Birmingham Metro
Remote Sensing and Interpretation for Urban Forestry Applications

Preliminary Results Report

Tuesday, April 16, 2002

Prepared For:

US Forest Service Region 8

And

Alabama Cooperative Extension System

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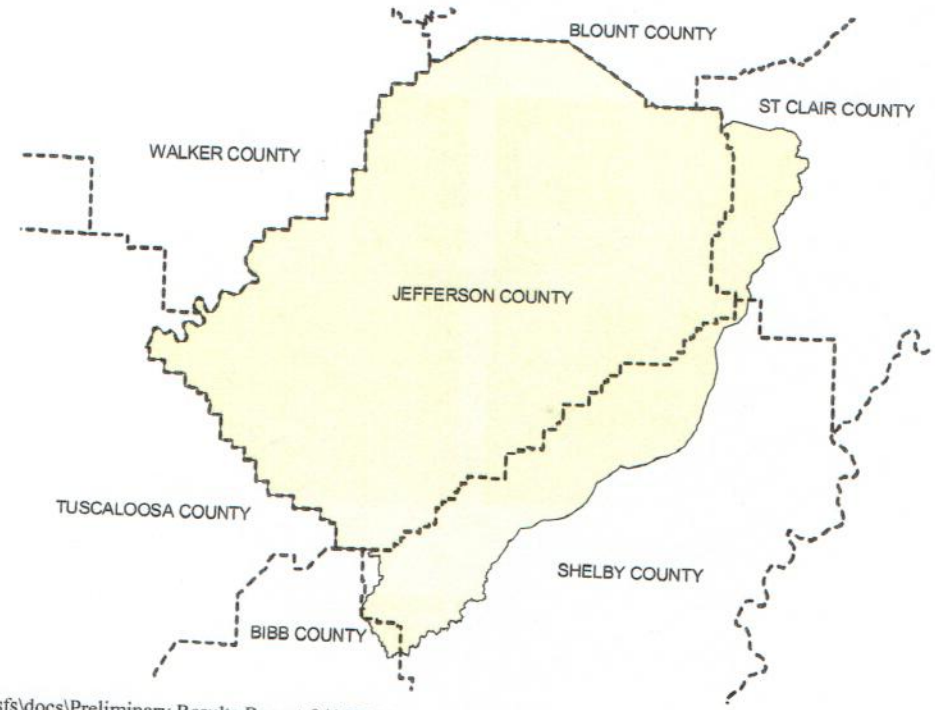
In March 2001, SWMA, Trees for Alabama, CAWACO, and Southern Environmental Center at Birmingham Southern College received a grant from United States Forest Service (USFS) in the amount of $200,000. The objective of this grant is to establish a baseline of information on the forest cover and related information in Jefferson County Alabama, and to inform the local governments and the public at large on the findings of the study. The project will apply current technology to forestry applications in a deteriorating urban and suburban forest. Benefits of this study include documentation of the existing forest cover, education of the general public, and establish the environmental and utility value of the forest canopy in Jefferson County.

A watershed model will be applied to the interpreted imagery to calculate storm water, heat island, and related urban forest impacts from development. Impervious surface areas will be delineated as will land use and land cover. Some subsections will receive a follow-up image capture in 12 months and in 24 months. From these we can characterize the impacts of an urban forest on water and air. This will provide the 'evidence' local groups and civic leaders need to improve the urban forest, encourage greater protection for existing cover, and restoration of impacted areas. To these goals, the following discusses the processes used in data preparation, preliminary analysis, and public outreach and education.

Section 1: Data Analysis

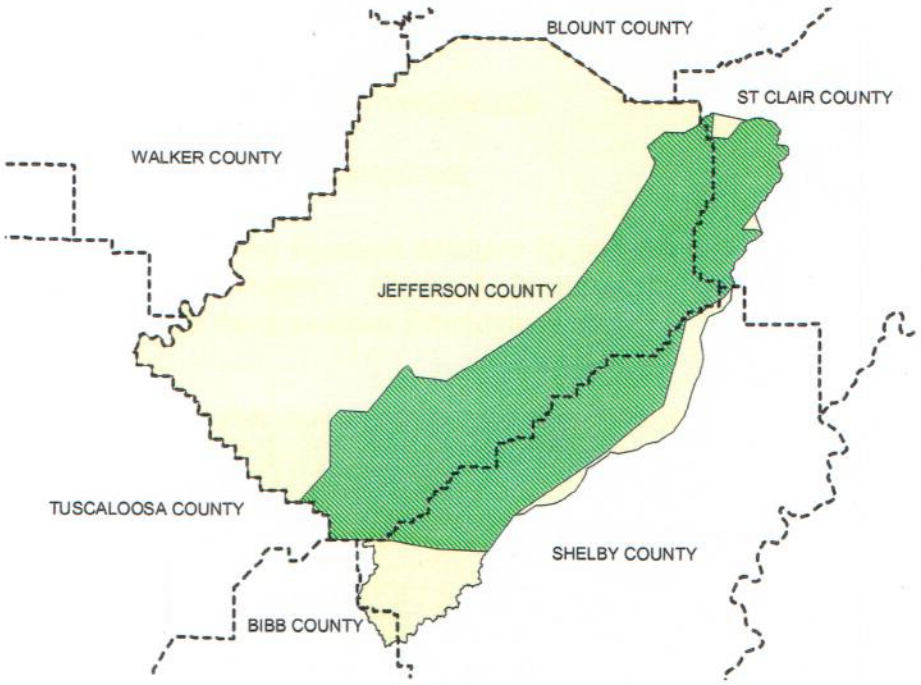
The project utilizes IKONOS satellite imagery by Space Imaging, LLC. The data is delivered in 4-meter resolution, 4-band multispectral imagery and 1-meter panchromatic imagery. The project area is approximately 1408 square miles and covers all of the 11 Hydrologic Unit Codes (HUC) including the entire Cahaba River watershed and Jefferson County. The project area is designated in **Figure 1**.

Figure 1



During the three-year duration of the project, two additional collections of satellite data are necessary to evaluate a smaller subset of the project area. The first collection occurred during the Winter of 2001 and a second acquisition is scheduled for the Summer of 2003. This data will cover an area of approximately 526 square miles encompassing the areas of most aggressive development within the Cahaba River Watershed. The subset is represented in **Figure 2.**

Figure 2



The imagery is delivered as 4-meter multispectral and 1-meter panchromatic 11 bit TIFF digital files. These files are processed and prepared for use in ERDAS Imagine. **Figure 3** shows examples of each data type.

Figure 3

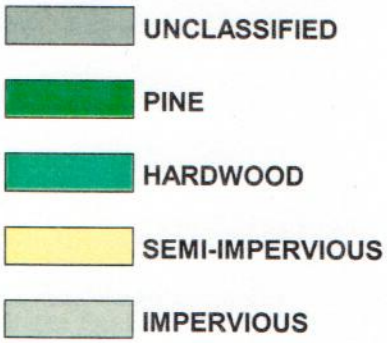
4m Multispectral

1m Panchromatic

Due to the large digital size of the data, an unsupervised classification of areas that were deemed to be representative of the project area was performed. This allowed for the

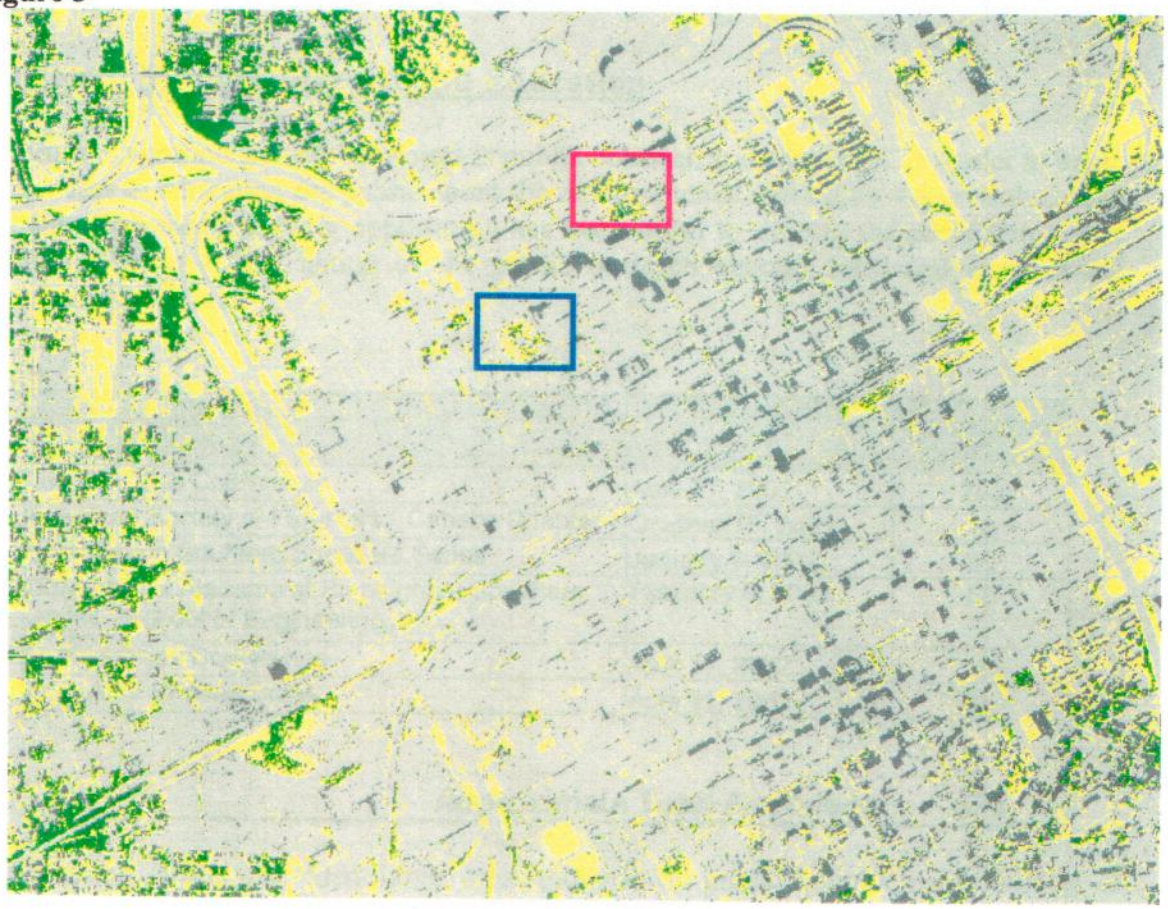
establishment of five thematic categories that could be utilized throughout the preliminary classification. **Figure 4** displays the color-coded thematic categories.

Figure 4

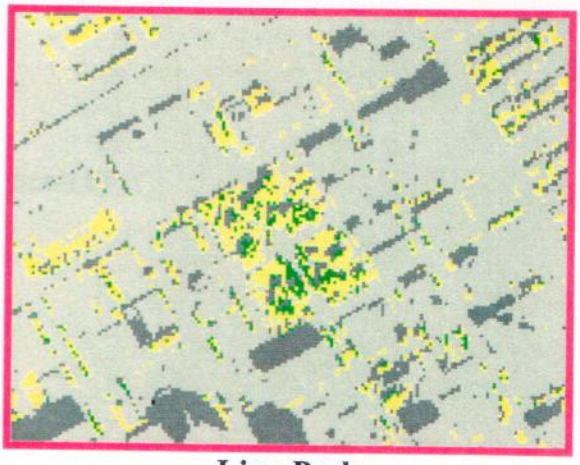


This process created a spectral signature database for use in a supervised classification of the remaining sections of imagery. **Figure 5** illustrates the results of classification on two well-known parks in the downtown Birmingham area.

Figure 5



Civil Rights Park



Linn Park

For more efficient analysis, the classified data was combined into a single data file to produce a mosaic. The preliminary statistics for each municipality having membership in the Storm Water Management Authority, Inc. (SWMA) were generated to allow project participants and technical staff to evaluate initial results **(Appendix A)**.

Section 2: Public Outreach and Education

A prominent component of the project is public outreach and education. In order to begin the process of educating the public about the environmental and utility value of the urban and suburban canopy, every opportunity has been taken to discuss the project in public forums. **Table 6** is a listing of the public outreach events, dates and approximate attendance.

Table 6

Event	Date	Approximate Attendance
Livable Cities Conference	April 11, 2001	200
American Society of Foresters - Cahaba Chapter	October 18, 2001	10
Birmingham Southern Speakers Series	January 7, 2002	50
University of Alabama at Birmingham Speakers Series - School of Engineering	February 8, 2002	50
Livable Cities Conference	April 11, 2002	125
Friends of Shades Creek	April 11, 2002	15
	Approximate Total Attendees:	**450**

The various events provided large cross-sections of public involvement ranging in attendance and background of attendees. Focus has been directed towards integrating the professional world, academics and the general public in an understanding of the importance of the urban and suburban canopy.

Section 3: Acknowledgements

1. USDA Forest Service Southern Region (Region 8)

2. Alabama Cooperative Extension System
   - Mr. Neil Letson

3. The Friends of Shade Creek
   - Mrs. Michelle Blackwood
   - Mr. Henry Hughes

4. The Society for American Foresters – Cahaba Chapter
   - Mr. Henry Hughes

5. The University of Alabama at Birmingham – School of Engineering
   - Dr. Mindy Lalor

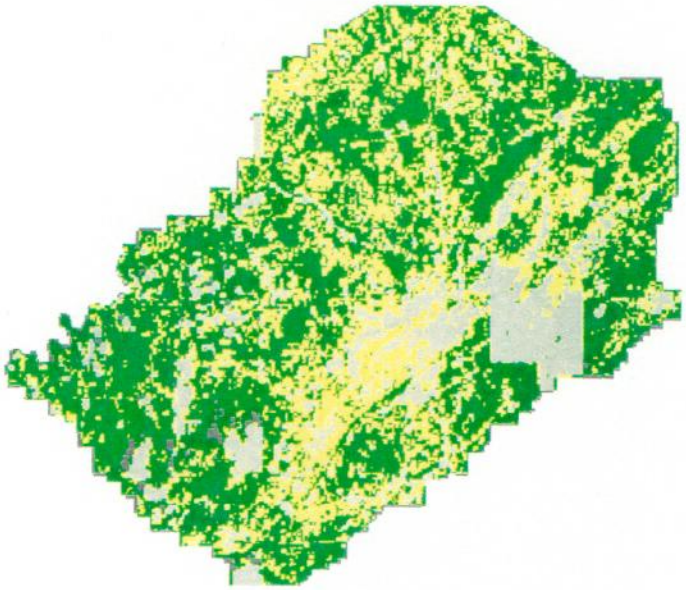
Appendix A

1. Comprehensive Preliminary Results Table
2. ADAMSVILLE
3. BESSEMER
4. BIRMINGHAM
5. BRIGHTON
6. BROOKSIDE
7. CARDIFF
8. CLAY
9. COUNTY LINE
10. FAIRFIELD
11. FULTONDALE
12. GARDENDALE
13. GRAYSVILLE
14. HOMEWOOD
15. HOOVER
16. HUEYTOWN
17. IRONDALE
18. JEFFERSON COUNTY
19. KIMBERLY
20. LEEDS
21. LIPSCOMB
22. MAYTOWN
23. MIDFIELD
24. MORRIS
25. MOUNTAIN BROOK
26. MULGA
27. NORTH JOHNS
28. PLEASANT GROVE
29. SYLVAN SPRINGS
30. TARRANT
31. TRAFFORD
32. TRUSSVILLE
33. VESTAVIA HILLS
34. WARRIOR
35. WEST JEFFERSON

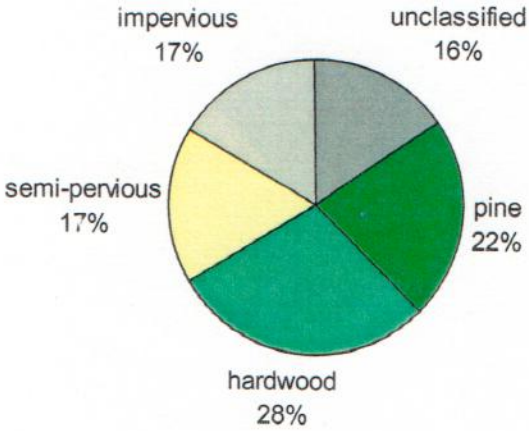
Comprehensive Preliminary Results Table

Municipality	Percent Tree Cover	Percent Impervious Surface	Square Mileage
ADAMSVILLE	59.82%	12.03%	24
BESSEMER	48.37%	22.34%	41
BIRMINGHAM	33.40%	30.56%	152
BRIGHTON	33.35%	26.40%	1
BROOKSIDE	63.61%	6.93%	8
CARDIFF	68.40%	5.17%	0.2
CLAY	46.69%	11.98%	5
COUNTY LINE	18.58%	11.62%	1
FAIRFIELD	19.81%	40.36%	3
FULTONDALE	49.16%	11.78%	11
GARDENDALE	50.41%	11.04%	18
GRAYSVILLE	52.06%	14.57%	11
HOMEWOOD	30.02%	28.67%	8
HOOVER	43.15%	21.98%	43
HUEYTOWN	33.00%	27.07%	12
IRONDALE	2.03%	64.94%	9
JEFFERSON COUNTY	50.29%	16.68%	1124
KIMBERLY	37.39%	14.51%	4
LEEDS	48.88%	12.15%	23
LIPSCOMB	42.75%	20.10%	1
MAYTOWN	48.87%	15.05%	3
MIDFIELD	33.98%	25.97%	2
MORRIS	34.12%	14.50%	3
MOUNTAIN BROOK	24.94%	47.08%	12
MULGA	46.90%	15.99%	0.6
NORTH JOHNS	61.34%	9.75%	0.2
PLEASANT GROVE	57.78%	10.88%	10
SYLVAN SPRINGS	40.52%	17.51%	9
TARRANT	24.94%	25.31%	6
TRAFFORD	32.60%	10.43%	2
TRUSSVILLE	53.56%	13.45%	22
VESTAVIA HILLS	31.51%	32.15%	15
WARRIOR	47.33%	11.66%	7
WEST JEFFERSON	42.02%	14.70%	1

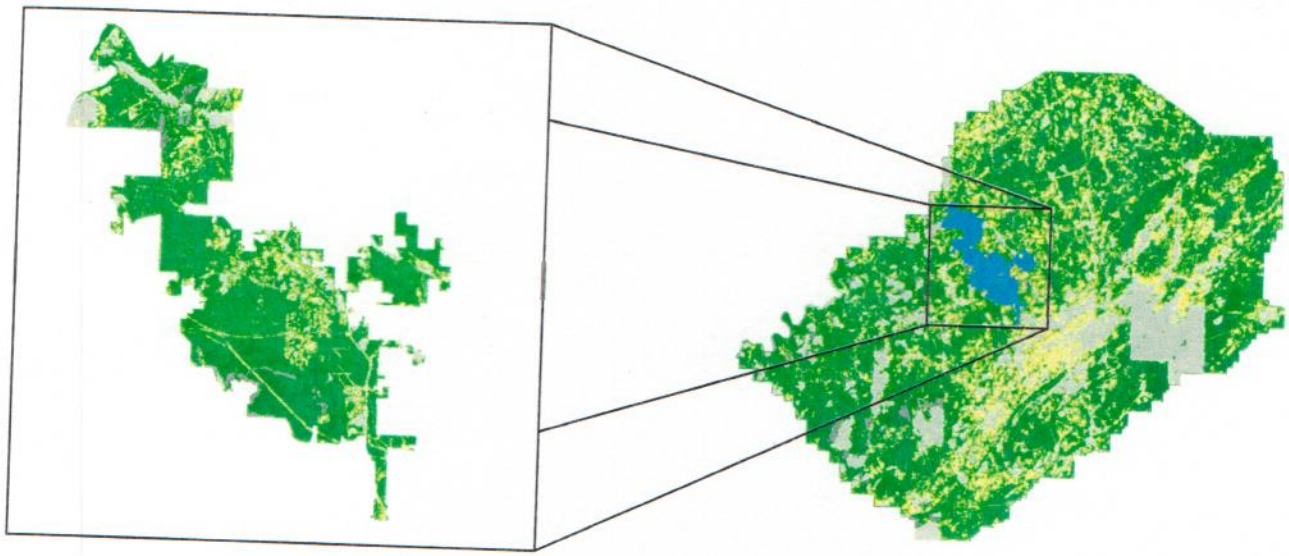
Jefferson County



		# of pixels	hectares	%total
0	null	135357284	216572	
1	unclassified	28582657	45732	0.157005
2	pine	39606858	63371	21.76%
3	hardwood	51952013	83123	28.54%
4	semi-pervious	31537901	50461	17.32%
5	impervious	30369383	48591	16.68%
	sum	182048812		
	%tree cover	50.29%		



City of Adamsville



		# of pixels	hectares	%total
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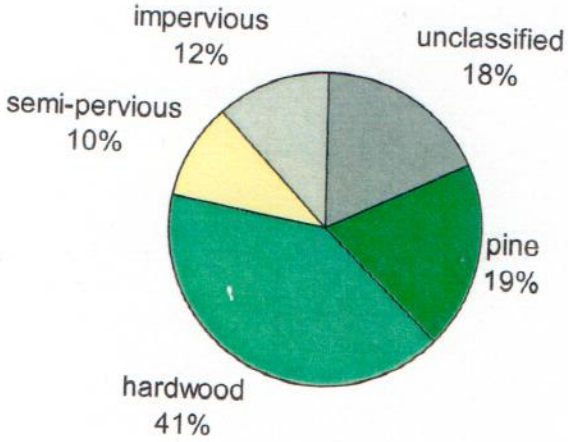
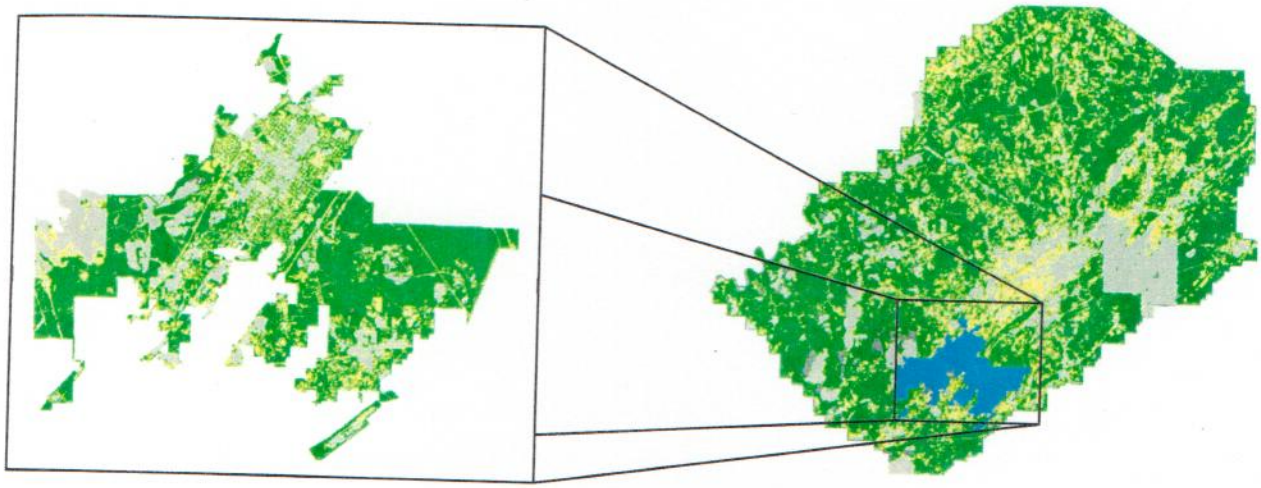
1	unclassified	755874	1209	0.180583
2	pine	805485	1289	19.24%
3	hardwood	1698322	2717	40.57%
4	semi-pervious	422417	676	10.09%
5	impervious	503651	806	12.03%
	sum	4185749		
	%tree cover	59.82%		



City of Bessemer



		# of pixels	hectares	%total
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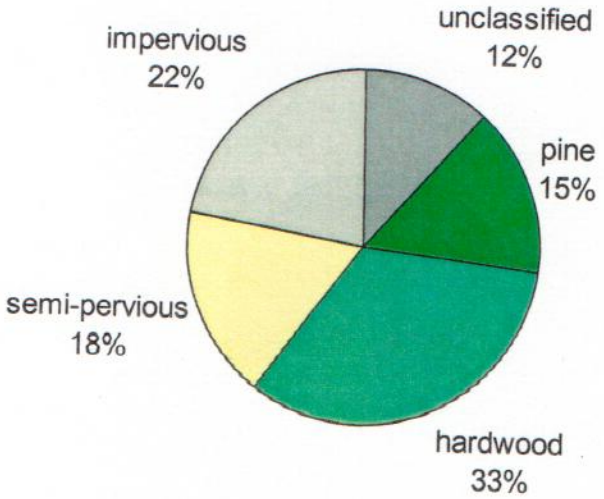
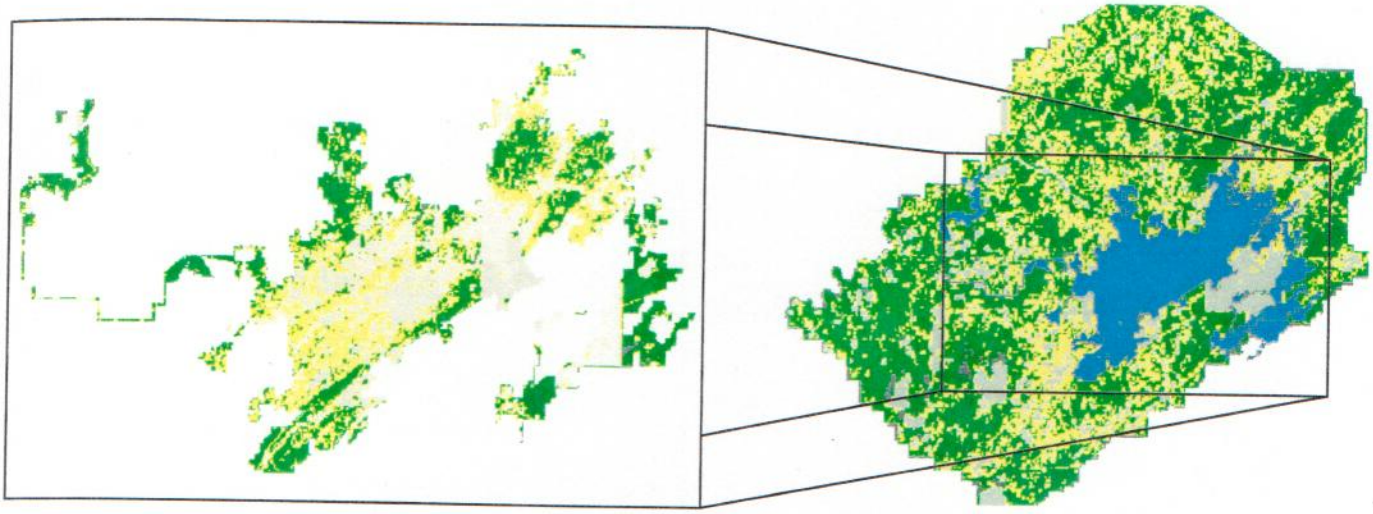
1	unclassified	786319	1258	0.116475
2	pine	1034781	1656	15.33%
3	hardwood	2230828	3569	33.04%
4	semi-pervious	1190555	1905	17.64%
5	impervious	1508506	2414	22.34%
	sum	6750989		
	%tree cover	48.37%		



City of Birmingham



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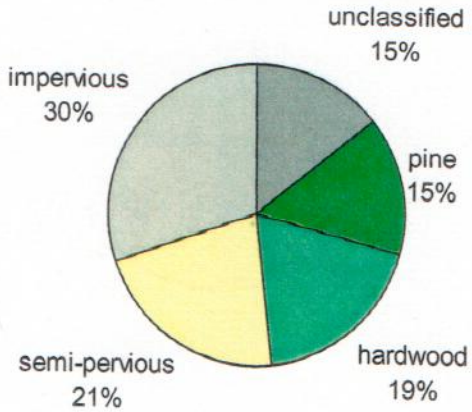
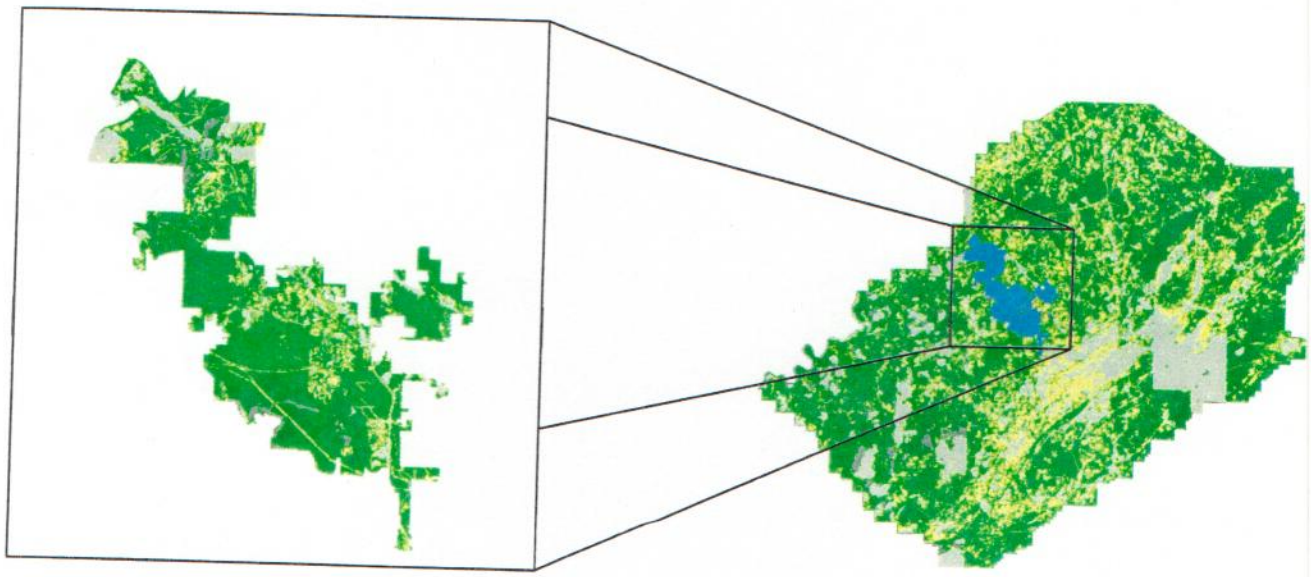
1	unclassified	3556988	5691	0.145387
2	pine	3564977	5704	14.57%
3	hardwood	4606719	7371	18.83%
4	semi-pervious	5260371	8417	21.50%
5	impervious	7476560	11962	30.56%
	sum	24465615		
	%tree cover	33.40%		



City of Brighton



		# of pixels	hectares	%total
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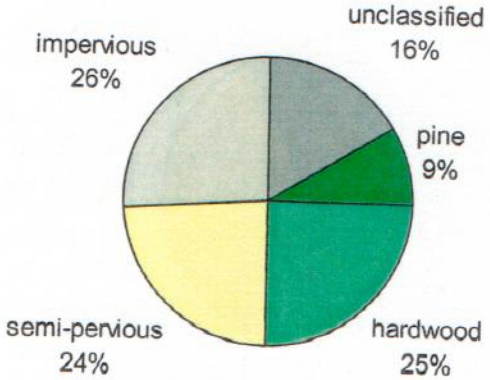
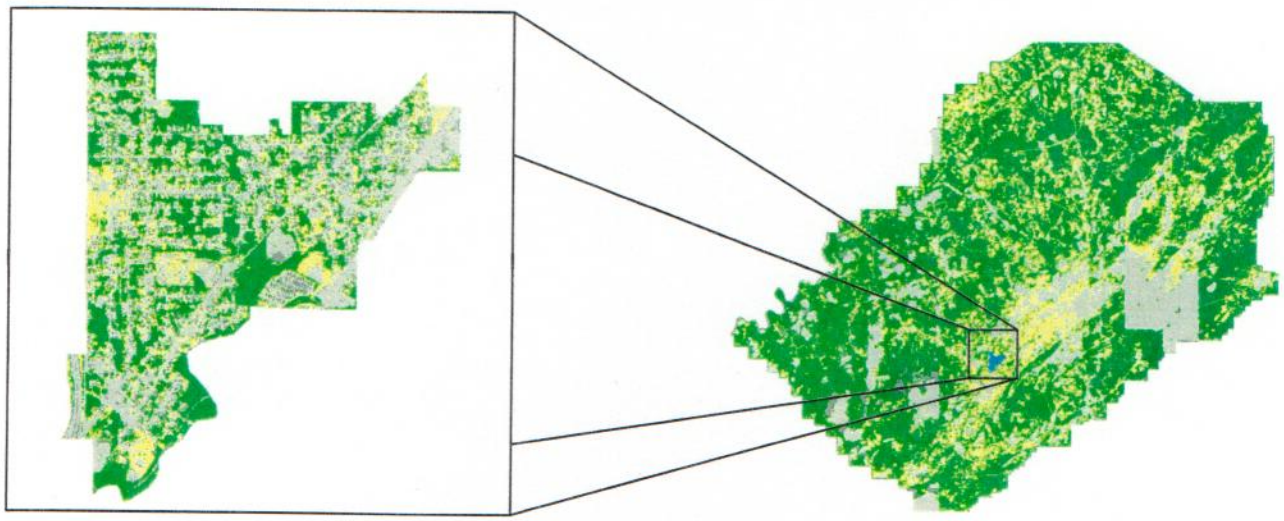
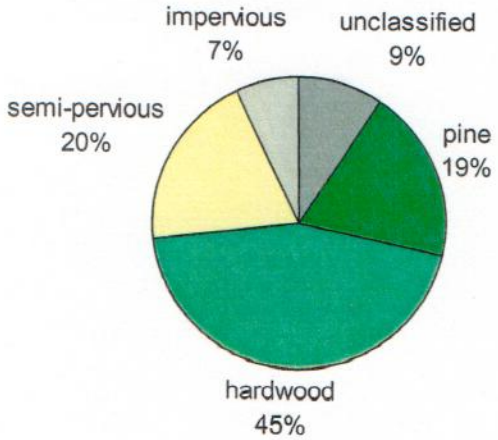
1	unclassified	32706	52	0.164169
2	pine	17599	28	8.83%
3	hardwood	48842	78	24.52%
4	semi-pervious	47482	76	23.83%
5	impervious	52592	84	26.40%
	sum	199221		
	%tree cover	33.35%		



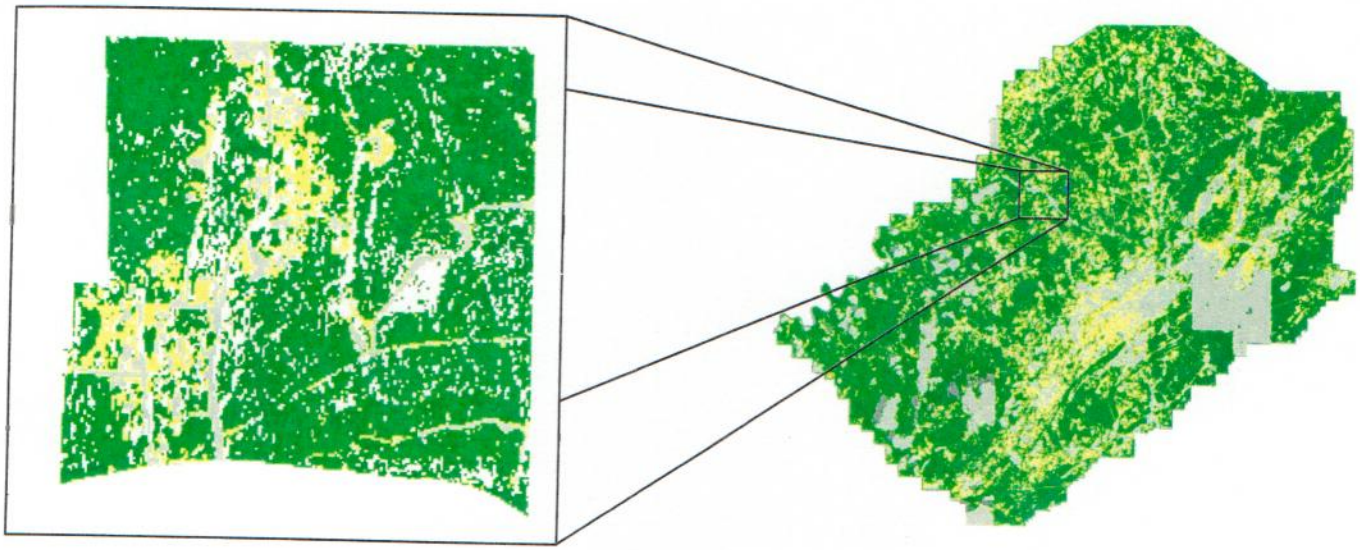
City of Brookside



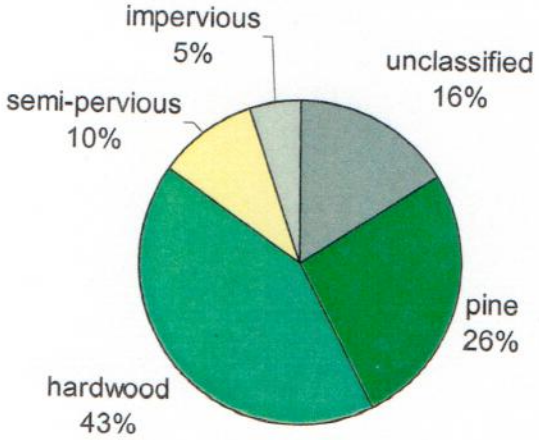
		# of pixels	hectares	%total
0	null	22	0	
1	unclassified	129938	208	0.094869
2	pine	263194	421	19.22%
3	hardwood	608091	973	44.40%
4	semi-pervious	273502	438	19.97%
5	impervious	94933	152	6.93%
	sum	1369658		
	%tree cover	63.61%		



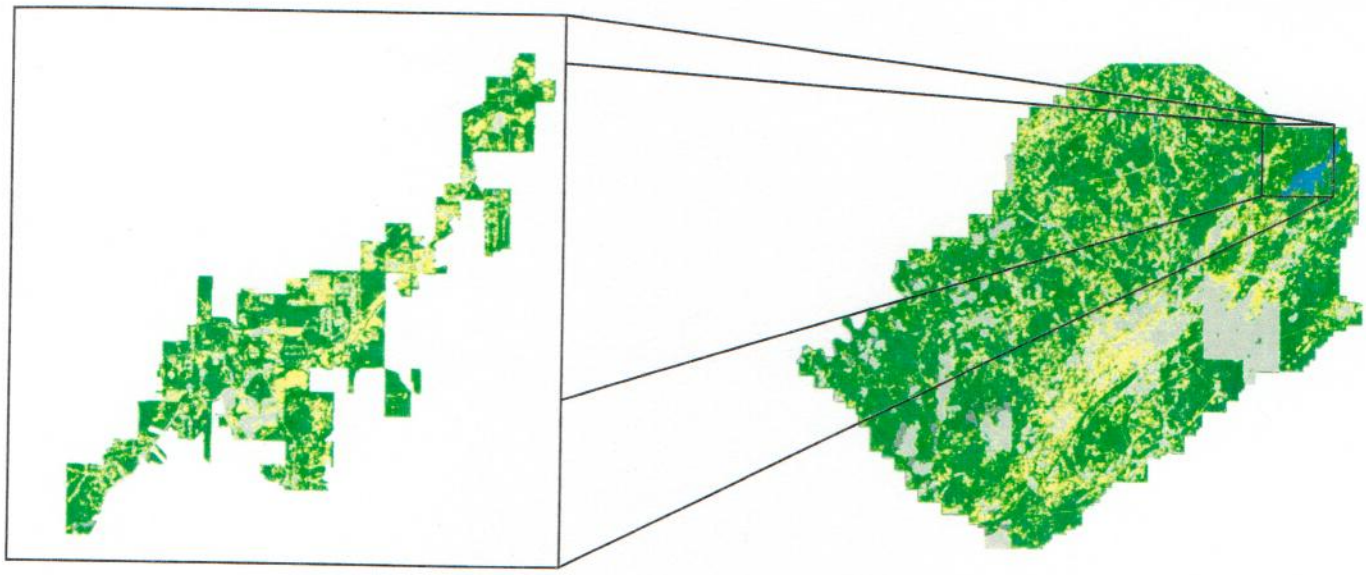
City of Cardiff



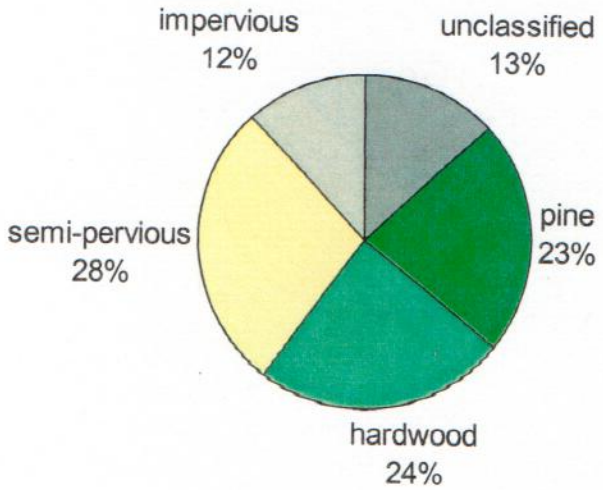
		# of pixels	hectares	%total
0	null	0	0	
1	unclassified	5310	8	0.16069
2	pine	8688	14	26.29%
3	hardwood	13914	22	42.11%
4	semi-pervious	3426	5	10.37%
5	impervious	1707	3	5.17%
	sum	33045		
	%tree cover	68.40%		



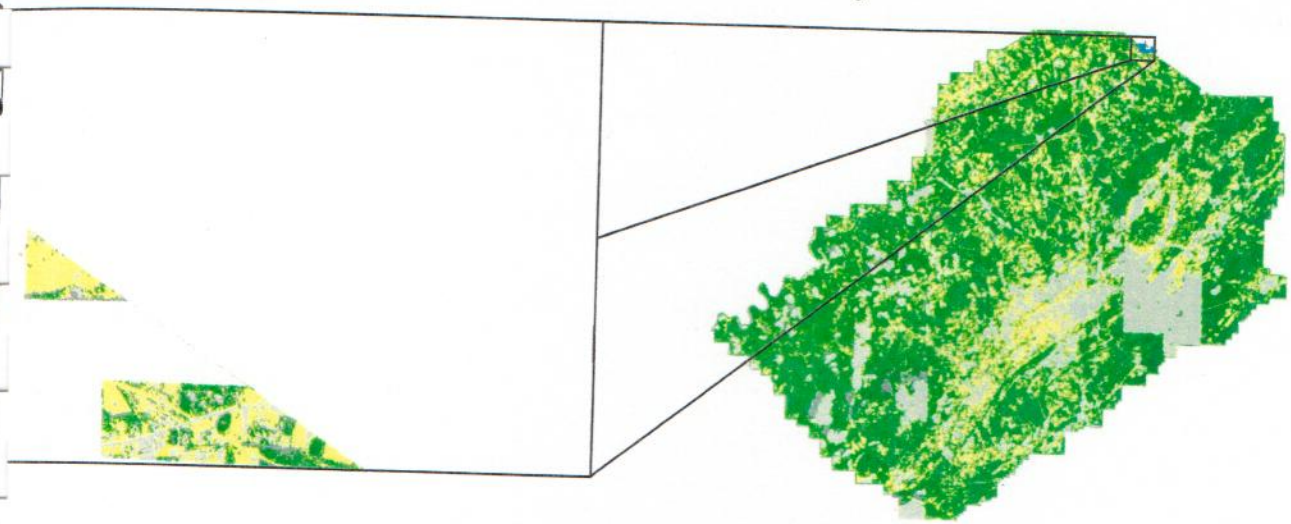
City of Clay



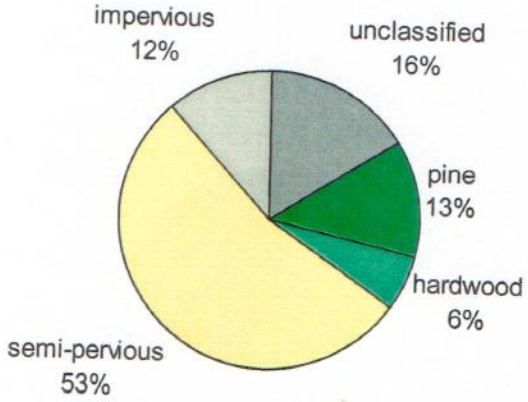
		# of pixels	hectares	%total
0	null	9	0	
1	unclassified	113718	182	0.134056
2	pine	191320	306	22.55%
3	hardwood	204785	328	24.14%
4	semi-pervious	236812	379	27.92%
5	impervious	101654	163	11.98%
	sum	848289		
	%tree cover	46.69%		



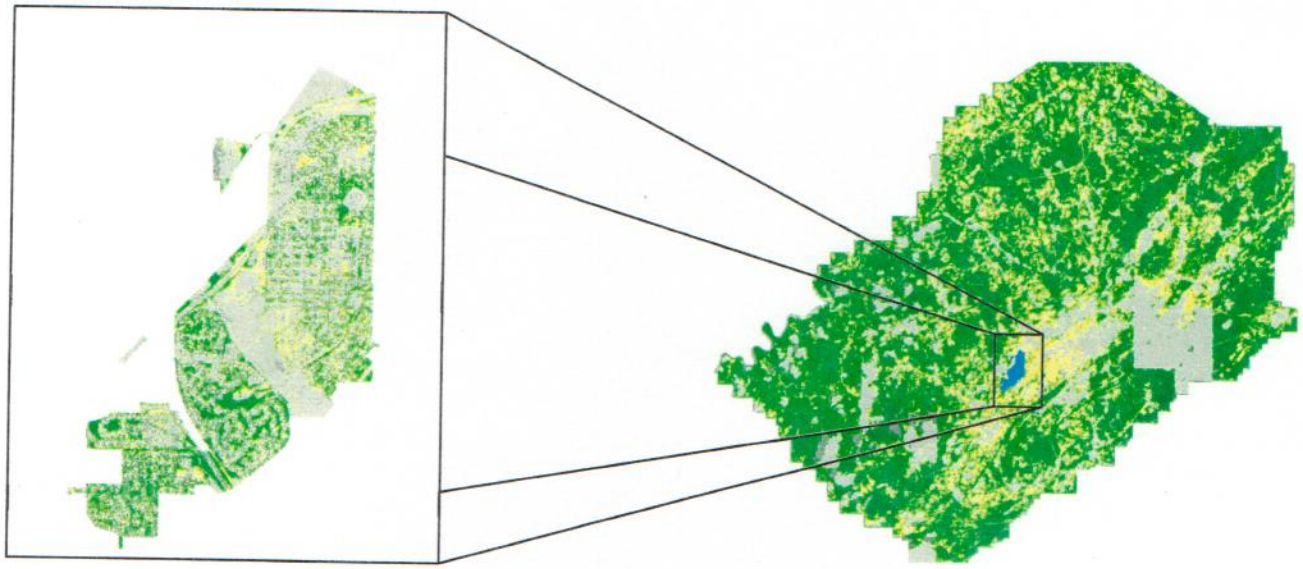
City of Countyline



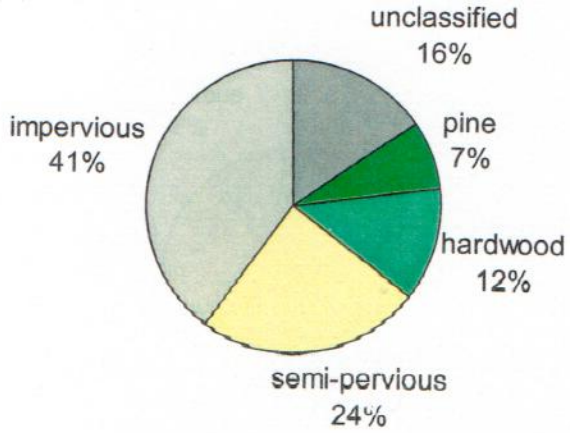
		# of pixels	hectares	%total
0	null	85123	136	
1	unclassified	5434	9	0.16175
2	pine	4274	7	12.72%
3	hardwood	1967	3	5.86%
4	semi-pervious	18015	29	53.62%
5	impervious	3905	6	11.62%
	sum	33595		
	%tree cover	18.58%		



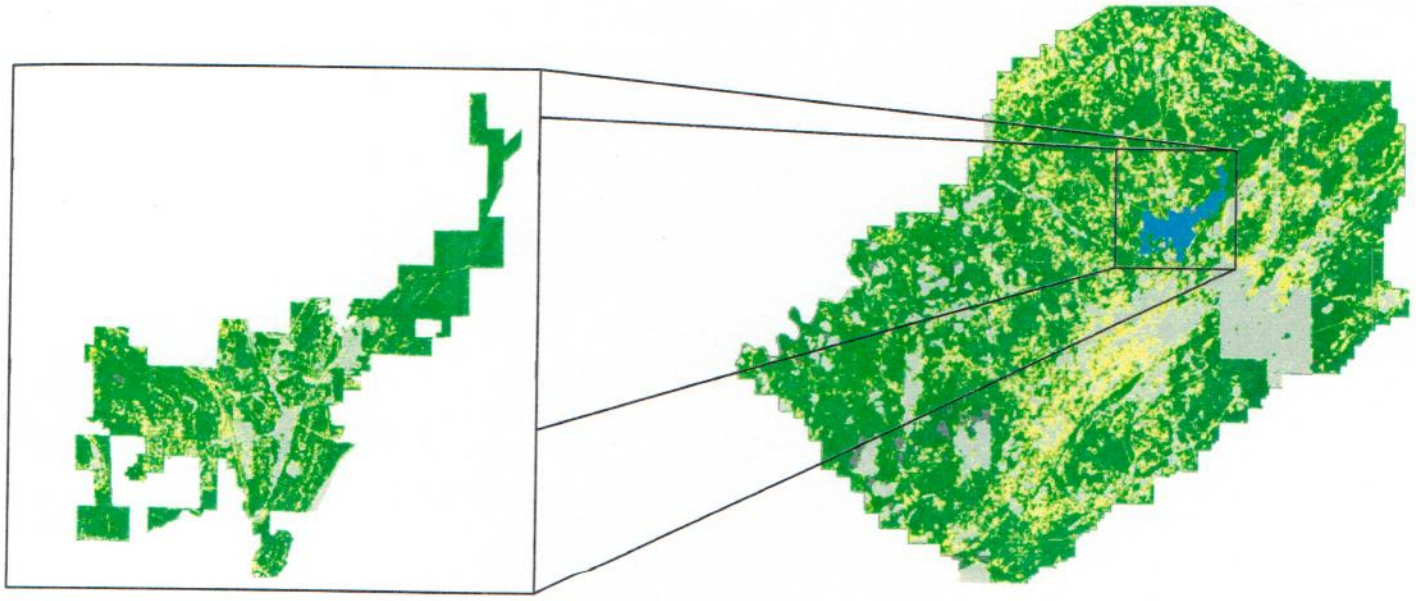
City of Fairfield



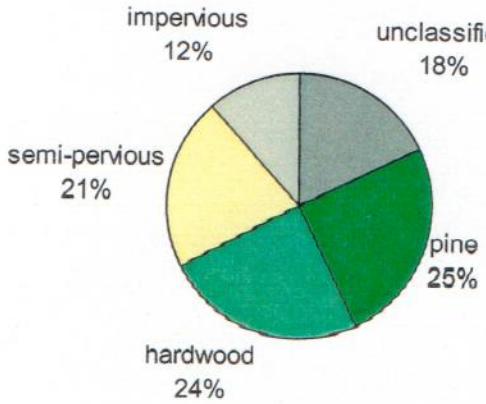
		# of pixels	hectares	%total
0	null	19	0	
1	unclassified	82054	131	0.157237
2	pine	39102	63	7.49%
3	hardwood	64298	103	12.32%
4	semi-pervious	125801	201	24.11%
5	impervious	210594	337	40.36%
	sum	521849		
	%tree cover	19.81%		



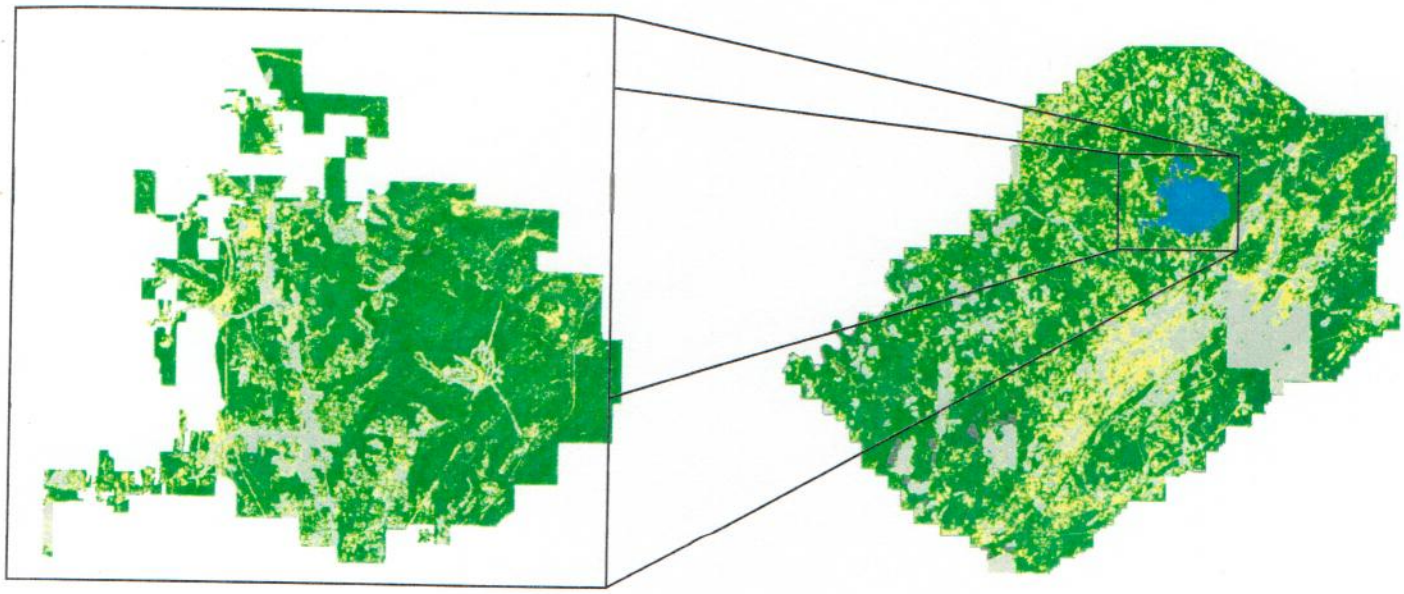
City of Fultondale



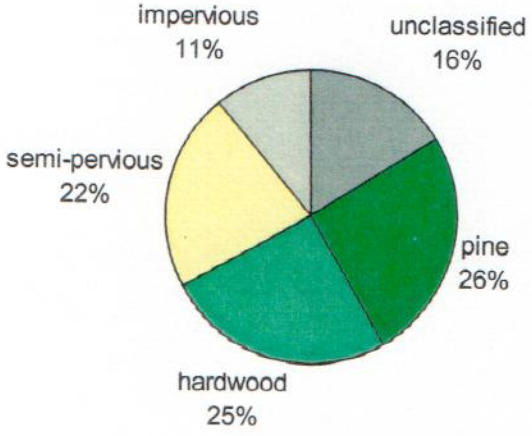
		# of pixels	hectares	%total
0	null	34	0	
1	unclassified	325553	521	0.180635
2	pine	446304	714	24.76%
3	hardwood	439721	704	24.40%
4	semi-pervious	378307	605	20.99%
5	impervious	212380	340	11.78%
	sum	1802265		
	%tree cover	49.16%		



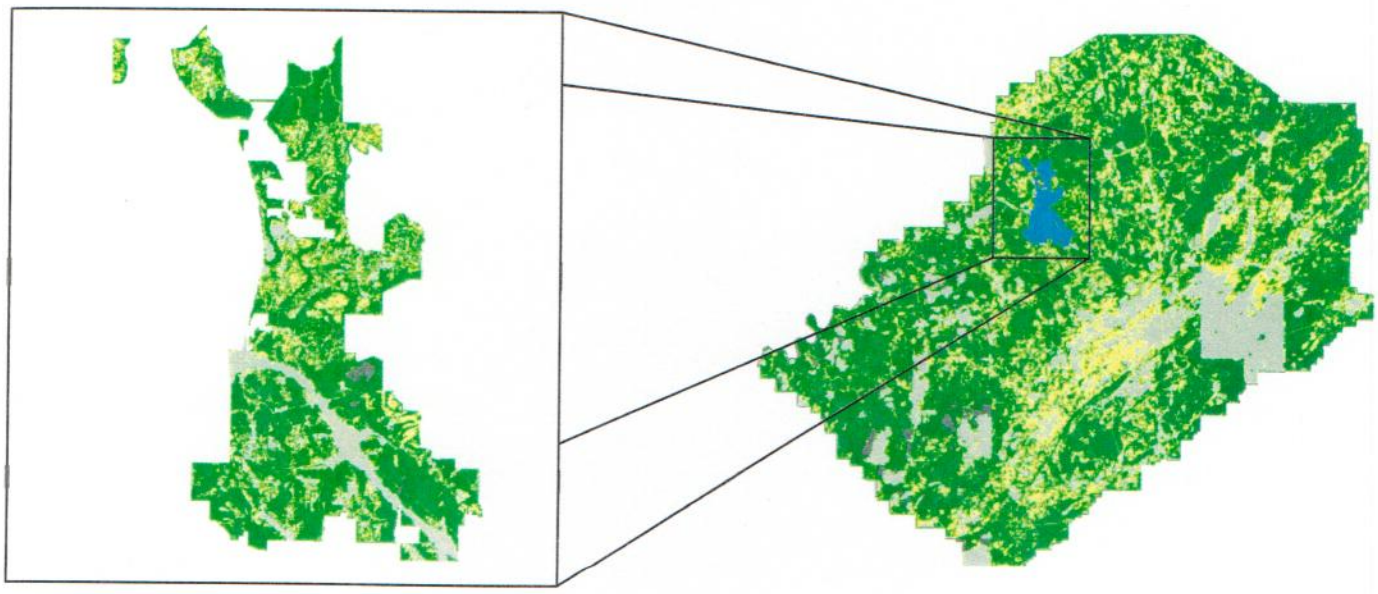
City of Gardendale



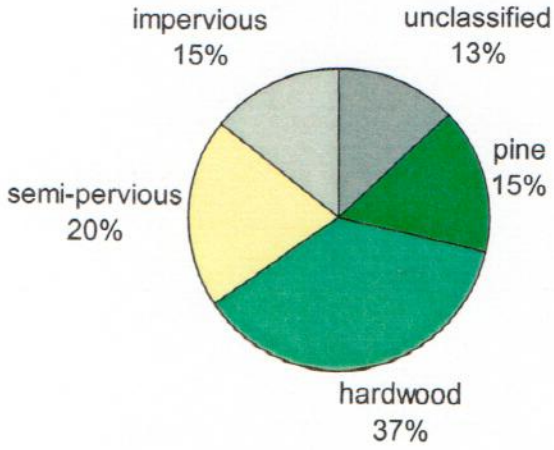
		# of pixels	hectares	%total
0	null	102	0	
1	unclassified	520849	833	0.162995
2	pine	801121	1282	25.07%
3	hardwood	809829	1296	25.34%
4	semi-pervious	710869	1137	22.25%
5	impervious	352826	565	11.04%
	sum	3195494		
	%tree cover	50.41%		



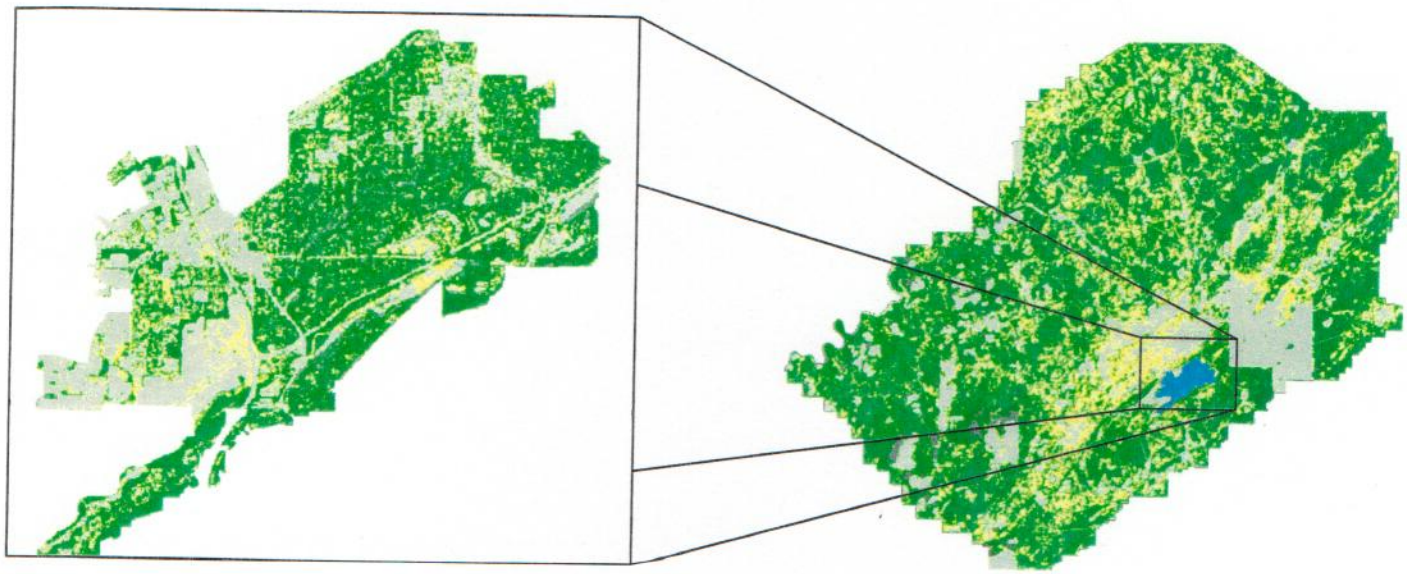
City of Graysville



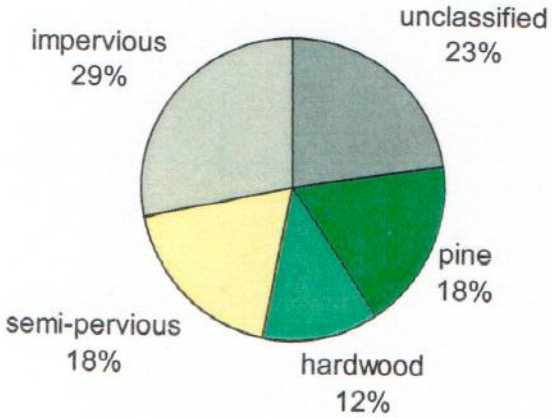
		# of pixels	hectares	%total
0	null	7	0	
1	unclassified	260798	417	0.131149
2	pine	306574	491	15.42%
3	hardwood	728666	1166	36.64%
4	semi-pervious	402750	644	20.25%
5	impervious	289778	464	14.57%
	sum	1988566		
	%tree cover	52.06%		



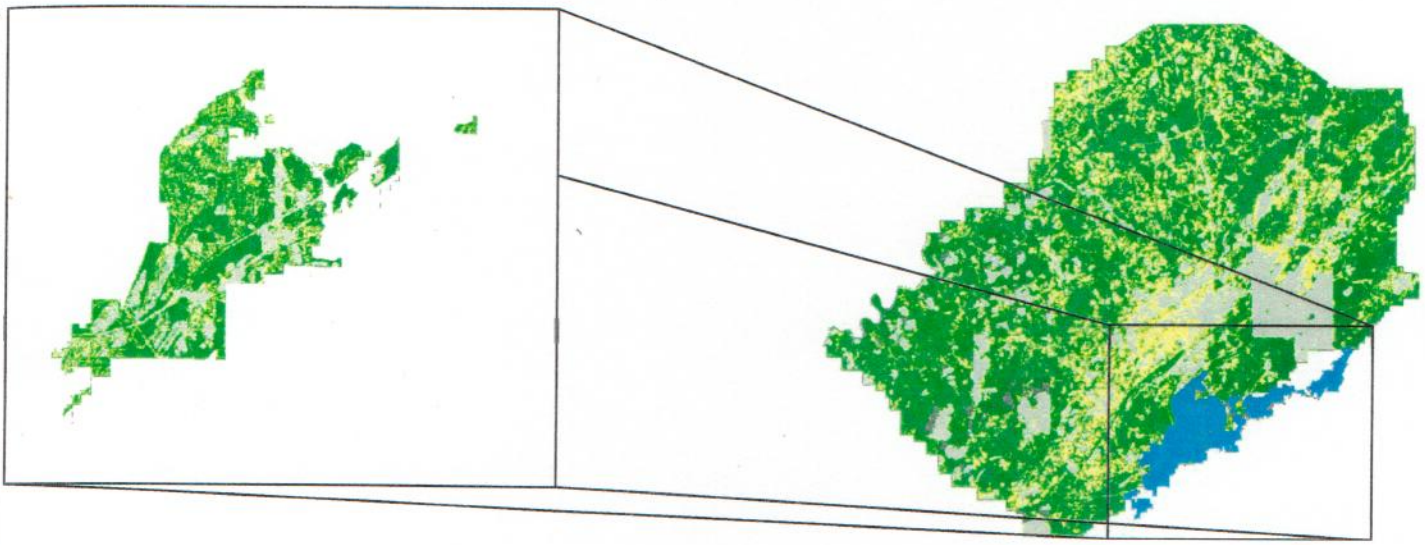
City of Homewood



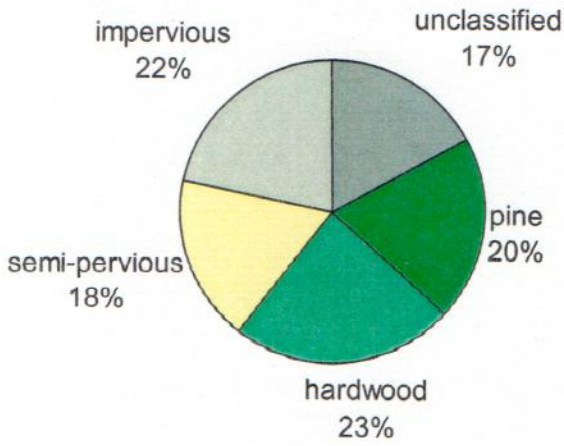
		# of pixels	hectares	%total
0	null	66	0	
1	unclassified	305432	489	0.228264
2	pine	238623	382	17.83%
3	hardwood	163123	261	12.19%
4	semi-pervious	247243	396	18.48%
5	impervious	383645	614	28.67%
	sum	1338066		
	%tree cover	30.02%		



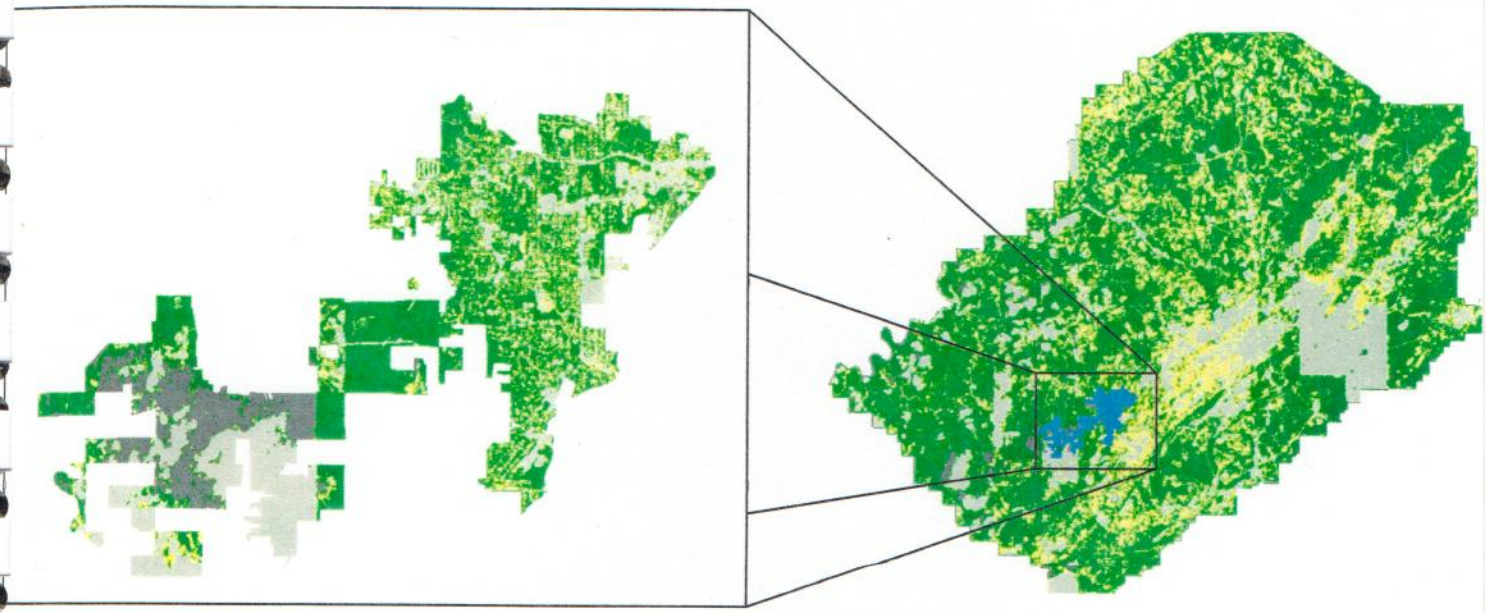
City of Hoover



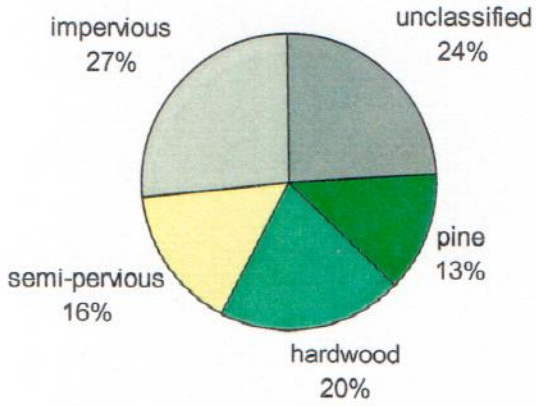
		# of pixels	hectares	%total
0	null	3739469	5983	
1	unclassified	703409	1125	0.17117
2	pine	805231	1288	19.59%
3	hardwood	968172	1549	23.56%
4	semi-pervious	729266	1167	17.75%
5	impervious	903344	1445	21.98%
	sum	4109422		
	%tree cover	43.15%		



City of Hueytown

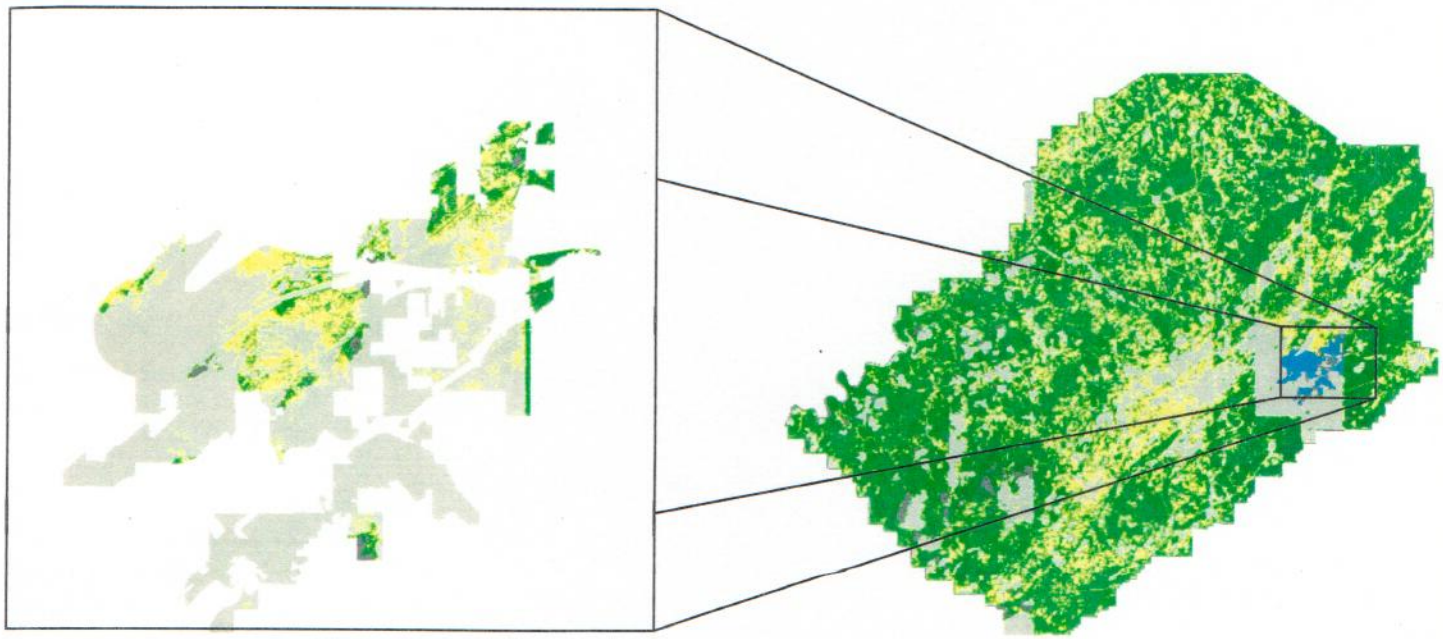


		# of pixels	hectares	%total
0	null	84	0	
1	unclassified	488215	781	0.243419
2	pine	256162	410	12.77%
3	hardwood	405650	649	20.23%
4	semi-pervious	312692	500	15.59%
5	impervious	542938	869	27.07%
	sum	2005657		
	%tree cover	33.00%		

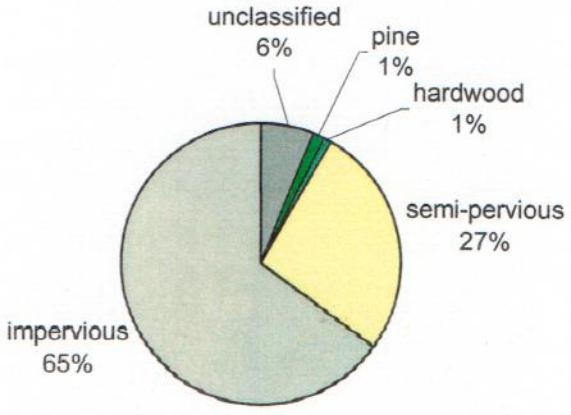


There is some obstruction in the image due to the presence of clouds.

City of Irondale

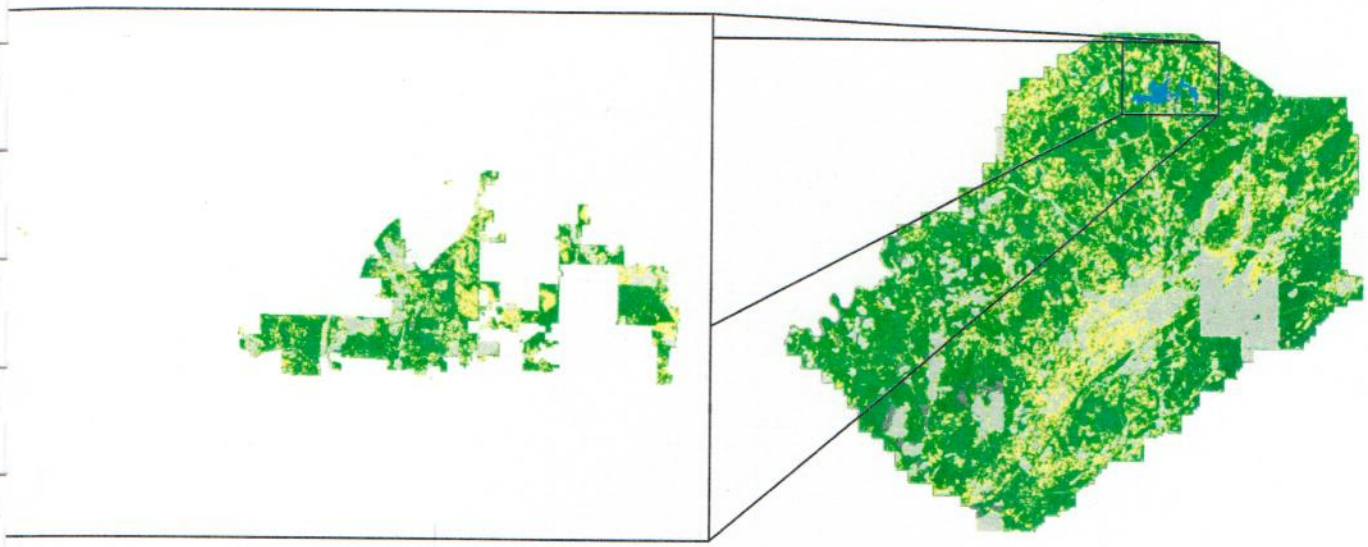


		# of pixels	hectares	%total
0	null	0	0	
1	unclassified	91367	146	0.062405
2	pine	19299	31	1.32%
3	hardwood	10402	17	0.71%
4	semi-pervious	392293	628	26.79%
5	impervious	950739	1521	64.94%
	sum	1464100		
	%tree cover	2.03%		

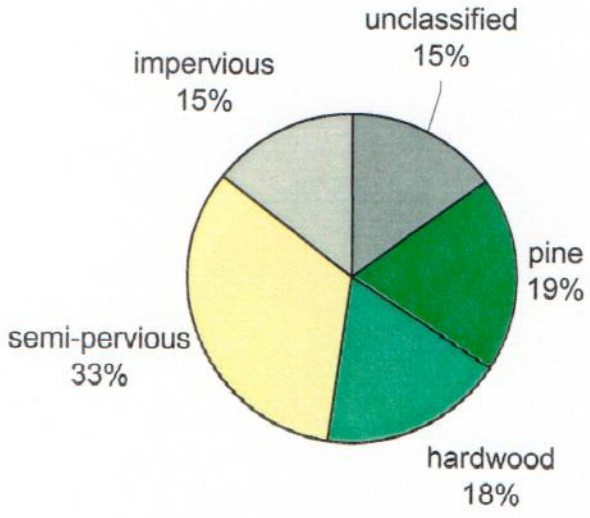


The high percentage of impervious area in the image is due to the presence of clouds.

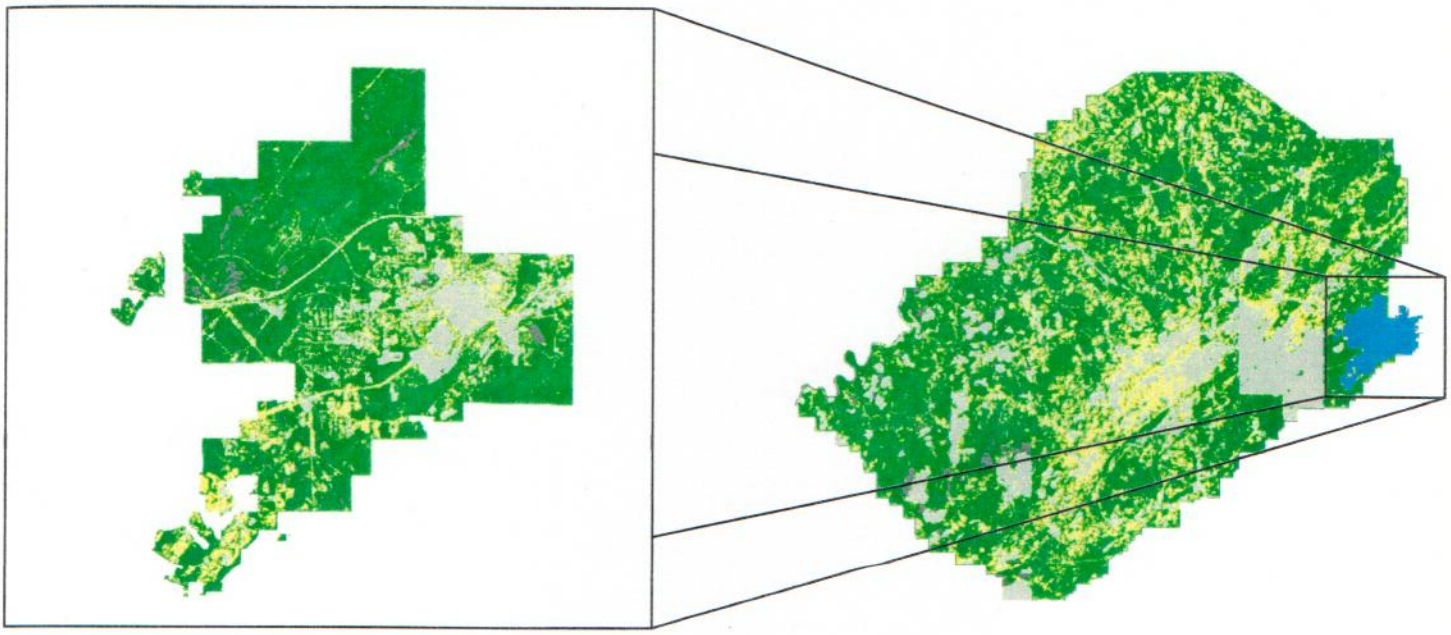
City of Kimberly



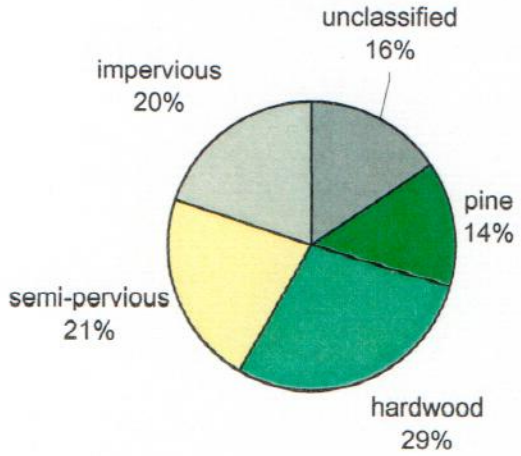
		# of pixels	hectares	%total
0	null	10	0	
1	unclassified	111450	178	0.149469
2	pine	143007	229	19.18%
3	hardwood	135766	217	18.21%
4	semi-pervious	247227	396	33.16%
5	impervious	108188	173	14.51%
	sum	745638		
	%tree cover	37.39%		



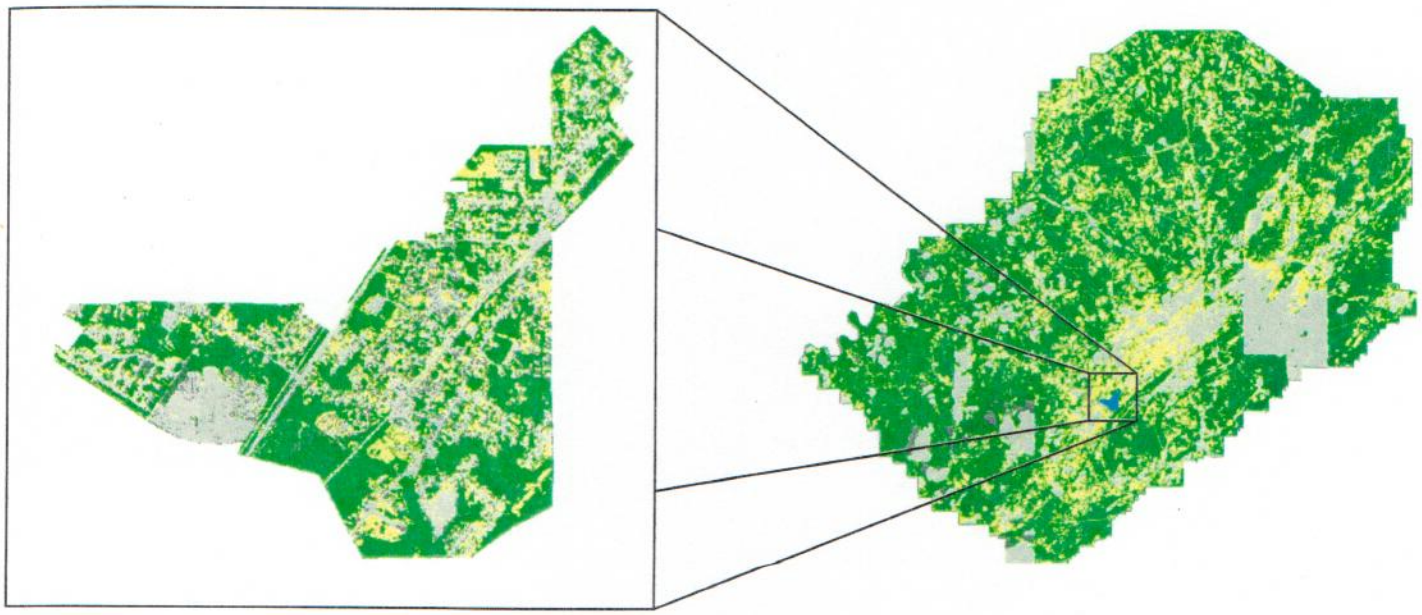
City of Leeds



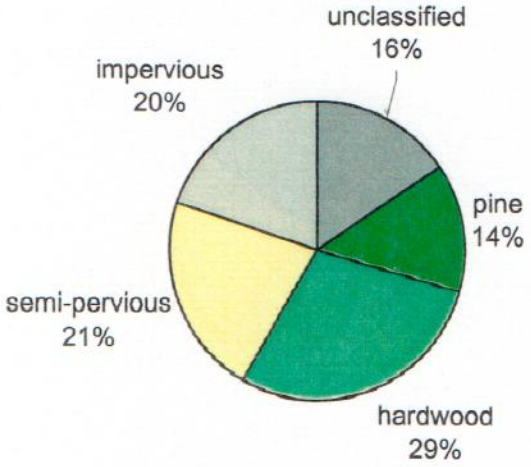
		# of pixels	hectares	%total
0	null	327327	524	
1	unclassified	654222	1047	0.203504
2	pine	922997	1477	28.71%
3	hardwood	648371	1037	20.17%
4	semi-pervious	598588	958	18.62%
5	impervious	390610	625	12.15%
	sum	3214788		
	%tree cover	48.88%		



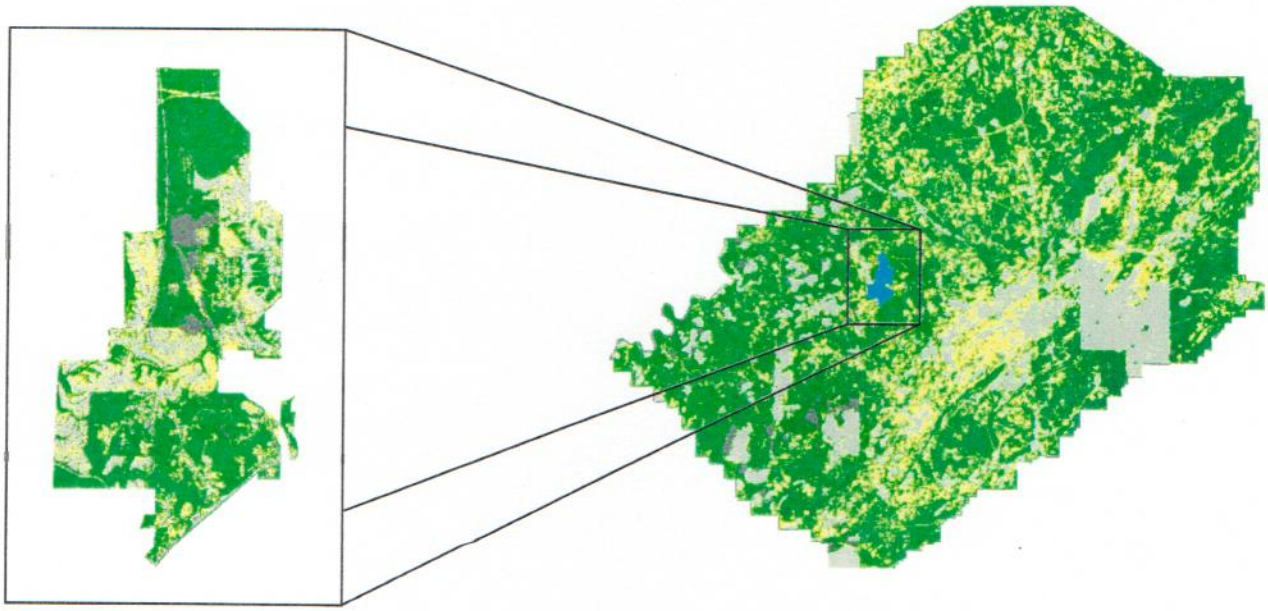
City of Lipscomb



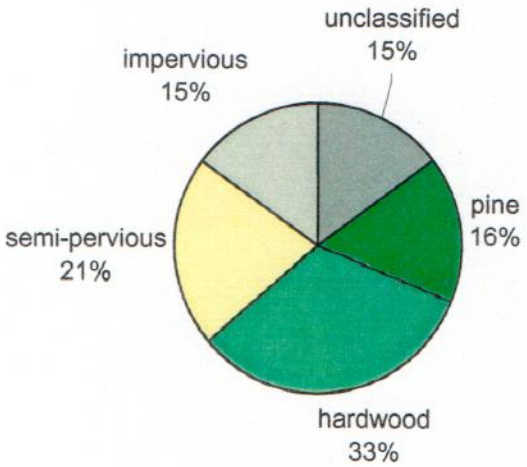
		# of pixels	hectares	%total
0	null	7	0	
1	unclassified	28617	46	0.156715
2	pine	24940	40	13.66%
3	hardwood	53122	85	29.09%
4	semi-pervious	39221	63	21.48%
5	impervious	36705	59	20.10%
	sum	182605		
	%tree cover	42.75%		



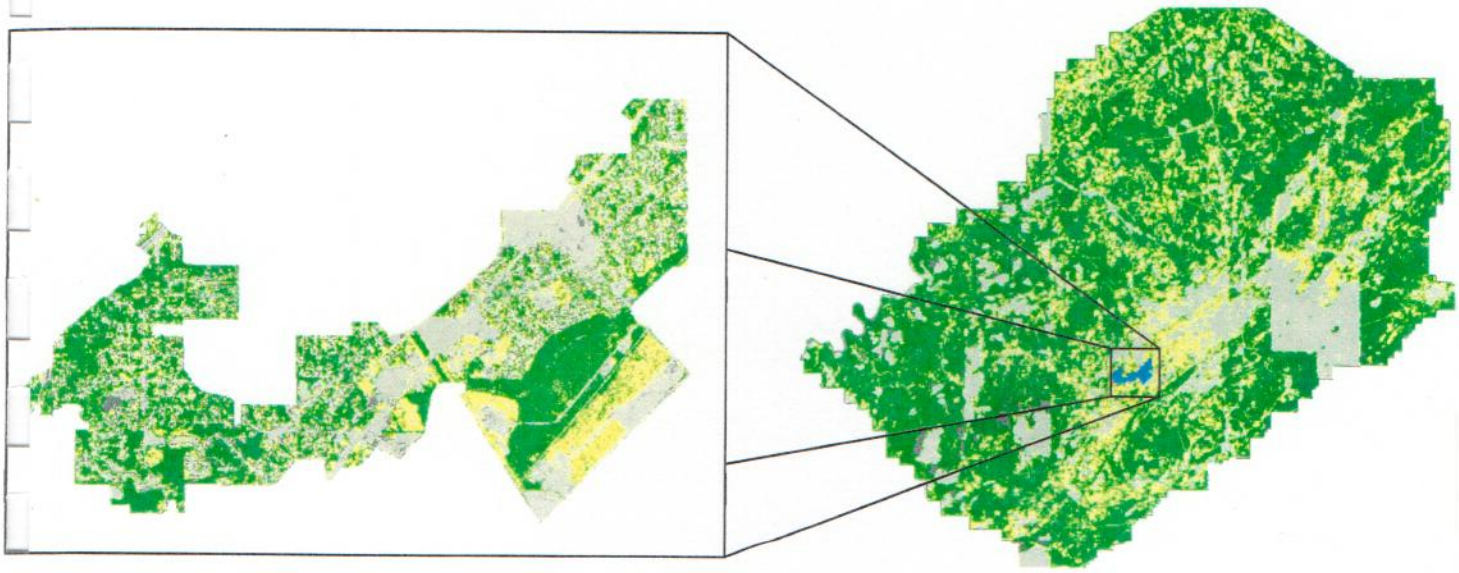
City of Maytown



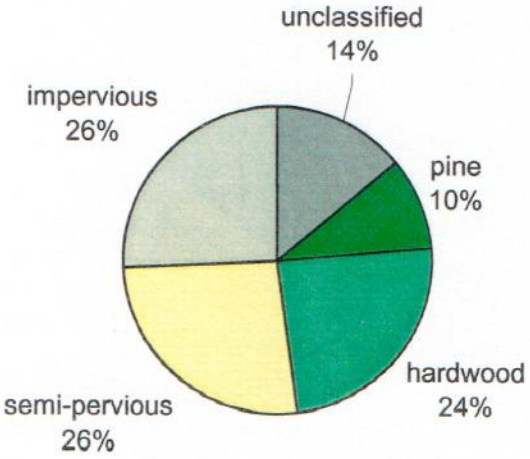
		# of pixels	hectares	%total
0	null	2	0	
1	unclassified	94726	152	0.148375
2	pine	103171	165	16.16%
3	hardwood	208854	334	32.71%
4	semi-pervious	135601	217	21.24%
5	impervious	96071	154	15.05%
	sum	638423		
	%tree cover	48.87%		



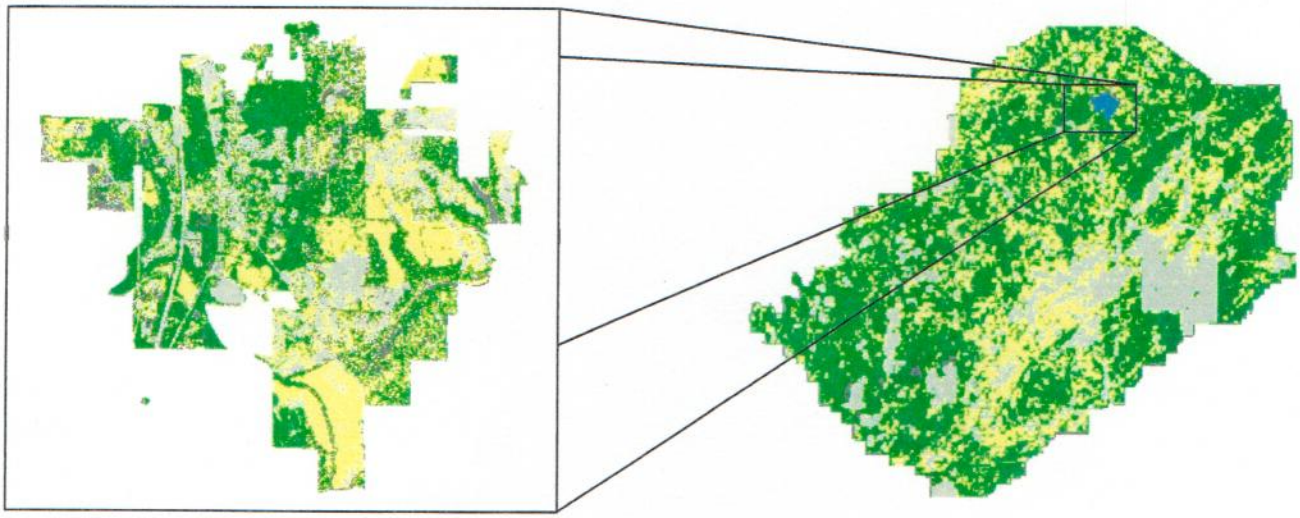
City of Midfield



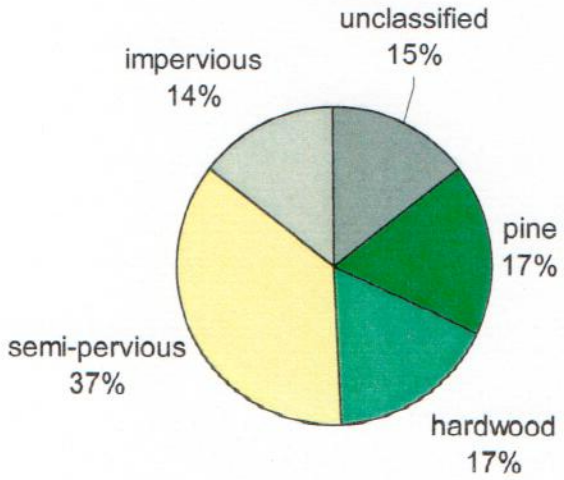
		# of pixels	hectares	%total
0	null	19	0	
1	unclassified	54501	87	0.138119
2	pine	38647	62	9.79%
3	hardwood	95447	153	24.19%
4	semi-pervious	103517	166	26.23%
5	impervious	102482	164	25.97%
	sum	394594		
	%tree cover	33.98%		



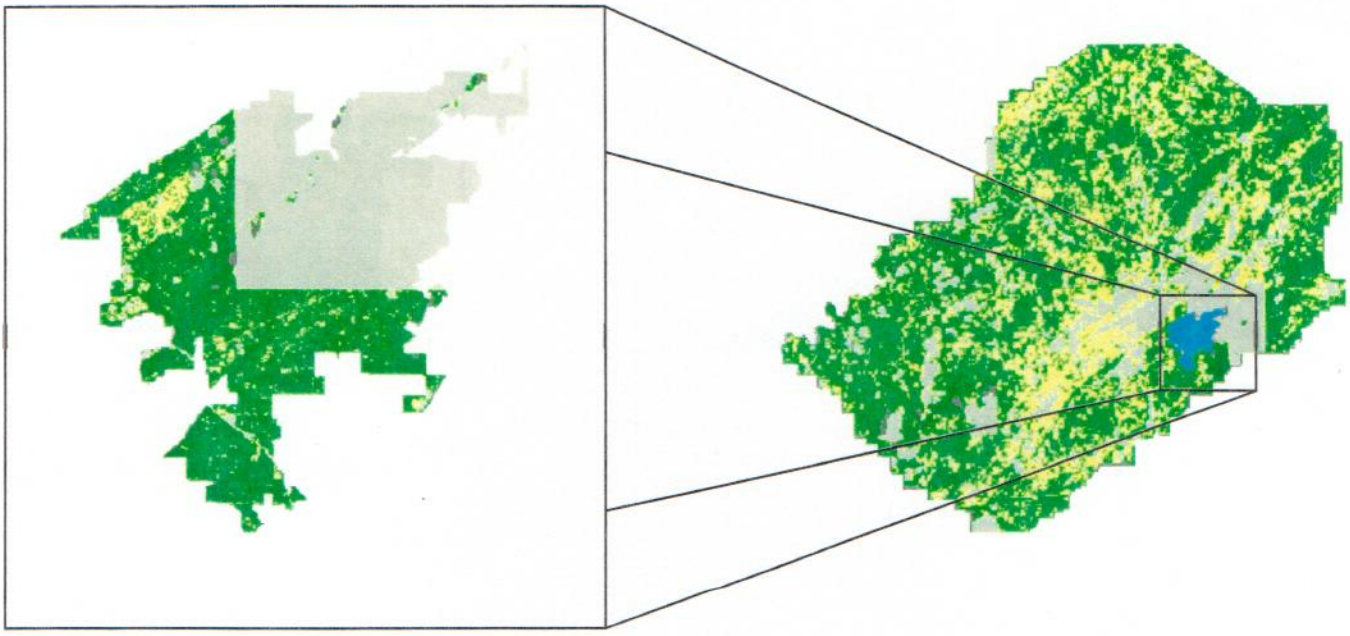
City of Morris



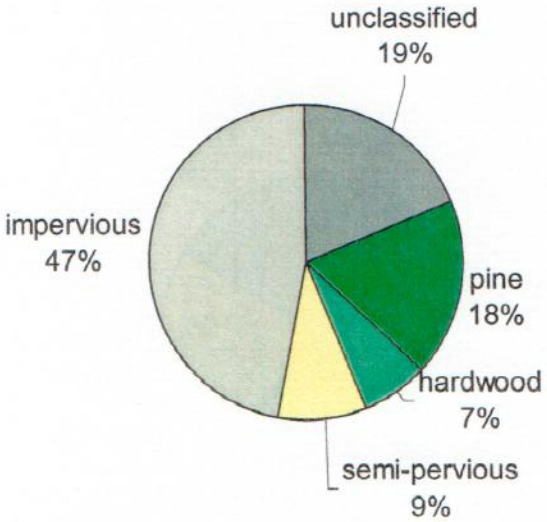
		# of pixels	hectares	%total
0	null	13	0	
1	unclassified	80425	129	0.148443
2	pine	92011	147	16.98%
3	hardwood	92842	149	17.14%
4	semi-pervious	197973	317	36.54%
5	impervious	78541	126	14.50%
	sum	541792		
	%tree cover	34.12%		



City of Mountain Brook

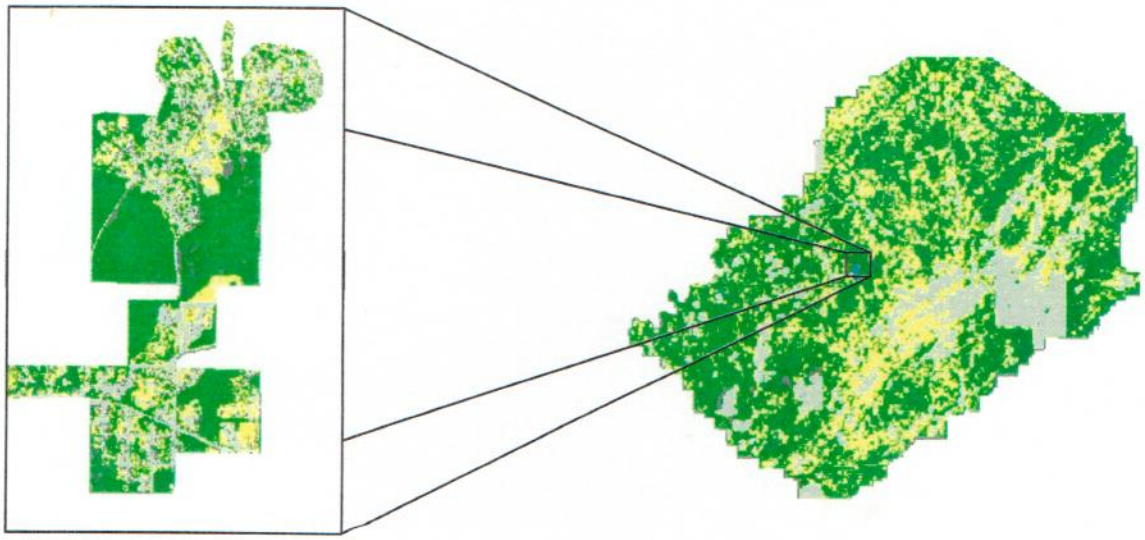


		# of pixels	hectares	%total
0	null	0	0	
1	unclassified	380024	608	0.187951
2	pine	365288	584	18.07%
3	hardwood	139079	223	6.88%
4	semi-pervious	185529	297	9.18%
5	impervious	952009	1523	47.08%
	sum	2021929		
	%tree cover	24.94%		

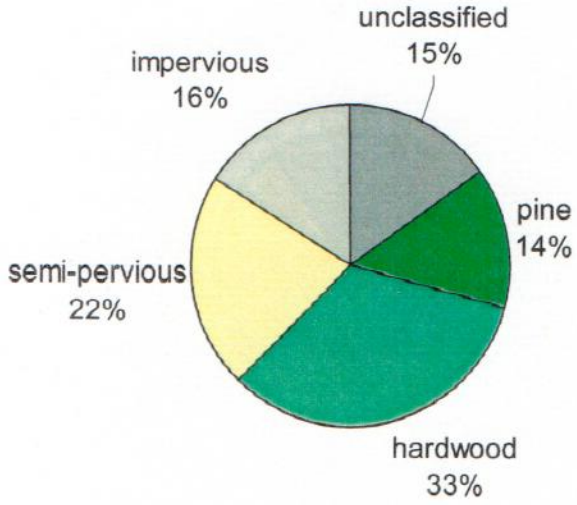


The percent of tree cover in this area has been skewed due to the presence of dense cloud cover during collection.

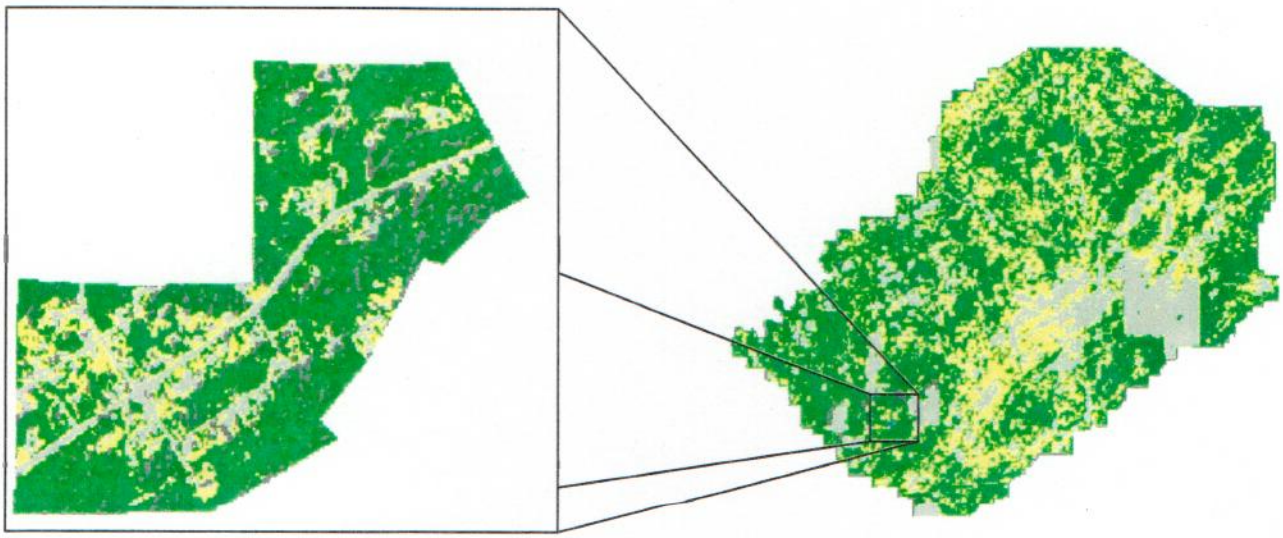
City of Mulga



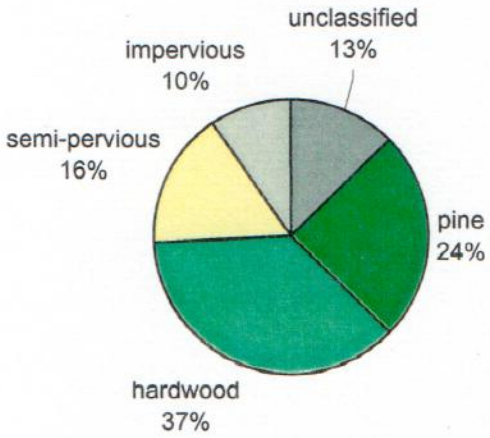
		# of pixels	hectares	%total
0	null	3	0	
1	unclassified	14501	23	0.153344
2	pine	13033	21	13.78%
3	hardwood	31316	50	33.12%
4	semi-pervious	20598	33	21.78%
5	impervious	15117	24	15.99%
	sum	94565		
	%tree cover	46.90%		



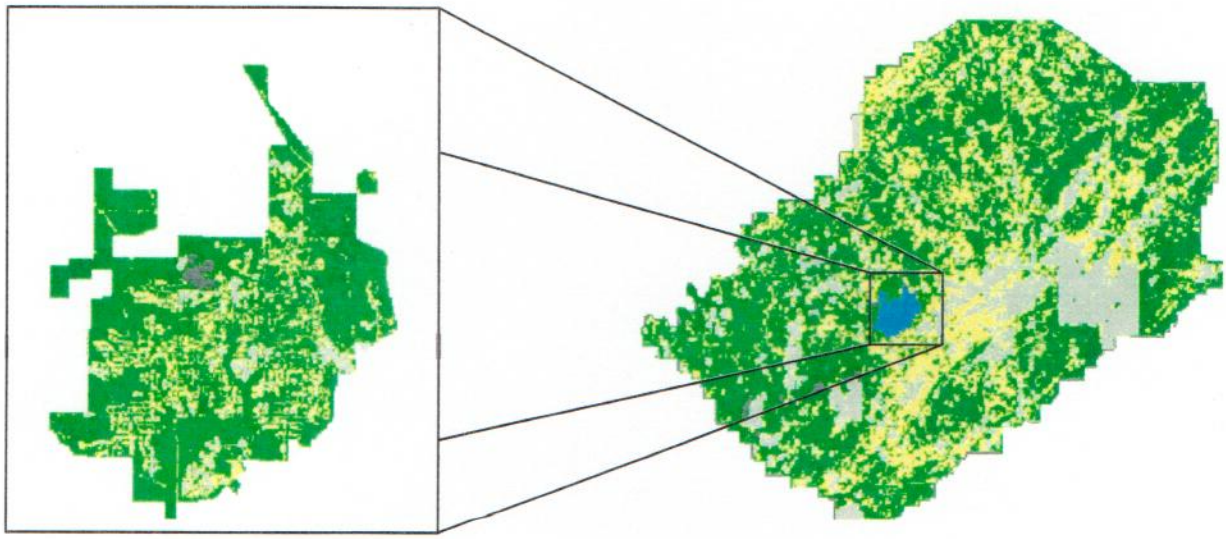
City of North Johns



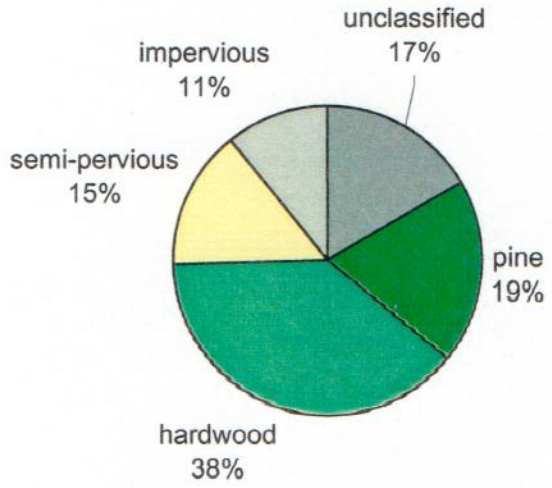
		# of pixels	hectares	%total
0	null	0	0	
1	unclassified	3576	6	0.128879
2	pine	6742	11	24.30%
3	hardwood	10278	16	37.04%
4	semi-pervious	4445	7	16.02%
5	impervious	2706	4	9.75%
	sum	27747		
	%tree cover	61.34%		



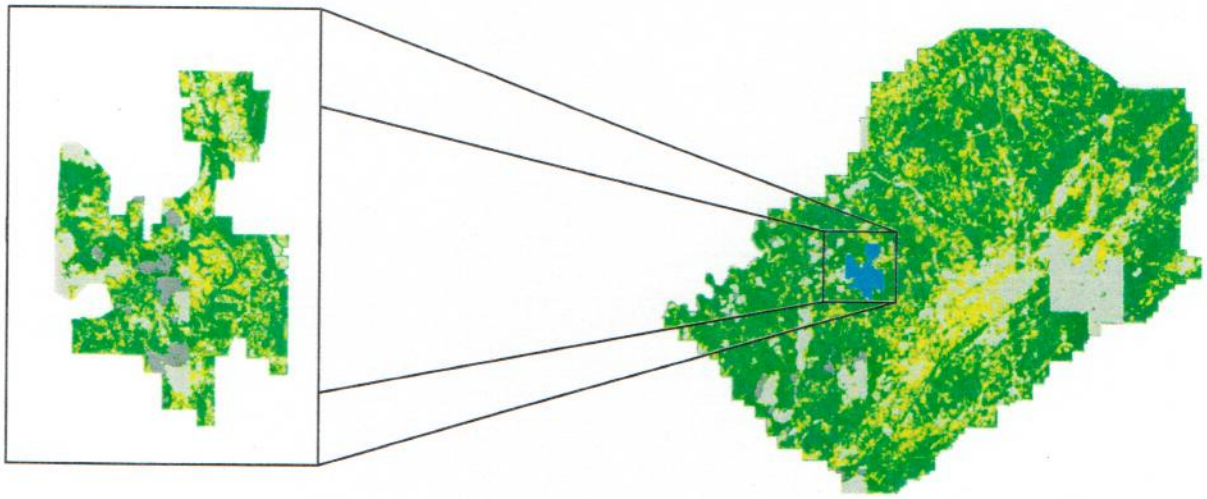
City of Pleasant Grove



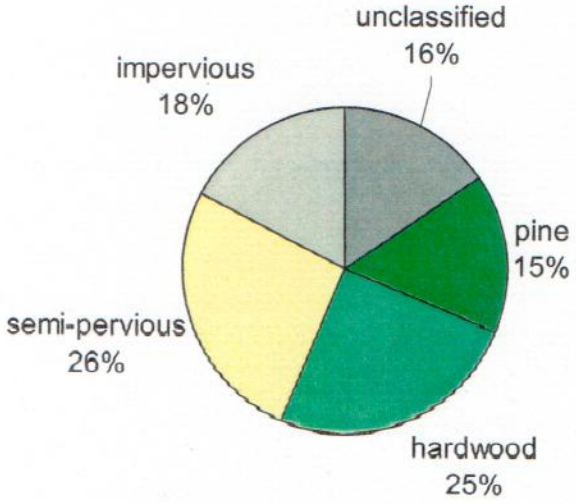
		# of pixels	hectares	%total
0	null	20	0	
1	unclassified	260794	417	0.167726
2	pine	296493	474	19.07%
3	hardwood	601989	963	38.72%
4	semi-pervious	226502	362	14.57%
5	impervious	169107	271	10.88%
	sum	1554885		
	%tree cover	57.78%		



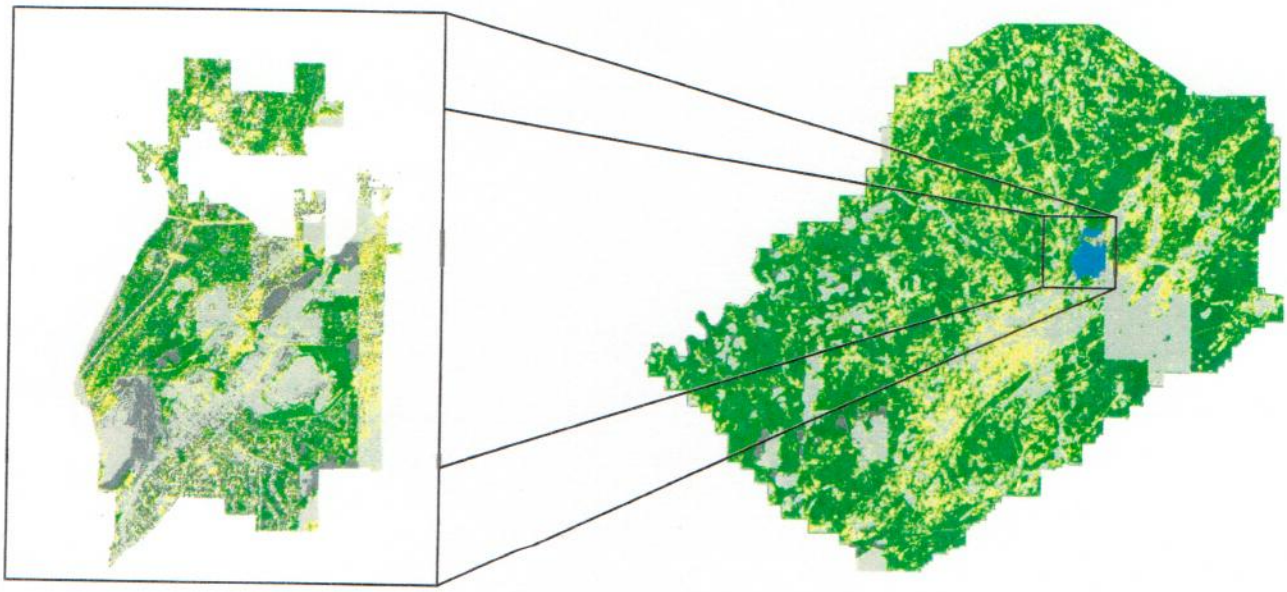
City of Sylvan Springs



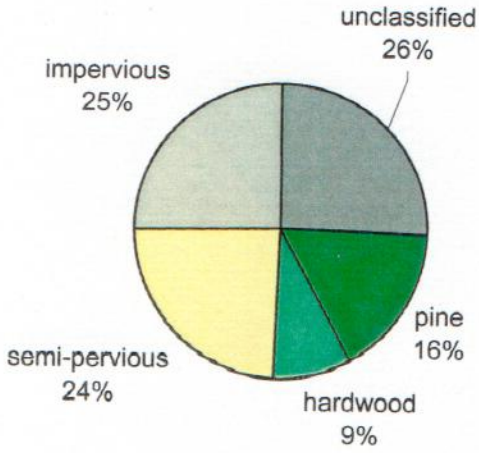
		# of pixels	hectares	%total
0	null	10	0	
1	unclassified	229884	368	15.69%
2	pine	224829	360	15.35%
3	hardwood	368843	590	25.17%
4	semi-pervious	384962	616	26.28%
5	impervious	256601	411	17.51%
	sum	1465119		
	%tree cover	40.52%		



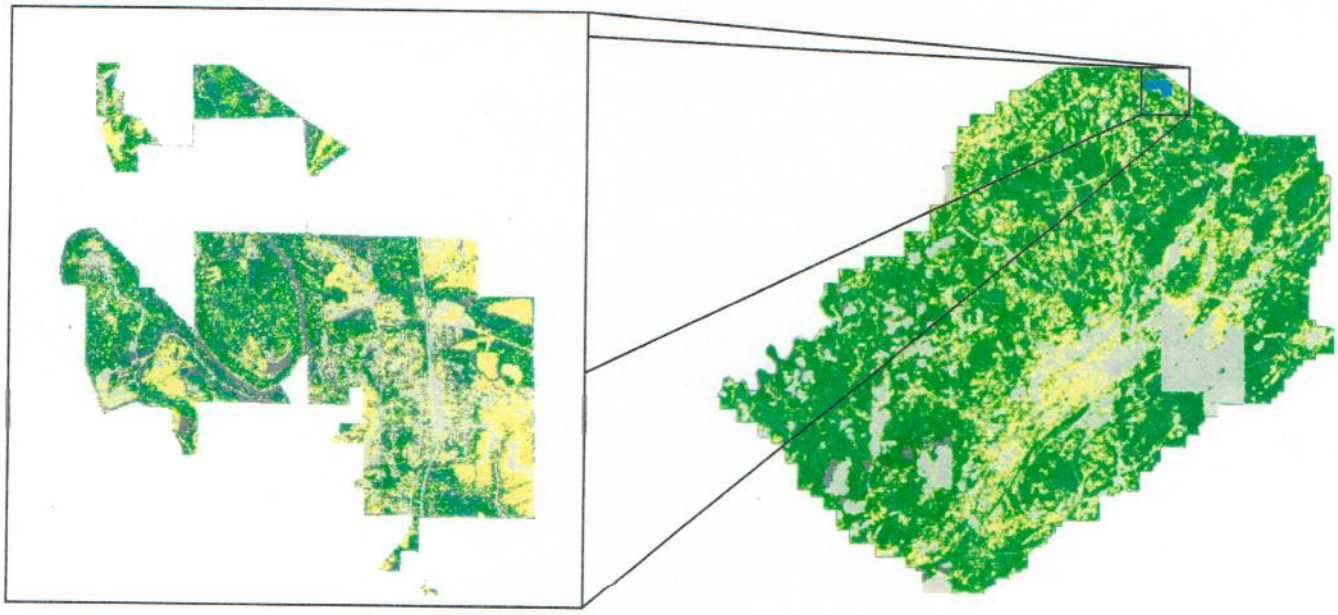
City of Tarrant



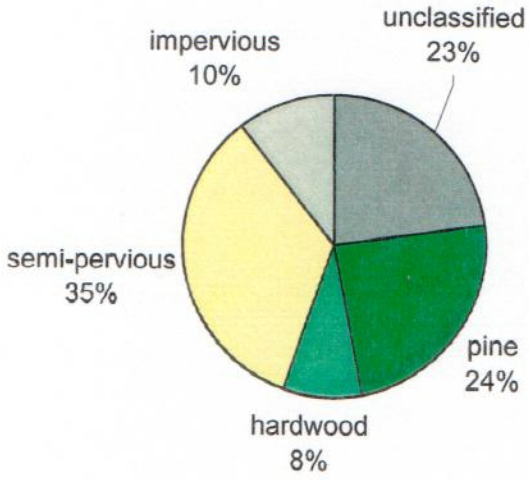
		# of pixels	hectares	%total
0	null	1	0	
1	unclassified	256896	411	0.255299
2	pine	164384	263	16.34%
3	hardwood	86582	139	8.60%
4	semi-pervious	243743	390	24.22%
5	impervious	254651	407	25.31%
	sum	1006256		
	%tree cover	24.94%		



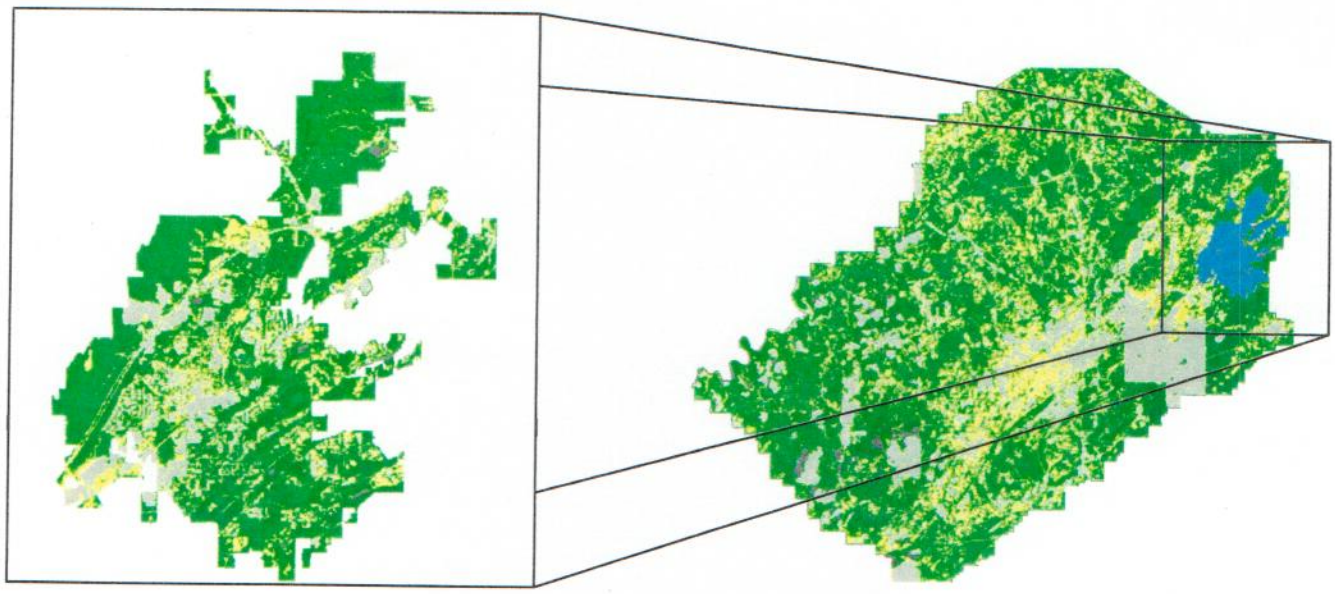
City of Trafford



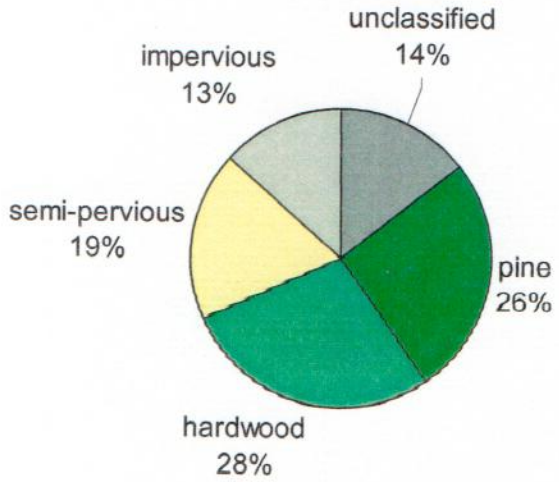
		# of pixels	hectares	%total
0	null	0	0	
1	unclassified	73840	118	0.22791
2	pine	78659	126	24.28%
3	hardwood	26960	43	8.32%
4	semi-pervious	110746	177	34.18%
5	impervious	33782	54	10.43%
	sum	323987		
	%tree cover	32.60%		



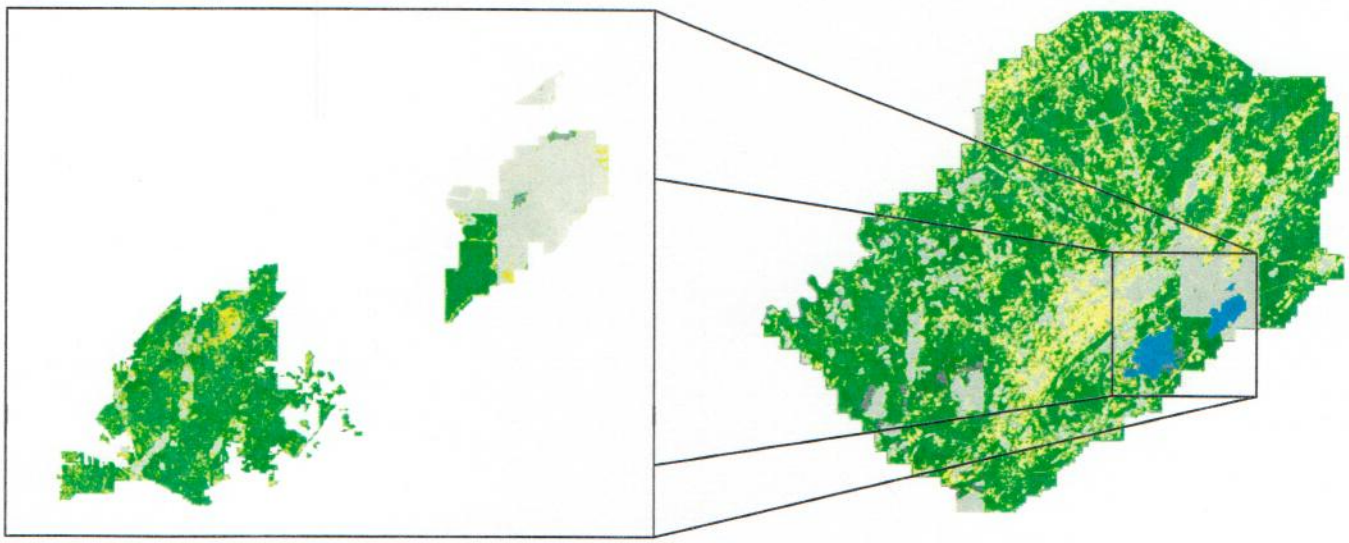
City of Trussville



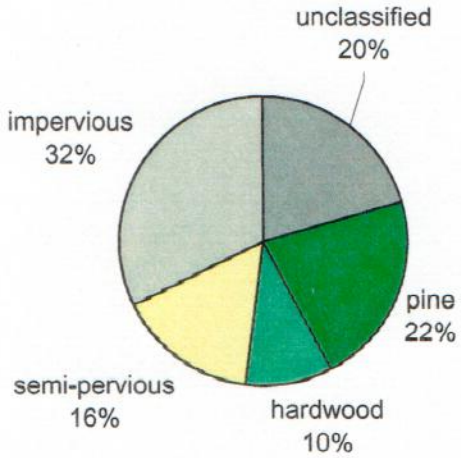
		# of pixels	hectares	%total
0	null	16	0	
1	unclassified	634273	1015	0.144147
2	pine	1134630	1815	25.79%
3	hardwood	1222125	1955	27.77%
4	semi-pervious	817526	1308	18.58%
5	impervious	591631	947	13.45%
	sum	4400185		
	%tree cover	53.56%		



City of Vestavia Hills

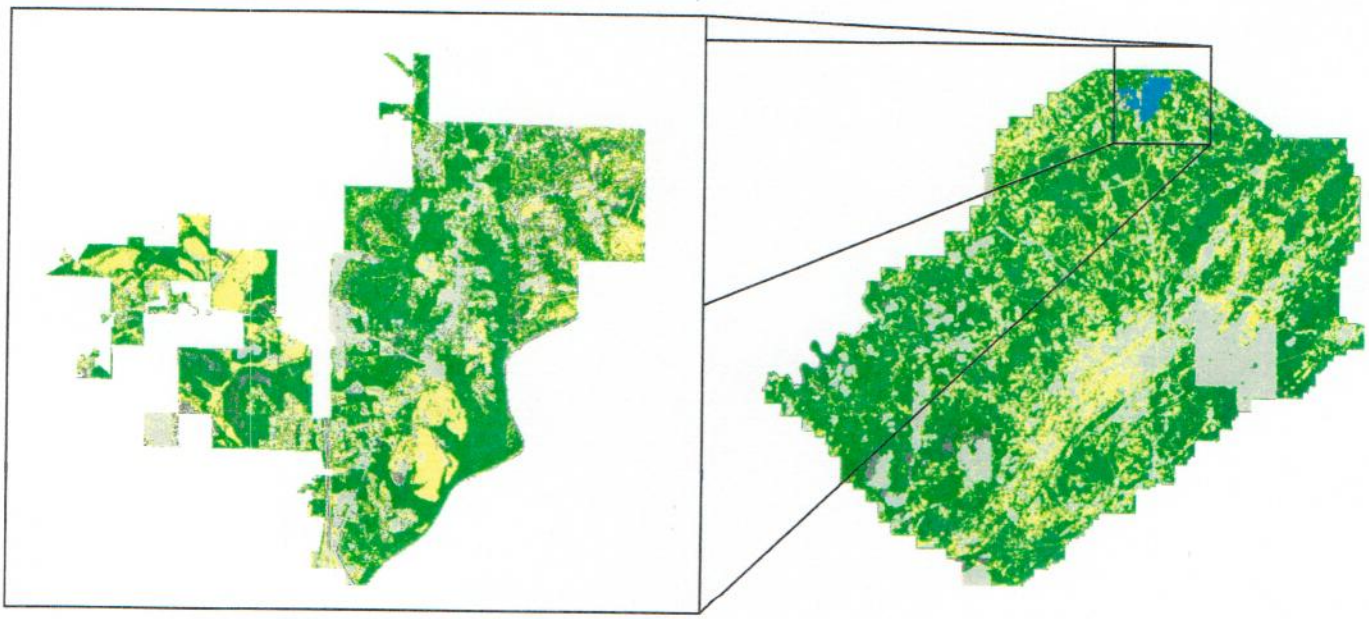


		# of pixels	hectares	%total
0	null	14	0	
1	unclassified	525492	841	0.204357
2	pine	558125	893	21.70%
3	hardwood	252090	403	9.80%
4	semi-pervious	408977	654	15.90%
5	impervious	826753	1323	32.15%
	sum	2571437		
	%tree cover	31.51%		

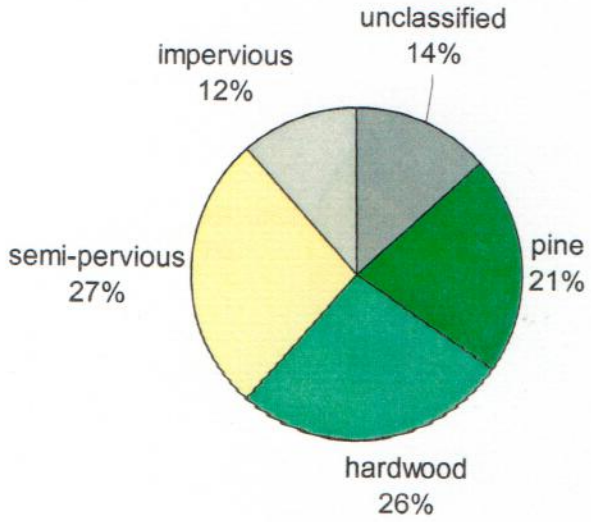


Cloud cover obstructed a significant portion of the municipality during data collection.

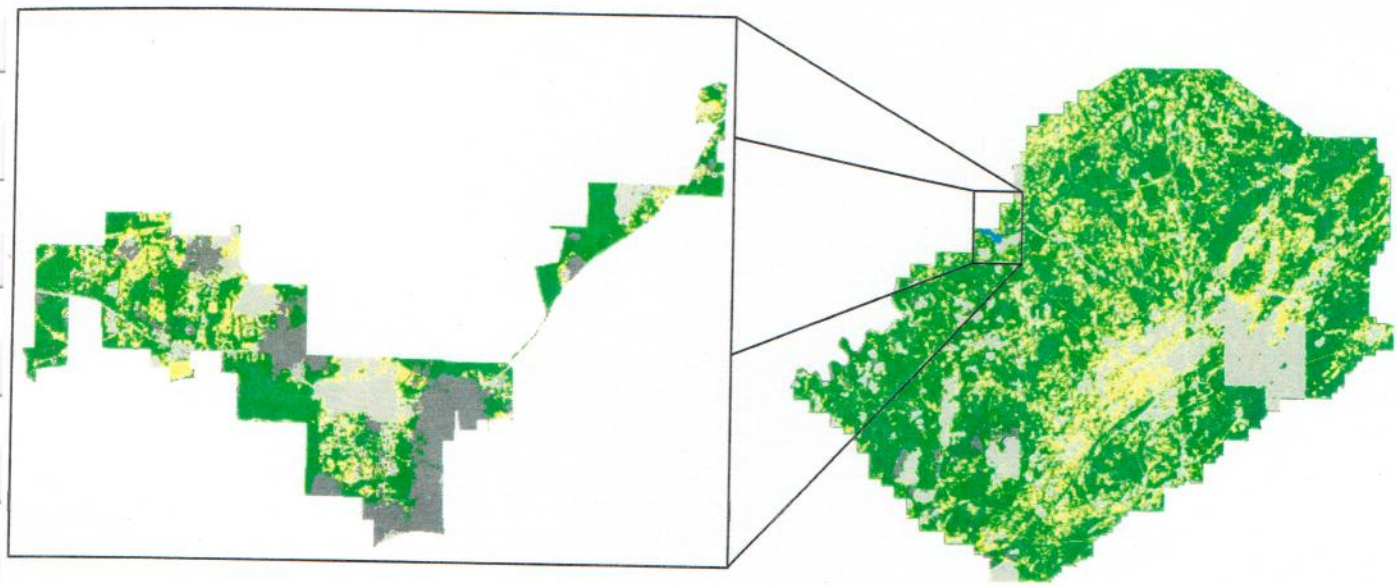
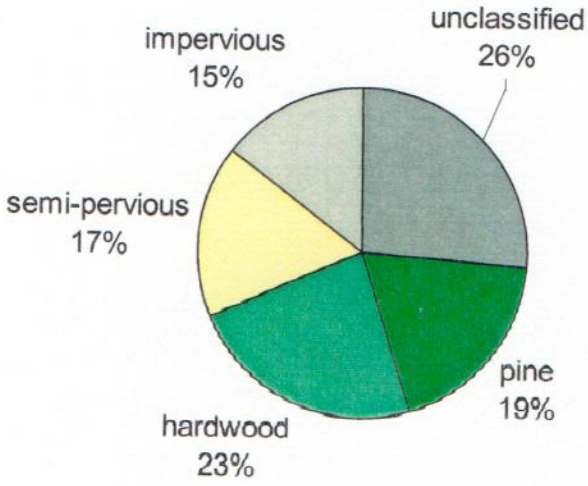
City of Warrior



		# of pixels	hectares	%total
0	null	36	0	
1	unclassified	154782	248	0.136791
2	pine	233590	374	20.64%
3	hardwood	302011	483	26.69%
4	semi-pervious	309249	495	27.33%
5	impervious	131886	211	11.66%
	sum	1131518		
	%tree cover	47.33%		



City of West Jefferson



		# of pixels	hectares	%total
0	null	1	0	
1	unclassified	40809	65	0.263204
2	pine	29017	46	18.71%
3	hardwood	36139	58	23.31%
4	semi-pervious	26295	42	16.96%
5	impervious	22787	36	14.70%
	sum	155047		
	%tree cover	42.02%