University of Toronto Carbon Stock

Faculty of Forestry, University of Toronto

Team:

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http://forestry.utoronto.ca/

http://forests-settled-urban-landscapes.org/

Background

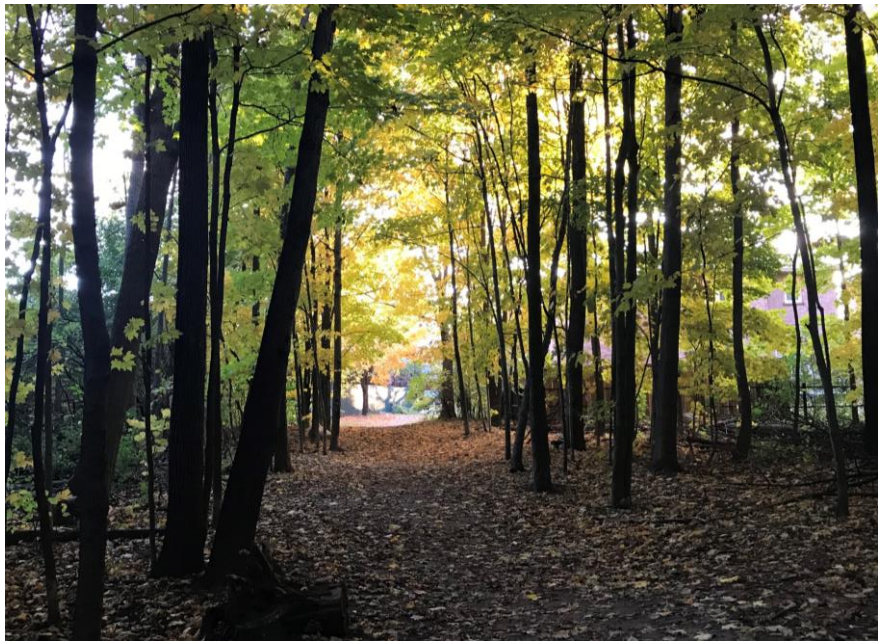
- The University of Toronto is committed to reducing greenhouse gas (GHG) emissions by 37% from 1990s levels by the year 2030 (Second Nature, 2018).
- Trees and forests provide a natural solution to GHG reduction and climate change impacts by
    - Serving as a carbon sink and storing carbon
    - Providing shading and cooling effects and thus ameliorating microclimate and helping to reduce energy use
- Trees and forests provide many other ecosystem services and functions
    - improve air and water quality, mitigate rainfall runoff and flooding, lower noise impacts, enhance human health and social well-being, provide aesthetic beauty, biodiversity conservation, invasive species, and many others.

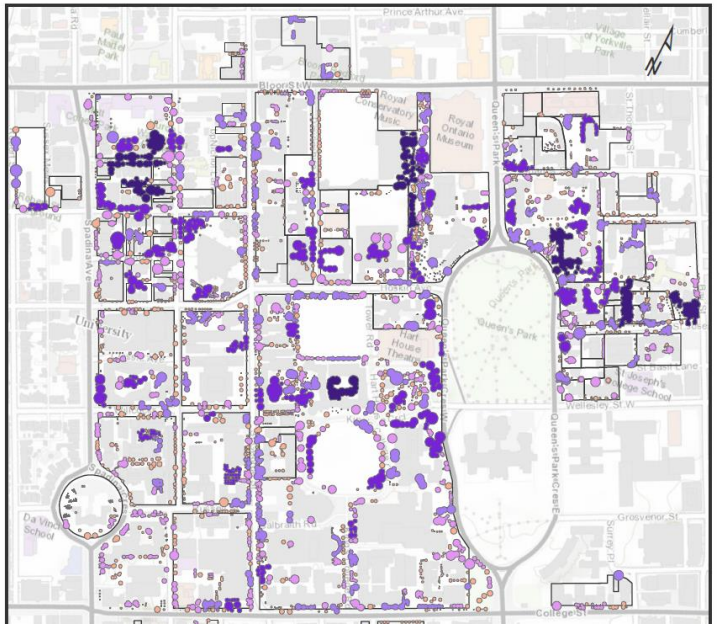
UofT properties

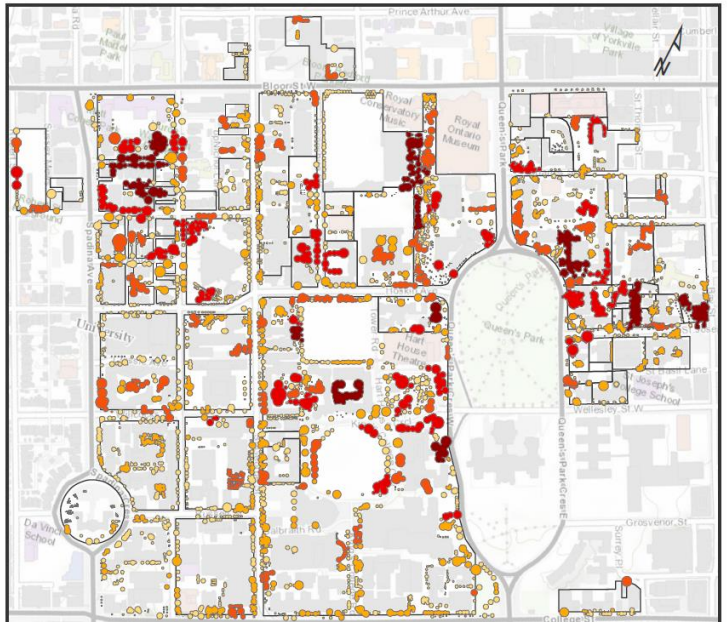
- The University of Toronto owns about 802 ha of lands across nine properties in rural, urban, and peri-urban areas of southern Ontario.
- UofT has an ability to manage its trees and forests
  - To conserve stored carbon and maximize forest carbon storage and sequestration.
  - While conserving and enhancing diversity and many other ecological and social functions.

Objectives

- Provide estimates of carbon stored and sequestered by trees and forests for the nine University properties
- Distinguish carbon stored and sequestered by
  - Single trees (e.g. around the buildings, parks, planters) and natural areas (i.e. woodlands)
  - Forest remnants, woodlands, and plantations
- Provide an outline of a proposed forest monitoring program for UofT properties

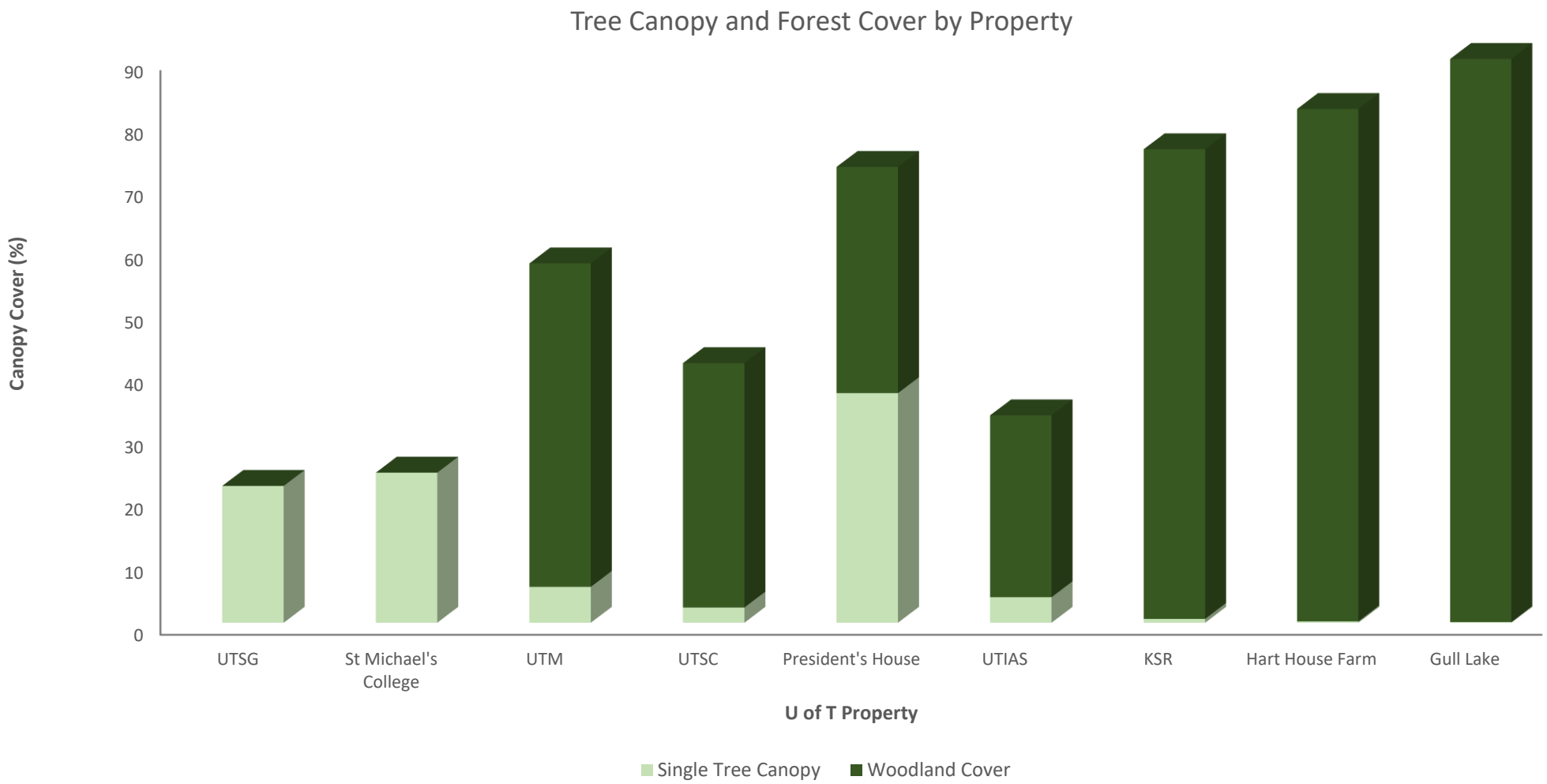




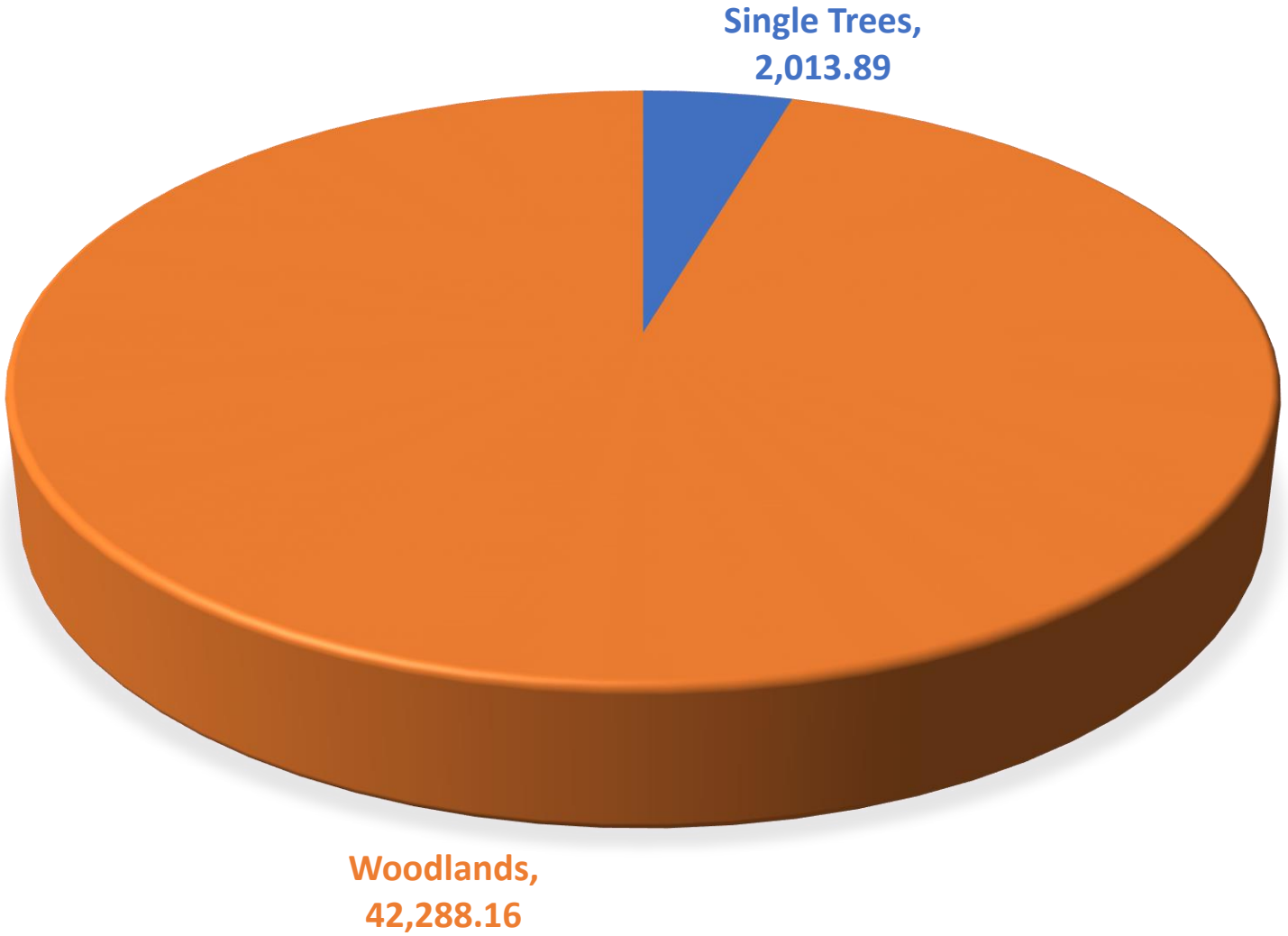


RESULTS

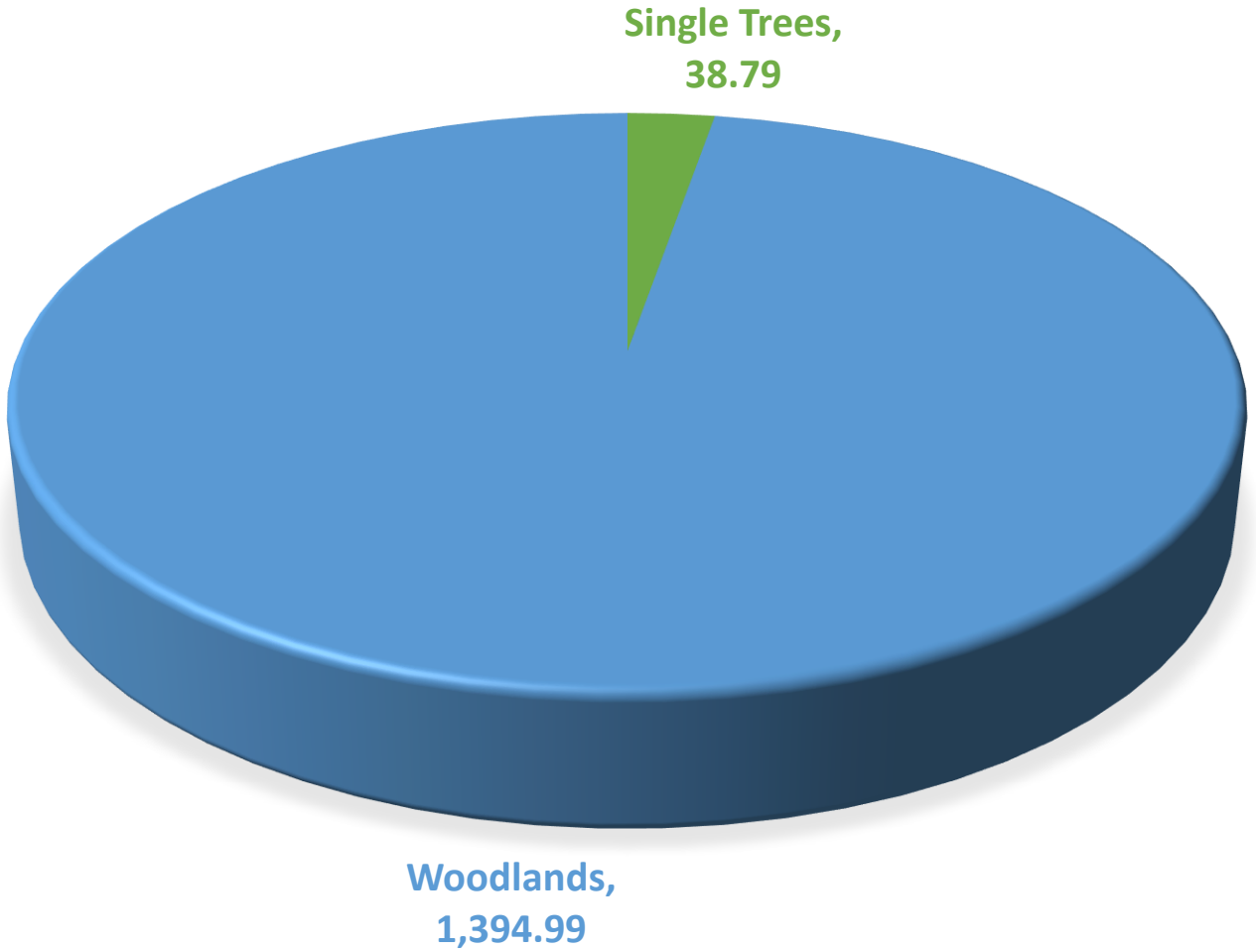
Tree and Forest Cover



Total Carbon Stored (Mg) by UofT Properties

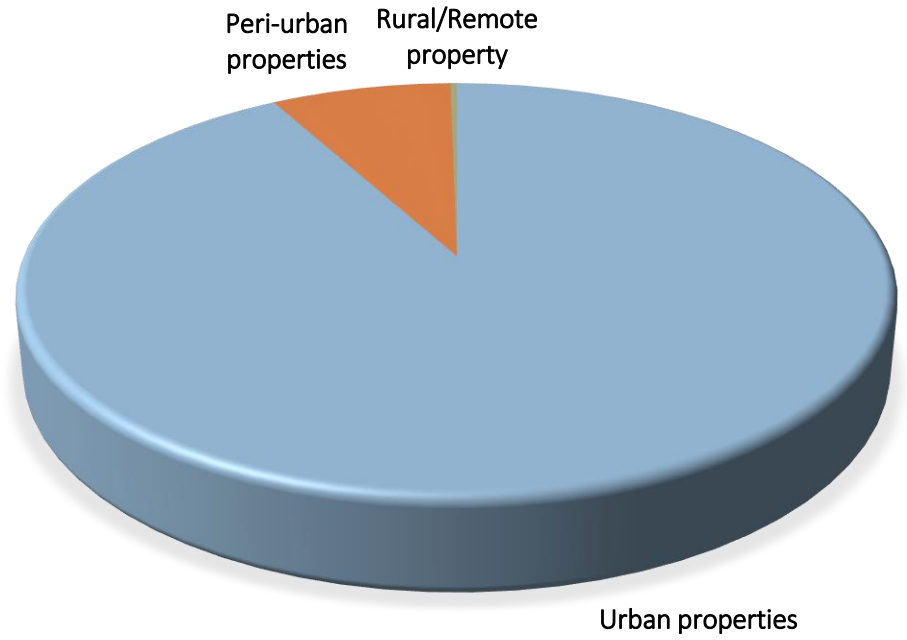


Total Carbon Sequestered (Mg) by UofT Properties

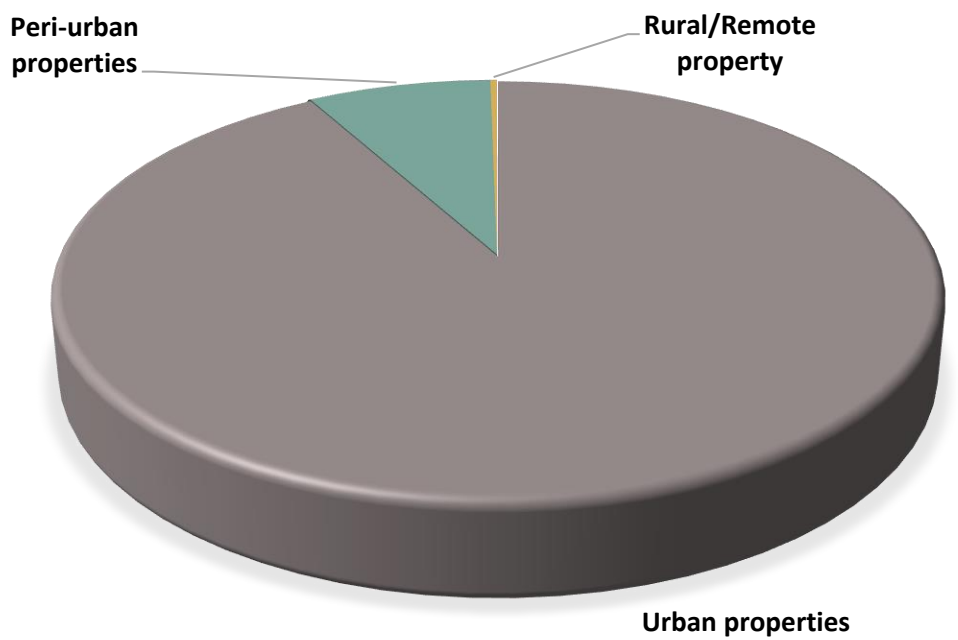


Carbon Stored and Sequestered by Single Trees by Property Type (urban, peri-urban, rural)

CARBON STORED BY SINGLE TREES (2,013.89 MG)

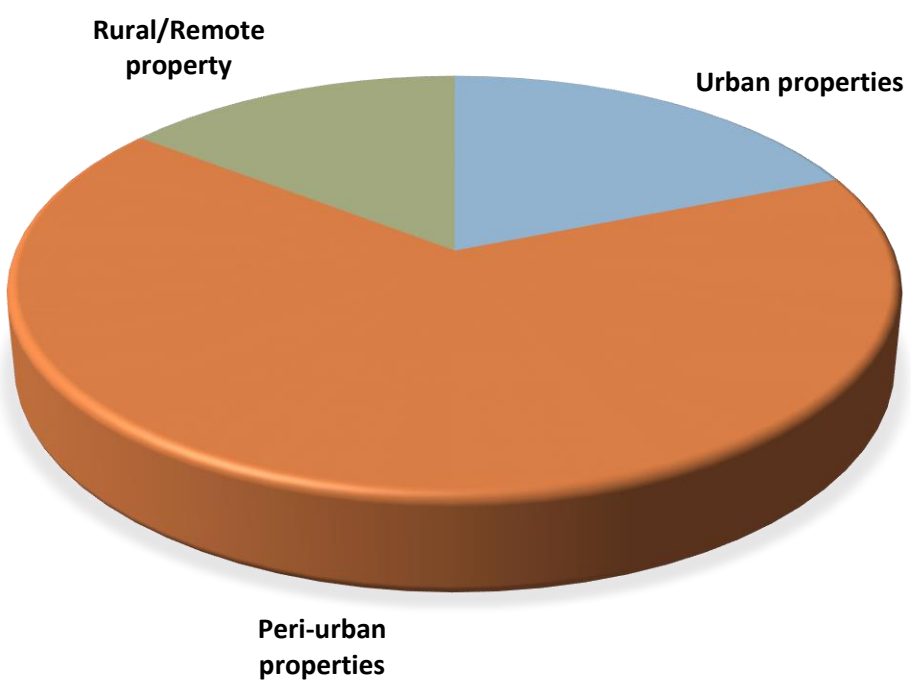


CARBON SEQUESTERED BY SINGLE TREES (38.79 MG)

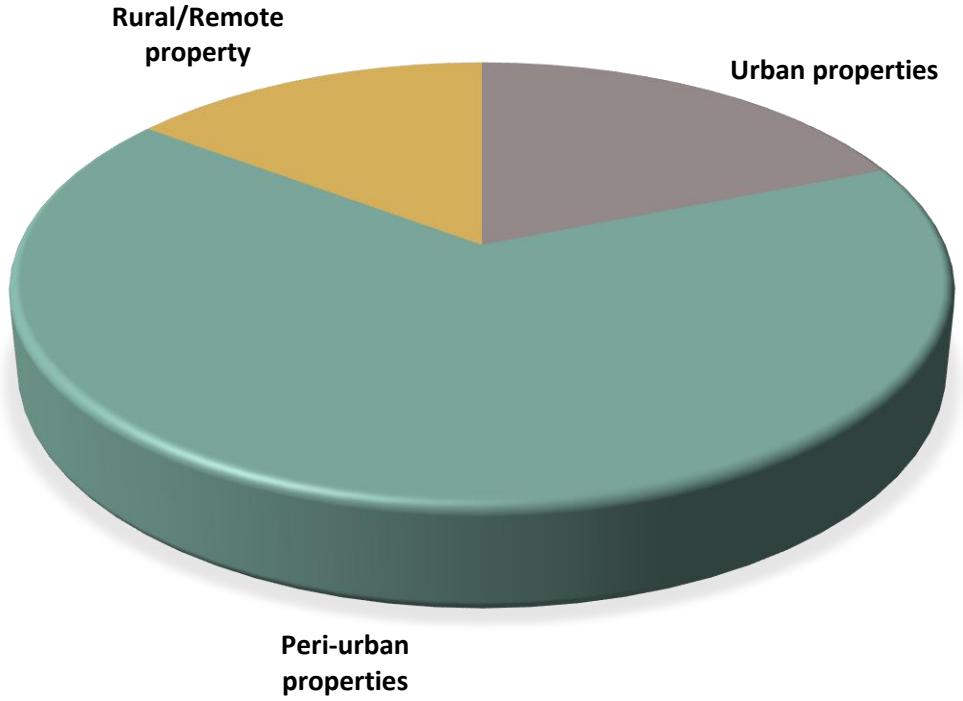


Carbon Stored and Sequestered by Woodlands by Property Type (urban, peri-urban, rural)

CARBON STORED BY WOODLANDS (42288.16 MG)



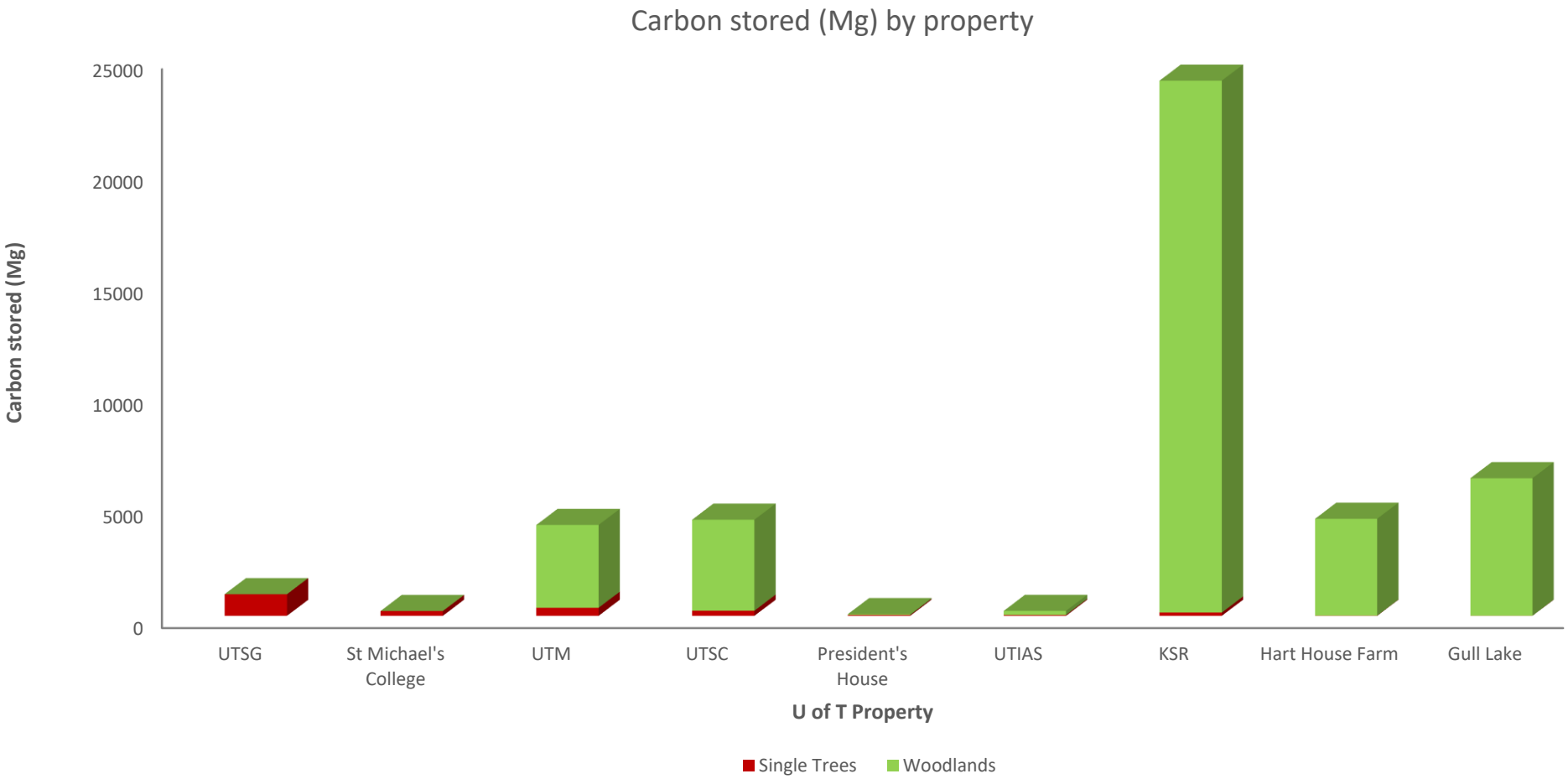
CARBON SEQUESTERED BY WOODLANDS (1395.0 MG)



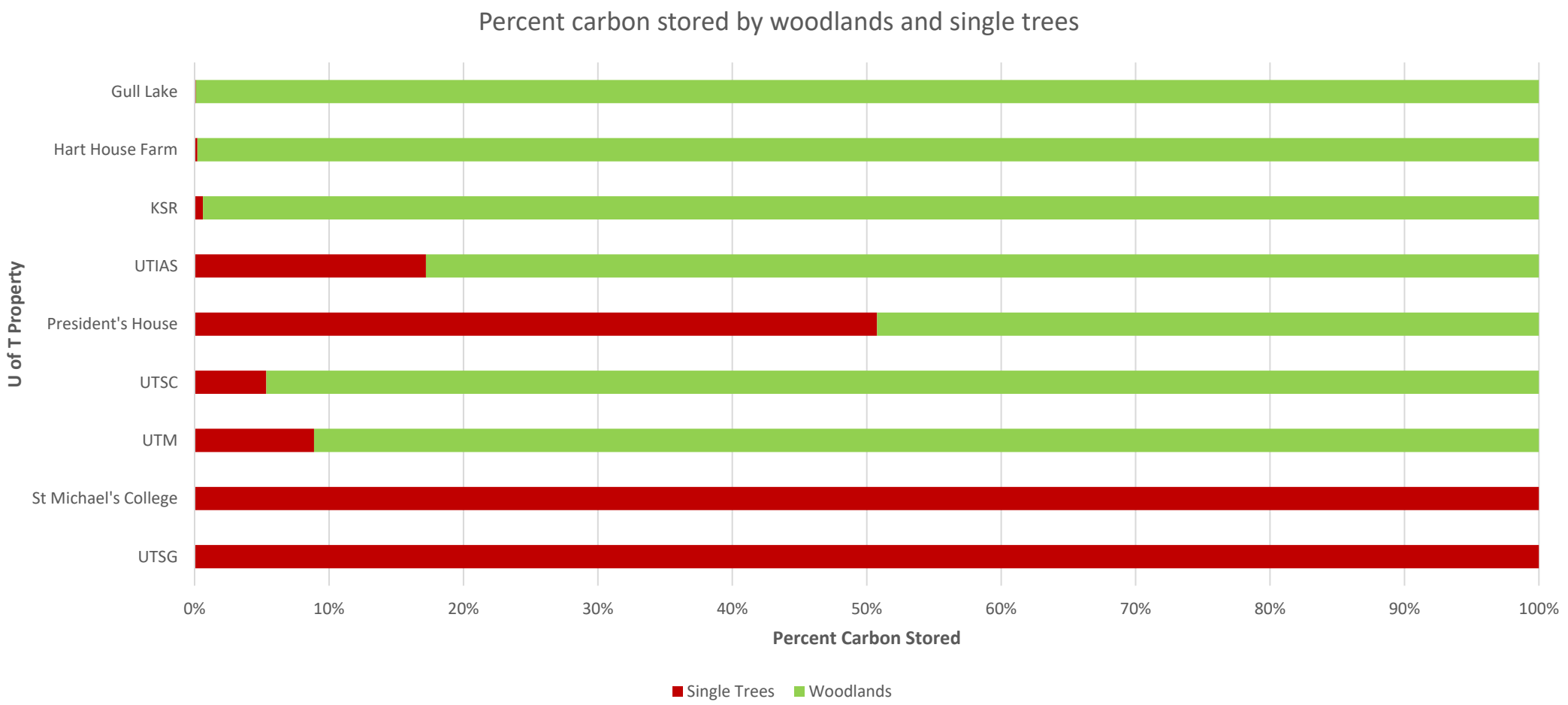
Carbon Stored (Mg) by Property

Property	Area (ha)	Single Trees	Woodlands	Total
St George	61.84	969.04	0.00	969.04
St Michaels	13.24	214.49	0.00	214.49
UTM	89.78	361.15	3704.49	4065.65
UTSC	122.60	229.23	4070.12	4299.35
Presidents House	1.32	39.35	38.16	77.51
UTIAS	12.08	38.05	183.04	221.09
KSR	362.35	147.73	23794.52	23942.24
Hart House Farm	63.95	8.88	4334.10	4342.98
Gull Lake	75.24	5.62	6150.88	6156.49
Total	**802.41**	**2013.54**	**42275.30**	**44288.85**

Carbon Stored (Mg) by Property



Carbon Stored (Mg) by Property

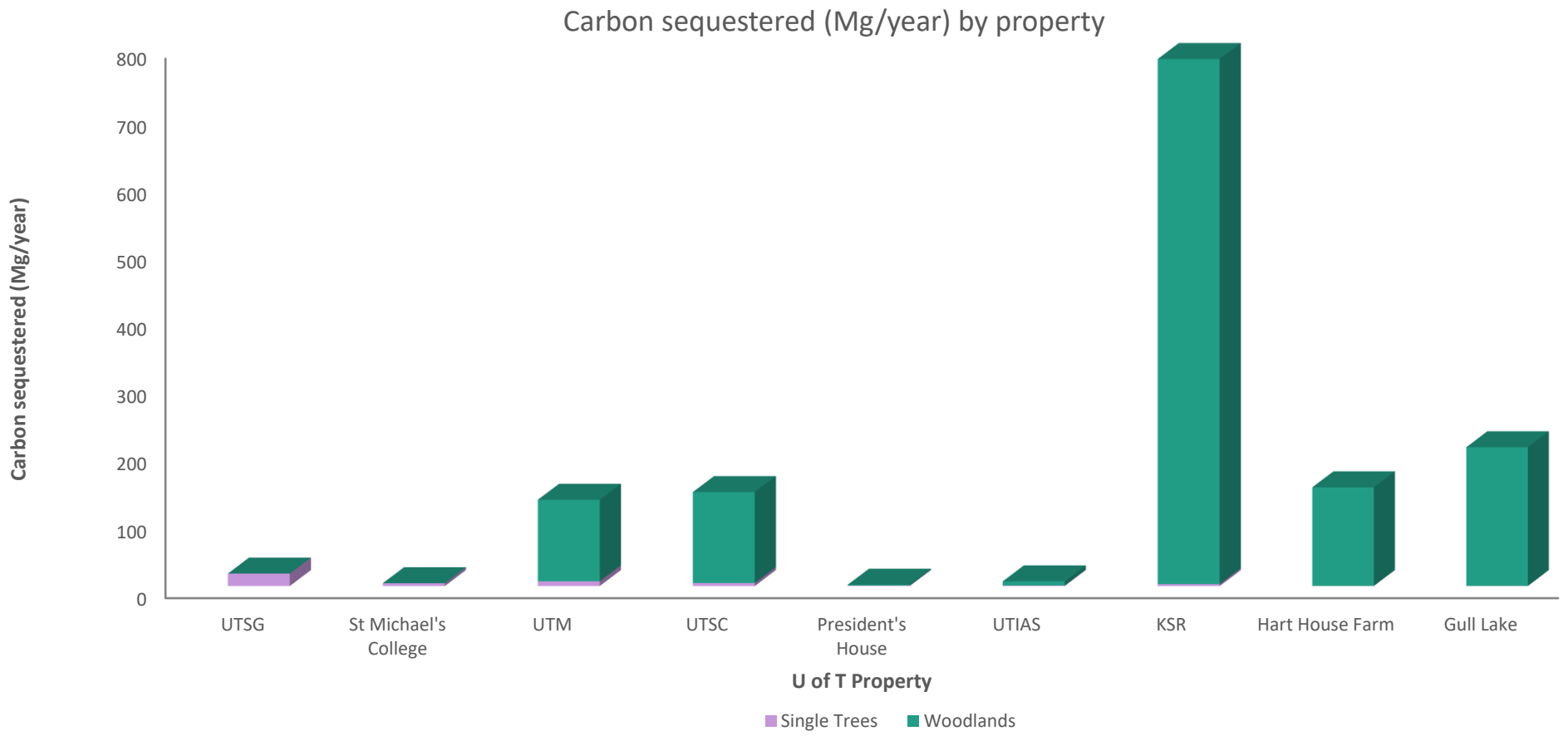


Carbon Sequestered (Mg) by Property

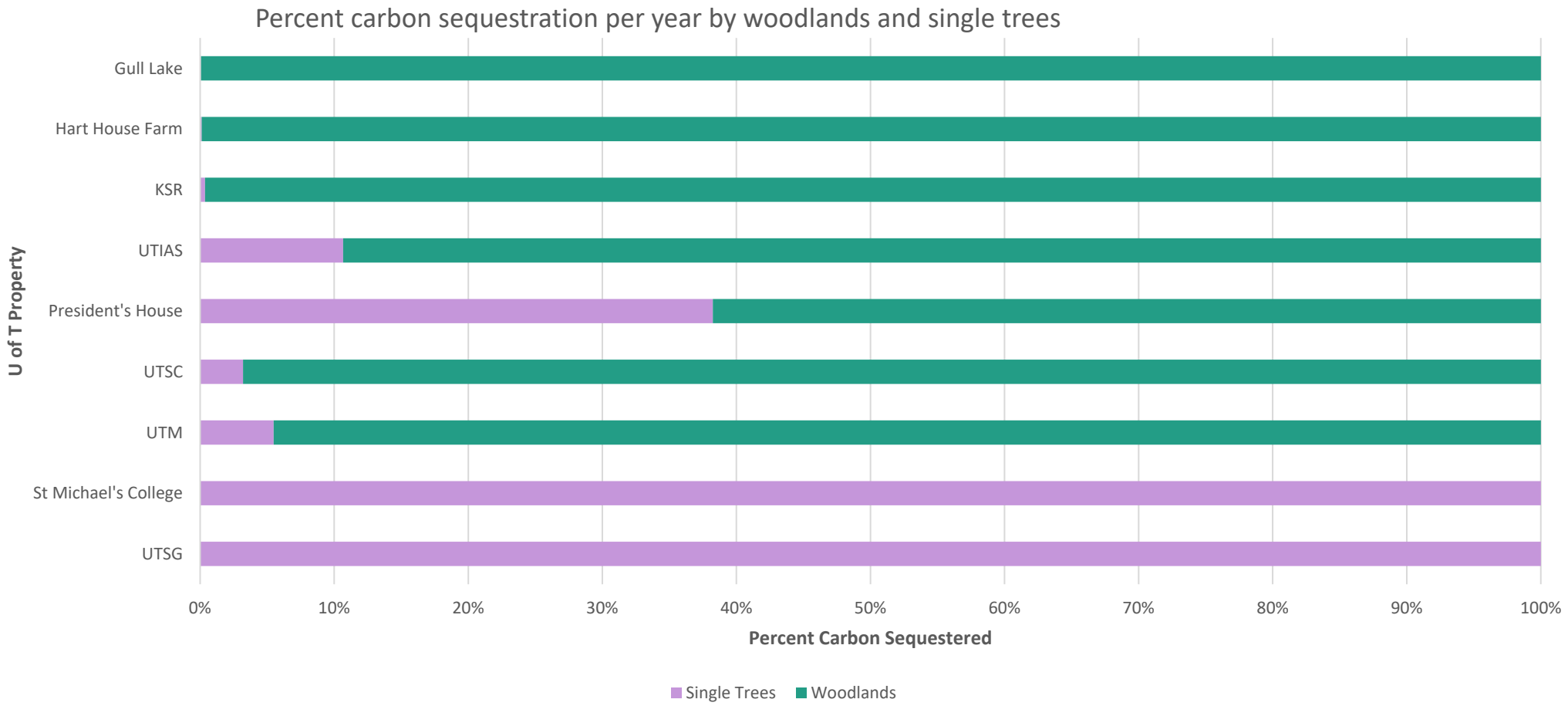
3 decimals		Single Trees	Woodlands	Total
Property	Area (ha)	Carbon sequestration (Mg)	Carbon sequestration (Mg)	
St George	61.84	18.455	0.000	18.455
St Michaels	13.24	4.174	0.000	4.174
UTM	89.78	7.028	121.049	128.078
UTSC	122.60	4.461	135.018	139.479
Presidents House	1.32	0.766	1.237	2.002
UTIAS	12.08	0.741	6.200	6.940
KSR	362.35	2.875	778.768	781.643
HartHouse Farm	63.95	0.173	146.356	146.529
Gull Lake	75.24	0.109	205.953	206.062
Total	802.41	**38.783**	**1394.580**	**1433.362**

2 decimals (on the maps)		Single Trees	Woodlands	Total
Property	Area (ha)	Carbon sequestration (Mg)	Carbon sequestration (Mg)	
St George	61.84	18.46	0.00	18.46
St Michaels	13.24	4.17	0.00	4.17
UTM	89.78	7.03	121.05	128.08
UTSC	122.60	4.46	135.02	139.48
Presidents House	1.32	0.77	1.24	2.00
UTIAS	12.08	0.74	6.20	6.94
KSR	362.35	2.87	778.77	781.64
HartHouse Farm	63.95	0.17	146.36	146.53
Gull Lake	75.24	0.11	205.95	206.06
Total	802.41	**38.78**	**1394.58**	**1433.36**

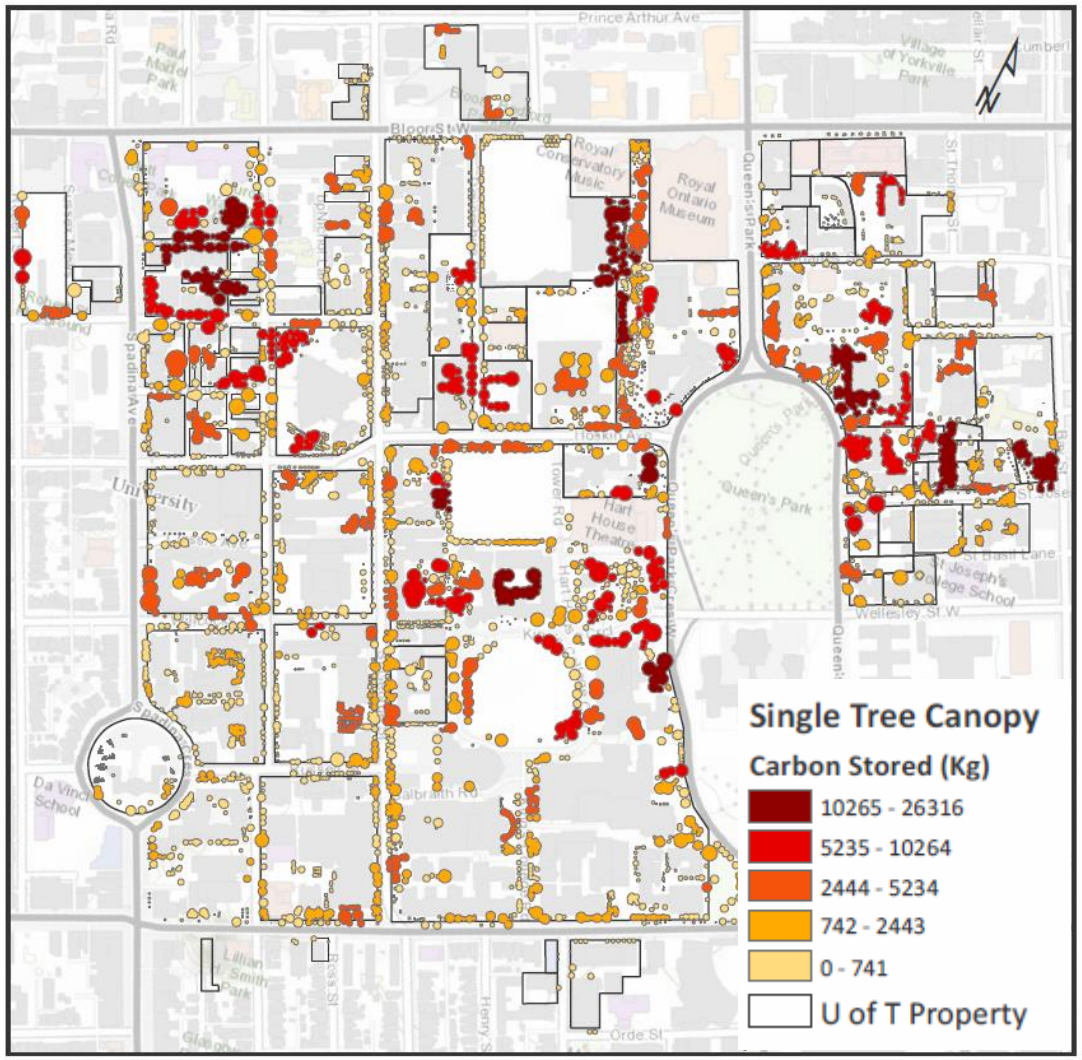
Carbon Sequestered (Mg) by Property



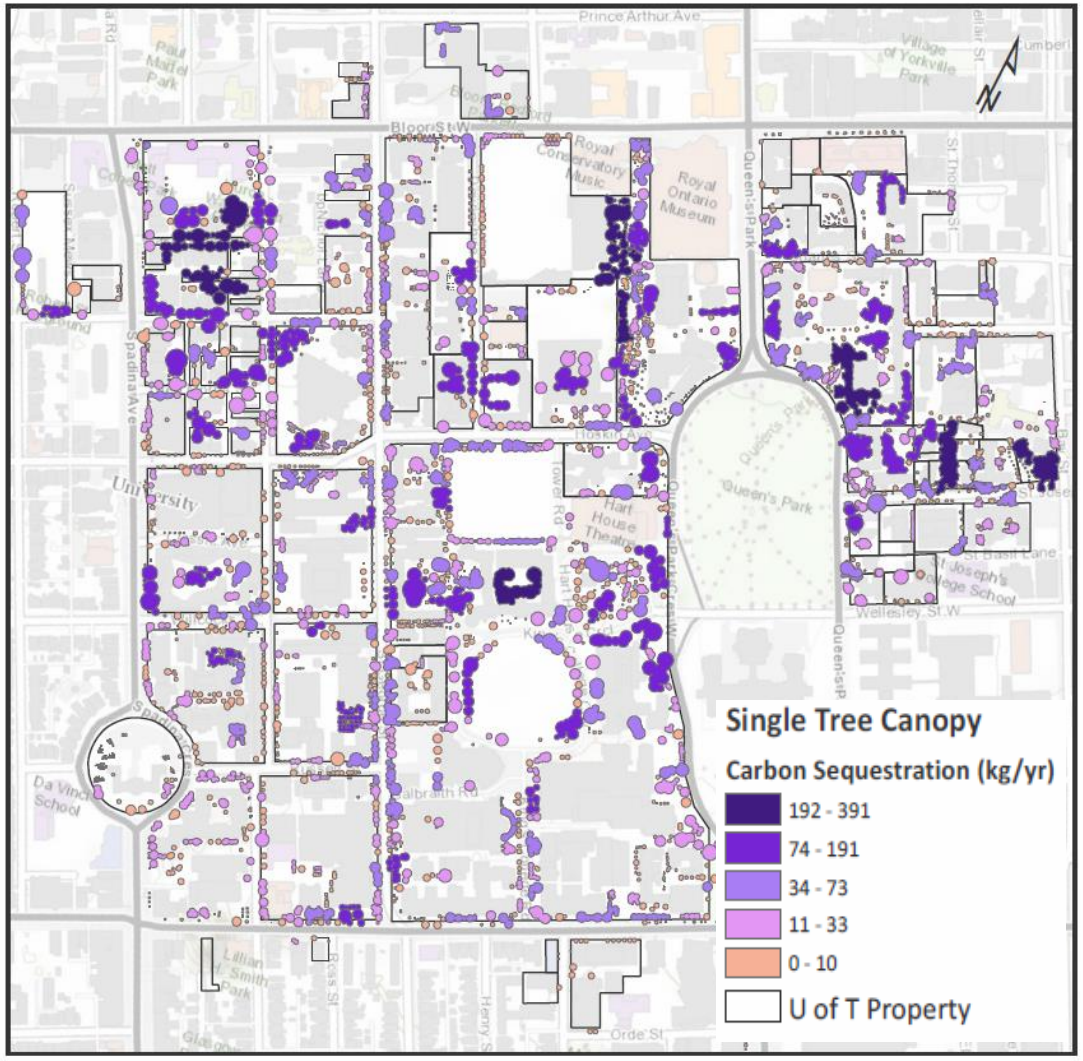
Carbon Sequestered (Mg) by Property



UTSG and St. Michael's College –Single Trees Canopies



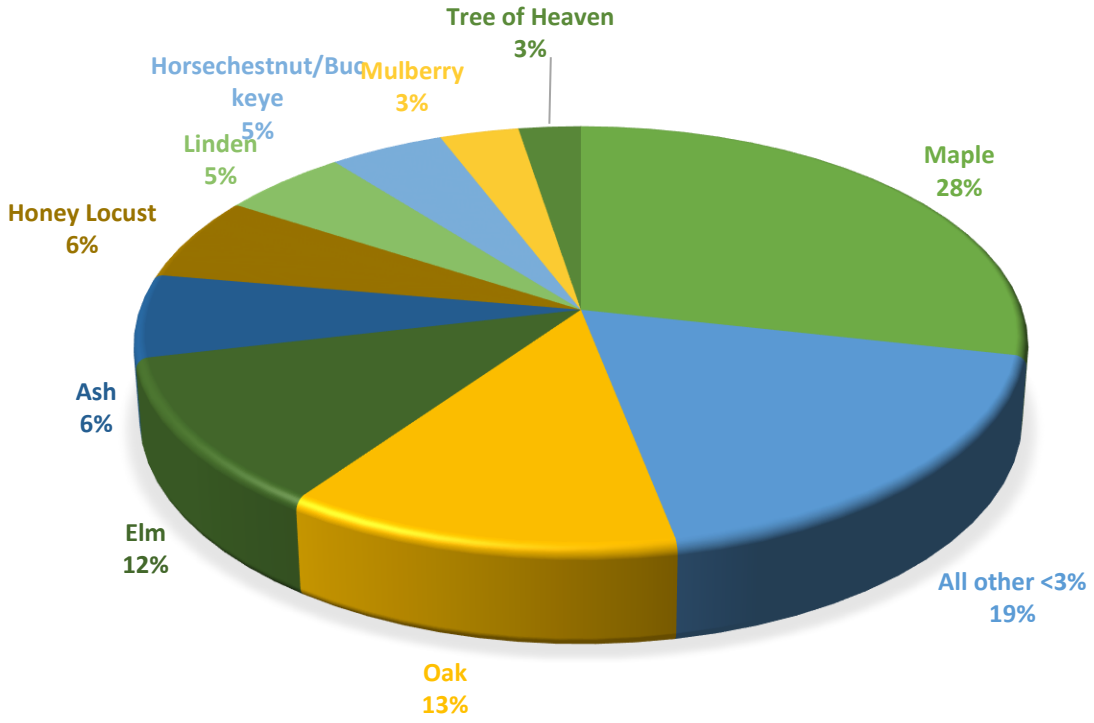
Total Carbon Stored: 1183.54 Mg



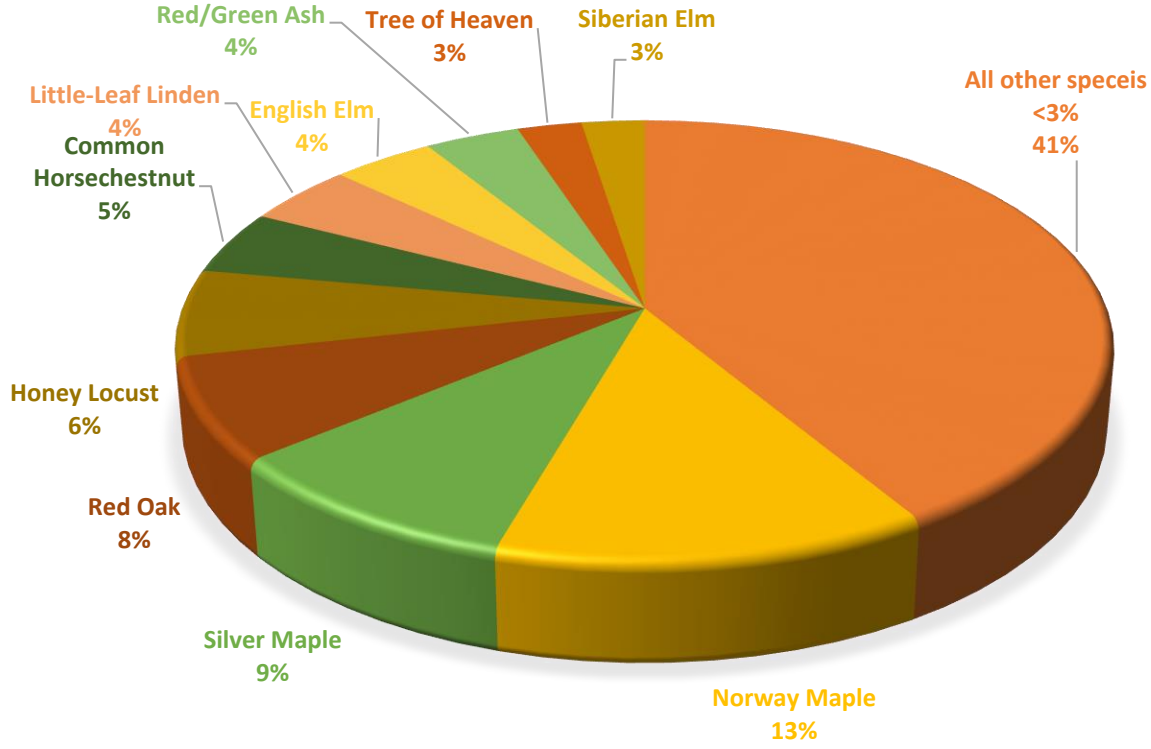
Total Carbon Sequestered: 22.63 Mg

Tree Species and Genus Contribution to Carbon Storage: only UTSG Inventoried trees in 2017/18 (without St. Michael's College)

GENUS CONTRIBUTION (%) TO TOTAL CARBON STORED BY TREES

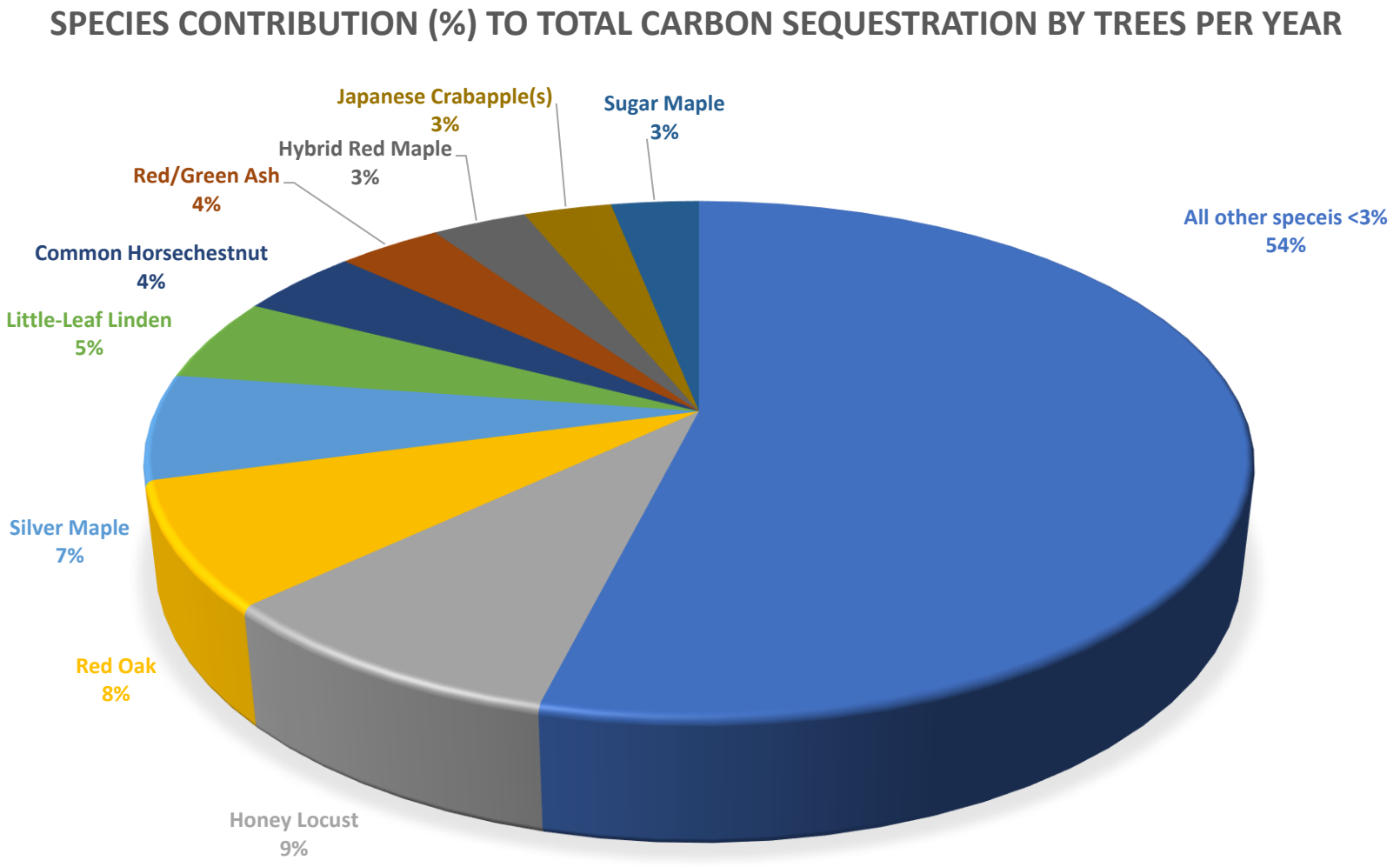


SPECIES CONTRIBUTION (%) TO TOTAL CARBON STORED BY TREES



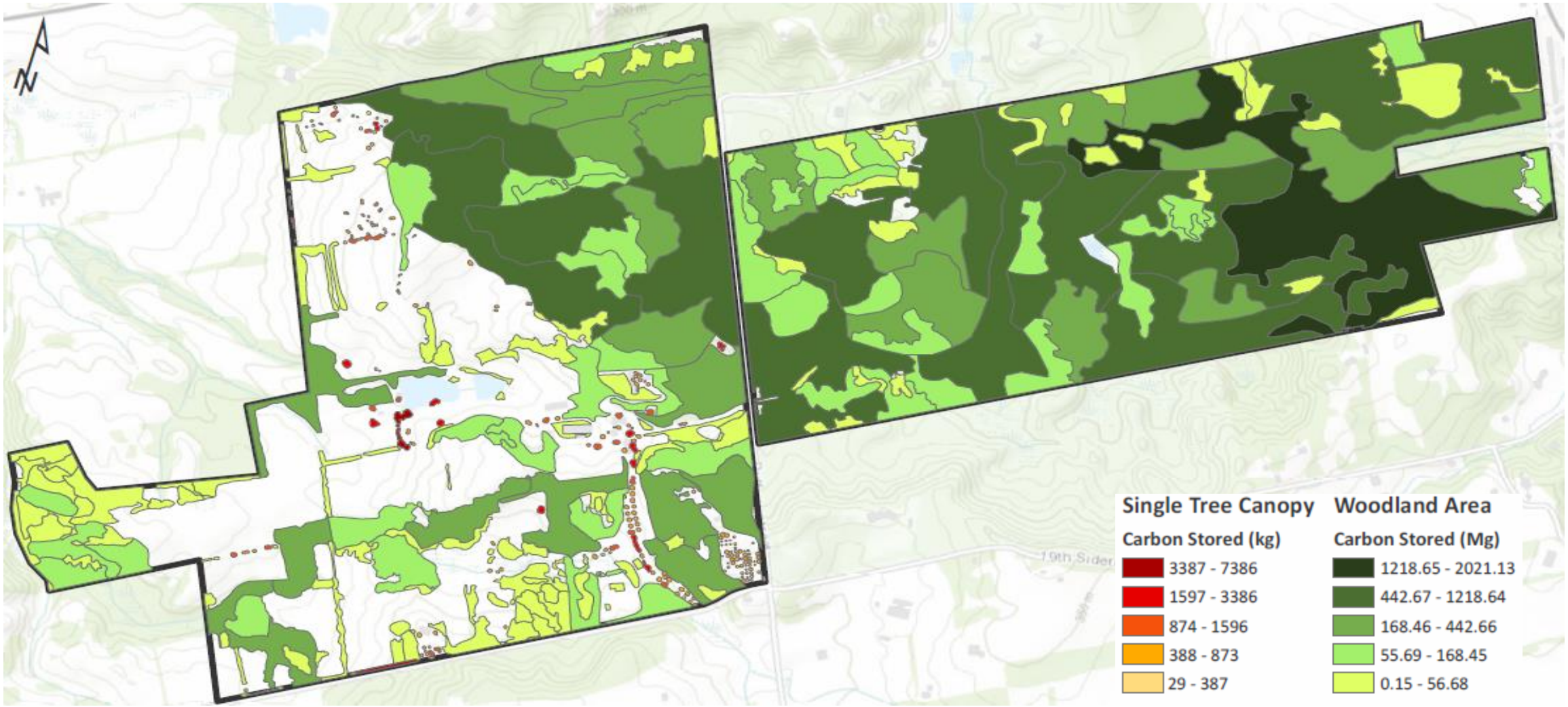
Total Carbon Stored at UTSG (without St. Michael's College): 969.04 Mg

Tree Species and Genus Contribution to Carbon Sequestration: Only UTSG Inventoried Trees in 2017/18 (without St. Michael's College)



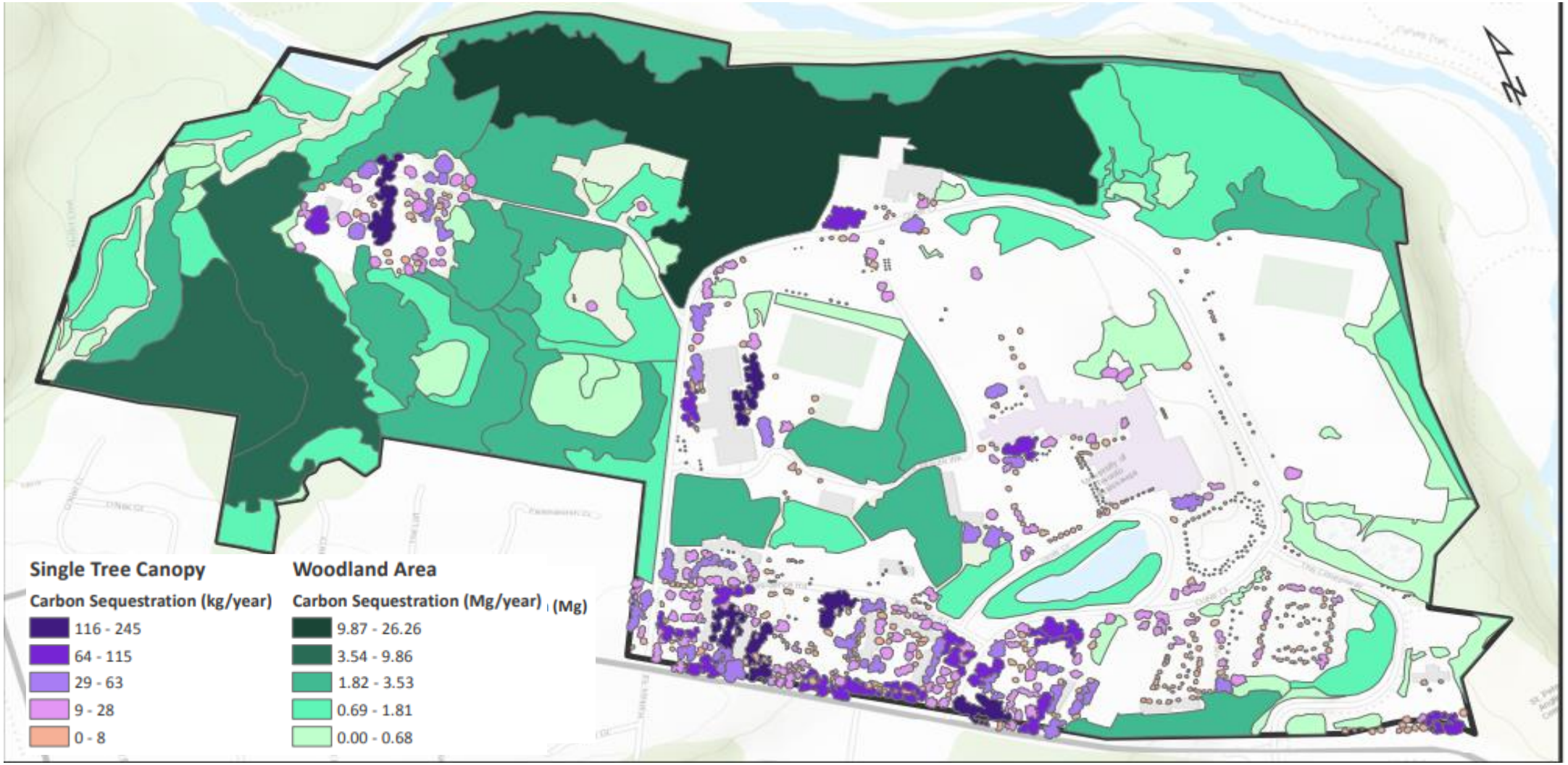
Total Carbon Sequestered (per year) at UTSG (without St. Michael's College): 18.46 Mg

KSR Carbon Storage – Single Trees and Woodlands



Total Carbon Stored: 4,342.98 Mg

UTM Carbon Sequestration – Single Trees and Woodlands



Total Carbon Sequestered per year: 128.08 Mg

UTS Carbon Sequestration – Single Trees and Woodlands

D.Puric-Mladenovic

Total Carbon Stored: 4,299.35 Mg

Recommendations and Opportunities

- Incorporate forest and carbon management into UofTs sustainable development
- To measure the impact start long term forest and tree monitoring
  - Carbon, biodiversity and functions
  - Based on site level, mapping, remote sensing
- Engage students
  - Open class and hands on learning
- Sustainability and climate action: lead by example

Monitoring of trees and natural areas/ woodlands

- Enables detecting and measuring changes in forest composition, structure, function and health
  - growth and mortality over time
- Determines baseline condition
- Provides more accurate estimates of carbon stock and sequestration
- Guides forest management, conservation and enhancement to maximize carbon storage and sequestration and other functions

Site-level monitoring

- Tree size and growth
- Biodiversity monitoring

Measuring and mapping tree canopy, woodland and stand boundaries

- Mapped canopy, woodland and stand boundaries produced for the UofT properties could
  - be used as a baseline condition upon which present and/or historical changes in forest area and tree canopy can be measured and assessed
  - guide future monitoring efforts based on a stratified sampling design
  - serve to support other practical, management, decision making, and educational needs
- Can be further improved using remotely sensed technology e.g., LiDAR
  - Take also an advantage of technology

Mapped carbon storage and estimates

Property and Forest Maps	Carbon Storage	Carbon Sequestered
St. George Campus (UTSG)	St George	St George
St. Michaels College, UTSG	St Michaels	St Michaels
Mississauga Campus (UTM)	UTM	UTM
Scarborough Campus (UTSC)	UTSC	UTSC
President's House	Presidents House	Presidents House
U of T Institute for Aerospace Studies (UTIAS)	UTIAS	UTIAS
Koffler Scientific Reserve (KSR)	KSR	KSR
Hart House Farm	Hart House Farm	HartHouse Farm
Gull Lake Survey Camp	Gull Lake	Gull Lake

Click on a hyper link to see the maps

Hands-on Teaching and Research

- Engage students in monitoring and analysis through field courses, research projects or internships
  - Combine field knowledge and technology
- Use UofT properties as on open lab and a classroom
- Provide hands-on experience for students
- Connect science with action and policies
- Make a change through learning

Set an example

- As one of larger landowners in southern Ontario, UofT has an ability to lead by example and influence forest management on its lands towards
    - Conserving stored carbon and maximizing forest carbon storage and sequestration.
    - Conserving and enhancing diversity, ecological and social functions
- Demonstrate how forest monitoring at a local scale is relevant to forest carbon management and climate change mitigation actions
    - Use that knowledge to reduce carbon footprint through improved forest management and restoration
- Train and teach students and community by an example
- Transfer knowledge to other private landowners in southern Ontario

Maps

Property and Forest Maps	Carbon Storage	Carbon Sequestered
St. George Campus (UTSG)	St George	St George
St. Michaels College, UTSG	St Michaels	St Michaels
Mississauga Campus (UTM)	UTM	UTM
Scarborough Campus (UTSC)	UTSC	UTSC
President's House	Presidents House	Presidents House
U of T Institute for Aerospace Studies (UTIAS)	UTIAS	UTIAS
Koffler Scientific Reserve (KSR)	KSR	KSR
Hart House Farm	Hart House Farm	HartHouse Farm
Gull Lake Survey Camp	Gull Lake	Gull Lake

Click on a hyper link to see the maps