greatly affected the upcoming nursery operators and even those who had been into the industry for a long time. This had a negative impact on entrepreneurs whose aim was to make profit.

6. Conclusion

Entrepreneurs, NGO's and the government were the key players in urban forest nurseries. The majority of players were individual entrepreneurs. The propagation equipment involved trays, seedbeds and pots. Propagules used in these urban forest nurseries were seed and vegetative methods such as budding, grafting and cuttings. These urban forest nurseries have a vital role in the nurturing and distribution of tree seedlings. They were the main sources of seedling hence; there is a great need to support these urban forest nurseries. However, the nurseries faced operational challenges such as financial constraints, unavailability and unreliability of water.

Recommendations

Training in record keeping is advisable to the urban forest nurseries operators for proper management of income from sales to cater for the operational costs of the nurseries such as buying of polybags, soil and seeds. Also urban forest nurseries operators should be advised on water use efficiency and storage in order to help in the proper utilisation of this limited resource. Urban forest nurseries operators should be encouraged to form associations for the sake of marketing and training.

Associations can also be helpful in gaining recognition from the City Council and EMA for compensation in cases where seedlings are taken or damaged, for example by road construction work and training nursery operators and seed dealers in seed collection procedures as well as encouragement in establishing alternative sources for seed, such as seed orchards. This will help to ensure a healthy tree population for the present and the future and create self-reliance. Since there is high competition among the urban forest nurseries operator's market research is of high importance for the urban nursery products.

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