UNDERTAKING A TREE AND URBAN FOREST ASSESSMENT IN THE CITY OF JOHANNESBURG

Elize van Staden, Lecturer UNISA, PhD candidate

Research project team: Elize van Staden, Prof Willie Nel and Prof Hennie Stoffberg

1. INTRODUCTION

The urban forest is an important component of green infrastructure in a city and provides economic, social, health, visual and aesthetic benefits to the city and the people that live there. The protection of the urban forest is crucial to maximise the benefits and value of this green infrastructure asset. Scientific proof exists to indicate that the urban forest reduces crime, air pollution, climate change, electricity consumption and floods and storm water damage and increases property values, commercial and retail sales, improves health and wellbeing as well as both fauna and flora. All of which translates to monetary benefits to the people and the municipality. These benefits are of critical importance to the poor and previously disadvantaged people and community of the city.

Recently the University of South Africa (UNISA) completed a research study of the urban forest of the City of Johannesburg. The project consisted of two sections. The first section consists of an estimation of the monetary value of the carbon stocks captured in the 200 000 street trees as part of the Greening of Soweto initiative for the 2010 FIFA World Cup. The standing carbon value as well as a projected value over a period of 30 years were calculated. These results indicated a need to investigate the direction or “Quo Vadis” and actions required to further develop the urban forest of the City of Johannesburg with the final aim to develop a strategic management plan for the urban forest.

If tree planting and maintenance in city parks and other green spaces are proven to benefit neighbourhoods, then monetary commitment to urban forestry efforts will be justified (Millward & Sabir, 2011).

This paper presents the project processes applied to complete the carbon sequestration valuation and the development of a strategic management plan, in separate phases, for the City of Johannesburg.

2. THE URBAN FOREST OF THE CITY OF JOHANNESBURG

The City of Johannesburg has claimed to be the largest man-made urban forest, with between six and ten million trees in public parks, private gardens, and planted as street trees, on pavements. On satellite pictures, the northern suburbs of the city closely resembles a rain forest (City of Johannesburg, 2003), yet this entire area used to be savannah grassland scattered with shrubs prior to the establishment of the city in 1886 (Mail & Guardian, 2012). Farmers and settlers brought seeds from exotic fruit and ornamental trees with them, from the Cape, Natal as well as overseas, and planted them in the area. By 1904 a parks department had been established, to take of the city's

parks and public trees and they continued planting exotic trees mainly in what is today known as the northern suburbs of the city (Mail & Guardian, 2012).

These days, Johannesburg boasts some wonderful parks, filled with hundreds of trees that form part of the urban forest of the city. Although most of the trees in the older parks of the city are exotics, such as Jacaranda, Eucalyptus and English Oak, they live happily alongside the indigenous trees. There are parks that are planted only with indigenous trees, plants and shrubs such as The Wilds in Parktown - a beautiful public garden and the Walter Sisulu National Botanical Gardens in Roodepoort that consists of around 300 hectares of landscaped and natural veld areas, planted with only indigenous trees, plants and shrubs (City of Johannesburg, 2003).

Up to the end of the apartheid era, street trees were planted and public parks mainly developed for beautification purposes of the historically affluent northern white suburbs in the city. Schaffler and Swilling (2013) stated that there is noticeably an unequal distribution in the extent of tree canopy cover between the north and south of the city. They also indicate that the tree canopy cover of the northern suburbs is approximately 24.2 percent of the total area while tree coverage in the poorer southern suburbs is approximately 6.7 percent. Therefore, the focus on greening only the northern suburbs of the city, resulted in what is known as the “green divide” between the affluent northern white and poorer black townships in the south (Schaffler and Swilling, 2013).

3. THE GREENING SOWETO PROJECT

The Greening Soweto Project was launched, by Mayor Amos Masondo, in 2006 with the planting of 6000 trees in 10 minutes and the target to plant 200 000 trees were reached in 2010, just before the start of the FIFA World Cup (City of Johannesburg, 2011). The aim of the project was to transform dustbowls and landfill sites towards winning parks and eco-services and eliminate the “green divide” a legacy of inequality, by separation between the wealthy north from the dusty south west (Johannesburg City Parks s.a). This greening initiative became one of the mayor’s Legacy Projects with the aim of ensuring that the benefits of the 2010 FIFA World Cup extend beyond the event (City of Johannesburg, 2011).

The development of regional parks, planting trees, beautifying road islands and installing outdoor recreational facilities were some of the steps taken by City Parks to green the landscape as part of the legacy project. Residents and school children were particularly encouraged to participate in the implementation to promote ownership and custodianship. Trees were planted on main arterials and in Soweto and other townships, where there is limited space on pavements, trees were given to residents to plant and care for in their home gardens (Johannesburg City Parks s.a).

On 8 November 2010 Johannesburg City Parks, now called Johannesburg City Parks and Zoo (JCPZ) won a gold Liveable Communities Award for its Greening the City legacy project, which addresses the environmental disparities in Joburg at the UN-endorsed Liveable Communities (LivCom) Awards in Chicago, in the United States. The Greening the City legacy project impressed

the judges as it focussed on balancing the distribution of the urban forest throughout the entire city, and brought a green environment to the entire population of Johannesburg.

The first part of the research project is the estimation of the carbon stocks of the trees planted during the Greening Soweto Legacy project.

4. CARBON SEQUESTRATION

Trees in urban areas store carbon and sequester carbon as they grow. This carbon can be emitted back to the atmosphere after tree death by decomposition. Thus, urban trees influence local climate, carbon cycles, energy use and climate change. The estimation of carbon storage and sequestration can provide information, which can be used to help assess the actual and potential role of urban forests in reducing atmospheric CO_2 (Nowak et al., 2013).

4.1 PROJECT PROCESS

A pilot study was conducted between February and May 2016 to provide an example of the conceptual information, the data to be collected for the project and to determine the sample size. Data were collected in two of the seven regions in the city. One of the regions is deemed to be representative of a previously majority white area representing the northern region of Johannesburg and the other region was the greater Soweto and represents the neglected southern regions during the apartheid era. Data were collect from 20 individual randomly selected trees per species, per suburb, which represent trees planted at the same age during the same planting period/year. Data collected included the tree circumference at ground level (DGL at 50mm from the basal flare) and the tree circumference at breast height (DBH at 137mm from the basal level). This data was used to calculate and determine the net carbon currently stored by the trees as well as for calculating carbon sequestrated since planting. The data collection was conducted from March 2017 and was concluded in July 2017 and a total of 2354 trees were measured. This is approximately 13% of the trees found in the regions after planting.

The carbon stock was calculated for indigenous trees only as very few exotic trees were planted during this project and they were therefore excluded from the results. The carbon calculations are based on the whole tree biomass estimates, which include both below and above ground biomass and is based on the methodology presented by Stoffberg et al., (2004 and 2010).

Carbon was calculated for each individual tree and then combined, to extrapolate to a potential projected total estimated CO_2 sequestration for all the trees planted during the Greening Soweto project. The value of the projected carbon dioxide stocks that were sequestrated, is determined by applying the carbon tax of ZAR120.00 per metric tonne of CO_2, proposed by National Treasury (Department: National Treasury, 2013).

The results indicated that if all 200 000 trees planted during the Greening Soweto project were still growing the standing carbon stocks are 13 539 221.69 kg CO_2 with a value of would be

R1 760 096.00 and the projected carbon stocks over a period of 30 years would be 729 271 tonnes CO_2 with a value of R94 805 230.00.

The scientific proof of the climate mitigation monetary value of the urban forest should provide evidence to secure funding for sustainable maintenance of the forest and to motivate the planting of additional trees

McPherson et al, (1994) states, carbon storage by individual trees is as much as 1,000 times greater in large than small trees, with sequestration rates as much as 90 times greater for healthy large than healthy small trees. Thus, to maximize carbon storage and sequestration from urban trees, it is necessary to ensure the survival and vigour of large trees and secure longevity of all planted trees. They also advise that urban forest managers should implement strategies to ensure optimum tree growth to maximize the carbon sequestration benefit of urban trees on atmospheric CO_2. Strategies should include sustaining or improve existing tree health, minimizing losses due to tree mortality and breakages as well as establishing more trees in the urban environment. Therefore, the development of a road map and action items leading to the development of a strategic management plan for the City of Johannesburg followed as the second step of the research project.

5. DEVELOPMENT OF A ROAD MAP AND AN ACTION PLAN

The urban forest includes all the trees and vegetation in streets, parks, privately owned and government owned gardens, campuses, commercial areas, natural areas, balconies and green roofs (Sangster, Nielsen & Steward, 2011; Escobedo, Kroeger & Wagner, 2011 & Roy et al., 2012). Welch, (1994) identified the two major components of the urban forest as park trees and street trees and deduced that the street tree component of the urban forest varies significantly from the other components of the urban forest necessitating different planning and management strategies.

The urban forest is inseparably tied to communities and the environment and it should be managed differently than rural forests (Dwyer, Nowak, & Noble, 2003). A comprehensive approach to planning and management is required that considers all the trees in the urban area as well as competing land uses, ownerships, and community values and is integral to shifting from reactive to proactive management of the urban forest (Nowak, Stein, & Randler, 2010). Urban forestry is a modern approach to urban tree management and focusses on safeguarding the health and vitality of the urban forest and therefore, the sustained provision of benefits, now and in the future (Kuchelmeister, 1999).

5.1 PROJECT PROCESS

A number of workshops were held from 2015 to 2017 where UNISA and JCPZ management and staff were represented and discussed the requirement of urban forestry strategic and management planning to be included in management planning documentation of the city. This information was integrated with a literature study and a few draft documents later a final Roadmap and Action Plan was compiled. This document presents the individual activities of the separate Action Plan items and

provides a detail description of the requirements of the activities to guide implementation. A final presentation was made to selected JCPZ stakeholders in February 2018.

As background the document provides detailed explanations with motivations and implementation steps in the form of individual action plans on a range of urban forestry concepts. Concepts discussed are:

- Urban forestry management planning documentation available and used worldwide and in South Africa;
- The need and methods to involve the local community in the urban forest; to complete a copy cover assessment; to complete a tree census and inventory; to determine the value and benefits of the urban forest. Quantifying tree canopy cover has been identified as one of the first steps in the management of the urban forest (Escobedo and Nowak, 2009 & Nowak et al., 2010). Canopy cover data, in conjunction with gathering structural data on ground level (eg. tree height, stem diameter, species composition and tree health) in an urban forestry tree inventory, will provide opportunities for comprehensive urban forest planning and management (Nowak et al., 1996).
- The importance and process to improve species diversity and composition in the urban forest;
- Methods used to identify space for new tree planting;
- The importance of and available tools that can be applied to conduct tree evaluation and risk assessment;
- The contribution of the urban forest can make towards climate change and how to determine carbon sequestration;
- The need to apply global best practices in the establishment and maintenance of the urban forest and
- The identification and management of champion trees.

The road Map and Action Plan also highlights the departments responsible for these actions. The roadmap strategy is divided into five objectives each with respective action plans, to provide strategic direction for the creation, implementation and management of an urban forestry management plan.

OBJECTIVE 1: Development of a Policy to guide and underpin the management of the urban forest of the City of Johannesburg.

- The urban forestry policy will link with existing policies of the City Council and specifically with the policies of JCPZ.

- The aim of the policy is to create a clear vision and guiding principles for all the stakeholders of the urban forest.

- Action plan to provide information to guide the planting, survival and improvement of trees in the city.

- Provides details on the benefits to the community
- Policy to include public and privately owned trees

OBJECTIVE 2: Complete a comprehensive assessment of the urban forest of the City of Johannesburg

- A tree census is required for the whole City of Johannesburg ensuring all the trees are identified and counted in all the Regions. Following from that a comprehensive assessment and tree inventory of the urban forest is required to determine the extent, potential risk, value and benefits of the urban forest.
- The data from the tree assessment can be used to model urban forest functions such as air pollution mitigation, carbon sequestration and quantify the benefits of the urban forest.
- The benefits provided by urban trees are crucial for managing urban forests and establishing the value of the asset of the city**.**

OBJECTIVE 3: Development of an Urban Forestry Management Plan for the City of Johannesburg

- Urban Forestry Management Plans are the defining documents enacting urban forest management and is used worldwide to justify the existence of an urban forest programme including budgeting and staffing purposes.
- It provides a framework for decision-making, documentation and standardised processes to ensure consistency in the management of the urban forest taking the current state and the future goals into account.
- An Urban Forestry Management Plan provides the ideal situation of the management of the urban forest. It is a master plan that provides the scope of the ultimate situation that will be ideal and links directly with global best practices.

OBJECTIVE 4: Development and implementation of operational plans to connect the strategic priorities with management activities

- Operational management plans connect the strategic priorities in the UFMP with day-to-day functional and operational activities and are usually specific to one task such as pruning or maintenance, and contains schedules and best management practices.
- The operational management plans will state what is needed to manage the urban forest, describe the activities and required services to execute these responsibilities.

OBJECTIVE 5: Develop a Measurement, Reporting & Verification (MRV) process and managing reporting review to ensure continuing improvement of the management of the urban forest

- Process needed to ensure continuing improvement in the management of the urban forest
- Internal assessment of all the related policies and procedures
- Ensure valuable reporting to management and all stakeholders

“Urban forests have to be actively managed (that is, receive a regular budget) on a long-term basis for their return on investment to be optimal.” If such management is in place, cost efficiency of urban forestry compares well with other management measures to reduce pollutant emissions in the city (Goosen, 2016).

The suggested next step in the implementation of this Roadmap and Action Plan would be to appoint a responsible person who can take ownership of the project, involve all the relevant departments in the City of Johannesburg and manage the project effectively.

6. CONCLUSION

The results from the study indicated that tree planting projects can be used as a method to increase the carbon sequestration value of an urban forest. Future tree-planting programmes should be carefully planned taking cognisance of the location of the planting, choice of tree species, planting and maintenance specifications as well as the future implications of the tree-planting programme on the capacity of the entity responsible for the management thereof.

It is anticipated that this project would become an opportunity to the city that could enhance the management of the existing urban forest based on scientific research findings. It is also anticipated that the results of this study may also capacitate JCPZ in terms of capital and operational financial resourcing for a sustained and advanced urban forest.

This Roadmap and Action Plan forms part of a larger PhD study and research project on the urban forest of the City of Johannesburg. The study is being carried out by the Department of Environmental Sciences in the College of Agriculture and Environmental Sciences of UNISA. It is envisaged that this information will be utilized in future publications on this topic and related topics.

This research has also identified opportunities for further research to ascertain the primary causes of tree mortality in parks and streets, with the aim to limit mortality and improve the value of the urban forest. The need, creation and implementation of best management practices required to promote tree survival including aspects such as the choice of tree, planting and maintenance specifications as well as improving the species diversity of the trees in the urban forest was also identified.

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