Florestas urbanas e serviços ecossistêmicos

Giuliano M. Locosselli

Passos da co-criação

- Definir o desafio
- Identificar os problemas e oportunidades
- Conhecer questões associadas
- Definir as equipes
- Elaborar as propostas e os protótipos
- Testar as ideias
- Escrutinar as melhores ideias




Florestas?

Von Martius

Von Martius

Florestas


https://pt.wikipedia.org


https://pt.wikipedia.org


https://parqueibirapuera.org/

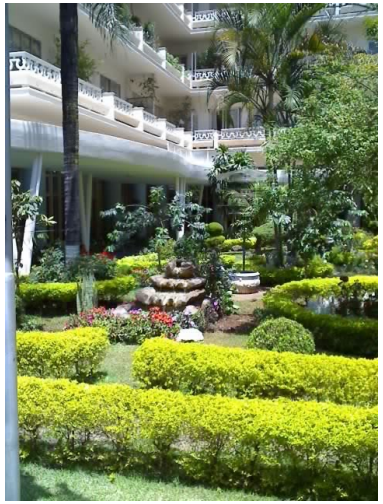

https://pt.wikipedia.org

https://noticias.r7.com

http://alcnolet.blogspot.com

Florestas naturais

Florestas urbanas




17
1
16
2
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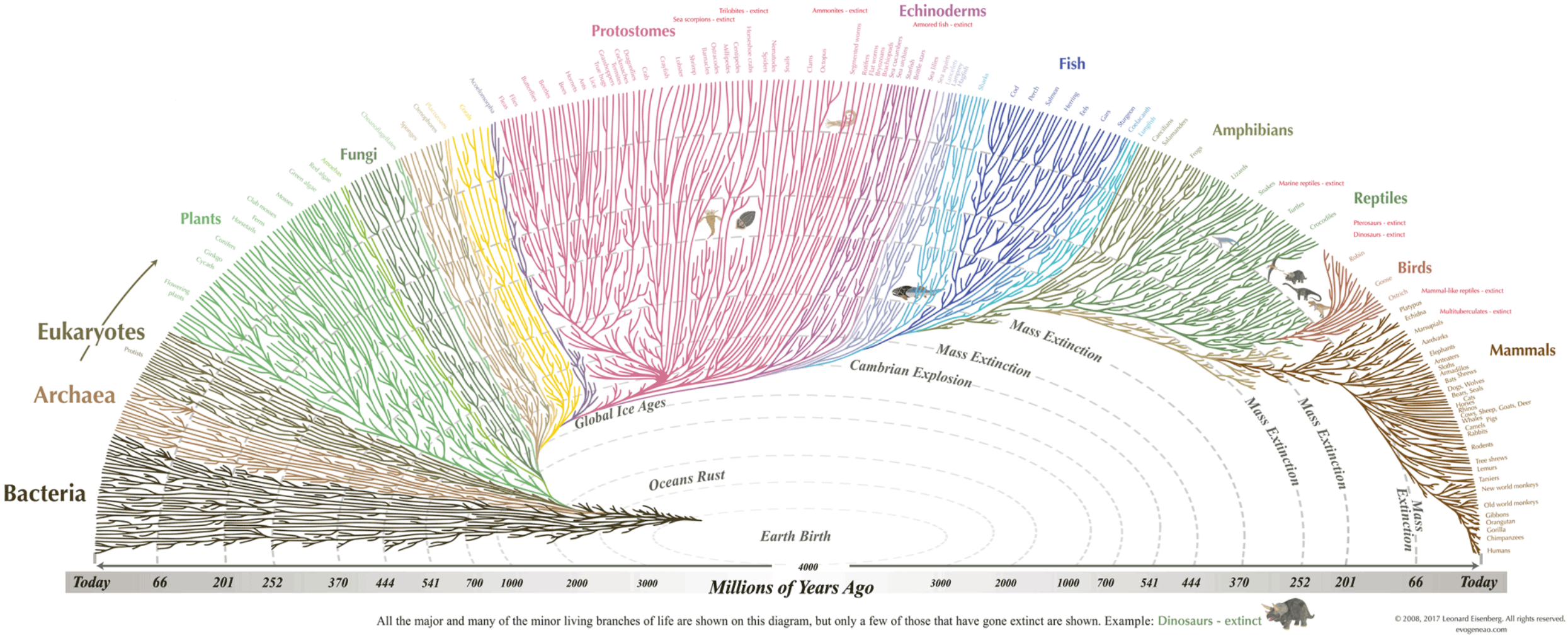
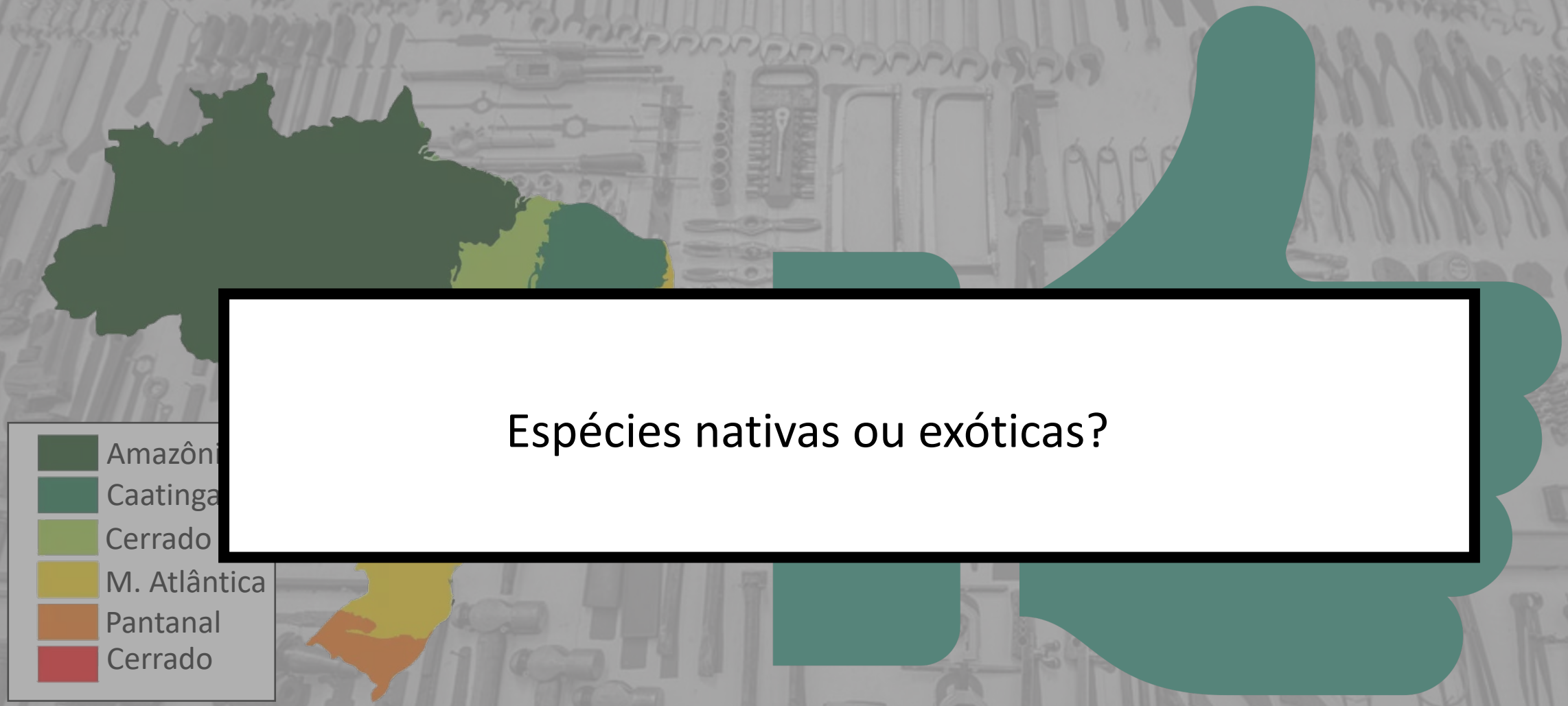
11
7

“inspiradas por, apoiadas por, ou copiadas da natureza”



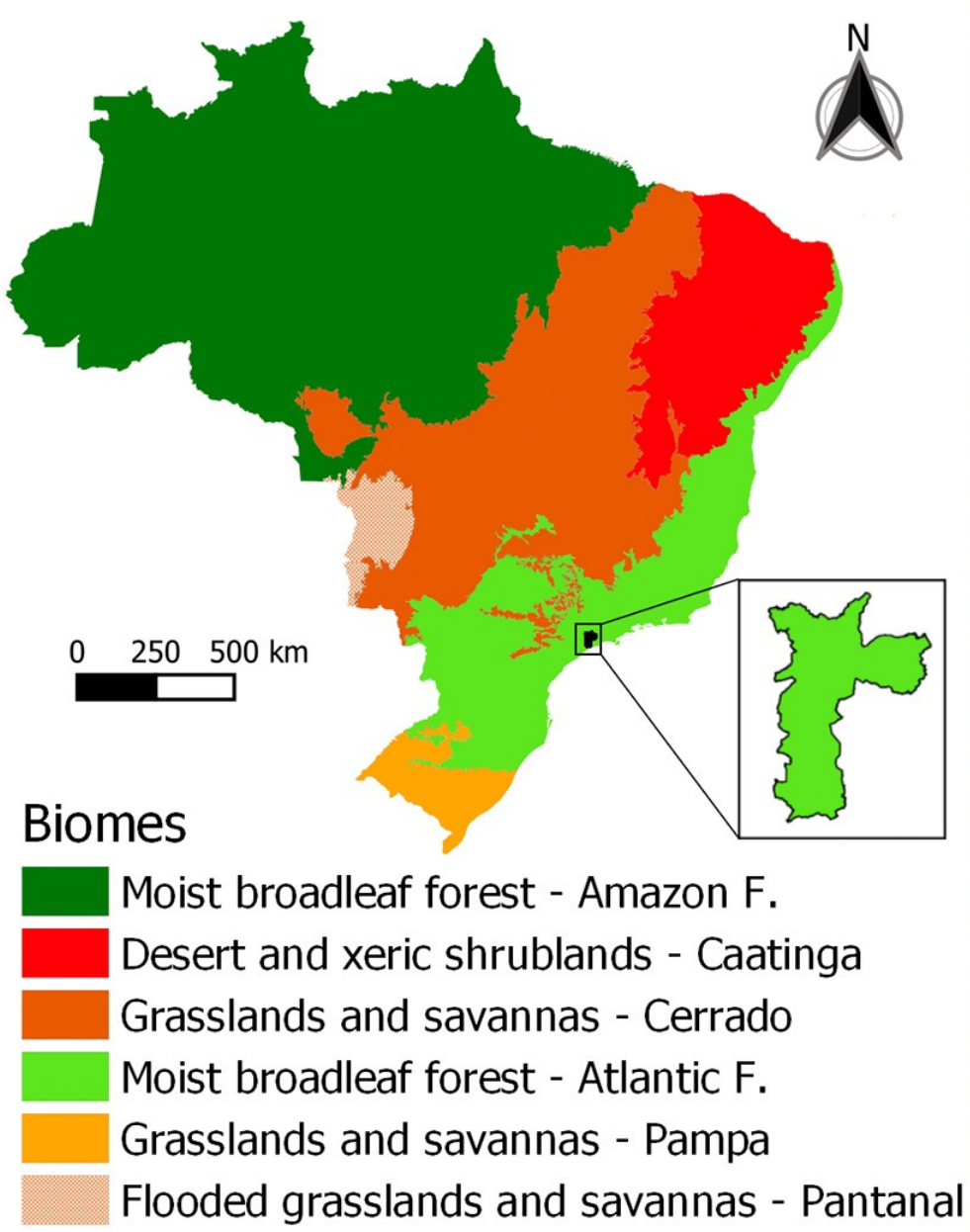

Amazônia
Caatinga
Cerrado
M. Atlântica
Pantanal
Cerrado

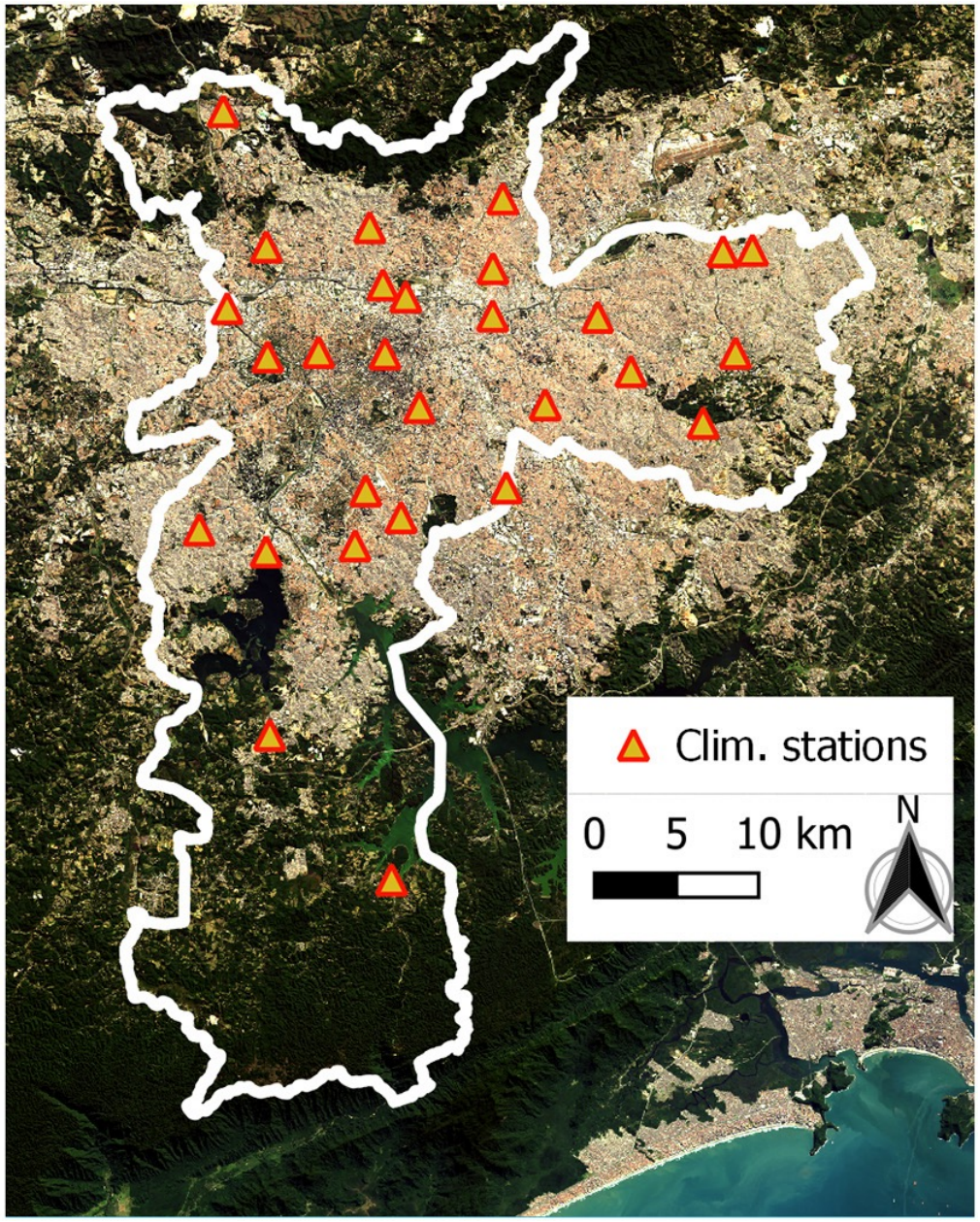


Espécies nativas ou exóticas?

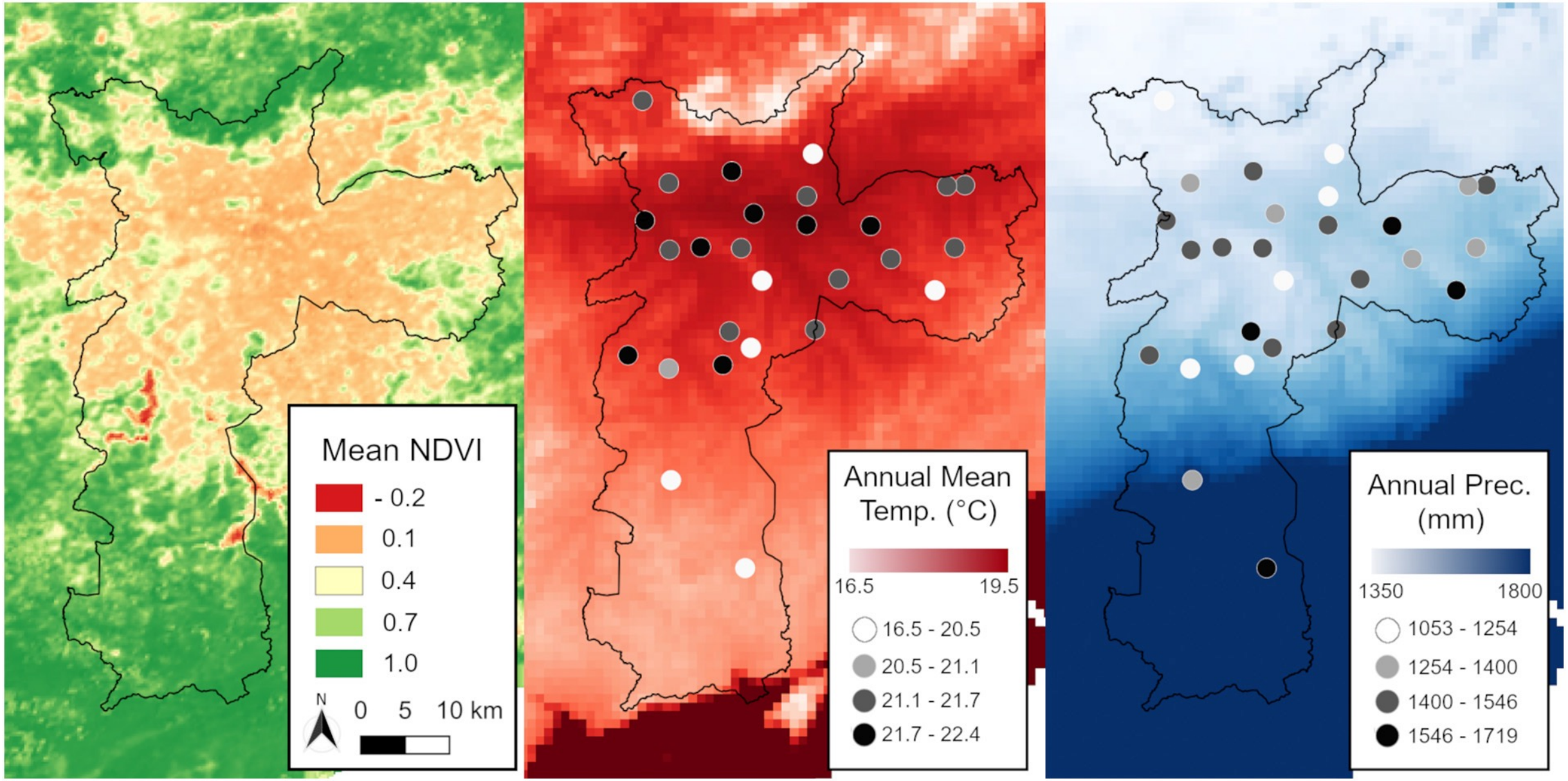
GESTÃO PÚBLICA

População de palmeiras se multiplica e ameaça Parque Trianon, em SP

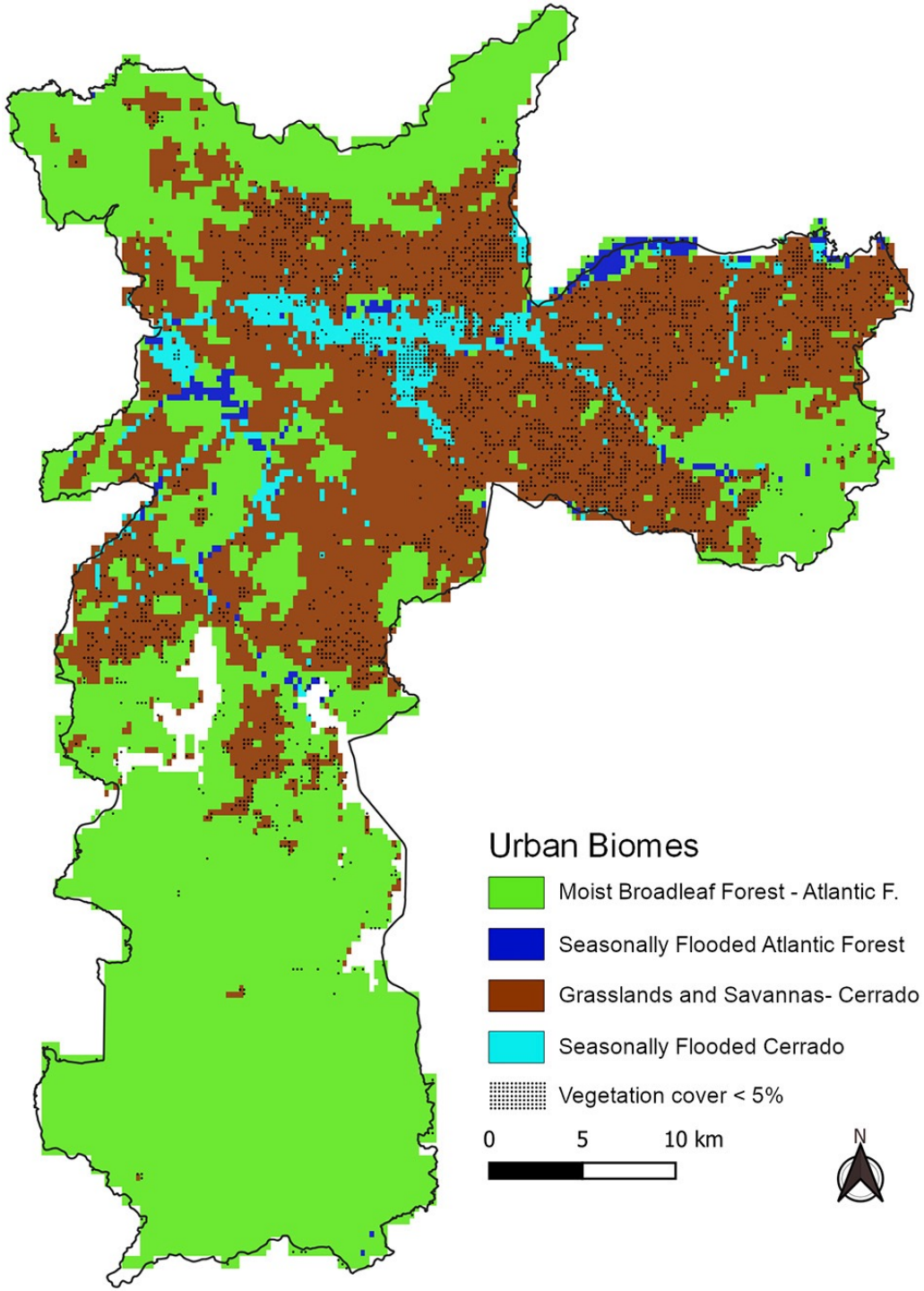


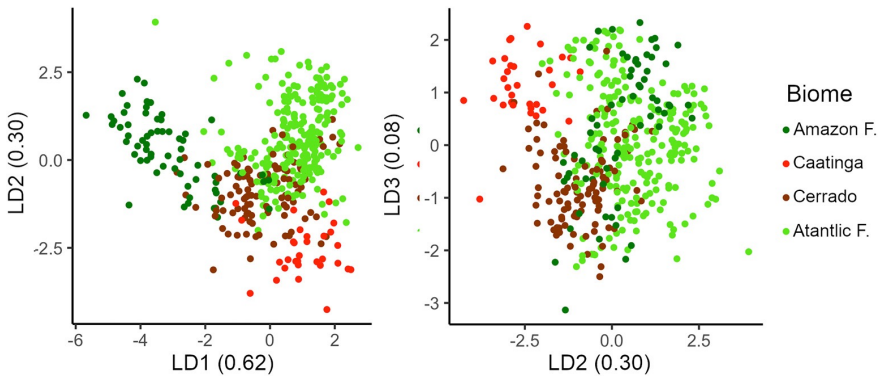


Miyahara et al 2022 **Developing and classifying urban biomes as a basis for nature-based solution**. *Urban Climate* 45: 101251

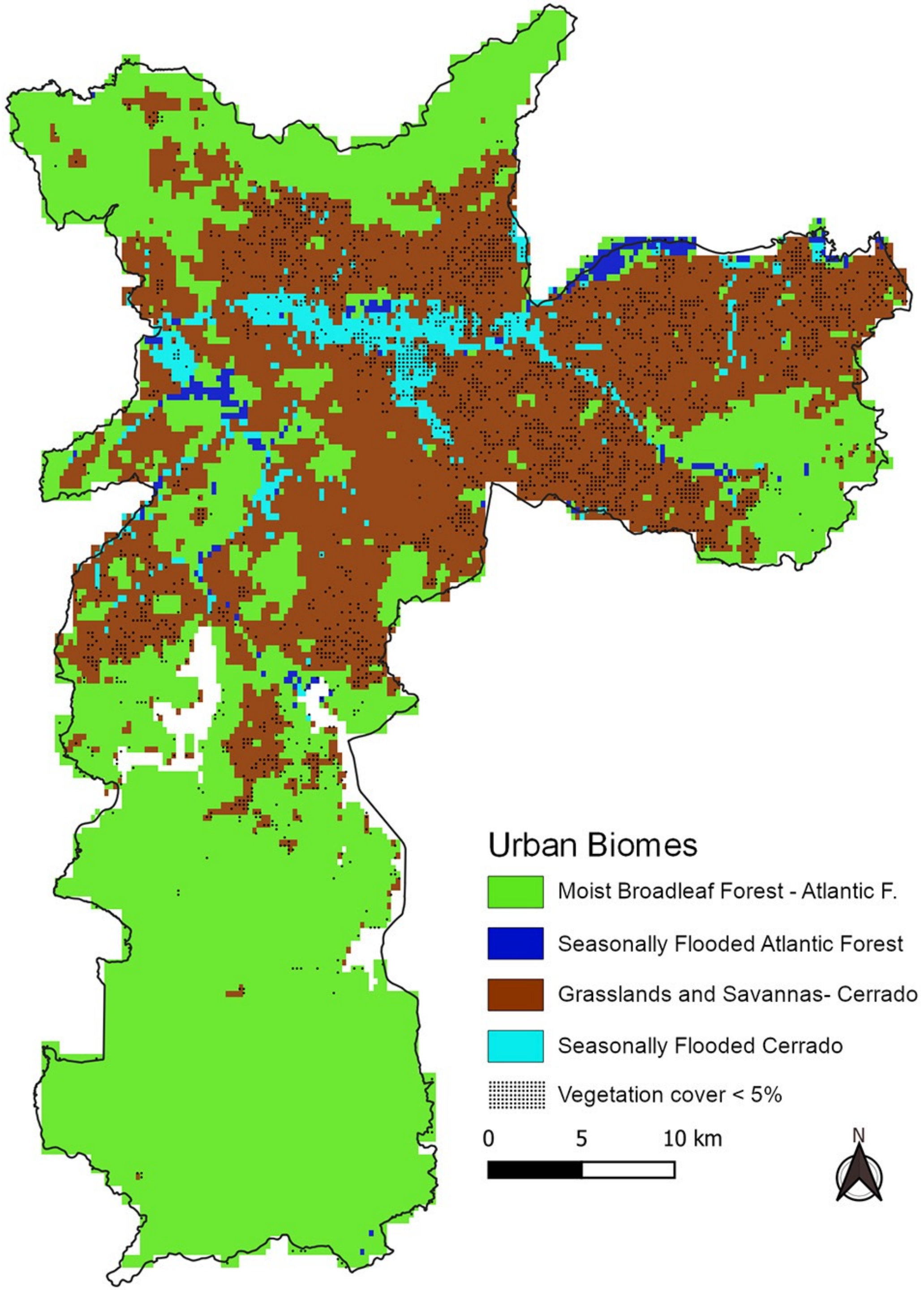


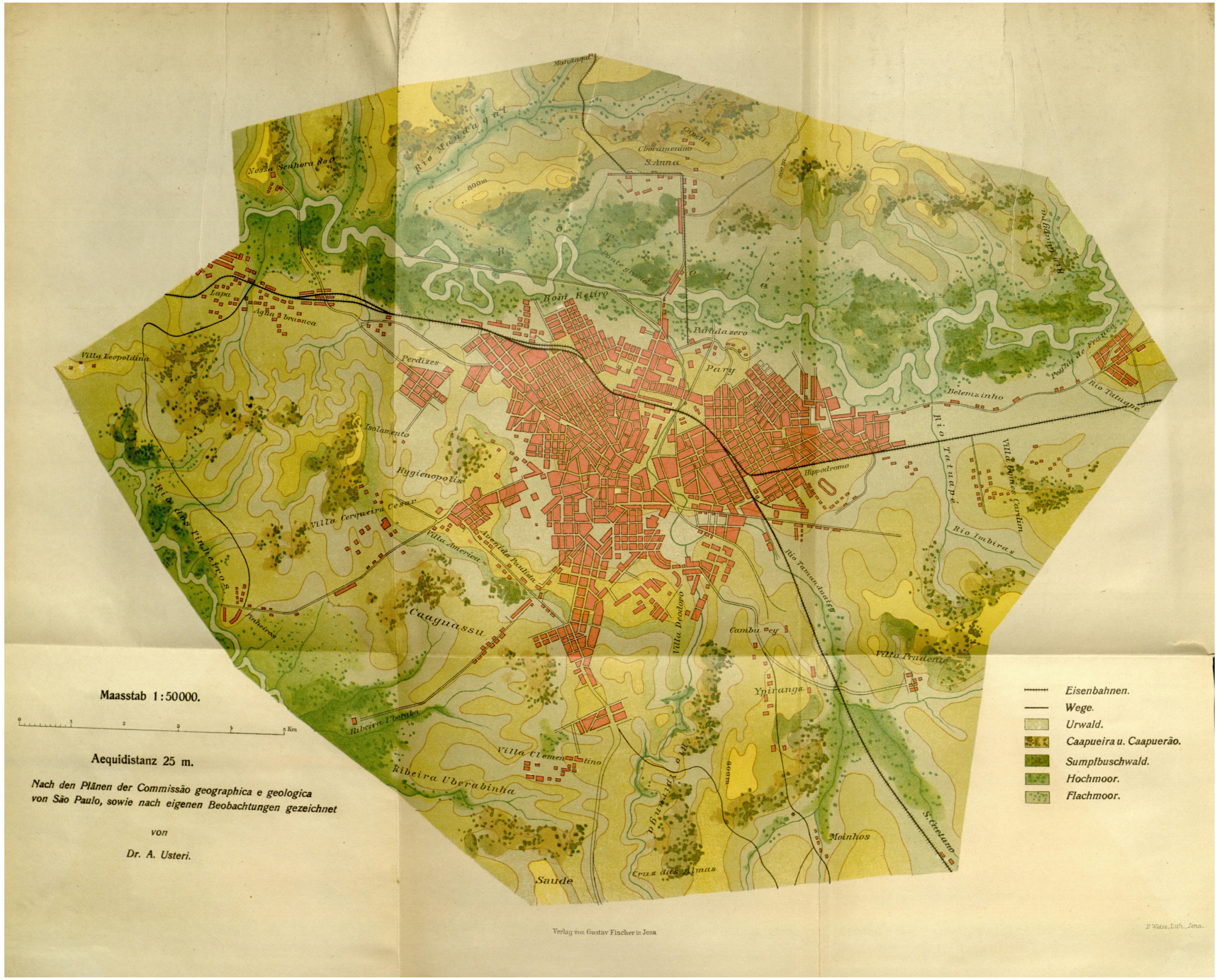
Miyahara et al 2022 **Developing and classifying urban biomes as a basis for nature-based solution**. *Urban Climate* 45: 101251



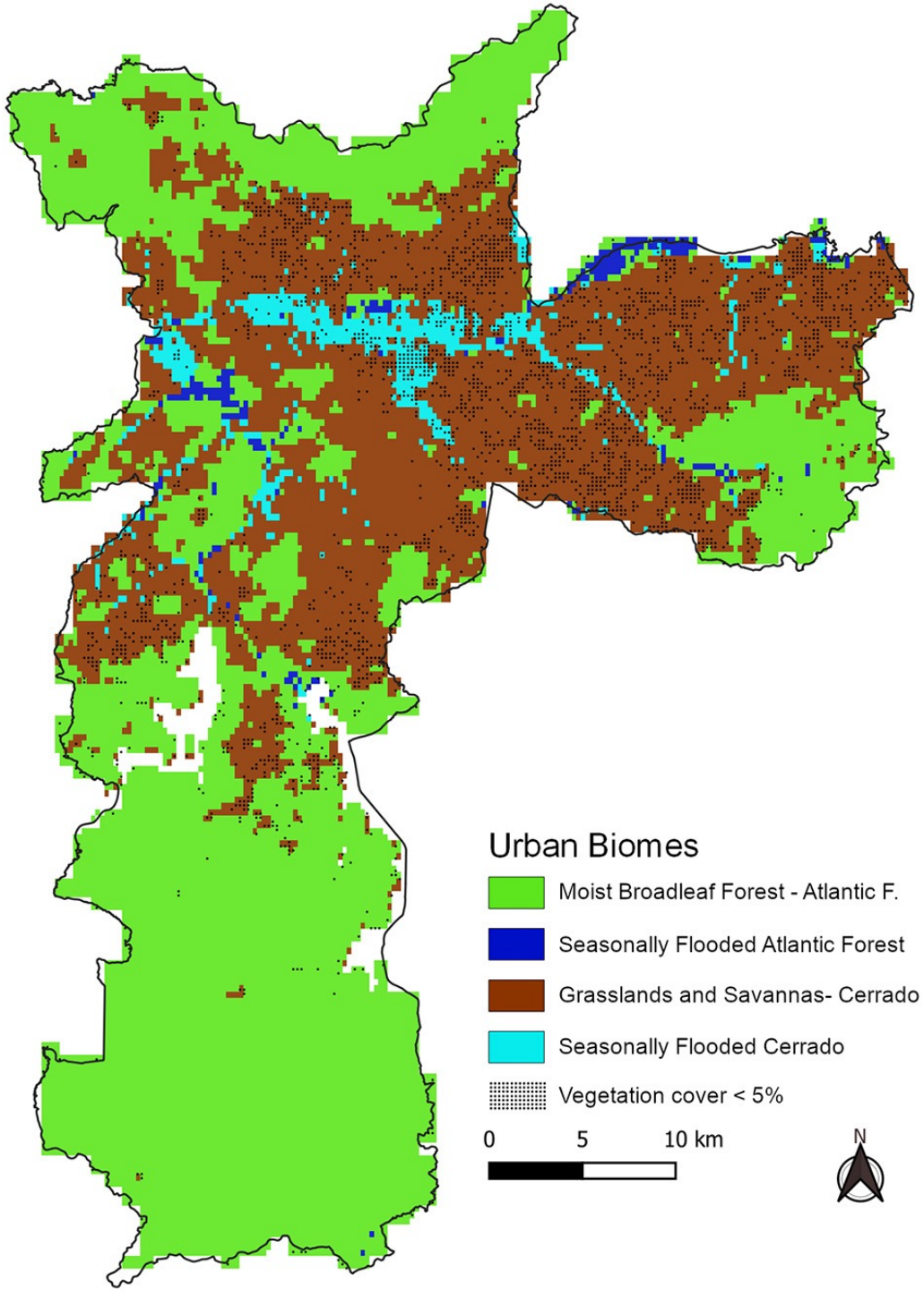


82% de acurácia

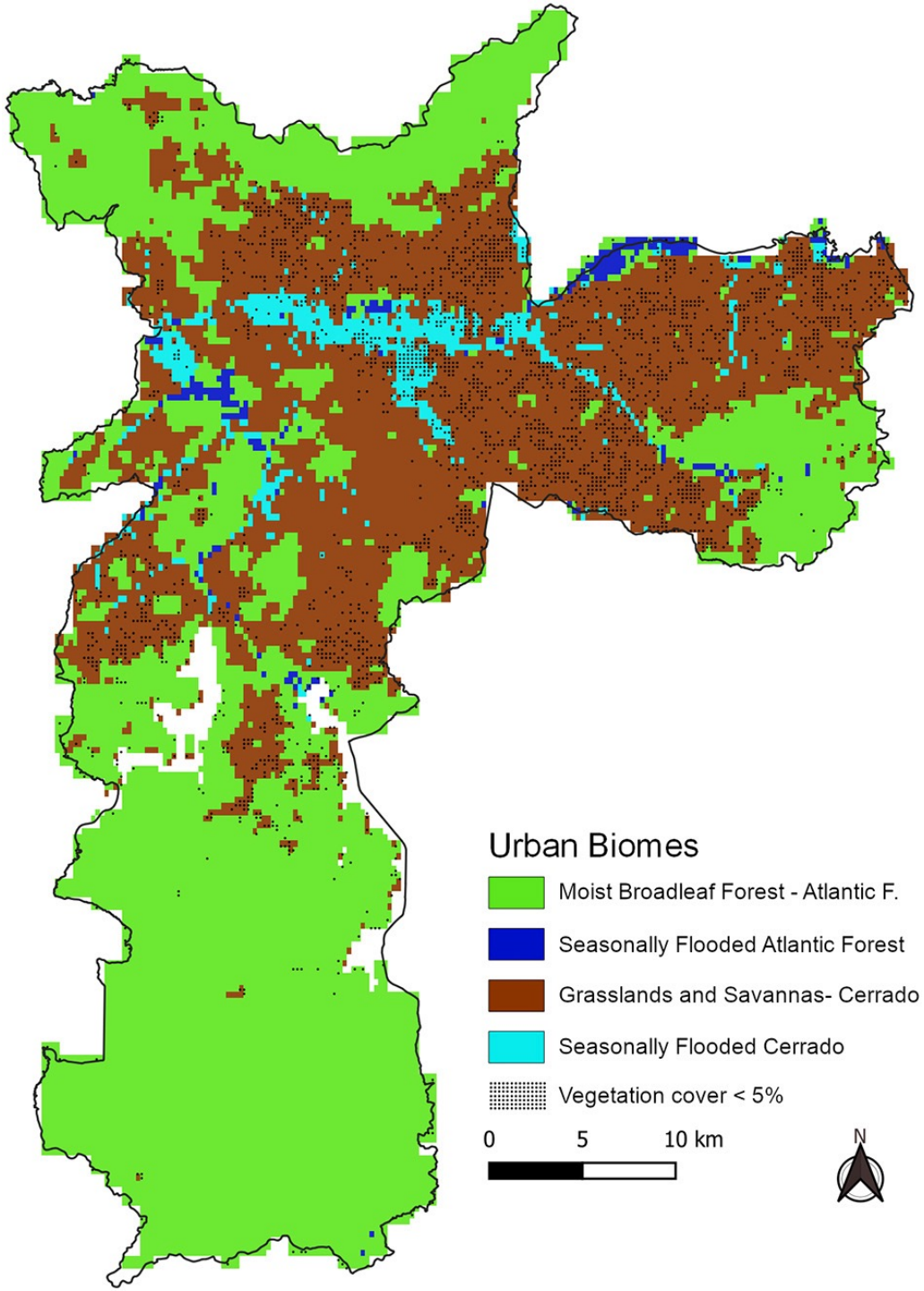

Urban Biomes
Moist Broadleaf Forest - Atlantic F.
Seasonally Flooded Atlantic Forest
Grasslands and Savannas- Cerrado
Seasonally Flooded Cerrado
Vegetation cover < 5%
0
5
10 km
N


Maasstab 1:50000.
Aequidistanz 25 m.
Nach den Plänen der Commissão geographica e geologica von São Paulo, sowie nach eigenen Beobachtungen gezeichnet
von
Dr. A. Usteri.
Eisenbahnen.
Wege.
Urwald.
Caapueira u. Caapuerão.
Sumpfbuschwald.
Hochmoor.
Flachmoor.
Verlag von Gustav Fischer in Jena

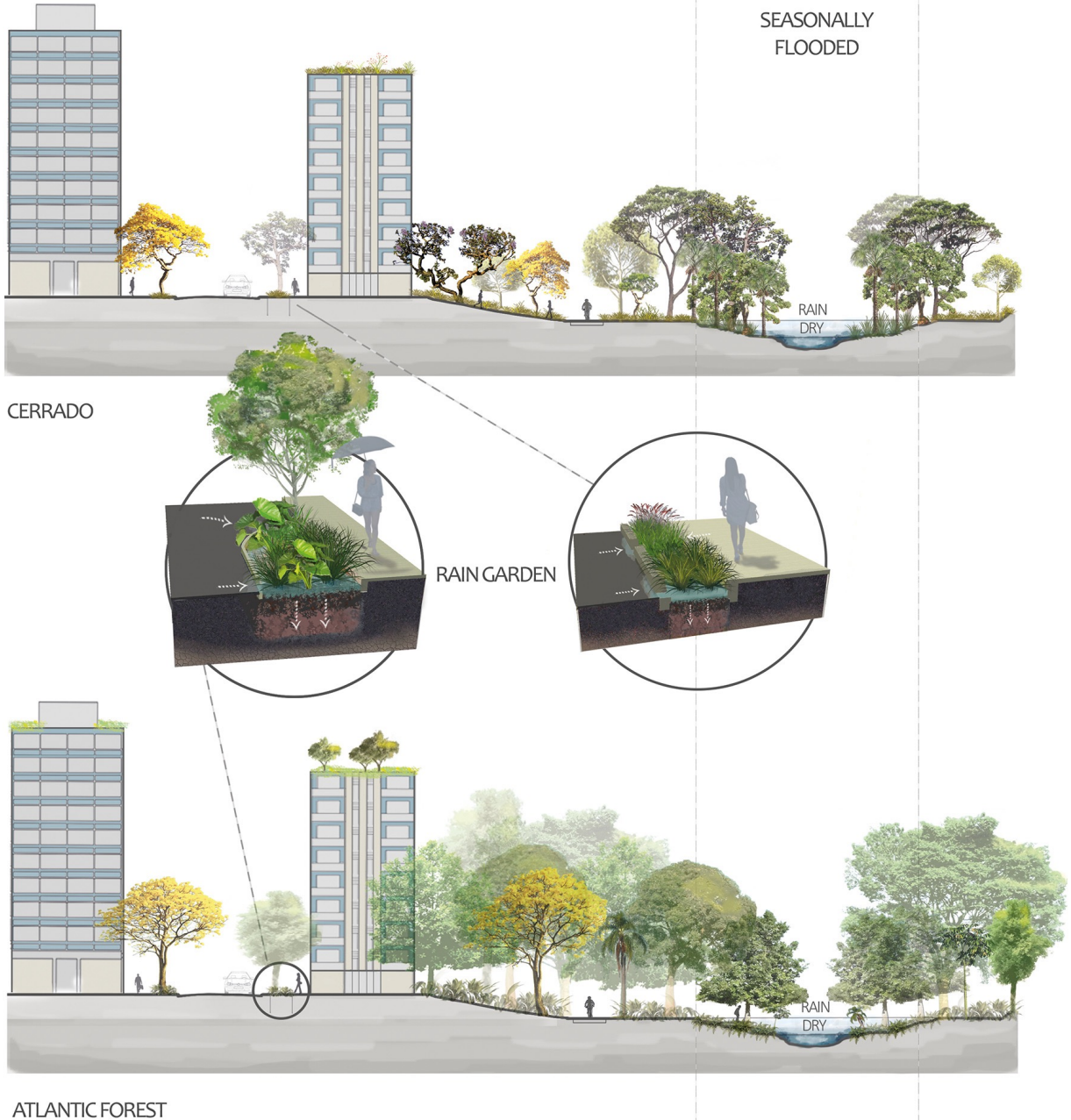
Usteri 1911



infraestruturameioambiente.sp.gov.br



infraestruturameioambiente.sp.gov.br



Miyahara et al 2022 **Developing and classifying urban biomes as a basis for nature-based solution**. *Urban Climate* 45: 101251

- Serviços ecossistêmicos

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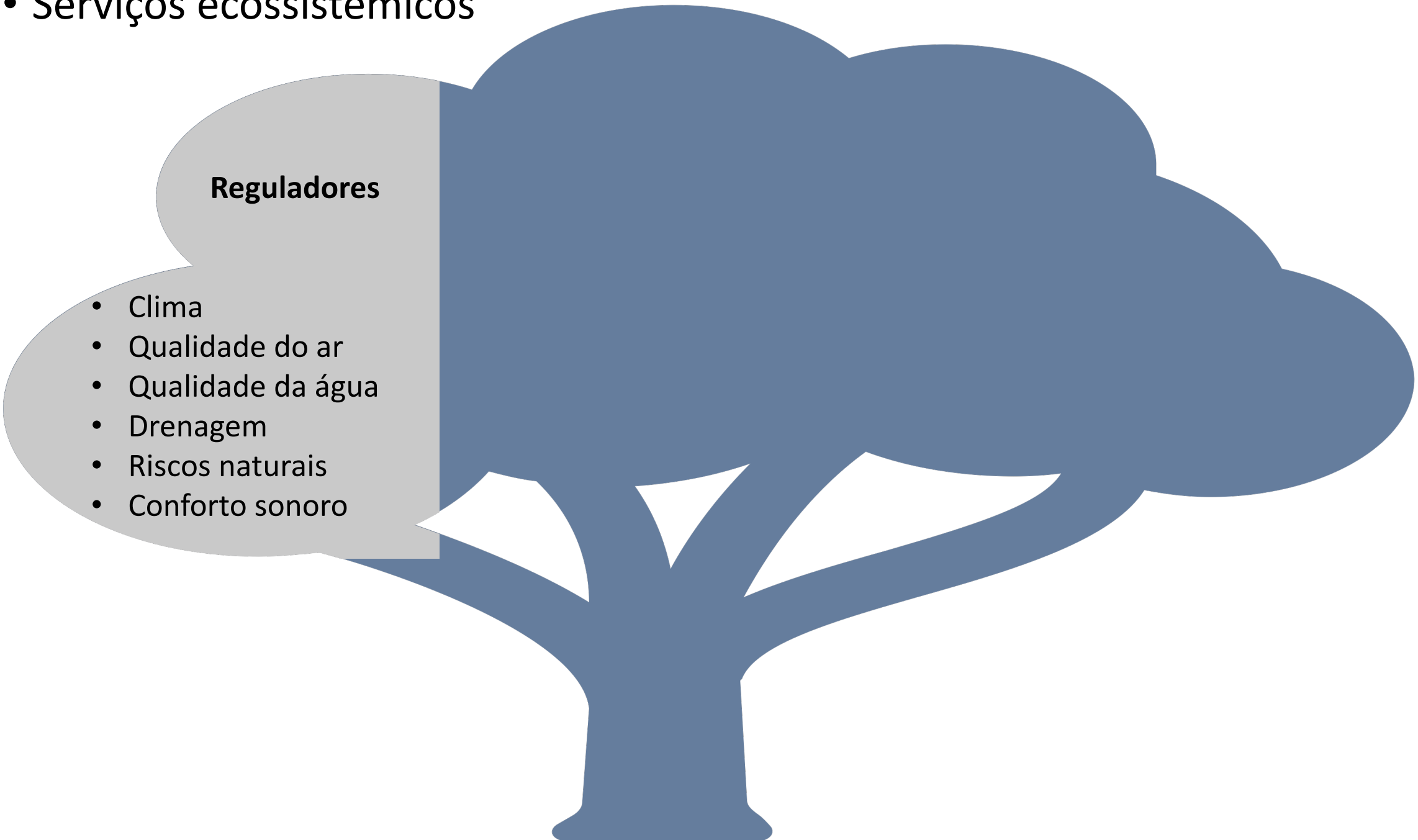
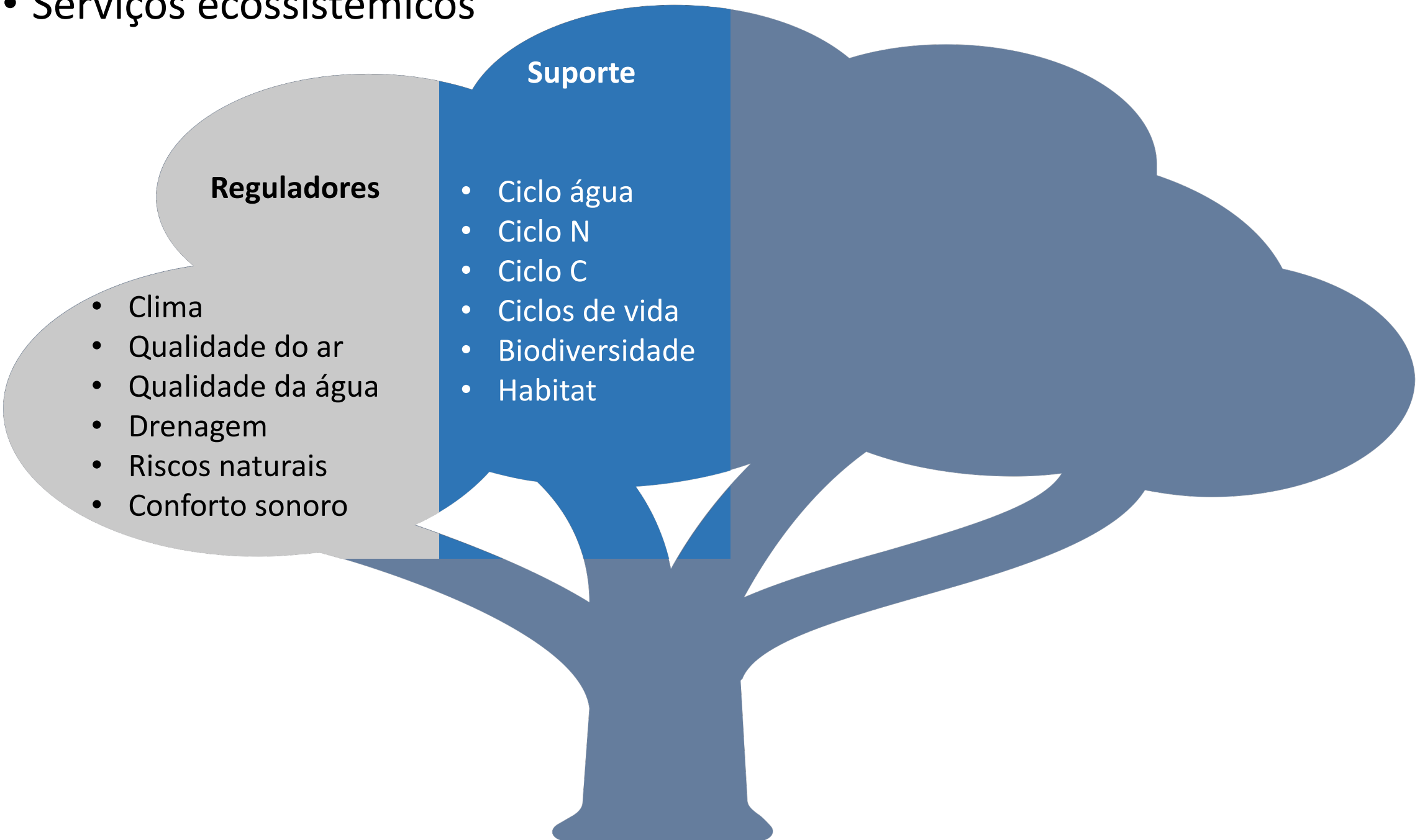
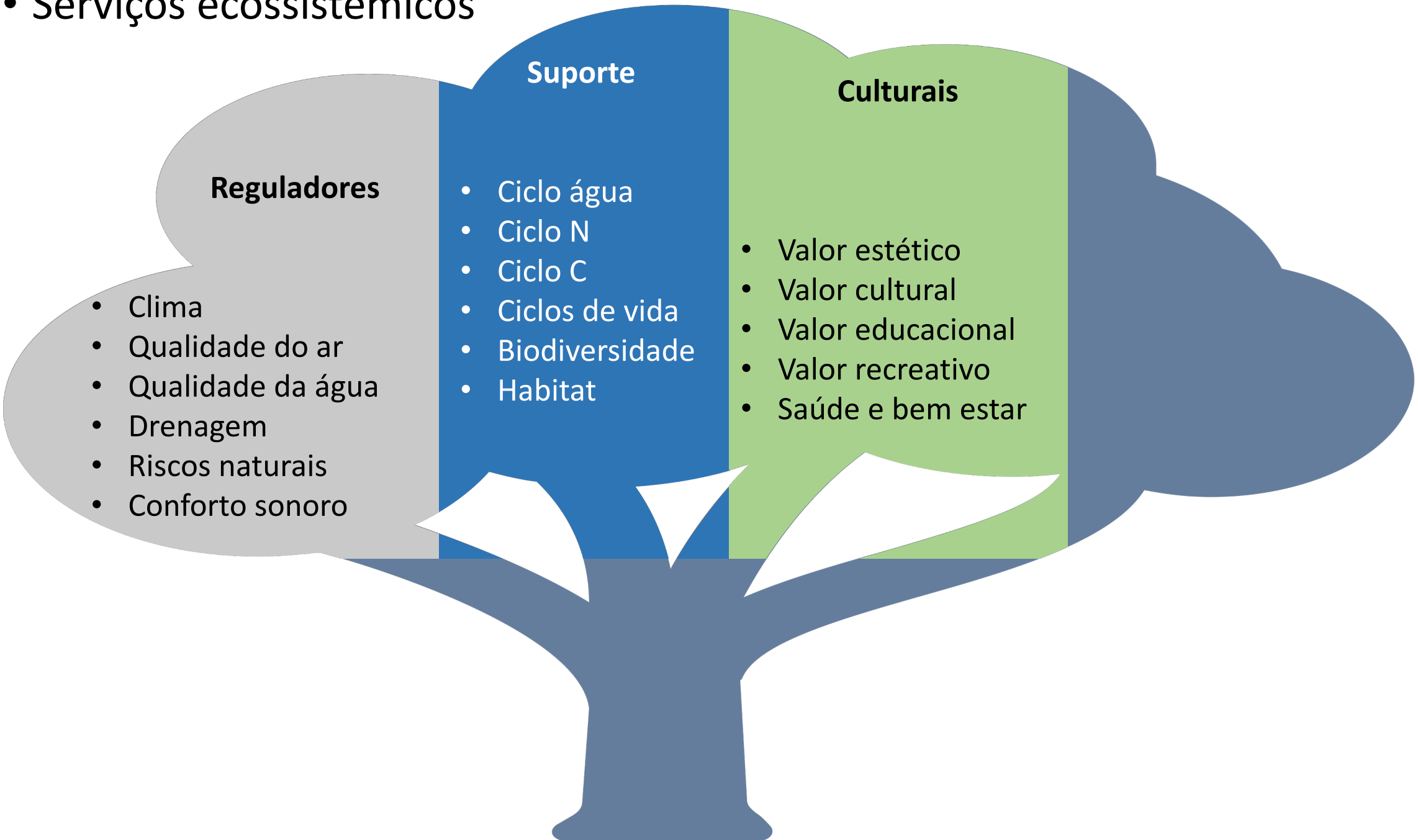


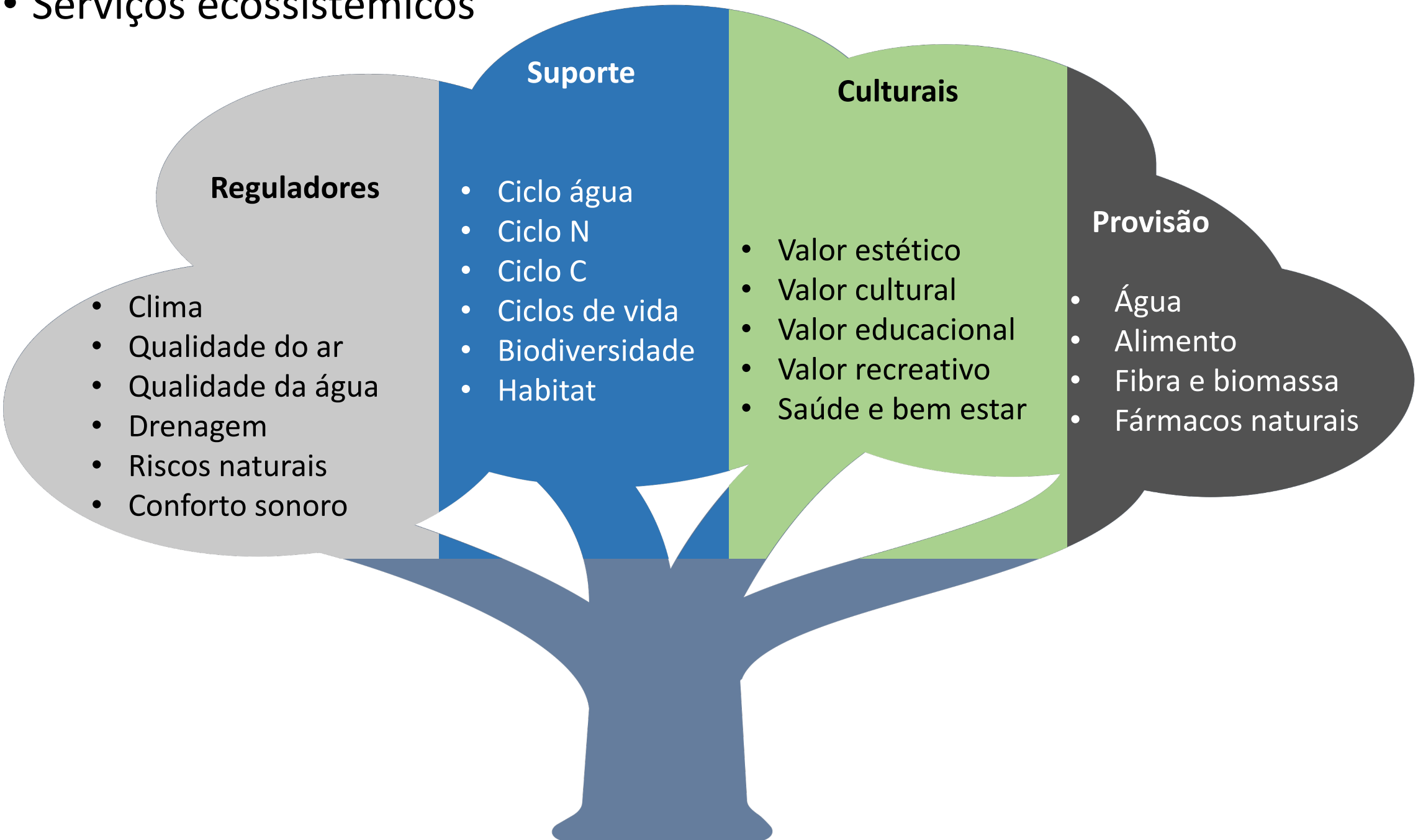
- Serviços ecossistêmicos



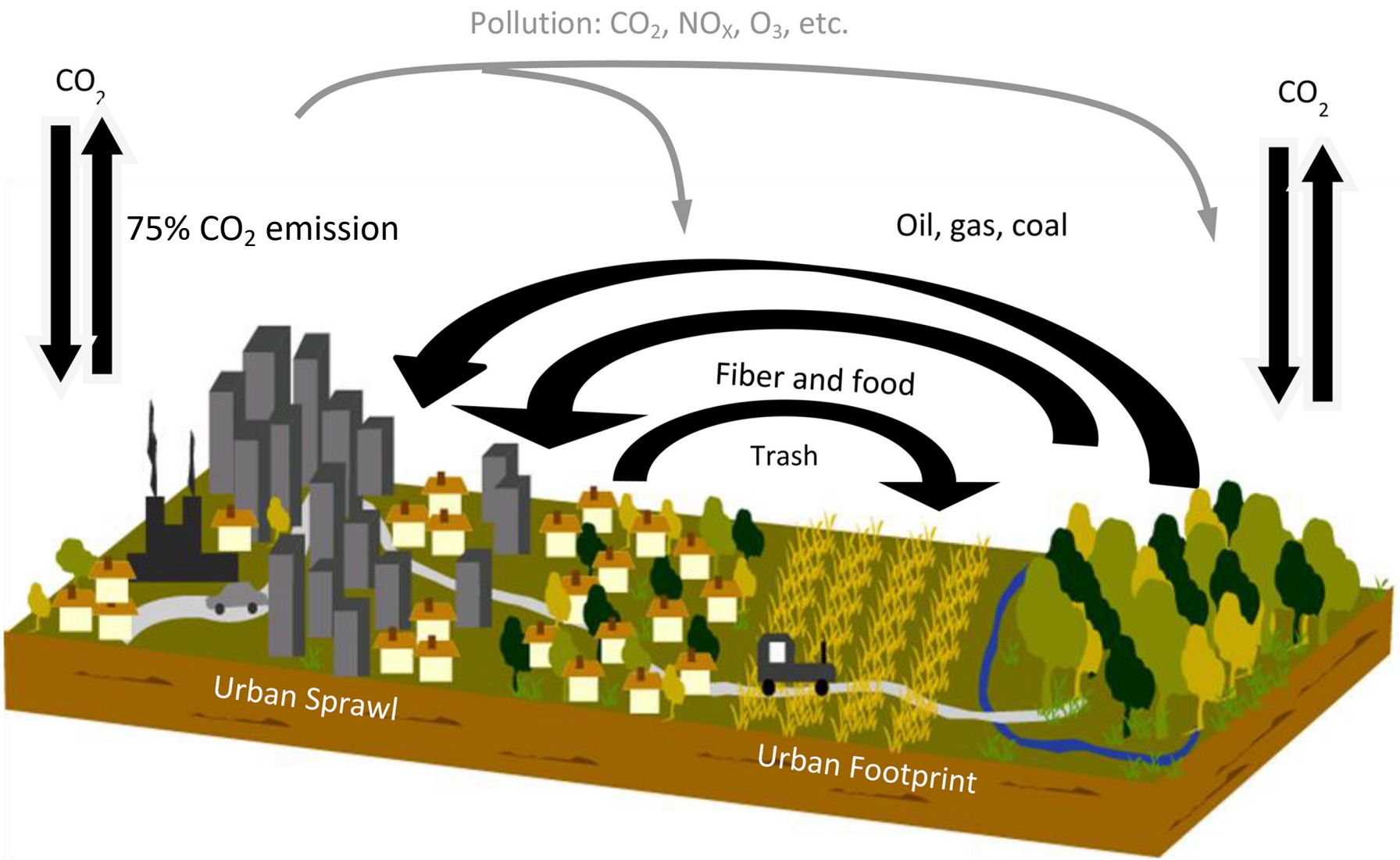
- Serviços ecossistêmicos



- Serviços ecossistêmicos

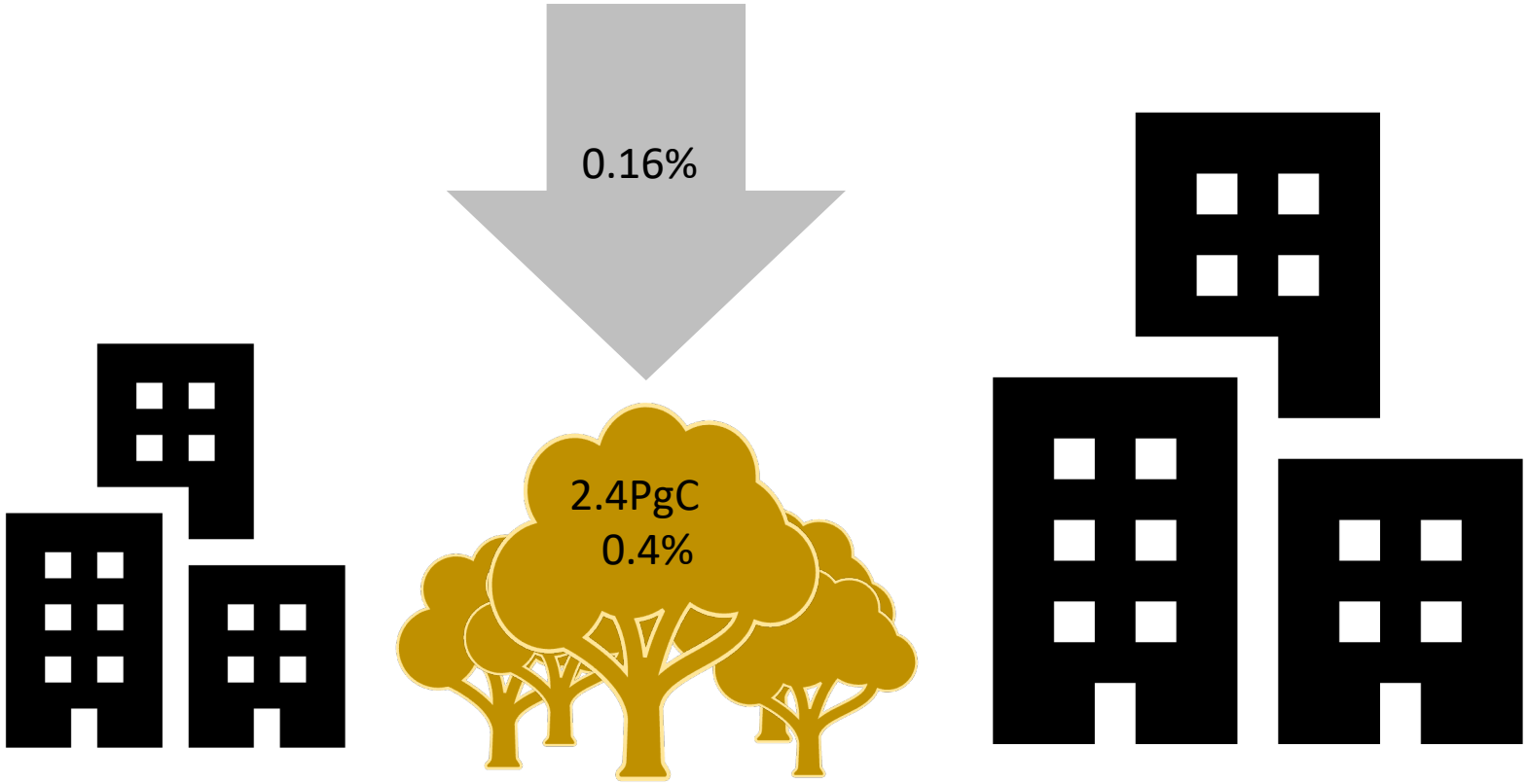


- Sequestro de carbono



Churkina 2016 Frontiers in Ecology and Evolution 3: 144

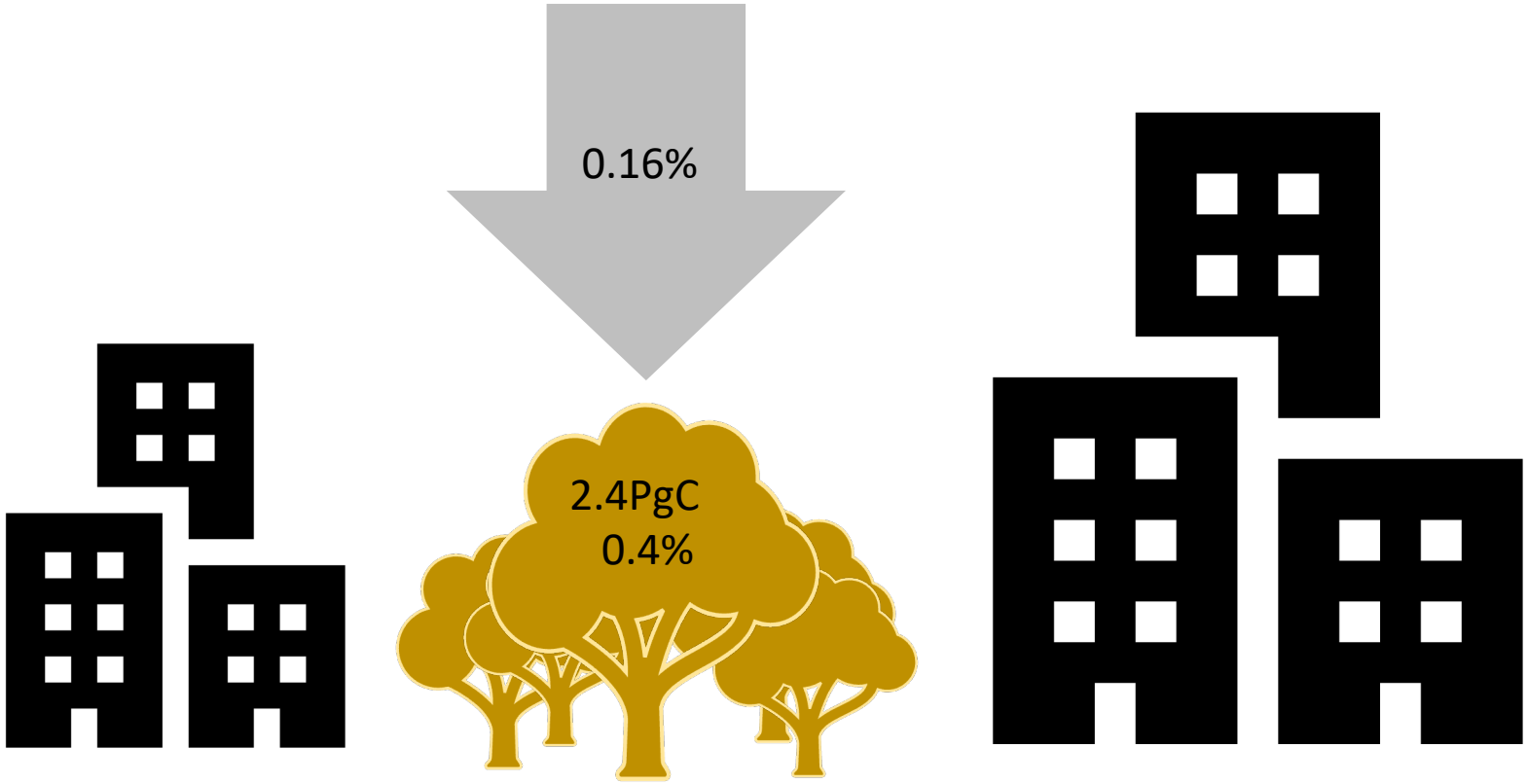
- Sequestro de carbono



Churkina 2016 Frontiers in Ecology and Evolution 3: 144

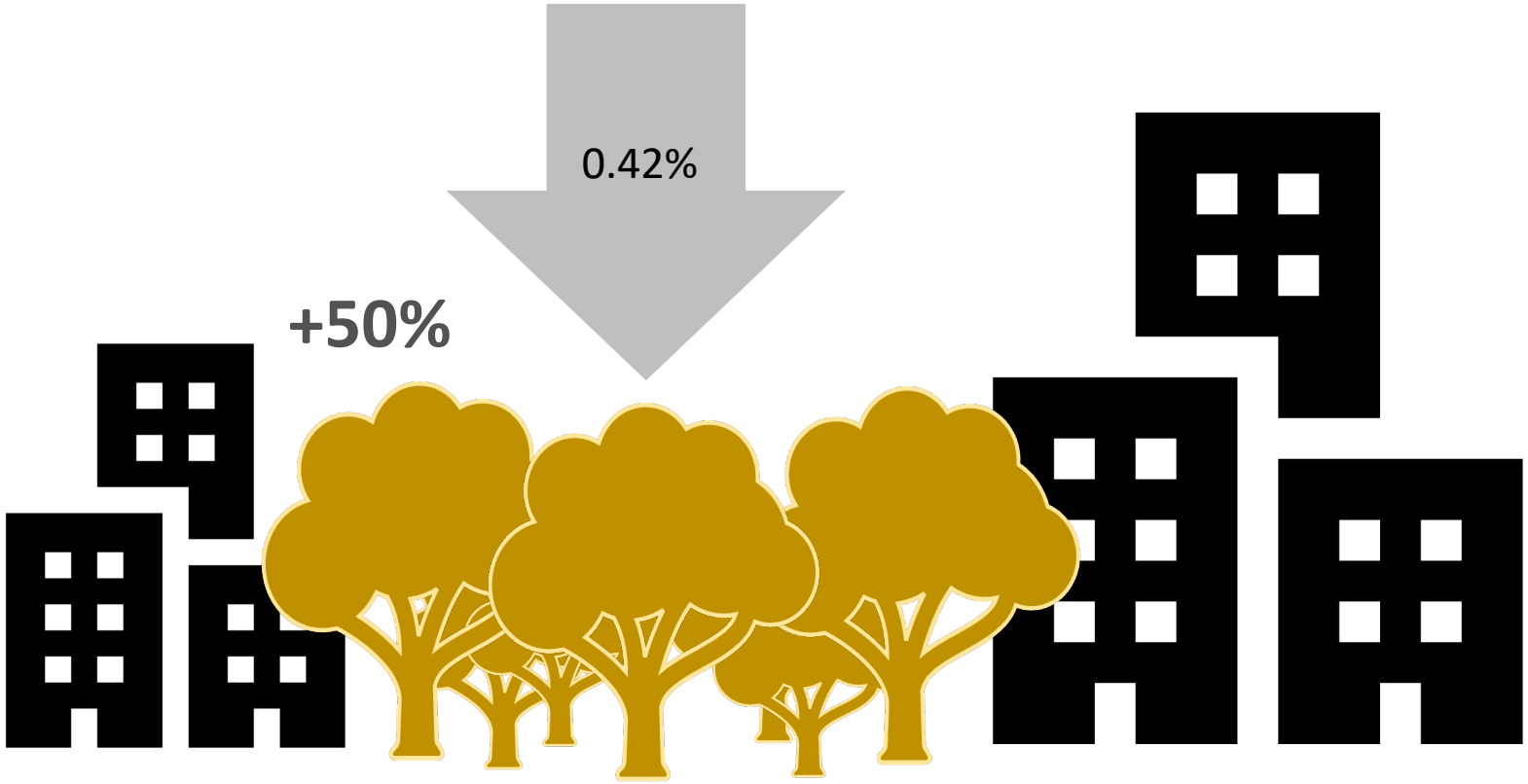
- Sequestro de carbono

$1PgC = 10^{15}\ gC = 1$ bilhão de toneladas



Churkina 2016 Frontiers in Ecology and Evolution 3: 144

- Sequestro de carbono



Churkina 2016 Frontiers in Ecology and Evolution 3: 144

- Sequestro de carbono

Nowak et al (2013) Environmental Pollution 178: 229-236

- Sequestro de carbono

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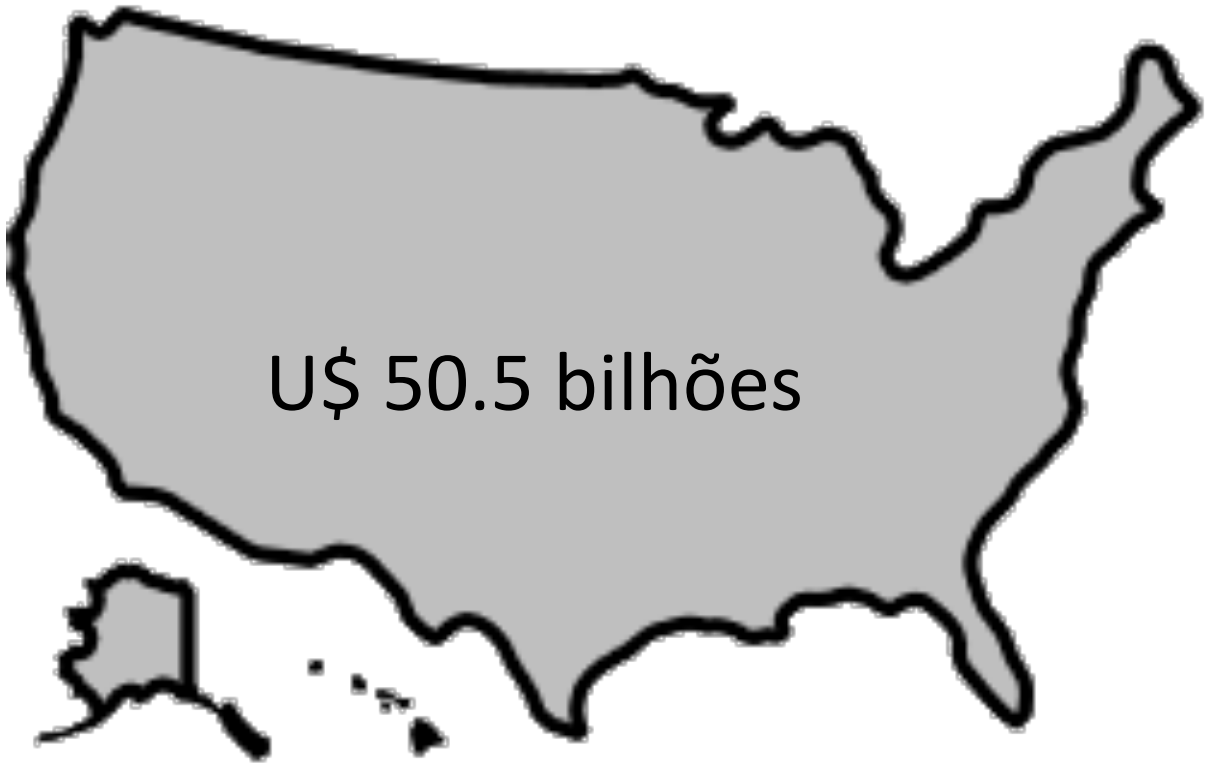

Nowak et al (2013) Environmental Pollution 178: 229-236

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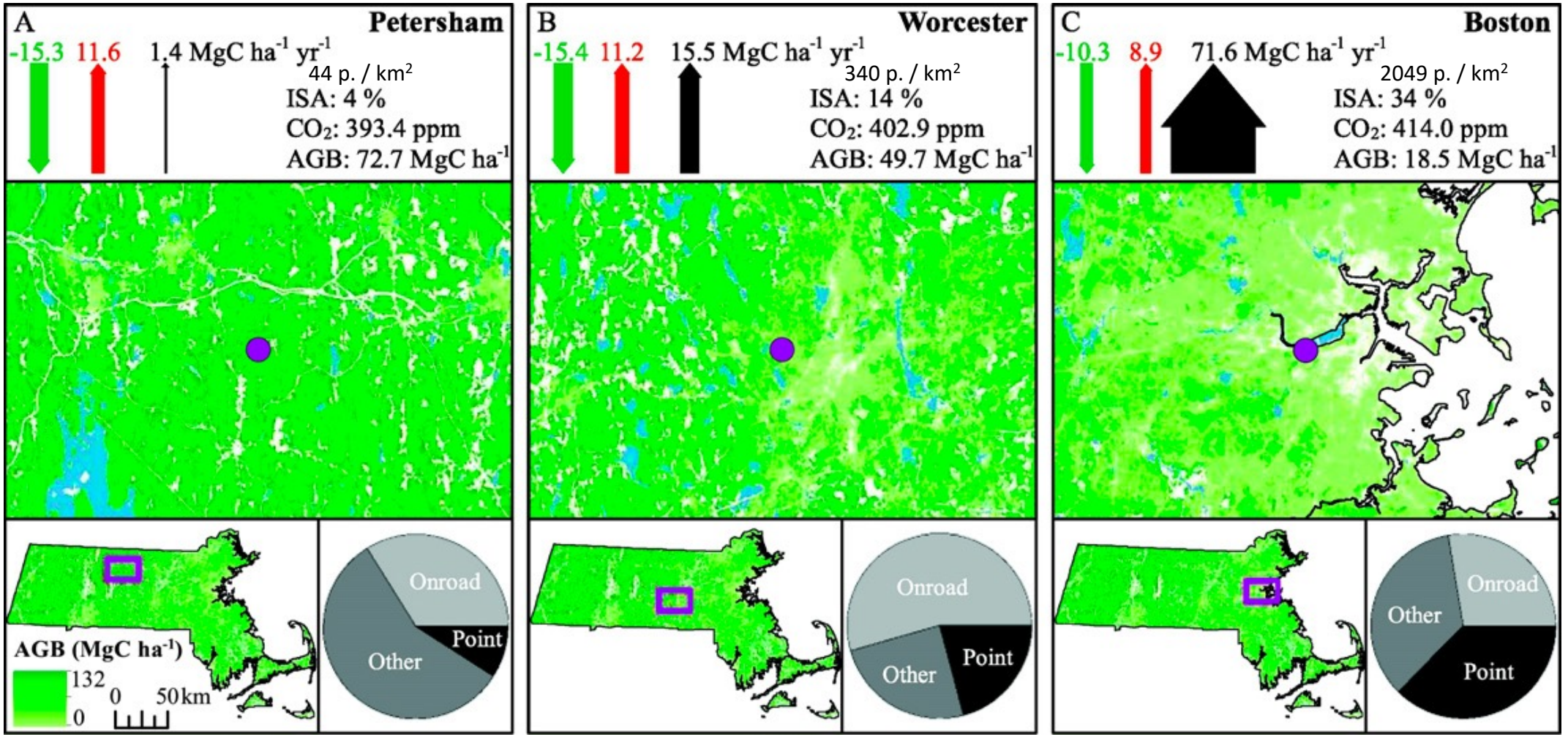
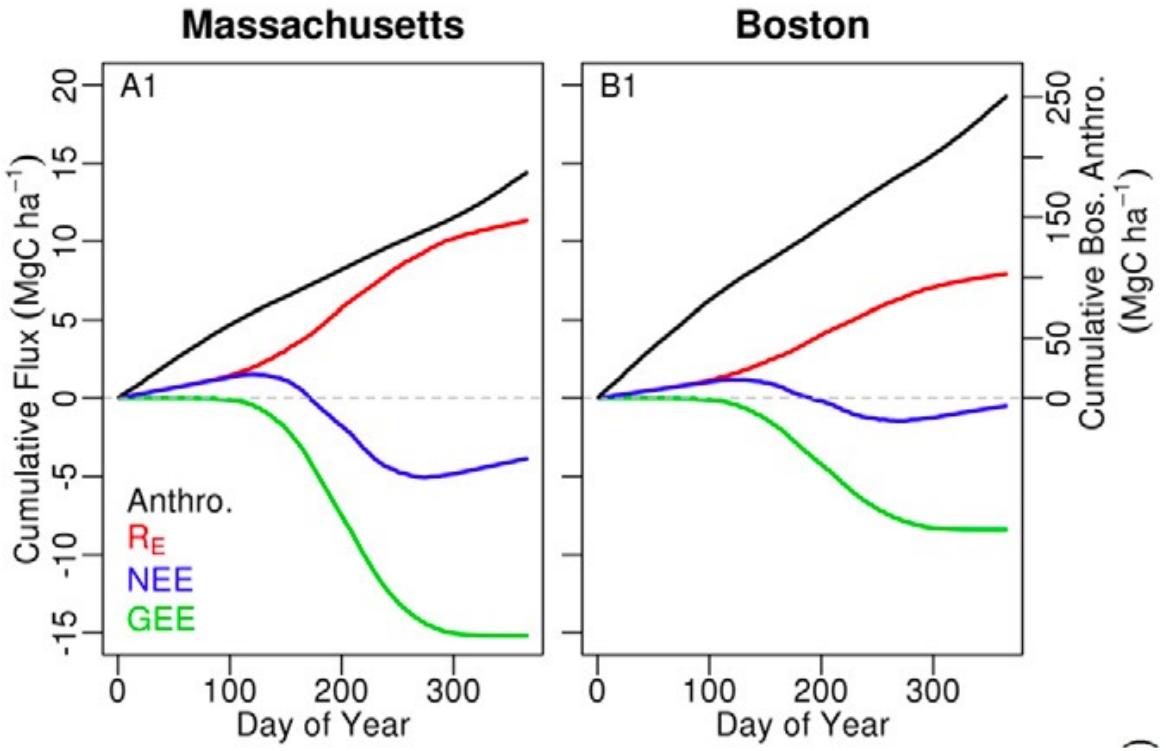


Hardiman et al (2017) Science of the Total Environment 592: 366-372

- Sequestro de carbono



Hardiman et al (2017) Science of the Total Environment 592: 366-372

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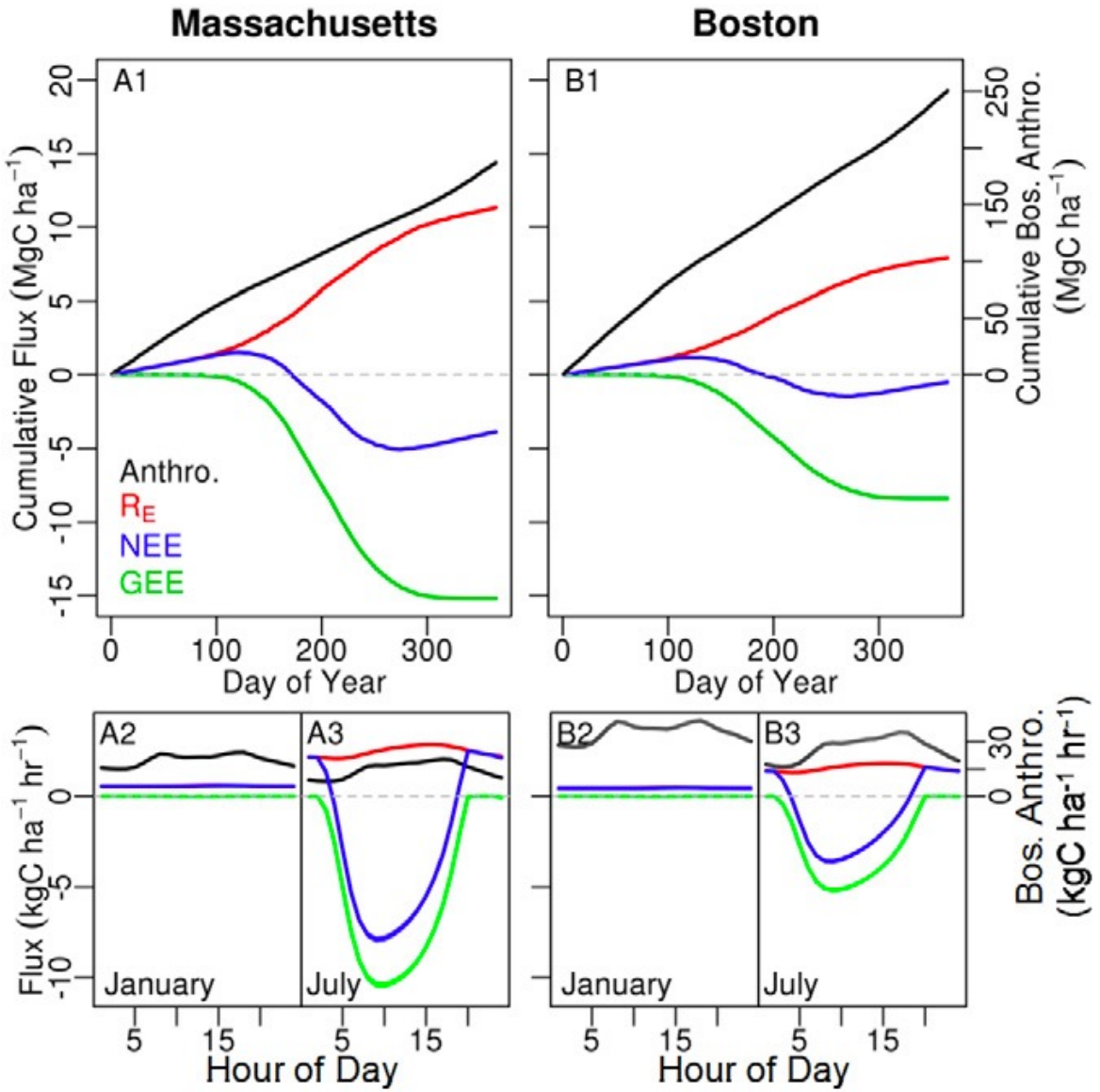

Hardiman et al (2017) Science of the Total Environment 592: 366-372

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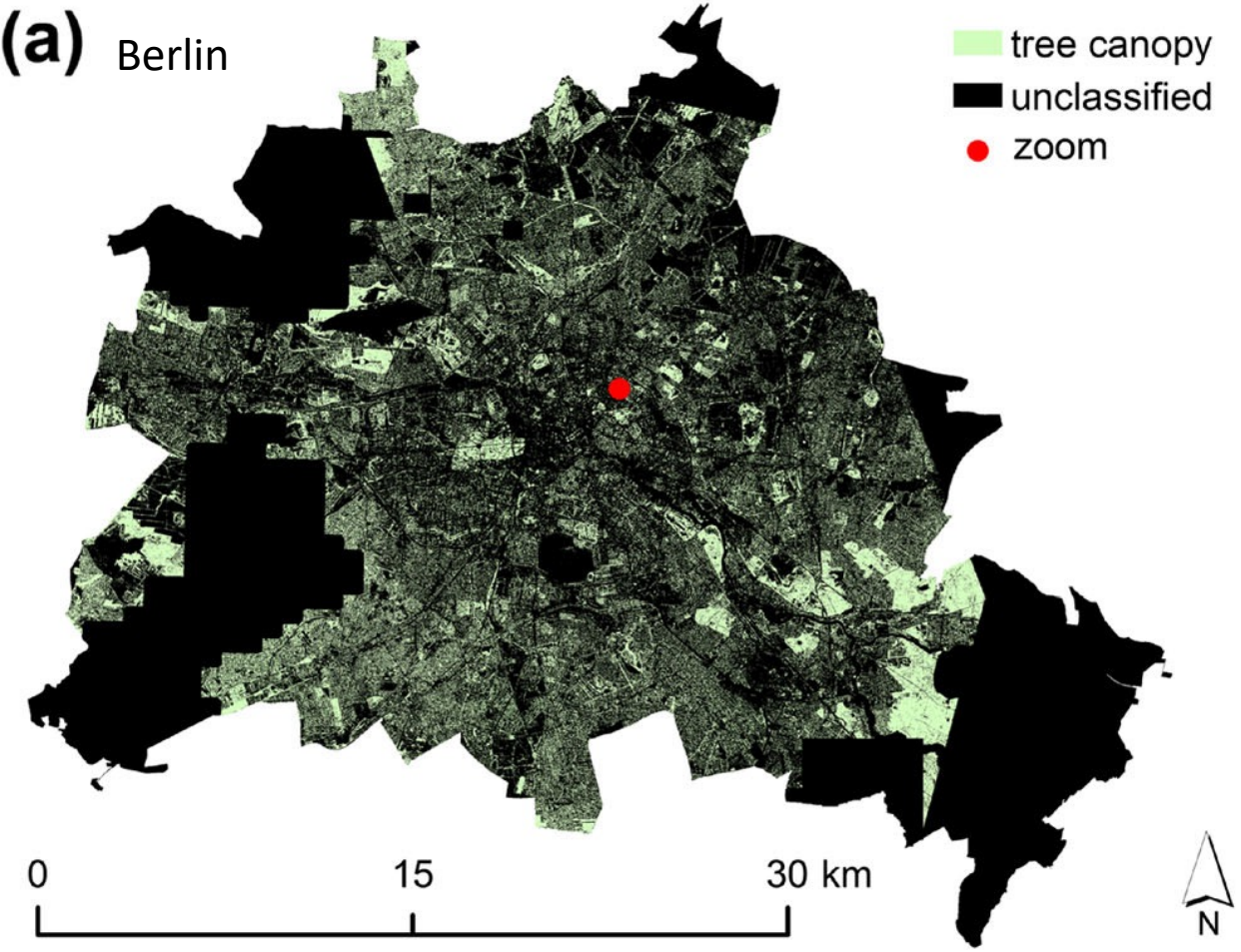
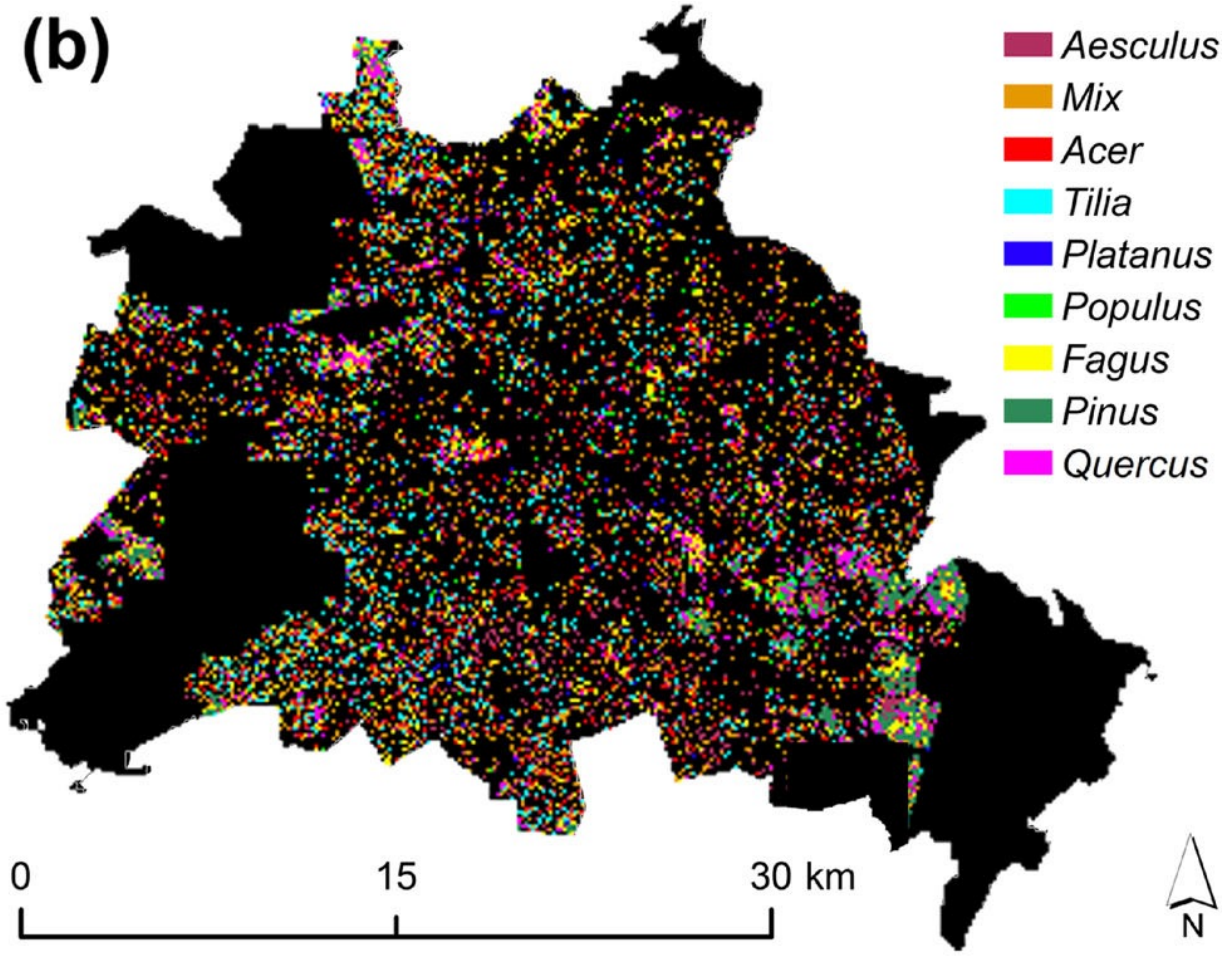
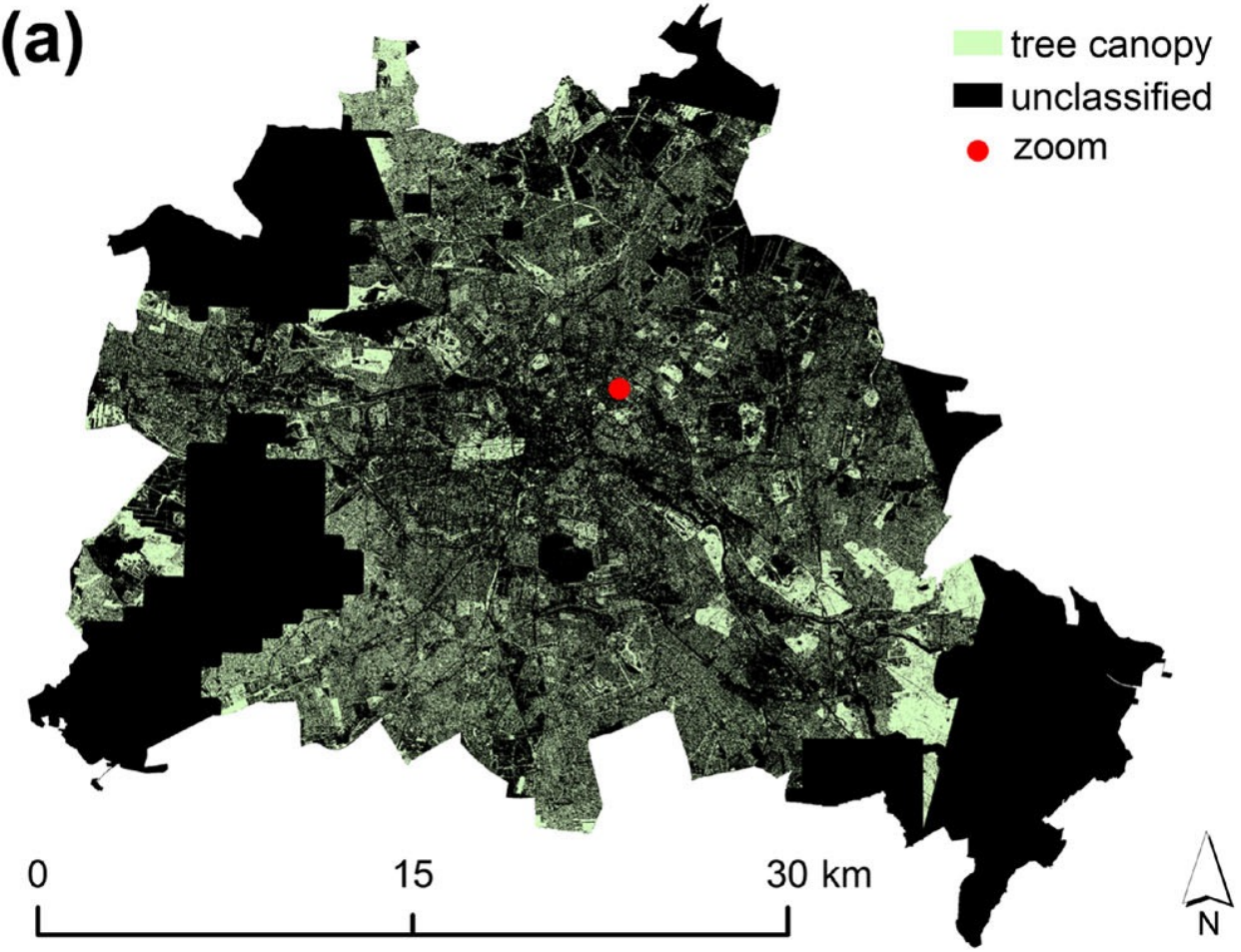
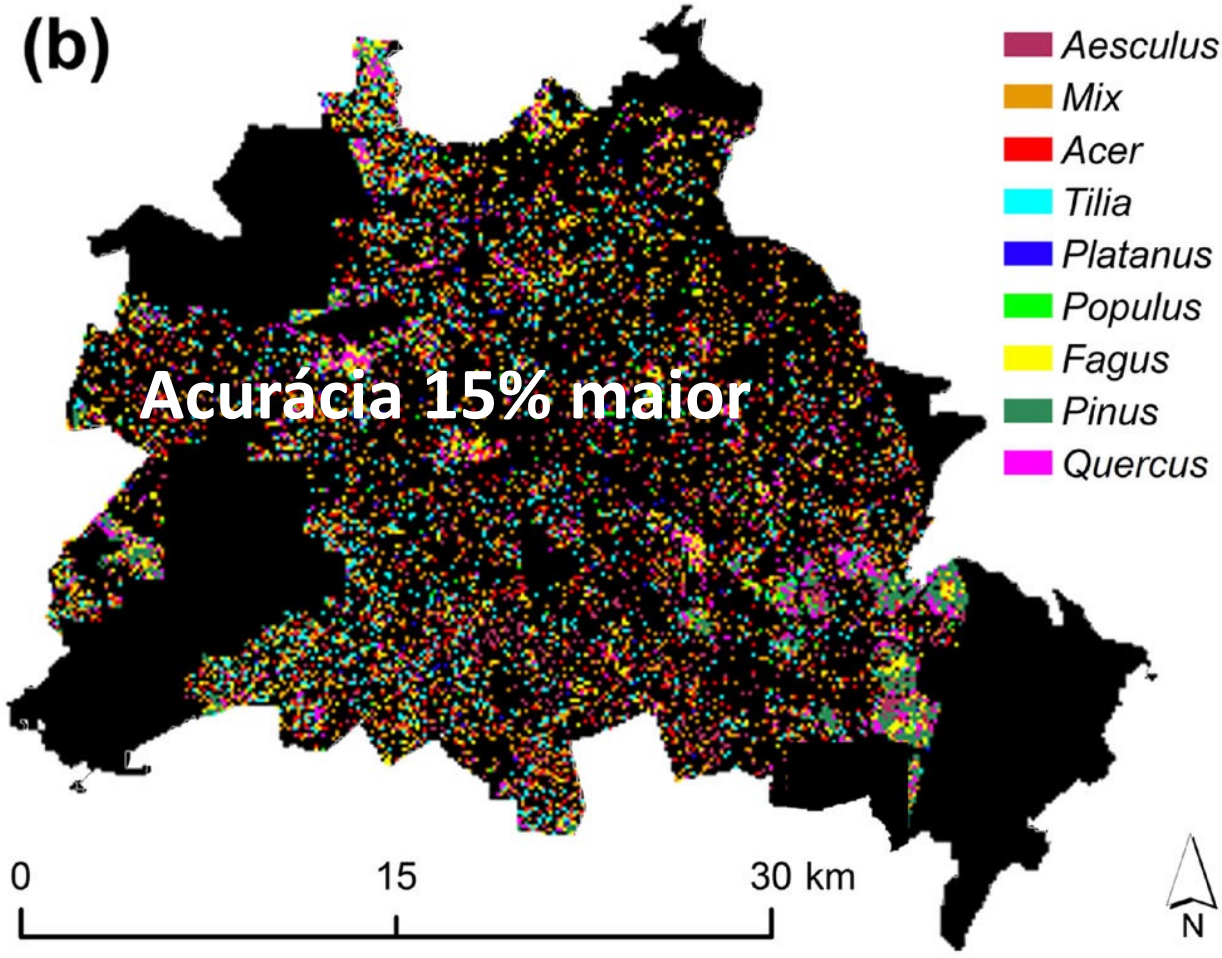




Tigges et al (2017) Urban Ecosystems 20: 97-111

- Sequestro de carbono





Tigges et al (2017) Urban Ecosystems 20: 97-111

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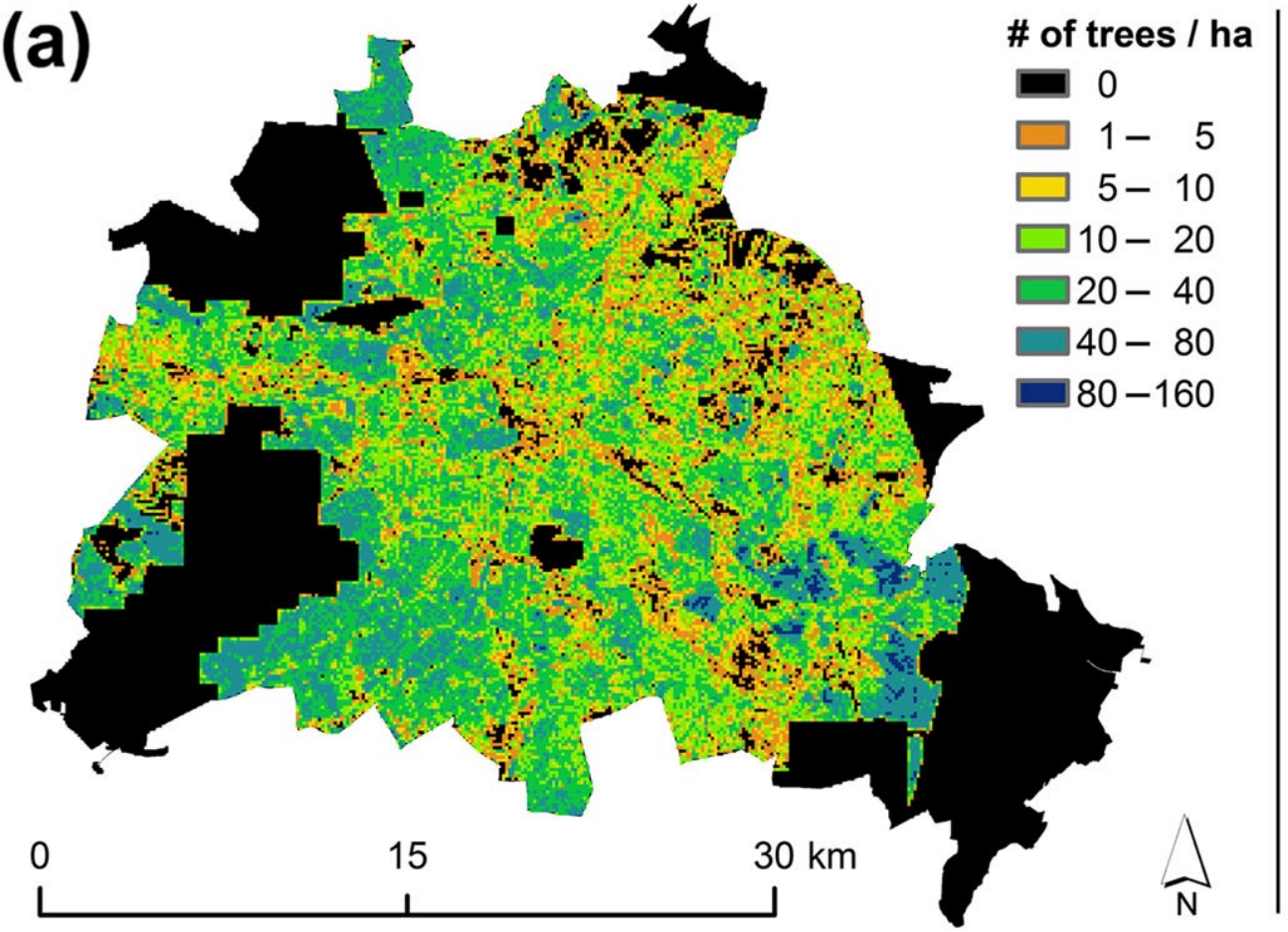

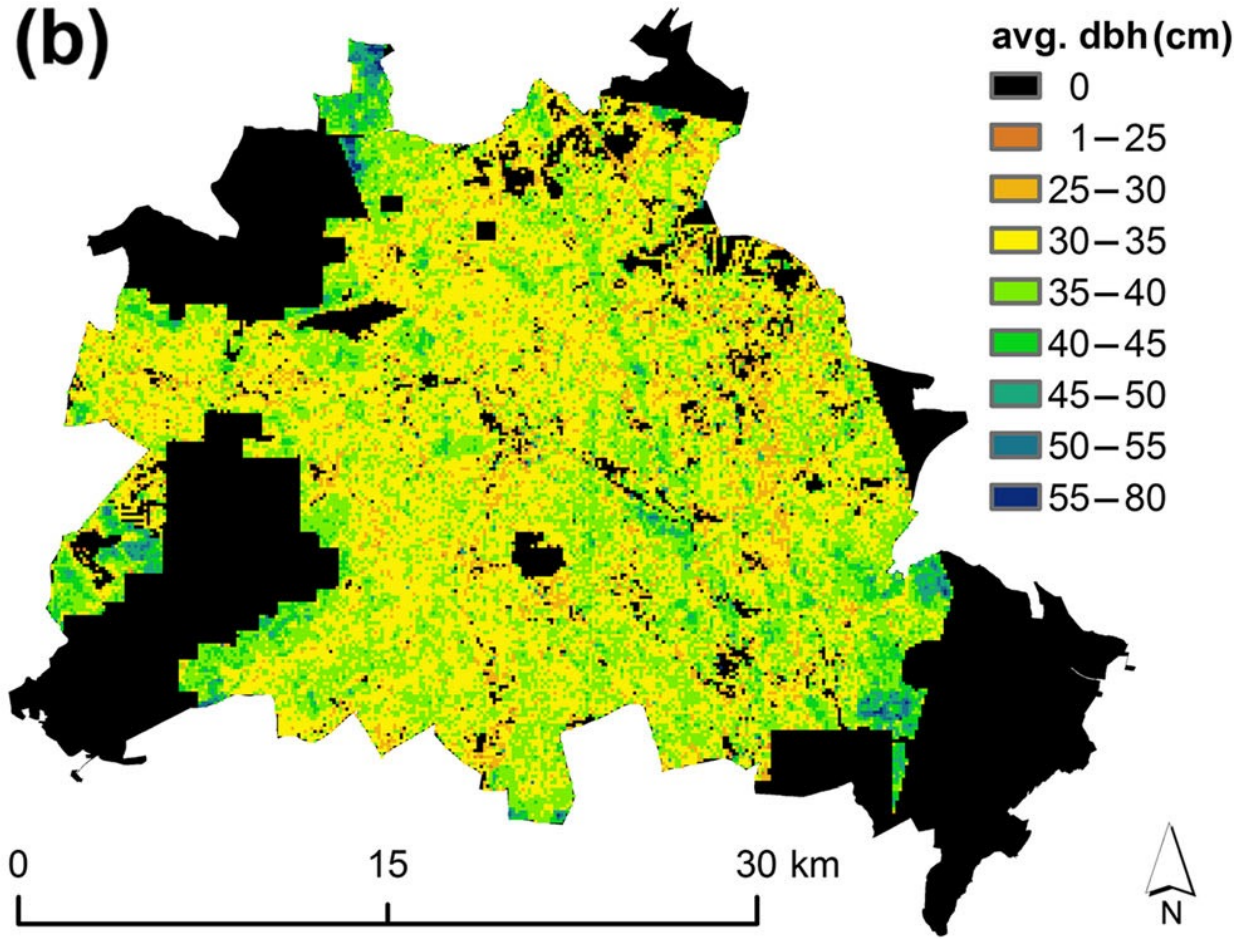

Tigges et al (2017) Urban Ecosystems 20: 97-111

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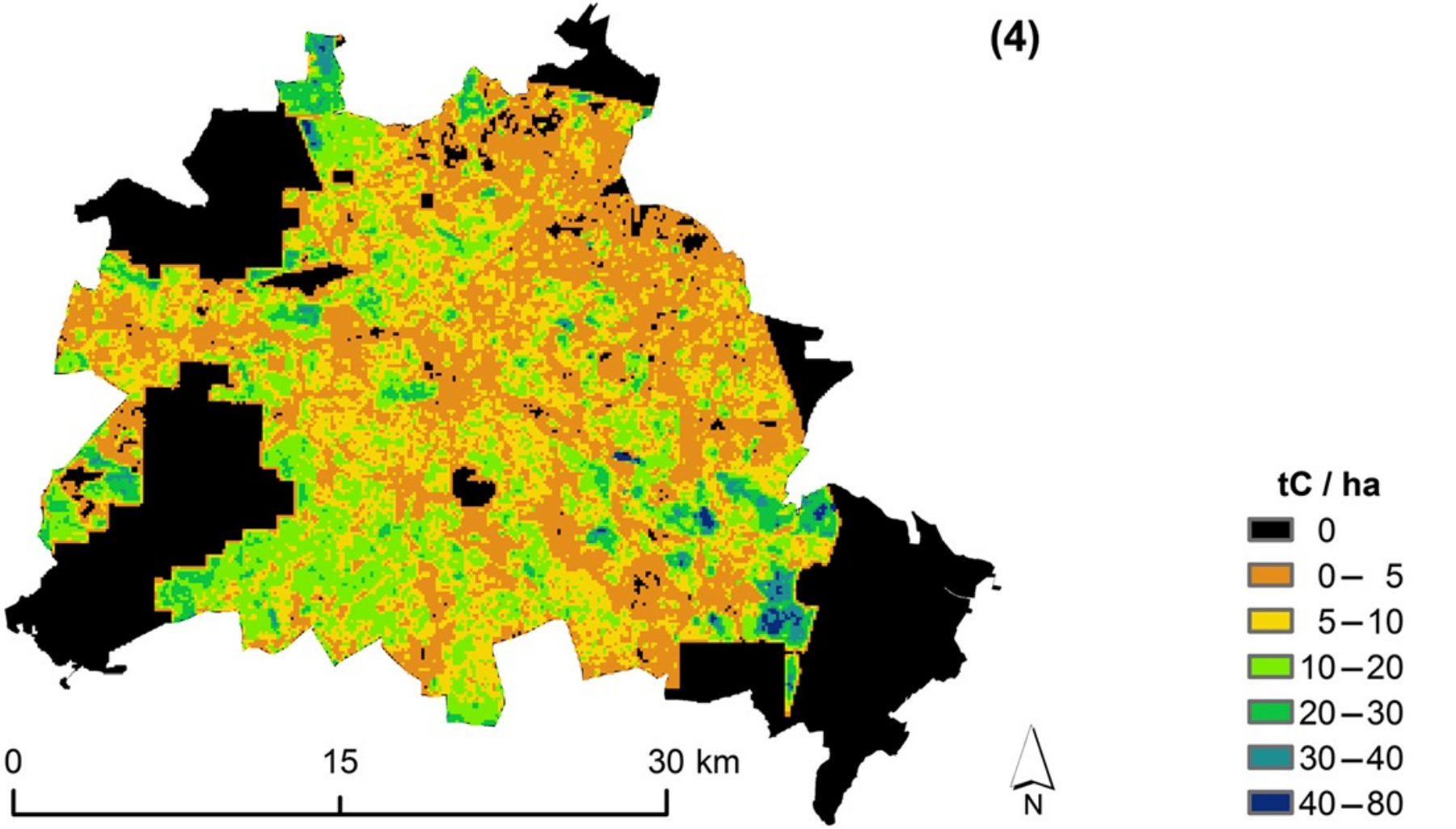
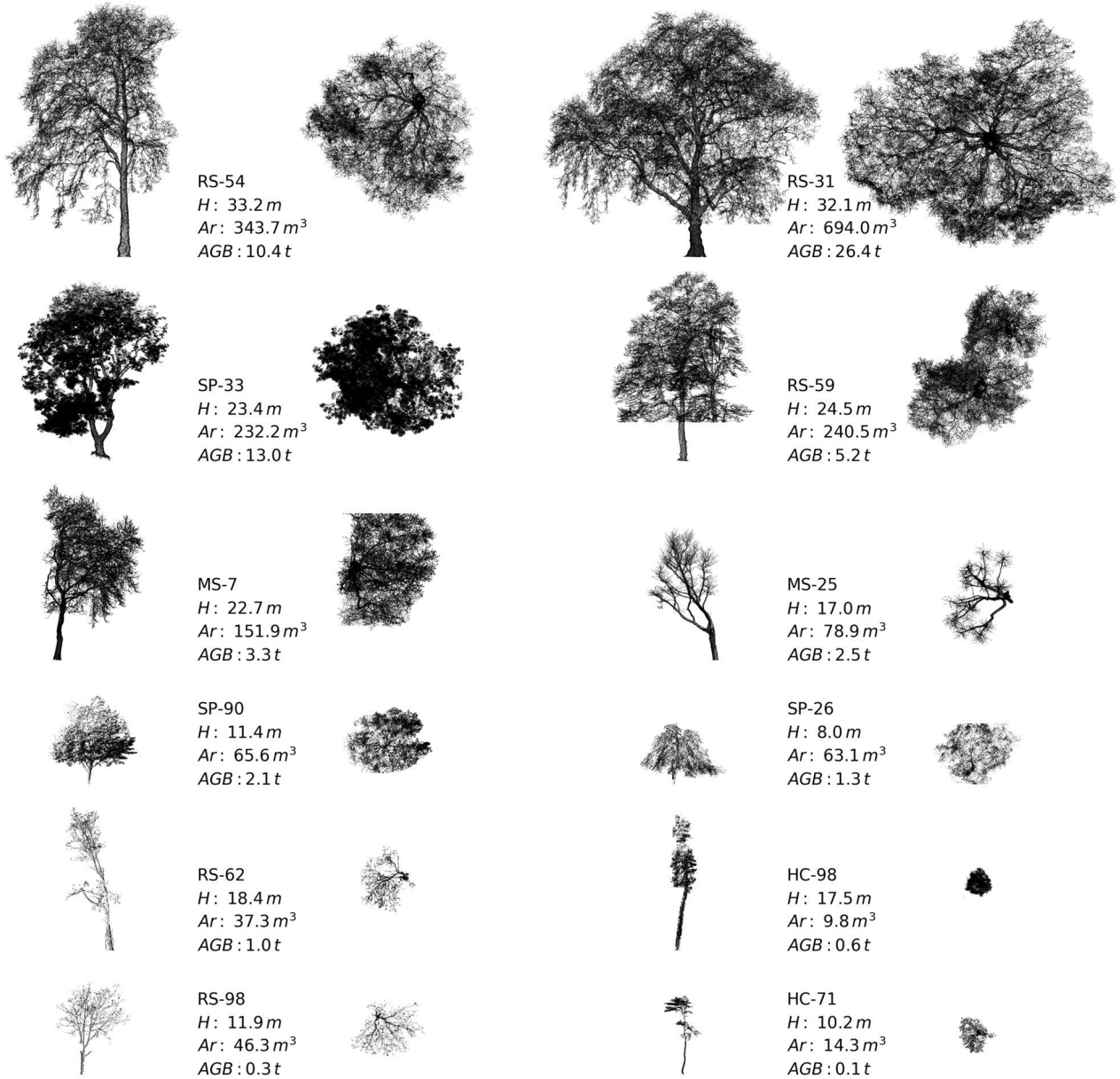


Tigges et al (2017) Urban Ecosystems 20: 97-111

- Sequestro de carbono

Wilkes et al (2018) Carbon Balance Management 13:10

Espécies encontradas em Auckland, Nova Zelândia



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Wilkes et al (2018) Carbon Balance Management 13:10

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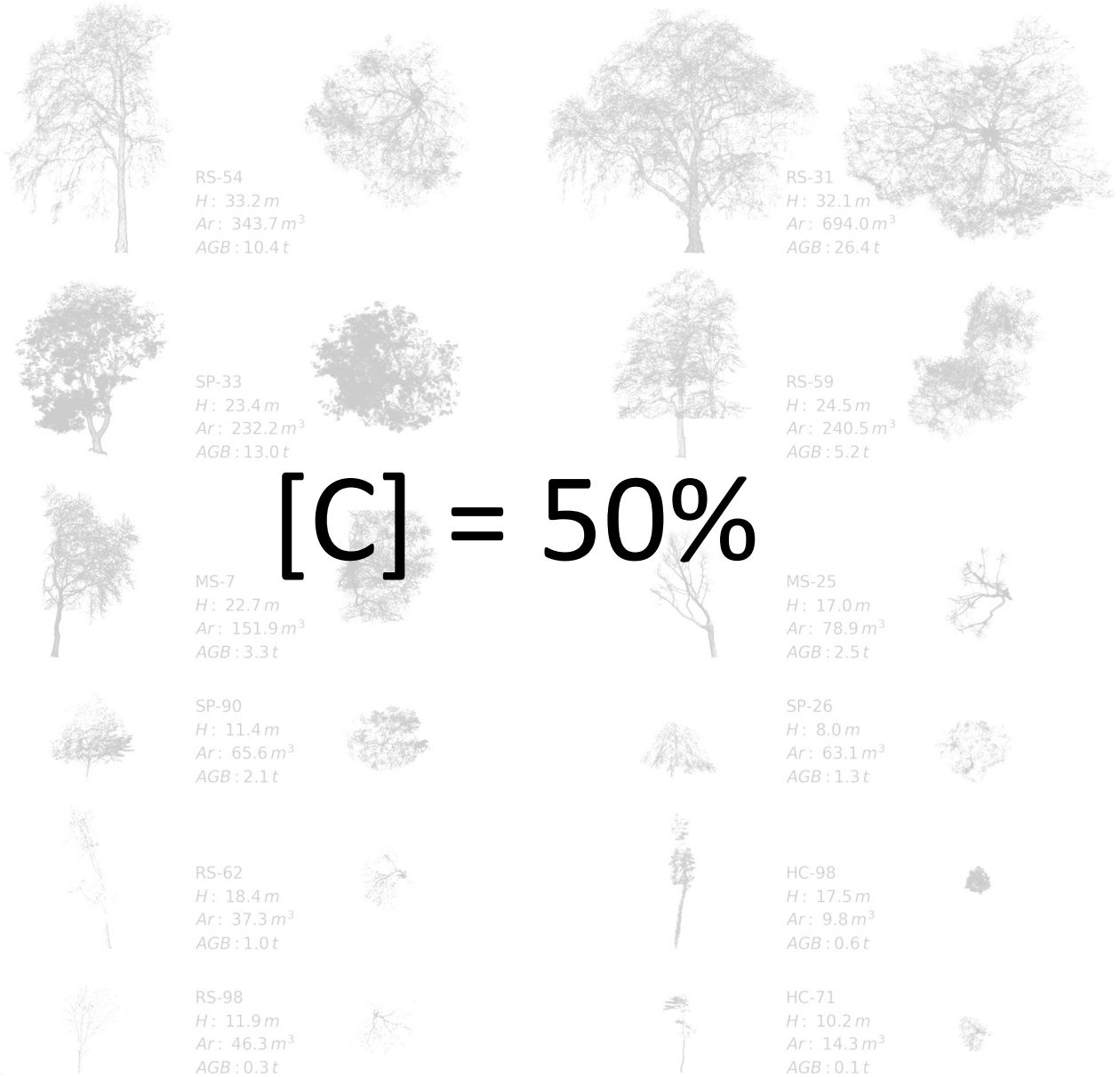

$$[C] = 50\%$$

- Sequestro de carbono

Tree species	C stored (kg C tree^{-1})		C sequestered (kg C year^{-1})		Annual diameter growth (mm year^{-1})	BAI (cm^2 year^{-1})	Relative BAI (%)
	EQ. 2	EQ. 3	EQ. 2	EQ. 3			
L. styraciflua	-	712.6	-	5.5	1.7	13.64	0.67
Q. robur	-	1178.3	-	11.2	2.6	25.95	0.82
V. lucens	877.6	-	7.53	-	2.5	22.94	0.86
M. excelsa	2111.9	-	12.41	-	2.3	28.22	0.59
A. excelsus	1573.9	-	14.81	-	3.2	34.16	0.95
P. tenuifolium[a]	323.9	-	0.35	-	0.2	1.16	0.11
P. eugenioides[a]	209.5	-	0	-	0	0	0
M. grandiflora	-	142.3	-	2.87	2.2	8.82	1.74
P. crassifolium	43.2	-	0.21	-	0.4	1.04	0.49
C. laevigatus[b]	18.6	-	na	-	na	na	na

[a] Younger trees (approx. 15 years compared to other trees, which are 46+ years old)

[b] Due to the small DBH no permanent tree girth measure tape was installed

Weissert et al 2017 Urban Ecosystem 20: 663-674.

Urbanizacao

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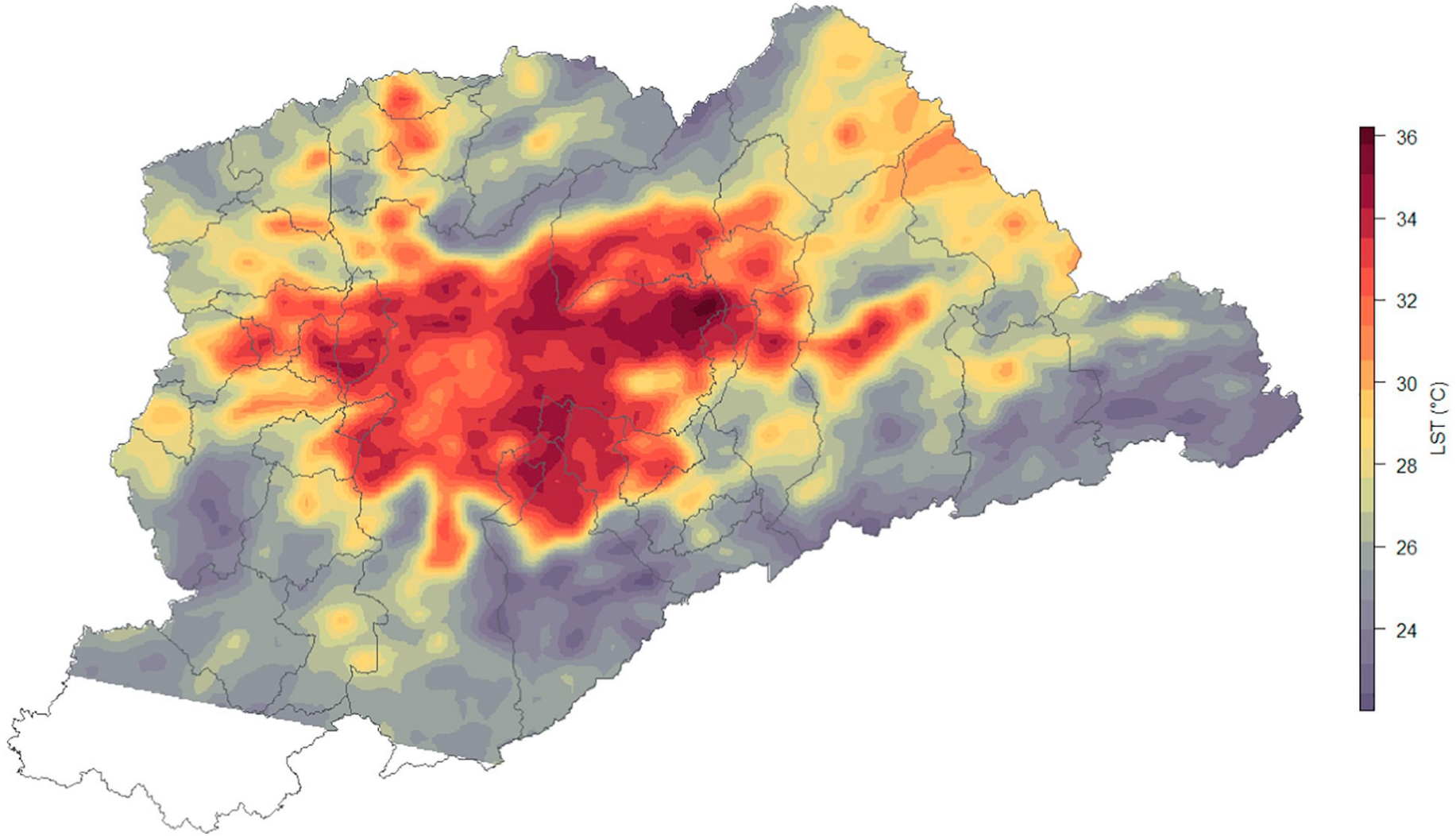
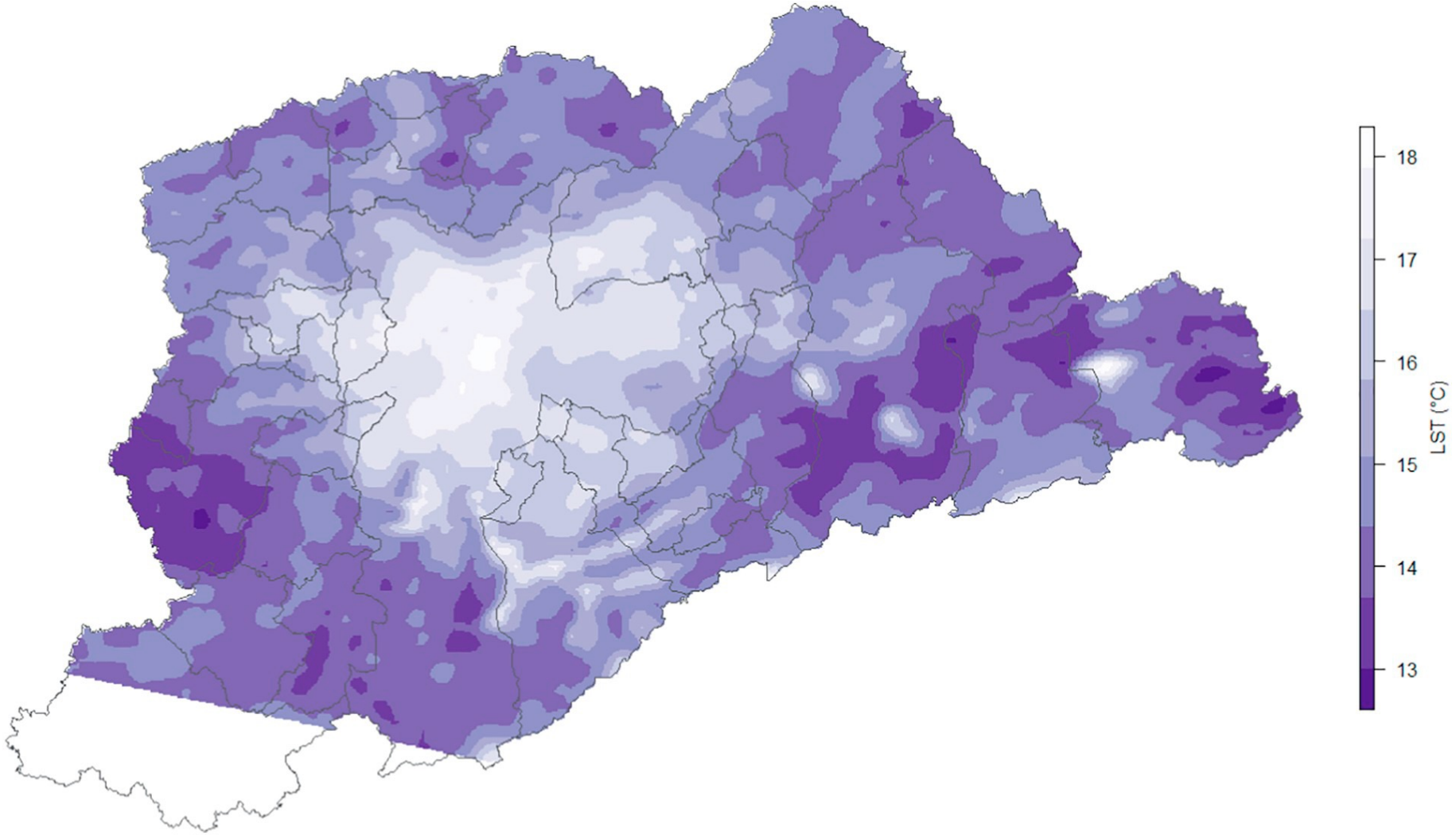
- Controle térmico



Duarte e Ferreira 2019 Urban Climate 27: 105-123

- Controle térmico



Duarte e Ferreira 2019 Urban Climate 27: 105-123

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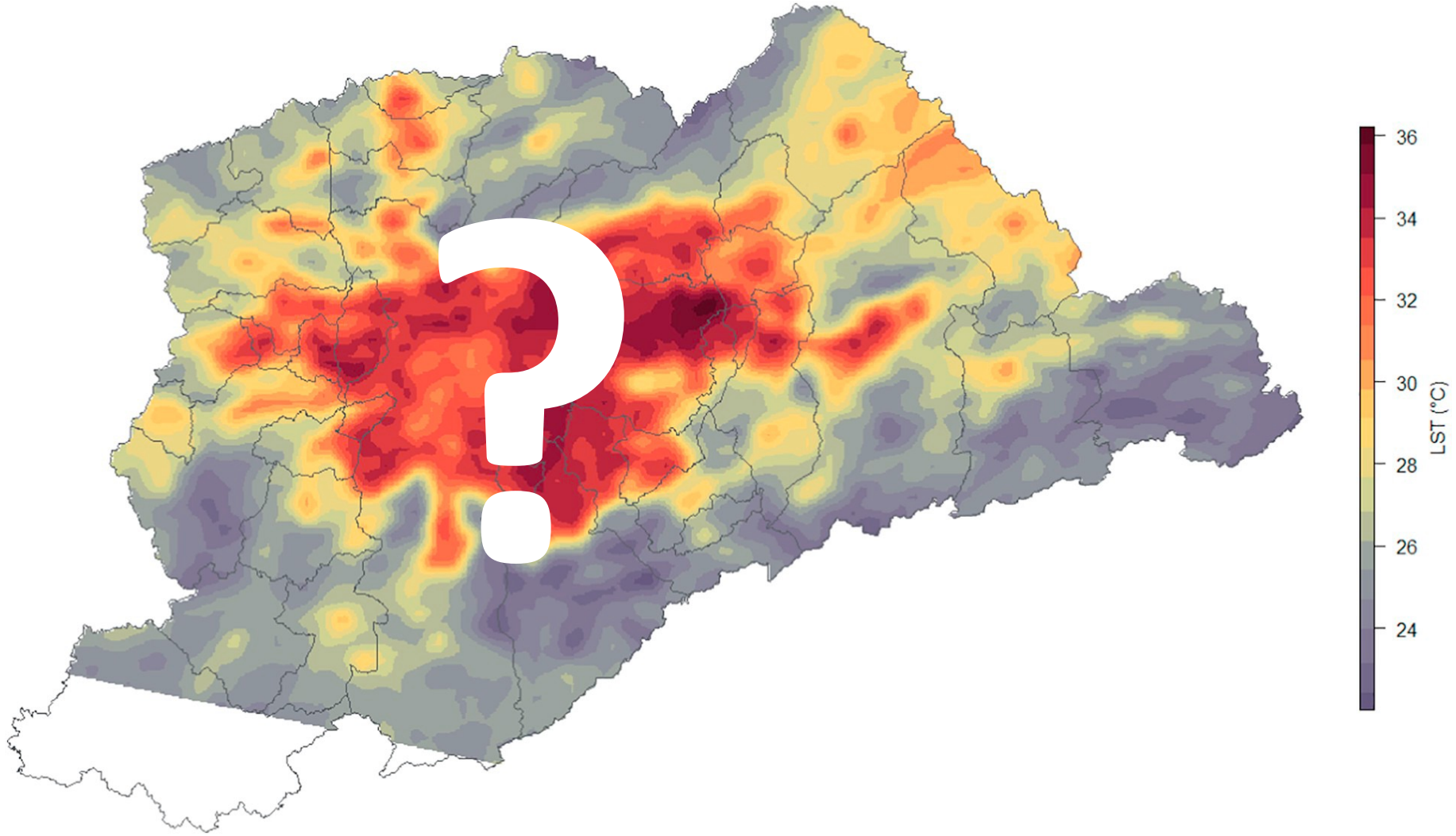

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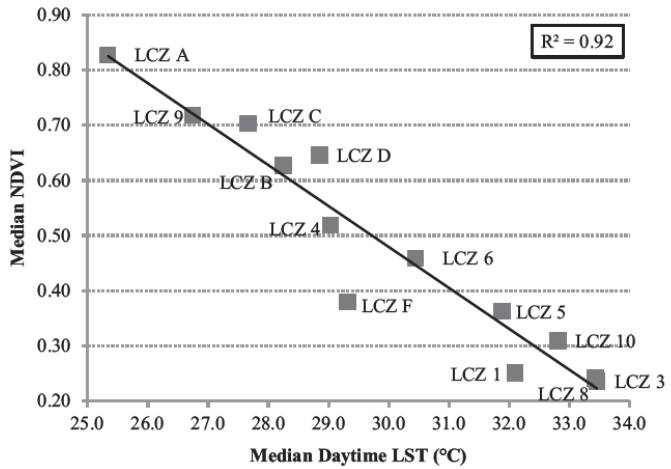
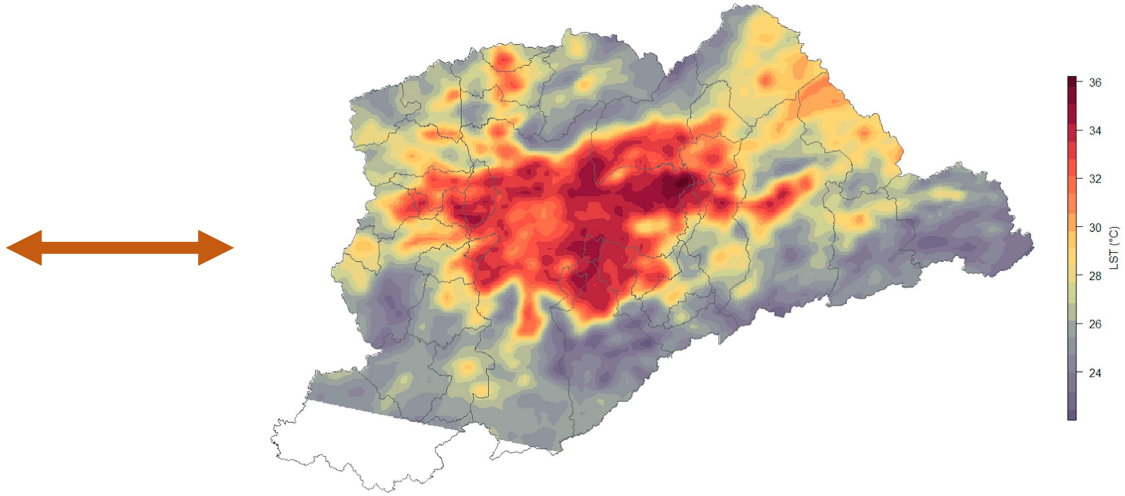
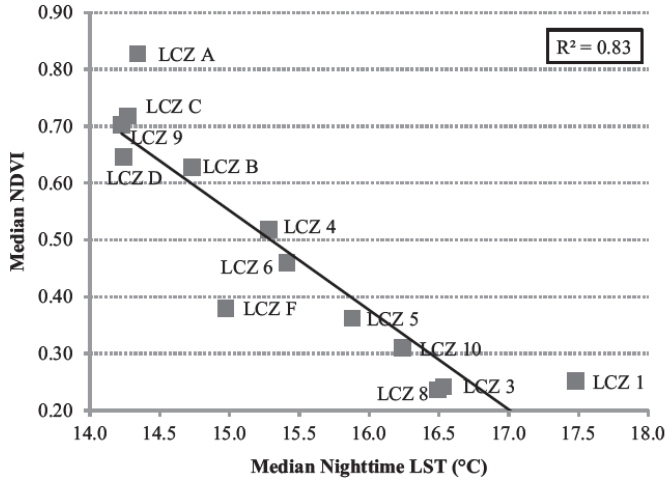
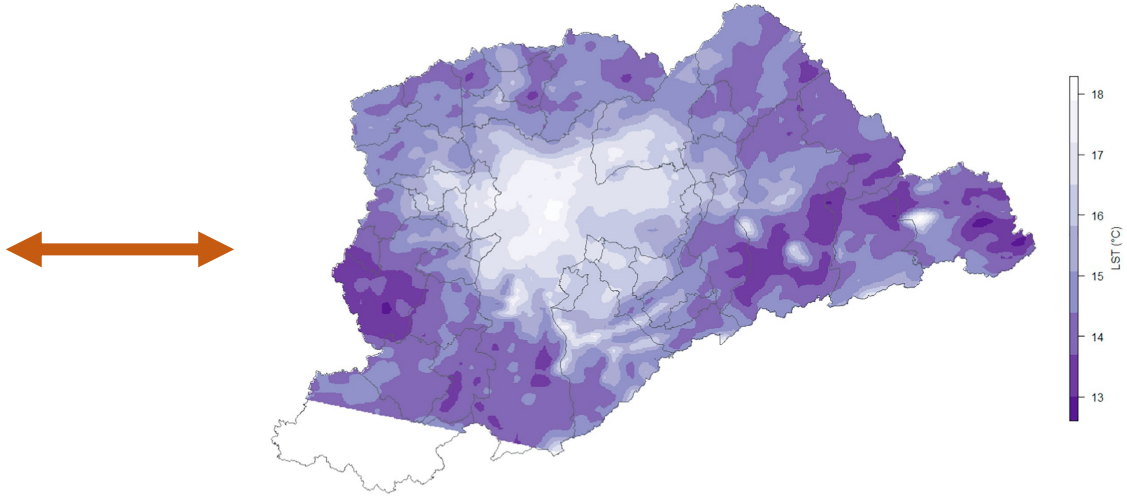


Fig. 13. Scatterplot of NDVI corresponding to daytime LST for each LCZ.







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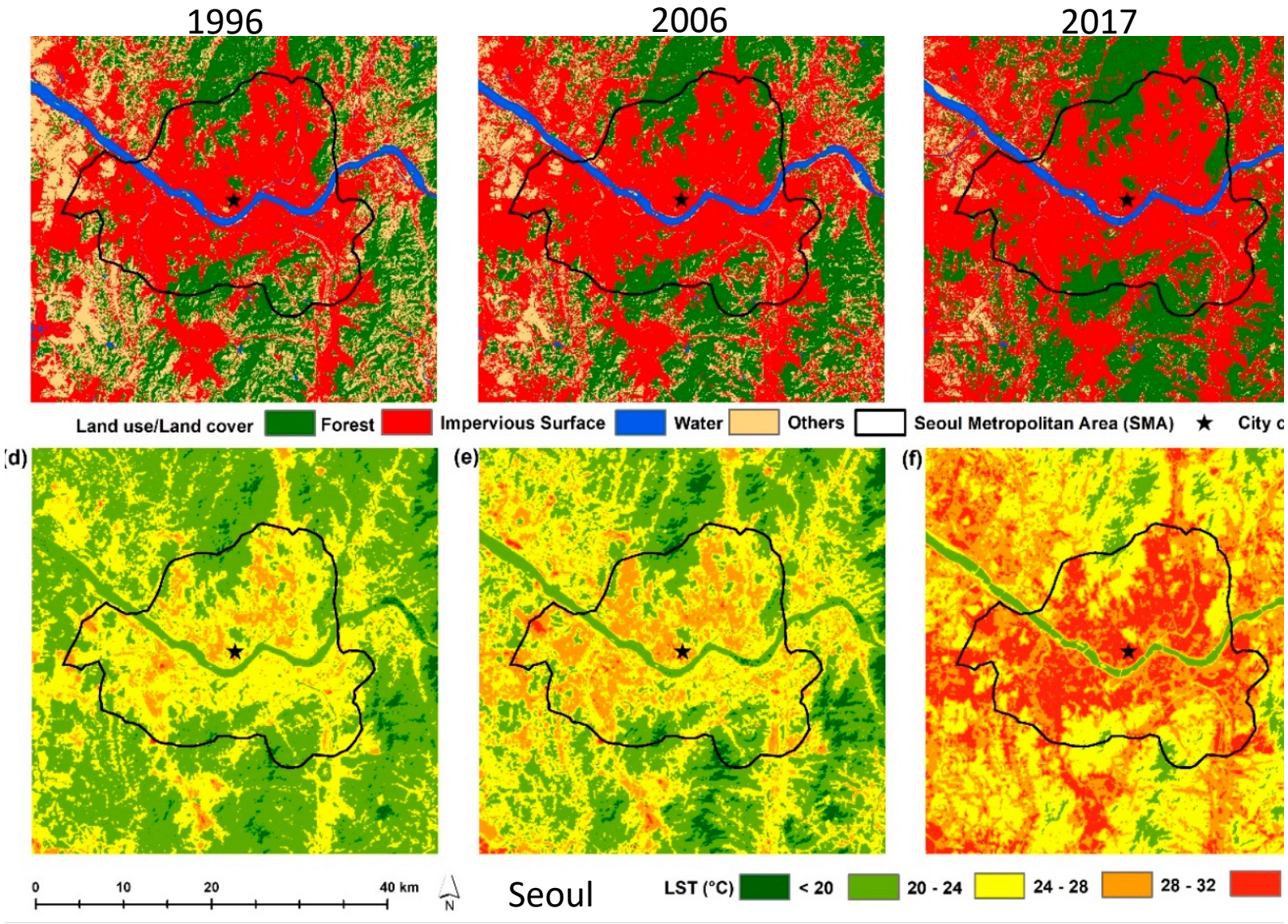
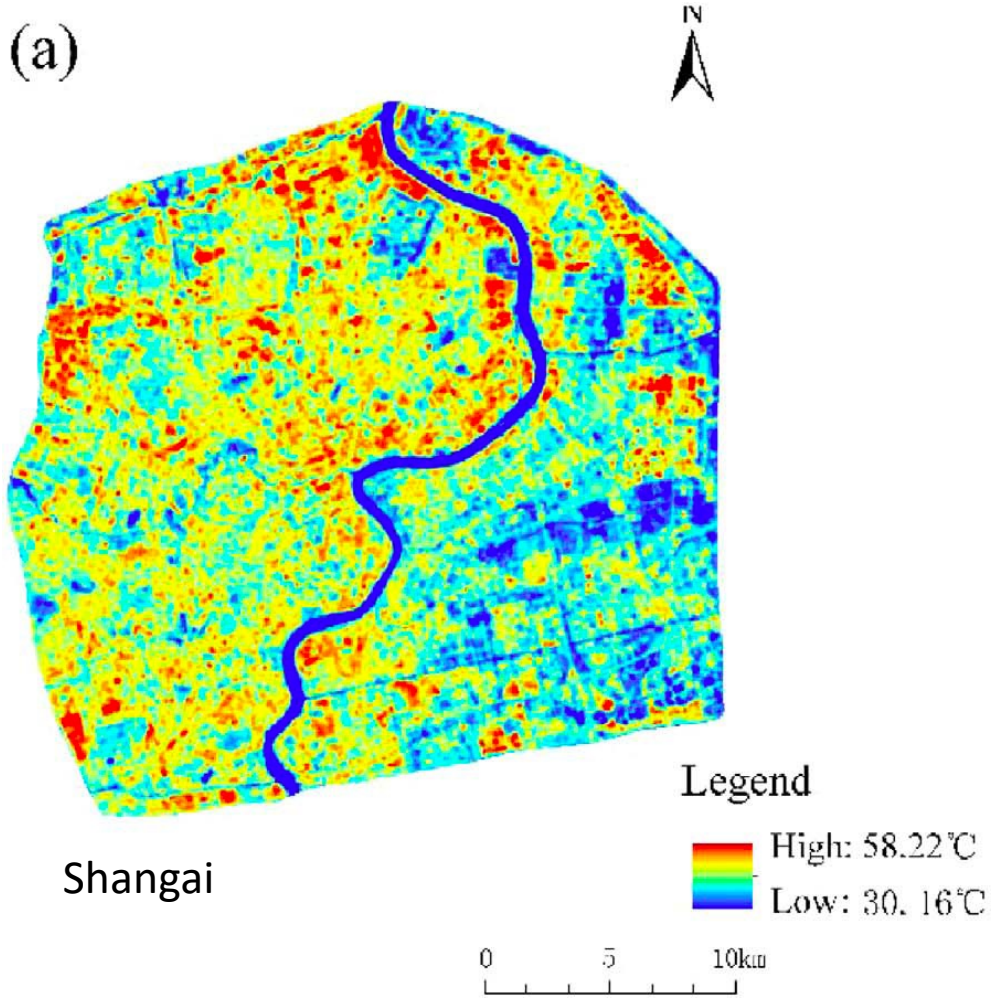
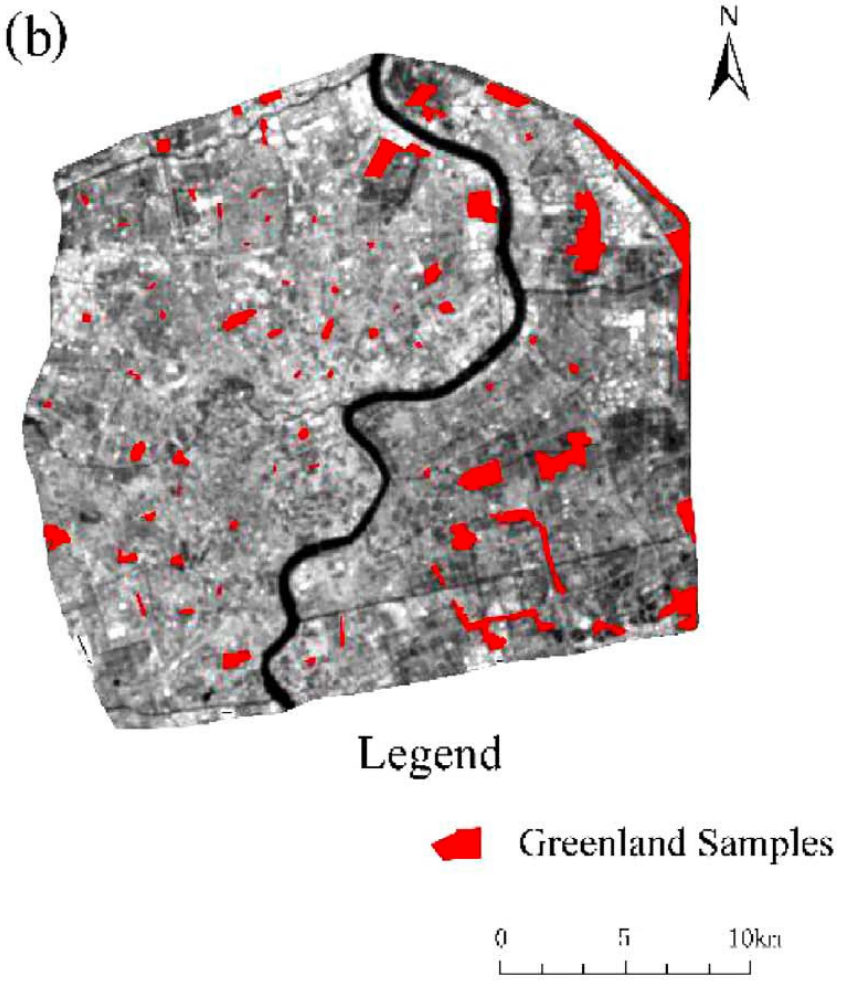


Priyankara et al 2019 Climate: 7: 110.

- Controle térmico

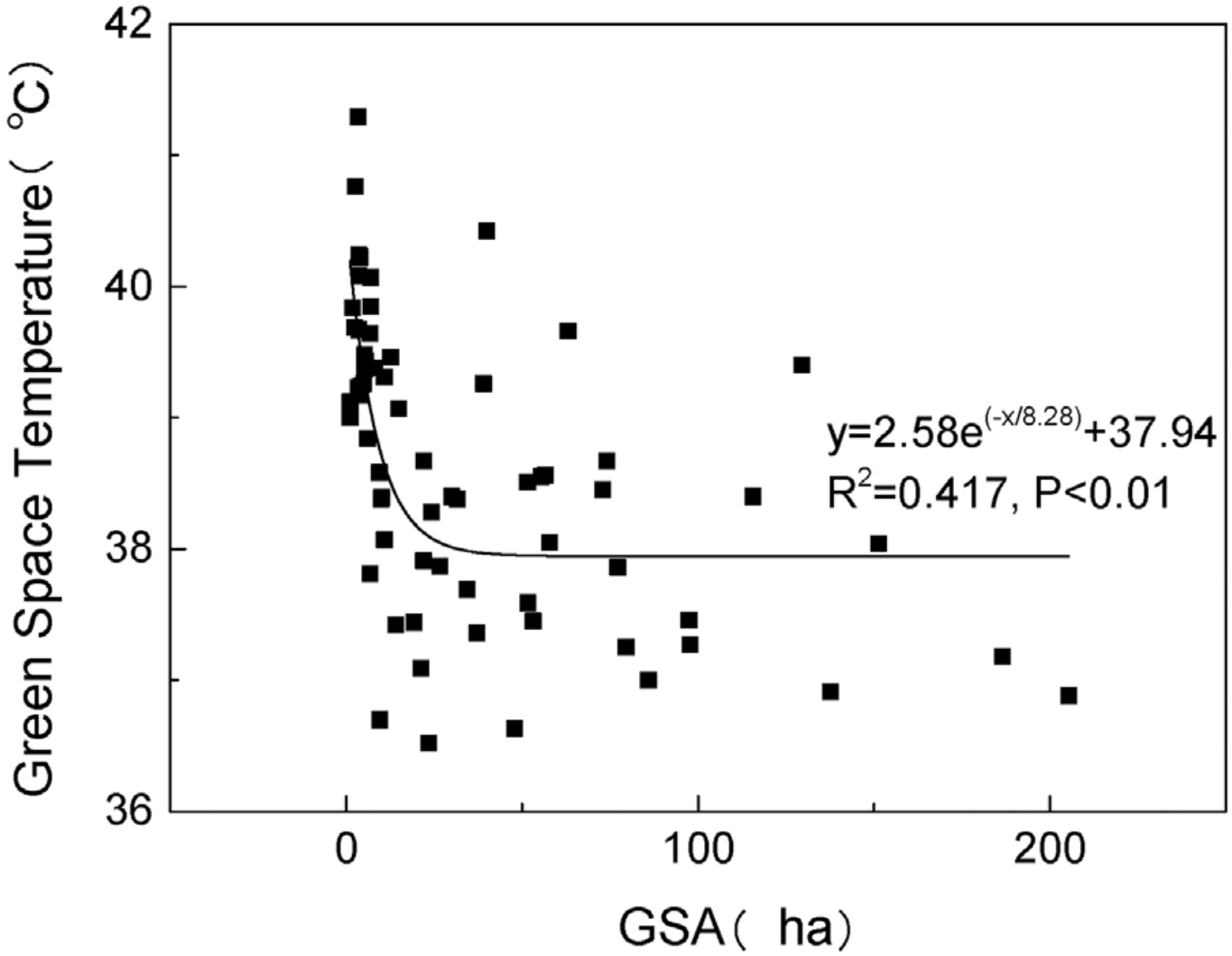


Shangai



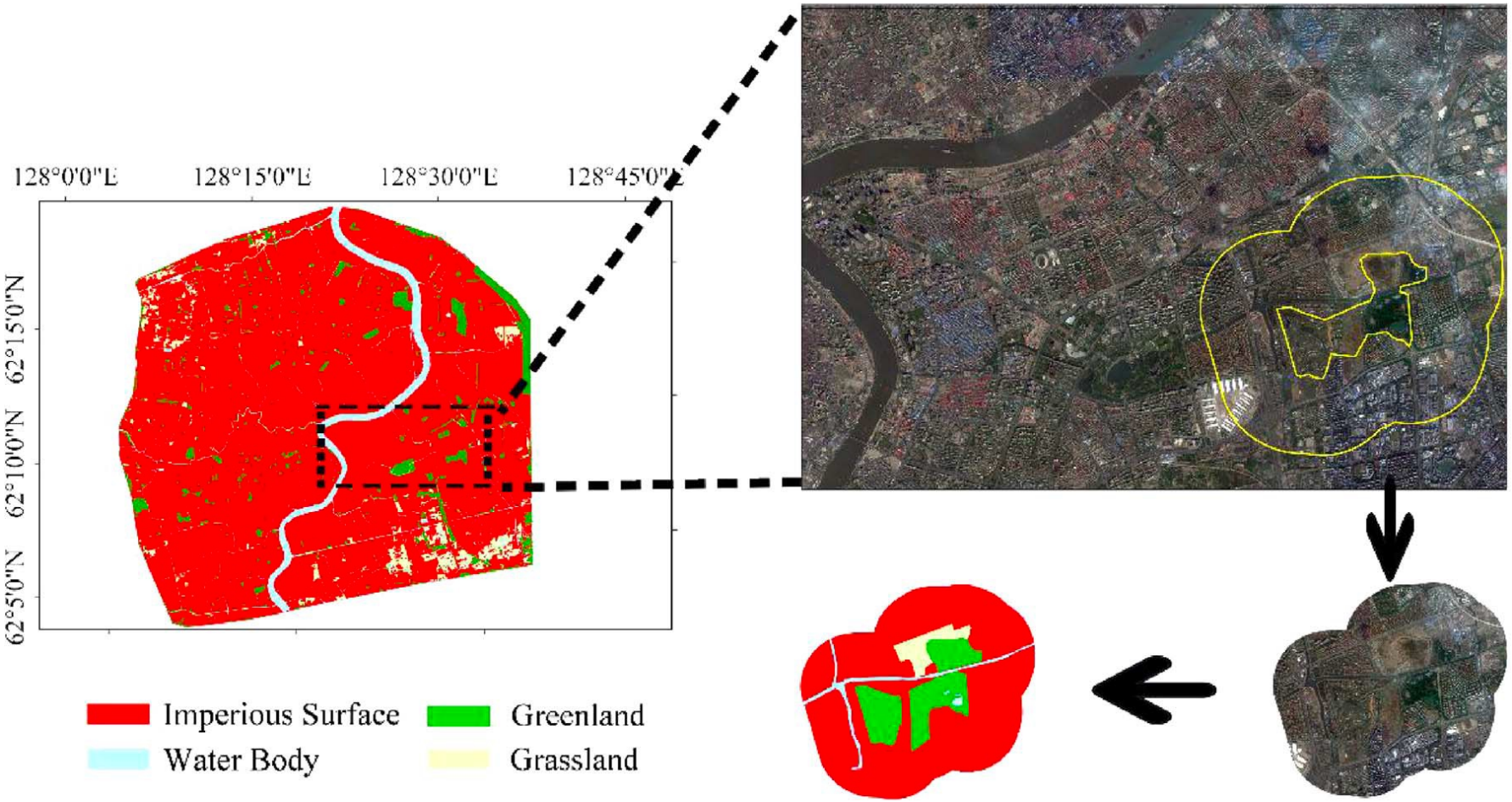
Du et al 2017 Urban Forestry & Urban Greening 27: 24-31

- Controle térmico



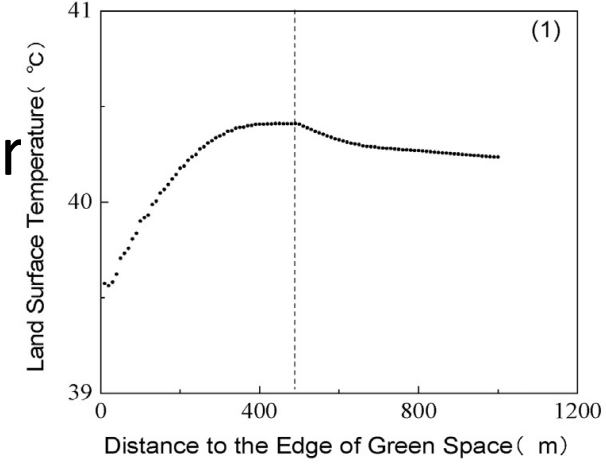
Du et al 2017 Urban Forestry & Urban Greening 27: 24-31

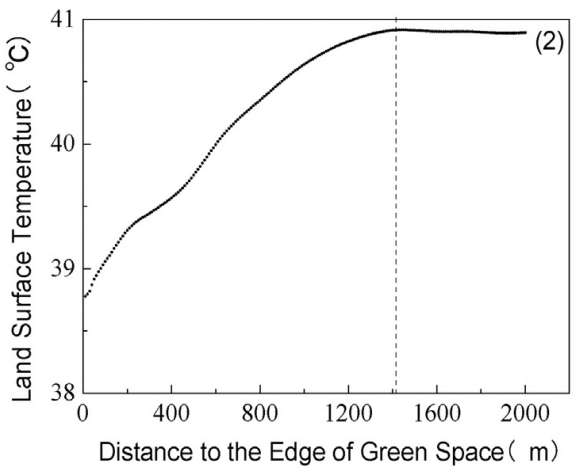
- Controle térmico

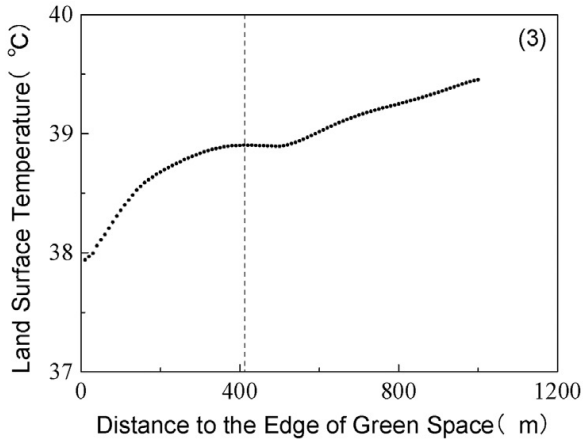


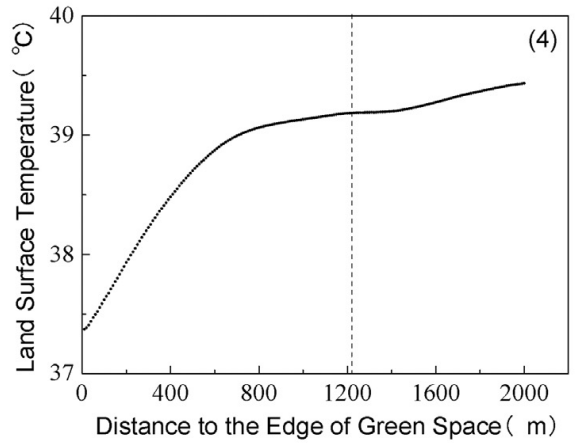
Du et al 2017 Urban Forestry & Urban Greening 27: 24-31

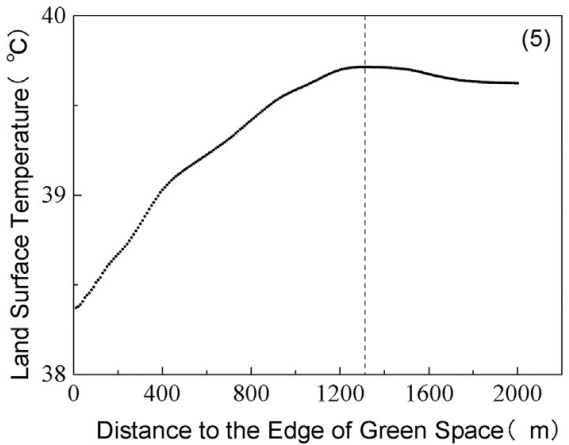
- Contr

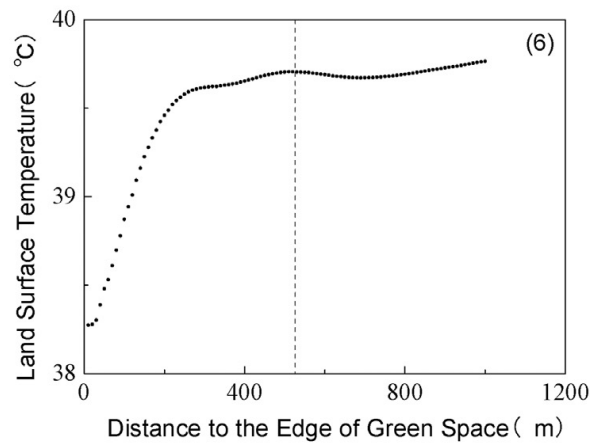

(1)
Land Surface Temperature（ ℃）
41
40
39
0
400
800
1200
Distance to the Edge of Green Space（ m）

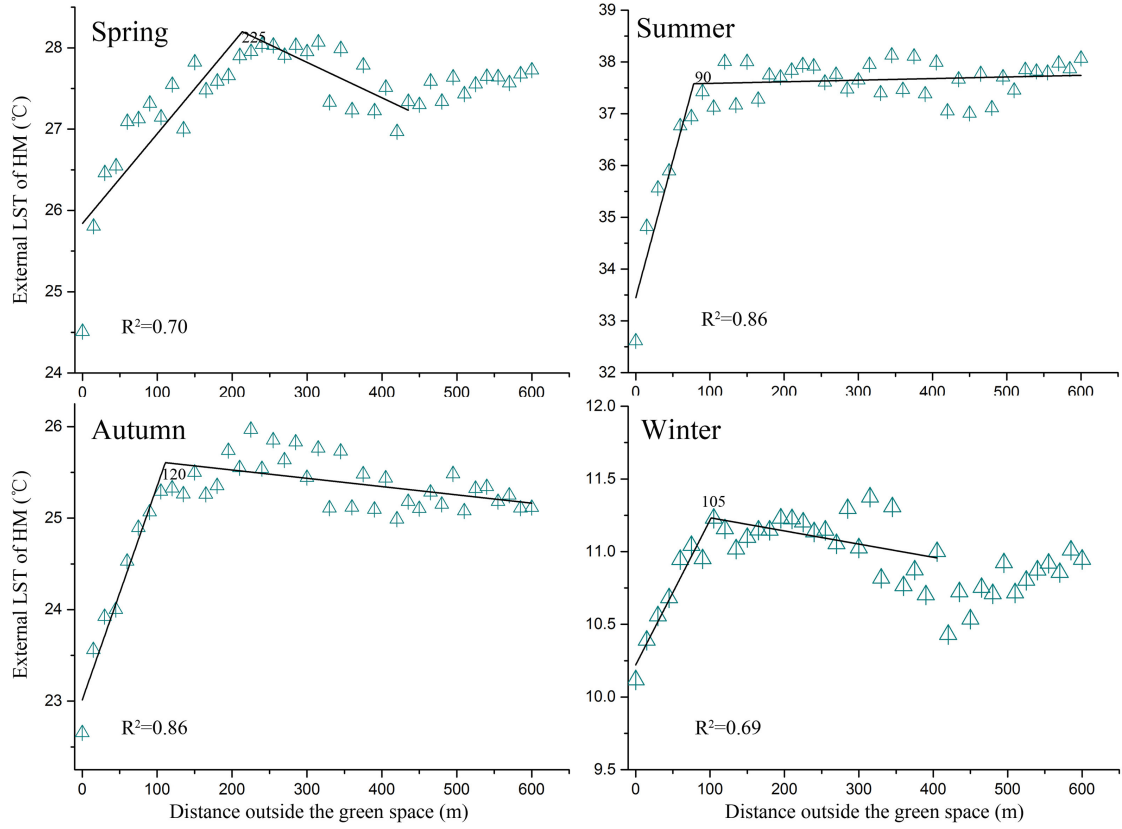

(2)
Land Surface Temperature（ ℃）
41
40
39
38
0
400
800
1200
1600
2000
Distance to the Edge of Green Space（ m）


(3)
Land Surface Temperature（ ℃）
40
39
38
37
0
400
800
1200
Distance to the Edge of Green Space（ m）


(4)
Land Surface Temperature（ ℃）
40
39
38
37
0
400
800
1200
1600
2000
Distance to the Edge of Green Space（ m）

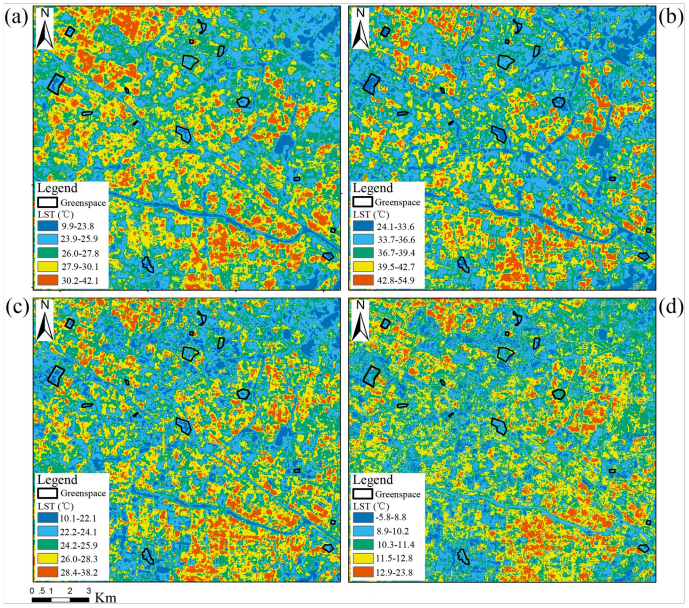

(5)
Land Surface Temperature（ ℃）
40
39
38
0
400
800
1200
1600
2000
Distance to the Edge of Green Space（ m）


(6)
Land Surface Temperature（ ℃）
40
39
38
0
400
800
1200
Distance to the Edge of Green Space（ m）



Primavera

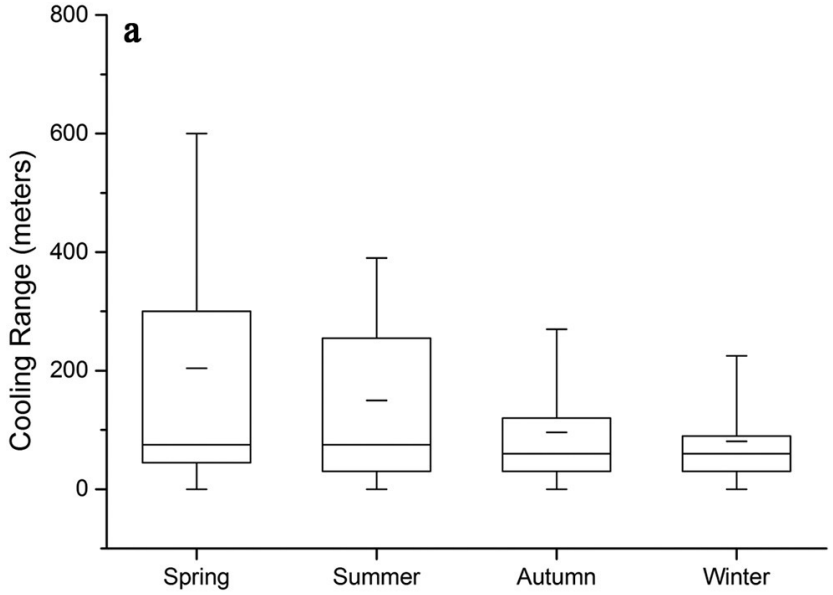
Verão



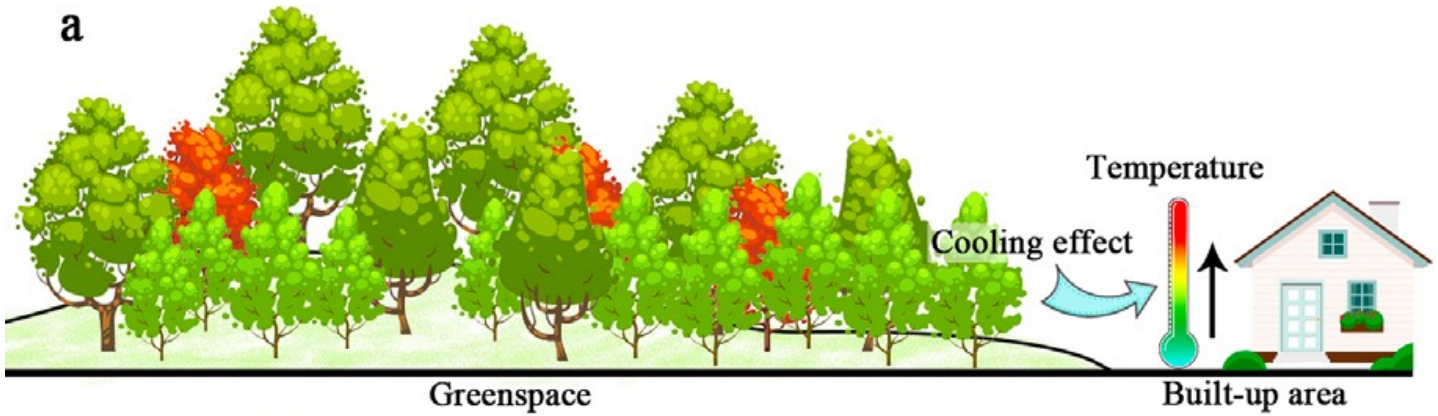
Outono

Inverno

Changzou, China



Wang et al 2021 Science of the Total Environment 770: 145211



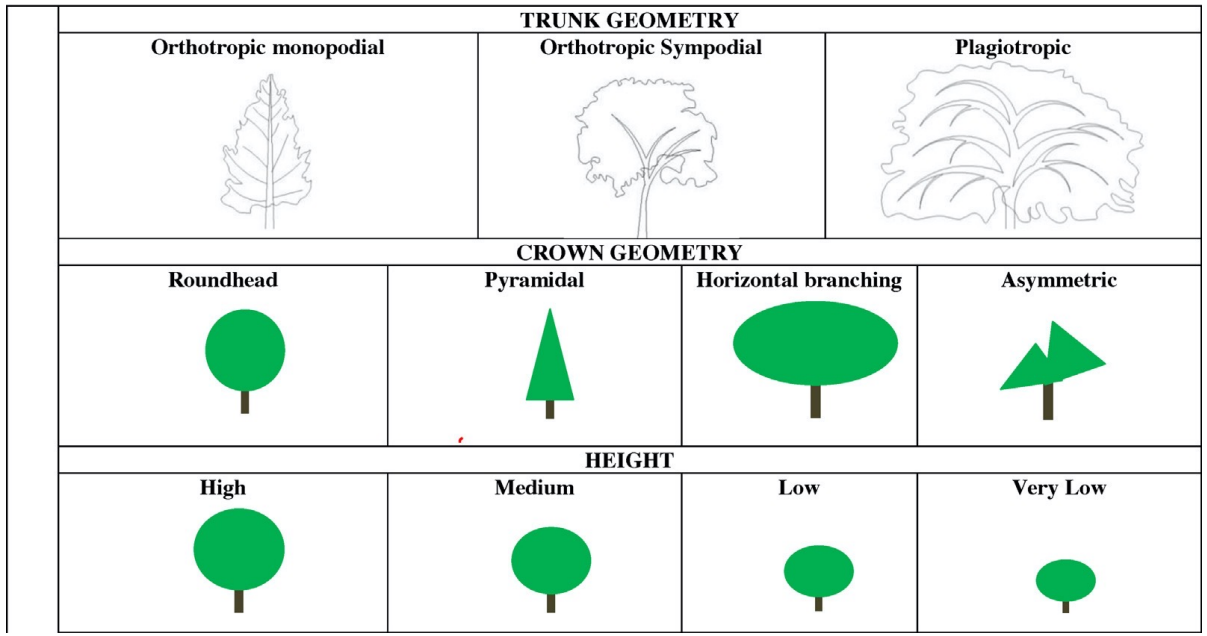
Greenspace (b) has a higher tree diversity. It provides a greater cooling effect than greenspace (a).

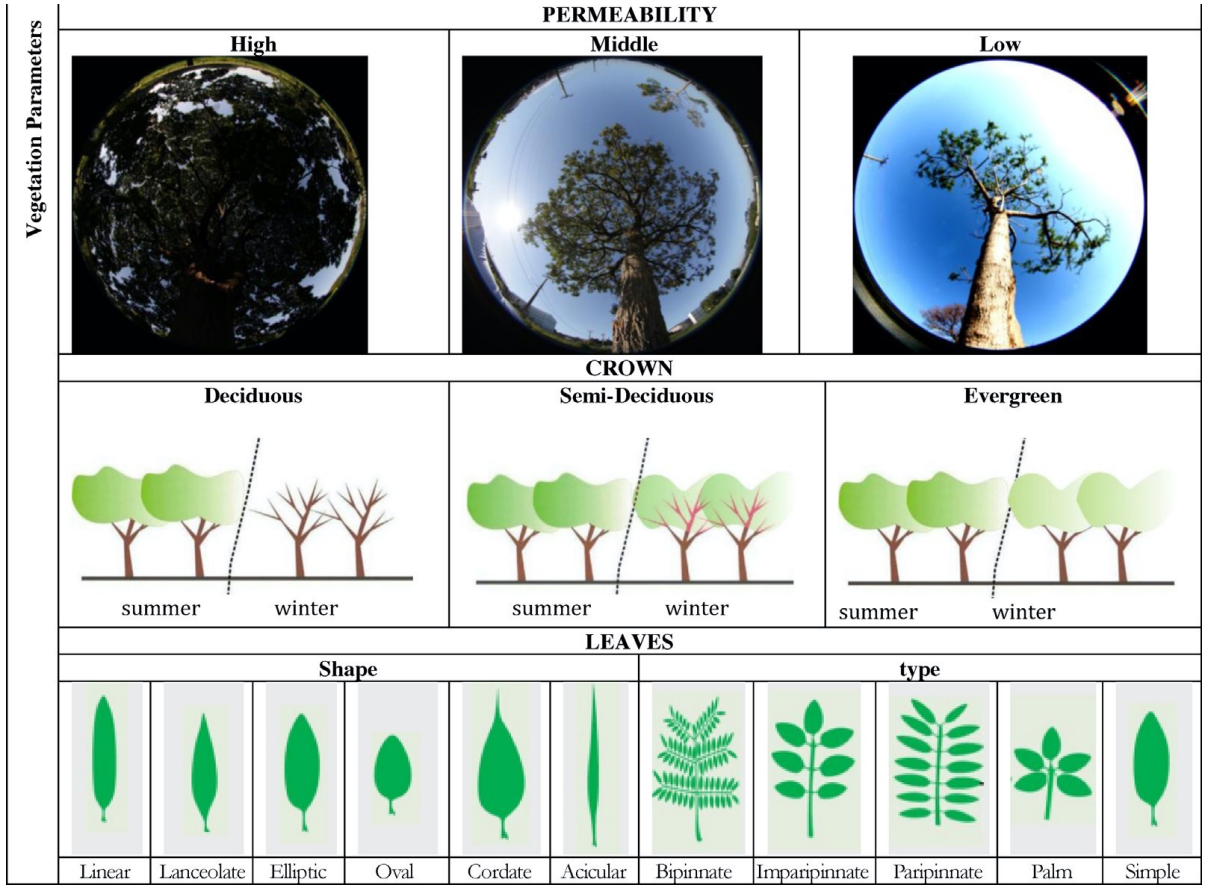
	Shannon-Wiener diversity index	Tree coverage	Intercept	Adjusted R^2	P
TDA Spring	1.29	3.07	−2.49	0.59	0.002
TDA Summer	2.03	2.74	−2.72	0.57	0.003
TDA Autumn	0.93		−0.55	0.31	0.018

Temperature Drop Amplitude (TDA)

Wang et al 2021 Science of the Total Environment 770: 145211

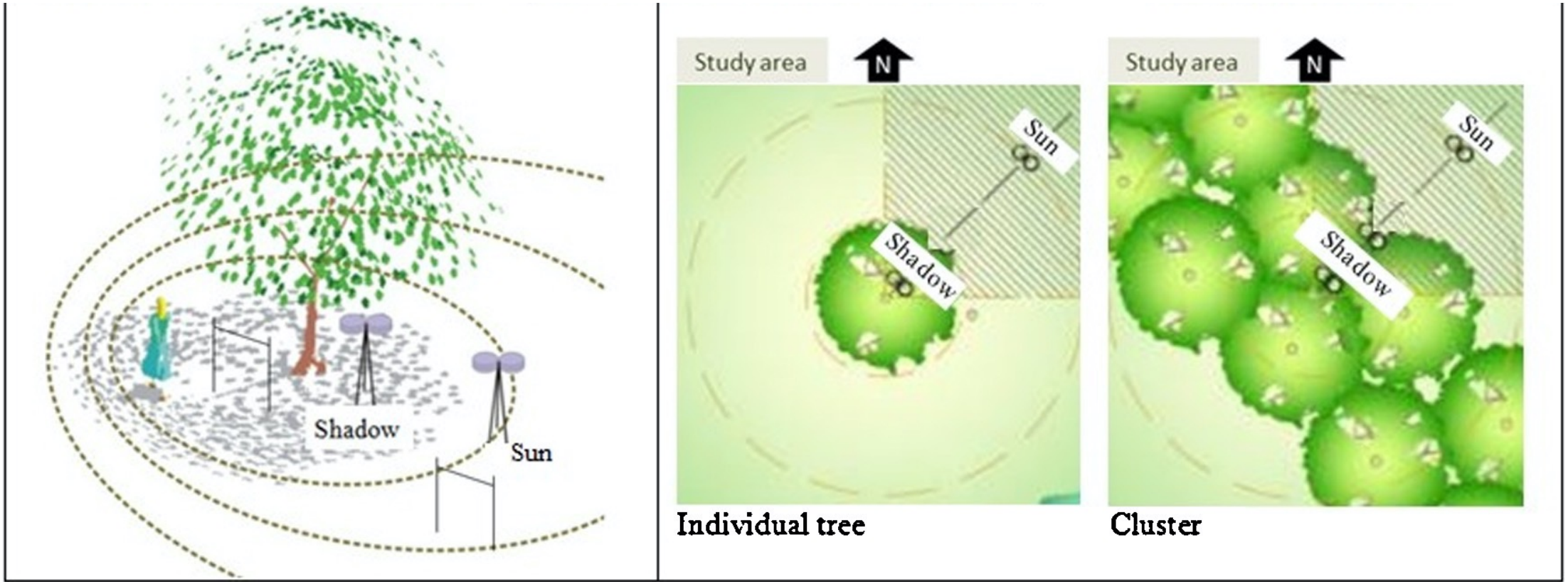
- Controle térmico





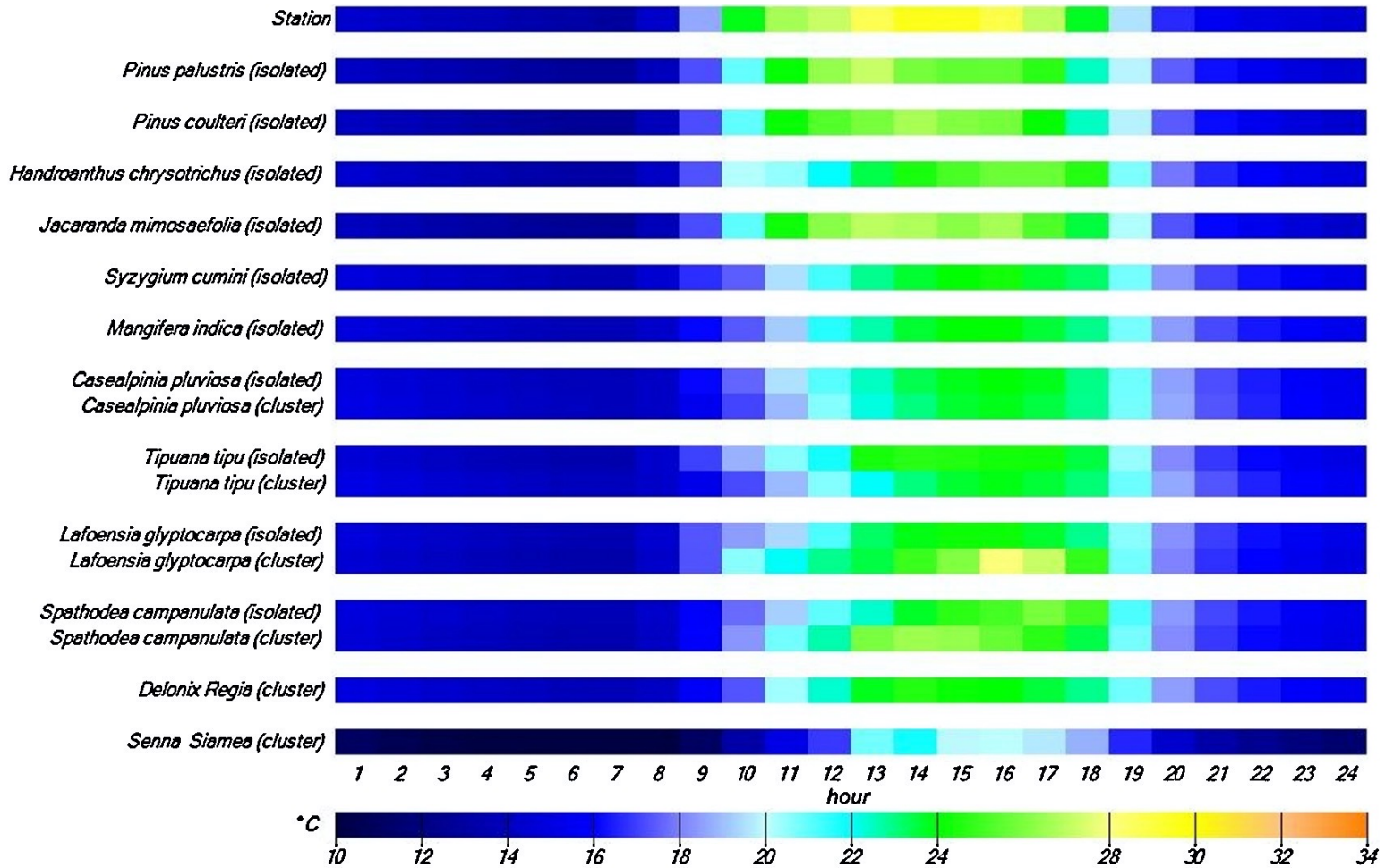
Abreu-Harbich et al 2015 Landscape and Urban Planning

- Controle térmico



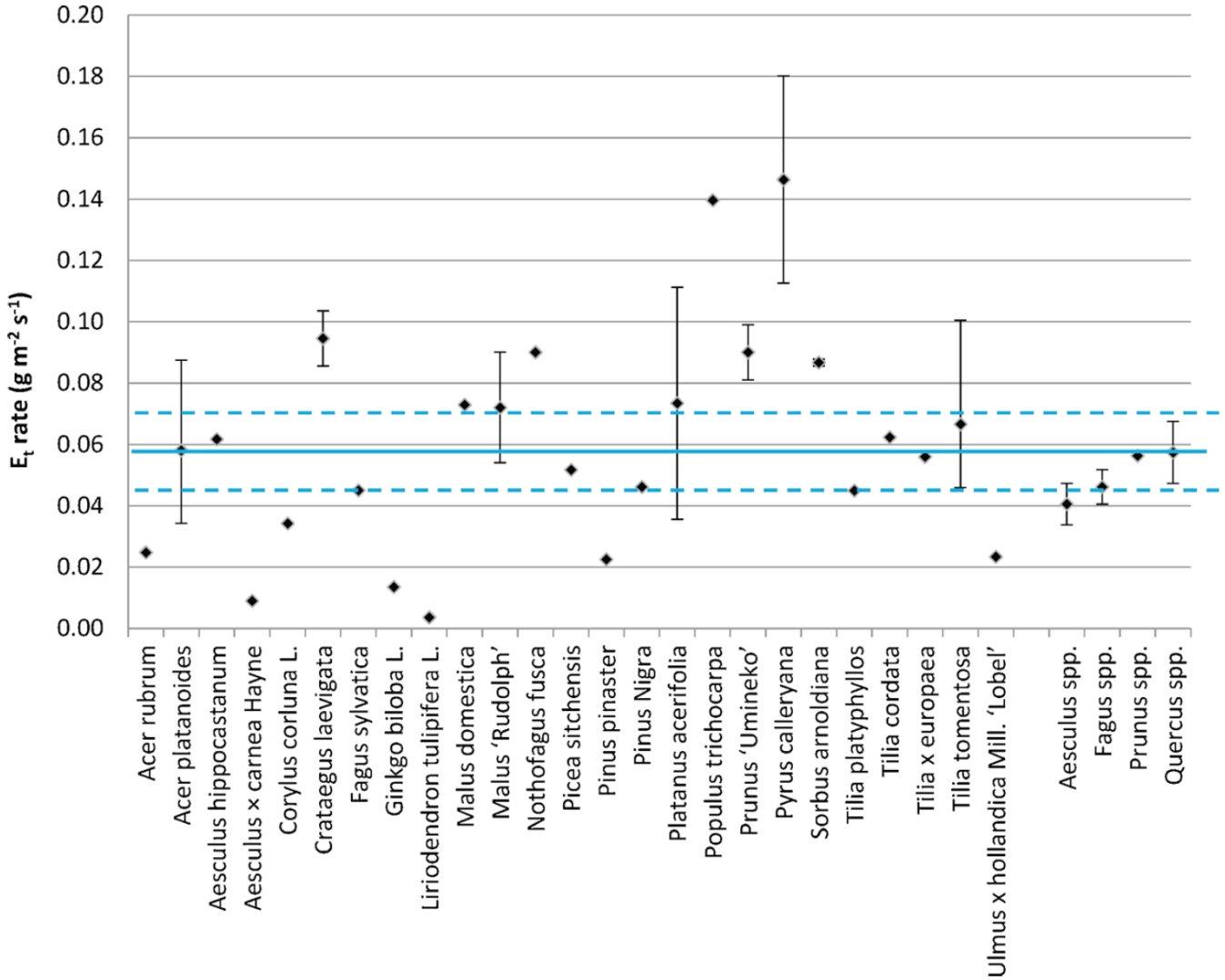
Abreu-Harbich et al 2015 Landscape and Urban Planning

- Controle térmico



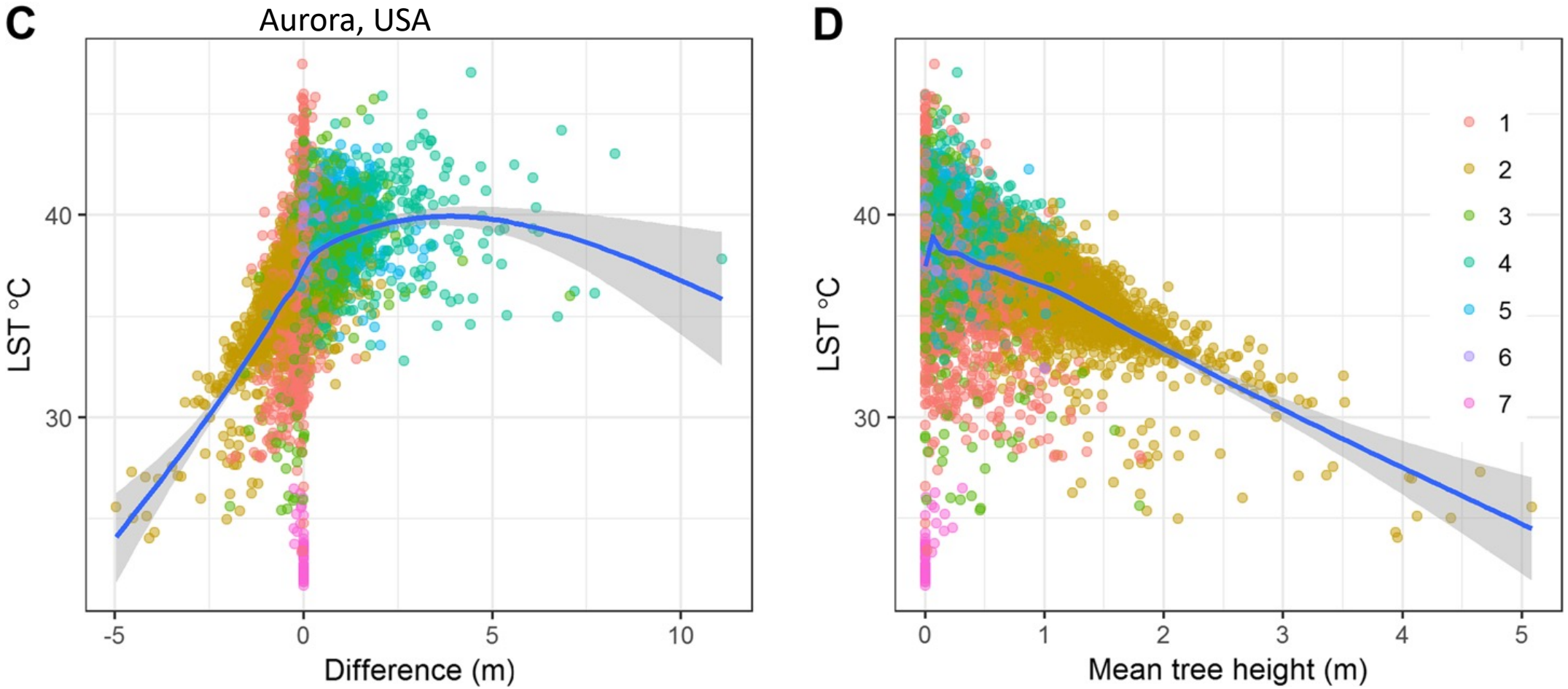
Abreu-Harbich et al 2015 Landscape and Urban Planning

- Controle térmico



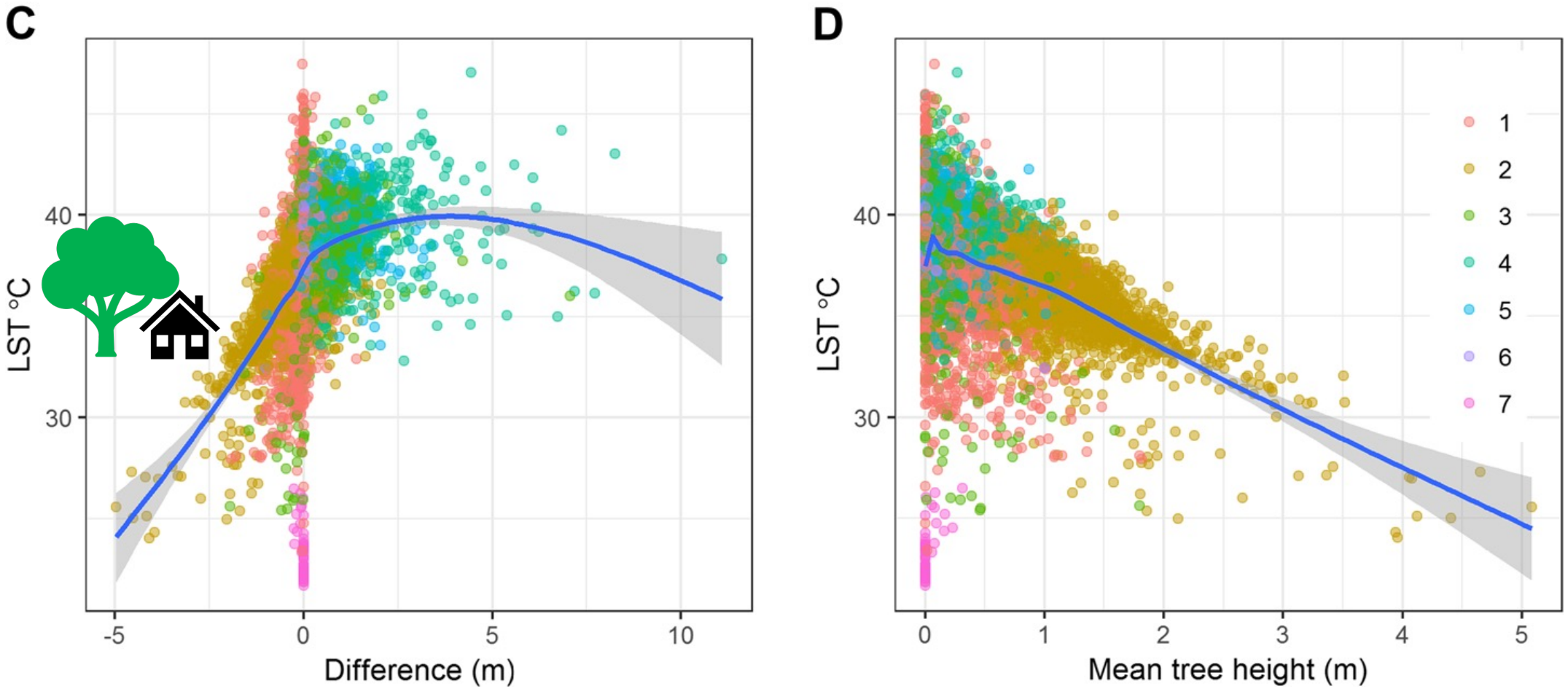
Moss et al 2019 Urban Forestry & Urban Greening 37: 65-73

- Controle térmico



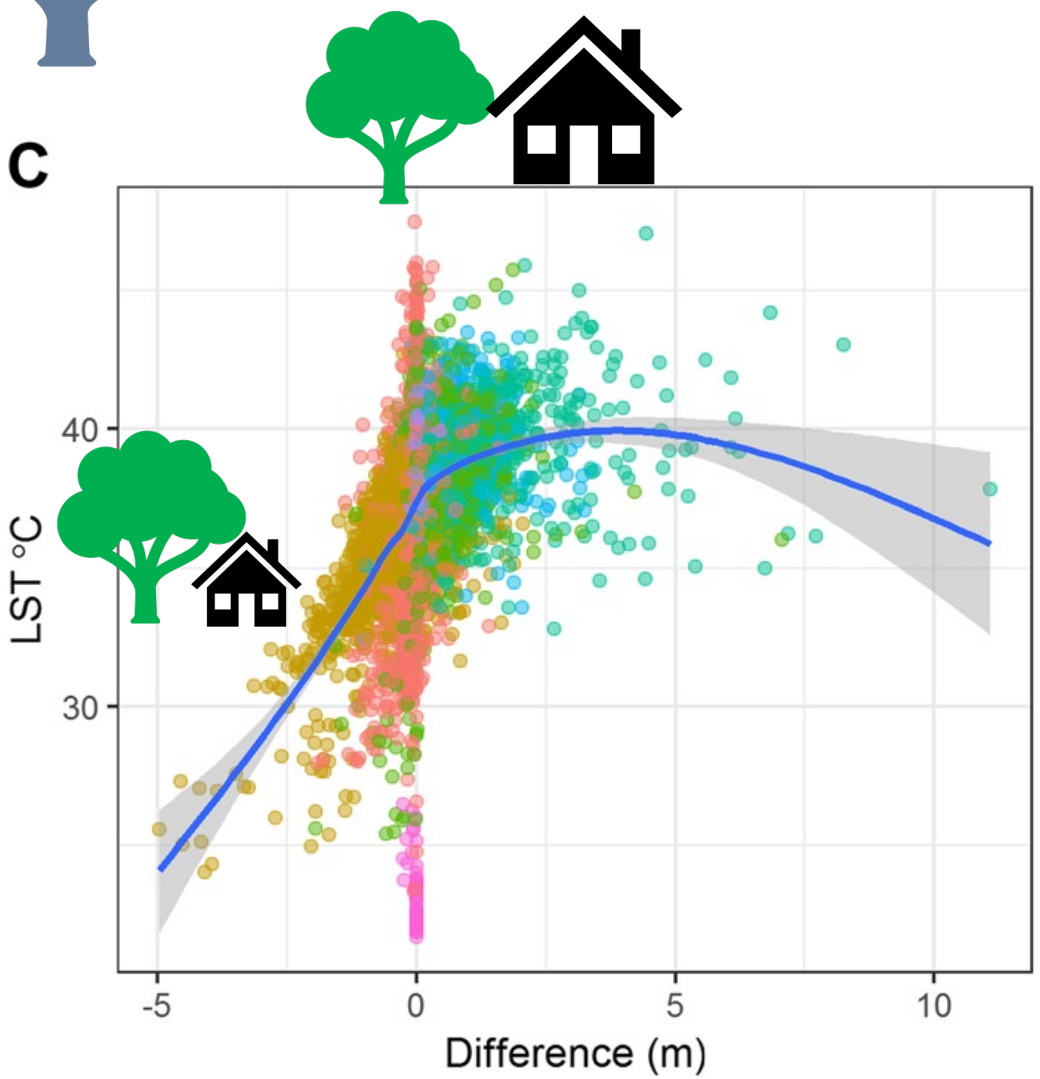
Gage and Cooper 2017 Urban Ecosystem 20: 1229-1238

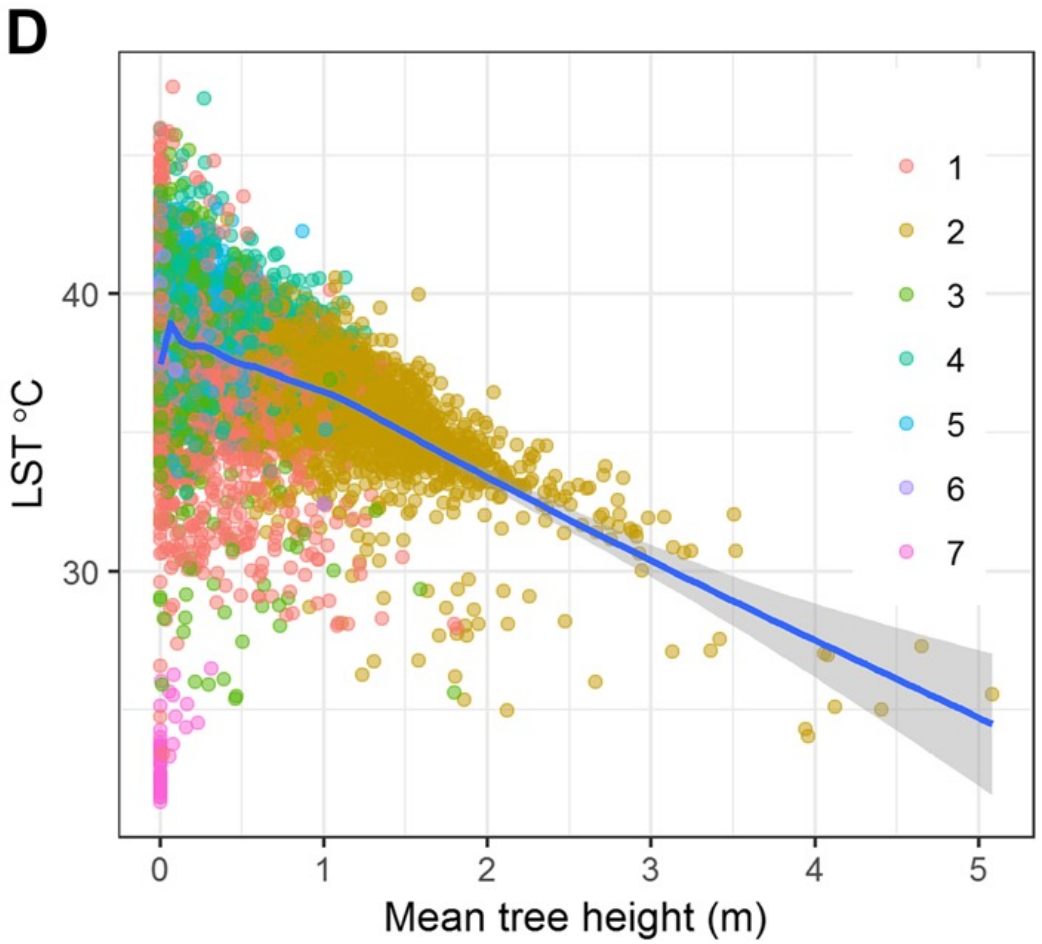
- Controle térmico



Gage and Cooper 2017 Urban Ecosystem 20: 1229-1238

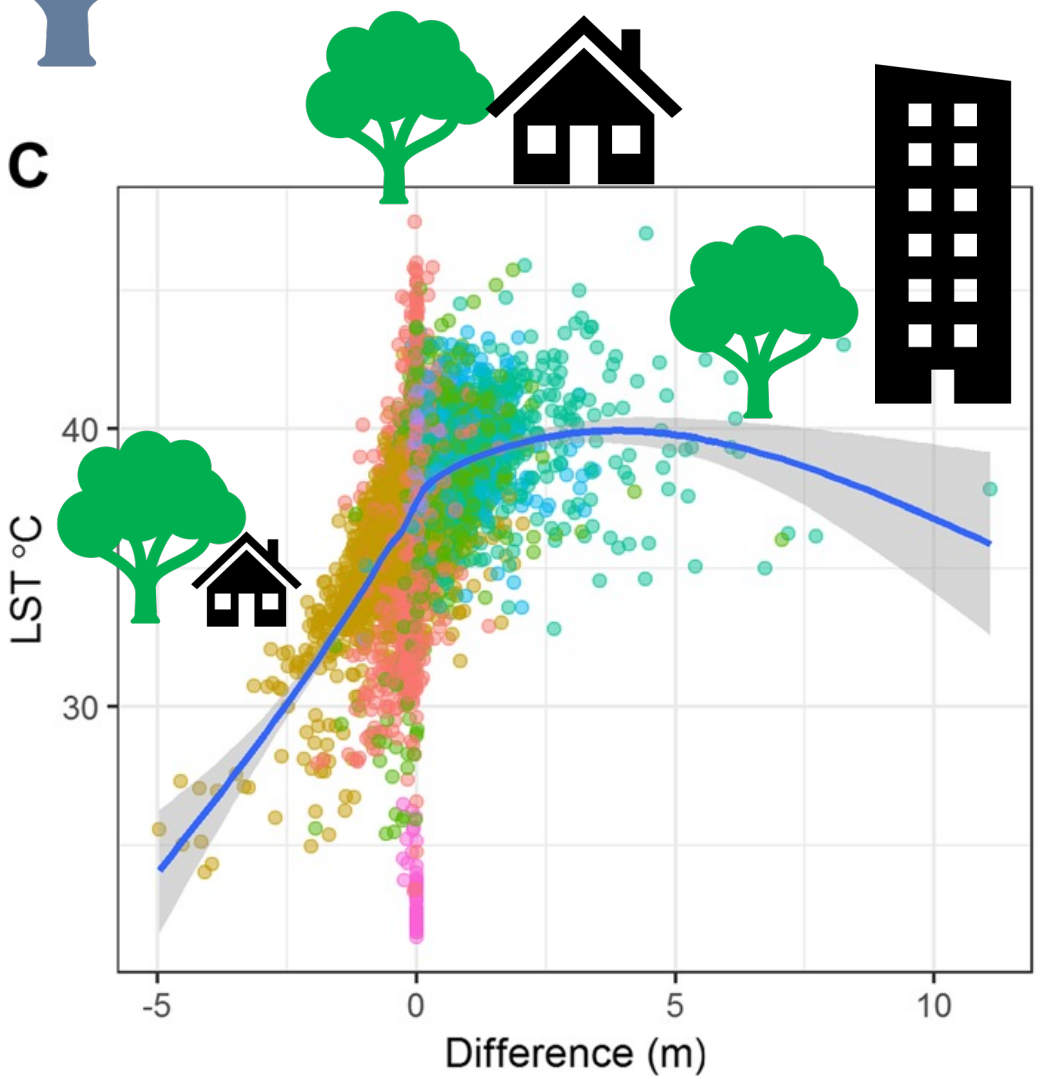
- Controle térmico

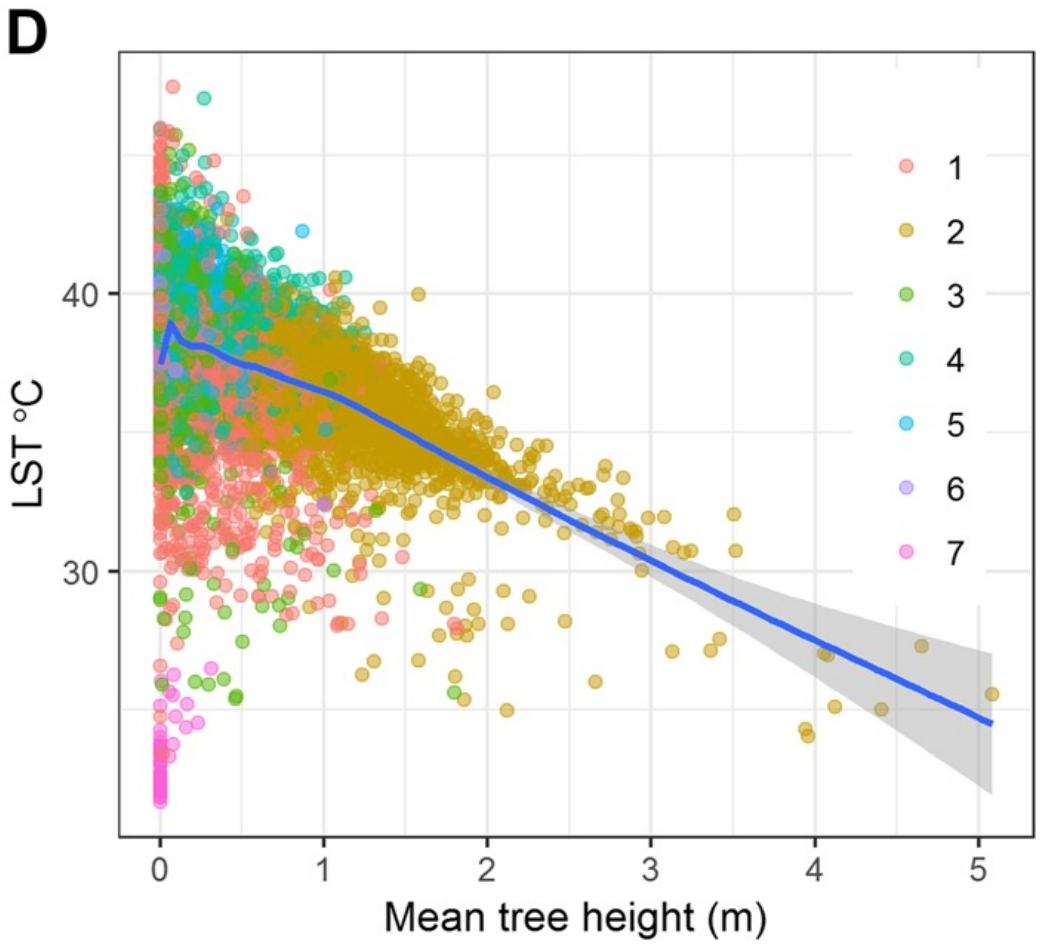




Gage and Cooper 2017 Urban Ecosystem 20: 1229-1238

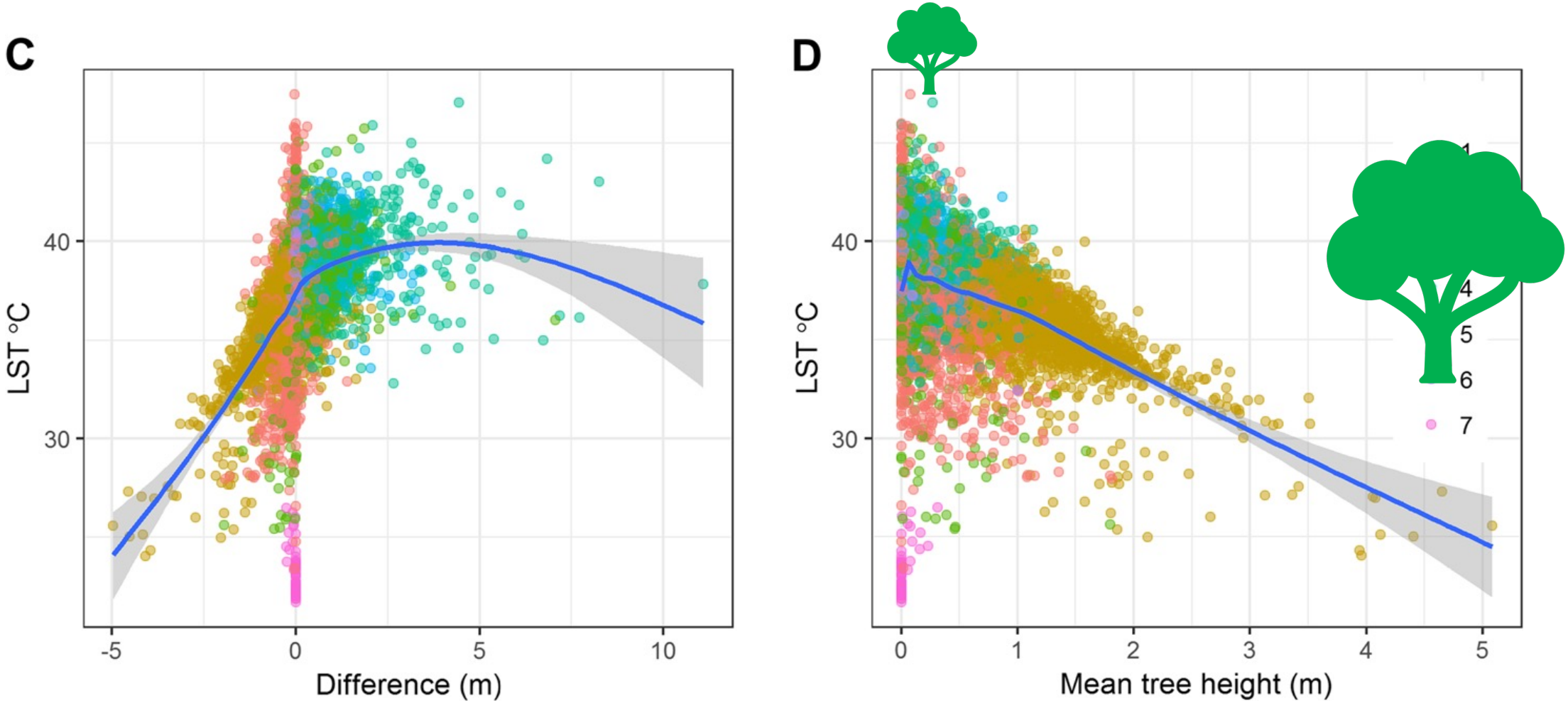
- Controle térmico





Gage and Cooper 2017 Urban Ecosystem 20: 1229-1238

- Controle térmico

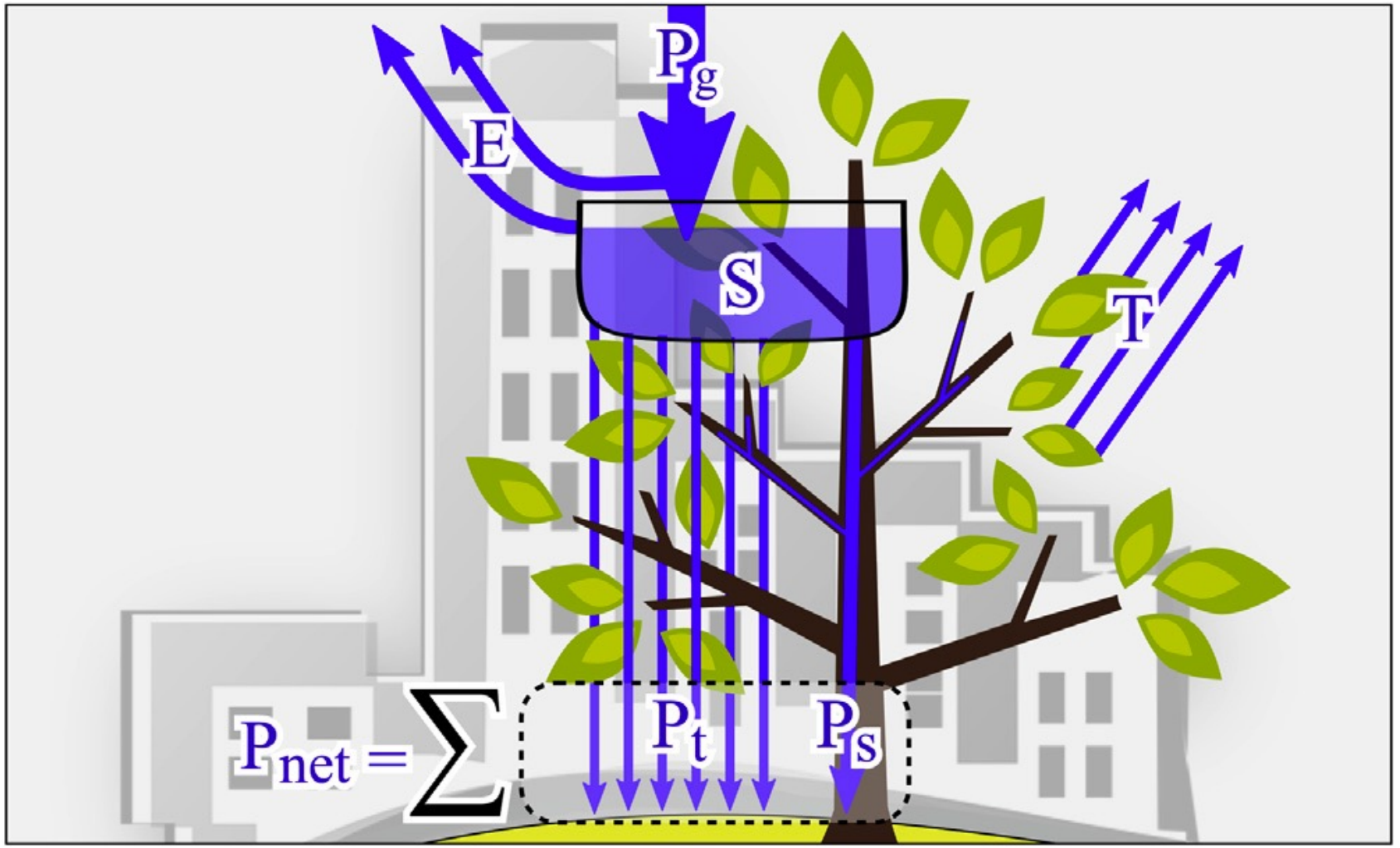


Gage and Cooper 2017 Urban Ecosystem 20: 1229-1238

Urbanização

retratoocular.wordpress.com

- Interceptação da água da chuva



Pg – gross precipitation

E – evaporation

S – water stored

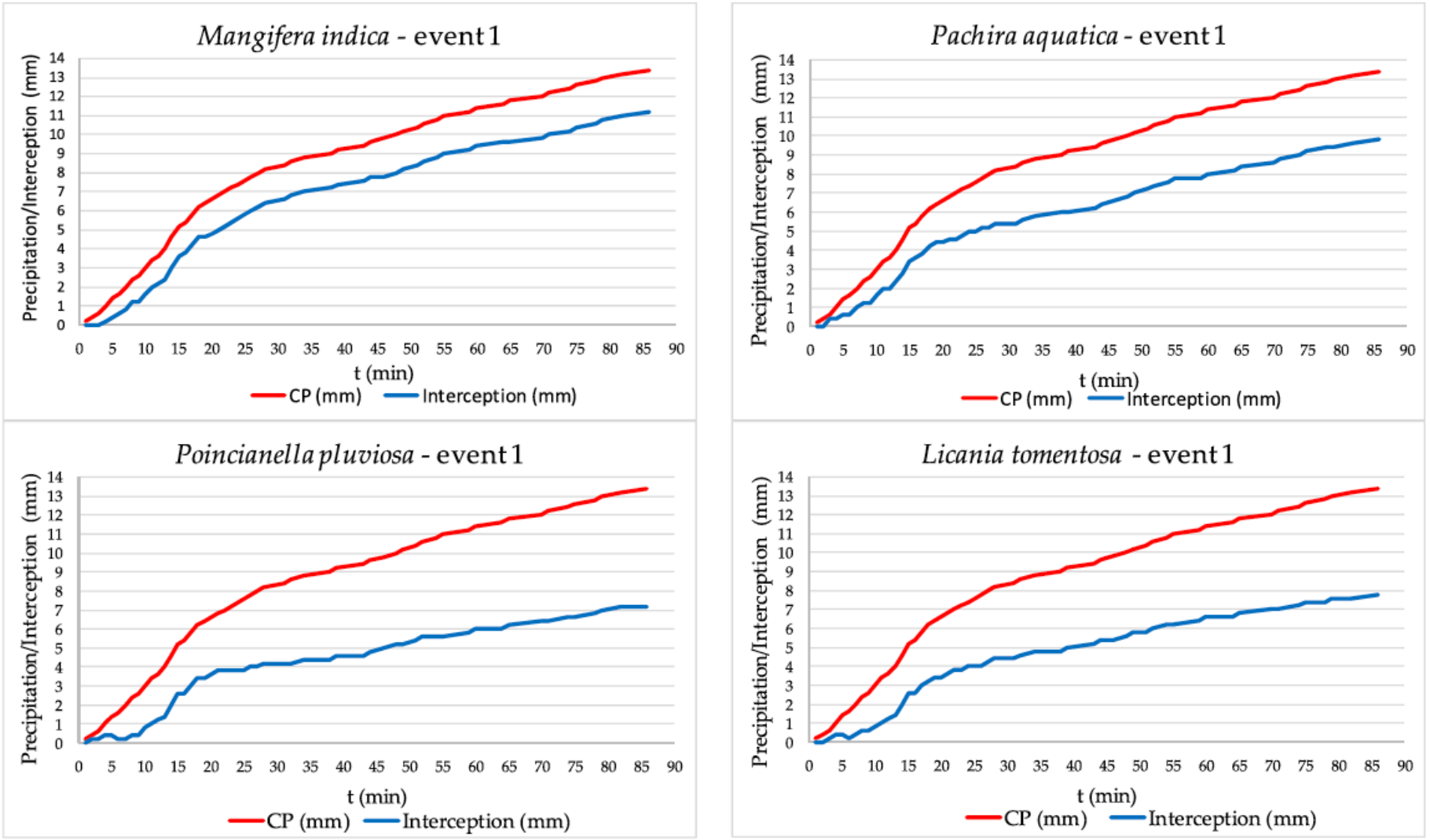
Pt – throughfall

Ps – stem flow

T - transpiration

Stan II (2018) Advances in Chemical Pollution, Environmental Management and Protection, 3: 35-61

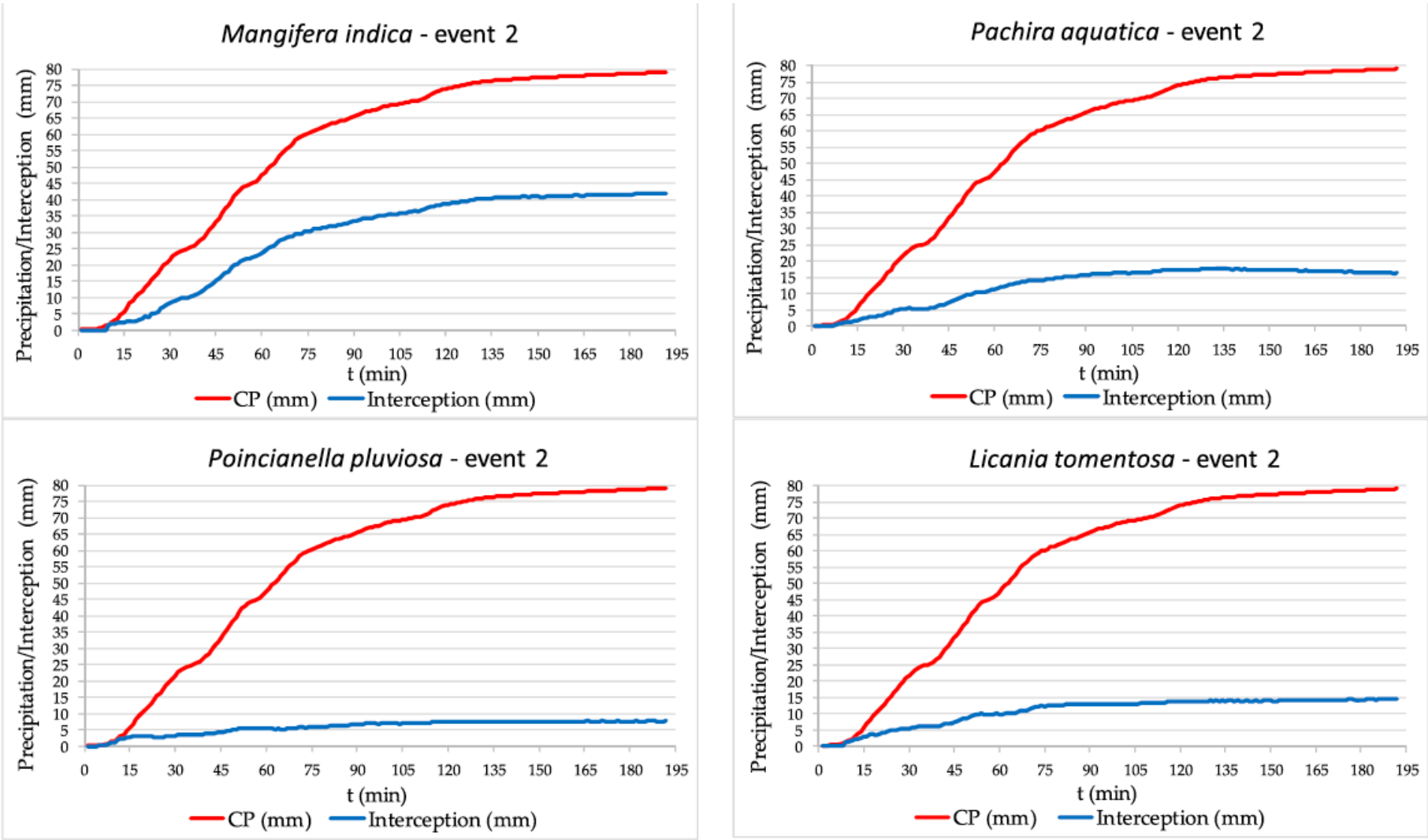
- Interceptação da água da chuva



(a)*

Alves et al (2018) Urban Ecosystems 21: 697-706

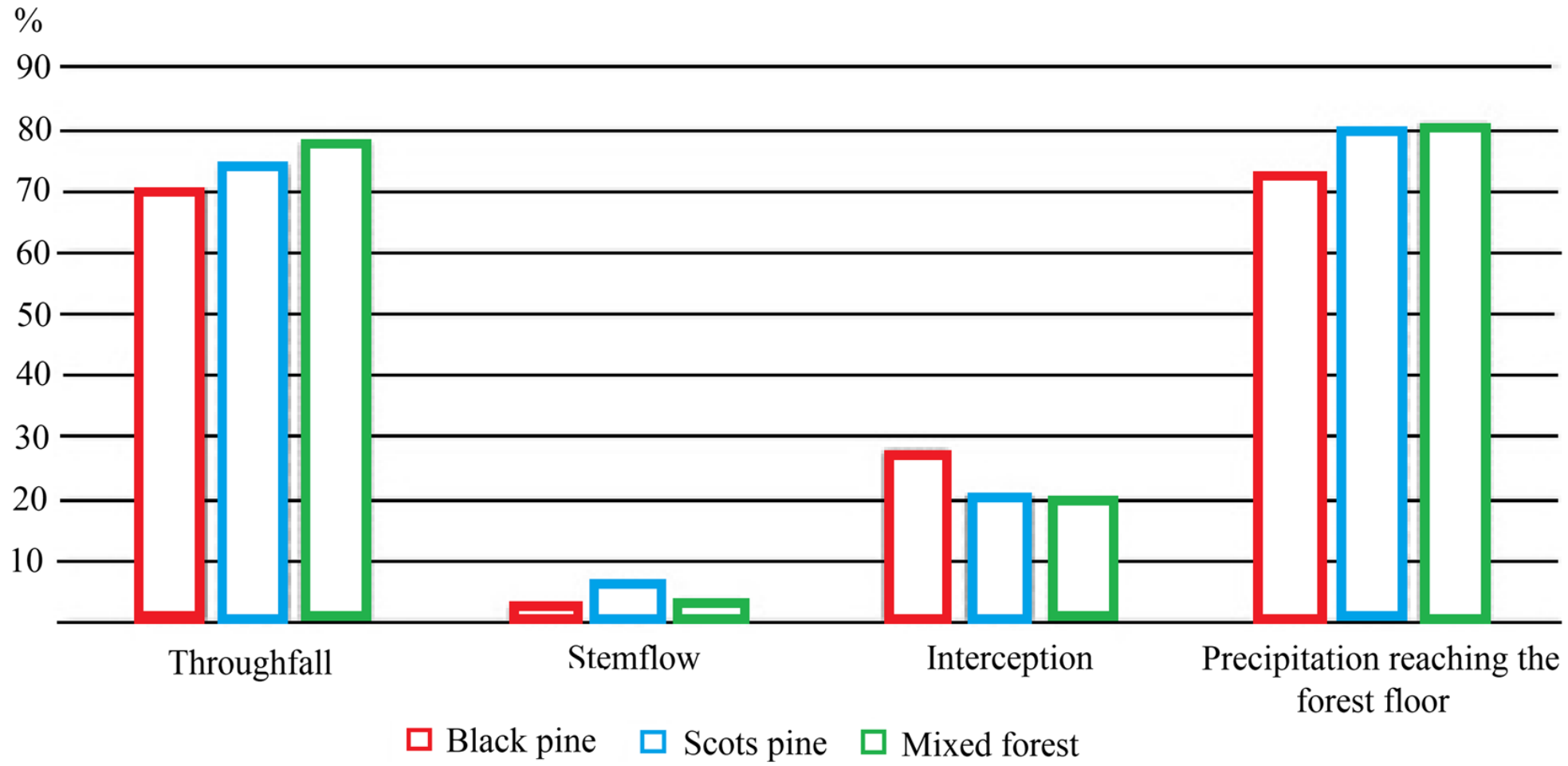
- Interceptação da água da chuva



(b)*

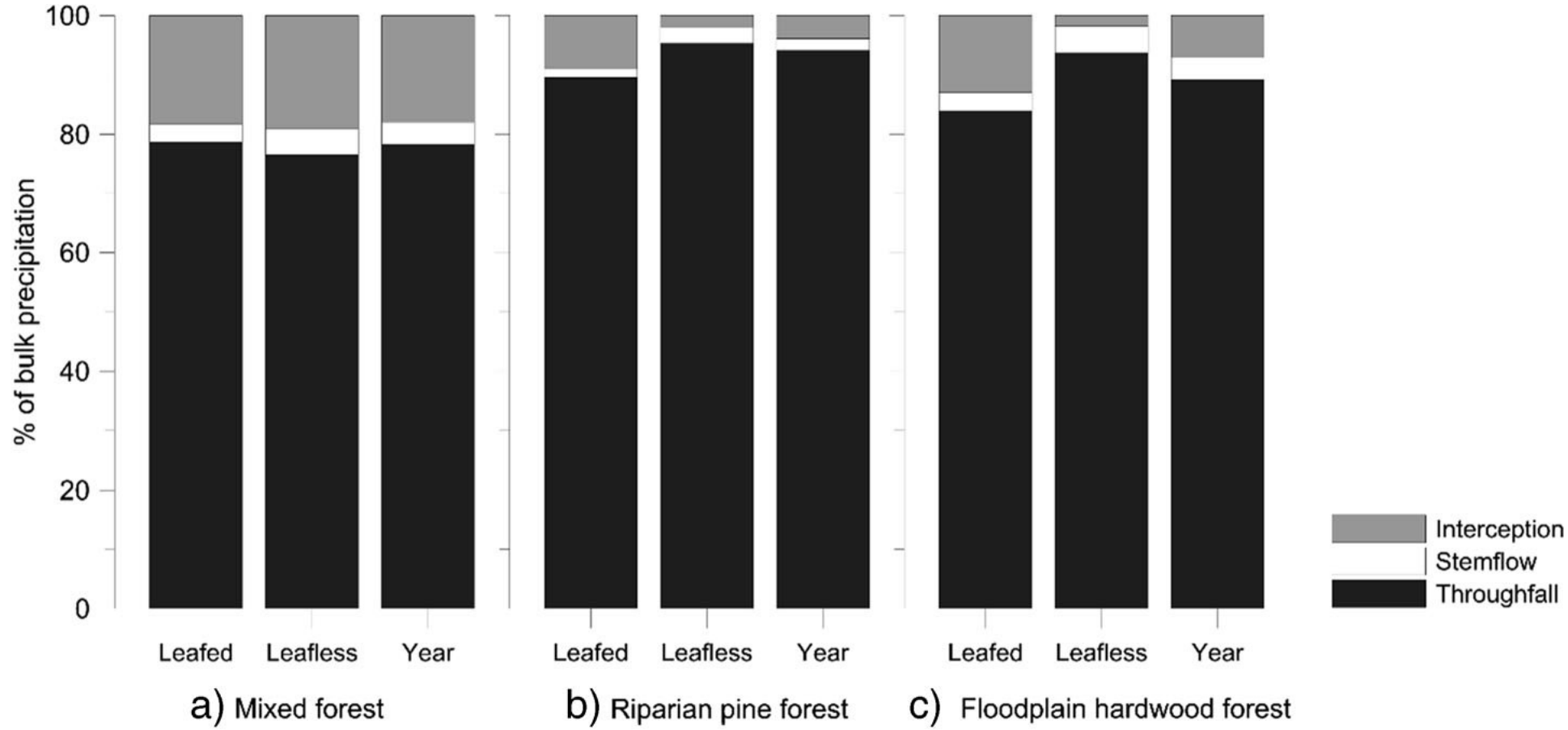
Alves et al (2018) Urban Ecosystems 21: 697-706

- Interceptação da água da chuva



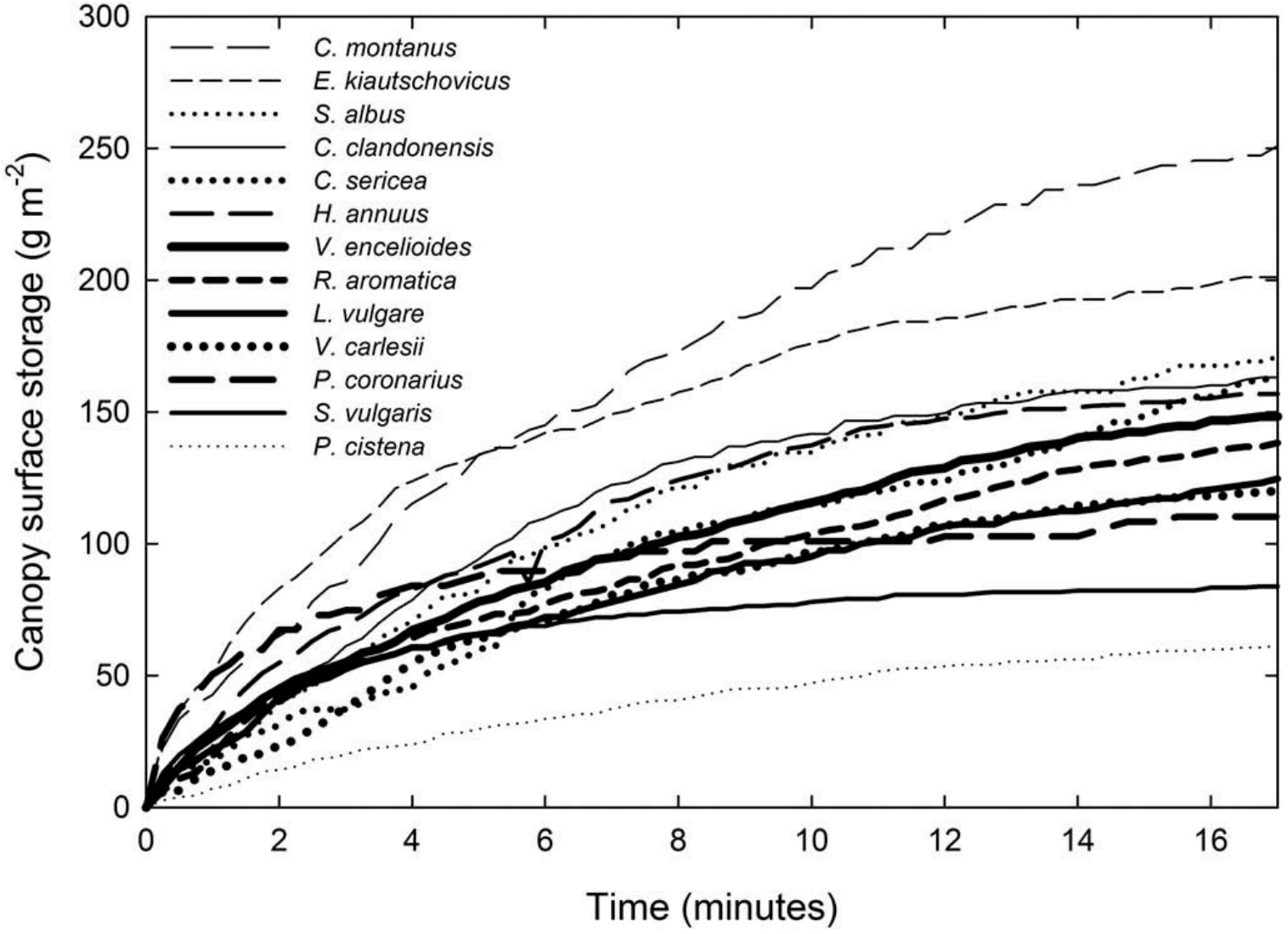
Aydin et al (2018) Environ Monit Assess 190: 316

- Interceptação da água da chuva



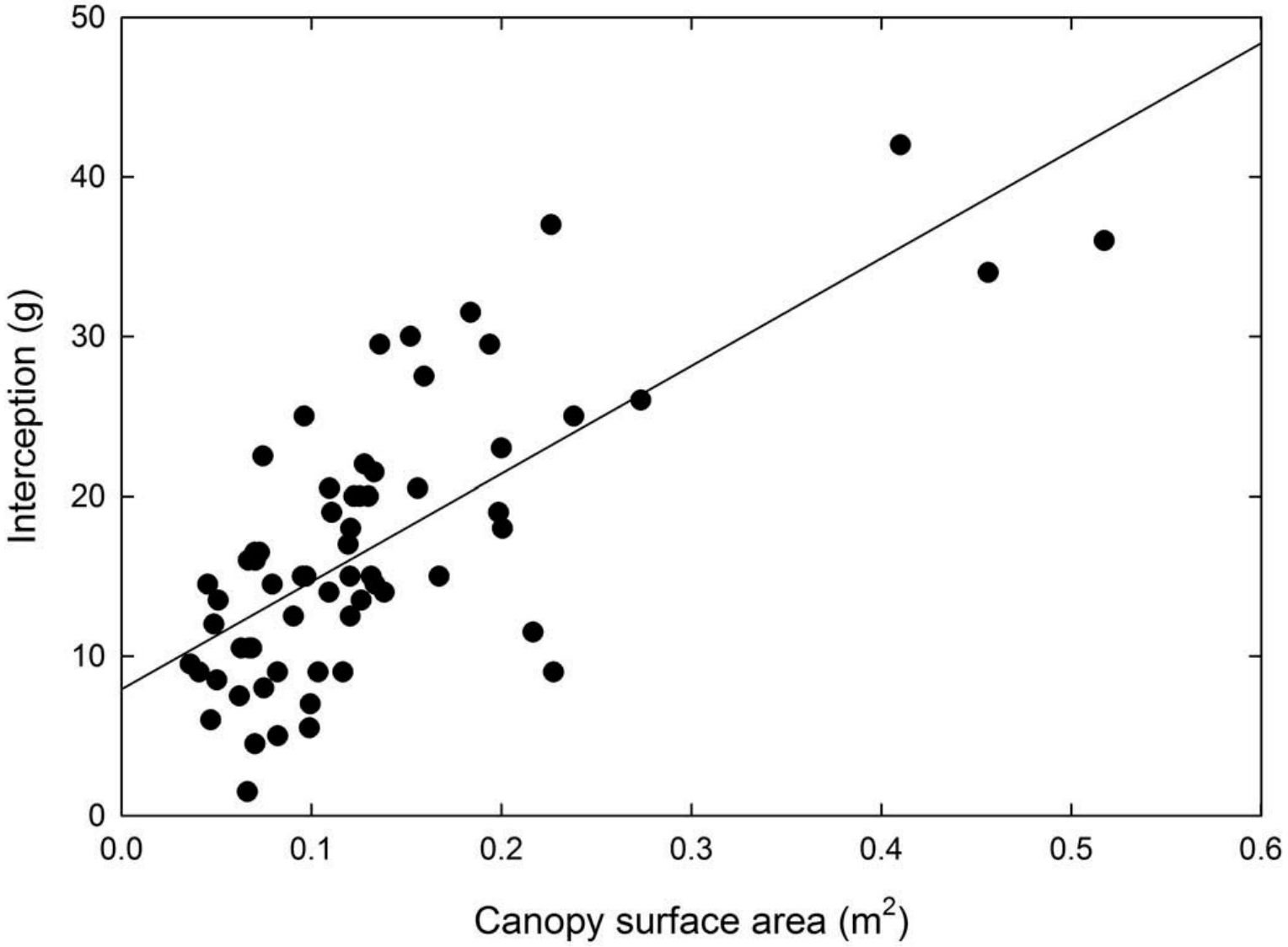
Kermavnar and Vilhar (2017) Urban Ecosystem 20: 1373-1387

- Interceptação da água da chuva



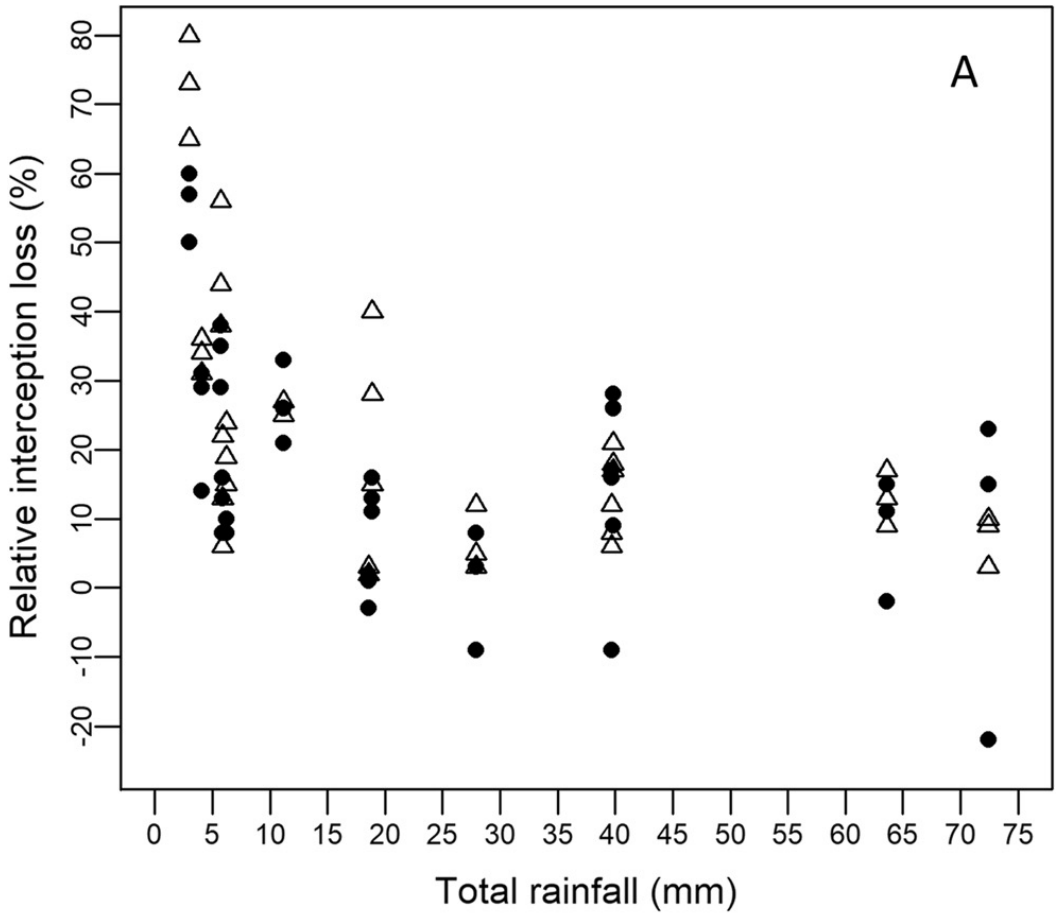
Holder and Gibbes (2017) Hydrological Science Journal 182-190

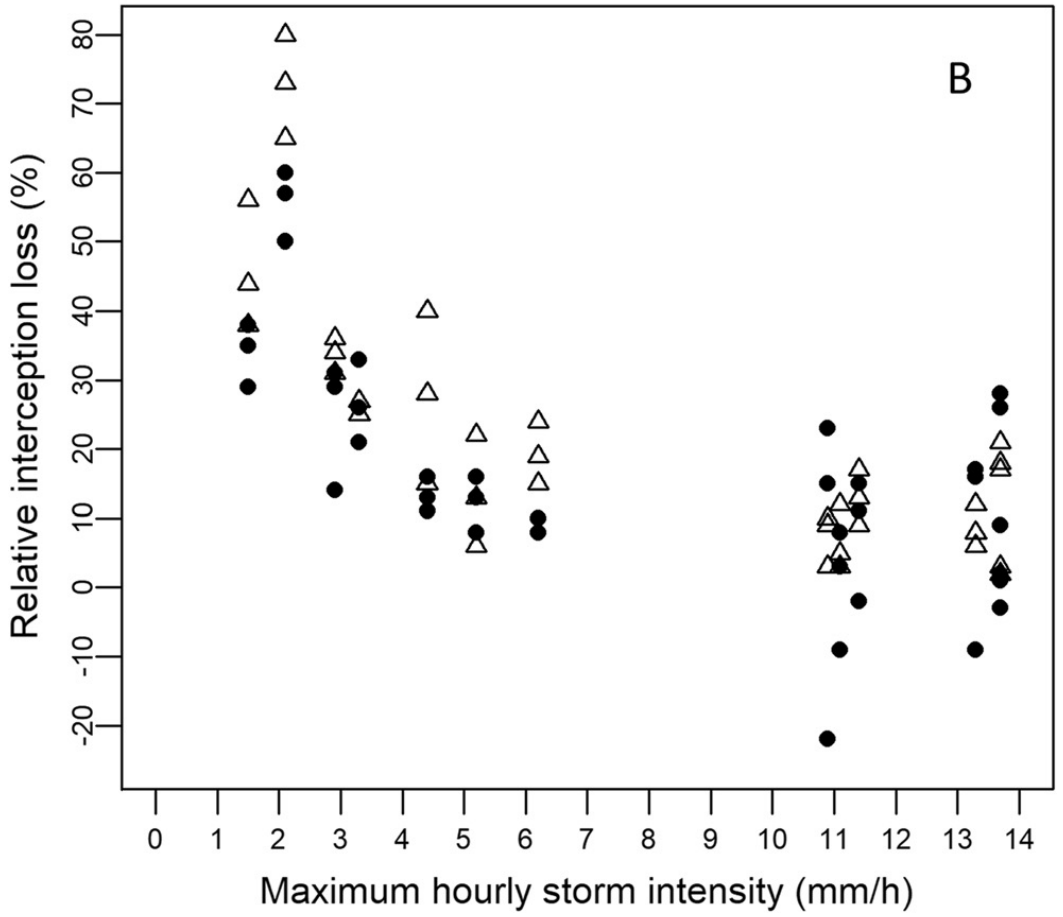
- Interceptação da água da chuva



Holder and Gibbes (2017) Hydrological Science Journal 182-190

- Interceptação da água da chuva

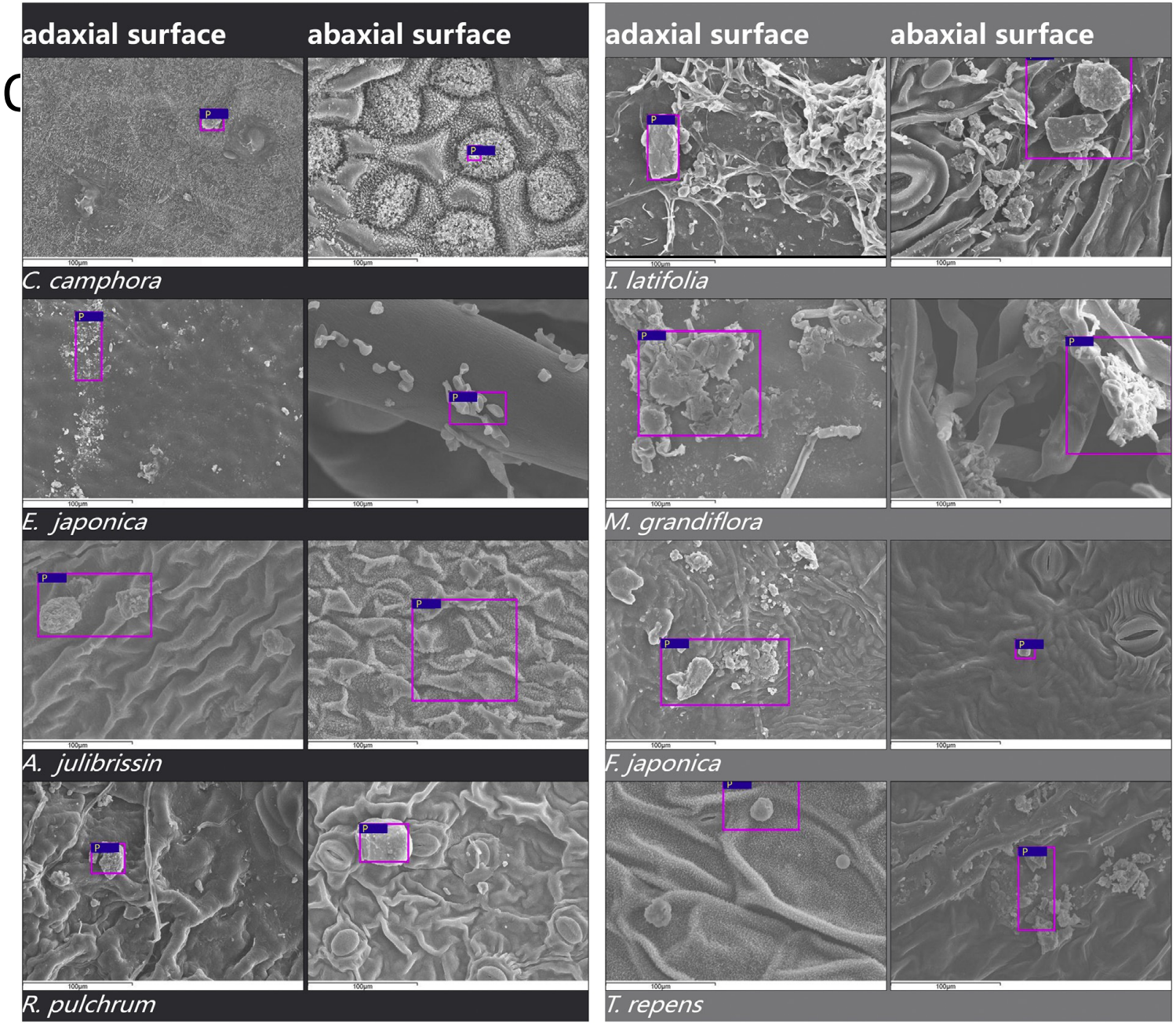




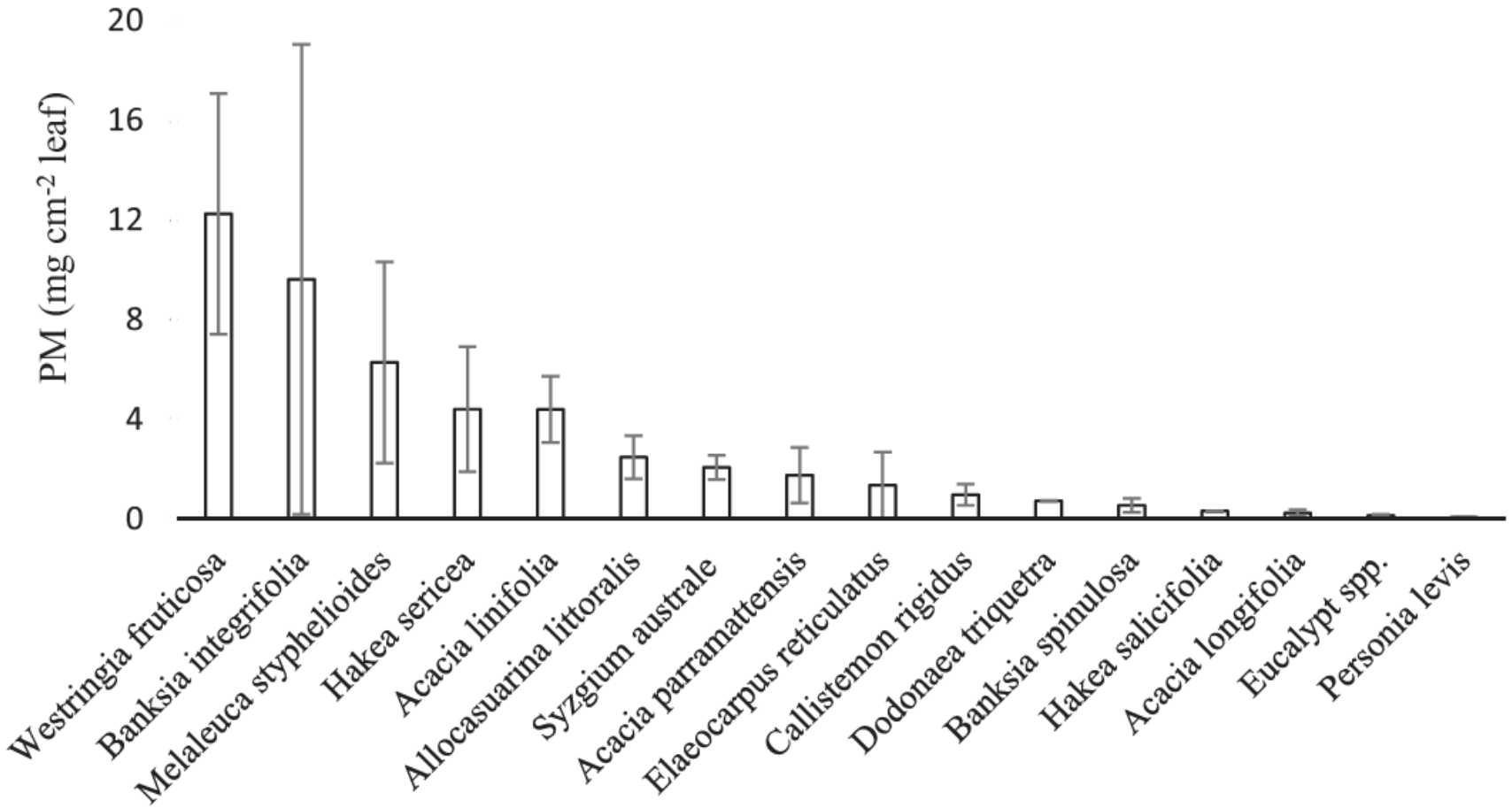
Nycht et al (2019) Urban Ecosystems 22:103-115

Urbanização

informacidade.com.b

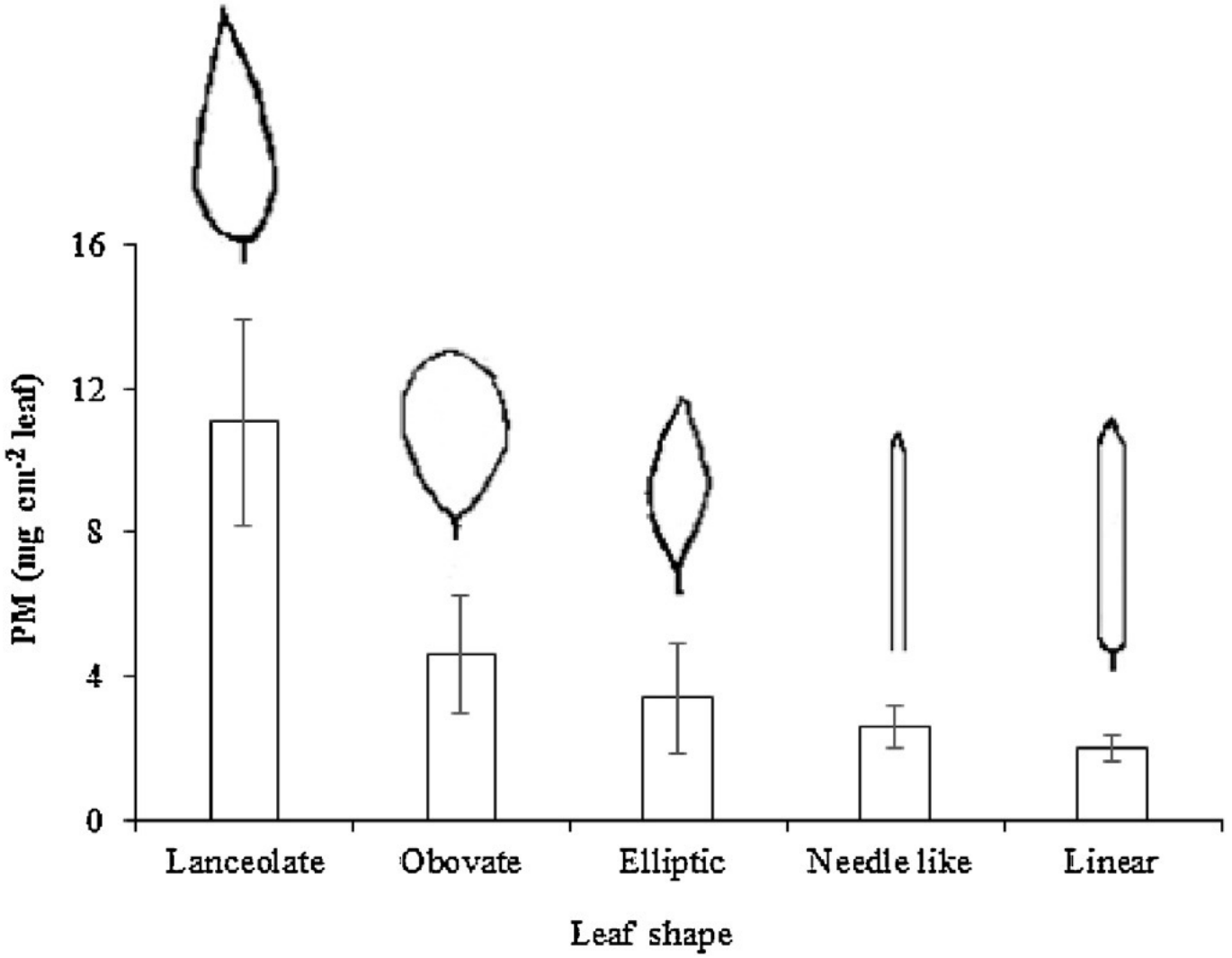

adaxial surface
abaxial surface
adaxial surface
abaxial surface
C. camphora
I. latifolia
E. japonica
M. grandiflora
A. julibrissin
F. japonica
R. pulchrum
T. repens

- Qualidade do ar



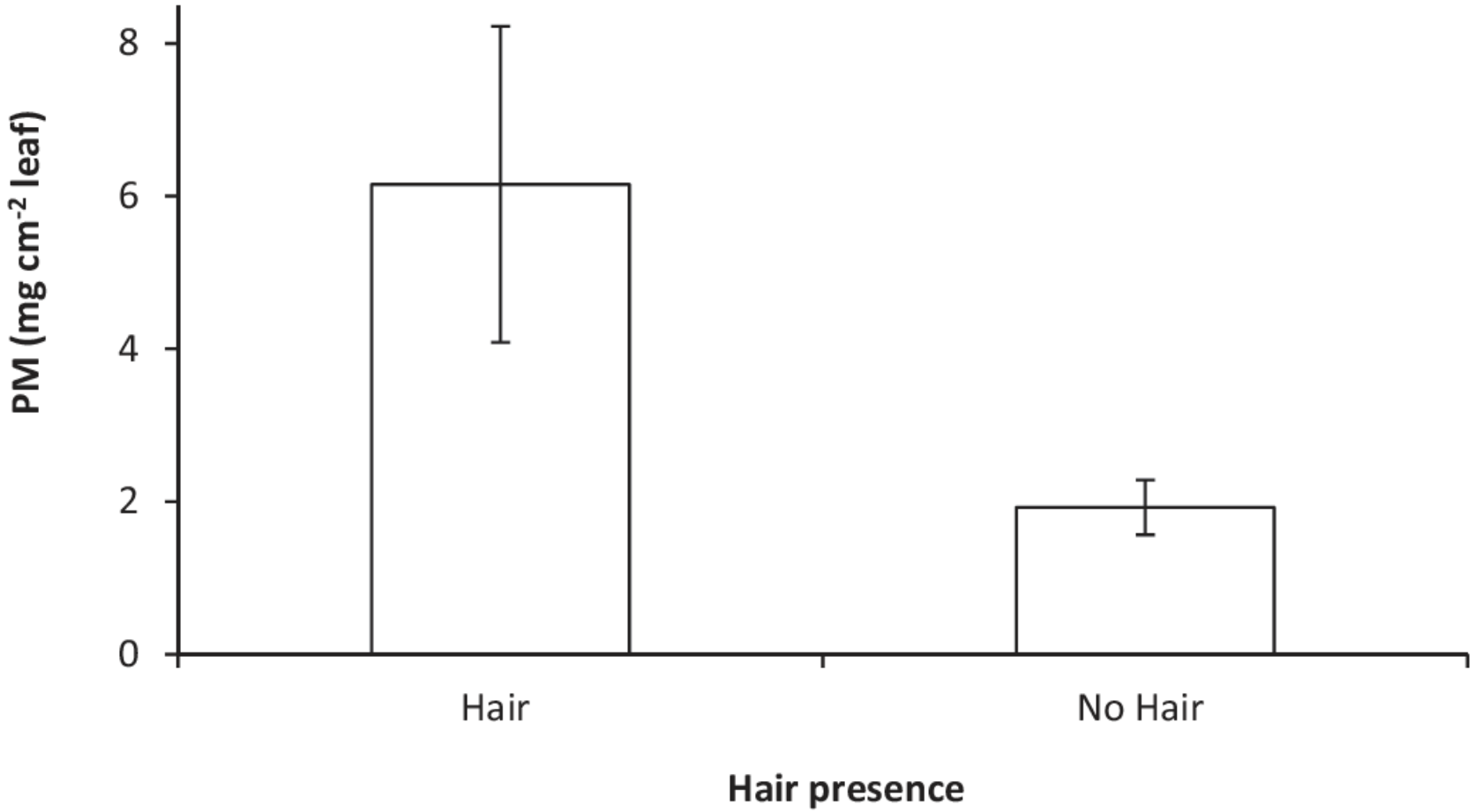
Leonard et al (2016) Urban Forestry & Urban Greening 20: 249-253

- Qualidade do ar

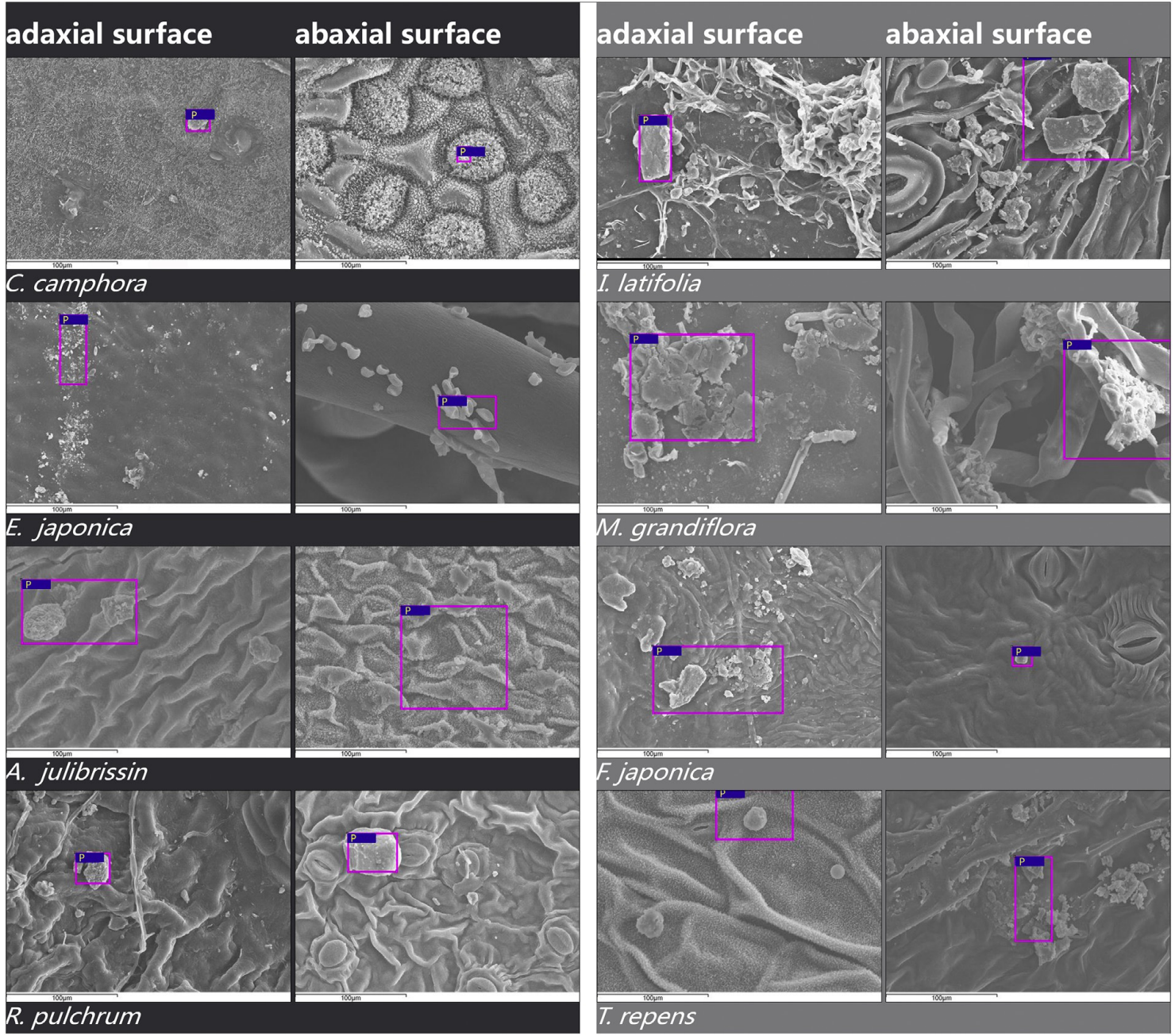


Leonard et al (2016) Urban Forestry & Urban Greening 20: 249-253

- Qualidade do ar



Leonard et al (2016) Urban Forestry & Urban Greening 20: 249-253



Shao et al 2019 Science of the Total Environment 652: 939-951

- Qualidade do ar

Table 3
Number of particles on the blade surfaces and percentage of each particle size.

	Species	Number of particles/each				Percentage/%			
		0.1–1	1–2.5	2.5–10	>10	0.1–1	1–2.5	2.5–10	>10
Adaxial surface	*C. camphora*	2162 ± 50	46 ± 2	10 ± 1	5 ± 1	97.23	2.07	0.46	0.24
	I. latifolia	1550 ± 33	127 ± 4	62 ± 2	7 ± 1	88.78	7.29	3.55	0.38
	E. japonica	1448 ± 26	162 ± 6	55 ± 7	5 ± 1	86.74	9.68	3.28	0.30
	M. grandiflora	1287 ± 18	9 ± 2	17 ± 3	3 ± 1	97.80	0.66	1.32	0.23
	A. julibrissin	155 ± 2	2 ± 1	10 ± 1	1 ± 1	92.45	1.19	5.76	0.60
	F. japonica	2493 ± 76	12 ± 1	12 ± 1	7 ± 2	98.80	0.46	0.48	0.26
	R. pulchrum	1674 ± 53	16 ± 3	14 ± 2	6 ± 2	97.87	0.96	0.84	0.33
	T. repens	240 ± 4	7 ± 1	12 ± 1	0	92.79	2.70	4.50	0
Abaxial surface	*C. camphora*	1049 ± 27	7 ± 1	1 ± 1	0	99.21	0.69	0.09	0
	I. latifolia	890 ± 17	39 ± 1	8 ± 1	4 ± 1	94.52	4.14	0.88	0.46
	E. japonica	452 ± 9	6 ± 1	6 ± 1	0	97.48	1.22	1.29	0
	M. grandiflora	558 ± 13	15 ± 2	4 ± 1	0	96.65	2.66	0.69	0
	A. julibrissin	223 ± 4	2 ± 1	11 ± 2	1 ± 1	94.23	0.84	4.50	0.42
	F. japonica	118 ± 2	4 ± 1	11 ± 1	0	88.76	3.00	8.24	0
	R. pulchrum	32 ± 1	3 ± 1	11 ± 3	1 ± 1	67.61	6.34	23.93	2.11
	T. repens	1466 ± 45	11 ± 2	13 ± 1	6 ± 1	97.99	0.71	0.87	0.42
Total surface	*C. camphora*	3211 ± 77	53 ± 1	11 ± 1	5 ± 1	97.91	1.62	0.33	0.15
	I. latifolia	2440 ± 49	166 ± 4	70 ± 1	11 ± 2	90.84	6.17	2.60	0.40
	E. japonica	1900 ± 35	169 ± 5	61 ± 2	5 ± 1	89.04	7.86	2.86	0.23
	M. grandiflora	1844 ± 31	24 ± 4	21 ± 1	3 ± 1	97.46	1.25	1.13	0.16
	A. julibrissin	379 ± 5	4 ± 1	21 ± 2	2 ± 1	93.34	1.07	5.10	0.49
	F. japonica	2611 ± 78	16 ± 1	23 ± 1	7 ± 2	98.24	0.61	0.87	0.27
	R. pulchrum	1705 ± 54	19 ± 2	25 ± 5	7 ± 1	97.15	1.06	1.40	0.38
	T. repens	1706 ± 49	18 ± 2	25 ± 3	6 ± 2	97.21	1.01	1.44	0.34

Leaf area: 256 μm × 192 μm.

Shao et al 2019 Science of the Total Environment 652: 939-951

• Qualidade do ar

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	M. grandiflora	1287 ± 18	9 ± 2	17 ± 3	3 ± 1	97.80	0.66	1.32	0.23
	A. julibrissin	155 ± 2	2 ± 1	10 ± 1	1 ± 1	92.45	1.19	5.76	0.60
	F. japonica	2493 ± 76	12 ± 1	12 ± 1	7 ± 2	98.80	0.46	0.48	0.26
	R. pulchrum	1674 ± 53	16 ± 3	14 ± 2	6 ± 2	97.87	0.96	0.84	0.33
	T. repens	240 ± 4	7 ± 1	12 ± 1	0	92.79	2.70	4.50	0
Abaxial surface	*C. camphora*	1049 ± 27	7 ± 1	1 ± 1	0	99.21	0.69	0.09	0
	I. latifolia	890 ± 17	39 ± 1	8 ± 1	4 ± 1	94.52	4.14	0.88	0.46
	E. japonica	452 ± 9	6 ± 1	6 ± 1	0	97.48	1.22	1.29	0
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	A. julibrissin	223 ± 4	2 ± 1	11 ± 2	1 ± 1	94.23	0.84	4.50	0.42
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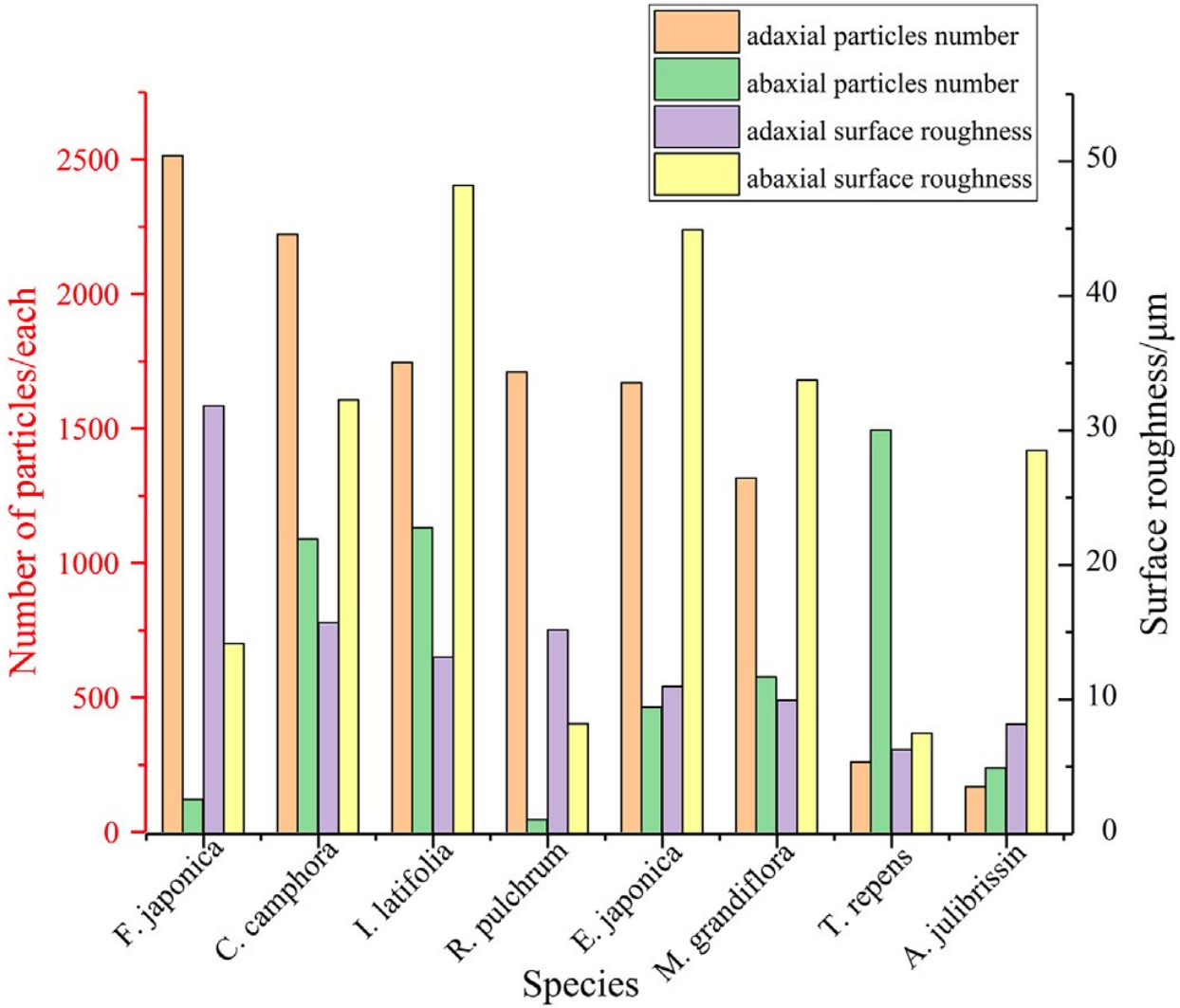
	F. japonica	2611 ± 78	16 ± 1	23 ± 1	7 ± 2	98.24	0.61	0.87	0.27
	R. pulchrum	1705 ± 54	19 ± 2	25 ± 5	7 ± 1	97.15	1.06	1.40	0.38
	T. repens	1706 ± 49	18 ± 2	25 ± 3	6 ± 2	97.21	1.01	1.44	0.34

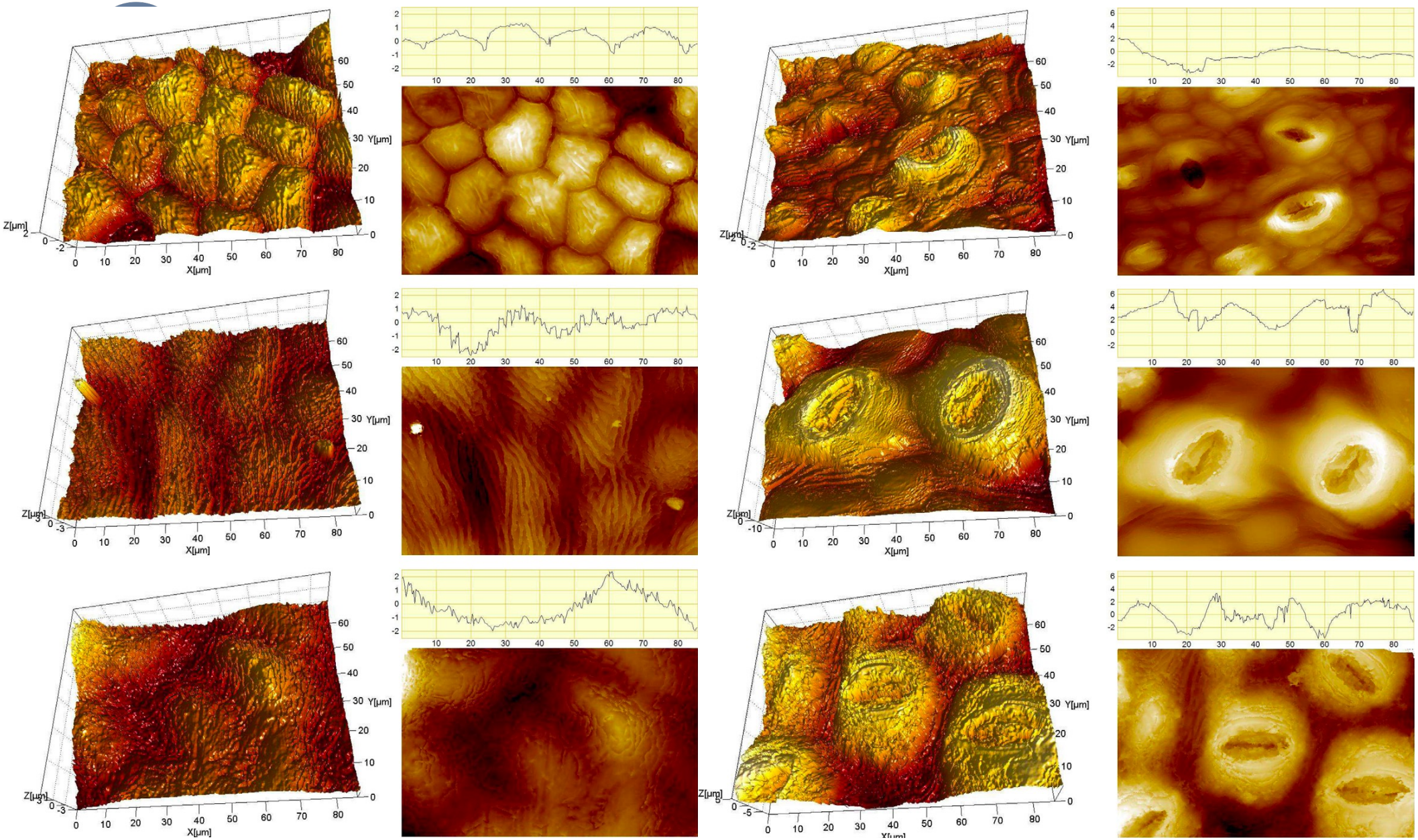
Leaf area: 256 μm × 192 μm.

Shao et al 2019 Science of the Total Environment 652: 939-951

- Qualidade do ar



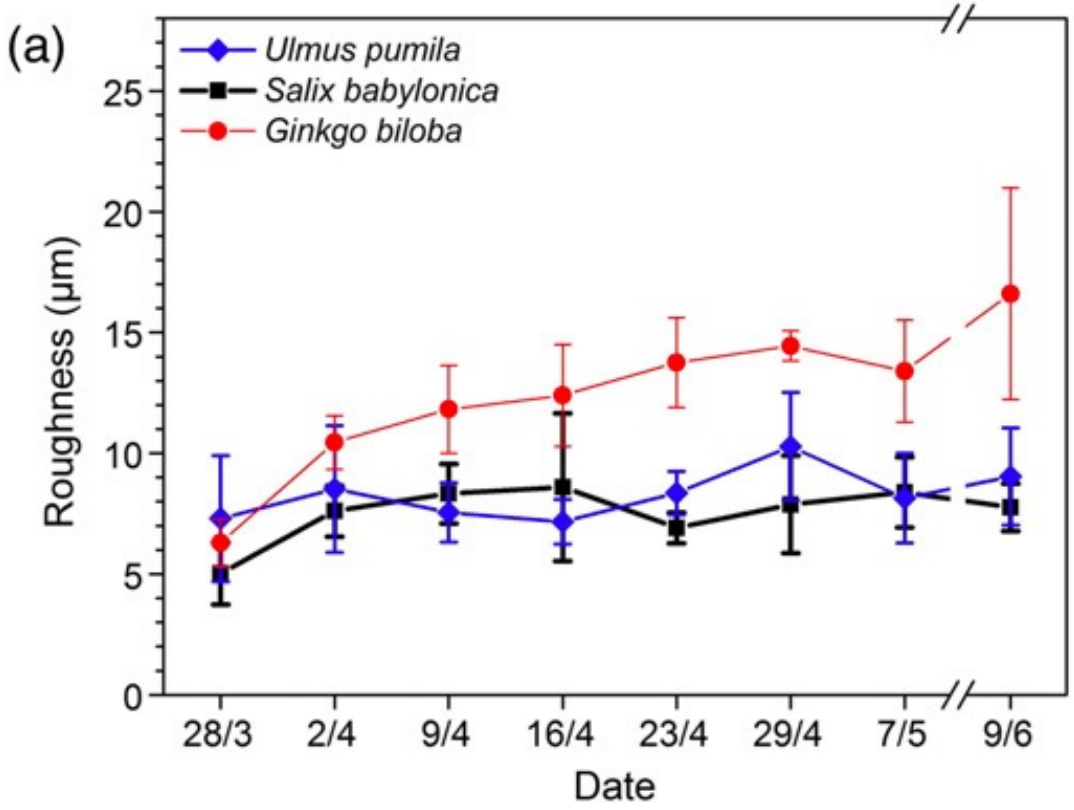
Shao et al 2019 Science of the Total Environment 652: 939-951



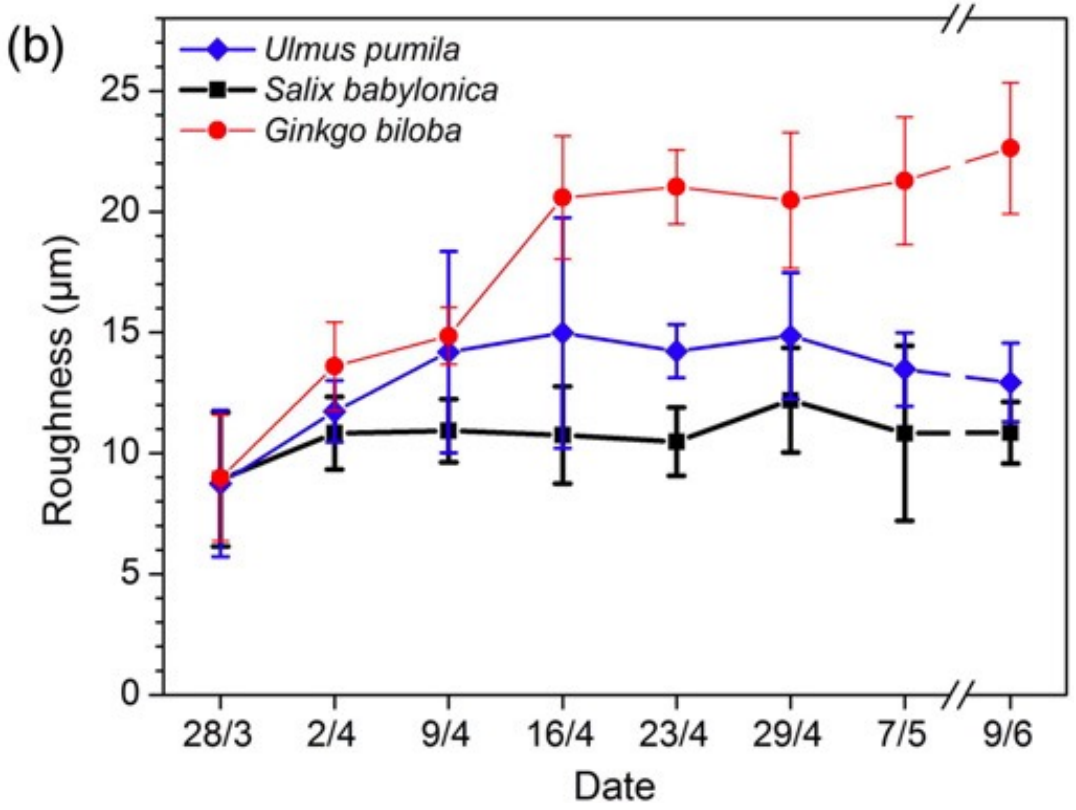
Wang et al 2015 Science of the Total Environment 532: 420-434

- Qualidade do ar

Adaxial



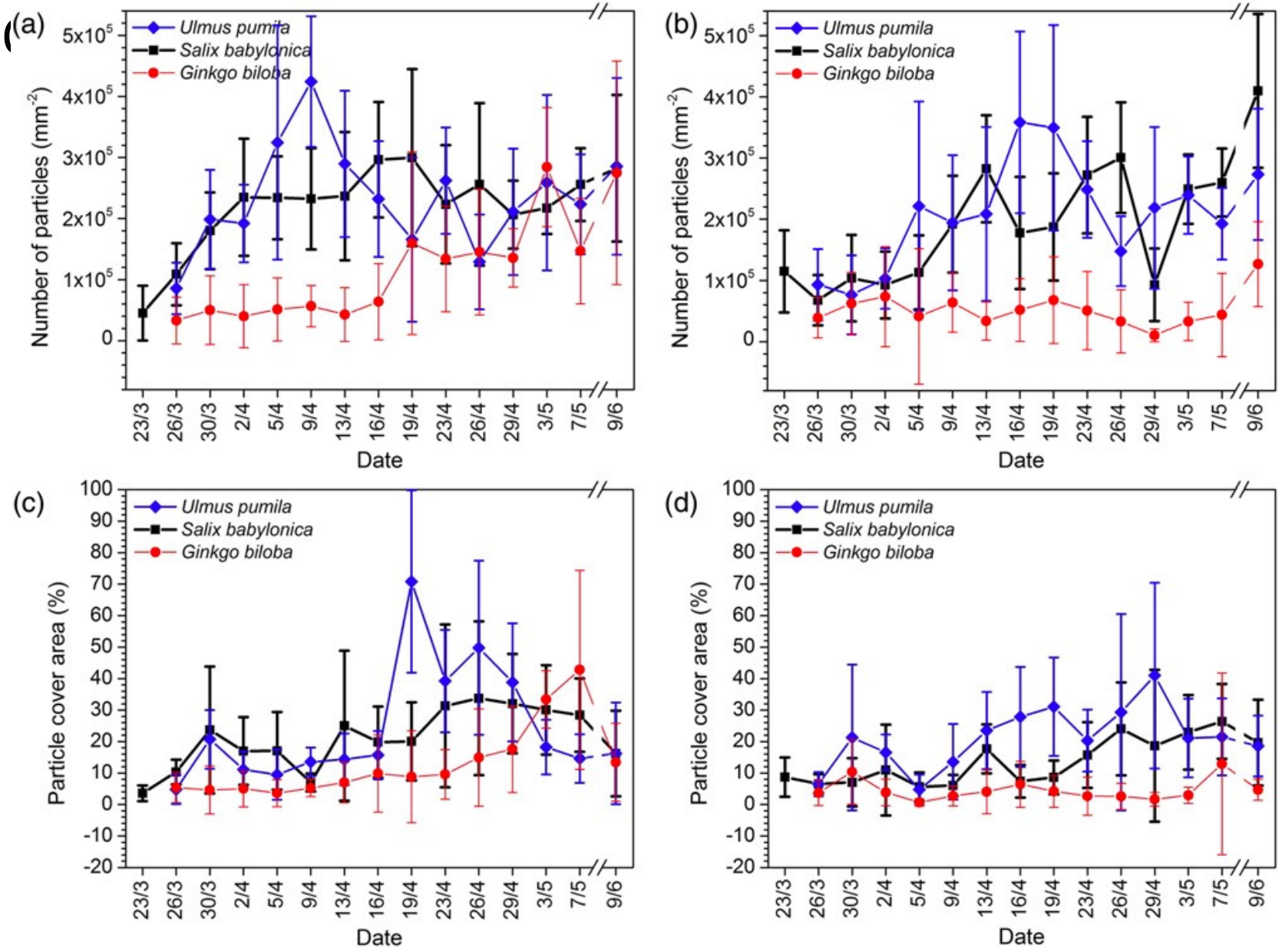
Abaxial



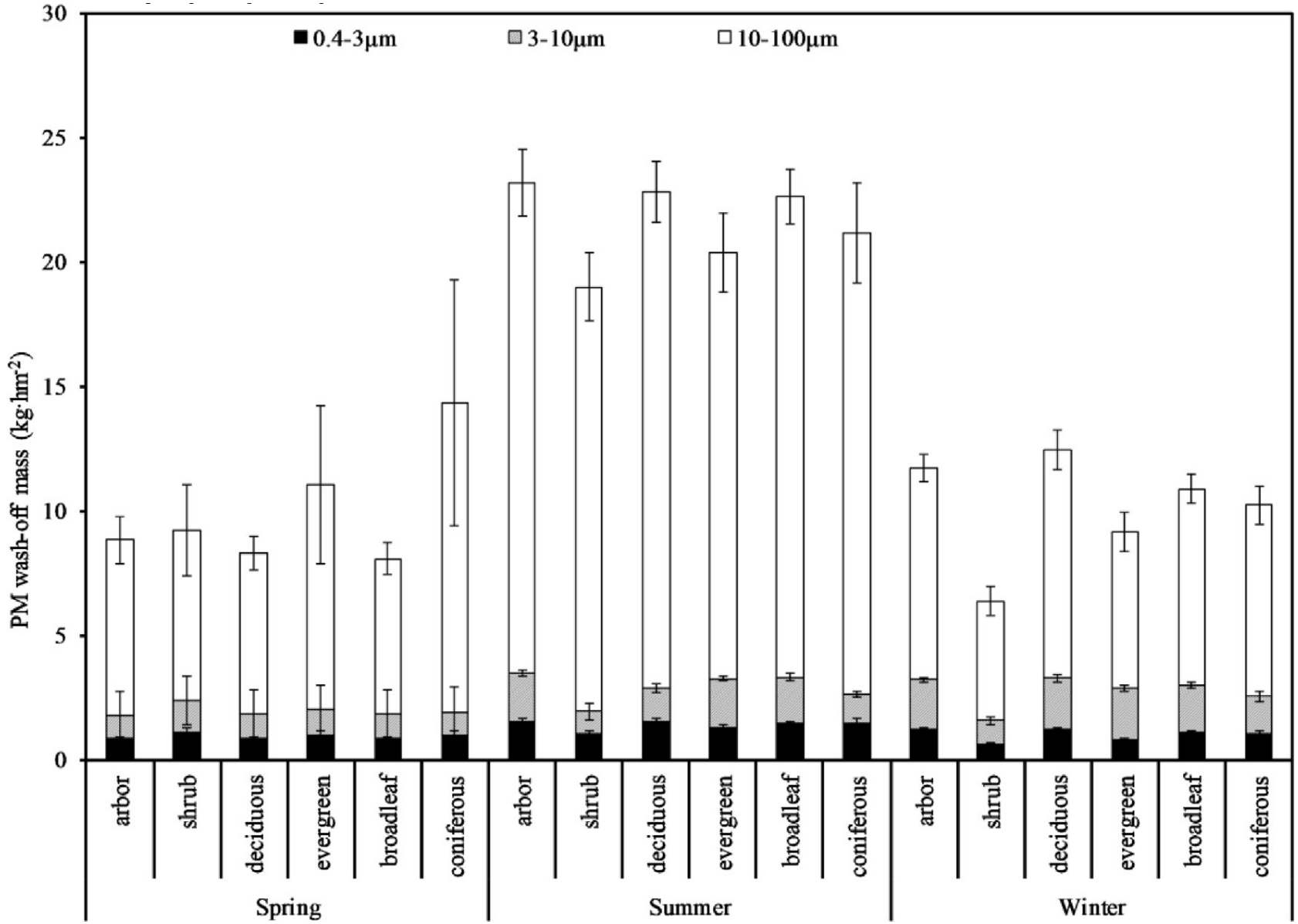
Wang et al 2015 Science of the Total Environment 532: 420-434

Adaxial

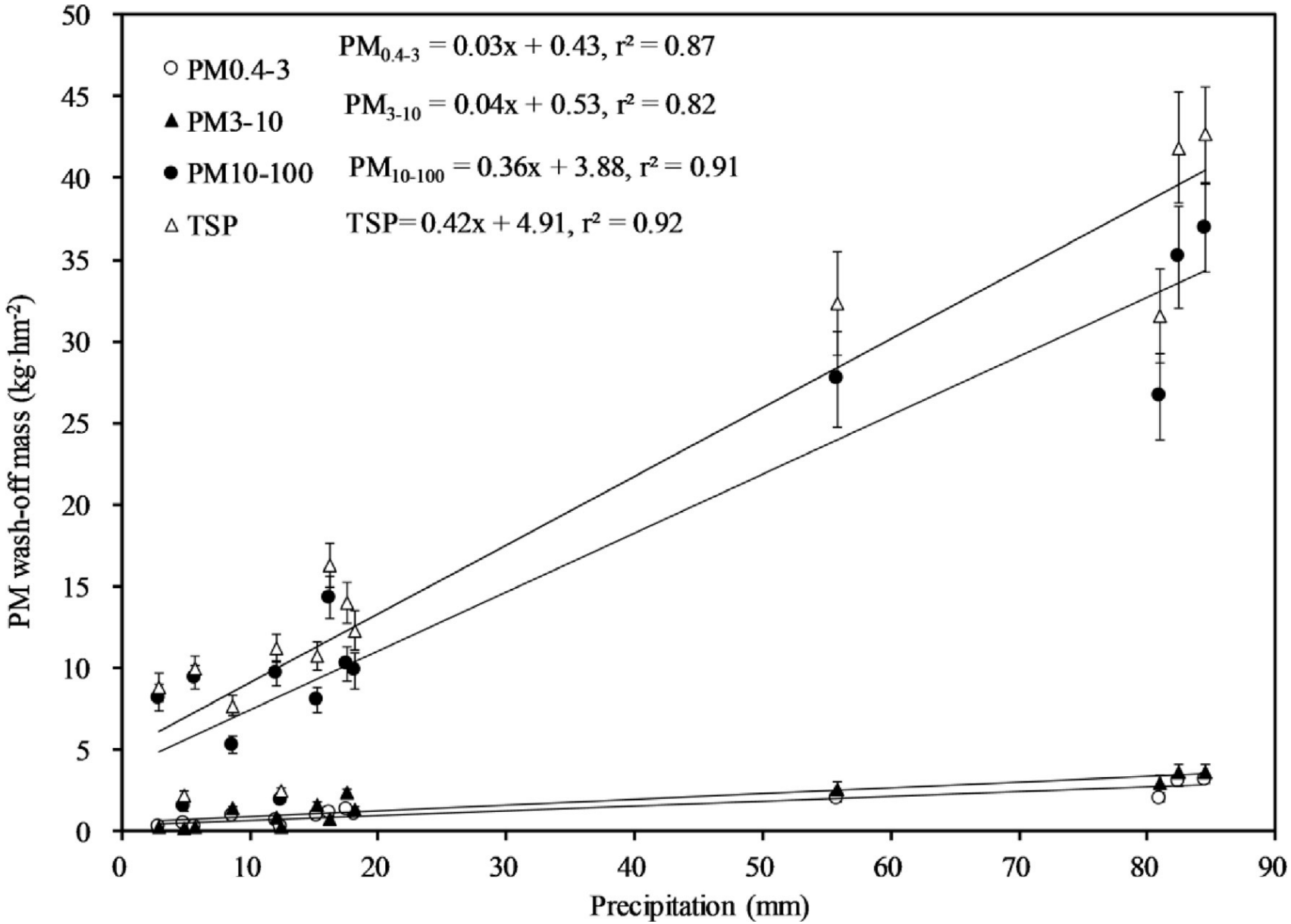
Abaxial



Wang et al 2015 Science of the Total Environment 532: 420-434



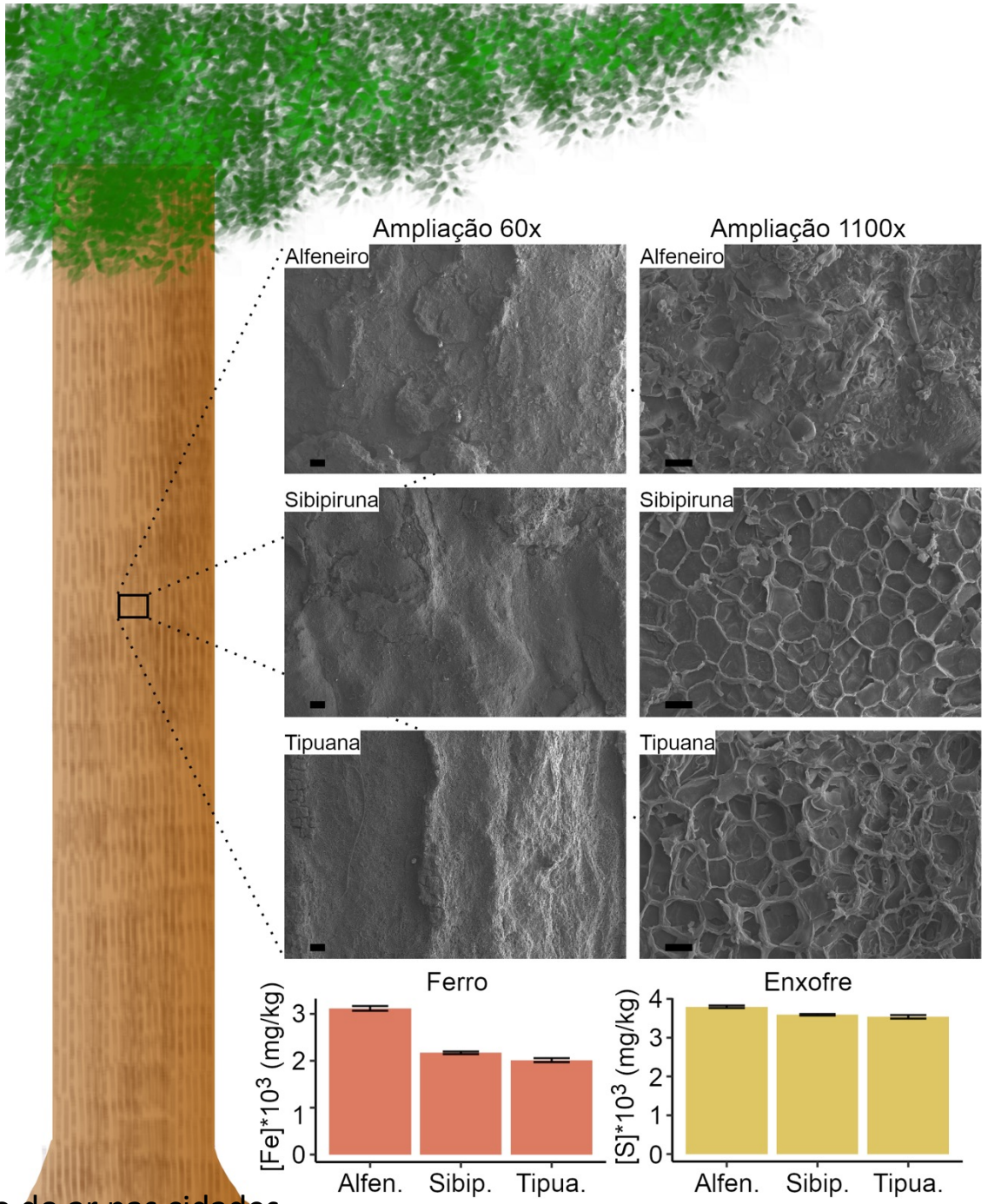
Cai et al 2019 Environmental Pollution 252: 1648-1658



Cai et al 2019 Environmental Pollution 252: 1648-1658

- Qualidade do ar

pixabay.com



Locosselli 2020 Soluções Baseadas na Natureza para a redução da poluição do ar nas cidades

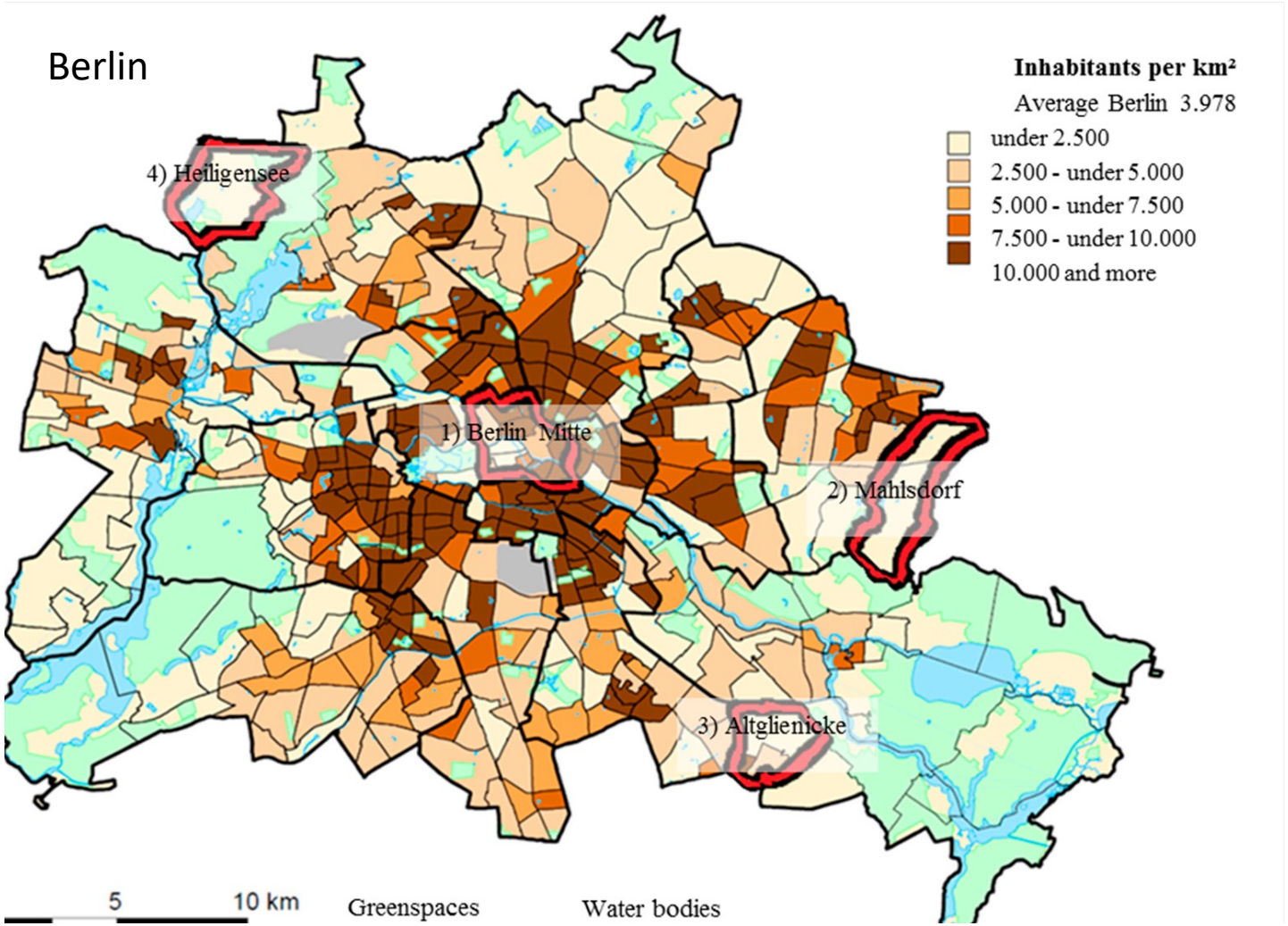
Urbanização

robe-trotting.com

- Culturais

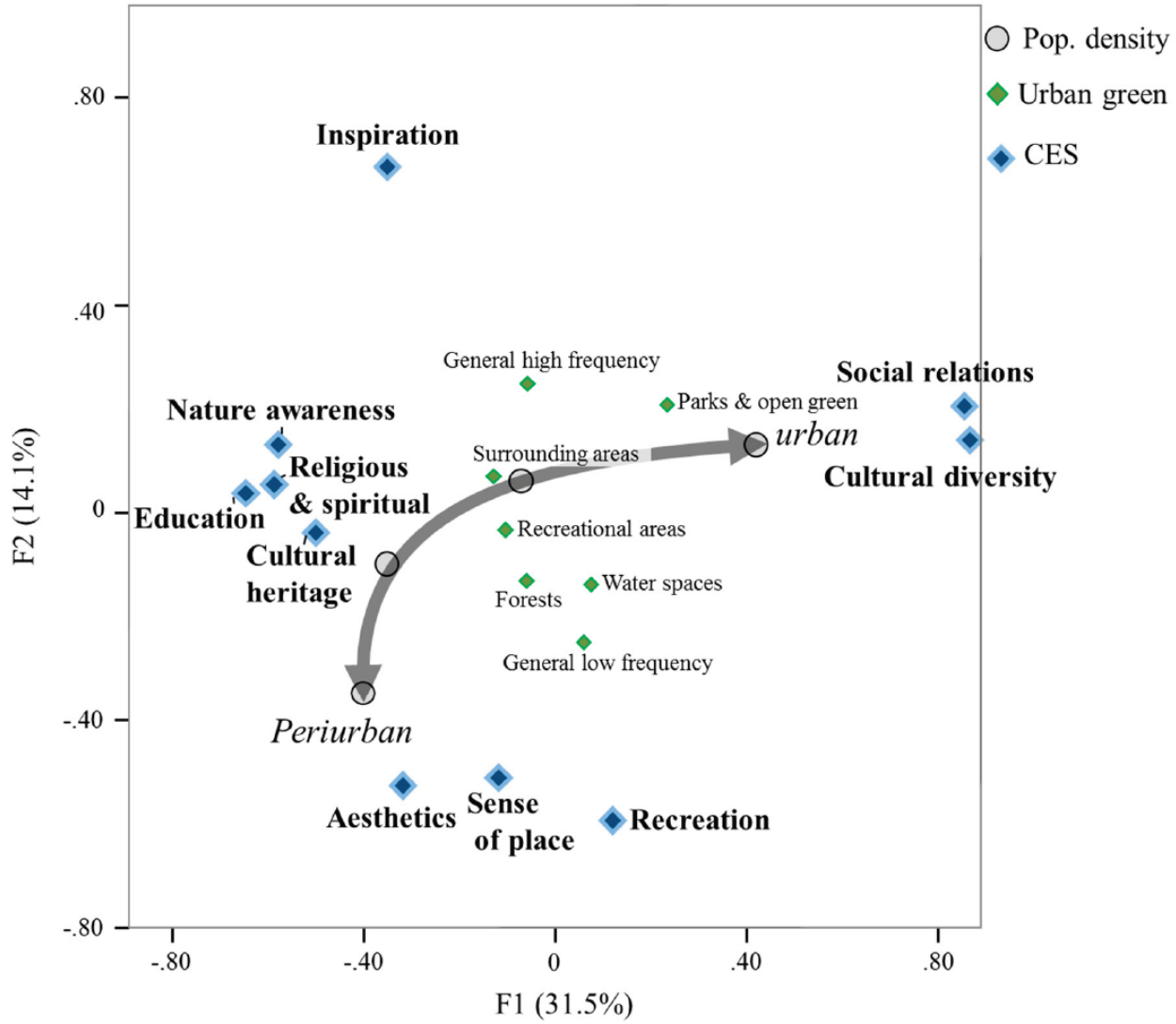
Holleland et al 2017 Conservation and Management of Archeological Sites 19:210-237

- Culturais



Riechers et al (2019) Sustainability 11: 645

- Culturais



Riechers et al (2019) Sustainability 11: 645

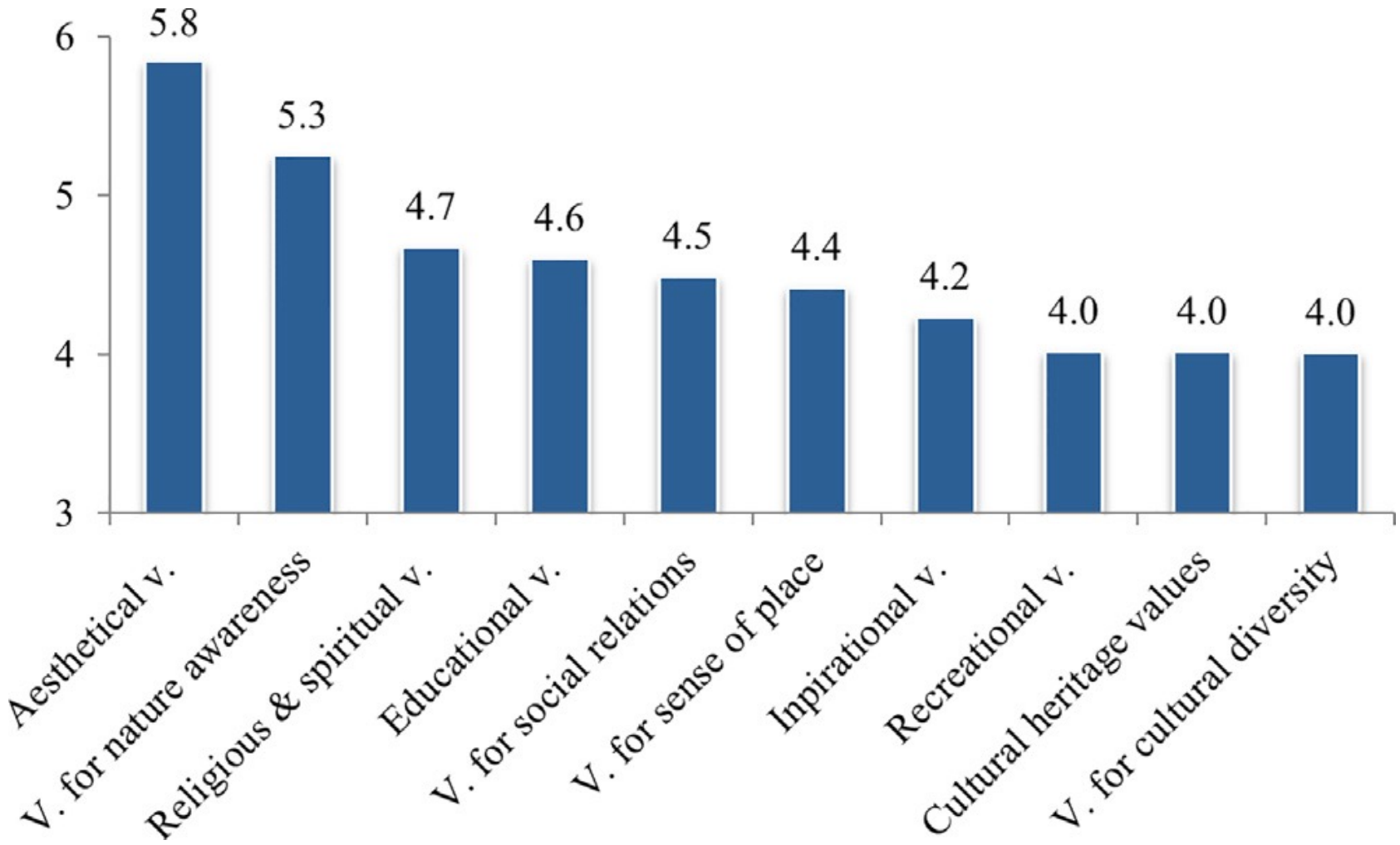
- Culturais

Cultural Ecosystem Service	Overall Mean	Age	Income	Population Density	
		Beta	Beta	Beta	R^2 Change
Social relation	4.5	−0.324 ***		0.269 ***	0.065 ***
Recreation	4.0	−0.233 ***		−0.255 ***	0.058 ***
Education	4.0	0.163 ***		−0.243 ***	0.053 ***
Cultural diversity	4.0	−0.234 ***	−0.090 *	0.218 ***	0.042 ***
Cultural heritage	4.0	0.337 ***	−0.113 **	−0.126 **	0.014 **
Natural awareness	5.3	0.168 ***		−0.122 **	0.013 **
Aesthetic	5.8		0.115 *	−0.110 *	0.011 *
Sense of place	4.4	0.098 *	−0.242 ***		
Religious & spiritual v.	4.7	0.248 ***			
Inspiration	4.2	0.251 ***	0.116 **		

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Riechers et al (2019) Sustainability 11: 645

- Culturais



Riechers et al (2018) Landscape and Urban Planning 11: 645

- Culturais

Cluster 1 n = 419 (75.6%)	Cluster 2 n = 135 (24.4%)	Eta	F-Value	p-value
Younger (42.6 yrs.)	Older (54.9 yrs.)	0.344	73.098	< 0.001
Shorter time of living in Berlin	Longer time of living in Berlin	0.312	32.961	< 0.001
Lower visiting frequency to urban green	Higher visiting frequency to urban green	0.150	12.767	< 0.001
Higher population density	Lower population density	0.135	10.261	= 0.001
Urban green perceived as not so well accessible	Urban green perceived as well accessible	0.112	7.028	= 0.008

Riechers et al (2018) Landscape and Urban Planning 11: 645

- Culturais

CES	Cluster 1 $n = 419$ (75.6%)	Difference	Cluster 2 $n = 135$ (24.4%)	Eta	F-Value	p-value
Religious/spiritual	4.2	+1.4	5.6	0.421	119.465	< 0.001
Cultural heritage	3.6	+1.3	4.9	0.360	82.933	< 0.001
Education	4.2	+1.2	5.4	0.423	121.209	< 0.001
Nature awareness	4.9	+1.1	6.0	0.355	79.790	< 0.000
Sense of place	4.1	+0.9	5.0	0.273	44.611	< 0.001
Inspiration	4.0	+0.8	4.8	0.260	39.970	< 0.001
Recreation	4.2	−0.5	3.7	0.210	25.744	< 0.001
Aesthetics	5.6	−0.9	6.3	0.275	45.419	< 0.001
Cultural diversity	4.4	−1.3	3.1	0.372	89.163	< 0.001
Social relations	5.1	−1.9	3.2	0.502	187.092	< 0.001

Riechers et al (2018) Landscape and Urban Planning 11: 645

- Culturais

Inductive CES codes	Experts (n = 946 codes)		Laypersons (n = 1560 codes)	
	% of codes	Order	% of codes	Order
Nature as recreational space	13.74%	1	17.31%	1
Designing nature creatively; occupation of nature	12.37%	2	1.67%	14
Nature as meeting place	11.21%	3	6.79%	5
Education based on nature perceptions	10.78%	4	4.04%	10
Awareness of nature	7.61%	5	9.87%	4
Needs and uses of nature are group specific	6.55%	6	2.69%	12
Recreational activities in nature	6.13%	7	13.46%	3
Cultural landscape / natural heritage	5.39%	8	5.06%	6
Alienation from nature	5.29%	9	1.86%	13
Aesthetic impressions of nature	4.97%	10	16.41%	2
Social and motoric development	4.33%	11	1.35%	16
Sense of place through nature	3.17%	12	4.87%	8
Socially just planning of green spaces needed	2.96%	13	0.00%	17
Love for nature	2.01%	14	3.21%	11
Spiritual / religious notions of nature	1.48%	15	5.00%	7
Visiting nearby recreational nature areas	1.06%	16	4.81%	9
Inspiration from and through stays in nature	0.95%	17	1.60%	15

Riechers et al (2017) Urban Ecosystems 20: 715-727

Árvore ser tecnológico

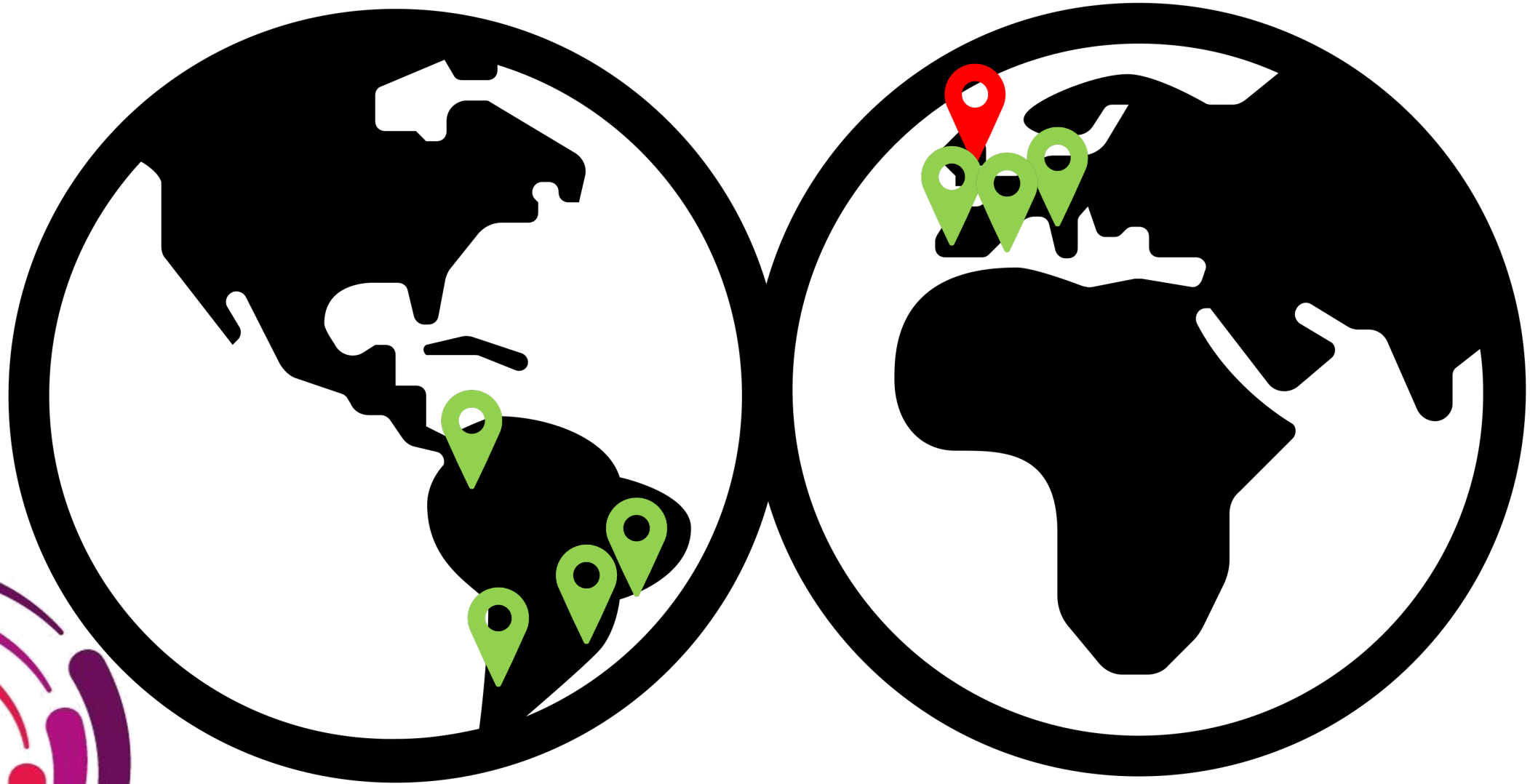
CONEXUS

Urban nature connects us
Conectados por la naturaleza urbana
Conectados pela natureza urbana

European Commission

FAPESP 60

earth.com



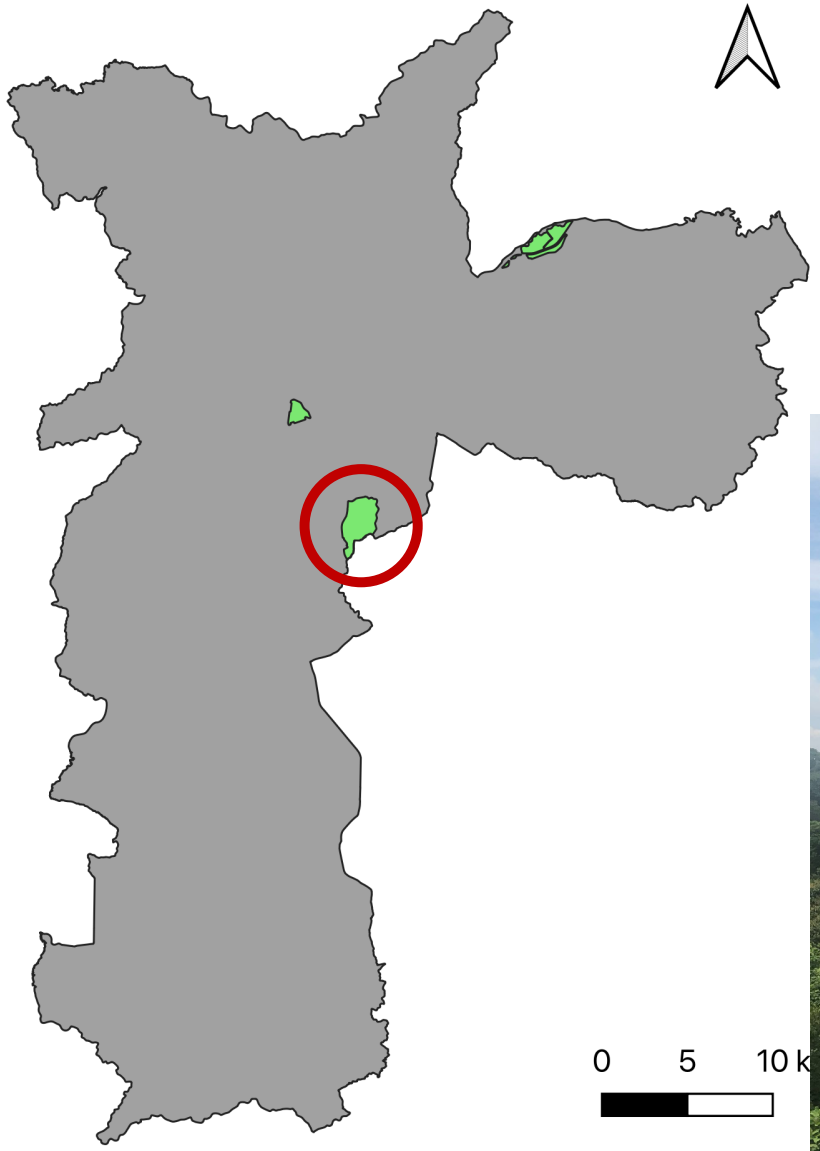
earth.com

Functional
Forests

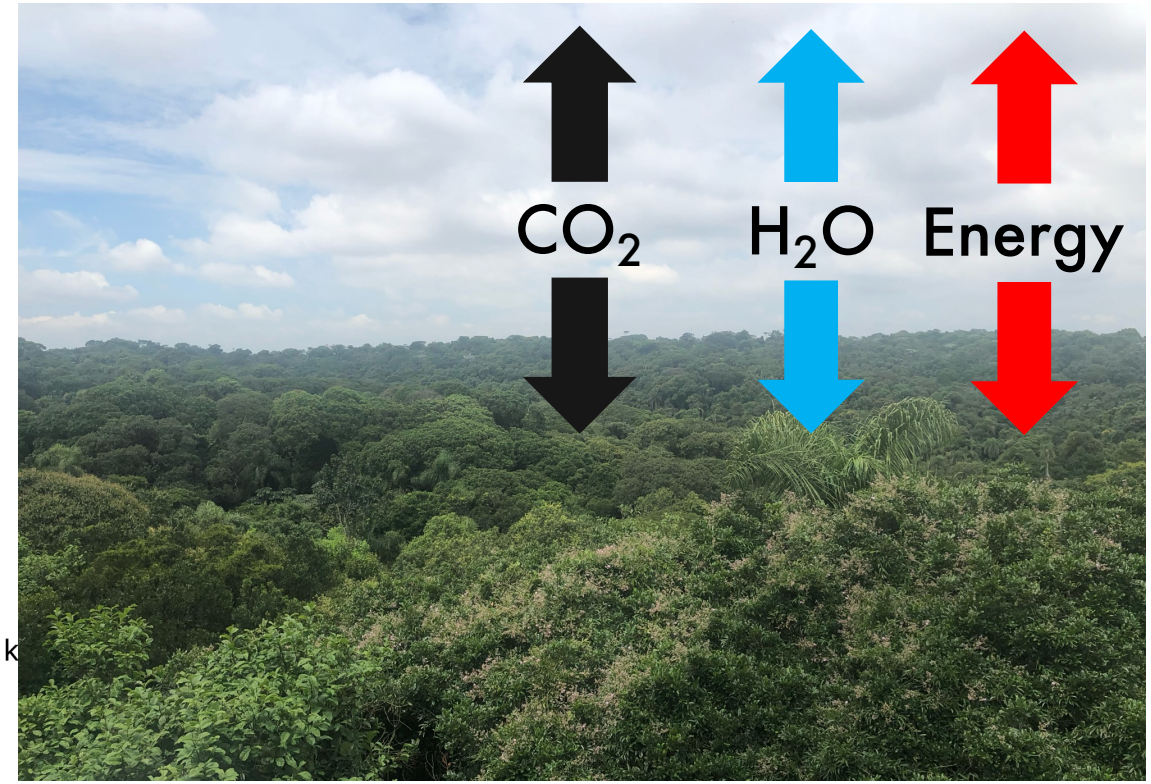
Life Labs:

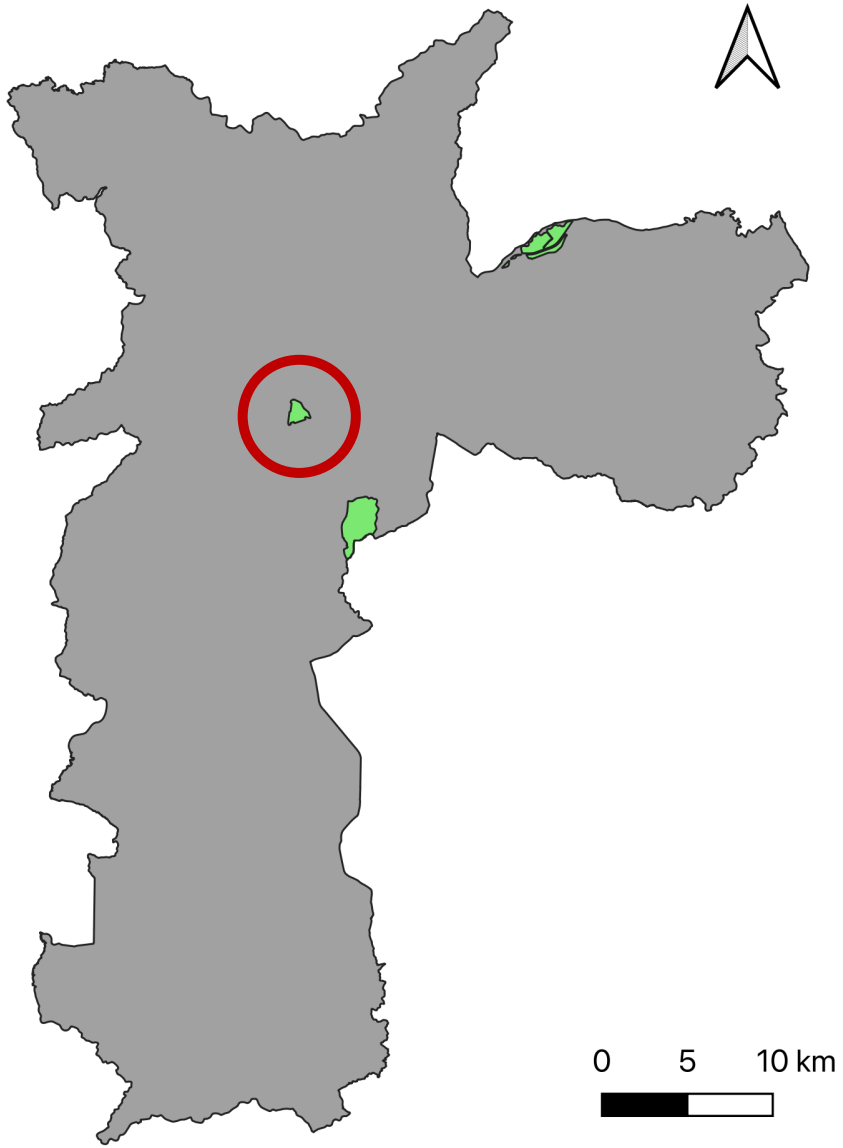
- Academia:
- Government:
- Third sector:

Cidades sustentáveis

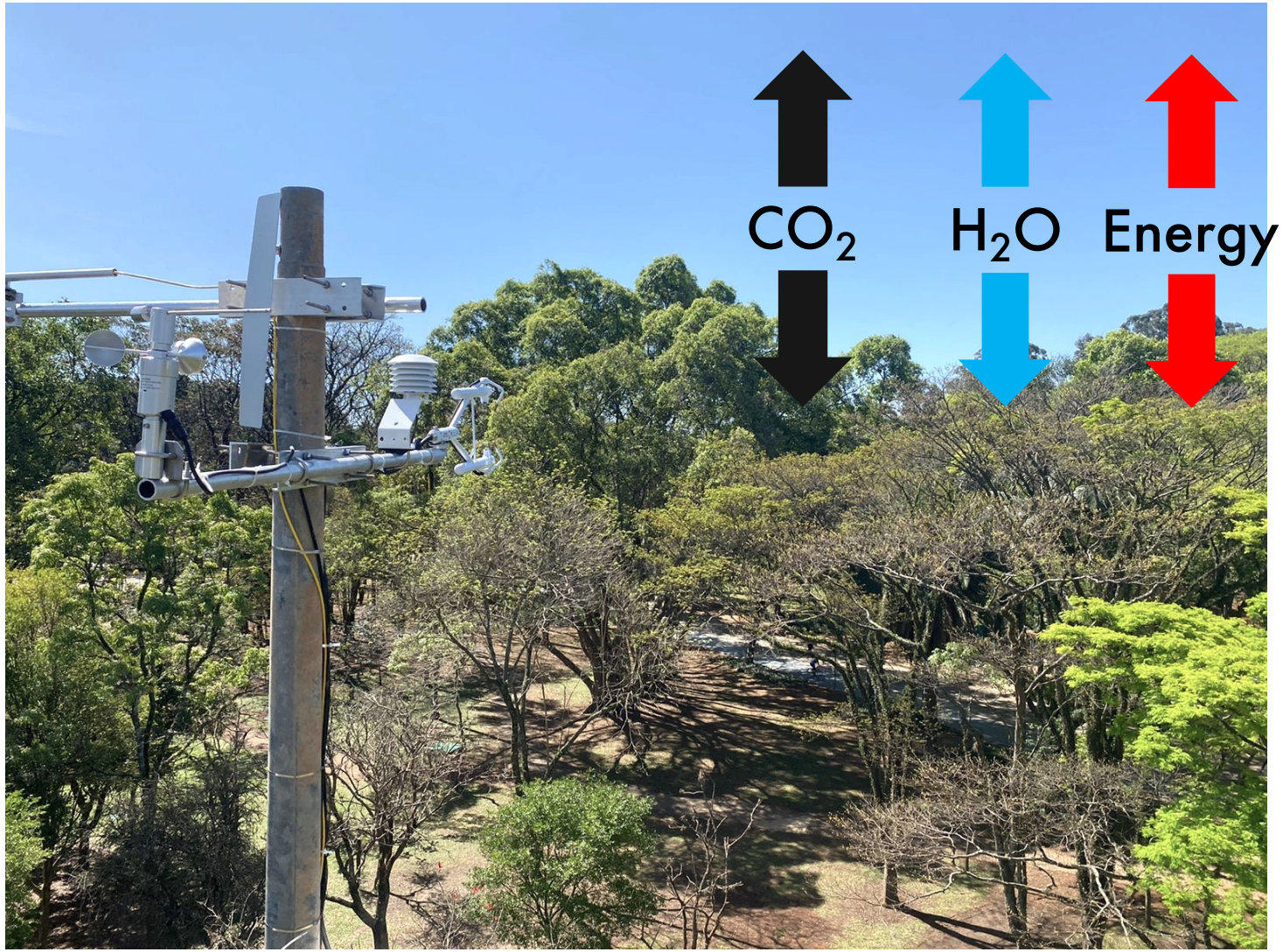


Fontes do Ipiranga Park





Fontes Ibirapuera



- Eddy covariance tower and the climate station are fully operational. They've been installed along a air quality station, making this area a spot for atmospheric science in the park.

Flux tower

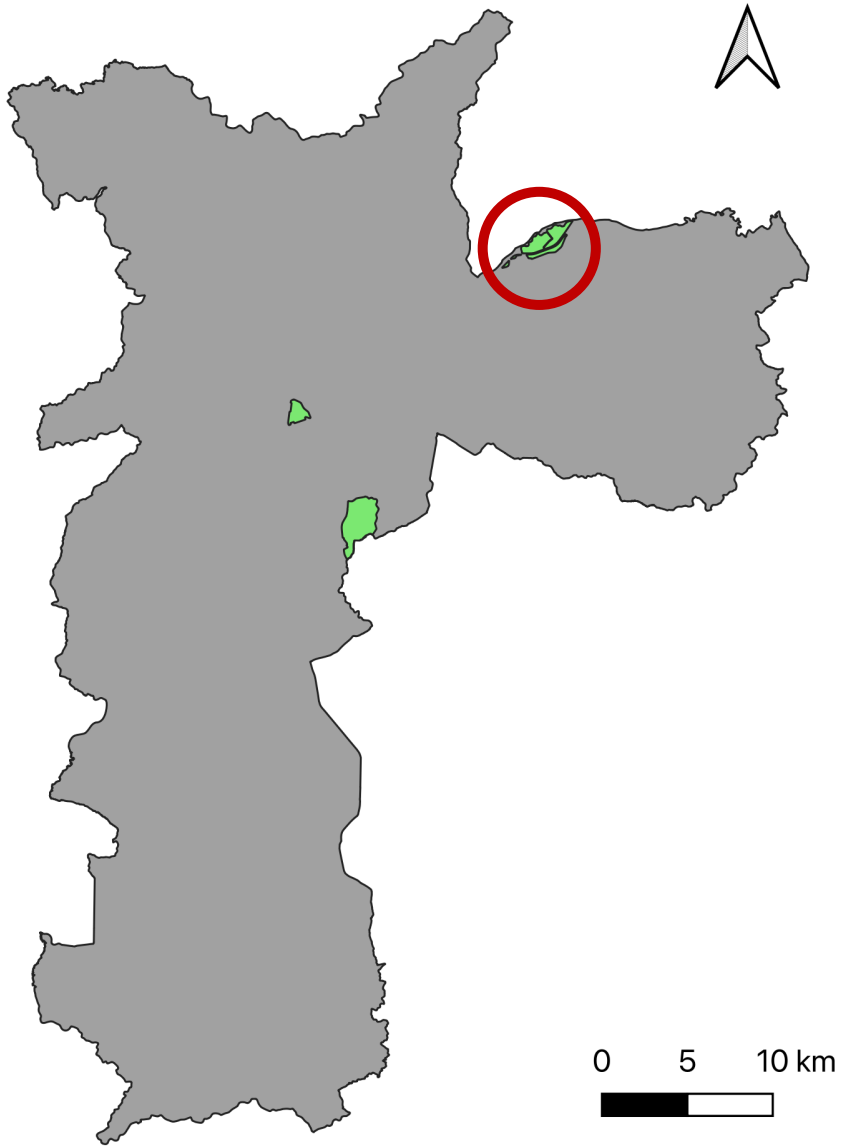
- CO_2
- H_2O
- Energy

Climate station

- Temperature
- Precipitation
- Wind direction and speed
- Air humidity
- Soil humidity
- Soil temperature
- Soil conductivity

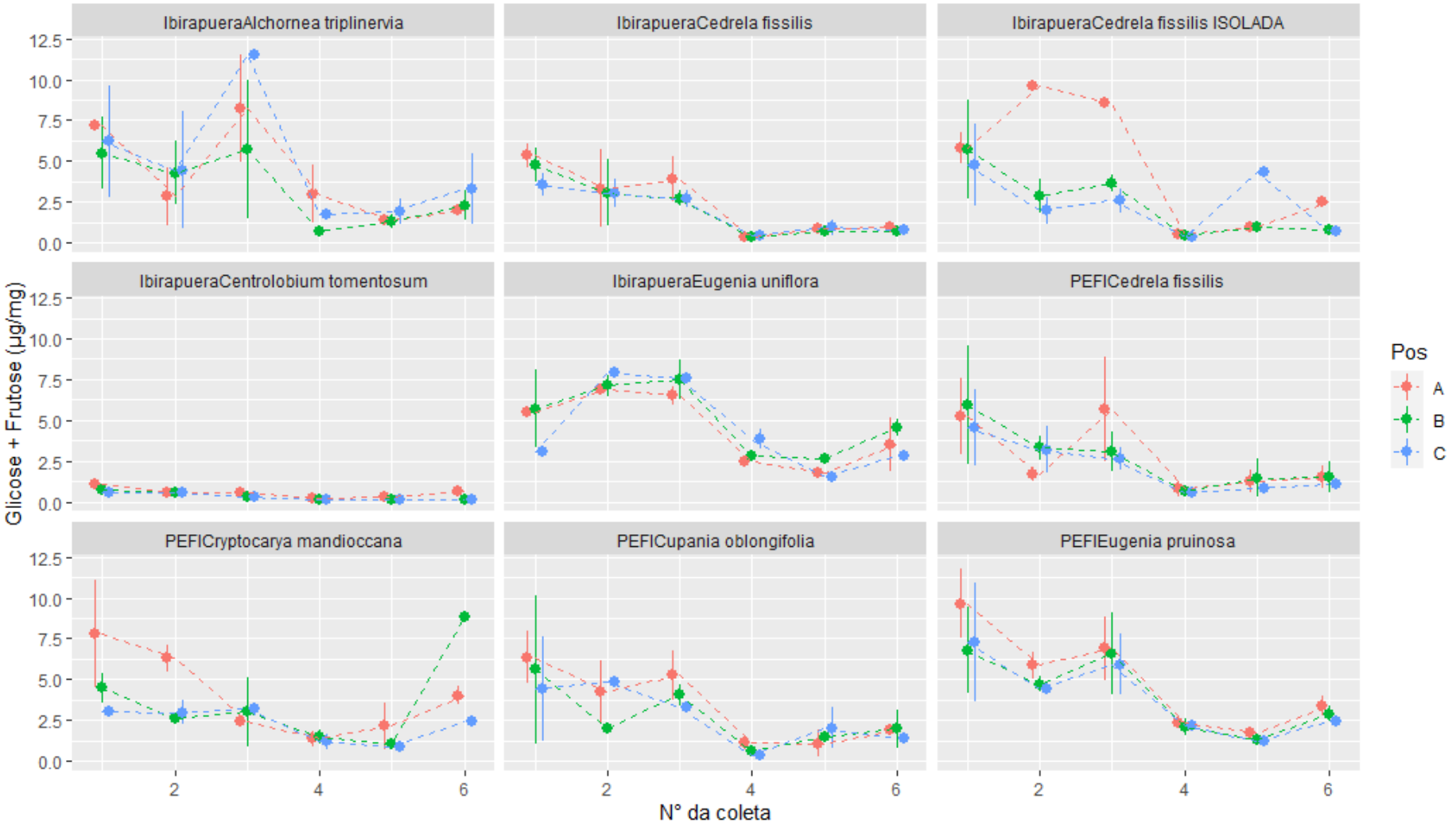
Air-quality station

- $MP_{2.5}$
- NO
- NO_2
- NOx
- CO
- O_3



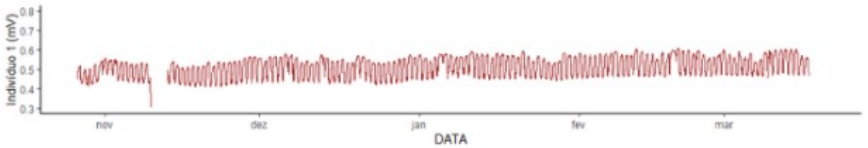
Parque Ecológico Tietê

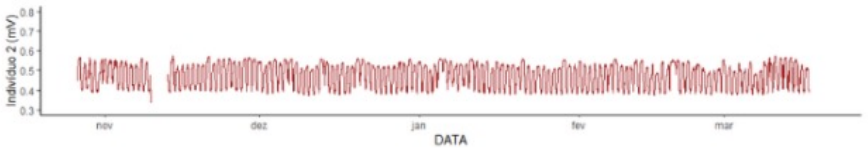
- *Centrolobium tomentosum*
- *Alchornea triplinervia*
- *Eugenia uniflora*
- *Cryptocaria mandioccana*
- *Eugenia pruinosa*
- *Cupania oblongifolia*
- *Cedrela fissilis PEFI*
- *Cedrela fissilis aglomereted*
- *Cedrela fissilis isolated*

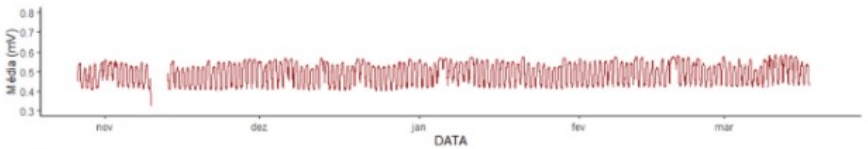

IbirapueraAlchornea triplinervia
IbirapueraCedrela fissilis
IbirapueraCedrela fissilis ISOLADA
IbirapueraCentrolobium tomentosum
IbirapueraEugenia uniflora
PEFICedrela fissilis
PEFICryptocarya mandioccana
PEFICupania oblongifolia
PEFIEugenia pruinosa
Glicose + Frutose (µg/mg)
N° da coleta
Pos
A
B
C

Parque Ibirapuera

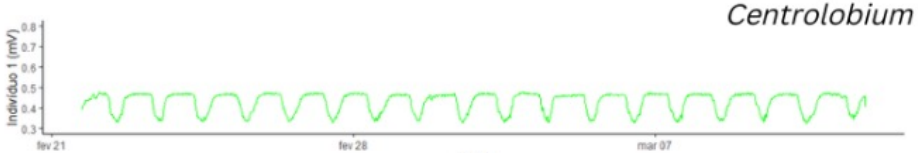
Cedrela fissilis

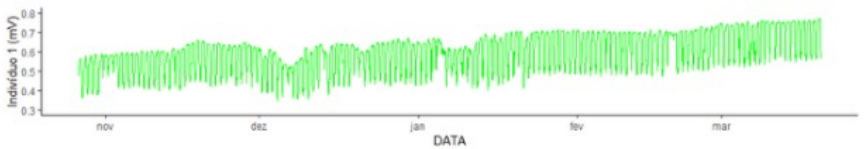


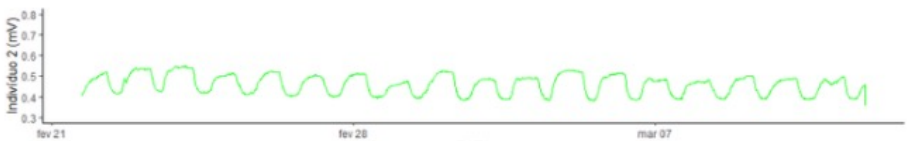


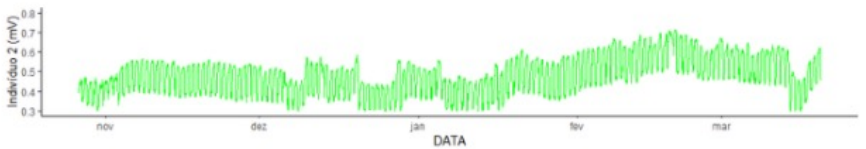


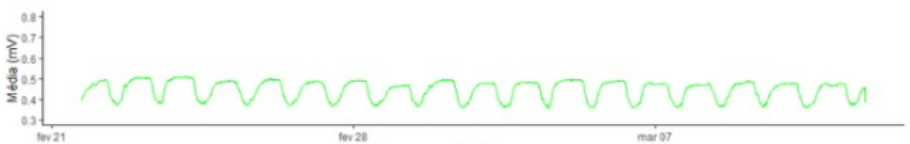
Centrolobium tomentosum

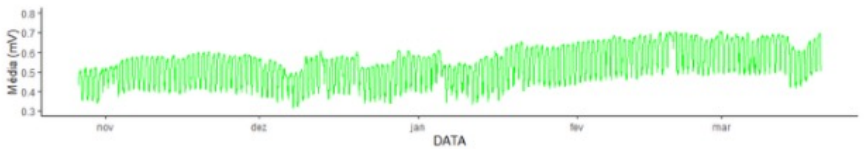


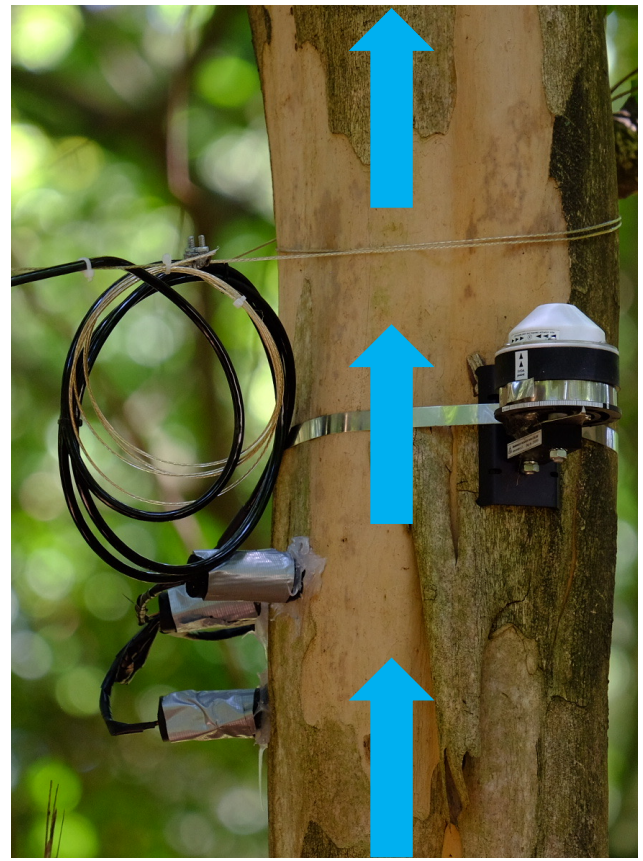








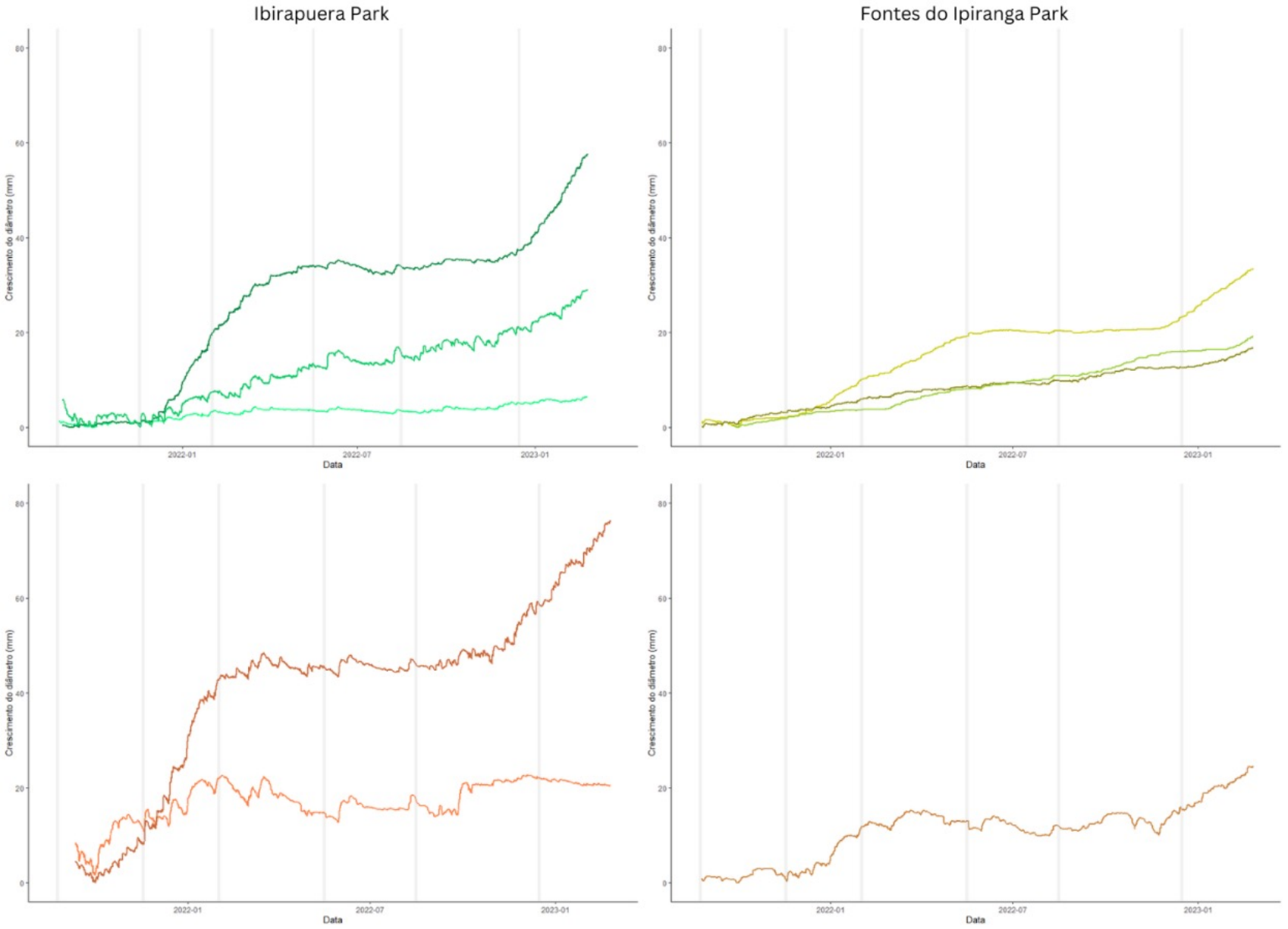




53 variables

Variables	Variable names	Units
u	Velocidade zonal do vento	m s^{-1}
v	Velocidade meridional do vento	m s^{-1}
w	Velocidade vertical do vento	m s^{-1}
T	Temperatura do ar	°C
Fc	Fluxo de CO_2	mmol$m^{-2}s^{-1}$
c	Concentração de CO_2	mgm^{-3}
Fq	Fluxo de vapor d'água	g$m^{-2}s^{-1}$
q	Concentração de H_2O	gm^{-3}
wind_dir	Direção do vento	°
RH	Umidade relativa do ar	%
PA	Pressão atmosférica	kPa
H	Calor sensível	Wm^{-2}
LE	Calor latente	Wm^{-2}
PREC	Precipitação	mm
TKE	Energia cinética turbulenta	m^2s^{-2}
Ri	Radiação solar incidente	Wm^{-2}
Rf	Radiação solar refletida	Wm^{-2}
W	Conteúdo de água do solo	m^3/m^3
Ts	Temperatura do solo	°C
EC	Condutividade elétrica aparente do solo	mS/cm Bulk EC
WD	Densidade aparente	g cm-3
ET	Taxa de evapotranspiração	mm dia $^{-1}$
Sap_flow	Fluxo de seiva	m s^{-1}
v1	Voltagem agulha 1	mV
v2	Voltagem agulha 2	mV
v3	Voltagem agulha 3	mV
CAI	Incremento corrente	mm
GR	Taxa de crescimento	cm/ano
WTD	Taxa de hidratação do tronco	ΔW
Xil	Xilose	mg/g
Gal	Galactose	mg/g
Ara	Arabinose	mg/g
Man	Manose	mg/g
Glu	Glicose	mg/g
Ram	Ramnose	mg/g
Fu	Fucose	mg/g
GluR	Glicose	µg / mg
Fru	Frutose	µg / mg
Sac	Sacarose	µg / mg
Raf	Rafinose	µg / mg
Starch	Amido	µg / mg
M_leaf	Folhas maduras	-
S_leaf	Senescência foliar	-
S_pleaf	Brotamento foliar	-
Fl	Flor	-
Fr	Fruto	-
$\delta^{13}C$	Razão do isótopo de carbono	‰
$\delta^{18}O$	Razão do isótopo de oxigênio	‰
TRW	Largura de anel de crescimento	mm
Length	Comprimento da cronologia	anos
Inter_series_correlation	Correlação entre séries temporais	-
EPS	Sinal expresso da população	-
r-bar	Intercorrelação	-

Updates since the last Co-learning Forum



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- *Eugenia pruinosa*
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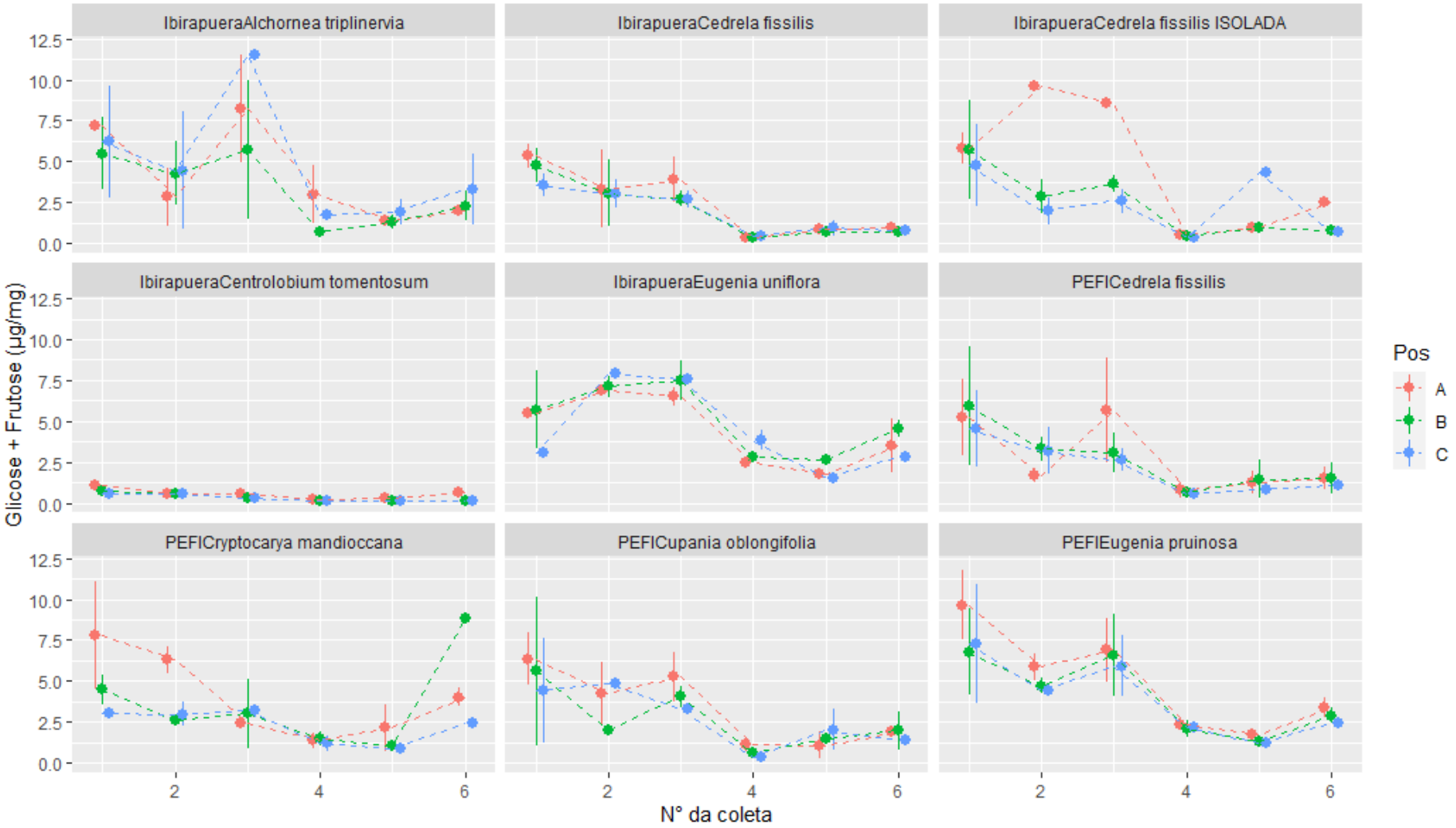
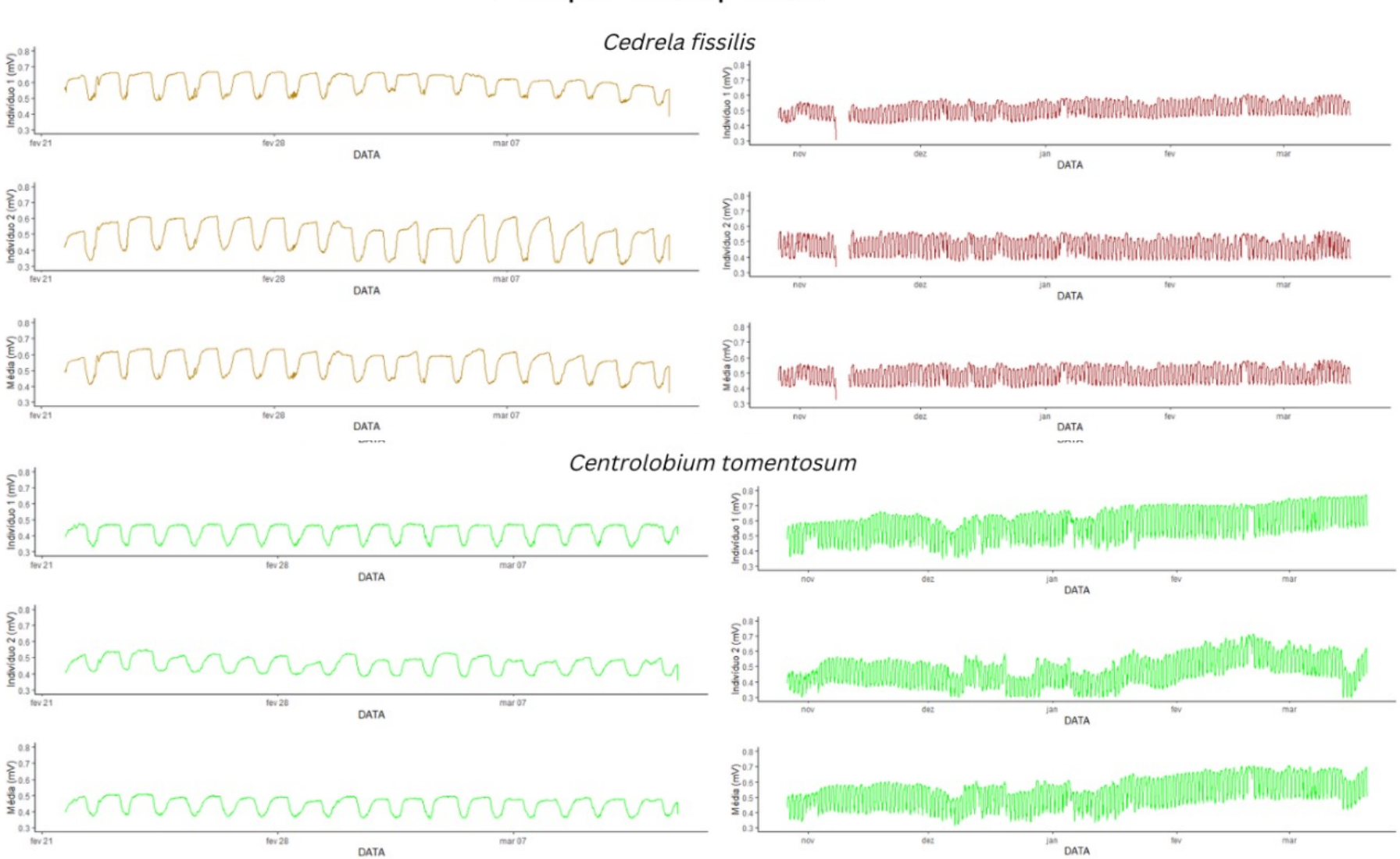
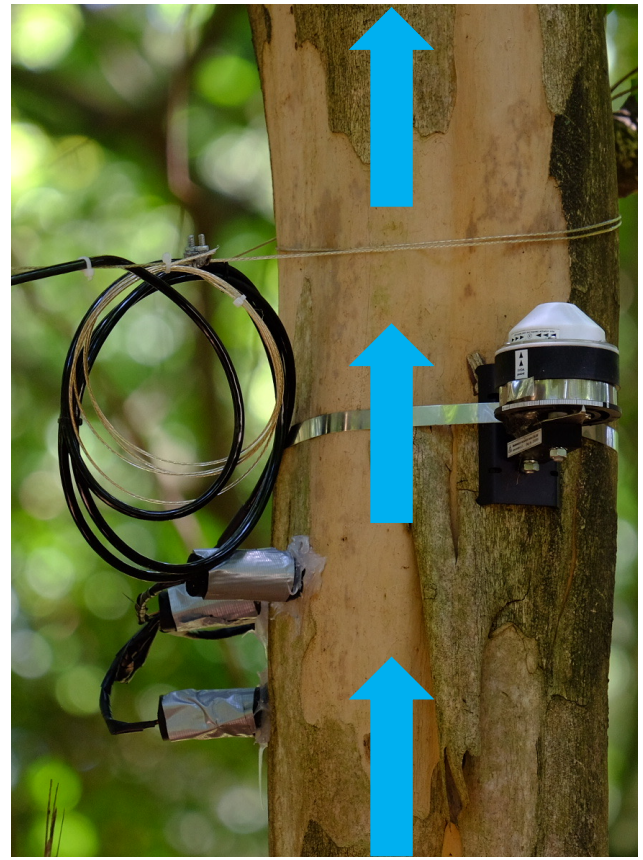


Updates since the last Co-learning Forum

H_2O





Cronograma da disciplina BMA 05 – Soluções baseadas na natureza para as cidades.	
Data	Tema
Seg. 31/05	Introdução da disciplina, apresentação do cronograma, formação dos grupos de trabalho.
Ter. 01/06	Plano Municipal de Arborização Urbana – Representante da SVMA – PMSP.
Quar. 02/06	Problemas ambientais urbanos. Oficina: discussão de problemas ambientais na cidade de São Paulo.
Qui. 03/06	Mudanças climáticas e cidades. Oficina: identificação de vulnerabilidades ao clima na cidade de São Paulo.
Sex. 04/06	Escrita científica.
Seg.07/06	Florestas urbanas e serviços ecossistêmicos. Oficina: caracterização das florestas urbanas na cidade de São Paulo.
Ter.08/06	Florestas urbanas e serviços ecossistêmicos. Oficina: caracterização das florestas urbanas na cidade de São Paulo.
Qua. 09/06	Morfologia e fisiologia de plantas urbanas. Como o ambiente urbano influencia a performance das plantas.
Qui. 10/06	Desserviços das florestas urbanas. Oficina: caracterização dos desserviços em SP.
Sex. 11/06	Paisagismo sustentável – Representante do setor privado.
Seg. 14/06	Infraestrutura verde, drenagem sustentável. – Paulo Pellegrino.
Ter. 15/06	Criação de parques urbanos em SP – Representante da SVMA – PMSP.
Qua. 16/06	Apresentação Plataforma Mariposa e Caderno de Bacias – Adriana Sandre.
Qui. 17/06	Biomonitoramento de poluição do ar.
Sex. 18/06	Apresentação final dos trabalhos.