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*PS 3.4 The Present 2 - Changing Benefits*

# Optimizing urban forest ecosystem services in Medellin, Colombia

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# Overview

- Pollutant removal by urban forests
- Carbon storage and sequestration
- Functional diversity
- Vegetation design

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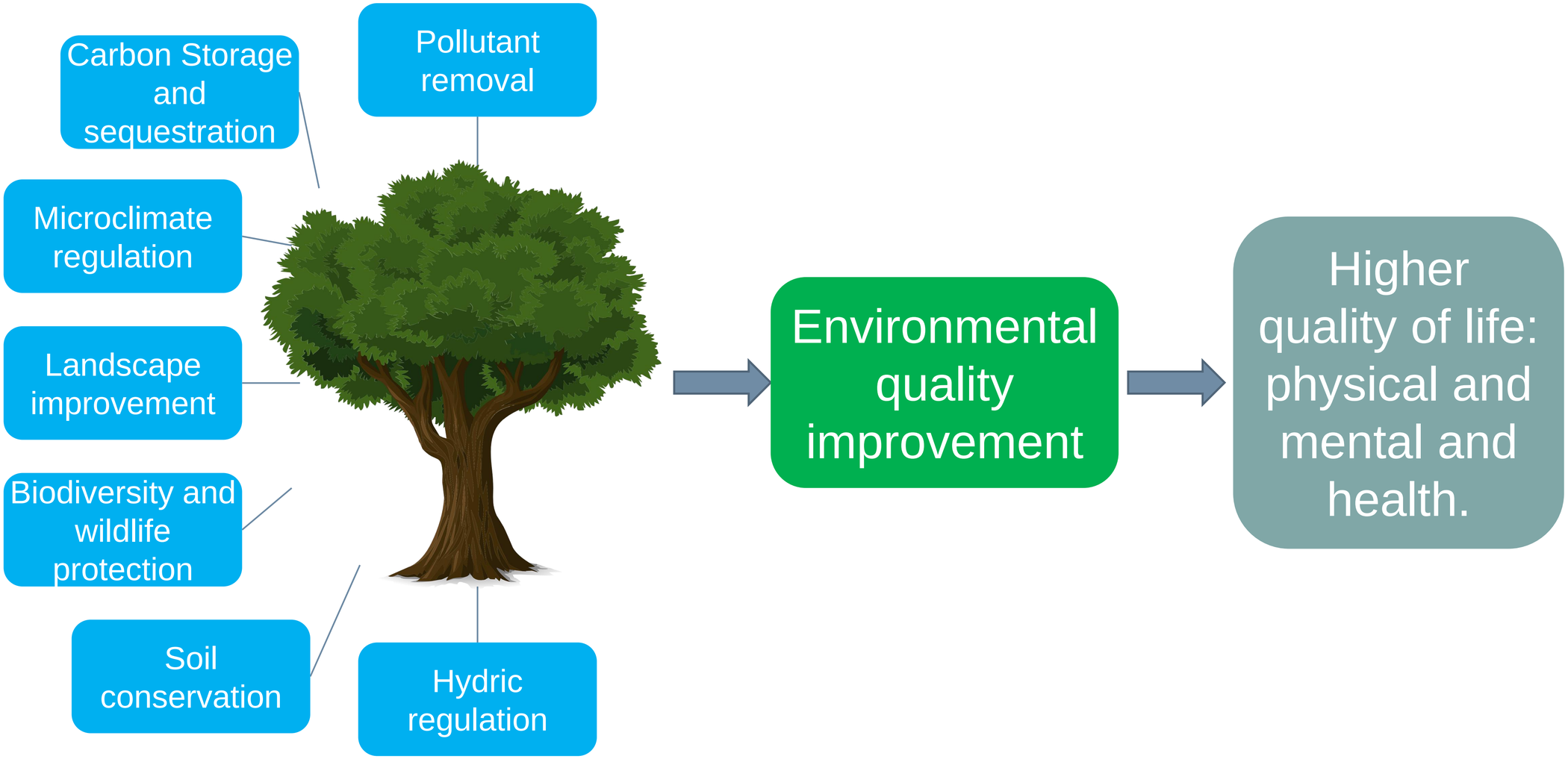
# Urban Forest Ecosystem services



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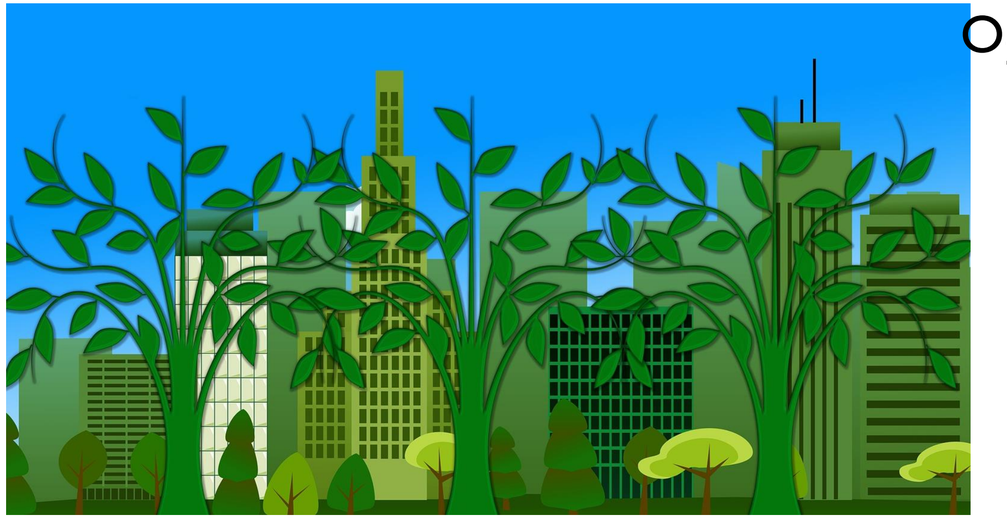
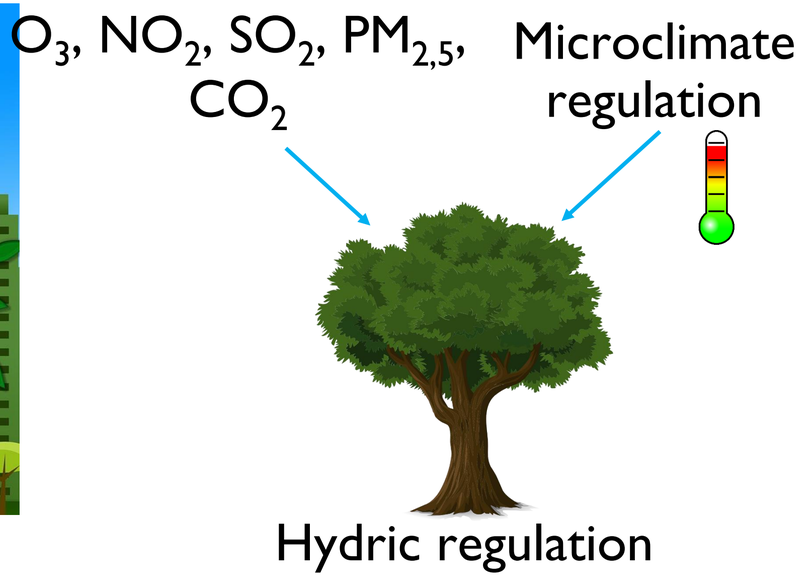
# Methodological scheme






Urban forest Structure
¿what do we have?

⇨

Ecosystems services ¿why is it important?

⇨

Value and management

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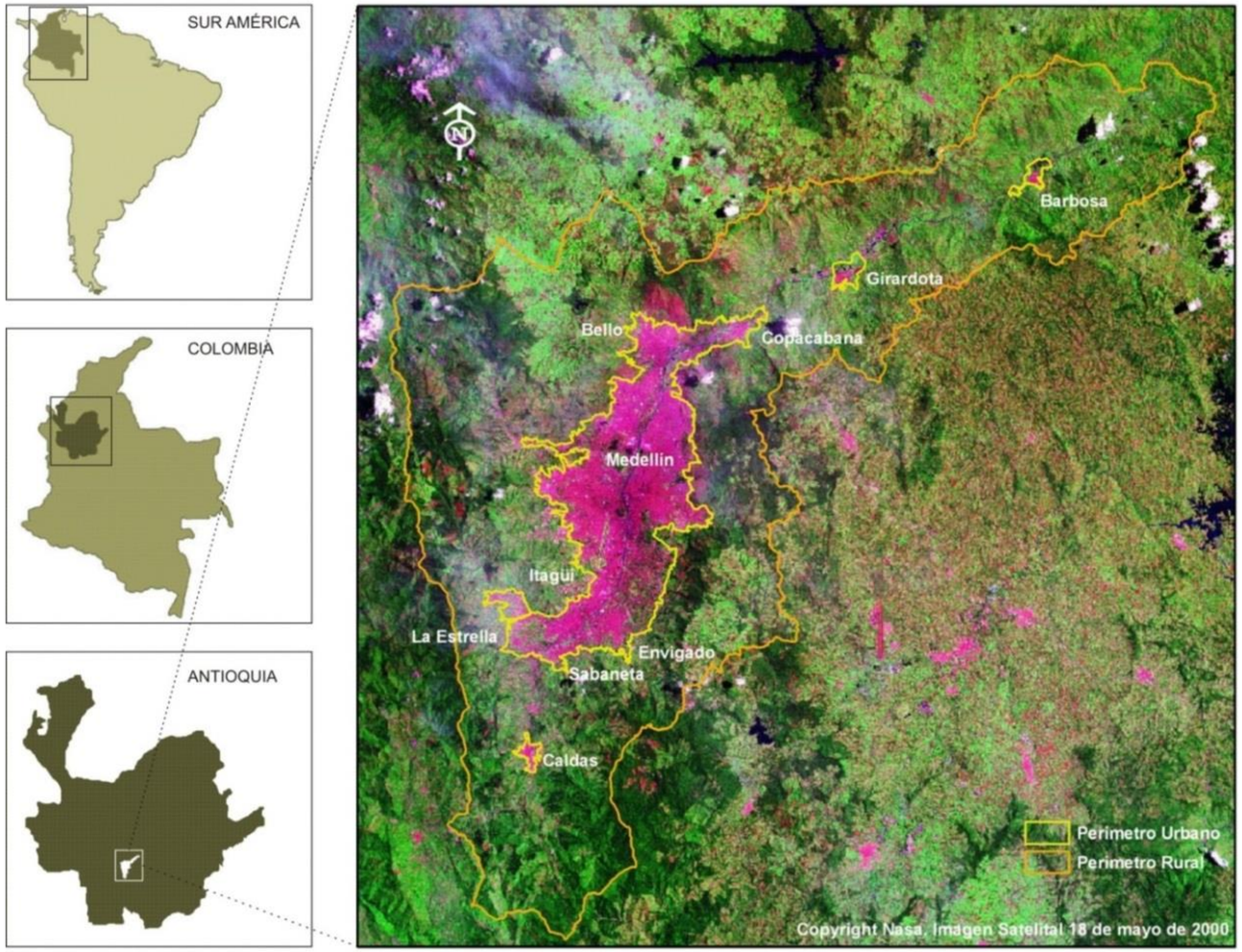
# Study area: Medellin metropolitan area




- Extension: 1.152 km$^2$
- Temperature: 18 – 22 °C
- Height above sea level: 1300 – 2800 m
- Rainfall: 1500 - 2500 mm
- Population: 3.306.490

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# Urban forest contribution to pollutant removal

| Variable | Pollutant | | | |
|---|---|---|---|---|
| | CO | $NO_2$ | $PM_{2.5}$ | $PM_{10}$ |
| Pollutant removal by urban forest (t/year) | 12.3 | 49.1 | 32.1 | 60.40 |
| **Emissions by vehicles** | | | | |
| Total (t/year) | 145 552 | 14 293 | 1508 | * |
| Urban forest contribution to pollutant removal (%) | 0.01 | 0.34 | 2.13 | * |
| **Emissions by industry** | | | | |
| Total (t/year) | 3213 | 2979 | 345 | 1166 |
| Urban forest contribution to pollutant removal (%) | 0.38 | 1.65 | 9.30 | 5.18 |
| **Total emissions** | | | | |
| Total (t/year) | 148 766 | 17 272 | 1852 | 1166 |
| Urban forest contribution to pollutant removal (%) | 0.01 | 0.28 | 1.73 | 5.18 |

Data for Aburra Valley, 2015

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# Carbon Storage and Sequestration

| Zone | Carbon storage (ton) | Carbon net sequestration(ton/year) | Carbon dioxide net sequestration (ton/year) |
|---|---|---|---|
| North | 41.136 | 879 | 3.223 |
| Middle (Medellin) | 147.779 | 2.940 | 10.780 |
| South | 52.351 | 880 | 3.227 |
| **Metropolitan area** | **241.265** | **4.699** | **17.229** |

Data for 2015

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# Economic Value

| Pollutant | Removal (ton) | Value/ton (USD) | Total value (USD) |
|---|---|---|---|
| CO | 12,3 | 1.619 | 19.914 |
| $NO_2$ | 49,1 | 11.397 | 559.593 |
| $O_3$ | 74,3 | 11.397 | 846.797 |
| $PM_{2,5}$ | 32,1 | 7.609 | 244.249 |
| $PM_{10}$ | 60,4 | 7.609 | 459.584 |
| **Total** | **228,2** | | **2.130.136** |

Data for Aburrá Valley, 2015

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# Functional traits

Atmospheric Pollution Research 6 (2015) 267-277

Atmospheric Pollution Research
www.atmospolres.com

## Ranking the suitability of common urban tree species for controllin PM2.5 pollution

Jun Yang [1], Yamin Chang [2], Pengbo Yan [2]

[1] Ministry of Education Key Laboratory for Earth System Modeling, Center for Earth System Science, Tsinghua University, Beijing, 100084, China
[2] College of Forestry, Beijing Forestry University, Beijing, 100083, China

Science of the Total Environment 427–428 (2012) 347–354

Contents lists available at SciVerse ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

## Plant species differences in particulate matter accumulation on leaf surfaces

A. Sæbø [a,*], R. Popek [b], B. Nawrot [b], H.M. Hanslin [a], H. Gawronska [b], S.W. Gawronski [b]

[a] Bioforsk, Norwegian Institute for Agricultural and Environmental Research, Postvegen 213, 4353 Klepp, Norway
[b] Laboratory of Basic Research in Horticulture, Faculty of Horticulture and Landscape Architecture, Warsaw University of Life Sciences – SGGW, Nowoursynowska 159, 02-776, Warsaw, Poland

i-Tree
Species Selector

REVIEWS REVIEWS REVIEWS

## Functional traits of urban trees: air pollution mitigation potential

Rüdiger Grote[1*], Roeland Samson[2], Rocío Alonso[3], Jorge Humberto Amorim[4], Paloma Cariñanos[5], Galina Churkina[6], Silvano Fares[7], Didier Le Thiec[8], Ülo Niinemets[9], Teis Norgaard Mikkelsen[10], Elena Paoletti[11], Abhishek Tiwary[12], and Carlo Calfapietra[13,14]

## Deposition of Particulate Matter of Different Size Fractions on Leaf Surfaces and in Waxes of Urban Forest Species

March 2011
*International Journal of Phytoremediation*
13(10):1037-46
DOI: 10.1080/15226514.2011.552929
SourcePubMed

Kajetan DzierzanowskiRobert PopekRobert PopekHelena GawrońskaHelena GawrońskaShow all 5 authorsStanislaw GawronskiStanislaw Gawronski

Leaf size, shape, area, composition, persistence, waxes, trichomes, longevity, crown density, growth rate

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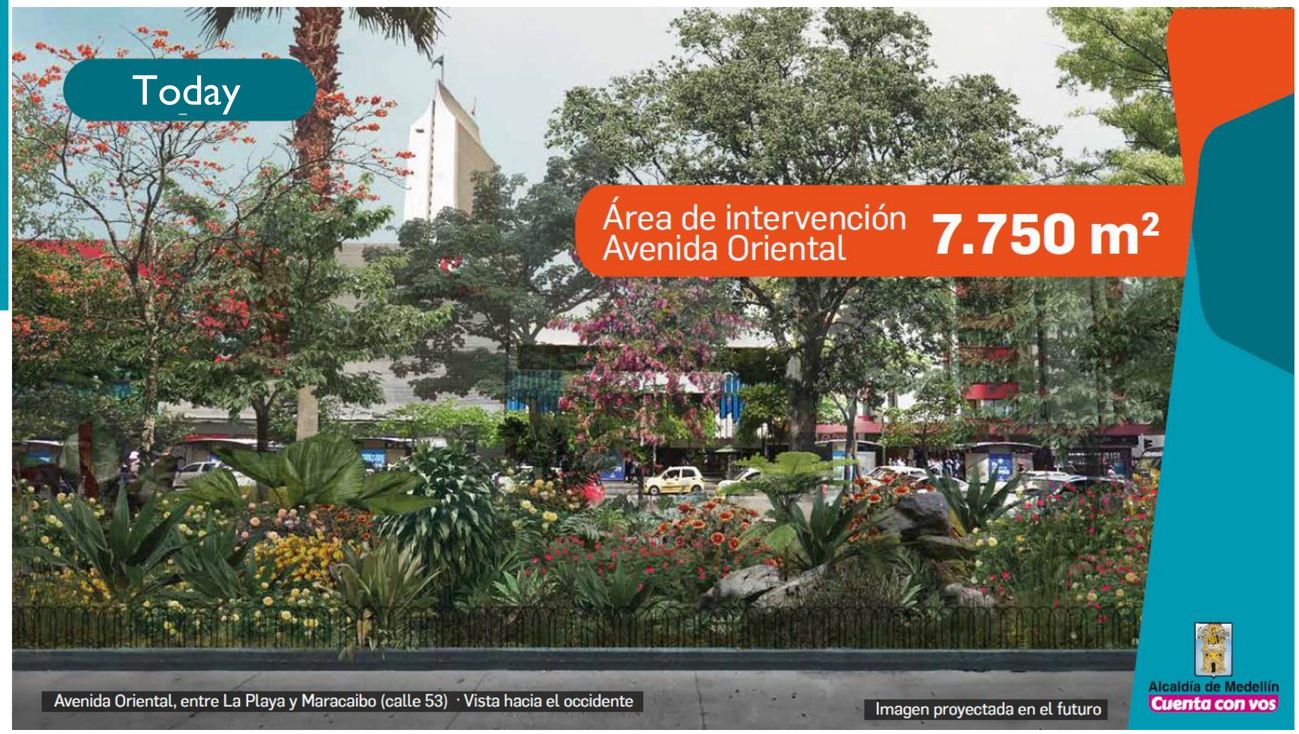
# Green corridor in Medellin


Low diversity
One stratum

High diversity
Stratification



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# Digital Catalog of Flora in the Aburra Valley


288 species

38 plant characteristics:

✓ Taxonomy
✓ Morphology
✓ Ecology

**https://catalogofloravalleaburra.eia.edu.co/**

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# Conclusions

- Increase tree cover
- Plant the right species for the right place
- Avoid species sensitive to pollution
- Dense and porous lateral barriers
- Allow vertical dispersion of pollutants
- Keep the plants healthy
- Increase stratification (different growth habits)

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# Thanks!

# Gracias!