# Change Analysis of Canopy Cover in La Crosse, Indiana

More small communities are beginning to reach out to the Indiana Department of Natural Resources (IDNR) Community and Urban Forestry (CUF) program for first time assistance. The urban forests in these communities have often never been managed or are infrequently managed when resources allow. Communities just starting to research how to manage their urban forest resource can feel overwhelmed by the lack of specific information they possess about their trees. As many of these communities have no designated staff, budget, or other resources for their trees it makes establishing a management plan more of a challenge. Canopy cover assessments using i-Tree Canopy are a free and relatively quick and easy way to provide new communities a starting point in their management journey.

*LaPorte County is located in the northwest region of Indiana.*

## Brief Background La Crosse

La Crosse is a rural town located in the southwest portion of LaPorte County. According to the US Census Bureau, it had an estimated population of 531 people in 2018 and covers approximately half of a square mile of land.

## Cover Class Selection

The format and description of the seven default cover classes were slightly modified. The biggest adjustment was the addition of the *Ag Field* cover class. La Crosse is a rural community and a quick visual assessment showed that agricultural fields are an abundant land use. It seemed worthwhile to separate it out from *Grass/Herbaceous* (or *Soil/Bare Ground* depending on the timing of the aerial images).

| Abbr. | Cover Class | Description |
|---|---|---|
| T | Tree/Shrub | anything that looks like a tree |
| H | Grass/Herbaceous | anything herbaceous that's not a tree or shrub |
| B | Impervious Buildings | impervious footprints of buildings |
| R | Roads | roads made of concrete, blacktop, gravel, etc. |
| I | Impervious Other | parking lots, sidewalks, and any other impervious surface that's not a road or building |
| W | Water | standing water |
| S | Soil/Bare Ground | miscellaneous pervious surfaces |
| A | Ag Field | either bare soil or herbaceous cover that is part of an agricultural field |

## Change Comparison Method

A canopy assessment was completed using 400 points. The newest available aerial imagery of La Crosse utilized in i-Tree Canopy was from April 22, 2017. The survey points were then uploaded into Google Earth Pro and the historical imagery feature was used to conduct the change analysis survey. Imagery from February 28, 2005 was selected as it was the oldest data with the highest resolution to ease the comparison process. This timeframe was expected to capture some of the aftereffects of emerald ash borer.

The 400 points from 2017 and their respective cover class abbreviations were input into an Excel spreadsheet. The cells were conditionally formatted to match their corresponding color used in i-Tree Canopy. Analysis began in Google Earth Pro by zooming into the northwest corner and recording the cover class in the spreadsheet for each visible point. Once all points were recorded the view was moved to new points. The survey was completed in a west to east and north to south grid. Any individual points missed in this method were found by clicking on the desired number in i-Tree Canopy so it zoomed into the point and gave a general idea of where it was on the map. For points that did change cover class, an observational cause was also noted.

## Change Analysis

Overall, 57 points showed a change in cover class from 2005 to 2017. The *Tree/Shrub*, *Grass/Herbaceous*, *Impervious Buildings*, and *Impervious Other* all showed net gains while *Ag Field* had a net loss. There was a net gain of two points classified as canopy.

Almost all the *Tree/Shrub* gains in 2017 appear to be from growth of existing trees, and not the planting of new trees. Only one *Tree/Shrub* loss seemed to be the apparent result of a construction project, while a handful of others seem to be from fencerow clearing. All trees were completely removed, so cause can only be inferenced.

| Cover Class | | 2005 | 2017 | NET CHANGE |
|---|---|---|---|---|
| Tree/Shrub | T | 64 | 66 | 2 |
| Grass/Herbaceous | H | 126 | 129 | 3 |
| Impervious Buildings | B | 20 | 21 | 1 |
| Roads | R | 31 | 31 | 0 |
| Impervious Other | I | 18 | 19 | 1 |
| Water | W | 0 | 0 | 0 |
| Soil/Bare Ground | S | 29 | 29 | 0 |
| Ag Field | A | 112 | 105 | -7 |
| **TOTAL** | | **400** | **400** | **57** |

*Net Change*

| 2005 | 2017 | # Change |
|---|---|---|
| TREE GAIN | | 18 |
| H | T | 16 |
| S | T | 1 |
| I | T | 1 |
| TREE LOSS | | 16 |
| T | H | 10 |
| T | S | 4 |
| T | I | 1 |
| T | B | 1 |
| NON TREE | | 23 |
| H | S | 3 |
| H | I | 1 |
| H | B | 1 |
| S | H | 8 |
| S | B | 1 |
| B | S | 2 |
| A | S | 1 |
| A | H | 6 |

*Total Change*

| | 05 | 17 | | 05 | 17 | | 05 | 17 | | 05 | 17 | | 05 | 17 | | 05 | 17 | | 05 | 17 | | 05 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | T | T | 51 | T | T | 101 | B | S | 151 | H | H | 201 | H | H | 251 | A | A | 301 | T | T | 351 | S | H |
| 2 | A | A | 52 | H | H | 102 | H | H | 152 | H | T | 202 | H | H | 252 | R | R | 302 | H | H | 352 | A | A |
| 3 | I | I | 53 | H | T | 103 | A | A | 153 | A | A | 203 | A | A | 253 | I | I | 303 | R | R | 353 | H | H |
| 4 | A | A | 54 | T | H | 104 | A | A | 154 | A | A | 204 | H | H | 254 | A | A | 304 | H | T | 354 | A | A |
| 5 | H | H | 55 | A | A | 105 | T | T | 155 | A | A | 205 | H | S | 255 | H | H | 305 | B | B | 355 | H | H |
| 6 | H | H | 56 | H | T | 106 | B | B | 156 | A | A | 206 | H | H | 256 | A | A | 306 | H | T | 356 | I | I |
| 7 | T | T | 57 | A | A | 107 | A | H | 157 | A | A | 207 | A | A | 257 | I | I | 307 | R | R | 357 | H | H |
| 8 | H | H | 58 | A | A | 108 | T | T | 158 | H | H | 208 | I | I | 258 | A | A | 308 | H | H | 358 | H | H |
| 9 | T | T | 59 | A | A | 109 | A | A | 159 | H | H | 209 | H | H | 259 | S | T | 309 | H | H | 359 | H | H |
| 10 | H | H | 60 | T | B | 110 | R | R | 160 | H | H | 210 | A | A | 260 | A | A | 310 | H | H | 360 | R | R |
| 11 | H | H | 61 | A | A | 111 | A | A | 161 | H | H | 211 | H | H | 261 | S | S | 311 | A | A | 361 | T | T |
| 12 | I | I | 62 | H | H | 112 | T | H | 162 | B | B | 212 | S | S | 262 | A | A | 312 | T | T | 362 | T | H |
| 13 | A | A | 63 | T | T | 113 | T | T | 163 | H | S | 213 | T | T | 263 | A | H | 313 | T | T | 363 | A | A |
| 14 | A | A | 64 | I | I | 114 | R | R | 164 | A | A | 214 | A | A | 264 | R | R | 314 | I | I | 364 | S | H |
| 15 | A | A | 65 | H | H | 115 | A | A | 165 | T | T | 215 | H | H | 265 | H | T | 315 | B | B | 365 | B | B |
| 16 | H | H | 66 | T | T | 116 | A | A | 166 | H | T | 216 | R | R | 266 | A | A | 316 | T | T | 366 | B | B |
| 17 | H | H | 67 | T | T | 117 | H | H | 167 | B | B | 217 | T | T | 267 | B | B | 317 | H | H | 367 | H | H |
| 18 | H | H | 68 | H | H | 118 | H | H | 168 | T | T | 218 | R | R | 268 | A | A | 318 | A | A | 368 | H | H |
| 19 | A | A | 69 | S | S | 119 | H | H | 169 | A | A | 219 | T | T | 269 | B | B | 319 | H | H | 369 | T | S |
| 20 | T | T | 70 | T | T | 120 | S | S | 170 | S | S | 220 | R | R | 270 | A | A | 320 | T | T | 370 | H | T |
| 21 | T | T | 71 | B | B | 121 | H | H | 171 | I | I | 221 | A | A | 271 | H | H | 321 | H | H | 371 | B | B |
| 22 | A | A | 72 | T | T | 122 | H | H | 172 | A | A | 222 | H | H | 272 | H | H | 322 | A | A | 372 | A | A |
| 23 | S | S | 73 | B | B | 123 | H | T | 173 | A | A | 223 | R | R | 273 | T | H | 323 | H | T | 373 | T | T |
| 24 | H | T | 74 | H | H | 124 | R | R | 174 | A | A | 224 | R | R | 274 | A | A | 324 | S | H | 374 | T | T |
| 25 | R | R | 75 | H | H | 125 | S | S | 175 | H | H | 225 | T | T | 275 | I | I | 325 | R | R | 375 | A | A |
| 26 | T | H | 76 | R | R | 126 | I | I | 176 | A | A | 226 | H | H | 276 | A | A | 326 | H | H | 376 | A | A |
| 27 | T | I | 77 | T | T | 127 | H | H | 177 | S | H | 227 | T | T | 277 | A | A | 327 | A | A | 377 | T | T |
| 28 | S | H | 78 | H | H | 128 | B | B | 178 | A | A | 228 | H | H | 278 | T | H | 328 | T | T | 378 | T | S |
| 29 | S | S | 79 | T | T | 129 | A | H | 179 | A | A | 229 | H | H | 279 | A | A | 329 | H | H | 379 | S | S |
| 30 | S | H | 80 | H | H | 130 | T | H | 180 | A | A | 230 | H | H | 280 | T | T | 330 | I | T | 380 | S | S |
| 31 | S | H | 81 | H | H | 131 | A | A | 181 | A | A | 231 | R | R | 281 | T | T | 331 | A | A | 381 | I | I |
| 32 | R | R | 82 | H | H | 132 | H | B | 182 | I | I | 232 | H | H | 282 | T | S | 332 | I | I | 382 | H | H |
| 33 | B | S | 83 | S | S | 133 | H | H | 183 | A | A | 233 | T | T | 283 | H | H | 333 | T | T | 383 | A | A |
| 34 | H | H | 84 | T | T | 134 | A | A | 184 | H | H | 234 | A | A | 284 | H | H | 334 | A | A | 384 | H | H |
| 35 | A | H | 85 | A | A | 135 | H | H | 185 | H | H | 235 | A | A | 285 | R | R | 335 | S | S | 385 | H | I |
| 36 | H | H | 86 | A | A | 136 | R | R | 186 | R | R | 236 | B | B | 286 | A | A | 336 | H | H | 386 | T | H |
| 37 | H | H | 87 | H | H | 137 | H | H | 187 | A | A | 237 | A | A | 287 | H | H | 337 | S | S | 387 | A | A |
| 38 | H | T | 88 | H | H | 138 | S | S | 188 | H | H | 238 | A | A | 288 | A | A | 338 | H | H | 388 | H | H |
| 39 | R | R | 89 | H | H | 139 | H | S | 189 | I | I | 239 | H | H | 289 | A | S | 339 | A | A | 389 | A | A |
| 40 | A | A | 90 | H | H | 140 | R | R | 190 | A | A | 240 | H | H | 290 | A | A | 340 | S | S | 390 | A | A |
| 41 | A | A | 91 | H | H | 141 | R | R | 191 | R | R | 241 | T | H | 291 | S | S | 341 | H | H | 391 | H | H |
| 42 | H | T | 92 | T | T | 142 | H | H | 192 | H | H | 242 | A | A | 292 | T | T | 342 | A | A | 392 | H | H |
| 43 | A | A | 93 | H | H | 143 | R | R | 193 | R | R | 243 | I | I | 293 | T | S | 343 | A | A | 393 | T | T |
| 44 | H | T | 94 | A | A | 144 | A | A | 194 | H | H | 244 | H | H | 294 | A | A | 344 | A | A | 394 | H | H |
| 45 | S | S | 95 | S | S | 145 | A | A | 195 | S | B | 245 | A | A | 295 | H | T | 345 | H | H | 395 | H | H |
| 46 | T | T | 96 | R | R | 146 | B | B | 196 | H | T | 246 | T | T | 296 | T | H | 346 | R | R | 396 | A | A |
| 47 | T | T | 97 | S | H | 147 | H | H | 197 | A | A | 247 | H | H | 297 | S | S | 347 | R | R | 397 | A | H |
| 48 | A | H | 98 | H | H | 148 | A | A | 198 | H | H | 248 | T | T | 298 | A | A | 348 | B | B | 398 | A | A |
| 49 | A | A | 99 | R | R | 149 | A | A | 199 | T | T | 249 | H | H | 299 | H | H | 349 | A | A | 399 | A | A |
| 50 | A | A | 100 | A | A | 150 | B | B | 200 | B | B | 250 | H | H | 300 | T | T | 350 | I | I | 400 | T | T |

*A visual representation from the spreadsheet of the 400 points and their cover classes in 2005 and 2017.*

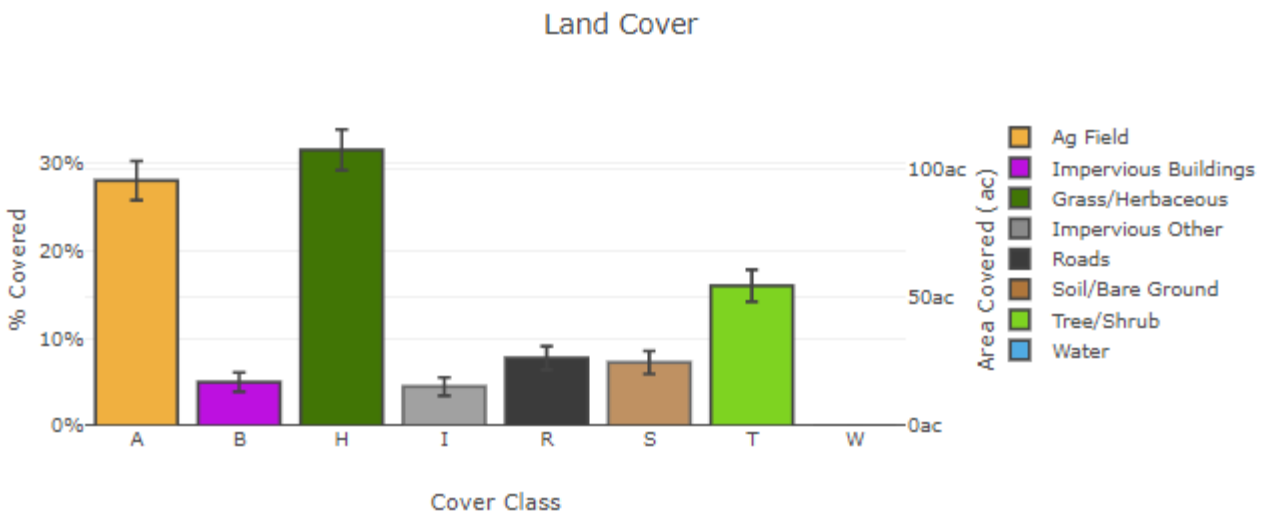
| KEY | |
|---|---|
| **Abbr.** | **Cover Class** |
| T | Tree/Shrub |
| H | Grass/Herbaceous |
| B | Impervious Buildings |
| R | Roads |
| I | Impervious Other |
| W | Water |
| S | Soil/Bare Ground |
| A | Ag Field |

*An example of a point changing cover class.*

***ABOVE*** *Point 112 was classified as* Grass/Herbaceous *in the original i-Tree Canopy assessment using the 2017 aerial imagery.*

***BELOW*** *The historical imagery analysis used in Google Earth Pro showed there used to be a tree in the same spot in 2005.*

## i-Tree Canopy Analysis



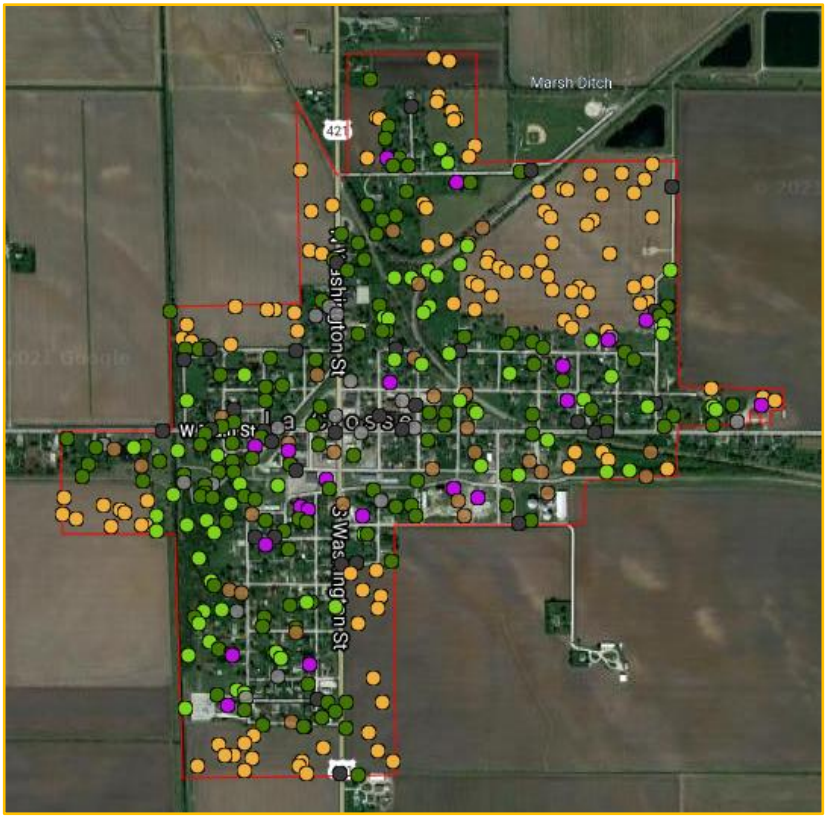

*This is the graph from the 2017 analysis, but the changes in cover class were so minute that at this scale there wasn't really an observable difference between the two graphs so only one was included.*

| Abbr. | Cover Class | Description | Points | % Cover ± SE | Area (ac) ± SE |
|---|---|---|---|---|---|
| A | Ag Field | either bare soil or herbaceous cover that is part of an agricultural field | 112 | 28.00 ± 2.24 | 95.24 ± 7.64 |
| B | Impervious Buildings | impervious footprints of buildings | 20 | 5.00 ± 1.09 | 17.01 ± 3.71 |
| H | Grass/Herbaceous | anything herbaceous that's not a tree or shrub | 126 | 31.50 ± 2.32 | 107.14 ± 7.90 |
| I | Impervious Other | parking lots, sidewalks, and any other impervious surface that's not a road or building | 18 | 4.50 ± 1.04 | 15.31 ± 3.53 |
| R | Roads | roads made of concrete, blacktop, gravel, etc. | 31 | 7.75 ± 1.34 | 26.36 ± 4.55 |
| S | Soil/Bare Ground | miscellaneous pervious surfaces | 29 | 7.25 ± 1.30 | 24.66 ± 4.41 |
| T | Tree/Shrub | anything that looks like a tree | 64 | 16.00 ± 1.83 | 54.42 ± 6.23 |
| W | Water | standing water | 0 | 0.00 ± 0.00 | 0.00 ± 0.00 |
| **Total** | | | **400** | **100.00** | **340.14** |

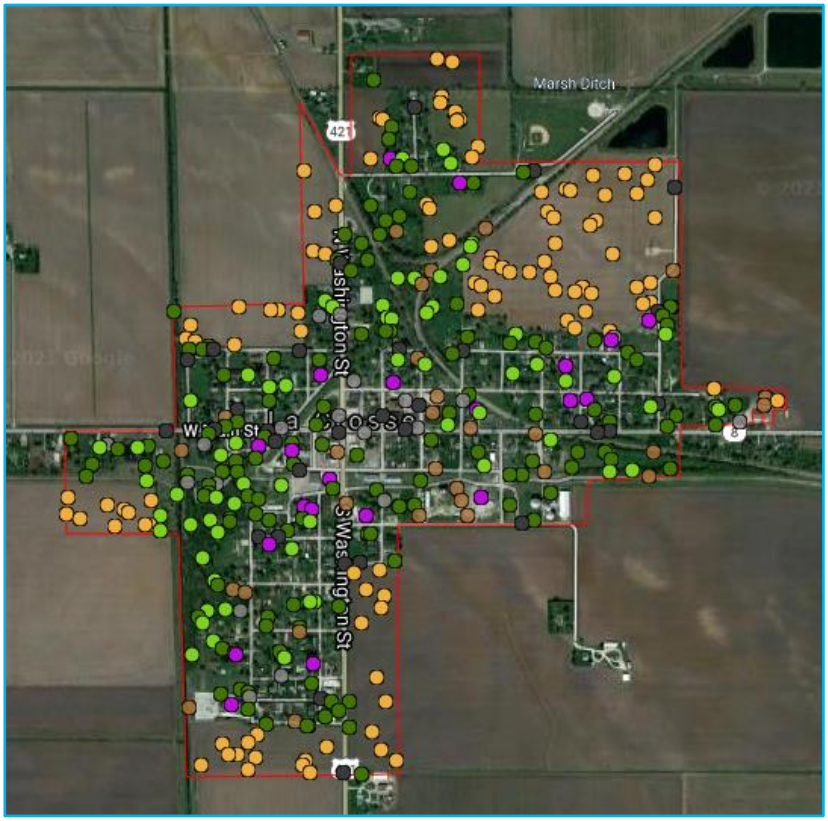
*2005*

| Abbr. | Cover Class | Description | Points | % Cover ± SE | Area (ac) ± SE |
|---|---|---|---|---|---|
| A | Ag Field | either bare soil or herbaceous cover that is part of an agricultural field | 105 | 26.25 ± 2.20 | 89.29 ± 7.48 |
| B | Impervious Buildings | impervious footprints of buildings | 21 | 5.25 ± 1.12 | 17.86 ± 3.79 |
| H | Grass/Herbaceous | anything herbaceous that's not a tree or shrub | 129 | 32.25 ± 2.34 | 109.70 ± 7.95 |
| I | Impervious Other | parking lots, sidewalks, and any other impervious surface that's not a road or building | 19 | 4.75 ± 1.06 | 16.16 ± 3.62 |
| R | Roads | roads made of concrete, blacktop, gravel, etc. | 31 | 7.75 ± 1.34 | 26.36 ± 4.55 |
| S | Soil/Bare Ground | miscellaneous pervious surfaces | 29 | 7.25 ± 1.30 | 24.66 ± 4.41 |
| T | Tree/Shrub | anything that looks like a tree | 66 | 16.50 ± 1.86 | 56.12 ± 6.31 |
| W | Water | standing water | 0 | 0.00 ± 0.00 | 0.00 ± 0.00 |
| **Total** | | | **400** | **100.00** | **340.14** |

*2017*


Marsh Ditch
421
W Washington St
S Washington St

*2005*


Marsh Ditch
421
W Washington St
S Washington St

*2017*

## Tree Benefit Estimates: Carbon (English units)

| Description | Carbon (T) | ±SE | $CO_2$ Equiv. (T) | ±SE | Value (USD) | ±SE |
|---|---|---|---|---|---|---|
| Sequestered annually in trees | 60.69 | ±6.95 | 222.54 | ±25.50 | $10,351 | ±1,186 |
| Stored in trees (Note: this benefit is not an annual rate) | 1,865.67 | ±213.74 | 6,840.80 | ±783.71 | $318,192 | ±36,453 |

Currency is in USD and rounded. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Amount sequestered is based on 1.115 T of Carbon, or 4.089 T of $CO_2$, per ac/yr and rounded. Amount stored is based on 34.281 T of Carbon, or 125.697 T of $CO_2$, per ac and rounded. Value (USD) is based on $170.55/T of Carbon, or $46.51/T of $CO_2$ and rounded. (English units: T = tons (2,000 pounds), ac = acres)

*2005*

## Tree Benefit Estimates: Carbon (English units)

| Description | Carbon (T) | ±SE | $CO_2$ Equiv. (T) | ±SE | Value (USD) | ±SE |
|---|---|---|---|---|---|---|
| Sequestered annually in trees | 62.59 | ±7.04 | 229.50 | ±25.81 | $10,675 | ±1,201 |
| Stored in trees (Note: this benefit is not an annual rate) | 1,923.98 | ±216.41 | 7,054.58 | ±793.49 | $328,136 | ±36,908 |

Currency is in USD and rounded. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Amount sequestered is based on 1.115 T of Carbon, or 4.089 T of $CO_2$, per ac/yr and rounded. Amount stored is based on 34.281 T of Carbon, or 125.697 T of $CO_2$, per ac and rounded. Value (USD) is based on $170.55/T of Carbon, or $46.51/T of $CO_2$ and rounded. (English units: T = tons (2,000 pounds), ac = acres)

*2017*

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

| Abbr. | Description | Amount (lb) | ±SE | Value (USD) | ±SE |
|---|---|---|---|---|---|
| CO | Carbon Monoxide removed annually | 156.12 | ±17.89 | $2 | ±0 |
| NO2 | Nitrogen Dioxide removed annually | 445.05 | ±50.99 | $4 | ±1 |
| O3 | Ozone removed annually | 2,326.04 | ±266.48 | $193 | ±22 |
| SO2 | Sulfur Dioxide removed annually | 176.16 | ±20.18 | $1 | ±0 |
| PM2.5 | Particulate Matter less than 2.5 microns removed annually | 139.26 | ±15.95 | $440 | ±50 |
| PM10* | Particulate Matter greater than 2.5 microns and less than 10 microns removed annually | 957.13 | ±109.65 | $55 | ±6 |
| **Total** | | **4,199.76** | **±481.14** | **$694** | **±80** |

Currency is in USD and rounded. 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 and rounded: CO 2.869 @ $0.01 | NO2 8.178 @ $0.01 | O3 42.740 @ $0.08 | SO2 3.237 @ $0.00 | PM2.5 2.559 @ $3.16 | PM10* 17.587 @ $0.06 (English units: lb = pounds, ac = acres)

*2005*

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

| Abbr. | Description | Amount (lb) | ±SE | Value (USD) | ±SE |
|---|---|---|---|---|---|
| CO | Carbon Monoxide removed annually | 161.00 | ±18.11 | $2 | ±0 |
| NO2 | Nitrogen Dioxide removed annually | 458.96 | ±51.62 | $5 | ±1 |
| O3 | Ozone removed annually | 2,398.73 | ±269.81 | $199 | ±22 |
| SO2 | Sulfur Dioxide removed annually | 181.67 | ±20.43 | $1 | ±0 |
| PM2.5 | Particulate Matter less than 2.5 microns removed annually | 143.61 | ±16.15 | $453 | ±51 |
| PM10* | Particulate Matter greater than 2.5 microns and less than 10 microns removed annually | 987.04 | ±111.02 | $56 | ±6 |
| **Total** | | **4,331.00** | **±487.15** | **$716** | **±81** |

Currency is in USD and rounded. 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 and rounded: CO 2.869 @ $0.01 | NO2 8.178 @ $0.01 | O3 42.740 @ $0.08 | SO2 3.237 @ $0.00 | PM2.5 2.559 @ $3.16 | PM10* 17.587 @ $0.06 (English units: lb = pounds, ac = acres)

*2017*

## Tree Benefit Estimates: Hydrological (English units)

| Abbr. | Benefit | Amount (Kgal) | ±SE | Value (USD) | ±SE |
|---|---|---|---|---|---|
| AVRO | Avoided Runoff | 67.09 | ±7.69 | $600 | ±69 |
| E | Evaporation | 4,525.62 | ±518.47 | N/A | N/A |
| I | Interception | 4,526.30 | ±518.55 | N/A | N/A |
| T | Transpiration | 6,407.97 | ±734.13 | N/A | N/A |
| PE | Potential Evaporation | 30,260.37 | ±3,466.76 | N/A | N/A |
| PET | Potential Evapotranspiration | 22,395.90 | ±2,565.77 | N/A | N/A |

Currency is in USD and rounded. 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 and rounded:
AVRO 1.233 @ $8.94 | E 83.157 @ N/A | I 83.169 @ N/A | T 117.744 @ N/A | PE 556.024 @ N/A | PET 411.517 @ N/A (English units: Kgal = thousands of gallons, ac = acres)

*2005*

## Tree Benefit Estimates: Hydrological (English units)

| Abbr. | Benefit | Amount (Kgal) | ±SE | Value (USD) | ±SE |
|---|---|---|---|---|---|
| AVRO | Avoided Runoff | 69.19 | ±7.78 | $618 | ±70 |
| E | Evaporation | 4,667.04 | ±524.94 | N/A | N/A |
| I | Interception | 4,667.75 | ±525.02 | N/A | N/A |
| T | Transpiration | 6,608.22 | ±743.29 | N/A | N/A |
| PE | Potential Evaporation | 31,206.01 | ±3,510.02 | N/A | N/A |
| PET | Potential Evapotranspiration | 23,095.77 | ±2,597.79 | N/A | N/A |

Currency is in USD and rounded. 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 and rounded:
AVRO 1.233 @ $8.94 | E 83.157 @ N/A | I 83.169 @ N/A | T 117.744 @ N/A | PE 556.024 @ N/A | PET 411.517 @ N/A (English units: Kgal = thousands of gallons, ac = acres)

*2017*