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PS 2.4 The Present 1 – Changing Benefits

Using the vitality class approach for the study of the status and condition of street trees in tropical cities. The case of Guayaquil, Ecuador

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JARDÍN BOTÁNICO DE GUAYAQUIL

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Condition and status of the dominant tree species
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Background

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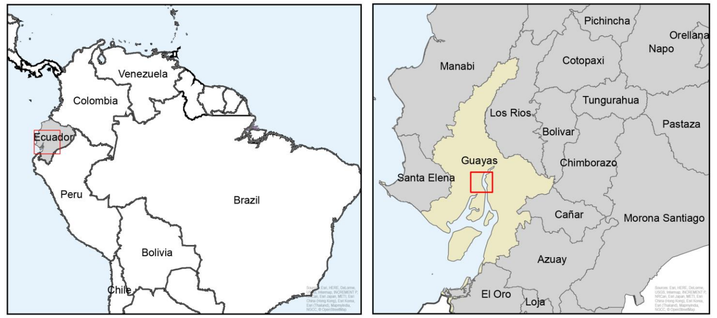
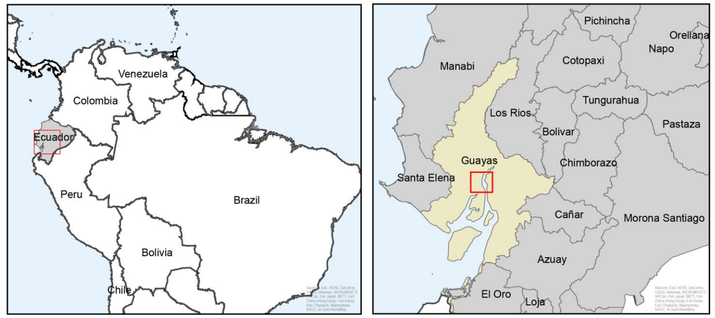
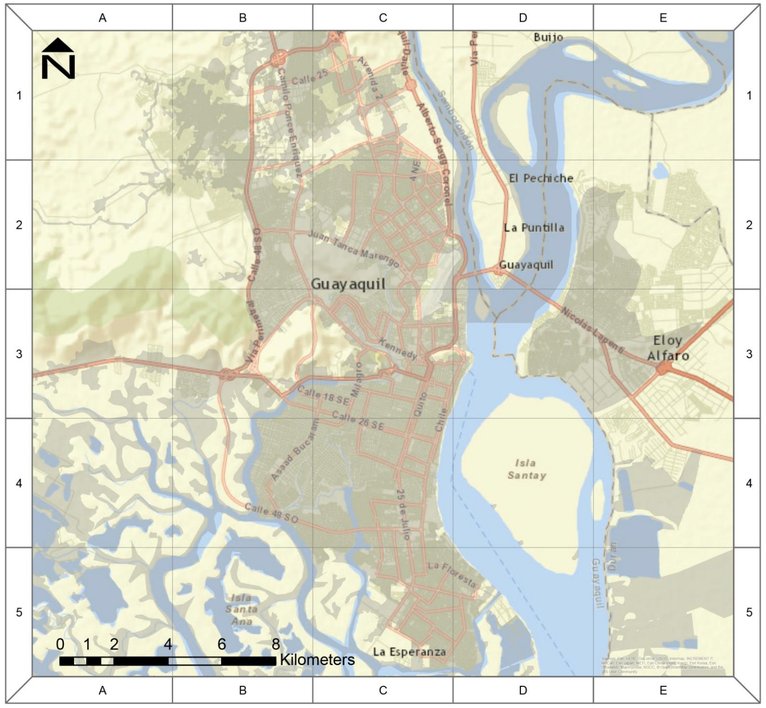


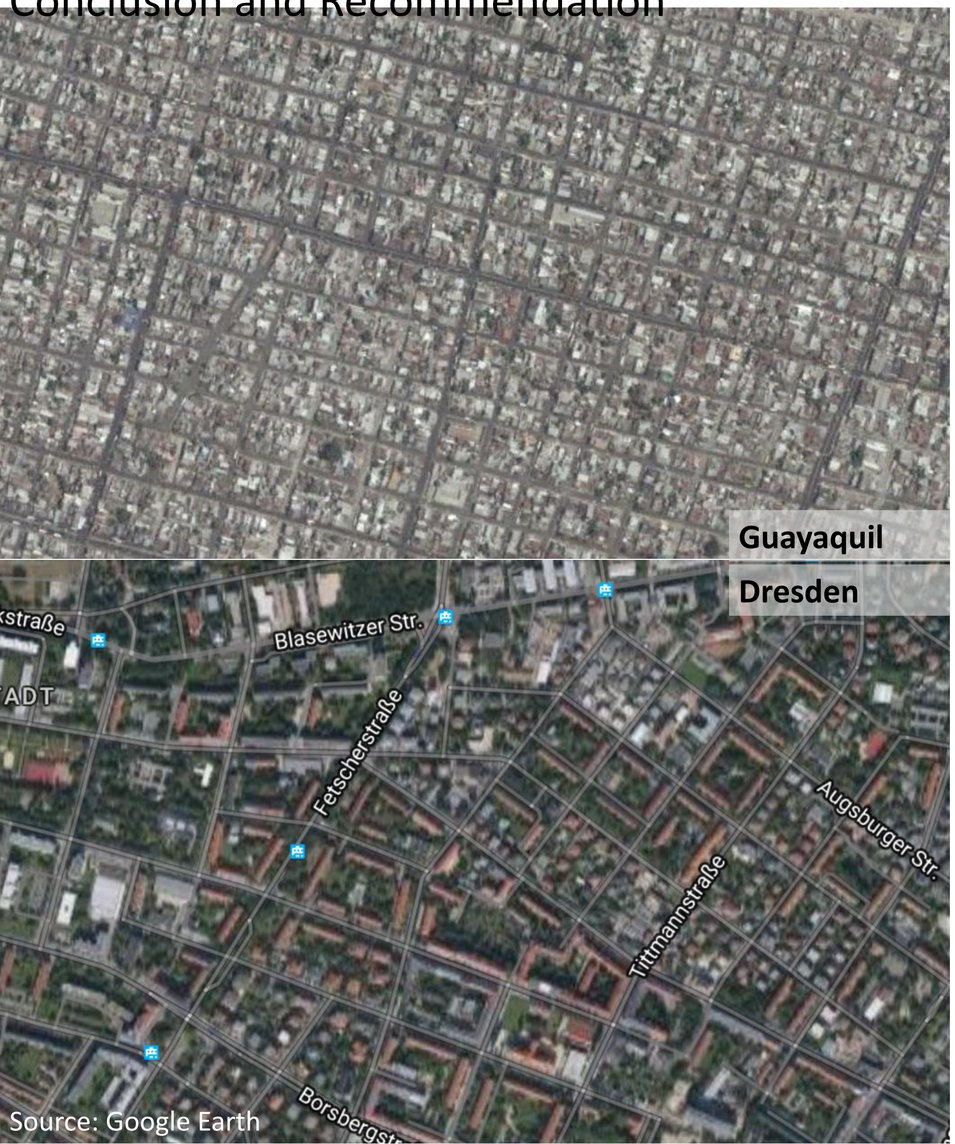
Background





- ✓**344 km2**.
- ✓**2’350,915** inhabitants
- ✓Tropical savanna climate.
- ✓Two climatic periods:
  The rainy and warm season from January to April (**1001.9 mm** of rain).
  The dry and cold season from May to December.
- ✓Two biomes: dry forest and mangrove forest.

Problem statement



- Comfort index between High precaution (33°C to 41°C) to a range of Danger (> 41°C), (INAMHI, 2015)

- 6.20 m^2/inhab of green areas. The World Health Organization suggests that every city should have a minimum of 9 m^2/ inhab. (World Health Organization, 2010)

- No database of the urban trees thus challenging to determine.

Problem statement

Human pressure, through many ways, has an effect on the vitality of trees:
high sealed surfaced for planted trees, inadequate growing space, unsuitable tree species, damage to trees, lack of management among others.

Source: Researcher

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Data collection

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Chair of Forest Botany

TU Dresden.

Tree register: data file *light* – module 'Urban Tree Management'

Name of evaluator: …… Date:……..……

City:…… Street / Place:……

Tree species:…… ☐ native ☐ endangered species

DBH (diameter):……,…m Height:……m Age:……ys.

☐ Tree with high ecological value

☐ Tree with high aesthetic value

Surroundings

Distance (m) to street…….. path…….. building……. lake/river…...

others (name)……

Crown

Vitality class 0 ☐ 0.5 ☐ 1 ☐ 1.5 ☐ 2 ☐ 2.5 ☐ 3 ☐ 3.5 ☐ 4 ☐

Crown transparency (%) ☐ 0-10 ☐ 15-25 ☐ 30-60 ☐ >60

☐ Dead leaders ☐ Dead branches inner/lower crown, number:…….

Damage/decay/injury (name)……..

VTA symptoms (name)……..……

VTA symptoms (name)……..

Regeneration potential ☐ not visible ☐ moderate ☐ high

Reiterations ☐ not visible ☐ few (<10) ☐ many (>10)

Trunk

☐ without damage / injury

Damage on ☐ 10% ☐ 15-25% ☐ >25% of trunk length

☐ Ribs ☐ Knods ☐ Decay

☐ Cracks ☐ Fungi ☐ Water shoots

☐ V-fork ☐ U-fork ☐ Climbers

☐ Intact wall < 20% ☐ Stripes on ribs ☐

Roots

☐ Sealing ☐ Compression ☐ Obstruction by……..

☐ Damage (name)…….. ☐ Root suckers (many)

☐ Unilateral development assumed ☐ Covered root collar

Conclusions

☐ Tree vigorous and without problems ☐ Tree with moderate problems

☐ Tree with major problems ☐ Need for immediate action

Measures

☐ Tree has to be preserved ☐ Tree has to be cut

☐ Tree maintenance necessary ☐ Pruning necessary

☐ Detailed investigation necessary ☐ Root protection necessary

☐ Further measures:……

……..

……..

Photographs

Tree inventory / registration

Intensity and extent of the tree register is dependant on money and staff of the municipality

Identification of trees by

- map / GPS
- button / badge
- chip / transponder

One data sheet per tree, data file on paper or by digital recording

Aim: collecting information on every tree

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Source: Researcher

Vegetation resource to assess: street trees.

Ubiquity across the urban landscape

“Spillover effect” of benefits

Data collection

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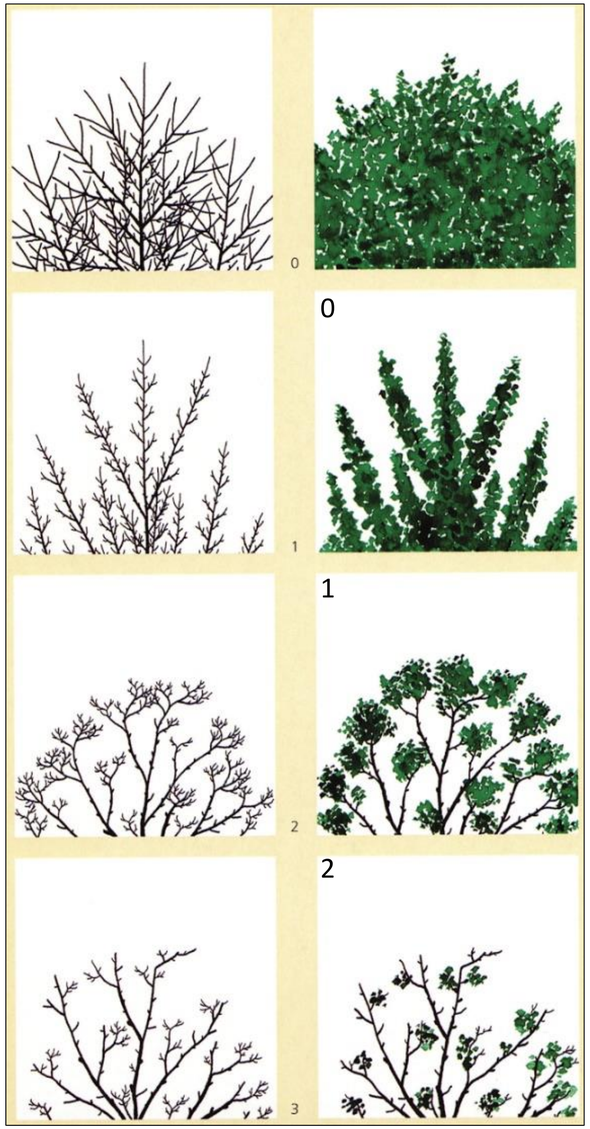

Source: Roloff, 2016.

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Study area

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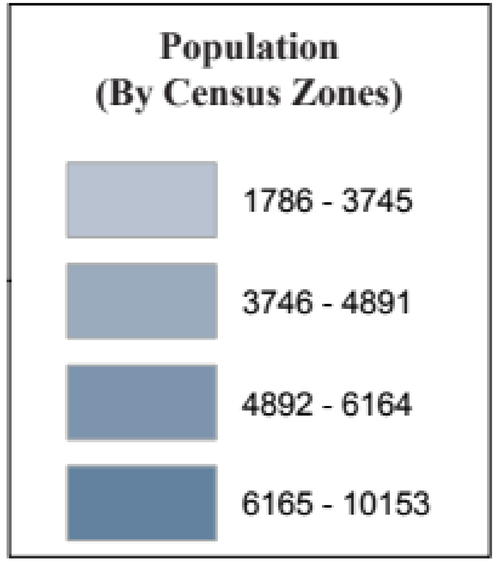

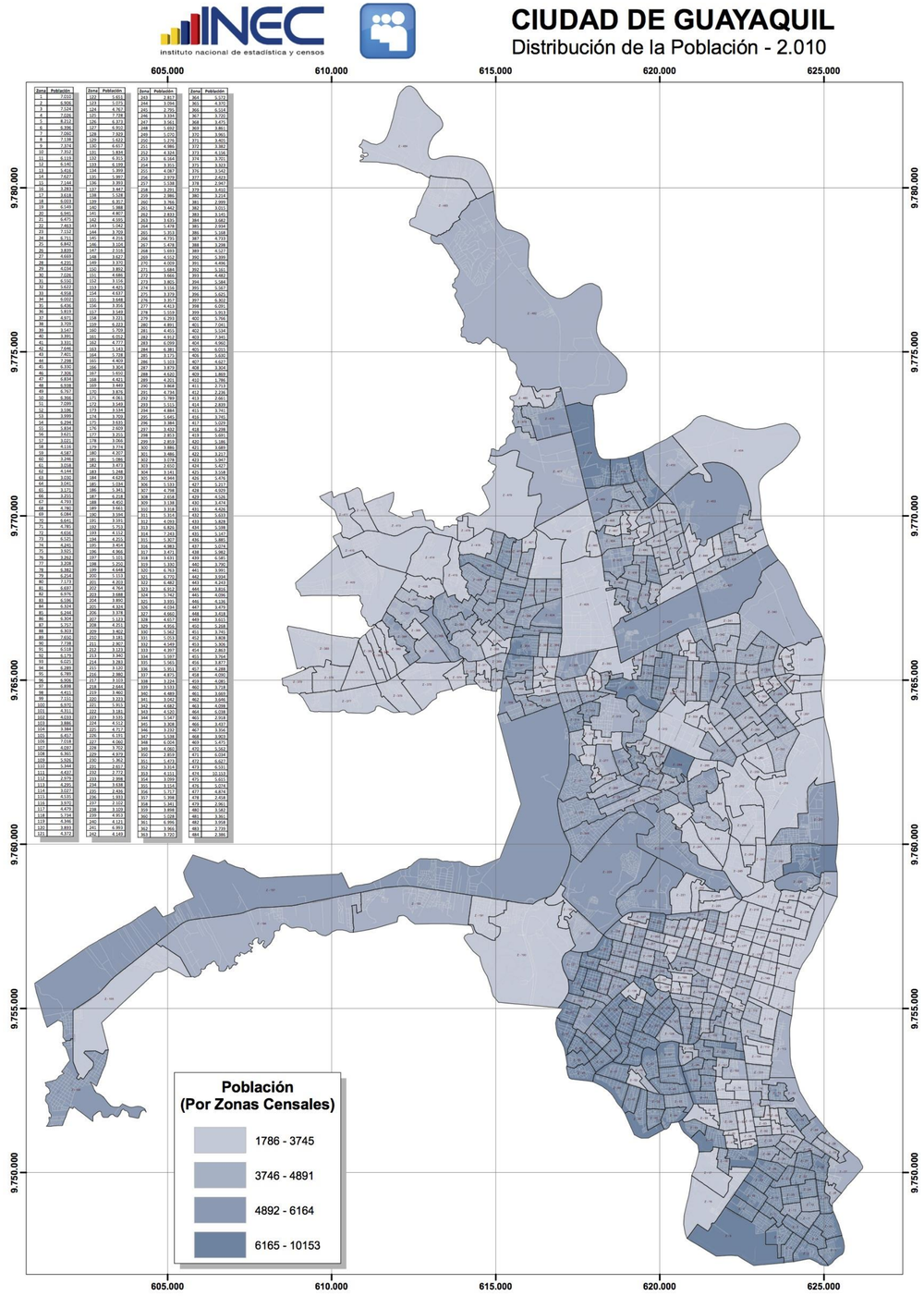

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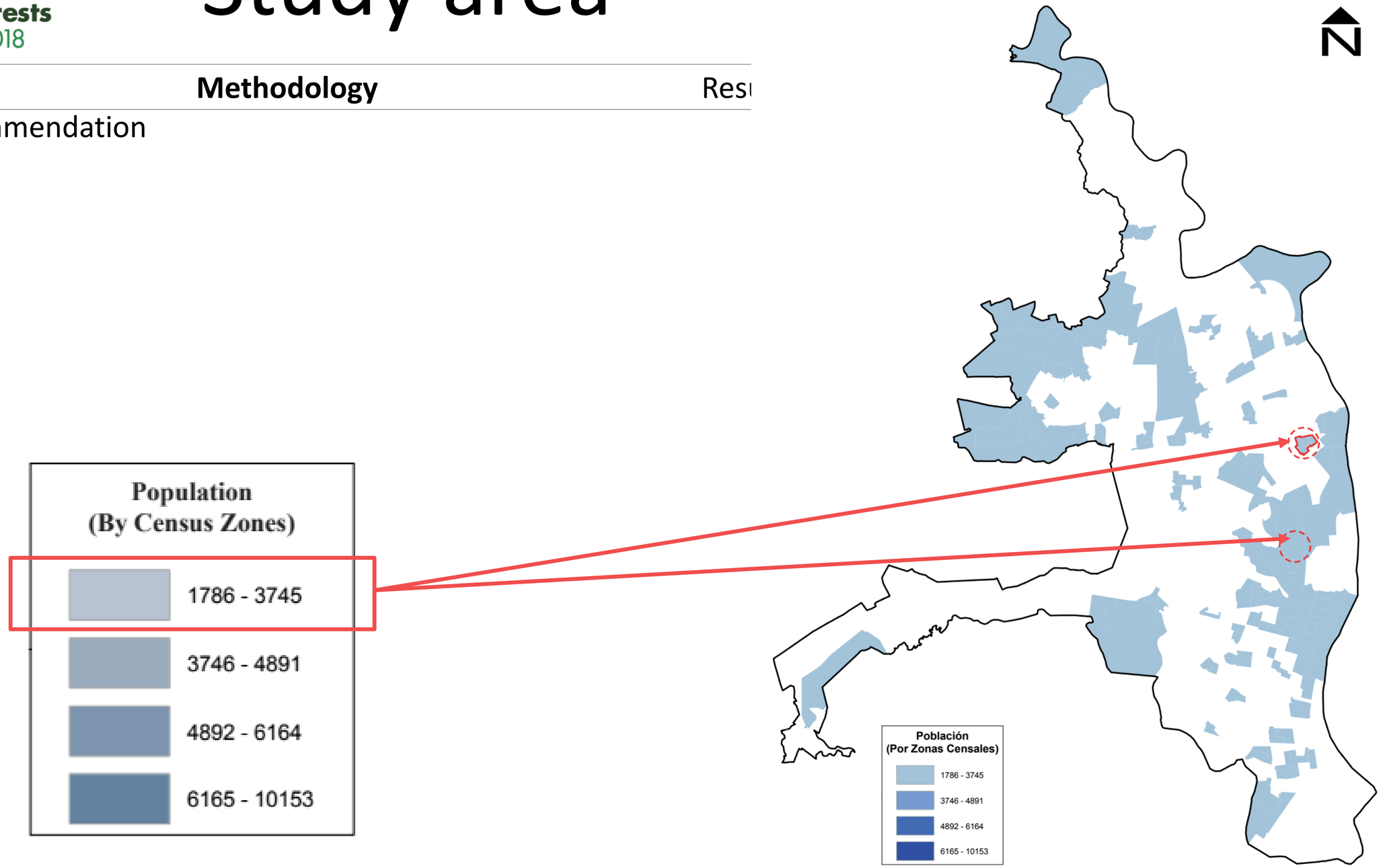
Study area



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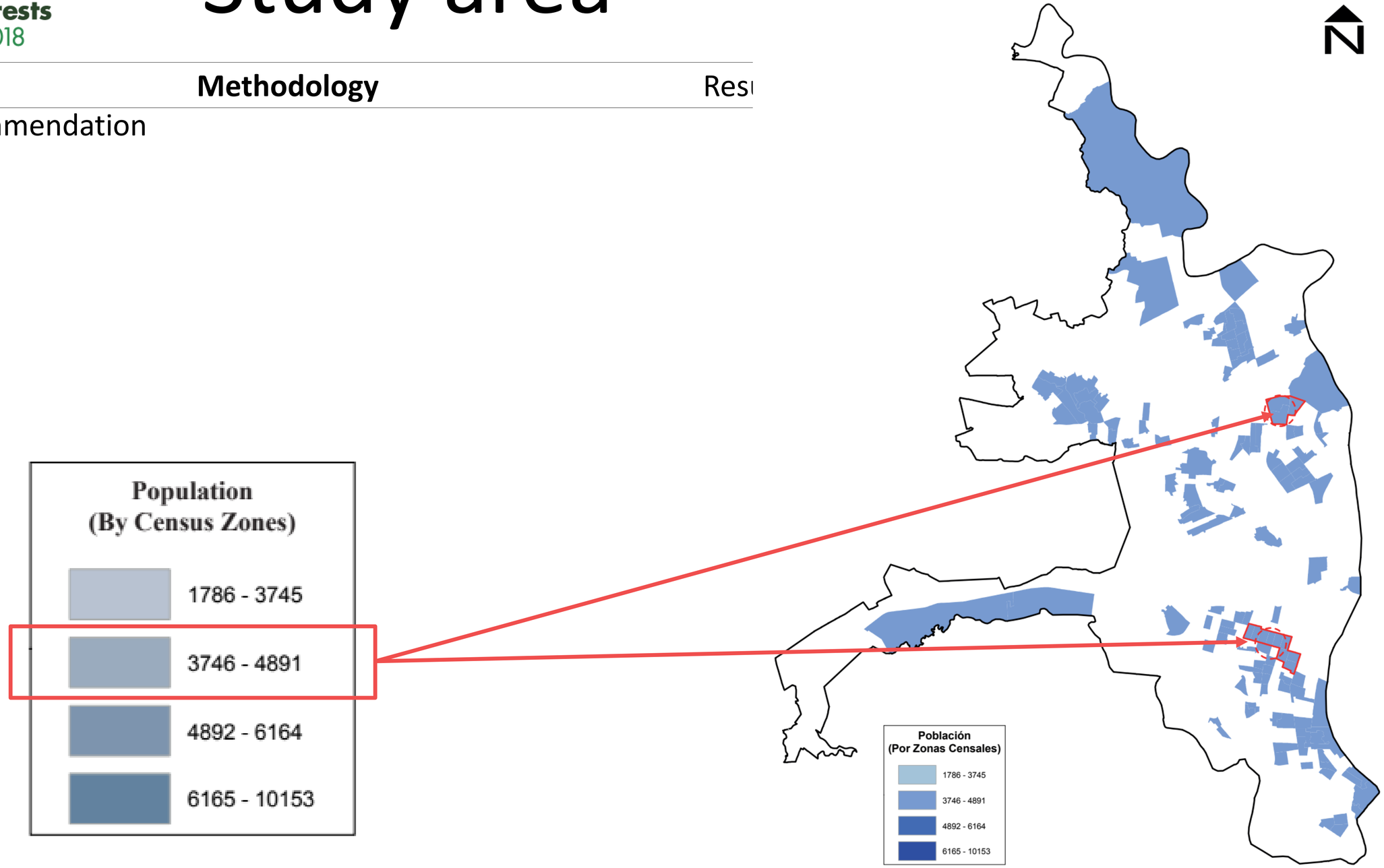

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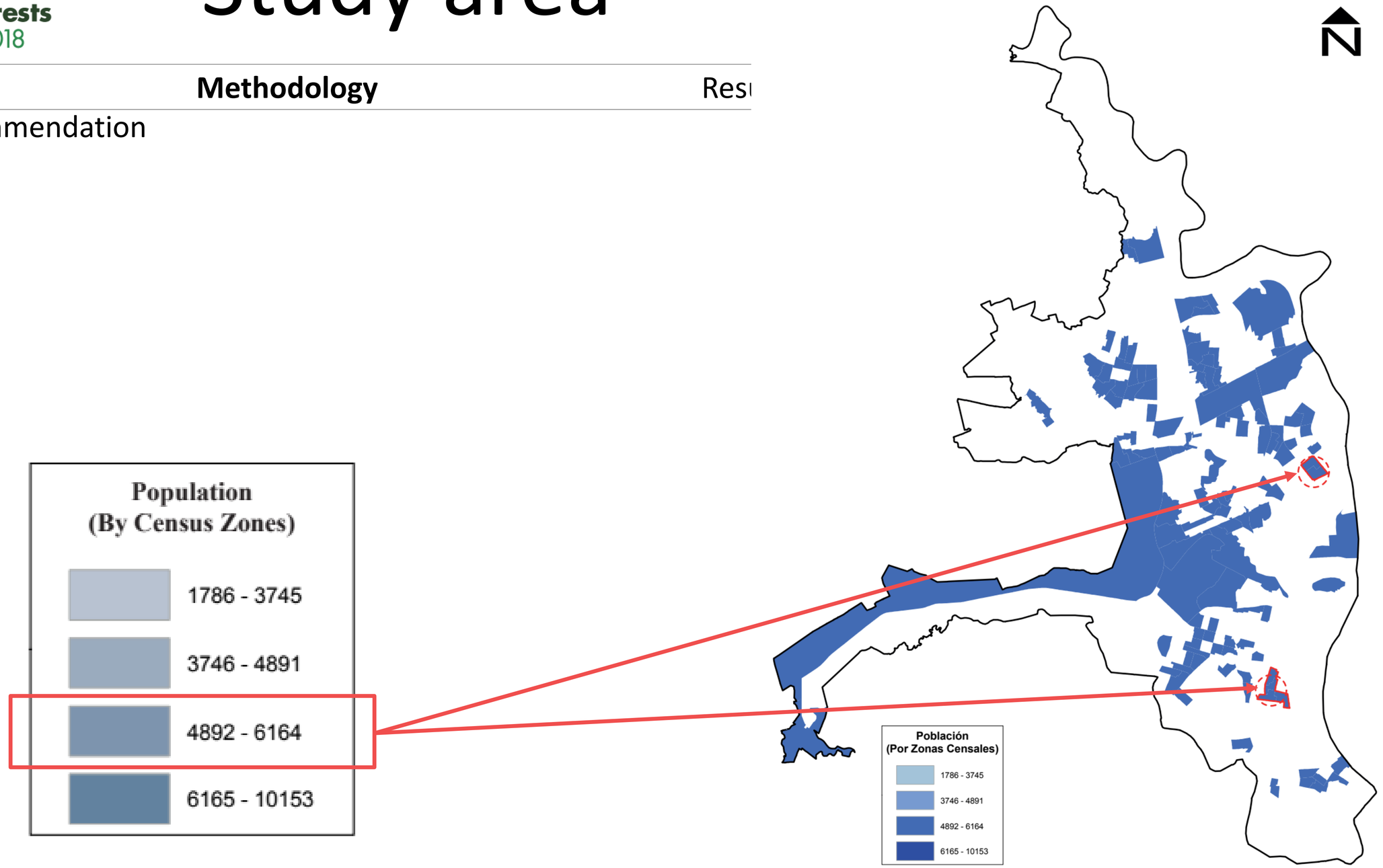

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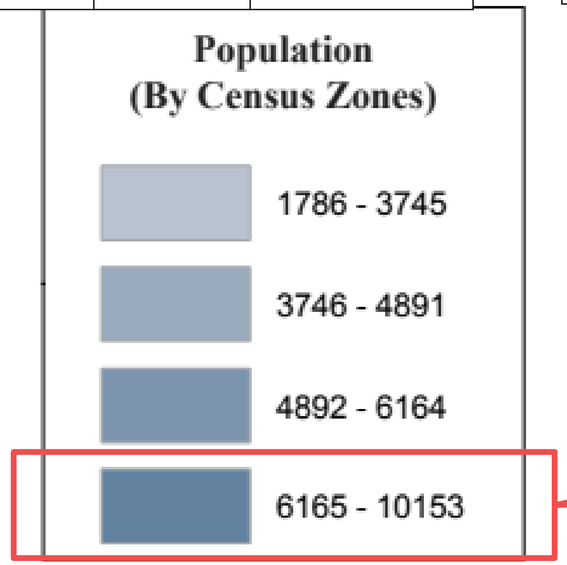
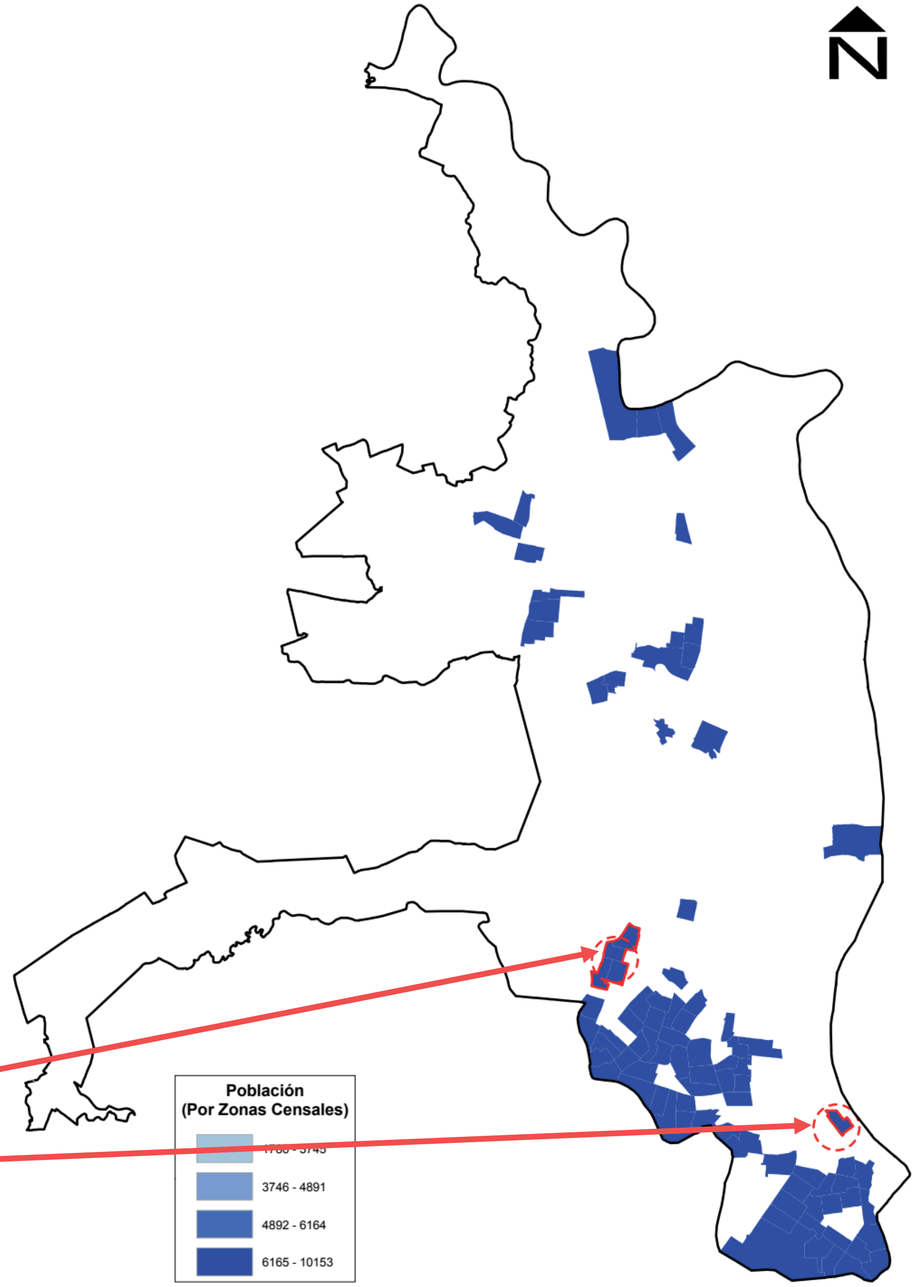
Study area

Census Groups	Population (inhab)	Area (ha)	Density (inhab/ha)
Group 1	6505	314.159	21
Group 1	12355	45.971	269
Group 2	13691	133.671	102
Group 2	36926	174.298	212
Group 3	11304	58.445	193
Group 3	22046	87.736	251
Group 4	25389	116.096	219
Group 4	6641	25.393	262

Density (inhab/ha)	Study site
21	1
102	2
193	3
212	4
219	5
251	6
262	7
269	8





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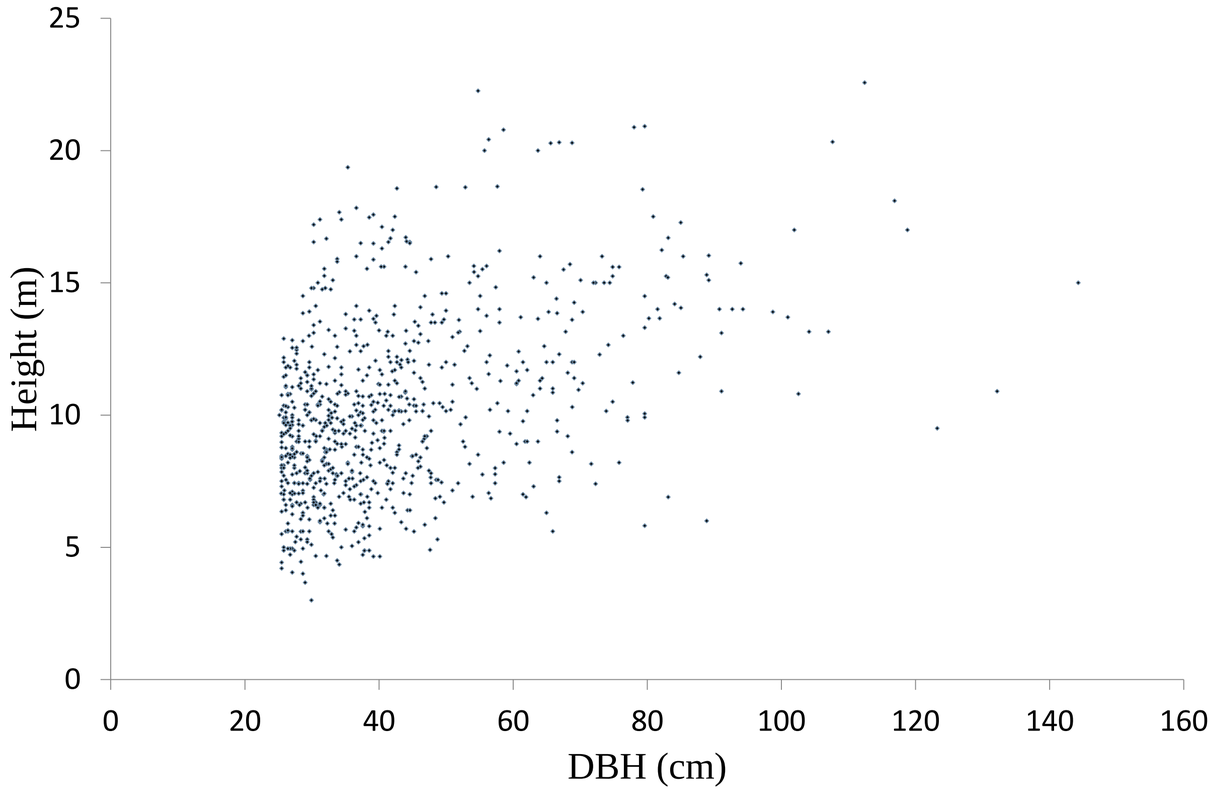
Current status of trees



A total of 844 street trees were found among the eight study sites (955.77 ha).
Concentration of tree population between DBH of 25 cm to 55 cm and Height of 5 m to 13 m.

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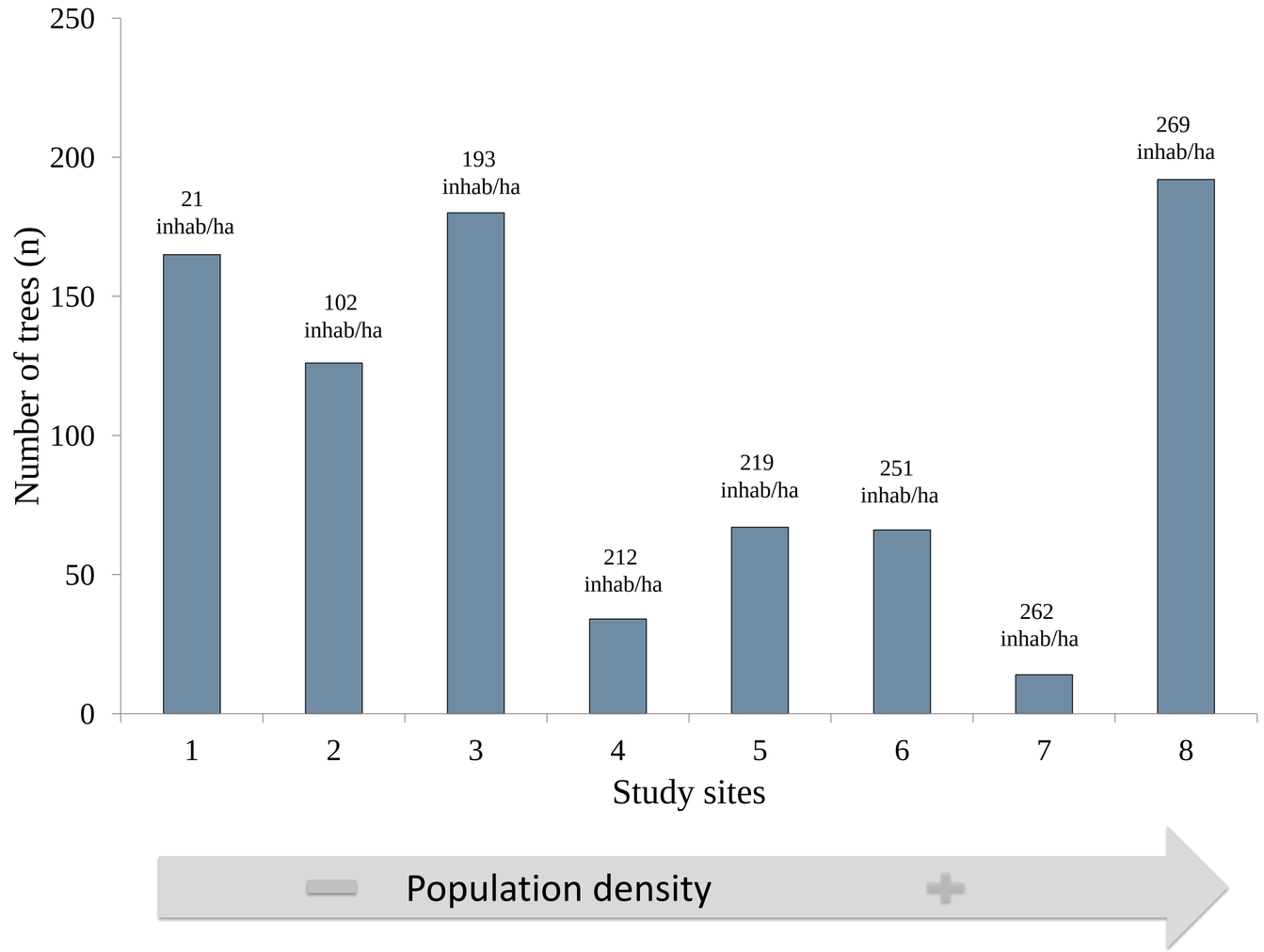
Current status of trees



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Composition

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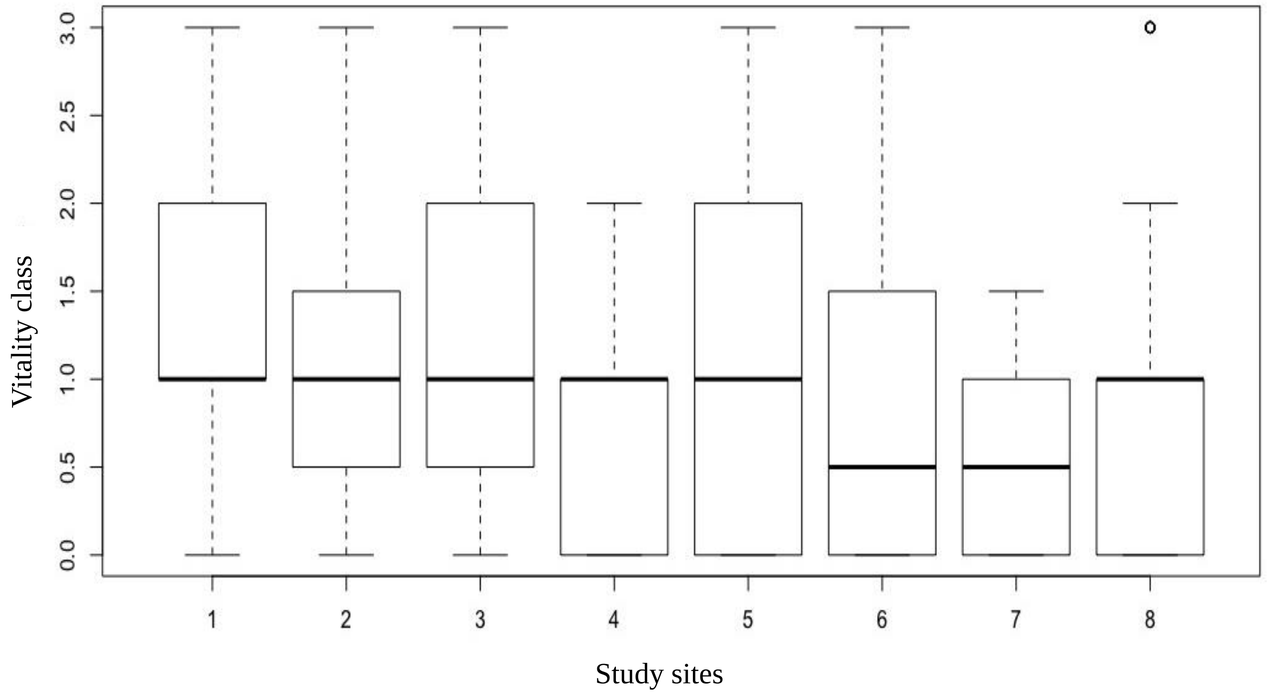
Botanical name	N	Family	Origin
Annona muricata	1	Annonaceae	Introduced
Artocarpus altilis	1	Moraceae	Introduced
Bauhinia purpurea	1	Fabaceae	Introduced
Cassia fistula	1	Fabaceae	Introduced
Cedrela odorata	1	Meliaceae	Native
Erythrina indica	1	Fabaceae	Introduced
Ficus elastica	1	Moraceae	Introduced
Ficus sp.	1	Moraceae	Introduced
Kigelia africana	1	Bignoniaceae	Introduced
Melia azedarach	1	Meliaceae	Introduced
Persea americana	1	Lauraceae	Native
Trema micrantha	1	Cannabaceae	Native
Spathodea campanulata	1	Bignoniaceae	Introduced
Albizia guachapele	2	Fabaceae	Native
Carica papaya	2	Caricaceae	Native
Psidium guajava	2	Myrtaceae	Native
Spondias purpurea	2	Anacardiaceae	Introduced
Tamarindus indica	2	Fabaceae	Introduced
Inga spectabilis	3	Fabaceae	Native
Inga edulis	4	Fabaceae	Native
Prosopis juliflora	5	Fabaceae	Native
Vitex gigantea	5	Lamiaceae	Native
Ceiba trichistandra	6	Malvaceae	Native
Swietenia mahagoni	7	Meliaceae	Introduced
Eucalyptus globulus	16	Myrtaceae	Introduced
Jacaranda mimosifolia	23	Bignoniaceae	Native
Terminalia catappa	27	Combretaceae	Introduced
Azadirachta indica	43	Meliaceae	Introduced
Delonix regia	58	Fabaceae	Introduced
Ficus benjamina	93	Moraceae	Introduced
Cassia siamea	158	Fabaceae	Introduced
Samanea saman	159	Fabaceae	Native
Mangifera indica	214	Anacardiaceae	Introduced
Total	**844**		

- 33 species
- 13 families
- 64% (20 species) are introduced
- 36% (13 species) are native
- 5 frequent species > 50 individuals
- Rule of 10-20-30:
- The tree species that surpass the 10% are:
  - Ficus benjamina with 11%
  - Cassia siamea with 19%
  - Samanea saman with 19%
  - Mangifera indica with 25%.
- There are 29 genera recorded with less than 20% of representation.
- The family Fabaceae exceeds the rule with 33%.

Condition: vitality class



Population density

Kruskal-Wallis test:
chi-squared = 31, df = 7, and a p-value = 6.216e-05.

Condition and status of the dominant tree species

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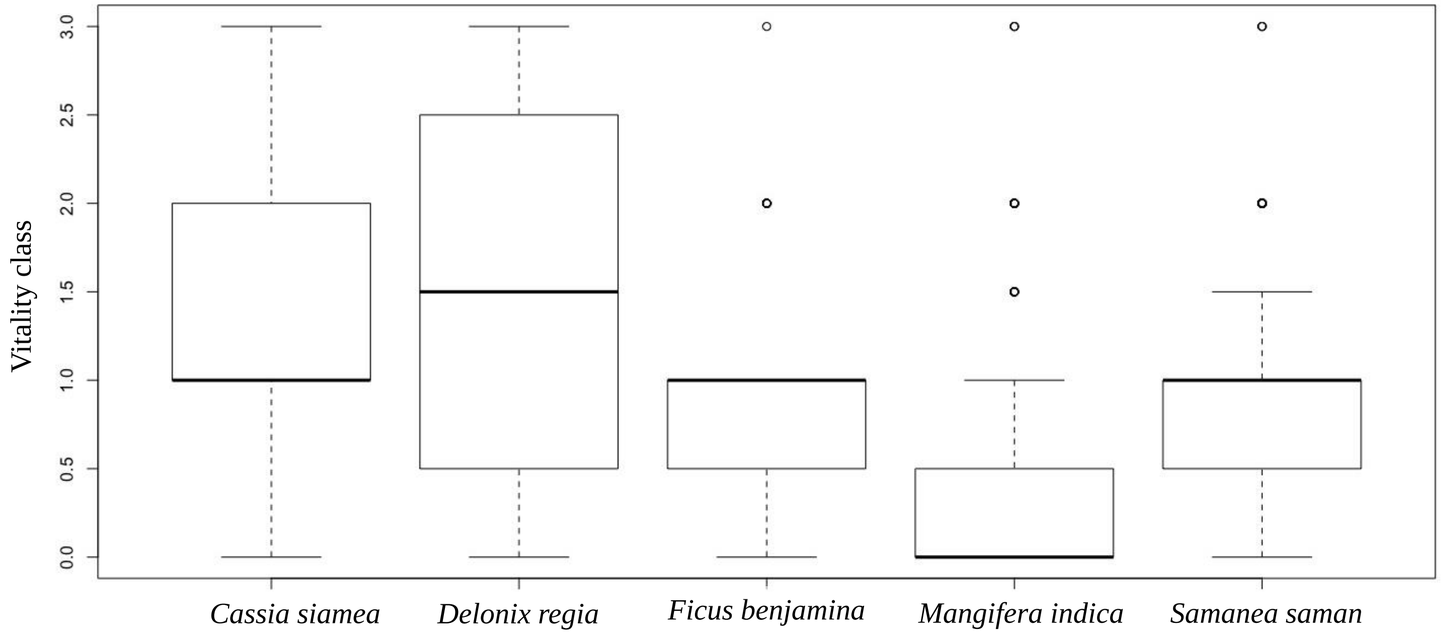

p= <0.001

Tree Species	*N*	*Median*	*Mean*	*Std. Deviation*	*Minimun*	*Maximum*	*Std. Error of Mean*
Cassia siamea	158	1	1.541	0.7443	0.0	3.0	0.0592
Delonix regia	65	1.5	1.454	1.1171	0.0	3.0	0.1386
Ficus benjamina	93	1	0.882	0.6229	0.0	3.0	0.0646
Mangifera indica	214	0	0.383	0.6357	0.0	3.0	0.0435
Samanea saman	159	1	0.899	0.7155	0.0	3.0	0.0567
Total	689		0.936	0.8616	0.0	3.0	0.0328

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Cassia siamea: Vitality class 1

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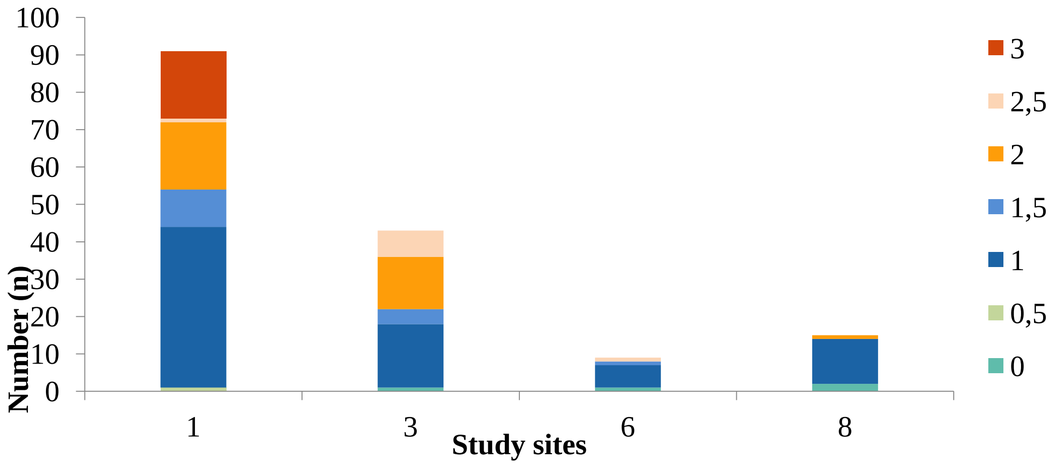

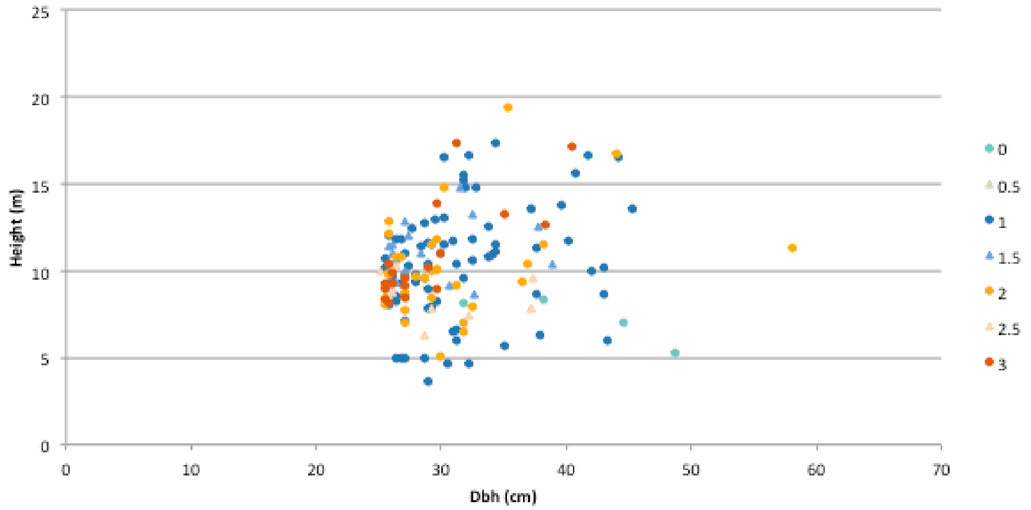

Source: Researcher

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Delonix regia: Vitality class 1.5

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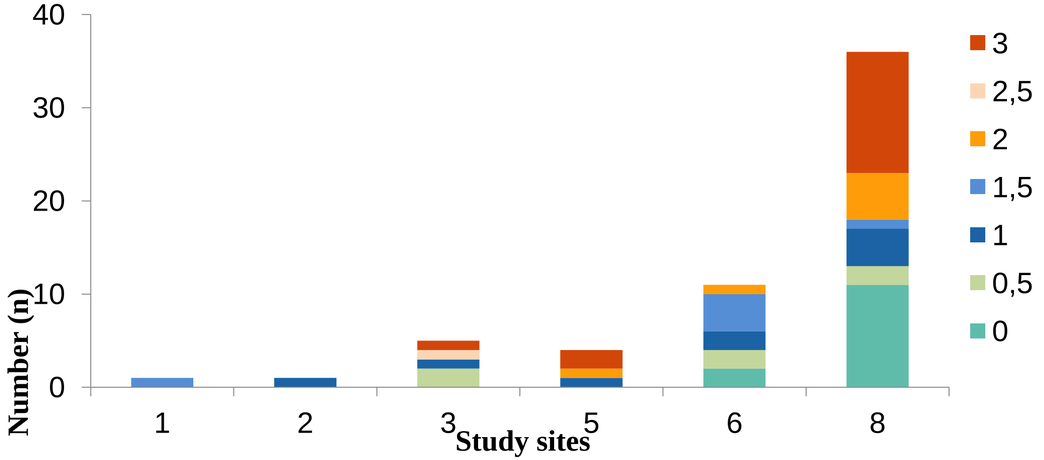

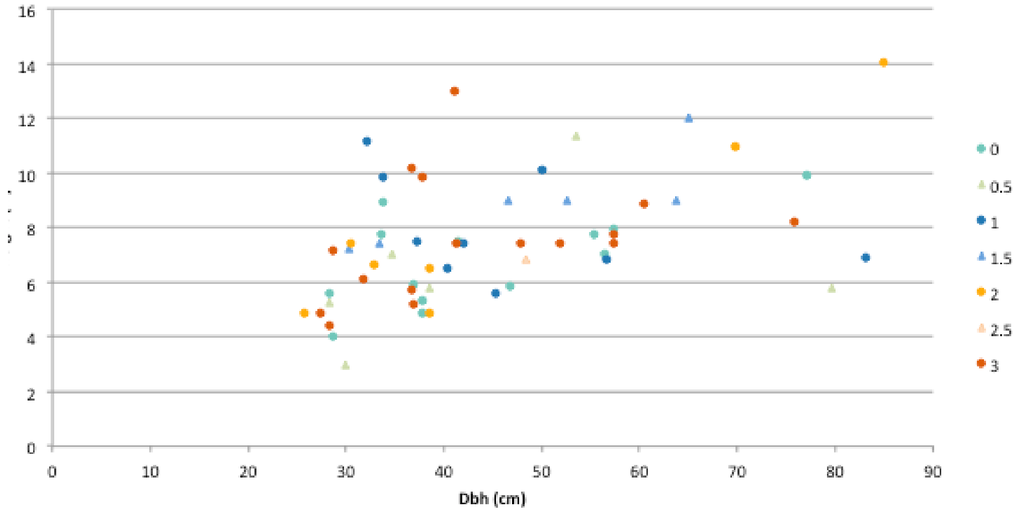

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Ficus benjamina: Vitality class 1

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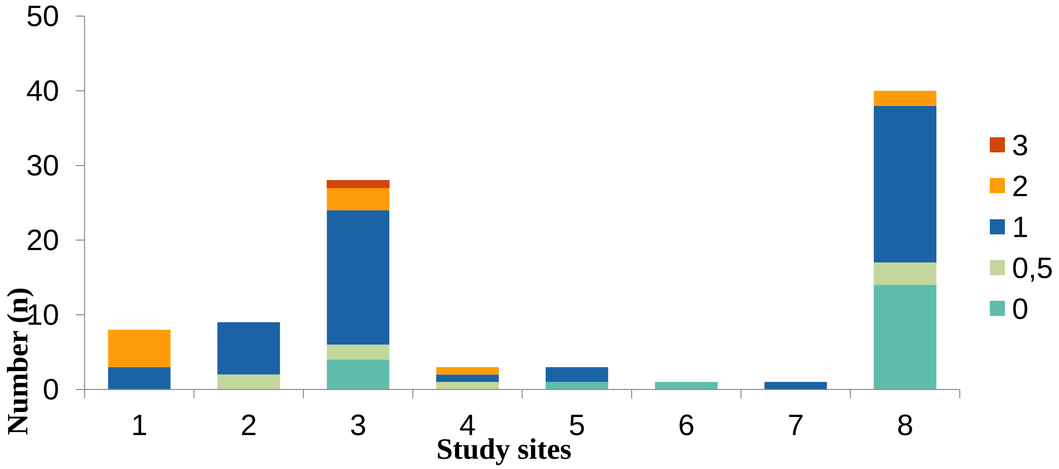

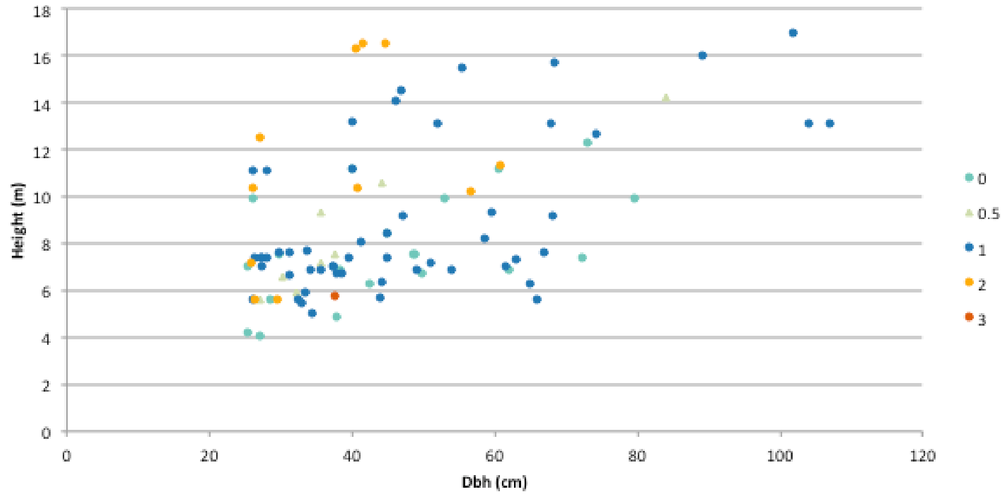

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Mangifera indica: Vitality class 0

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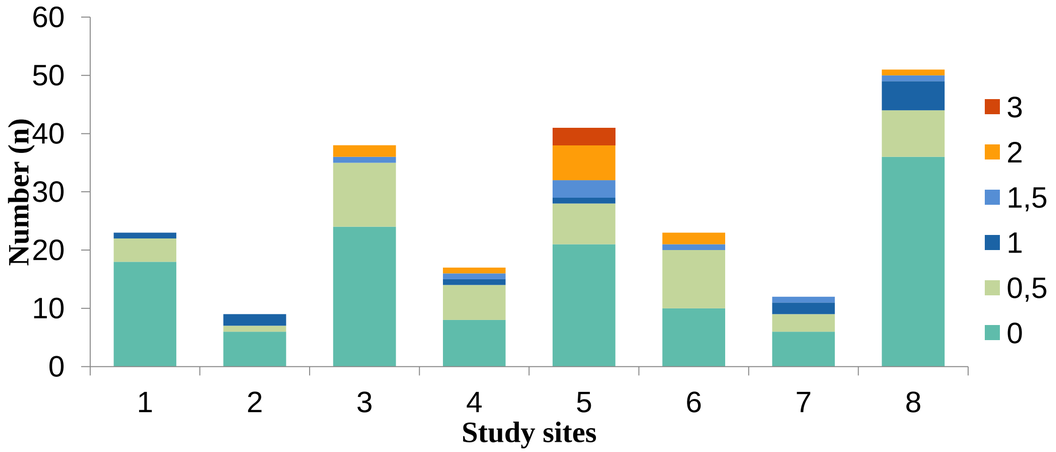

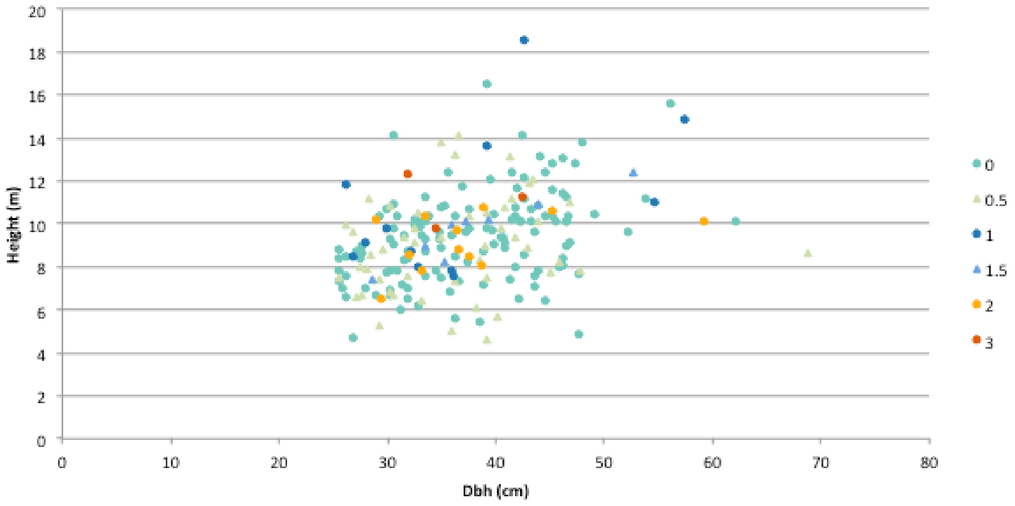

Source: Researcher

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Samanea saman: Vitality class 1

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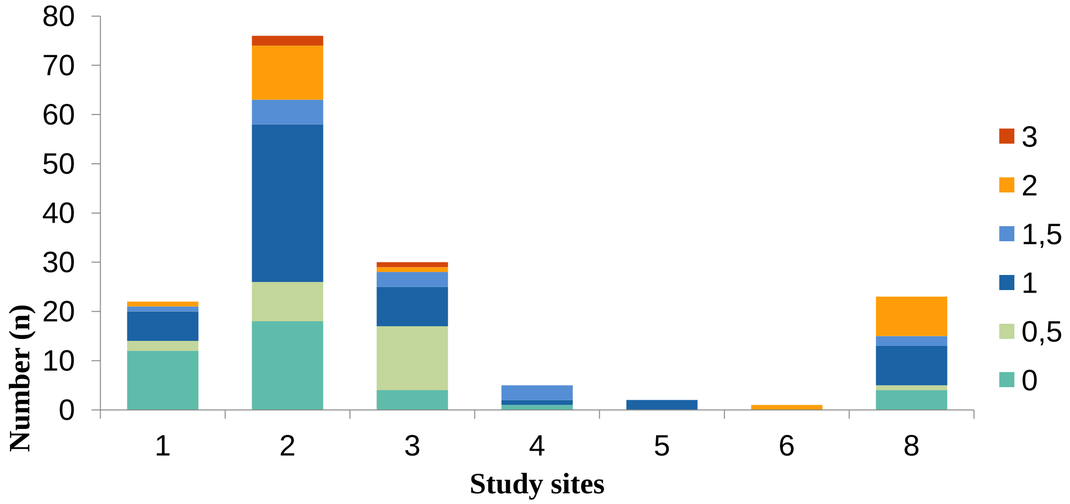

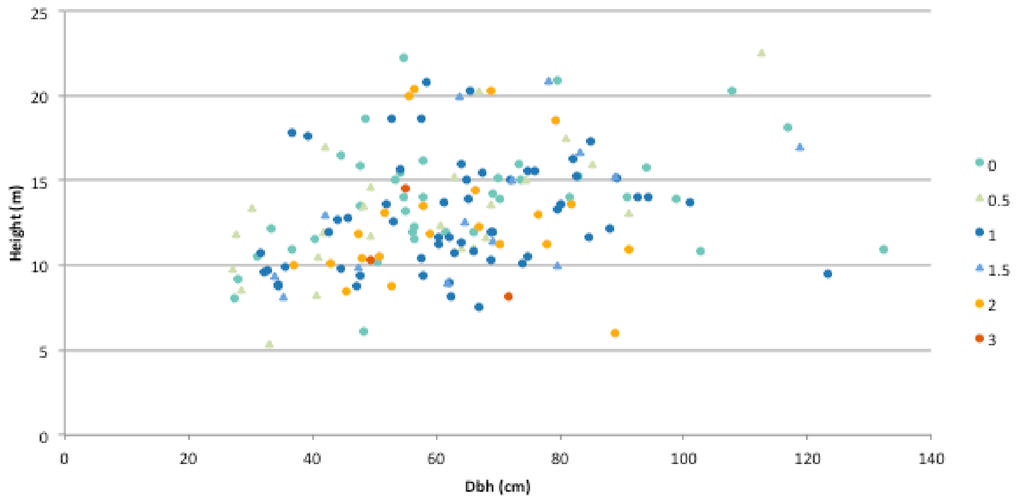

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Multiple comparisons

Introduction | Methodology | **Results and Discussion**

Tests of Between-Subjects Effects

Dependent Variable:Vitality

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	Hypothesis	250.195	1	250.195	231.828	.000
	Error	13.936	12.913	1.079[a]		
sp	Hypothesis	135.364	4	33.841	61.464	.000
	Error	368.889	670	.551[b]		
site	Hypothesis	11.530	7	1.647	2.992	.004
	Error	368.889	670	.551[b]		

a. .482 MS(site) + .518 MS(Error)
b. MS(Error)

Vitality
Tukey HSD

(I) sp	(J) sp	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Cassia	Delonix	.10	.114	.905	-.21	.41
	Ficus	.62*	.097	.000	.36	.89
	Mangifera	1.21*	.078	.000	1.00	1.43
	Samanea	.68*	.083	.000	.45	.91
Delonix	Cassia	-.10	.114	.905	-.41	.21
	Ficus	.52*	.124	.000	.18	.86
	Mangifera	1.11*	.110	.000	.81	1.41
	Samanea	.58*	.114	.000	.27	.89
Ficus	Cassia	-.62*	.097	.000	-.89	-.36
	Delonix	-.52*	.124	.000	-.86	-.18
	Mangifera	.59*	.092	.000	.34	.84
	Samanea	.06	.097	.974	-.21	.32
Mangifera	Cassia	-1.21*	.078	.000	-1.43	-1.00
	Delonix	-1.11*	.110	.000	-1.41	-.81
	Ficus	-.59*	.092	.000	-.84	-.34
	Samanea	-.53*	.078	.000	-.74	-.32
Samanea	Cassia	-.68*	.083	.000	-.91	-.45
	Delonix	-.58*	.114	.000	-.89	-.27
	Ficus	-.06	.097	.974	-.32	.21
	Mangifera	.53*	.078	.000	.32	.74

Based on observed means.
The error term is Mean Square(Error) = .551.

*. The mean difference is significant at the 0.05 level.

Conclusion and Recommendation

Status

- Low tree cover.
- The population density does not have an effect on abundance and vitality of trees.
- The abundance of trees is related to sites with urban planning, and the vitality to the species found
- There is a low diversity of species.

Condition and Suitable trees species

- The results indicate that mainly all trees are in a good state while the *Mangifera indica* is in a healthier condition.
- However, there is a need for further assessment and proper management for individuals that have critical observations.

Future planning

- As a guide to create awareness of a low and uneven tree cover.
- As a base for the selection of tree species and balance between introduced and native species.
- To create a list of tree species that are not suitable for being used as street trees.
- The methodology applied to this research for the assessment of the tree condition can be applied to improve the tree management in public and private lands.

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Thank you