ACWQ
Austin Canopy & Water Quality

Final Report: Austin Tree-Canopy Resource, Phase II

Urban Forestry Program and Urban Forestry Board, City of Austin, Texas

Spring 2012, Geography 4427, Texas State University
May 4, 2012

Summary

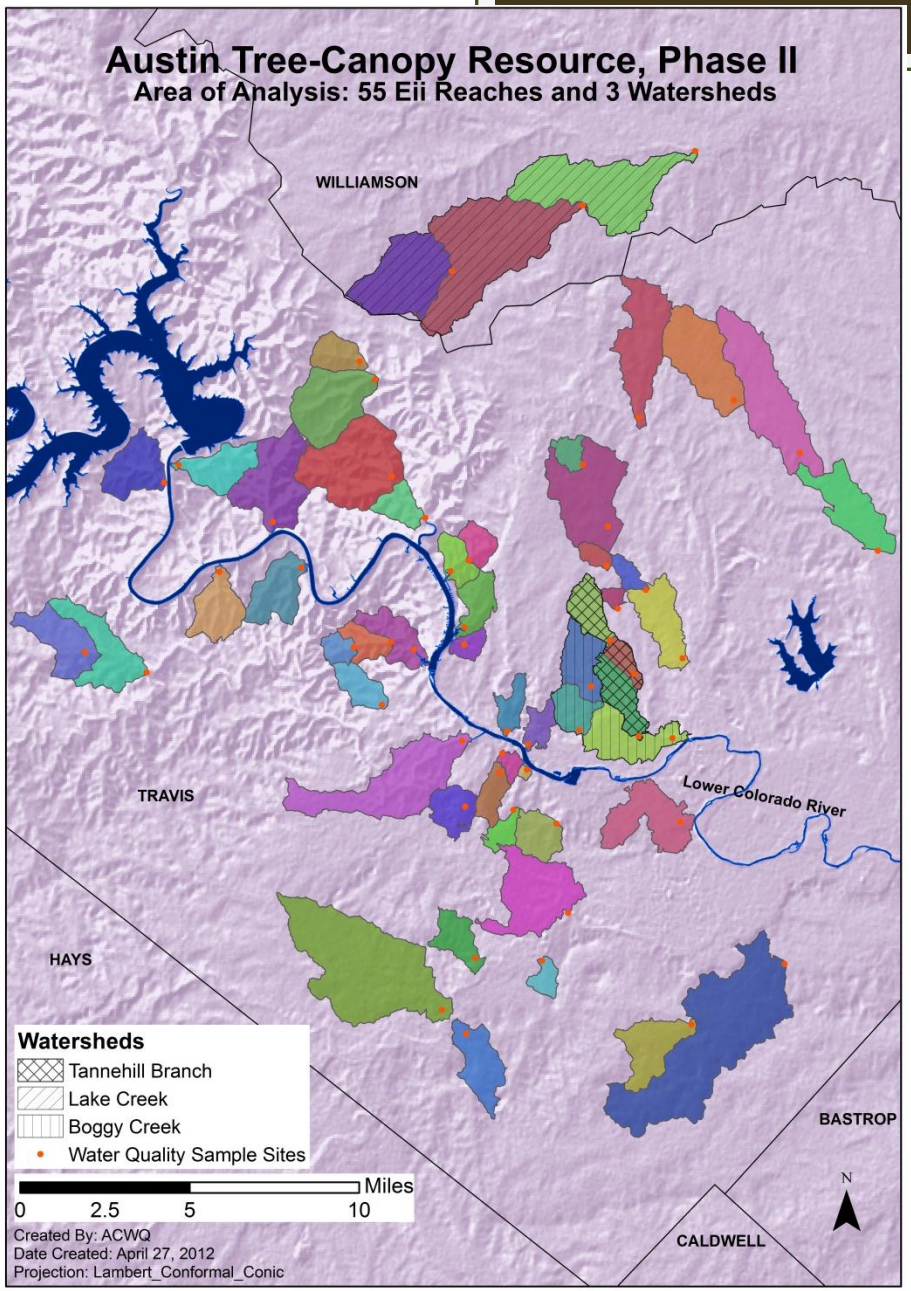
- The canopy of the tree is not only vital to the tree, but also the environment around it.
- City of Austin's Urban Forestry Program approached the team at Austin Canopy and Water Quality about this relationship.
- As GIS analysts and environmental researchers the team possesses the knowledge and skills needed to complete there request.

Purpose

- The purpose of ACWQ'S work was to determine the percentage of tree canopy/impervious cover for the EII reaches defined by the City of Austin.
- The team was also tasked with finding the percentage of canopy/impervious cover for the City of Austin's creek line buffer layer as well as a 300ft buffer.
- The ultimate goal of the project was to relate canopy/impervious cover to water quality within the EII Reaches and provide recommendations to planting areas.

Scope

- Study area included 126 EII reaches within 76 watersheds.
- Our area of analysis was limited to 55 reaches and 3 watersheds that contained water quality sample sites at or within 0.5 miles of the intersect of the downstream creek line and reach boundary.
- Sample sites selected contained data from 2011 as well as data on Turbidity, Water Temperature, and Total Inorganic Nitrogen levels.



Map 1.3. Area of Analysis: 55 Watersheds and 3 Watersheds

Literature Review

- Water Quality
  - Lowell Hughes
- Canopy Coverage
  - Ashley Zavala
- Impervious Cover
  - Eli Pruitt

Water Quality

- How trees benefit water quality
- Interception
- The benefits of trees

Canopy Coverage

- Remove pollution from the nation's waterways
- Urban development
- Benefits of Tree Canopy

Impervious Cover

- Impervious cover is any surface that does not allow rainfall to be absorbed or infiltrated through it.
- With the addition of impervious cover there is a loss of vegetation.
- Impervious cover can have a negative impact on water quality.

Data

- ESRI ArcGIS, a geographic information system, was used to evaluate selected benefits provided by the tree canopy in the City of Austin, Texas.
- ACWQ primary objective was to explore how water quality is related to the presence of tree canopy coverage with in the designated EII watershed reaches. Esri ArcMap will allow the team to calculate the percentage of tree canopy and impervious cover within the designated EII watershed reaches

Data

Table 1. Data

Data Set	Source
Tree Canopy	City of Austin (COA)
Watershed	City of Austin (COA)
Creek lines	City of Austin (COA)
County Lines	City of Austin (COA)
City boundary	City of Austin (COA)
Receiving Waters	City of Austin (COA)
EII REACH Watersheds	COA Urban Forestry Program
Digital Elevation Model (DEM)	COA Urban Forestry Program
Hillshade raster layer	Barton Springs Edwards Aquifer Conservation District (BSEACD)
Water Quality Monitoring Stations	Texas Commission on Environmental Quality (TCEQ)
Impervious Cover raster layer	United States Geological Survey (USGS)
Land Cover raster layer	United States Geological Survey (USGS)
National Hydrography dataset	United States Geological Survey (USGS)

Methodology

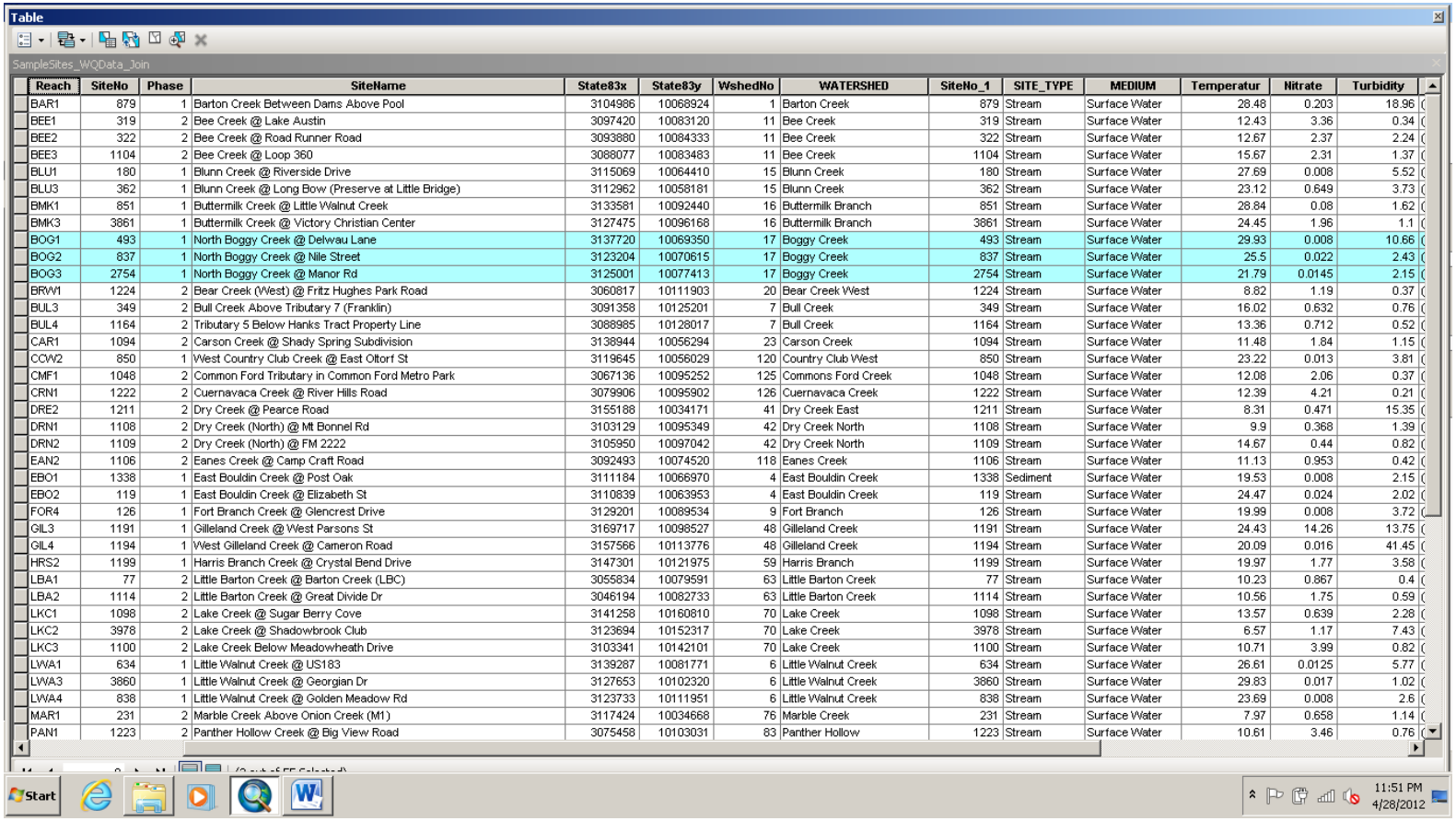
- The first step in the analysis was to examine the available datasets and interpret what attributes and features were present.
- Since a stream network did not exist we will were unable to cumulatively calculate percentages upstream from sample sites.

Methodology

- Select those EII reaches that contain water quality sample sites at or within 0.5 miles from the drainage point and contained 3 water quality parameters
- Ran sample sites through City of Austin's online water quality database.
- Imported the results into Microsoft Excel in order to sort and clean data
- Final results were 55 sample sites that had data from 2011 on water temperature, turbidity and nitrogen level
- This data was joined to sampling site layer based on the sampling site number field in the layer and spreadsheet

Methodology

Table 2. Sample Site and Water Quality Data



Table

SampleSites_WQData_Join

Reach	SiteNo	Phase	SiteName	State83x	State83y	WshedNo	WATERSHED	SiteNo_1	SITE_TYPE	MEDIUM	Temperatur	Nitrate	Turbidity
BAR1	879	1	Barton Creek Between Dams Above Pool	3104986	10068924	1	Barton Creek	879	Stream	Surface Water	28.48	0.203	18.96
BEE1	319	2	Bee Creek @ Lake Austin	3097420	10083120	11	Bee Creek	319	Stream	Surface Water	12.43	3.36	0.34
BEE2	322	2	Bee Creek @ Road Runner Road	3093880	10084333	11	Bee Creek	322	Stream	Surface Water	12.67	2.37	2.24
BEE3	1104	2	Bee Creek @ Loop 360	3088077	10083483	11	Bee Creek	1104	Stream	Surface Water	15.67	2.31	1.37
BLU1	180	1	Blunn Creek @ Riverside Drive	3115069	10064410	15	Blunn Creek	180	Stream	Surface Water	27.69	0.008	5.52
BLU3	362	1	Blunn Creek @ Long Bow (Preserve at Little Bridge)	3112962	10058181	15	Blunn Creek	362	Stream	Surface Water	23.12	0.649	3.73
BMK1	851	1	Buttermilk Creek @ Little Walnut Creek	3133581	10092440	16	Buttermilk Branch	851	Stream	Surface Water	28.84	0.08	1.62
BMK3	3861	1	Buttermilk Creek @ Victory Christian Center	3127475	10096168	16	Buttermilk Branch	3861	Stream	Surface Water	24.45	1.96	1.1
BOG1	493	1	North Boggy Creek @ Delwau Lane	3137720	10069350	17	Boggy Creek	493	Stream	Surface Water	29.93	0.008	10.66
BOG2	837	1	North Boggy Creek @ Nile Street	3123204	10070615	17	Boggy Creek	837	Stream	Surface Water	25.5	0.022	2.43
BOG3	2754	1	North Boggy Creek @ Manor Rd	3125001	10077413	17	Boggy Creek	2754	Stream	Surface Water	21.79	0.0145	2.15
BRW1	1224	2	Bear Creek (West) @ Fritz Hughes Park Road	3060817	10111903	20	Bear Creek West	1224	Stream	Surface Water	8.82	1.19	0.37
BUL3	349	2	Bull Creek Above Tributary 7 (Franklin)	3091358	10125201	7	Bull Creek	349	Stream	Surface Water	16.02	0.632	0.76
BUL4	1164	2	Tributary 5 Below Hanks Tract Property Line	3088985	10128017	7	Bull Creek	1164	Stream	Surface Water	13.36	0.712	0.52
CAR1	1094	2	Carson Creek @ Shady Spring Subdivision	3138944	10056294	23	Carson Creek	1094	Stream	Surface Water	11.48	1.84	1.15
CCW2	850	1	West Country Club Creek @ East Oltorf St	3119645	10056029	120	Country Club West	850	Stream	Surface Water	23.22	0.013	3.81
CMF1	1048	2	Common Ford Tributary in Common Ford Metro Park	3067136	10095252	125	Commons Ford Creek	1048	Stream	Surface Water	12.08	2.06	0.37
CRN1	1222	2	Cuernavaca Creek @ River Hills Road	3079906	10095902	126	Cuernavaca Creek	1222	Stream	Surface Water	12.39	4.21	0.21
DRE2	1211	2	Dry Creek @ Pearce Road	3155188	10034171	41	Dry Creek East	1211	Stream	Surface Water	8.31	0.471	15.35
DRN1	1108	2	Dry Creek (North) @ Mt Bonnel Rd	3103129	10095349	42	Dry Creek North	1108	Stream	Surface Water	9.9	0.368	1.39
DRN2	1109	2	Dry Creek (North) @ FM 2222	3105950	10097042	42	Dry Creek North	1109	Stream	Surface Water	14.67	0.44	0.82
EAN2	1106	2	Eanes Creek @ Camp Craft Road	3092493	10074520	118	Eanes Creek	1106	Stream	Surface Water	11.13	0.953	0.42
EBO1	1338	1	East Bouldin Creek @ Post Oak	3111184	10066970	4	East Bouldin Creek	1338	Sediment	Surface Water	19.53	0.008	2.15
EBO2	119	1	East Bouldin Creek @ Elizabeth St	3110839	10063953	4	East Bouldin Creek	119	Stream	Surface Water	24.47	0.024	2.02
FOR4	126	1	Fort Branch Creek @ Glencrest Drive	3129201	10089534	9	Fort Branch	126	Stream	Surface Water	19.99	0.008	3.72
GIL3	1191	1	Gilleland Creek @ West Parsons St	3169717	10098527	48	Gilleland Creek	1191	Stream	Surface Water	24.43	14.26	13.75
GIL4	1194	1	West Gilleland Creek @ Cameron Road	3157566	10113776	48	Gilleland Creek	1194	Stream	Surface Water	20.09	0.016	41.45
HRS2	1199	1	Harris Branch Creek @ Crystal Bend Drive	3147301	10121975	59	Harris Branch	1199	Stream	Surface Water	19.97	1.77	3.58
LBA1	77	2	Little Barton Creek @ Barton Creek (LBC)	3055834	10079591	63	Little Barton Creek	77	Stream	Surface Water	10.23	0.867	0.4
LBA2	1114	2	Little Barton Creek @ Great Divide Dr	3046194	10082733	63	Little Barton Creek	1114	Stream	Surface Water	10.56	1.75	0.59
LKC1	1098	2	Lake Creek @ Sugar Berry Cove	3141258	10160810	70	Lake Creek	1098	Stream	Surface Water	13.57	0.639	2.28
LKC2	3978	2	Lake Creek @ Shadowbrook Club	3123694	10152317	70	Lake Creek	3978	Stream	Surface Water	6.57	1.17	7.43
LKC3	1100	2	Lake Creek Below Meadowheath Drive	3103341	10142101	70	Lake Creek	1100	Stream	Surface Water	10.71	3.99	0.82
LWA1	634	1	Little Walnut Creek @ US183	3139287	10081771	6	Little Walnut Creek	634	Stream	Surface Water	26.61	0.0125	5.77
LWA3	3860	1	Little Walnut Creek @ Georgian Dr	3127653	10102320	6	Little Walnut Creek	3860	Stream	Surface Water	29.83	0.017	1.02
LWA4	838	1	Little Walnut Creek @ Golden Meadow Rd	3123733	10111951	6	Little Walnut Creek	838	Stream	Surface Water	23.69	0.008	2.6
MAR1	231	2	Marble Creek Above Onion Creek (M1)	3117424	10034668	76	Marble Creek	231	Stream	Surface Water	7.97	0.658	1.14
PAN1	1223	2	Panther Hollow Creek @ Big View Road	3075458	10103031	83	Panther Hollow	1223	Stream	Surface Water	10.61	3.46	0.76

Start

11:51 PM
4/28/2012

Methodology

- Digital elevation model (DEM)
- ACWQ creates a 300ft centerline buffer
- Clip the tree canopy and impervious cover data
- A new “double-type” field was added
- Field calculator

Methodology

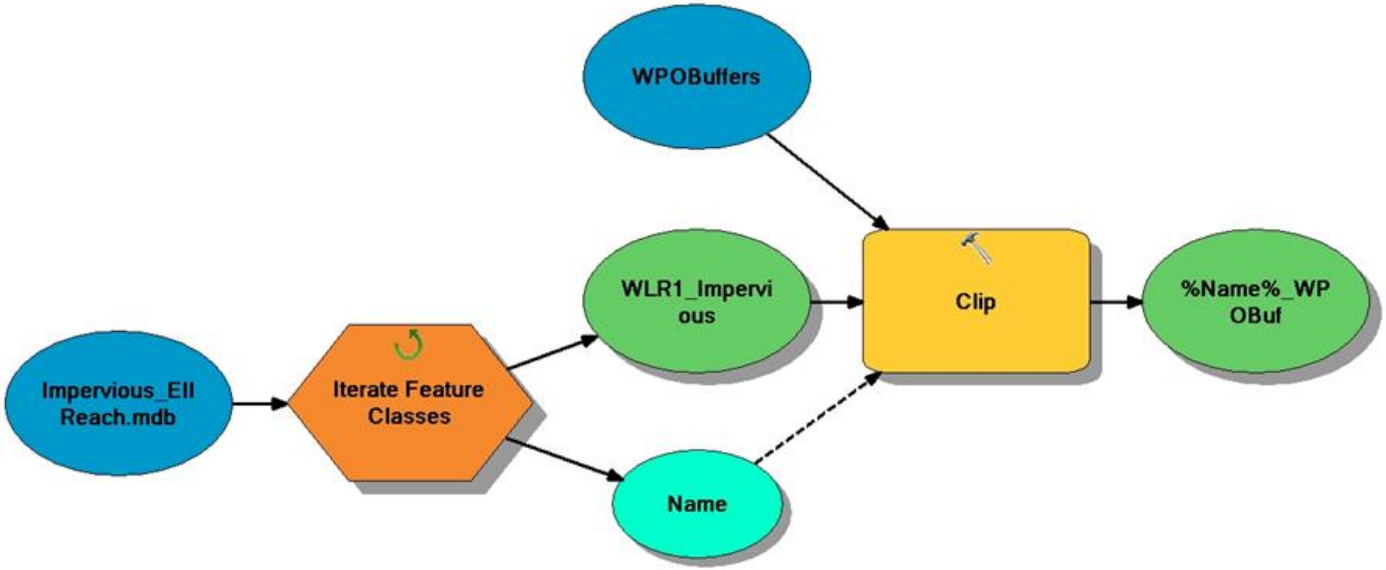


Figure 1. Feature Class Clip Model

Methodology

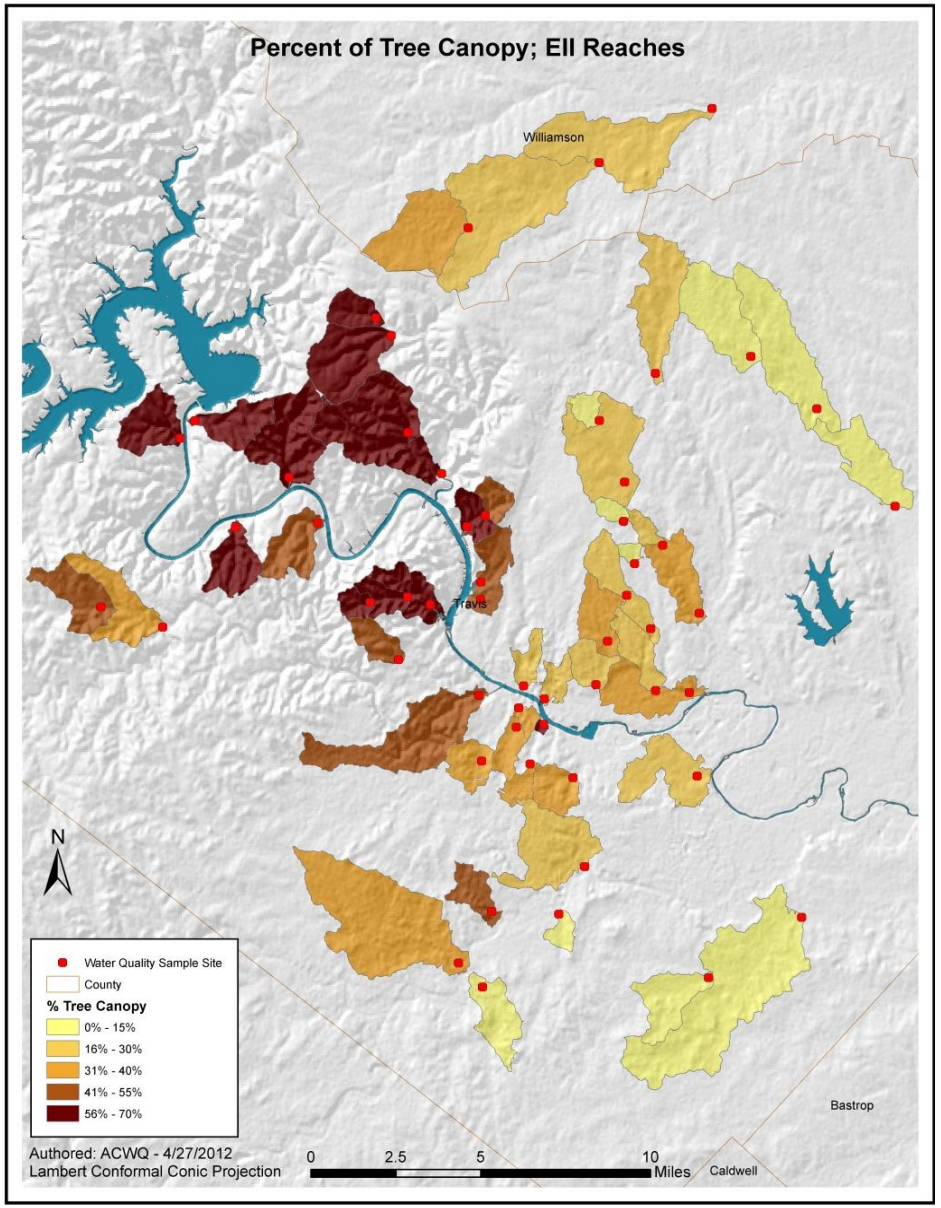
- The impervious cover raster file was reclassified, by grouping entries. The non-imperious cover was labeled “0” and the impervious cover labeled “1”.
- The impervious cover raster file was then converted into a vector file, which consisted of non-impervious and impervious features.
- The non-impervious features were deleted.
- Resulting in a feature class consisting of only of impervious cover.

Methodology

- Subsequent maps were developed utilizing this new information.
- Manipulating the symbology of the attributes as they relate to tree canopy and impervious cover percentages.
- This allowed ACWQ to analyze any trends that might exist.
- ACWQ was able to transform maps depicting areas that contain high or low tree canopy and impervious cover. The water quality data was analyzed in conjunction with the tree canopy and impervious cover data and no obvious trend was noticed.

Results

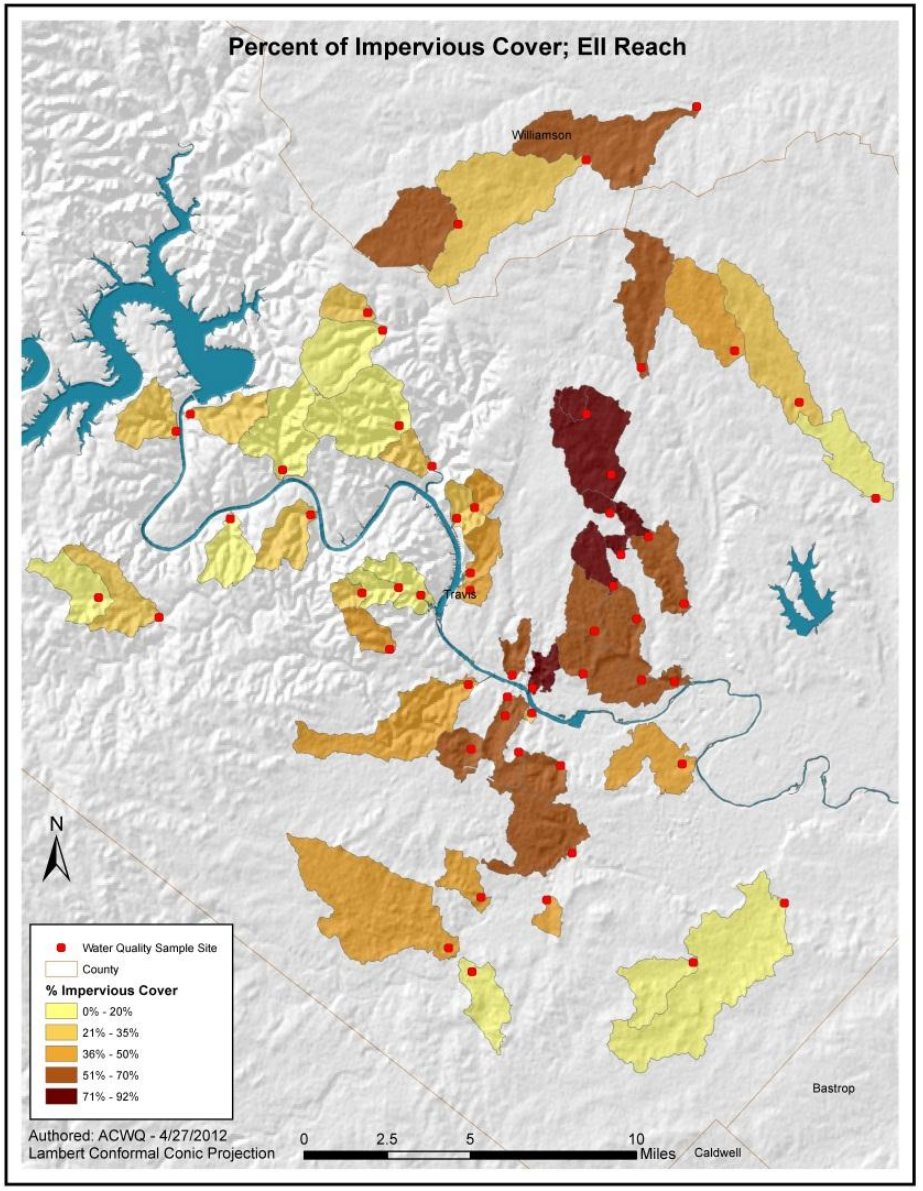
- BEE Creek Watershed
  - BEE 1 = 66%
  - BEE 2 = 69%
- West Bull Creek Watershed
  - WBL 1 = 64%
  - WBL 2 = 64%



Map 2.1. Percent of Tree Canopy; EII Reaches

Results

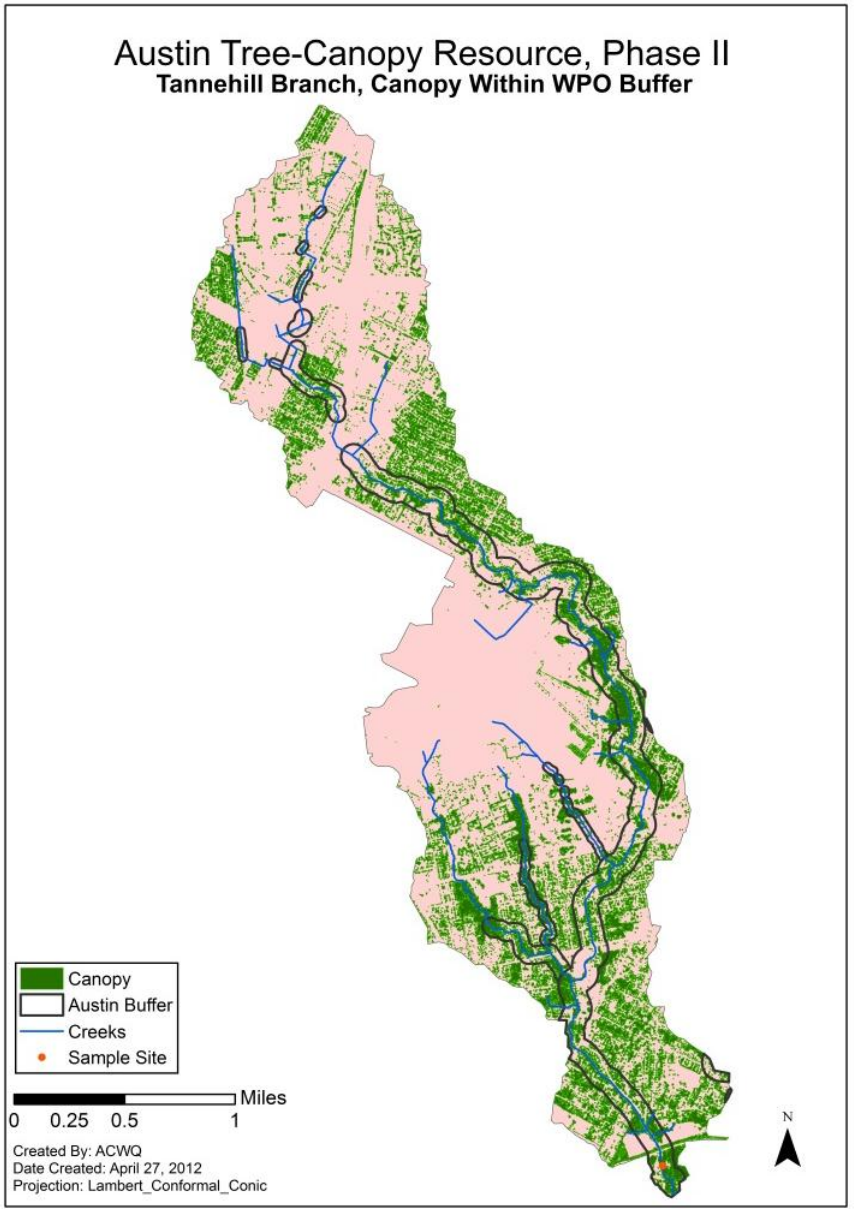
- Little Walnut Creek Watershed
  - LWA 4 = 92%
- Fort Branch Watershed
  - FOR 4 = 84%
- Buttermilk Branch Watershed
  - BMK 3 = 84%
- Tannehill Branch Watershed
  - TAN 3 = 82%



Map 3.1. Percent of Impervious Cover; EII Reaches

Results

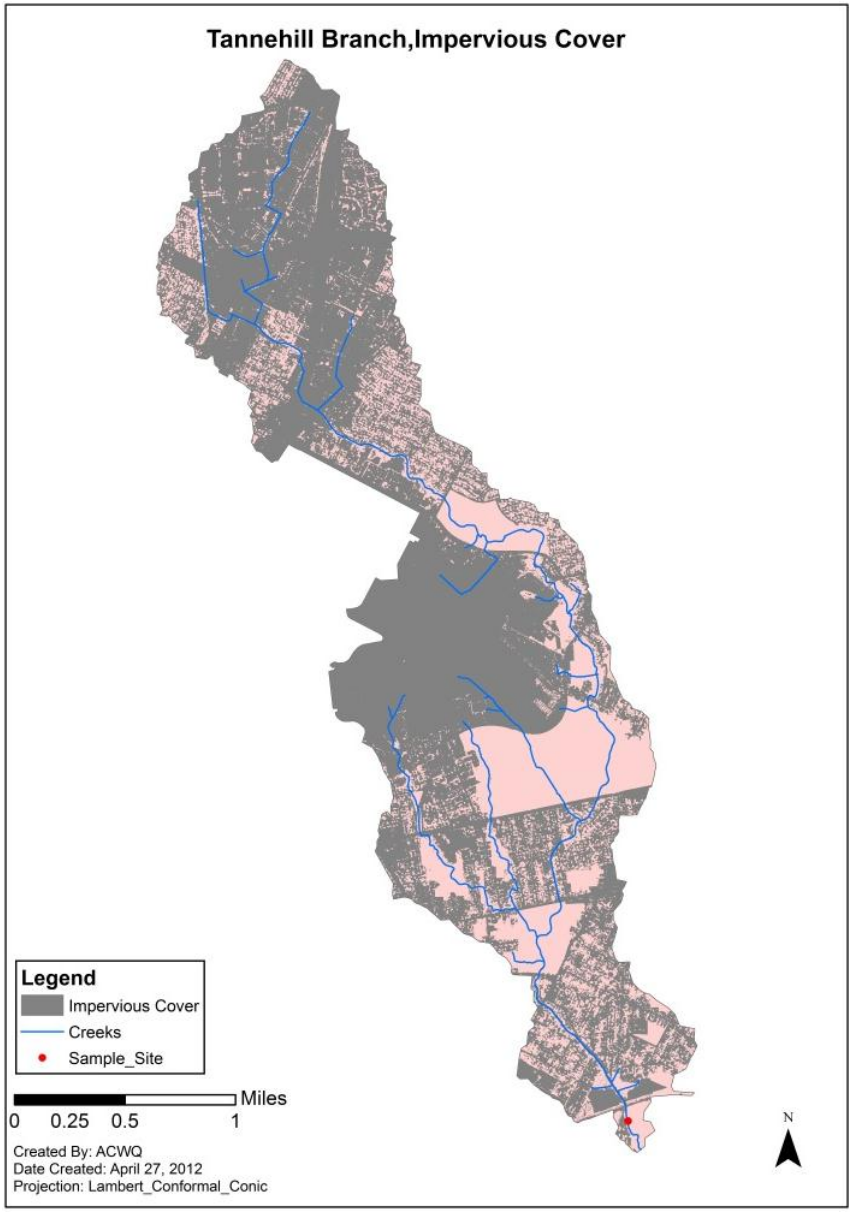
- (TAN 1 EII Reach) Tannehill Branch Watershed
  - 24% - EII Reach is Tree Canopy.
  - 29% - Tree Canopy in EII Reach is within WPO Creek Buffer.
  - 71% - Tree Canopy in EII Reach is within 300 ft. Creek Buffer.



Map 2.9. Tree Canopy in Tannehill Branch and WPO Buffer

Results

- (TAN 1 EII Reach) Tannehill Branch Watershed
  - 62% - EII Reach is Impervious Cover.
  - 11% - Impervious Cover in EII Reach is within WPO Creek Buffer.
  - 30% - Impervious Cover in EII Reach is within 300 ft. Creek Buffer.



Map 3.5. Impervious Cover in Tannehill Branch Watershed

Discussion

- The team was able to successfully calculate percentages for canopy/impervious cover.
- No relationship found between water quality and tree canopy/impervious cover.

Limitations

- Data provided
- Lack of stream network

Recommendations

- Creation of stream network
- More water quality sampling
- Continued Reasearch

Final Deliverables

- 1. CD's
  - All Data
  - Metadata
  - Microsoft Power Point Presentation
  - Proposal, Progress, and Final Reports
- 2. Website
- 3. Final Report
  - Data
  - Maps
  - Metadata
  - References
- 4. Instructions on how to use the CD (readme file)
- 5. Professional Poster to be displayed in Evans Liberal Arts Building

Conclusions

- Overall the goals of the project were met
- GIS was essential in completion of project
- It our belief that further research will allow a relationship to be created between tree canopy/impervious cover and water quality.

Questions?

References

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