



Optimizing urban forest ecosystem services in Medellin, Colombia

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Overview

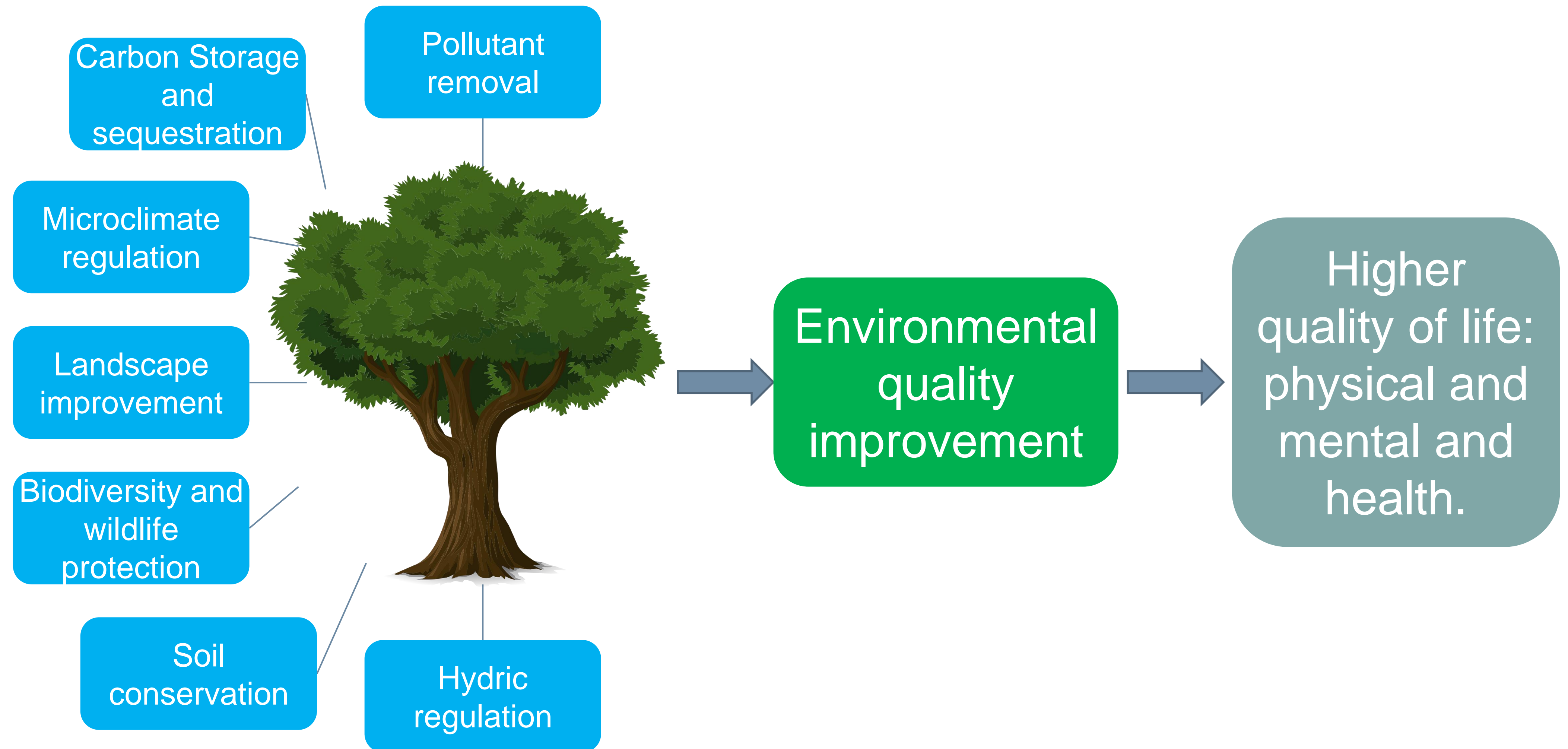
- Pollutant removal by urban forests
- Carbon storage and sequestration
- Functional diversity
- Vegetation design





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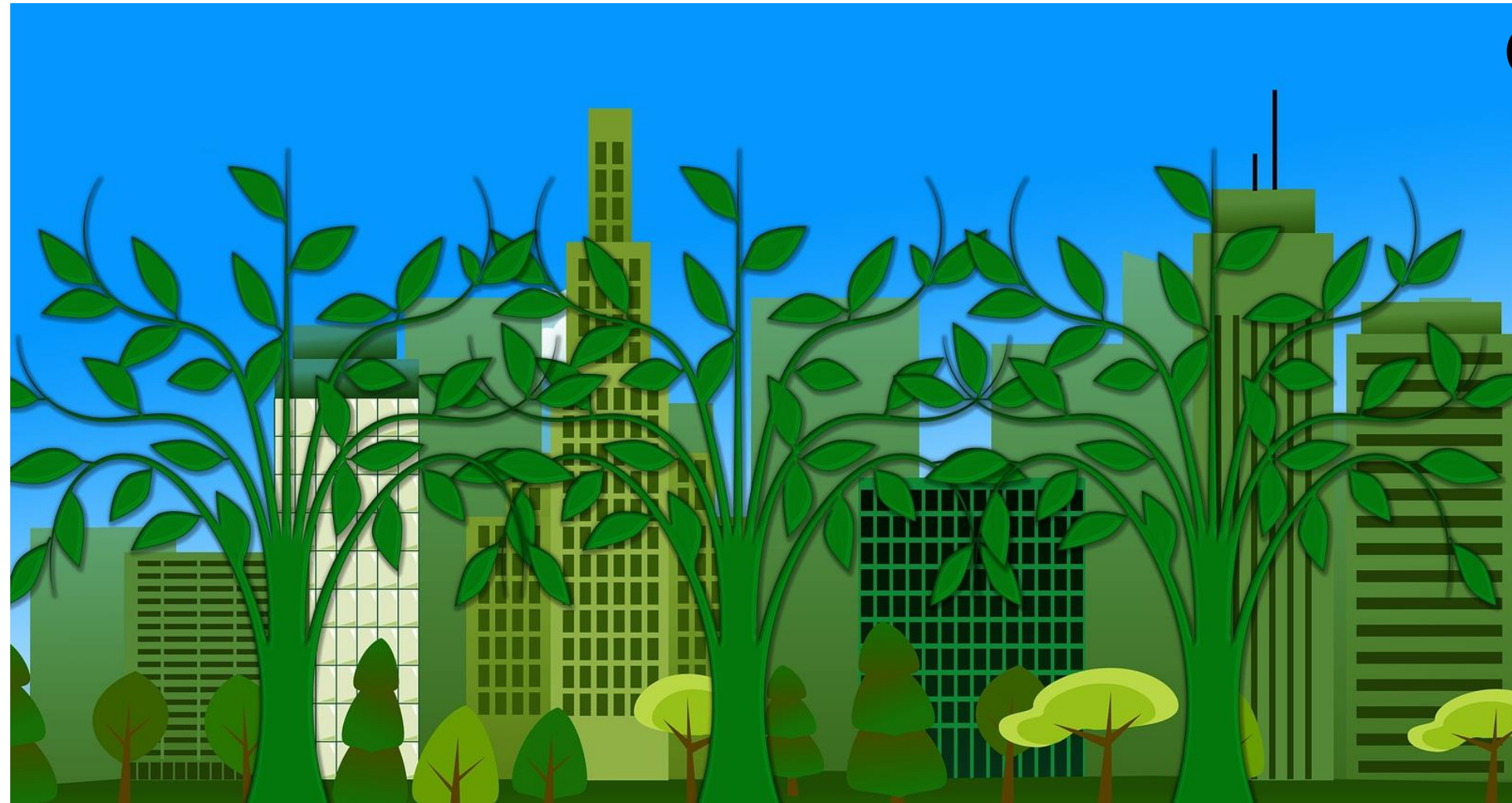
Urban Forest Ecosystem services



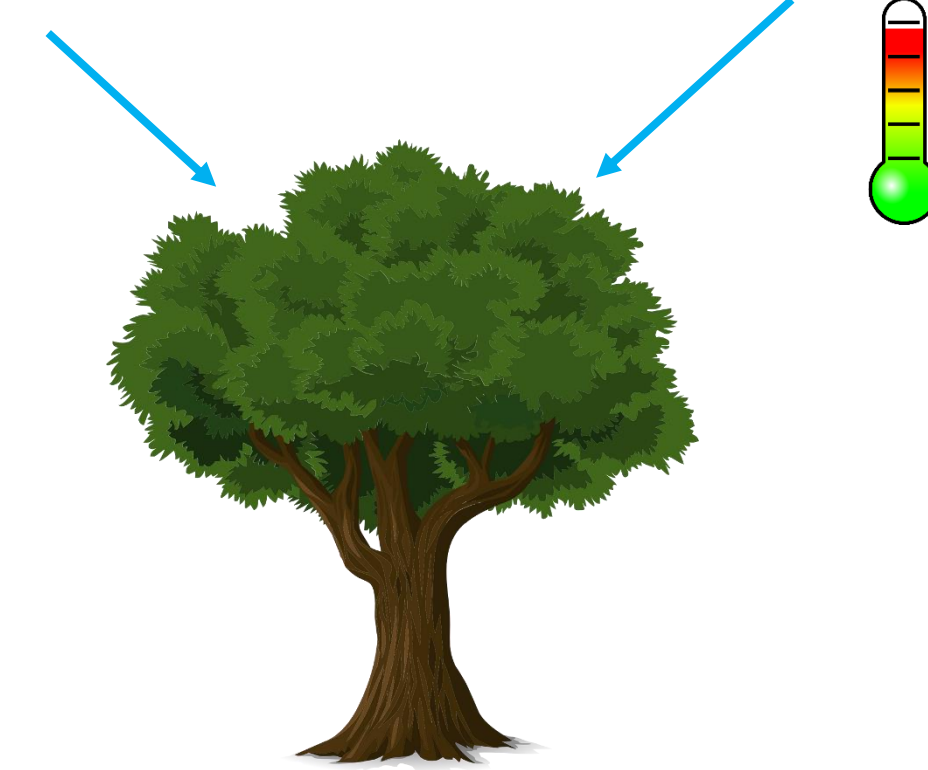


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Methodological scheme



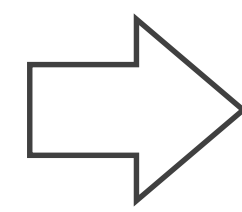
O_3 , NO_2 , SO_2 , $PM_{2,5}$, CO_2 Microclimate regulation



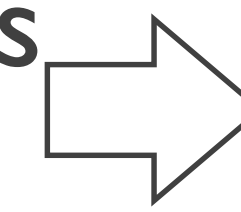
Hydric regulation



Urban forest Structure
¿what do we have?



Ecosystems services ¿why is
it important?

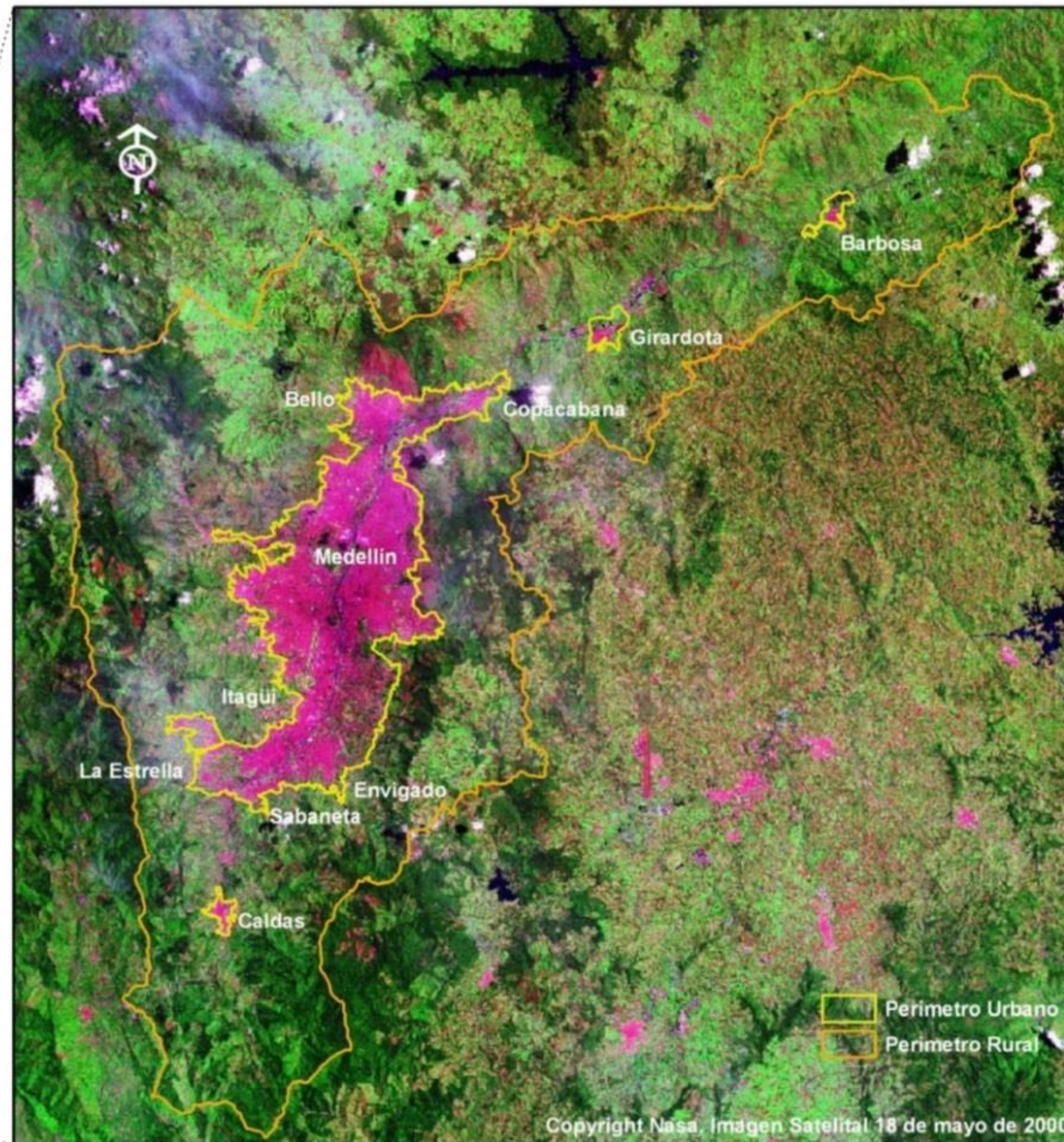


Value and
management



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Study area: Medellin metropolitan area



- Extension: 1.152 km²
- 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



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



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 controlling PM_{2.5} pollution

Jun Yang¹, Yamin Chang², Pengbo Yan²

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



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Science of the Total Environment

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



i-Tree
Species Selector

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

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REVIEWS REVIEWS REVIEWS

Functional traits of urban trees: air pollution mitigation potential

Rüdiger Grote^{1*}, Roeland Samson², Rocío Alonso³, Jorge Humberto Amorim⁴, Paloma Cariñanos⁵, Galina Churkina⁶, Silvano Fares⁷, Didier Le Thiec⁸, Ülo Niinemets⁹, Teis Norgaard Mikkelsen¹⁰, Elena Paoletti¹¹, Abhishek Tiwary¹², 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 Dzierzanowski Robert Popek Robert Popek Helena Gawrońska Helena Gawrońska Show all 5 authors Stanisław Gawronski Stanisław Gawronski

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



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Green corridor in Medellin

Before



Avenida Oriental, entre La Playa y Maracaibo (calle 53) · Vista hacia el occidente



High diversity
Stratification

Today



Área de intervención
Avenida Oriental **7.750 m²**

Avenida Oriental, entre La Playa y Maracaibo (calle 53) · Vista hacia el occidente

Imagen proyectada en el futuro



Low diversity
One stratum



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Digital Catalog of Flora in the Aburra Valley

Catálogo virtual de flora del Valle de Aburrá

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FAMILIAS NOMBRE CIENTÍFICO NOMBRE COMÚN SELECTOR DE ESPECIES CONTÁCTENOS

Inicio Administración Buscar

Guayacán azul, lignum vitae (*Guaiacum officinale*) Zygophyllaceae

En este sitio encontrará información de las características botánicas y ecológicas de una selección de especies de árboles y arbustos existentes en el Valle de Aburrá (Antioquia, Colombia) y sus alrededores. Podrá acceder a la información y registro fotográfico de las especies ubicándolas por familias, nombre científico o nombre común, o utilizando el selector de especies como una herramienta de búsqueda avanzada.

Selector de especies

Permite ingresar las características deseadas de las especies o las condiciones del sitio donde serán plantadas, para obtener como resultado un listado de especies que cumplen con estas especificaciones.

Realizadores

Este catálogo virtual ha sido realizado por investigadores del grupo SITE (Sostenibilidad, Infraestructura y Territorio) de la Universidad EIA, con la colaboración de los estudiantes del semillero de investigación en Biodiversidad.

288 species

38 plant characteristics:

- ✓ Taxonomy
- ✓ Morphology
- ✓ Ecology

<https://catalogofloravalleaburra.eia.edu.co/>



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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Ser, Sabery Servir
Con Acreditación Institucional

Thanks!

Gracias!

