Carbon Sequestration of Trees in Orlando West Park and Chris Hani Street, Soweto South Africa

Ms EM van Staden
Prof GH Stoffberg
Prof WAJ Nel

Define tomorrow.

UNISA | university of south africa

Contents

- Project Background
- Pilot Sites
- Research Aim
- Methodology

Elize van Staden

- Results and Discussion
- Recommendations
- Concluding Remarks
- The Way Forward

Prof Hennie Stoffberg

Project Background

Project Background

Valuing the urban forest as a **green asset** and a **green infrastructure component** to enable the quantification of its **monetary value**, to enable the **motivation** for **preservation**, **maintenance** and **increase** in capital and operational **expenses**

Project Background

- Estimated **220000** trees planted during the run-up and after to the **2010 FIFA World Cup**

- The project became known as the **"Mayoral Greening of Soweto Project"**

- UNISA is tasked to **determine the carbon storage** of the trees planted.

- It was decided to use **Chris Hani Street** and **Orlando West Park** in Soweto as the **pilot** sample sites.

Pilot Sites
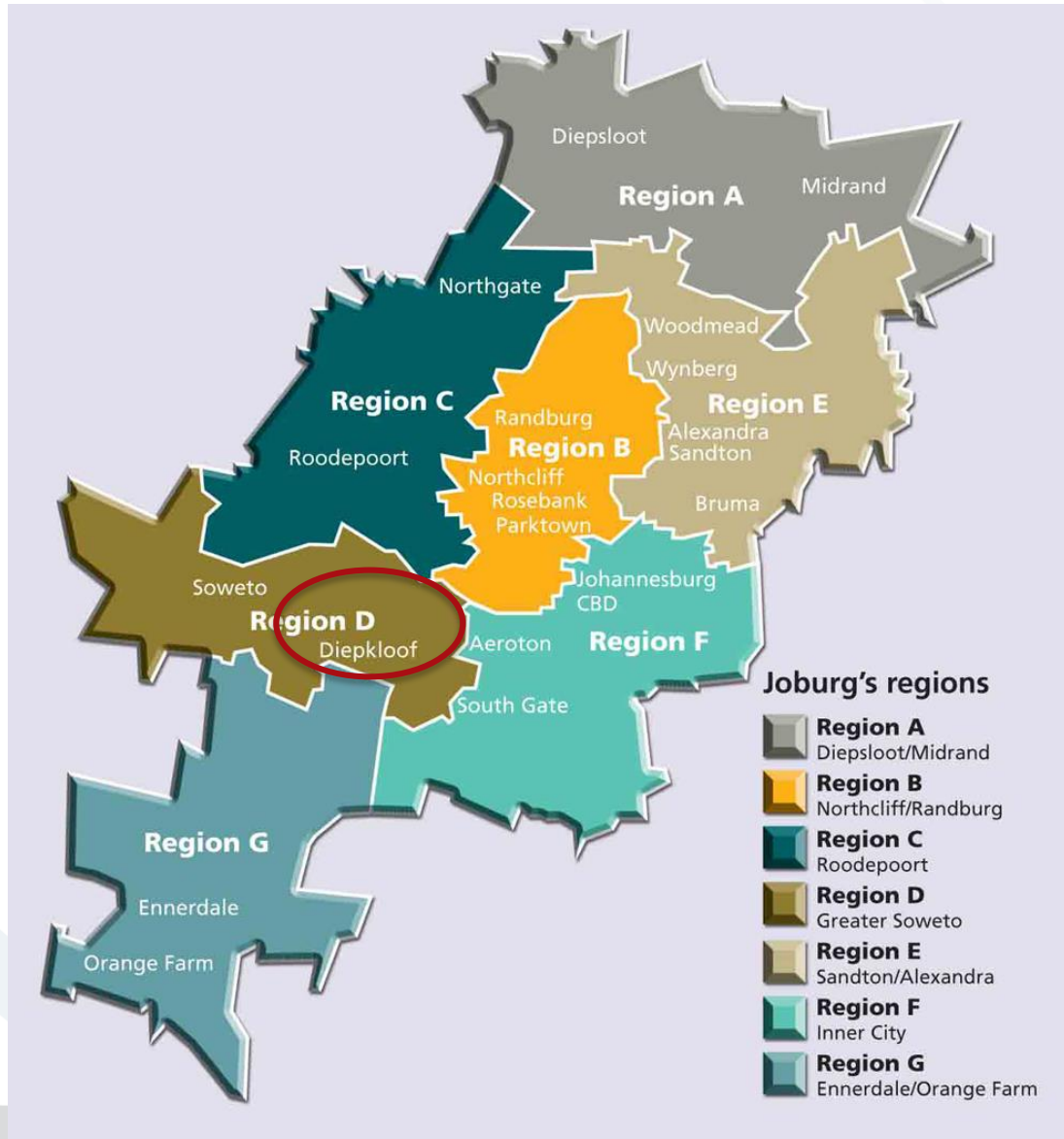
Pilot Sites – location of sites

Pilot Sites

ORLANDO WEST PARK

- **Greening Soweto 2010 Legacy Project**
- **Estimated: 37 500 m^2**
- **498 indigenous trees**
- **Small shrub bed**
- **Grass mixture of Kikuyu and *Cynodon spp.***
- **Designed by INSITE Group - Landscape Architects**

Pilot Sites

CHRIS HANI STREET

- Main arterial route (8.2km)
- 2246 street trees
- Diverse adjacent land uses
- Entire street is divided by a wide median

Research Aim

- **Estimate the standing carbon stocks**
  - **carbon stored** in the trees as at **date of fieldwork** measurement (2016)

- **Determine the projected carbon sequestration**
  - **statistically project** the estimated **carbon sequestrated** over a 30 and 45 year period

Research Aim: Why carbon?

- Trees store carbon through photosynthesis
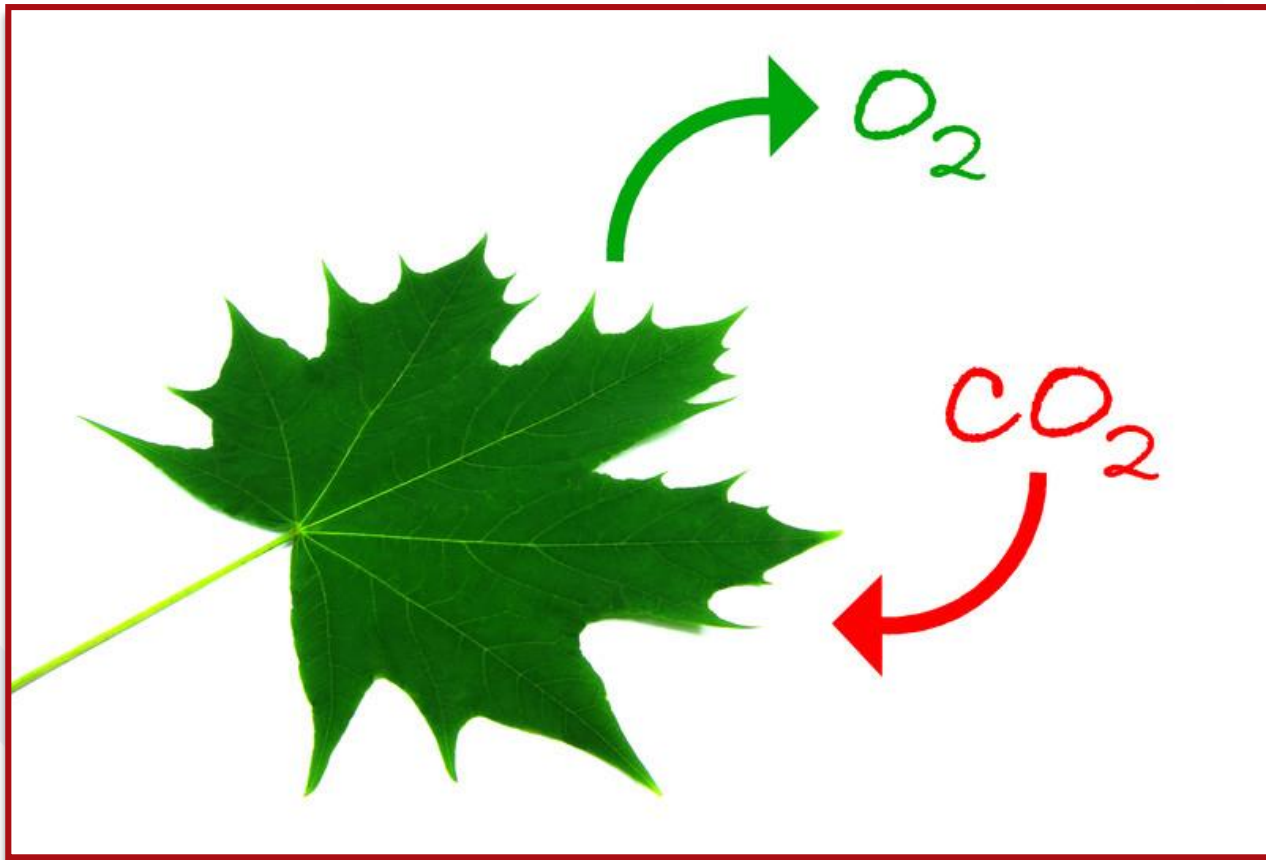
Research Aim: Why carbon?

- **Carbon sink:** Accumulation and **storing of carbon** compounds.

- **Carbon Sequestration:** **Process** by which **carbon sinks remove carbon dioxide** (CO_2) from the atmosphere (Intergovernmental Panel on Climate Change, 2000).

Research Aim: Why carbon?

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).

How does this work?

- Higher CO_2 levels = higher temperature on earth

- Remove CO_2 from the atmosphere.

- **Mitigation** of **global warming** (Nowak & Crane, 2002)

Methodology - Data Collection

**ORLANDO WEST
PARK**

- Total trees: **498**
- Conducted a complete tree inventory

Methodology - Data Collection

ORLANDO WEST PARK

- Total trees: 498
- Conducted a complete tree inventory

CHRIS HANI STREET

- Total trees: 2246
- Conducted a random and representative tree sample
- Sampled 20% of total number of street trees
- Inventory **450** trees

Methodology – Data collection

Indigenous trees:

Stem circumference measurements were taken at ground level

Methodology – Data collection

Indigenous trees:

Stem circumference measurements at ground level

Exotic trees:

Stem circumference measurements were taken at Breast Height (DBH measurements)

Methodology – Data collection

Specie diversity - Orlando West Park

| Species	Number of trees*	Percentage of trees
Acacia caffra	3	0.7
Celtis africana	**94**	**21.9**
Combretum erythrophyllum	**193**	**44.9**
Olea europaea subsp. Africana	64	14.9
Searsia pendulina	14	3.3
Searsia lancea	62	14.4
Total	**449**	100

*Note: Missing trees not included: **19 unknown**

Dead stumps /Coppice growth only not included: **49**

# Specie diversity - Orlando West Park

Specie diversity in percentage

- Acacia caffra
- Celtis africana
- Combretum erythrophyllum
- Olea europaea subsp. Africana
- Searsia pendulina
- Searsia lancea

1%
22%
14%
3%
15%
45%
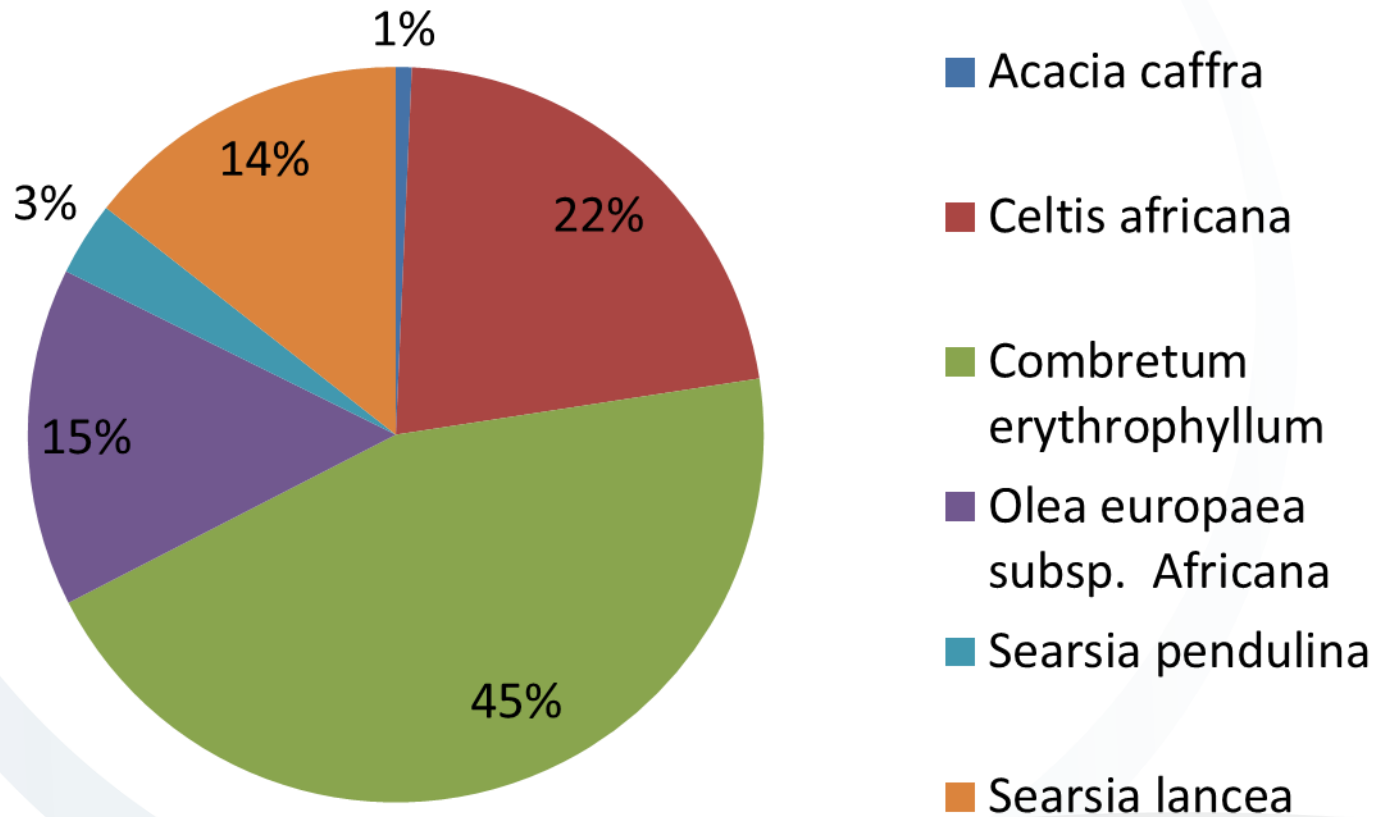
Smallest & largest trees

Plant name	DGL (mm)	
	Smallest	Largest
Celtis africana	54	300
Acacia caffra	185	245
Olea europea subsp Africana	43	161
Combretum erythrophyllum	15	322
Searsia lancea	87	281
Searsia pendulina	86	204

Specie diversity - Chris Hani Street

- Celtis — 71%
- Other trees — 22%
- Missing — 7%
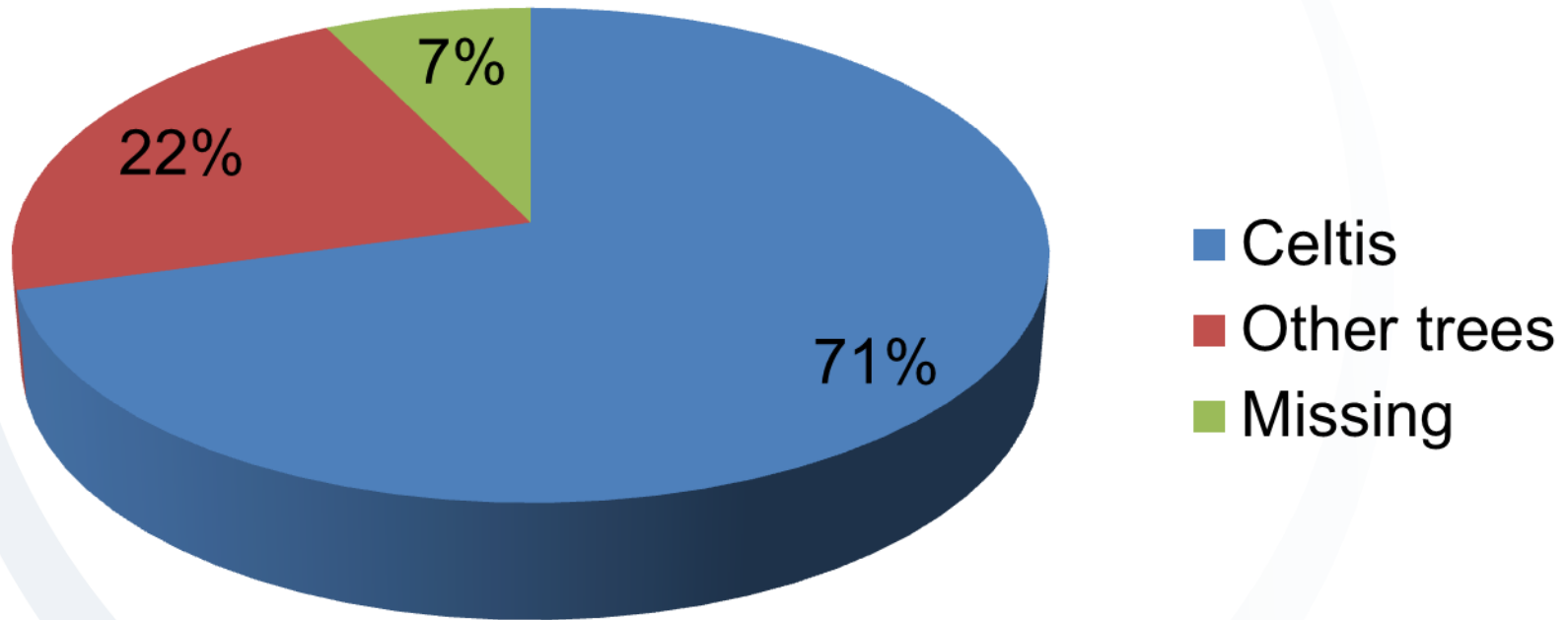
Specie diversity - Chris Hani Street
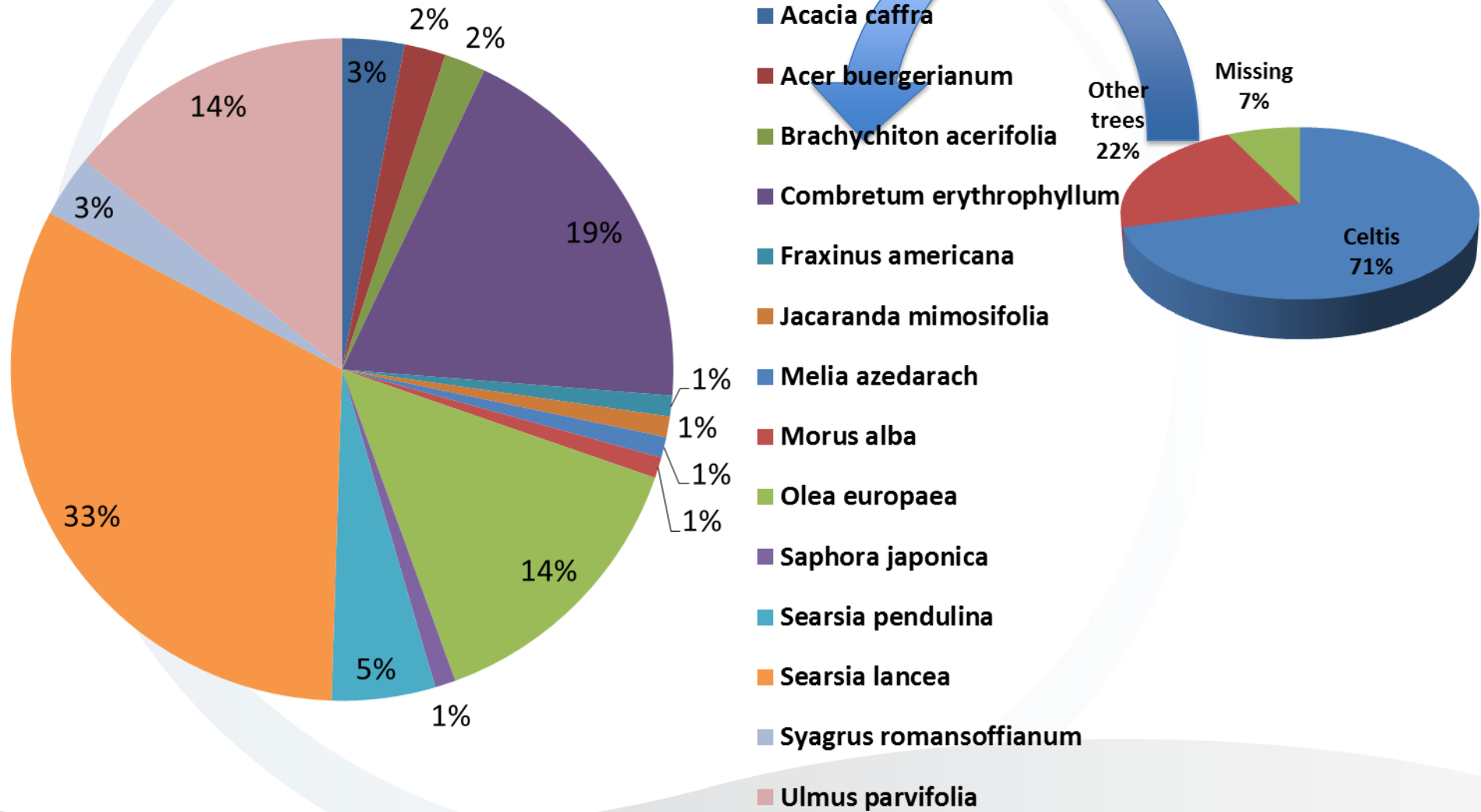
Smallest & largest trees

Plant name	DGL (mm)	
	Smallest	Largest
Celtis africana	27	428
Acacia caffra	37	291
Olea europea subsp Africana	62	190
Combretum erythrophyllum	75	447
Searsia lancea	156	425
Searsia pendulina	181	379

Methodology - Estimate carbon storage and sequestration approach

- Indigenous trees only

- Standing Carbon Stock

- Statistically Projected Carbon Sequestration

Carbon storage and sequestration

- Carbon calculations are based on the whole tree biomass estimates (below and above ground biomass).

- Methodology presented by Stoffberg et al 2004 and 2010 used stem circumference at ground level.

Carbon storage and sequestration

- All carbon values are presented as both Carbon and Carbon Dioxide values.

- The conversion to carbon dioxide is necessary to determine the greenhouse gas (CO_2) removal impacts that the trees attain through plant growth.
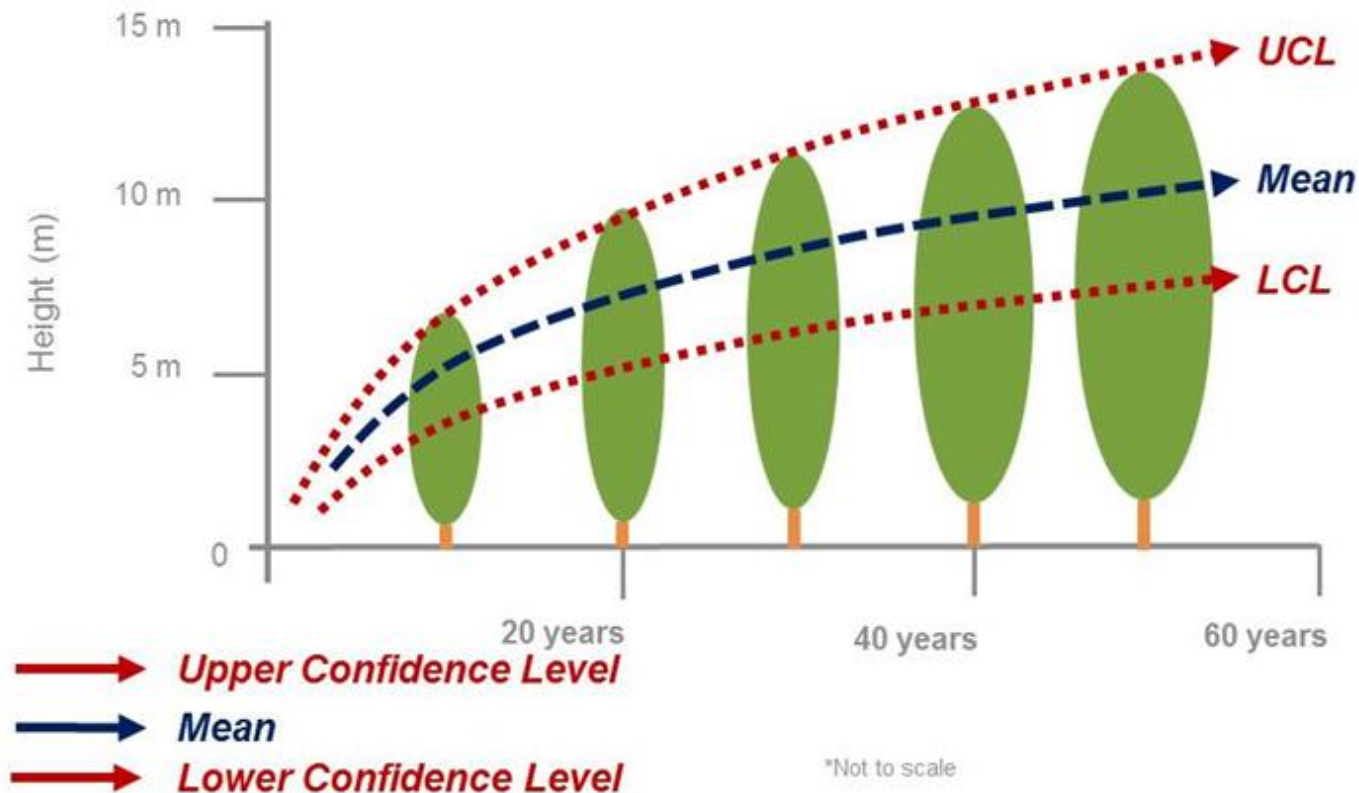
Carbon storage and sequestration

- Results presented:

  - **Lower**, **Mean** and **Upper** confidence levels (at 95%)

  - **Forecasted Growth Rates** over a **period of time**

Lower, Mean and Upper confidence levels

Statistical Growth Rates: 95% Confidence Levels
Tree height - tree age

Potential projected carbon sequestration

30 years	45 years
Acacia caffra	Celtis africana
Olea europaea subsp Africana	Combretum erythrophyllum
Searsia pendulina	
Searsia lancea	

South African Rand Value

South African Rand Value

Value of the Carbon Dioxide in a local context and common denominator for comparable purposes.

- Carbon tax - ZAR120.00

- Formerly proposed by National Treasury

   (Department: National Treasury, 2013)

Potential projected carbon sequestration

Tree based, **time and growth rate relationships** enable the creation of **carbon sequestration regression equations** which allowed for the calculation of **estimated** projected **(future growth)** carbon sequestration by the indigenous trees.

Summary

- Hennie Stoffberg will present the results

Thank you