

SUPPLEMENTARY MATERIAL

Urban Green Fabric Analysis: Implications for Planning in Guatemala City.

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Land

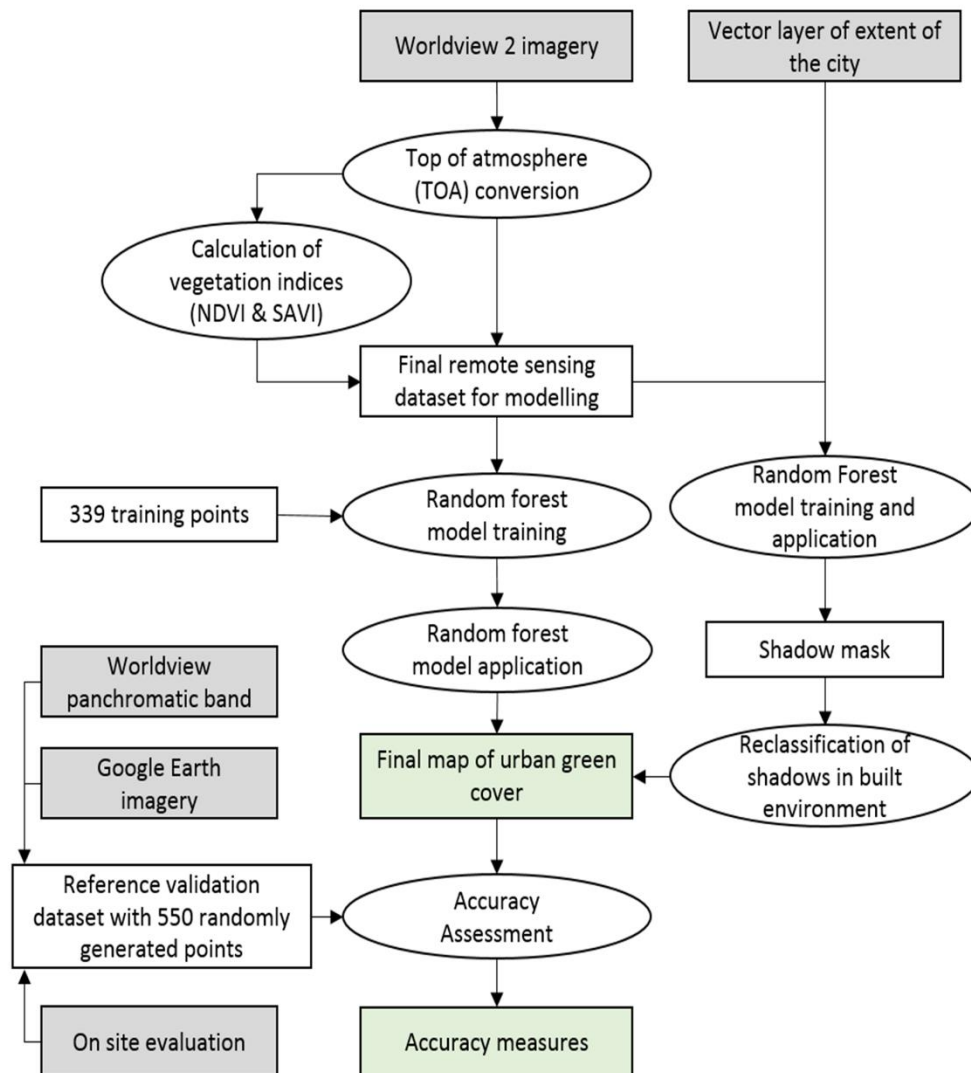


Figure S1. Methodological flux of high-resolution image processing for land cover mapping. The image shows the steps done for classification of WordlView-2 image (DigitalGlobe®). Gray boxes indicate input data, white ovals the methods used, white rectangles the derived data and finally, green boxes the results.

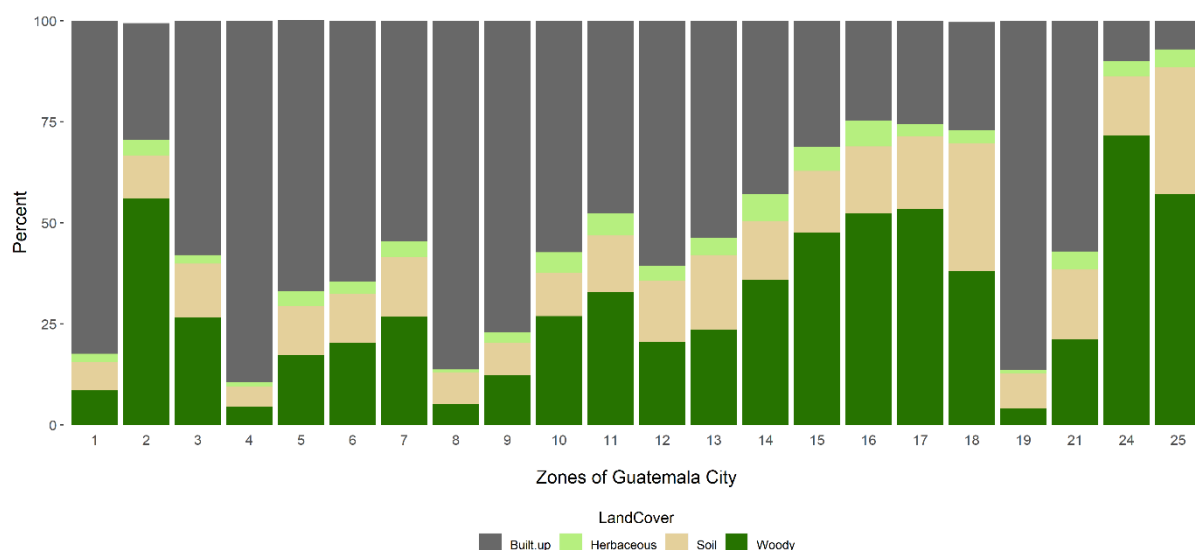


Figure S2. Share of Urban Land Cover per zones in Guatemala City. Percentage for four different land covers among Guatemala City's zones: herbaceous and woody vegetation (includes shrub and trees), soil and built up. Majority of zones depicts more built up cover with the exception of zones 2, 15, 16, 17, 24 and 25.

Table S1. Urban Land Cover estimations for Guatemala City zones

Urban Land Cover									
ZONES	Area (km ²)	Woody cover		Herbaceous cover		Soil cover		Built-up cover	
		km ²	%	km ²	%	km ²	%	km ²	%
1	6.44	0.55	8.5	0.13	2.0	0.46	7.1	5.31	82.4
2	8.49	4.77	56.1	0.33	3.9	0.89	10.5	2.45	28.9
3	4.16	1.10	26.5	0.09	2.1	0.56	13.4	2.41	58.0
4	1.01	0.05	4.5	0.01	1.2	0.05	4.9	0.91	89.4
5	5.39	0.93	17.3	0.20	3.7	0.65	12.0	3.62	67.1
6	7.26	1.47	20.3	0.23	3.1	0.88	12.1	4.69	64.5
7	12.73	3.40	26.7	0.49	3.8	1.90	14.9	6.94	54.5
8	1.31	0.07	5.1	0.01	0.7	0.10	7.9	1.13	86.3
9	2.42	0.30	12.3	0.06	2.5	0.19	8.0	1.87	77.2
10	5.49	1.48	26.9	0.28	5.1	0.59	10.7	3.14	57.3
11	11.41	3.75	32.9	0.63	5.5	1.58	13.9	5.45	47.7
12	12.13	2.50	20.6	0.44	3.6	1.83	15.1	7.36	60.7
13	8.13	1.92	23.6	0.34	4.2	1.49	18.4	4.37	53.8
14	4.70	1.69	35.9	0.32	6.8	0.68	14.4	2.01	42.9
15	9.42	4.48	47.6	0.56	6.0	1.43	15.2	2.94	31.2
16	19.75	10.34	52.3	1.25	6.3	3.28	16.6	4.88	24.7
17	9.96	5.31	53.3	0.30	3.0	1.80	18.0	2.56	25.7
18	43.64	16.58	38.0	1.38	3.2	13.81	31.6	11.71	26.8
19	1.07	0.04	4.0	0.01	0.9	0.09	8.7	0.92	86.4
21	5.52	1.17	21.2	0.25	4.5	0.95	17.2	3.15	57.1
24	17.62	12.62	71.6	0.67	3.8	2.58	14.6	1.75	9.9
25	30.91	17.63	57.0	1.36	4.4	9.73	31.5	2.19	7.1
TOTAL	228.95	92.14	40.00	9.32	4.00	45.51	20.00	81.75	36.00

Table S2. Urban Land Use classes of Guatemala City

Primary Urban Land Use	Detailed Land use*	Primary Urban Land Use	Detailed Land use*
Commercial	Specialized services	Protection	Strict G0
	Wholesale		Partially strict G1
	Retail	Recreative	Sports
Industrial	Light		Other
	Heavy		Squares
	Extractive		Parks
Institutional	Institutional services		Special
	Special	Residential	Special
	Military		Single storey
	Administrative-government		Multiple storey
	Educational	Transport	National and Department Roads
	Health		Urban street networks
	Cultural		Rural road networks
	Religious		Transport Centres
	Communications	Non identified	Non identified
	Commercial-Residential		
Mixed	Livestock	* in many cases was not possible to identify detailed land use at the plot level	
Productive	Agricultural		
	Forestry		

Figure S3. Share of Urban Land Uses per zones of Guatemala City

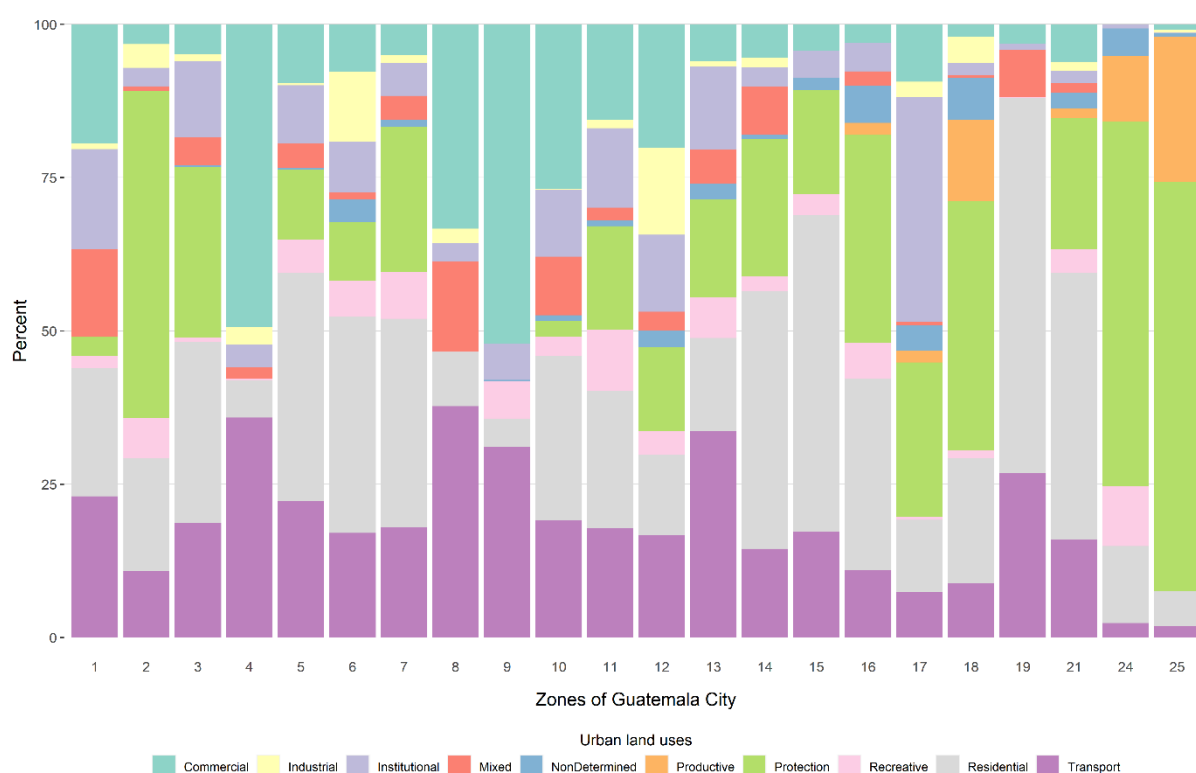


Table S3. Urban land uses area (%) per zones in Guatemala City.

<i>Zones</i>	<i>Commercial</i>	<i>Industrial</i>	<i>Institutional</i>	<i>Mixed</i>	<i>Productive</i>	<i>Protection</i>	<i>Recreative</i>	<i>Residential</i>	<i>Transport</i>	<i>Non determined</i>
1	19.40	0.93	16.34	14.33		3.04	2.03	20.90	23.01	
2	3.20	3.89	3.00	0.74		53.34	6.51	18.50	10.79	
3	4.90	1.16	12.31	4.57		27.76	0.81	29.51	18.65	0.29
4	49.32	2.82	3.82	1.80			0.25	6.11	35.84	
5	9.57	0.33	9.52	4.01		11.41	5.43	37.16	22.26	0.28
6	7.67	11.44	8.30	1.13		9.51	5.89	35.27	17.05	3.68
7	4.99	1.28	5.36	3.96		23.66	7.67	33.96	17.98	1.08
8	33.28	2.40	2.94	14.69			0.09	8.86	37.70	
9	52.09		5.89	0.00			6.03	4.61	31.09	0.27
10	26.85	0.15	10.89	9.55		2.59	3.14	26.83	19.08	0.88
11	15.55	1.35	12.98	2.10		16.92	9.96	22.33	17.86	0.90
12	20.12	14.16	12.58	3.03		13.66	3.84	13.06	16.73	2.78
13	5.93	0.90	13.54	5.60		16.01	6.59	15.25	33.60	2.52
14	5.48	1.50	3.18	7.76		22.41	2.42	41.98	14.46	0.77
15	4.28		4.37	0.04		16.94	3.46	51.60	17.26	2.00
16	2.94	0.02	4.66	2.35	1.97	33.87	5.92	31.20	10.94	6.07
17	9.34	2.52	36.69	0.46	1.96	25.11	0.52	11.81	7.38	4.17
18	1.96	4.33	1.93	0.49	13.34	40.56	1.28	20.47	8.81	6.79
19	3.14		0.98	7.71			0.14	61.22	26.77	
21	6.09	1.47	1.99	1.61	1.57	21.44	3.85	43.45	15.98	2.51
24			0.66		10.69	59.41	9.80	12.55	2.35	4.51
25	0.86	0.48	0.06	0.07	23.62	66.73		5.71	1.86	0.57

Table S4. Green spaces of Guatemala City's Urban green fabric

Green spaces types	ha	%
Agricultural and Silvicultural spaces	808.85	8.27
Vacant spaces	6.06	0.06
Gardens	934.34	9.55
Urban forested spaces	782.22	8.00
Parks and Plazas	222.47	2.27
Sport spaces	257.92	2.64
Special green spaces	311.89	3.19
Other green spaces	294.11	3.01
Non identified green spaces	317.93	3.25
Street network green spaces	469.30	4.80
Urban forests	5377.57	54.97
Total	9782.67	100

Table S5. Share of urban green spaces area per zones total area in Guatemala City

Zones	Surface (ha)	Share (%)
1	644	9.82
2	849	58.43
3	416	27.49
4	101	5.48
5	539	19.39
6	666	22.22
7	1273	28.95
8	131	5.26
9	242	14.60
10	549	31.62
11	1141	37.74
12	1213	23.47
13	813	26.72
14	470	40.86
15	942	52.70
16	1975	57.33
17	996	55.23
18	4364	39.15
19	107	3.90
21	552	23.33
24	1762	73.79
25	3091	58.83

Table S6. Zones' share of UGS in Guatemala City (%)

Zones	Agricultural and silvicultural spaces	Vacant spaces	Gardens	Urban forested spaces	Parks and Plazas	Sport spaces	Special green spaces	Other green spaces	Non identified green spaces	Street network green spaces	Urban forests
1			2.15		2.51	0.01	1.08	4.43		2.01	0.22
2		0.99	3.08	0.98	17.98	1.05	2.83	2.17		4.09	7.06
3			0.87	0.93	0.68		2.32	1.26	0.19	1.81	1.44
4			0.08		0.01		0.04	0.42		0.72	0.00
5			1.87	0.55	0.88	3.05	4.47	3.01	0.13	2.89	0.67
6		0.02	2.02	4.09	2.06	3.83	2.64	4.42	5.95	2.33	0.84
7		1.78	4.30	2.08	25.26	0.69	3.32	5.09	1.96	6.72	3.55
8			0.13		0.00		0.08	0.69		0.73	
9			0.24		1.60		0.66	3.72	0.20	3.37	
10			6.82	3.37	1.00	1.14	4.66	8.95	0.86	4.95	0.21
11		1.57	5.57	2.28	4.70	35.23	19.34	6.00	2.20	7.53	2.59
12		1.37	3.38	1.54	2.62	1.88	22.47	9.67	1.66	5.32	1.89
13		4.52	3.23	0.96	3.48	2.89	6.41	11.70	3.34	4.67	1.43
14		23.28	7.34	0.83	2.69		1.67	2.40	0.56	3.84	1.44
15			15.61	12.08	7.40	1.70	6.13	4.01	4.74	11.62	2.50
16	2.28	42.34	18.99	9.71	16.66	19.87	10.42	10.61	24.63	13.53	10.48
17	1.05	12.79	2.42	36.81	0.28	0.08	0.40	6.44	4.36	3.19	3.36
18	35.07		13.36	8.90	7.25	1.02	7.43	11.23	25.98	11.59	18.82
19			0.25		0.03		0.03	0.02		0.33	
21	0.76	0.19	2.68	0.86	2.90	0.30	0.85	1.64	1.48	2.51	1.11
24	16.43		2.74	10.99	0.03	27.22	2.65	0.00	20.71	3.69	16.62
25	44.42	11.16	2.87	3.05		0.05	0.10	2.11	1.04	2.57	25.77

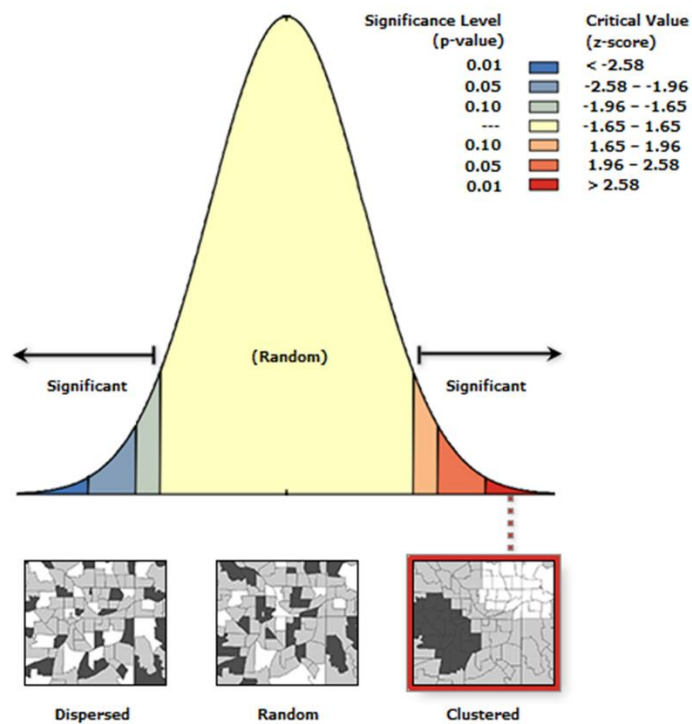


Figure. S4. Local Moran's I results for urban green spaces distribution in Guatemala City.

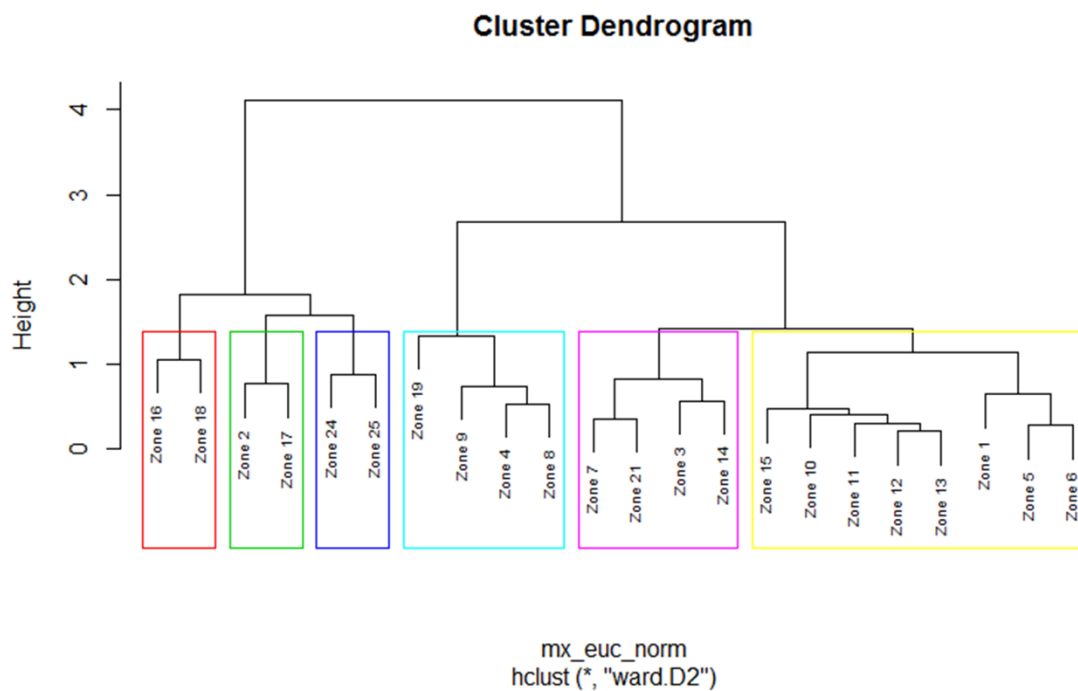


Figure S5 Dendrogram Agglomerative Hierarchical Clustering of Zones in Guatemala City based on indicators.

Table S7. Indicators for Guatemala City zones.

Zones	Urban intensity		Urban green spaces metrics										
	POP_DENS	STREET_DENS	TOT_GS_A	GS_CAP	NP	LPI	PAFRAC	CONTAG	MESH	RPR	SHDI	MSIEI	AI
1	13647	20.64	63.21	7.19	21517	8.90	1.36	54.86	1.12	63.64	1.66	0.80	76.93
2	3400	5.99	493.3	170.71	23747	74.37	1.38	79.22	275.28	90.91	0.92	0.22	90.92
3	7989	16.46	114.3	34.42	14734	31.71	1.37	71.57	17.54	81.82	1.19	0.34	82.69
4	2342	29.21	5.55	23.41	3707	3.10	1.36	64.21	0.02	45.45	1.01	0.50	67.64
5	15839	21.66	104.54	12.24	24586	13.05	1.39	55.97	2.51	81.82	1.83	0.74	78.76
6	14984	19.05	161.34	16.18	30209	10.58	1.39	54.90	3.96	90.91	1.99	0.79	82.02
7	14251	17.53	368.46	20.32	53307	12.64	1.40	64.81	15.13	90.91	1.55	0.50	82.91
8	12320	32.98	6.92	4.27	3684	4.08	1.40	60.43	0.04	45.45	1.14	0.63	68.55
9	943	20.99	35.28	154.79	10839	2.29	1.37	58.51	0.11	54.55	1.37	0.64	76.11
10	2869	15.49	173.5	110.19	30175	3.41	1.39	56.35	1.12	81.82	1.79	0.71	83.16
11	4528	14.57	430.66	83.36	44941	20.33	1.41	58.21	30.15	90.91	1.85	0.71	86.64
12	4661	12.62	284.55	50.35	47176	16.72	1.40	60.21	10.42	90.91	1.76	0.66	81.59
13	4283	10.27	217.28	62.41	33168	16.25	1.41	57.01	7.28	90.91	1.89	0.71	81.20
14	5079	12.67	191.93	80.44	22467	31.39	1.41	64.18	19.90	81.82	1.48	0.54	83.41
15	2012	12.2	496.25	261.91	41283	13.27	1.42	57.90	11.34	81.82	1.75	0.71	86.82
16	1286	5.71	1132.05	445.79	74105	20.00	1.42	62.98	60.15	100.00	1.70	0.52	89.06
17	2915	13.11	550.27	189.51	34213	49.27	1.43	73.37	152.70	100.00	1.24	0.40	90.20
18	5951	7.55	1701.74	65.52	229750	16.55	1.44	68.85	73.98	90.91	1.38	0.41	83.61
19	30065	21.15	4.17	1.3	2925	1.07	1.31	68.91	0.01	45.45	0.89	0.47	65.31
21	17770	17.92	128.7	13.13	26530	18.46	1.39	62.55	5.29	100.00	1.70	0.55	79.47
24	1095	5.45	1299.9	673.98	34390	45.85	1.44	73.01	299.06	81.82	1.15	0.32	92.26
25	827	2.04	1818.6	711.75	116018	52.40	1.45	83.82	514.94	90.91	0.72	0.21	87.85
Units	Hab/km ²	km/km ²	ha	m ² /capita	Number	%	Unitless	%	ha	%	Information bits	Unitless	%

POP_DENS = Population density. STREET_DENS = streets density. TOT_GS_A = Total Green Space Area. GS_CAP = Green space per capita. NP = number of patches. LPI = Largest Patch Index. PAFRAC = Perimeter Area Fractal Dimension. CONTAG = Contagion. MESH = Effective Mesh Size. RPR = relative Patch Richness. SHDI = Shannon Diversity Index. MSIEI = Modified Simpson's Evenness Index. AI = Aggregation Index.

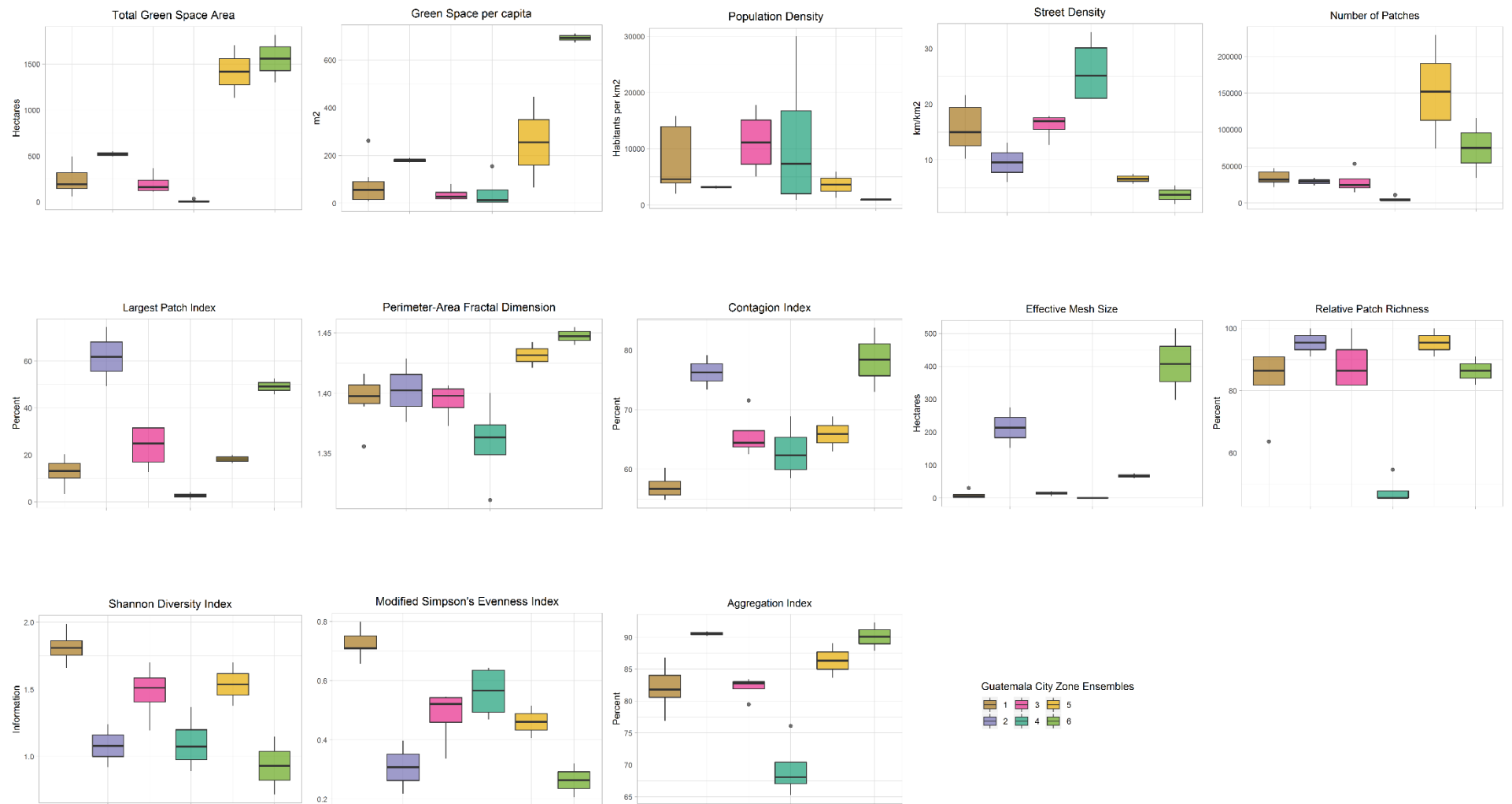


Figure S6. Boxplots of Indicators in each cluster of zones in Guatemala City



Figure S7. Code cloud of reasons to support the creation of a large urban park in Guatemala City