All Mapped Out: Land Use/Land Cover of Aquinas College Grand Rapids, Michigan
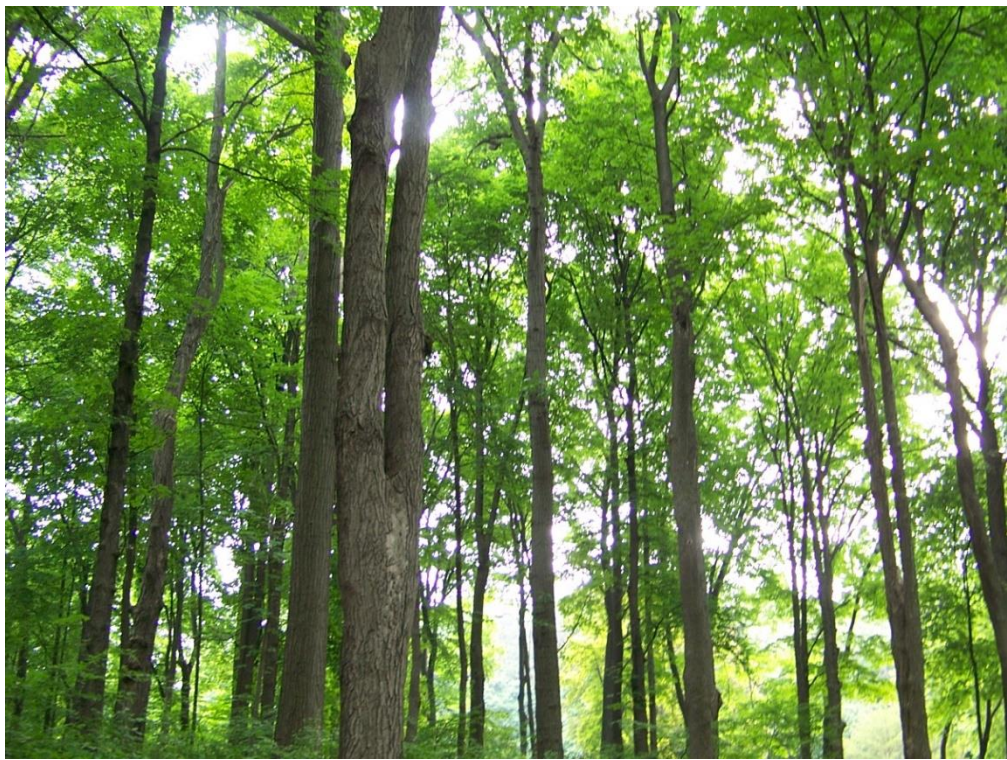
By: Emily Macqueen

ABSTRACT

Aquinas College lacked a current Land Use/Land Cover map. I created such a base map of Aquinas College, at a very high resolution which can be used as a base map for many different disciplines. Economic valuation of the land cover/land use of the campus for sustainable planning will be a future use of this map. Recently many campus buildings were renamed. This map identifies these changes, and should prove very useful to students and faculty.
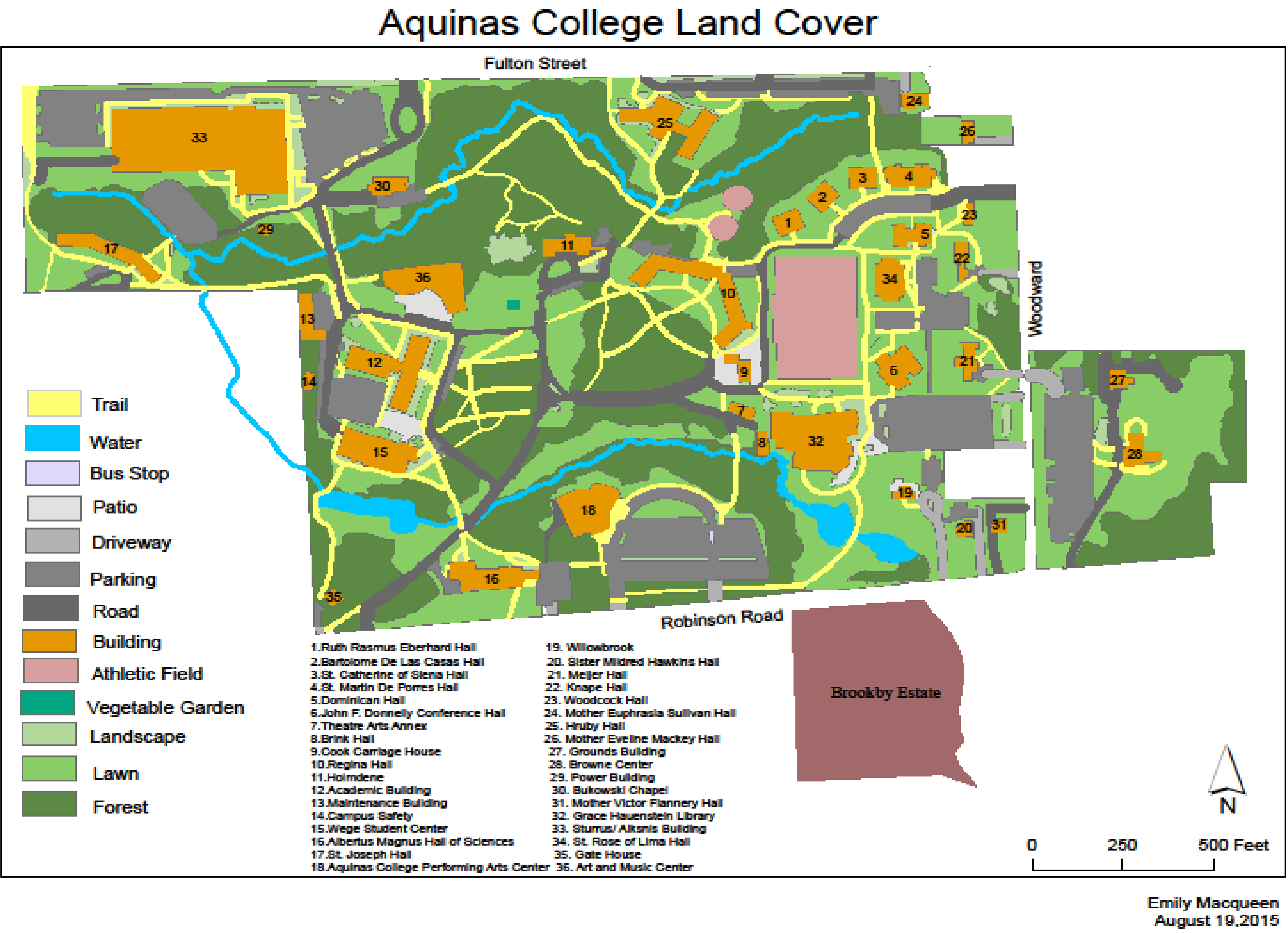
STUDY AREA

- Aquinas College Campus located in Grand Rapids, Michigan
- Landscape
    - Two streams that create two valleys
    - Contoured by the Wisconsin glaciation
- Land cover
    - Formerly hardwood deciduous forest
    - Beech and maple
    - Invasive and non-native species
- Climate (2014 Statistics)
    - Average high temperature: 57.8ºFahrenheit
    - Average low temperature: 40.3º Fahrenheit
    - Precipitation: 38.27 inches, including 78 inches of snow

METHODS

- Data Dictionary Land Use/Land Cover (based on the Michigan LULC)
- GNSS data collection via tablet and Trimble R1 receiver
- Pathfinder software for data correction
- Export corrected and uncorrected data from Pathfinder to ArcGIS
- ArcGIS used for mapping, editing, and area calculations

Aquinas College Land Cover

Legend: Trail, Water, Bus Stop, Patio, Driveway, Parking, Road, Building, Athletic Field, Vegetable Garden, Landscape, Lawn, Forest

1. Ruth Rasmus Eberhard Hall
2. Bartolome De Las Casas Hall
3. St. Catherine of Siena Hall
4. St. Martin De Porres Hall
5. Dominican Hall
6. John F. Donnelly Conference Hall
7. Theatre Arts Annex
8. Brink Hall
9. Cook Carriage House
10. Regina Hall
11. Holmdene
12. Academic Building
13. Maintenance Building
14. Campus Safety
15. Wege Student Center
16. Albertus Magnus Hall of Sciences
17. St. Joseph Hall
18. Aquinas College Performing Arts Center
19. Willowbrook
20. Sister Mildred Hawkins Hall
21. Meijer Hall
22. Knape Hall
23. Woodcock Hall
24. Mother Euphrasia Sullivan Hall
25. Hruby Hall
26. Mother Evelne Mackey Hall
27. Grounds Building
28. Browne Center
29. Power Building
30. Bukowski Chapel
31. Mother Victor Flannery Hall
32. Grace Hauenstein Library
33. Sturrus/Aitkins Building
34. St. Rose of Lima Hall
35. Gate House
36. Art and Music Center

0 — 250 — 500 Feet

Emily Macqueen
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CALCULATIONS

Mowing Lawn

- 22.44 acres of lawn need to be mowed on campus (Table 1).
- If we mow the lawns at Aquinas College 20 times a year, our mowing is over 7 miles². That is the equivalent of 1/6th of Grand Rapids or twice the size of East Grand Rapids (1 acre = 43,560 ft²)

Permeable vs. Impermeable

- 49.34 acres of permeable surface, 37.91 acres of impermeable surface (Table 2). These calculations do not include the Brookby Estate.
- Grand Rapids receives 38.27 inches of precipitation every year, which includes 78 inches of snowfall every year ("Grand Rapids Michigan", 2014).
- 37.91 acres/ 87.80 acres = 43% of campus is impermeable
- 49.34 acres/ 87.80 acres =57% of campus is permeable

Snow Removal

- 24.44 acres of Aquinas College need to be plowed (Table 3)
- 78 inches = 6.5 ft
- 43,560 ft² = 1 acre
- 43,560 ft² * 6.5 ft = 283,140 ft³/acre³
- 283,140 ft³/acre³ * 22.44 acres = 6.92 million ft³ of snow removal
- The volume of an Olympic swimming pool is 88,000 ft³, so roughly 78 Olympic swimming pools of snow is moved each winter.

RESULTS

Aquinas has a mission for sustainability, and with this land use/land cover map future researchers will be able to quantify the data for sustainability. The ability to quantify the data will lend itself to making the Aquinas College Campus more sustainable in how the land cover is used.

Table 1. Land Cover

Land Cover Types	Area (square meters)	Acres
Athletic Field	8845	2.19
BrookbyEstate	2227	0.55
Buildings	38463	9.50
Bus Stop	42	0.01
Driveway		
One Lane	2530	0.63
Two Lane	1386	0.34
Forest	86036	21.26
Landscape		
Planted Garden	7391	1.83
Natural Vegetation	289	0.07
Botanical Garden	803	0.20
Lawns		
Open	8442	2.09
Some Trees	82364	20.35
Parking	47114	11.64
Patio	3275	0.81
Ponds	3542	0.88
Roads		
One Lane Road	10503	2.60
Two Lane Road	17783	4.39
Stream	6428	1.59
Trails		
Unpaved Bare	2447	0.60
Unpaved Mulch	1825	0.45
Paved Concrete	21804	5.39
Paved Asphalt	1672	0.41
Vegetable Garden	95	0.02
Total	**355306**	**87.80**

Table 2. Impermeable Surface vs. Permeable Surface

Impermeable Surface	Area (square meters)	Acres
Athletic Field		
Basketball Court	479	0.12
Turf Field	7885	1.95
Volleyball Court	481	0.12
Buildings	38463	9.50
Bus Stop	42	0.01
Driveway		
One Lane	2530	0.63
Two Lane	1386	0.34
Parking	47114	11.64
Patio	3275	0.81
Roads		
One Lane	10503	2.60
Two Lane	17783	4.39
Trails		
Paved Asphalt	1672	0.41
Paved Concrete	21804	5.59
Total	**153417**	**37.91**

Permeable Surface	Area (square meters)	Acres
Forest	86036	21.26
Landscape		
Planted Garden	7391	1.83
Natural Vegetation	289	0.07
Botanical Garden	803	0.20
Lawns		
Open	8442	2.09
Some trees	82364	20.35
Ponds	3542	0.88
Streams	6428	1.59
Trails		
Unpaved Bare	2447	0.60
Unpaved Mulch	1825	0.45
Vegetable Garden	95	0.02
Total	**199662**	**49.34**

Table 3. Plowed Land Cover

Land Cover	Area (square meters)	Acres
Trails		
Paved Asphalt	21804	5.39
Paved Concrete	1672	0.41
Roads		
One Lane	10503	2.60
Two Lane	17783	4.39
Bus Stop	42	0.01
Parking	47114	11.64
Total	**98918**	**24.44**

CONCLUSIONS

This research can support future projects:

- In-depth study of each of the different types of land cover
- Calculation of savings if we stopped doing lawn maintenance
- Mapping native and non-native vegetation areas on campus to see if we can improve ecological function by replacing certain areas with native vegetation
- The tree walk map that we have on campus could also be advanced by making it a digital tree walk map including pictures and audio commentary

References

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