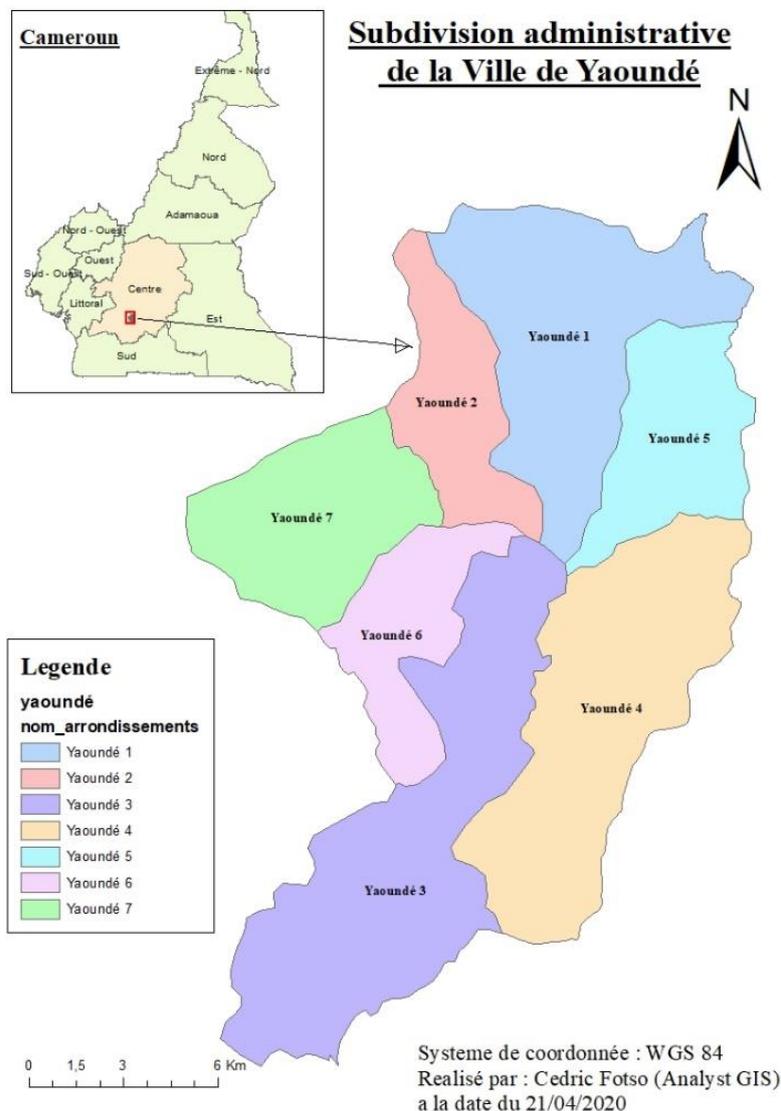


# I-tree final project : Assessment of the carbon sequestered by trees in the 7 districts of the city of Yaoundé, Cameroon thanks to i-tree Canopy (22/04/20)

Cedric Fotso, Analyst GIS

## General presentation

The city of Yaoundé is the political capital of Cameroon, located south of the Center region and 250 km east of the coast of Biafra Bay. This hill site is divided into three topographic units inscribed in a rocky base of Precambrian gneiss: the barrier of the inselbergs to the northwest dominated by the Mbam Minkom mountains (1295 m) and Mount Nkolodom (1221 m) and to the southwest with Mount Eloumden (1159 m); a set of hills from 600 to 700 m above sea level and plateaus; the valleys



Also called elobis.

The different districts are arranged according to the rugged terrain of the city site. Roads and buildings develop mainly on the heights of different hills, while swampy lowlands often give way to subsistence farming, vegetation and many petits stream. Some of them are the Mfoundi, Ékozoa, Biyeme and

Mefou rivers. Near the administrative center of Yaoundé is a lake called Lac Municipal, created in 1951-1952.

The city of Yaoundé covers an area of 304 km<sup>2</sup>, including an urbanized area of 183 km<sup>2</sup> and is home to an estimated population in 2005 of 1,817,524 inhabitants, an average density of 5,691 inhabitants



per km

The city of Yaoundé is circumscribed in the urban community of Yaoundé (CUY) which is divided into 7 districts: Yaoundé 1, Nlongkak

- Yaoundé 2 (Tsinga),
- Yaoundé 3 (Efoulan),
- Yaoundé 4 (Kondengui),
- Yaoundé 5 (Essos),
- Yaoundé 6 (Biyem-Assi),
- Yaoundé 7 (Nkolbisson)

### **Goal of the project**

It is a question in this study of making an evaluation on the advantages that trees offer in the city of Yaoundé this Thanks to a study made on the tree cover. I-tree canopy was the tool par excellence of the i-tree software that we used for this study.

### **Méthodologie**

I-tree canopy is this tool that provides us with an assessment report on the coverage and benefits of trees. It is done online and the methodology is as follows:

Introduce the borders of our study area or we have an ESRI shape file and by that we configure the elements necessary for our studies by defining the different elements necessary for the interpretation linked to the land use then i-tree we gives the possibility of making an interpretation on the Google map image linked to the study area. Study was made rounding after arrondissement and finally this table summarizes a brief summary of the advantage that trees offer in each district of the city of yaoundé.

Note that this study may allow the urban community of the city to better orient the tree (carbon, greenhouse gas) needs of the city

Arrondissements	populations	Carbone séquestré(KT)	CO2 Séquestré(KT)
Yaoundé 1	281586	4.80	17.60
Yaoundé 2	247184	5.87	21.51
Yaoundé 3	252501	11.25	41.24
Yaoundé 4	477950	5.28	19.36
Yaoundé 5	265087	2.37	8.69
Yaoundé 6	268971	1.37	5.01
Yaoundé 7	89197	3.07	11.27

(comparison table between the different districts of the city of Yaoundé)

# i-Tree Canopy v7.0

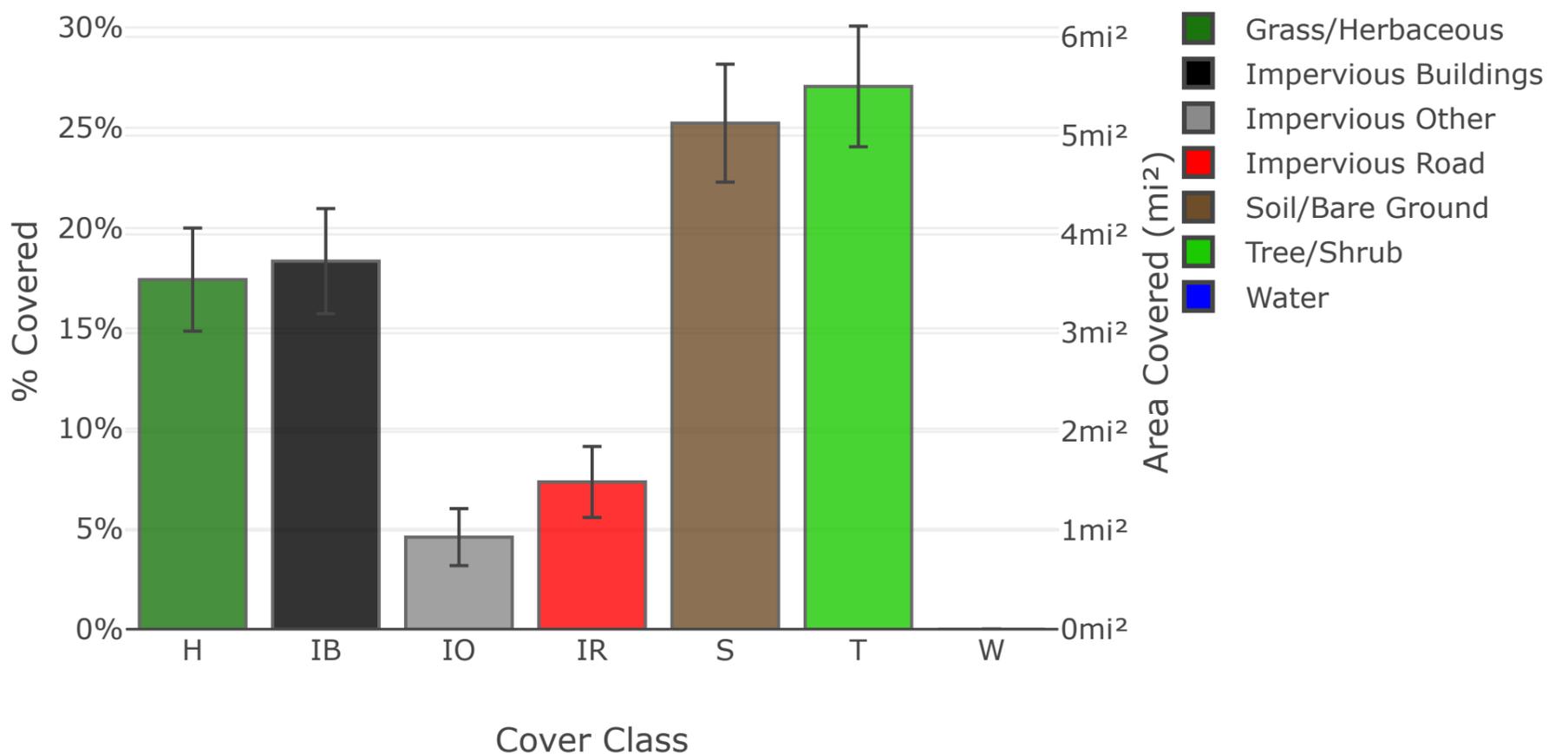
## Cover Assessment and Tree Benefits Report Yaoundé 1

Estimated using random sampling statistics on 5/4/2020



Google

### Land Cover



Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (mi <sup>2</sup> ) ± SE
H	Grass/Herbaceous		38	17.43 ± 2.57	3.54 ± 0.52
IB	Impervious Buildings		40	18.35 ± 2.62	3.73 ± 0.53
IO	Impervious Other		10	4.59 ± 1.42	0.93 ± 0.29
IR	Impervious Road		16	7.34 ± 1.77	1.49 ± 0.36
S	Soil/Bare Ground		55	25.23 ± 2.94	5.12 ± 0.60
T	Tree/Shrub		59	27.06 ± 3.01	5.50 ± 0.61
W	Water		0	0.00 ± 0.00	0.00 ± 0.00
<b>Total</b>			<b>218</b>	<b>100.00</b>	<b>20.31</b>

### Tree Benefit Estimates: Carbon (English units)

Description	Carbon (kT)	±SE	CO <sub>2</sub> Equiv. (kT)	±SE	Value (USD)	±SE
Sequestered annually in trees	4.80	±0.53	17.60	±1.96	\$818,806	±91,039
Stored in trees (Note: this benefit is not an annual rate)	120.57	±13.41	442.09	±49.15	\$20,563,302	±2,286,321

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Carbon sequestered is based on 0.874 kT/mi<sup>2</sup>/yr. Carbon stored is based on 21.940 kT/mi<sup>2</sup>. Carbon is valued at \$46,513.84/kT. (English units: kT = kilotons (1,000 tons), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Amount (T)	±SE	Value (USD)	±SE
CO	Carbon Monoxide removed annually	1.59	±0.18	\$135	±15
NO <sub>2</sub>	Nitrogen Dioxide removed annually	8.65	±0.96	\$232	±26
O <sub>3</sub>	Ozone removed annually	86.11	±9.57	\$12,096	±1,345
PM <sub>10</sub> *	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	28.84	±3.21	\$8,781	±976
PM <sub>2.5</sub>	Particulate Matter less than 2.5 microns removed annually	4.18	±0.47	\$25,004	±2,780
SO <sub>2</sub>	Sulfur Dioxide removed annually	5.45	±0.61	\$41	±5
<b>Total</b>		<b>134.82</b>	<b>±14.99</b>	<b>\$46,290</b>	<b>±5,147</b>

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Air Pollution Estimates are based on these values in T/mi<sup>2</sup>/yr @ \$/T/yr:

CO 0.289 @ \$85.08 | NO<sub>2</sub> 1.573 @ \$26.86 | O<sub>3</sub> 15.670 @ \$140.47 | PM<sub>10</sub>\* 5.249 @ \$304.43 | PM<sub>2.5</sub> 0.761 @ \$5,975.67 | SO<sub>2</sub> 0.991 @ \$7.45 (English units: T = tons (2,000 pounds), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Hydrological (English units)

Abbr.	Benefit	Amount (Kgal)	±SE	Value (USD)	±SE
AVRO	Avoided Runoff	1.82	±0.20	\$16	±2
E	Evaporation	150.16	±16.70	N/A	N/A
I	Interception	151.00	±16.79	N/A	N/A
T	Transpiration	203.19	±22.59	N/A	N/A
PE	Potential Evaporation	1,137.81	±126.51	N/A	N/A
PET	Potential Evapotranspiration	928.36	±103.22	N/A	N/A

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Hydrological Estimates are based on these values in Kgal/mi<sup>2</sup>/yr @ \$/Kgal/yr:

AVRO 0.331 @ \$8.94 | E 27.324 @ N/A | I 27.477 @ N/A | T 36.974 @ N/A | PE 207.046 @ N/A | PET 168.932 @ N/A (English units: Kgal = thousands of gallons, mi<sup>2</sup> = square miles)

#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton, and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company)

#### Limitations of i-Tree Canopy

The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.

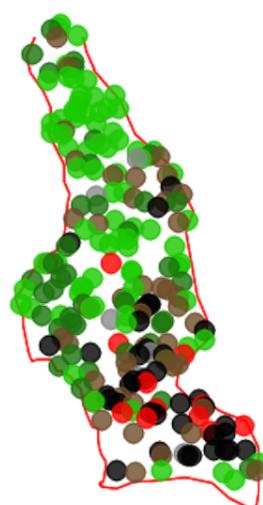


Use of this tool indicates acceptance of the [EULA](#).

# i-Tree Canopy v7.0

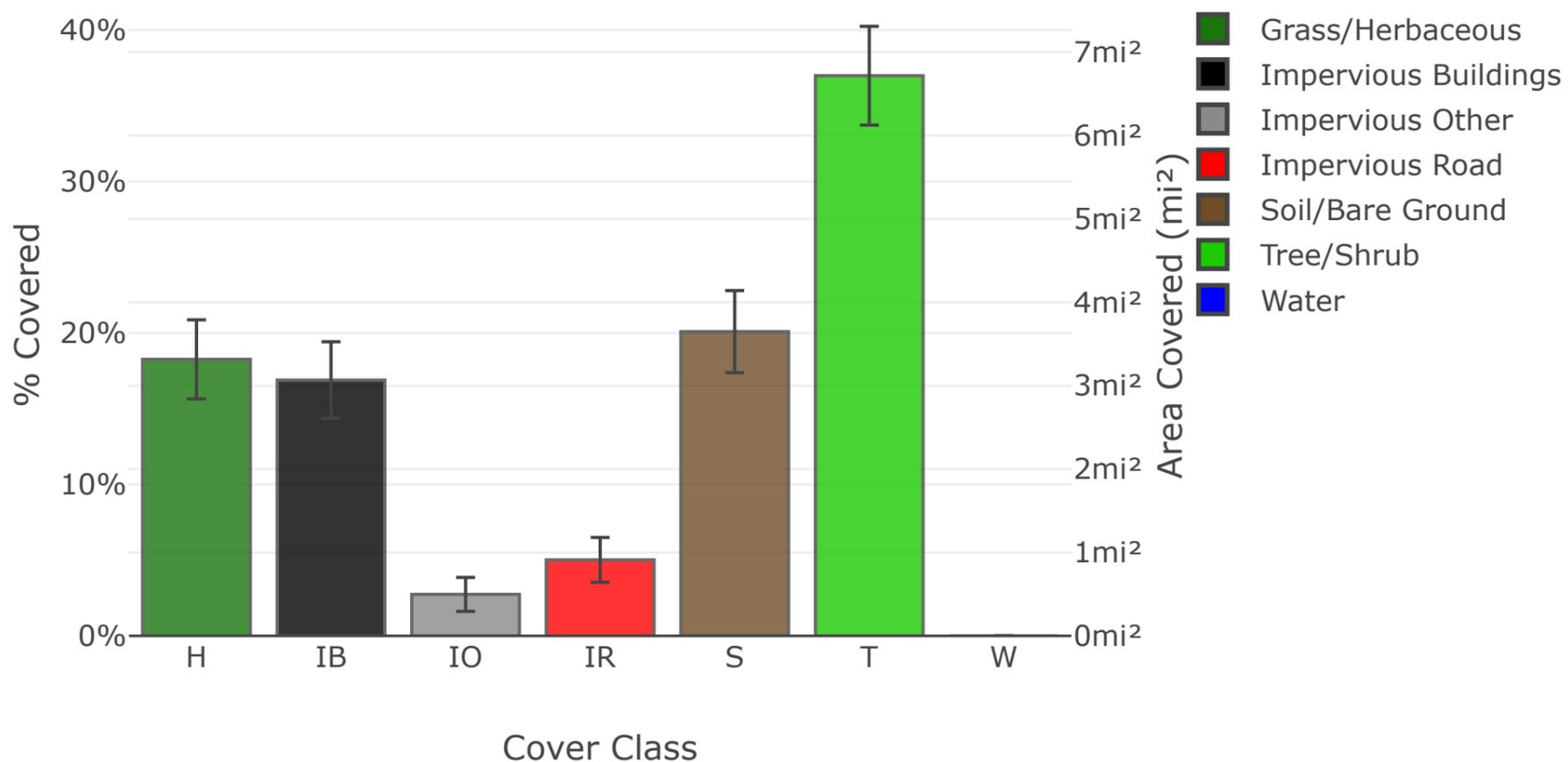
## Cover Assessment and Tree Benefits Report Yaoundé 2

Estimated using random sampling statistics on 5/4/2020



Google

### Land Cover



Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (mi <sup>2</sup> ) ± SE
H	Grass/Herbaceous		40	18.26 ± 2.61	3.32 ± 0.47
IB	Impervious Buildings		37	16.89 ± 2.53	3.07 ± 0.46
IO	Impervious Other		6	2.74 ± 1.12	0.50 ± 0.20
IR	Impervious Road		11	5.02 ± 1.48	0.91 ± 0.27
S	Soil/Bare Ground		44	20.09 ± 2.71	3.65 ± 0.49
T	Tree/Shrub		81	36.99 ± 3.26	6.72 ± 0.59
W	Water		0	0.00 ± 0.00	0.00 ± 0.00
<b>Total</b>			<b>219</b>	<b>100.00</b>	<b>18.16</b>

### Tree Benefit Estimates: Carbon (English units)

Description	Carbon (kT)	±SE	CO <sub>2</sub> Equiv. (kT)	±SE	Value (USD)	±SE
Sequestered annually in trees	5.87	±0.52	21.51	±1.90	\$1,000,574	±88,252
Stored in trees (Note: this benefit is not an annual rate)	147.34	±13.00	540.23	±47.65	\$25,128,159	±2,216,336

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Carbon sequestered is based on 0.874 kT/mi<sup>2</sup>/yr. Carbon stored is based on 21.940 kT/mi<sup>2</sup>. Carbon is valued at \$46,513.84/kT. (English units: kT = kilotons (1,000 tons), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Amount (T)	±SE	Value (USD)	±SE
CO	Carbon Monoxide removed annually	1.94	±0.17	\$165	±15
NO <sub>2</sub>	Nitrogen Dioxide removed annually	10.57	±0.93	\$284	±25
O <sub>3</sub>	Ozone removed annually	105.23	±9.28	\$14,781	±1,304
PM <sub>10</sub> *	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	35.25	±3.11	\$10,731	±946
PM <sub>2.5</sub>	Particulate Matter less than 2.5 microns removed annually	5.11	±0.45	\$30,555	±2,695
SO <sub>2</sub>	Sulfur Dioxide removed annually	6.66	±0.59	\$50	±4
<b>Total</b>		<b>164.75</b>	<b>±14.53</b>	<b>\$56,565</b>	<b>±4,989</b>

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Air Pollution Estimates are based on these values in T/mi<sup>2</sup>/yr @ \$/T/yr:

CO 0.289 @ \$85.08 | NO<sub>2</sub> 1.573 @ \$26.86 | O<sub>3</sub> 15.670 @ \$140.47 | PM<sub>10</sub>\* 5.249 @ \$304.43 | PM<sub>2.5</sub> 0.761 @ \$5,975.67 | SO<sub>2</sub> 0.991 @ \$7.45 (English units: T = tons (2,000 pounds), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Hydrological (English units)

Abbr.	Benefit	Amount (Kgal)	±SE	Value (USD)	±SE
AVRO	Avoided Runoff	2.22	±0.20	\$20	±2
E	Evaporation	183.49	±16.18	N/A	N/A
I	Interception	184.52	±16.27	N/A	N/A
T	Transpiration	248.29	±21.90	N/A	N/A
PE	Potential Evaporation	1,390.40	±122.63	N/A	N/A
PET	Potential Evapotranspiration	1,134.45	±100.06	N/A	N/A

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Hydrological Estimates are based on these values in Kgal/mi<sup>2</sup>/yr @ \$/Kgal/yr:

AVRO 0.331 @ \$8.94 | E 27.324 @ N/A | I 27.477 @ N/A | T 36.974 @ N/A | PE 207.046 @ N/A | PET 168.932 @ N/A (English units: Kgal = thousands of gallons, mi<sup>2</sup> = square miles)

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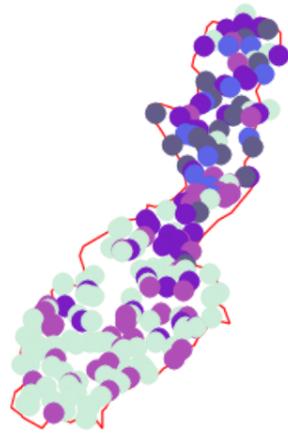


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# i-Tree Canopy v7.0

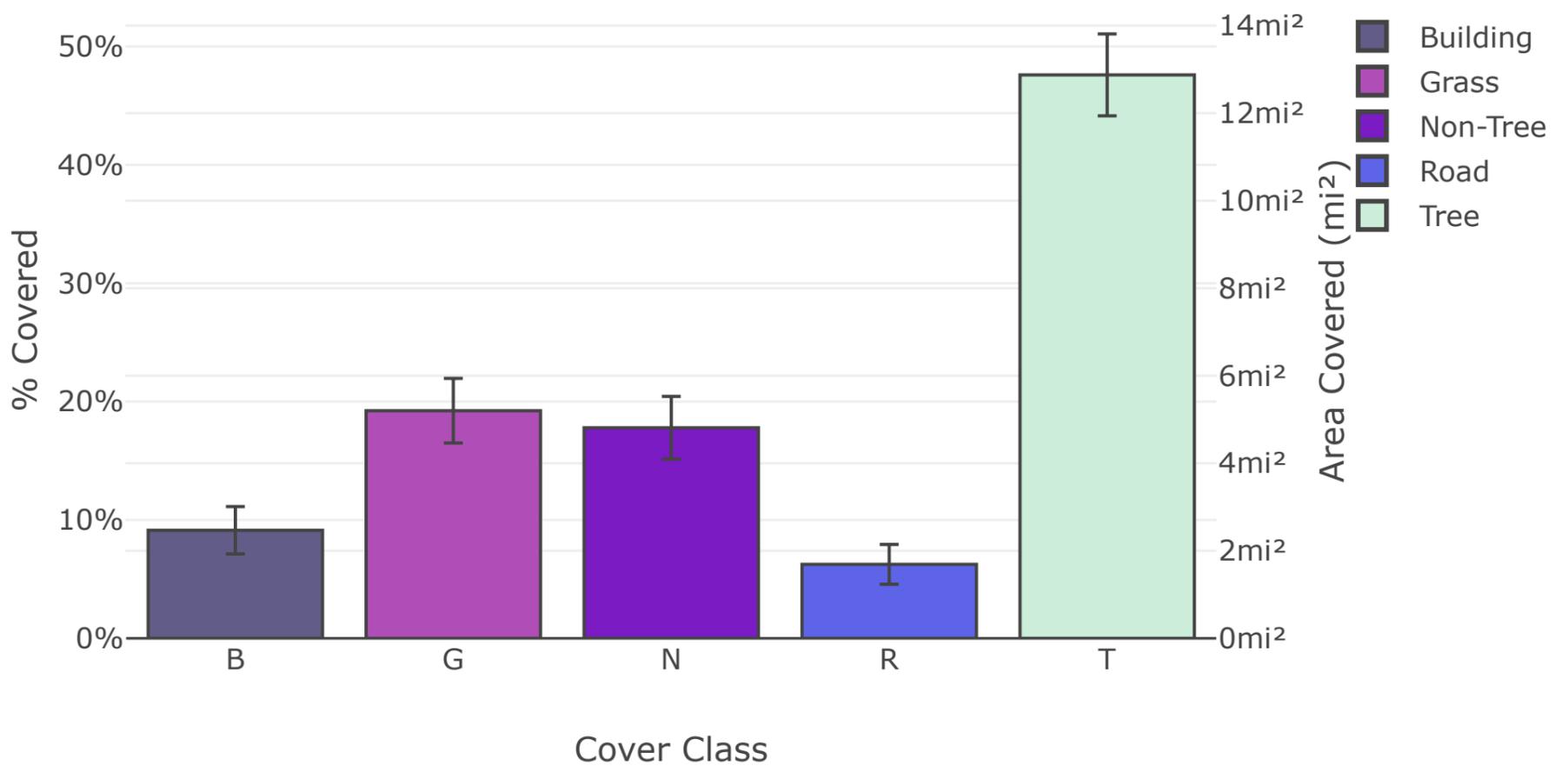
## Cover Assessment and Tree Benefits Report Yaoundé 3

Estimated using random sampling statistics on 5/4/2020



Google

### Land Cover



Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (mi <sup>2</sup> ) ± SE
B	Building	Construction	19	9.13 ± 2.00	2.47 ± 0.54
G	Grass	Zone herbeuse	40	19.23 ± 2.73	5.20 ± 0.74
N	Non-Tree	sols nu	37	17.79 ± 2.65	4.81 ± 0.72
R	Road	Route	13	6.25 ± 1.68	1.69 ± 0.45
T	Tree	Tree, non-shrub	99	47.60 ± 3.46	12.87 ± 0.94
<b>Total</b>			<b>208</b>	<b>100.00</b>	<b>27.05</b>

### Tree Benefit Estimates: Carbon (English units)

Description	Carbon (kT)	±SE	CO <sub>2</sub> Equiv. (kT)	±SE	Value (USD)	±SE
Squestered annually in trees	11.25	±0.82	41.24	±3.00	1,917,972 USD	±139,542
Stored in trees (Note: this benefit is not an annual rate)	282.44	±20.55	1,035.61	±75.35	48,167,464 USD	±3,504,433

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Carbon sequestered is based on 0.874 kT/mi<sup>2</sup>/yr. Carbon stored is based on 21.940 kT/mi<sup>2</sup>. Carbon is valued at 46,511.36 USD/kT. (English units: kT = kilotons (1,000 tons), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Amount (T)	±SE	Value (USD)	±SE
CO	Carbon Monoxide removed annually	3.71	±0.27	316 USD	±23
NO <sub>2</sub>	Nitrogen Dioxide removed annually	20.25	±1.47	544 USD	±40
O <sub>3</sub>	Ozone removed annually	201.72	±14.68	28,335 USD	±2,062
PM <sub>10</sub> *	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	67.57	±4.92	20,570 USD	±1,497
PM <sub>2.5</sub>	Particulate Matter less than 2.5 microns removed annually	9.80	±0.71	58,574 USD	±4,262
SO <sub>2</sub>	Sulfur Dioxide removed annually	12.76	±0.93	95 USD	±7
<b>Total</b>		<b>315.83</b>	<b>±22.98</b>	<b>108,434 USD</b>	<b>±7,889</b>

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Air Pollution Estimates are based on these values in T/mi<sup>2</sup>/yr @ USD/T/yr:

CO 0.289 @ 85.08 USD | NO<sub>2</sub> 1.573 @ 26.86 USD | O<sub>3</sub> 15.670 @ 140.47 USD | PM<sub>10</sub>\* 5.249 @ 304.43 USD | PM<sub>2.5</sub> 0.761 @ 5,975.67 USD | SO<sub>2</sub> 0.991 @ 7.45 USD (English units: T = tons (2,000 pounds), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Hydrological (English units)

Abbr.	Benefit	Amount (Kgal)	±SE	Value (USD)	±SE
AVRO	Avoided Runoff	4.26	±0.31	38 USD	±3
E	Evaporation	351.75	±25.59	N/A	N/A
I	Interception	353.72	±25.73	N/A	N/A
T	Transpiration	475.97	±34.63	N/A	N/A
PE	Potential Evaporation	2,665.35	±193.92	N/A	N/A
PET	Potential Evapotranspiration	2,174.70	±158.22	N/A	N/A

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Hydrological Estimates are based on these values in Kgal/mi<sup>2</sup>/yr @ USD/Kgal/yr:

AVRO 0.331 @ 8.94 USD | E 27.324 @ N/A | I 27.477 @ N/A | T 36.974 @ N/A | PE 207.046 @ N/A | PET 168.932 @ N/A (English units: Kgal = thousands of gallons, mi<sup>2</sup> = square miles)

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#### Limitations of i-Tree Canopy

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# i-Tree Canopy v7.0

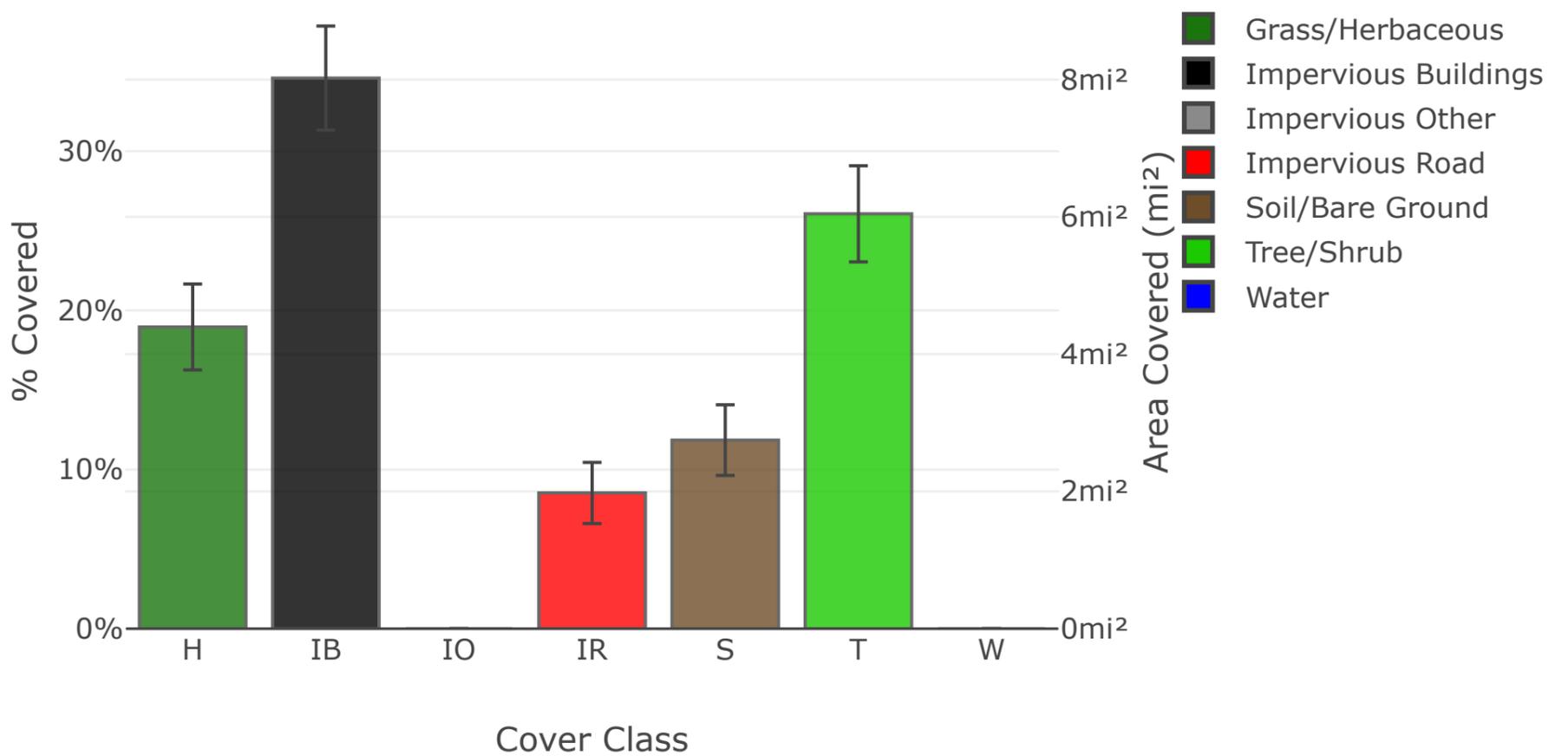
## Cover Assessment and Tree Benefits Report Yaoundé 4

Estimated using random sampling statistics on 5/4/2020



Google

### Land Cover



Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (mi <sup>2</sup> ) ± SE
H	Grass/Herbaceous		40	18.96 ± 2.70	4.39 ± 0.63
IB	Impervious Buildings		73	34.60 ± 3.27	8.02 ± 0.76
IO	Impervious Other		0	0.00 ± 0.00	0.00 ± 0.00
IR	Impervious Road		18	8.53 ± 1.92	1.98 ± 0.45
S	Soil/Bare Ground		25	11.85 ± 2.22	2.75 ± 0.52
T	Tree/Shrub		55	26.07 ± 3.02	6.04 ± 0.70
W	Water		0	0.00 ± 0.00	0.00 ± 0.00
<b>Total</b>			<b>211</b>	<b>100.00</b>	<b>23.18</b>

### Tree Benefit Estimates: Carbon (English units)

Description	Carbon (kT)	±SE	CO <sub>2</sub> Equiv. (kT)	±SE	Value (USD)	±SE
Sequestered annually in trees	5.28	±0.61	19.36	±2.24	\$900,350	±104,388
Stored in trees (Note: this benefit is not an annual rate)	132.58	±15.37	486.12	±56.36	\$22,611,179	±2,621,579

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Carbon sequestered is based on 0.874 kT/mi<sup>2</sup>/yr. Carbon stored is based on 21.940 kT/mi<sup>2</sup>. Carbon is valued at \$46,513.84/kT. (English units: kT = kilotons (1,000 tons), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Amount (T)	±SE	Value (USD)	±SE
CO	Carbon Monoxide removed annually	1.74	±0.20	\$148	±17
NO <sub>2</sub>	Nitrogen Dioxide removed annually	9.51	±1.10	\$255	±30
O <sub>3</sub>	Ozone removed annually	94.69	±10.98	\$13,301	±1,542
PM <sub>10</sub> *	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	31.72	±3.68	\$9,656	±1,120
PM <sub>2.5</sub>	Particulate Matter less than 2.5 microns removed annually	4.60	±0.53	\$27,495	±3,188
SO <sub>2</sub>	Sulfur Dioxide removed annually	5.99	±0.69	\$45	±5
<b>Total</b>		<b>148.25</b>	<b>±17.19</b>	<b>\$50,899</b>	<b>±5,901</b>

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### Tree Benefit Estimates: Hydrological (English units)

Abbr.	Benefit	Amount (Kgal)	±SE	Value (USD)	±SE
AVRO	Avoided Runoff	2.00	±0.23	\$18	±2
E	Evaporation	165.11	±19.14	N/A	N/A
I	Interception	166.04	±19.25	N/A	N/A
T	Transpiration	223.42	±25.90	N/A	N/A
PE	Potential Evaporation	1,251.13	±145.06	N/A	N/A
PET	Potential Evapotranspiration	1,020.81	±118.35	N/A	N/A

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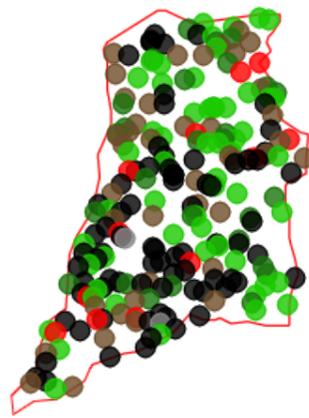


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# i-Tree Canopy v7.0

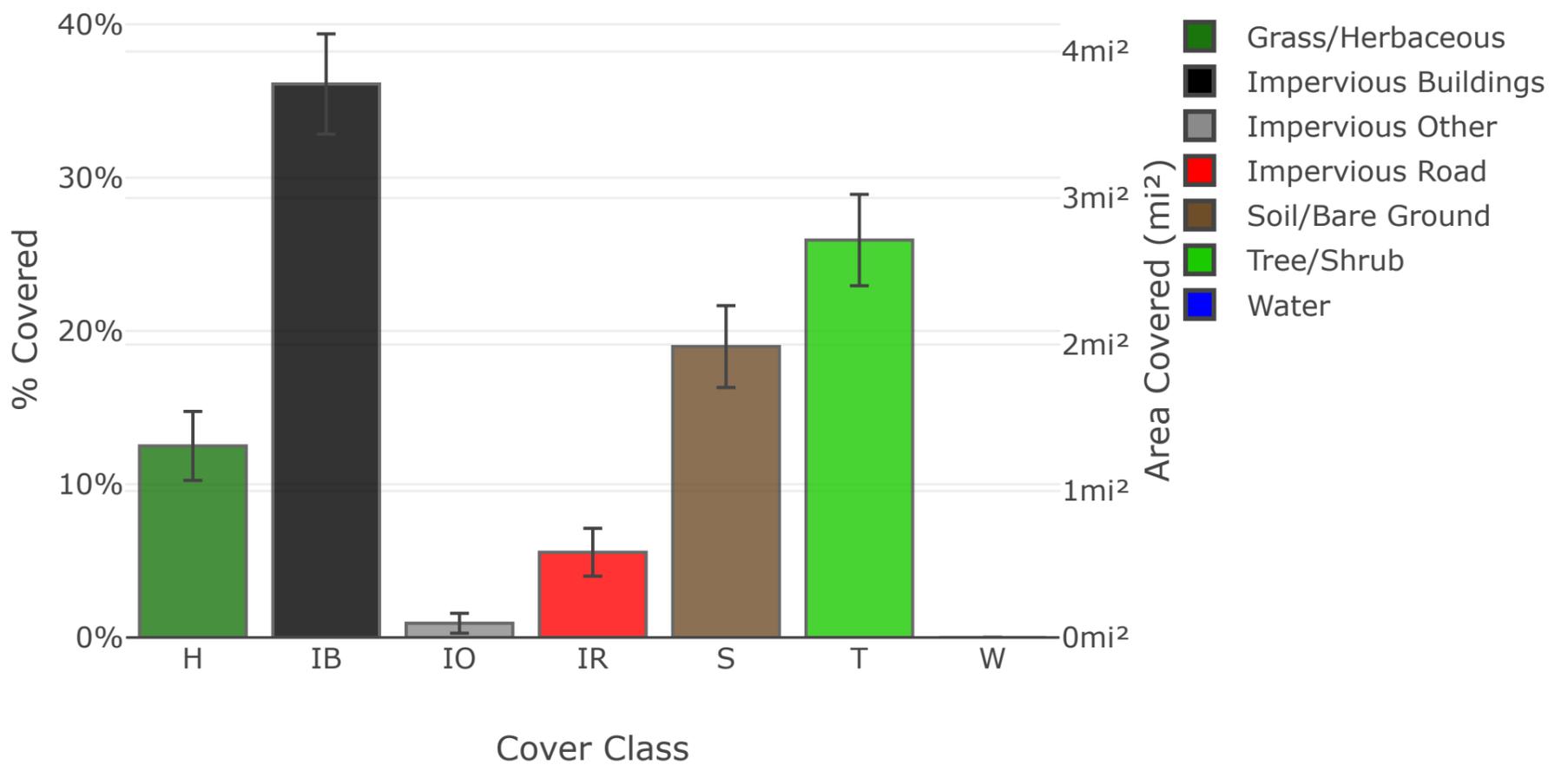
## Cover Assessment and Tree Benefits Report Yaoundé 5

Estimated using random sampling statistics on 5/4/2020



Google

### Land Cover



Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (mi <sup>2</sup> ) ± SE
H	Grass/Herbaceous		27	12.50 ± 2.25	1.31 ± 0.24
IB	Impervious Buildings		78	36.11 ± 3.27	3.78 ± 0.34
IO	Impervious Other		2	0.93 ± 0.65	0.10 ± 0.07
IR	Impervious Road		12	5.56 ± 1.56	0.58 ± 0.16
S	Soil/Bare Ground		41	18.98 ± 2.67	1.99 ± 0.28
T	Tree/Shrub		56	25.93 ± 2.98	2.71 ± 0.31
W	Water		0	0.00 ± 0.00	0.00 ± 0.00
<b>Total</b>			<b>216</b>	<b>100.00</b>	<b>10.47</b>

### Tree Benefit Estimates: Carbon (English units)

Description	Carbon (kT)	±SE	CO <sub>2</sub> Equiv. (kT)	±SE	Value (USD)	±SE
Sequestered annually in trees	2.37	±0.27	8.69	±1.00	\$404,421	±46,513
Stored in trees (Note: this benefit is not an annual rate)	59.55	±6.85	218.35	±25.11	\$10,156,521	±1,168,111

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Carbon sequestered is based on 0.874 kT/mi<sup>2</sup>/yr. Carbon stored is based on 21.940 kT/mi<sup>2</sup>. Carbon is valued at \$46,513.84/kT. (English units: kT = kilotons (1,000 tons), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Amount (lb)	±SE	Value (USD)	±SE
CO	Carbon Monoxide removed annually	1,566.37	±180.15	\$67	±8
NO <sub>2</sub>	Nitrogen Dioxide removed annually	8,541.05	±982.31	\$115	±13
O <sub>3</sub>	Ozone removed annually	85,065.12	±9,783.42	\$5,974	±687
PM <sub>10</sub> *	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	28,493.65	±3,277.08	\$4,337	±499
PM <sub>2.5</sub>	Particulate Matter less than 2.5 microns removed annually	4,133.46	±475.39	\$12,350	±1,420
SO <sub>2</sub>	Sulfur Dioxide removed annually	5,382.36	±619.03	\$20	±2
<b>Total</b>		<b>133,182.02</b>	<b>±15,317.39</b>	<b>\$22,863</b>	<b>±2,630</b>

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Air Pollution Estimates are based on these values in lb/mi<sup>2</sup>/yr @ \$/lb/yr:

CO 577.084 @ \$0.04 | NO<sub>2</sub> 3,146.698 @ \$0.01 | O<sub>3</sub> 31,339.728 @ \$0.07 | PM<sub>10</sub>\* 10,497.643 @ \$0.15 | PM<sub>2.5</sub> 1,522.851 @ \$2.99 | SO<sub>2</sub> 1,982.970 @ \$0.00 (English units: lb = pounds, mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Hydrological (English units)

Abbr.	Benefit	Amount (gal)	±SE	Value (USD)	±SE
AVRO	Avoided Runoff	898.29	±103.31	\$8	±1
E	Evaporation	74,165.20	±8,529.81	N/A	N/A
I	Interception	74,580.25	±8,577.54	N/A	N/A
T	Transpiration	100,356.95	±11,542.15	N/A	N/A
PE	Potential Evaporation	561,982.24	±64,634.10	N/A	N/A
PET	Potential Evapotranspiration	458,530.50	±52,736.02	N/A	N/A

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Hydrological Estimates are based on these values in gal/mi<sup>2</sup>/yr @ \$/gal/yr:

AVRO 330.949 @ \$0.01 | E 27,323.972 @ N/A | I 27,476.886 @ N/A | T 36,973.547 @ N/A | PE 207,045.729 @ N/A | PET 168,931.995 @ N/A (English units: gal = gallons, mi<sup>2</sup> = square miles)

#### About i-Tree Canopy

The concept and prototype of this program were developed by David J. Nowak, Jeffery T. Walton, and Eric J. Greenfield (USDA Forest Service). The current version of this program was developed and adapted to i-Tree by David Ellingsworth, Mike Binkley, and Scott Maco (The Davey Tree Expert Company)

#### Limitations of i-Tree Canopy

The accuracy of the analysis depends upon the ability of the user to correctly classify each point into its correct class. As the number of points increase, the precision of the estimate will increase as the standard error of the estimate will decrease. If too few points are classified, the standard error will be too high to have any real certainty of the estimate.



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# i-Tree Canopy v7.0

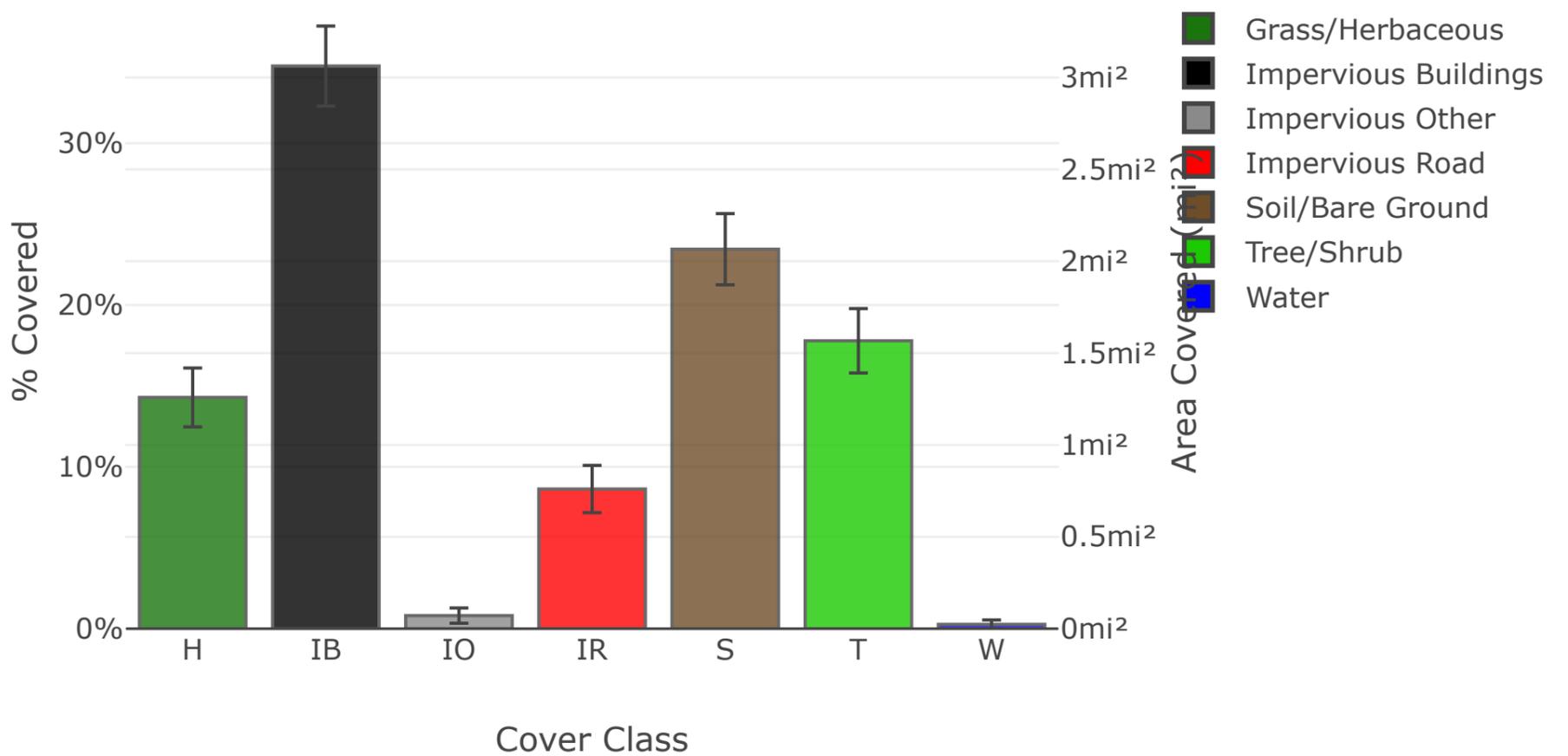
## Cover Assessment and Tree Benefits Report Yaoundé 6

Estimated using random sampling statistics on 4/29/2020



Google

### Land Cover



Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (mi <sup>2</sup> ) ± SE
H	Grass/Herbaceous		53	14.29 ± 1.82	1.26 ± 0.16
IB	Impervious Buildings		129	34.77 ± 2.47	3.06 ± 0.22
IO	Impervious Other		3	0.81 ± 0.47	0.07 ± 0.04
IR	Impervious Road		32	8.63 ± 1.46	0.76 ± 0.13
S	Soil/Bare Ground		87	23.45 ± 2.20	2.06 ± 0.19
T	Tree/Shrub		66	17.79 ± 1.99	1.56 ± 0.17
W	Water		1	0.27 ± 0.27	0.02 ± 0.02
<b>Total</b>			<b>371</b>	<b>100.00</b>	<b>8.79</b>

### Tree Benefit Estimates: Carbon (English units)

Description	Carbon (kT)	±SE	CO <sub>2</sub> Equiv. (kT)	±SE	Value (USD)	±SE
Sequestered annually in trees	1.37	±0.15	5.01	±0.56	\$232,941	±25,998
Stored in trees (Note: this benefit is not an annual rate)	34.30	±3.83	125.77	±14.04	\$5,850,025	±652,903

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Carbon sequestered is based on 0.874 kT/mi<sup>2</sup>/yr. Carbon stored is based on 21.940 kT/mi<sup>2</sup>. Carbon is valued at \$46,513.84/kT. (English units: kT = kilotons (1,000 tons), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Amount (lb)	±SE	Value (USD)	±SE
CO	Carbon Monoxide removed annually	902.21	±100.69	\$38	±4
NO <sub>2</sub>	Nitrogen Dioxide removed annually	4,919.54	±549.05	\$66	±7
O <sub>3</sub>	Ozone removed annually	48,996.41	±5,468.34	\$3,441	±384
PM <sub>10</sub> *	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	16,411.98	±1,831.69	\$2,498	±279
PM <sub>2.5</sub>	Particulate Matter less than 2.5 microns removed annually	2,380.82	±265.72	\$7,113	±794
SO <sub>2</sub>	Sulfur Dioxide removed annually	3,100.17	±346.00	\$12	±1
<b>Total</b>		<b>76,711.12</b>	<b>±8,561.49</b>	<b>\$13,169</b>	<b>±1,470</b>

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Air Pollution Estimates are based on these values in lb/mi<sup>2</sup>/yr @ \$/lb/yr:

CO 577.084 @ \$0.04 | NO<sub>2</sub> 3,146.698 @ \$0.01 | O<sub>3</sub> 31,339.728 @ \$0.07 | PM<sub>10</sub>\* 10,497.643 @ \$0.15 | PM<sub>2.5</sub> 1,522.851 @ \$2.99 | SO<sub>2</sub> 1,982.970 @ \$0.00 (English units: lb = pounds, mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Hydrological (English units)

Abbr.	Benefit	Amount (gal)	±SE	Value (USD)	±SE
AVRO	Avoided Runoff	517.40	±57.75	\$5	±1
E	Evaporation	42,718.20	±4,767.64	N/A	N/A
I	Interception	42,957.26	±4,794.33	N/A	N/A
T	Transpiration	57,804.31	±6,451.36	N/A	N/A
PE	Potential Evaporation	323,694.52	±36,126.54	N/A	N/A
PET	Potential Evapotranspiration	264,107.65	±29,476.23	N/A	N/A

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Hydrological Estimates are based on these values in gal/mi<sup>2</sup>/yr @ \$/gal/yr:

AVRO 330.949 @ \$0.01 | E 27,323.972 @ N/A | I 27,476.886 @ N/A | T 36,973.547 @ N/A | PE 207,045.729 @ N/A | PET 168,931.995 @ N/A (English units: gal = gallons, mi<sup>2</sup> = square miles)

#### About i-Tree Canopy

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#### Limitations of i-Tree Canopy

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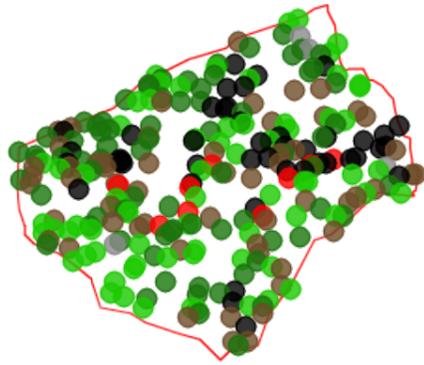


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# i-Tree Canopy v7.0

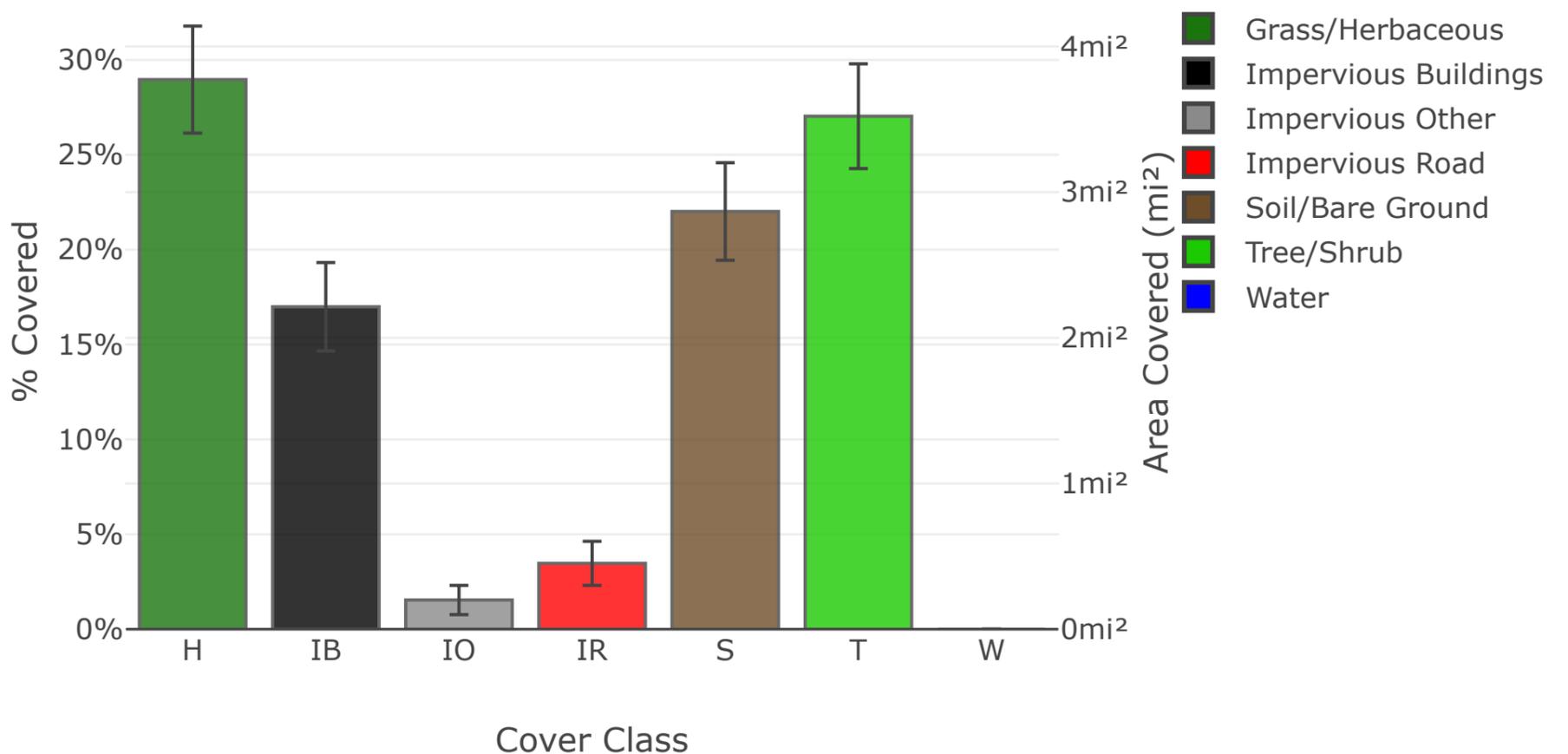
## Cover Assessment and Tree Benefits Report Yaoundé 7

Estimated using random sampling statistics on 5/4/2020



Google

### Land Cover



Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (mi <sup>2</sup> ) ± SE
H	Grass/Herbaceous		75	28.96 ± 2.82	3.77 ± 0.37
IB	Impervious Buildings		44	16.99 ± 2.33	2.21 ± 0.30
IO	Impervious Other		4	1.54 ± 0.77	0.20 ± 0.10
IR	Impervious Road		9	3.47 ± 1.16	0.45 ± 0.15
S	Soil/Bare Ground		57	22.01 ± 2.57	2.86 ± 0.34
T	Tree/Shrub		70	27.03 ± 2.76	3.52 ± 0.36
W	Water		0	0.00 ± 0.00	0.00 ± 0.00
<b>Total</b>			<b>259</b>	<b>100.00</b>	<b>13.01</b>

### Tree Benefit Estimates: Carbon (English units)

Description	Carbon (kT)	±SE	CO <sub>2</sub> Equiv. (kT)	±SE	Value (USD)	±SE
Sequestered annually in trees	3.07	±0.31	11.27	±1.15	\$524,047	±53,506
Stored in trees (Note: this benefit is not an annual rate)	77.17	±7.88	282.94	±28.89	\$13,160,790	±1,343,736

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Carbon sequestered is based on 0.874 kT/mi<sup>2</sup>/yr. Carbon stored is based on 21.940 kT/mi<sup>2</sup>. Carbon is valued at \$46,513.84/kT. (English units: kT = kilotons (1,000 tons), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Amount (T)	±SE	Value (USD)	±SE
CO	Carbon Monoxide removed annually	1.01	±0.10	\$86	±9
NO <sub>2</sub>	Nitrogen Dioxide removed annually	5.53	±0.57	\$149	±15
O <sub>3</sub>	Ozone removed annually	55.11	±5.63	\$7,742	±790
PM <sub>10</sub> *	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	18.46	±1.88	\$5,620	±574
PM <sub>2.5</sub>	Particulate Matter less than 2.5 microns removed annually	2.68	±0.27	\$16,003	±1,634
SO <sub>2</sub>	Sulfur Dioxide removed annually	3.49	±0.36	\$26	±3
<b>Total</b>		<b>86.29</b>	<b>±8.81</b>	<b>\$29,626</b>	<b>±3,025</b>

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Air Pollution Estimates are based on these values in T/mi<sup>2</sup>/yr @ \$/T/yr:

CO 0.289 @ \$85.08 | NO<sub>2</sub> 1.573 @ \$26.86 | O<sub>3</sub> 15.670 @ \$140.47 | PM<sub>10</sub>\* 5.249 @ \$304.43 | PM<sub>2.5</sub> 0.761 @ \$5,975.67 | SO<sub>2</sub> 0.991 @ \$7.45 (English units: T = tons (2,000 pounds), mi<sup>2</sup> = square miles)

### Tree Benefit Estimates: Hydrological (English units)

Abbr.	Benefit	Amount (Kgal)	±SE	Value (USD)	±SE
AVRO	Avoided Runoff	1.16	±0.12	\$10	±1
E	Evaporation	96.10	±9.81	N/A	N/A
I	Interception	96.64	±9.87	N/A	N/A
T	Transpiration	130.04	±13.28	N/A	N/A
PE	Potential Evaporation	728.21	±74.35	N/A	N/A
PET	Potential Evapotranspiration	594.16	±60.66	N/A	N/A

Currency is in USD. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Hydrological Estimates are based on these values in Kgal/mi<sup>2</sup>/yr @ \$/Kgal/yr:

AVRO 0.331 @ \$8.94 | E 27.324 @ N/A | I 27.477 @ N/A | T 36.974 @ N/A | PE 207.046 @ N/A | PET 168.932 @ N/A (English units: Kgal = thousands of gallons, mi<sup>2</sup> = square miles)

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