iTree Academy 2020 Capstone Project

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Canopy studies of Southwestern quarter and eighth areas of Greenfield, Indiana 46140

These quadrants encompass several new housing developments, 2 churches with large open grassy areas, downtown commercial areas, City utility properties, some agriculture and a mix of a range of socio-economic income residents.

Because of the very small street tree easements which occur in the lower socio-economic neighborhoods located south of our downtown, I was interested to know where we might focus tree planting efforts to bring improved environmental benefits to these areas. This seems to be only the start of such an investigation.

First study – Southwest 1/8 portion of Greenfield

This neighborhood includes a large number of small homes on small lots. Street easements are, in many cases, too narrow for street tree planting of even the smallest caliper. It also includes sections of the well-wooded Pennsy Trail and numerous light industrial and City utility properties.

27.35% grass/herbaceous
11.43% trees
Impervious (total all) 45%

There are some areas that would be appropriate for tree planting projects, primarily by bulking up tree plantings along the Pennsy Trail and at the edges of municipal utility properties. Anticipated growth of canopy percentage would probably not exceed 15% of the total area.

Second study – Southwest quadrant of Greenfield

This area incorporates and expands the survey area of the first study, adding several neighborhoods of larger homes and lots, agricultural parcels and 2 churches with large grassed areas.

41.60% grass/herbaceous
15.40% trees
Impervious (total all) 35%

This area includes more residential neighborhoods which could be encouraged to increase tree planting on individual owners' properties. The several churches with large open grassed areas could also be encouraged to make tree planting a part of their mission.

With the expansion into the neighborhoods with larger lots (unless their 'codes' prohibit more plantings) we could perhaps encourage enough homeowners to add more trees, enough to boost the canopy cover to 20%. (Sad….)

In both areas (they are combined), there are many plantable spaces. As always, one of the difficulties is convincing residents and City entities to take on the (usually) minor tree maintenance of a newly planted tree. Our volunteer organization does care for street and some Parks plantings, and, as yet, has not chosen to take on a more varied program of encouraging industrial and municipal facilities, and even housing 'developments', to take on the care of new trees.
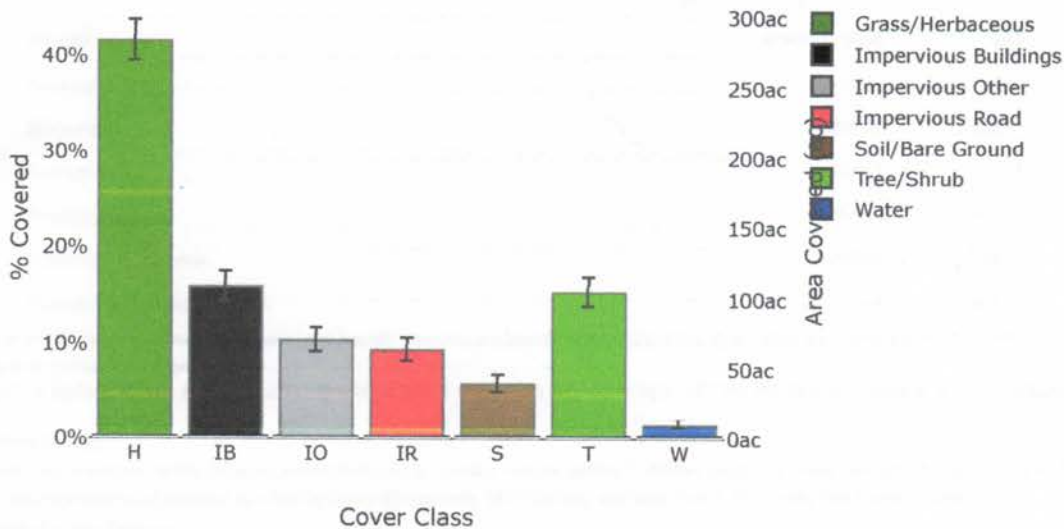
Southwest quadrant 1/4th

i-Tree Canopy v7.0

Cover Assessment and Tree Benefits Report

Estimated using random sampling statistics on 5/1/2020

Imagery ©2020 , IndianaMap Framework Data, Landsat / Copernicus, Maxar Technologies, USDA F: Report a map error

Land Cover

Legend:
- Grass/Herbaceous
- Impervious Buildings
- Impervious Other
- Impervious Road
- Soil/Bare Ground
- Tree/Shrub
- Water

Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (ac) ± SE
H	Grass/Herbaceous		208	41.60 ± 2.20	283.55 ± 15.02
IB	Impervious Buildings		80	16.00 ± 1.64	109.06 ± 11.18
IO	Impervious Other		52	10.40 ± 1.37	70.89 ± 9.31

Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (ac) ± SE
IR	Impervious Road		47	9.40 ± 1.31	64.07 ± 8.90
S	Soil/Bare Ground		29	5.80 ± 1.05	39.53 ± 7.13
T	Tree/Shrub		77	15.40 ± 1.61	104.97 ± 11.00
W	Water		7	1.40 ± 0.53	9.54 ± 3.61
Total			**500**	**100.00**	**681.62**

Tree Benefit Estimates: Carbon (English units)

Description	Carbon (T)	±SE	CO_2 Equiv. (T)	±SE	Value (USD)	±SE
Sequestered annually in trees	143.29	±15.02	525.39	±55.07	$24,438	±2,562
Stored in trees (Note: this benefit is not an annual rate)	3,598.48	±377.19	13,194.44	±1,383.03	$613,724	±64,330

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 1.365 T/ac/yr. Carbon stored is based on 34.281 T/ac. Carbon is valued at $46.51/T. (English units: T = tons (2,000 pounds), ac = acres)

Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Amount (lb)	±SE	Value (USD)	±SE
CO	Carbon Monoxide removed annually	94.65	±9.92	$4	±0
NO2	Nitrogen Dioxide removed annually	516.11	±54.10	$7	±1
O3	Ozone removed annually	5,140.20	±538.79	$361	±38
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	1,721.77	±180.47	$262	±27
PM2.5	Particulate Matter less than 2.5 microns removed annually	249.77	±26.18	$746	±78
SO2	Sulfur Dioxide removed annually	325.24	±34.09	$1	±0
Total		**8,047.74**	**±843.56**	**$1,382**	**±145**

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/ac/yr @ $/lb/yr:
CO 0.902 @ $0.04 | NO2 4.917 @ $0.01 | O3 48.968 @ $0.07 | PM10* 16.403 @ $0.15 | PM2.5 2.379 @ $2.99 | SO2 3.098 @ $0.00 (English units: lb = pounds, ac = acres)

Tree Benefit Estimates: Hydrological (English units)

Abbr.	Benefit	Amount (gal)	±SE	Value (USD)	±SE
AVRO	Avoided Runoff	54.28	±5.69	$0	±0
E	Evaporation	4,481.55	±469.75	N/A	N/A
I	Interception	4,506.63	±472.38	N/A	N/A
T	Transpiration	6,064.23	±635.65	N/A	N/A
PE	Potential Evaporation	33,958.68	±3,559.51	N/A	N/A
PET	Potential Evapotranspiration	27,707.44	±2,904.27	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/ac/yr @ $/gal/yr:
AVRO 0.517 @ $0.01 | E 42.694 @ N/A | I 42.933 @ N/A | T 57.771 @ N/A | PE 323.509 @ N/A | PET 263.956 @ N/A (English units: gal = gallons, ac = acres)

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.

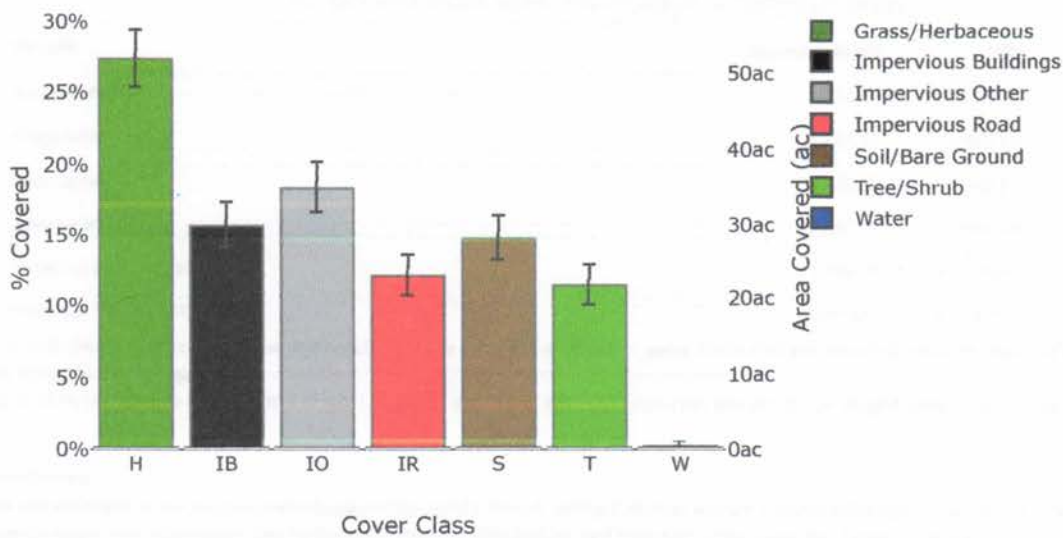Use of this tool indicates acceptance of the EULA

i-Tree Canopy v7.0

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Estimated using random sampling statistics on 5/4/2020

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Land Cover

Legend:
- Grass/Herbaceous
- Impervious Buildings
- Impervious Other
- Impervious Road
- Soil/Bare Ground
- Tree/Shrub
- Water

Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (ac) ± SE
H	Grass/Herbaceous		122	27.35 ± 2.11	52.02 ± 4.01
IB	Impervious Buildings		70	15.70 ± 1.72	29.85 ± 3.28
IO	Impervious Other		82	18.39 ± 1.83	34.96 ± 3.49

Abbr.	Cover Class	Description	Points	% Cover ± SE	Area (ac) ± SE
IR	Impervious Road		54	12.11 ± 1.54	23.02 ± 2.94
S	Soil/Bare Ground		66	14.80 ± 1.68	28.14 ± 3.20
T	Tree/Shrub		51	11.43 ± 1.51	21.75 ± 2.87
W	Water		1	0.22 ± 0.22	0.43 ± 0.43
Total			**446**	**100.00**	**190.16**

Tree Benefit Estimates: Carbon (English units)

Description	Carbon (T)	±SE	CO_2 Equiv. (T)	±SE	Value (USD)	±SE
Sequestered annually in trees	29.68	±3.91	108.84	±14.34	$2,531	±334
Stored in trees (Note: this benefit is not an annual rate)	745.45	±98.23	2,733.32	±360.19	$63,568	±8,377

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 1.365 T/ac/yr. Carbon stored is based on 34.281 T/ac. Carbon is valued at $23.26/T. (English units: T = tons (2,000 pounds), ac = acres)

Tree Benefit Estimates: Air Pollution (English units)

Abbr.	Description	Amount (lb)	±SE	Value (USD)	±SE
CO	Carbon Monoxide removed annually	14.01	±1.85	$1	±0
NO2	Nitrogen Dioxide removed annually	123.34	±16.25	$4	±0
O3	Ozone removed annually	925.05	±121.90	$125	±16
PM10*	Particulate Matter greater than 2.5 microns and less than 10 microns removed annually	177.26	±23.36	$48	±6
PM2.5	Particulate Matter less than 2.5 microns removed annually	37.34	±4.92	$262	±35
SO2	Sulfur Dioxide removed annually	86.19	±11.36	$1	±0
Total		**1,363.19**	**±179.64**	**$441**	**±58**

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/ac/yr @ $/lb/yr:
CO 0.644 @ $0.09 | NO2 5.672 @ $0.03 | O3 42.541 @ $0.14 | PM10* 8.151 @ $0.27 | PM2.5 1.717 @ $7.03 | SO2 3.964 @ $0.01 (English units: lb = pounds, ac = acres)

Tree Benefit Estimates: Hydrological (English units)

Abbr.	Benefit	Amount (Kgal)	±SE	Value (USD)	±SE
AVRO	Avoided Runoff	30.08	±3.96	$269	±35
E	Evaporation	1,283.32	±169.11	N/A	N/A
I	Interception	1,283.32	±169.11	N/A	N/A
T	Transpiration	3,676.05	±484.43	N/A	N/A
PE	Potential Evaporation	13,499.05	±1,778.89	N/A	N/A
PET	Potential Evapotranspiration	9,446.92	±1,244.91	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/ac/yr @ $/Kgal/yr:
AVRO 1.383 @ $8.94 | E 59.016 @ N/A | I 59.016 @ N/A | T 169.051 @ N/A | PE 620.783 @ N/A | PET 434.437 @ N/A (English units: Kgal = thousands of gallons, ac = acres)

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