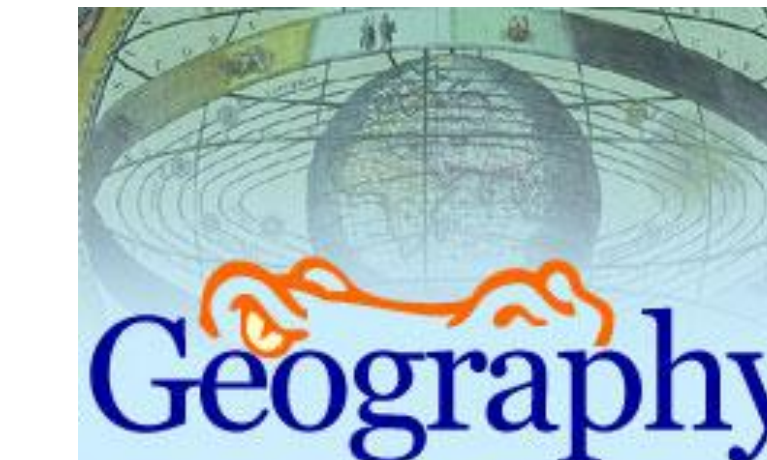


Linking Regional Carbon Storage to Land-Ownership Changes in the Southeastern United States



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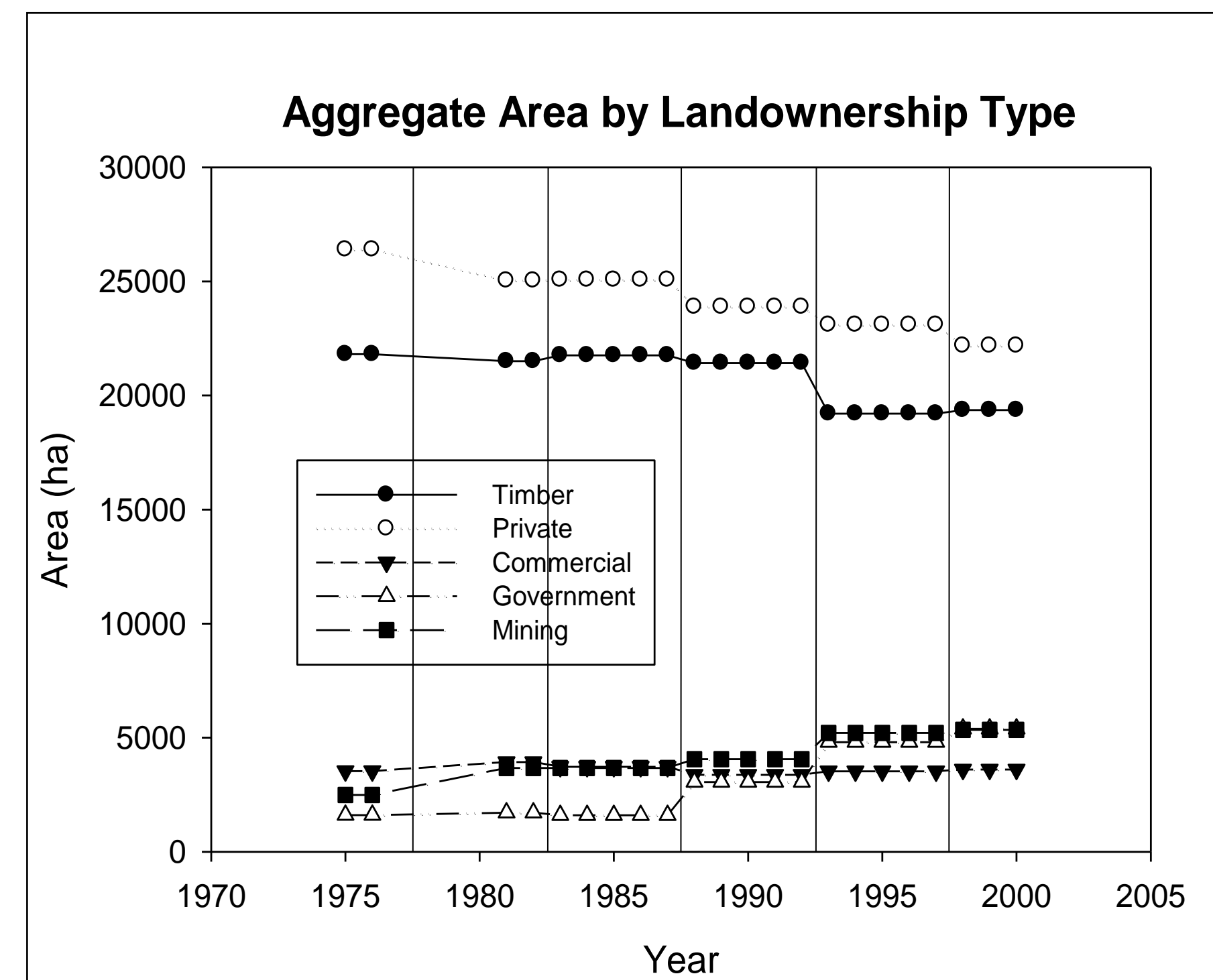
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Over-arching Research Question: How do land ownership and changes in land ownership affect regional carbon storage over time?

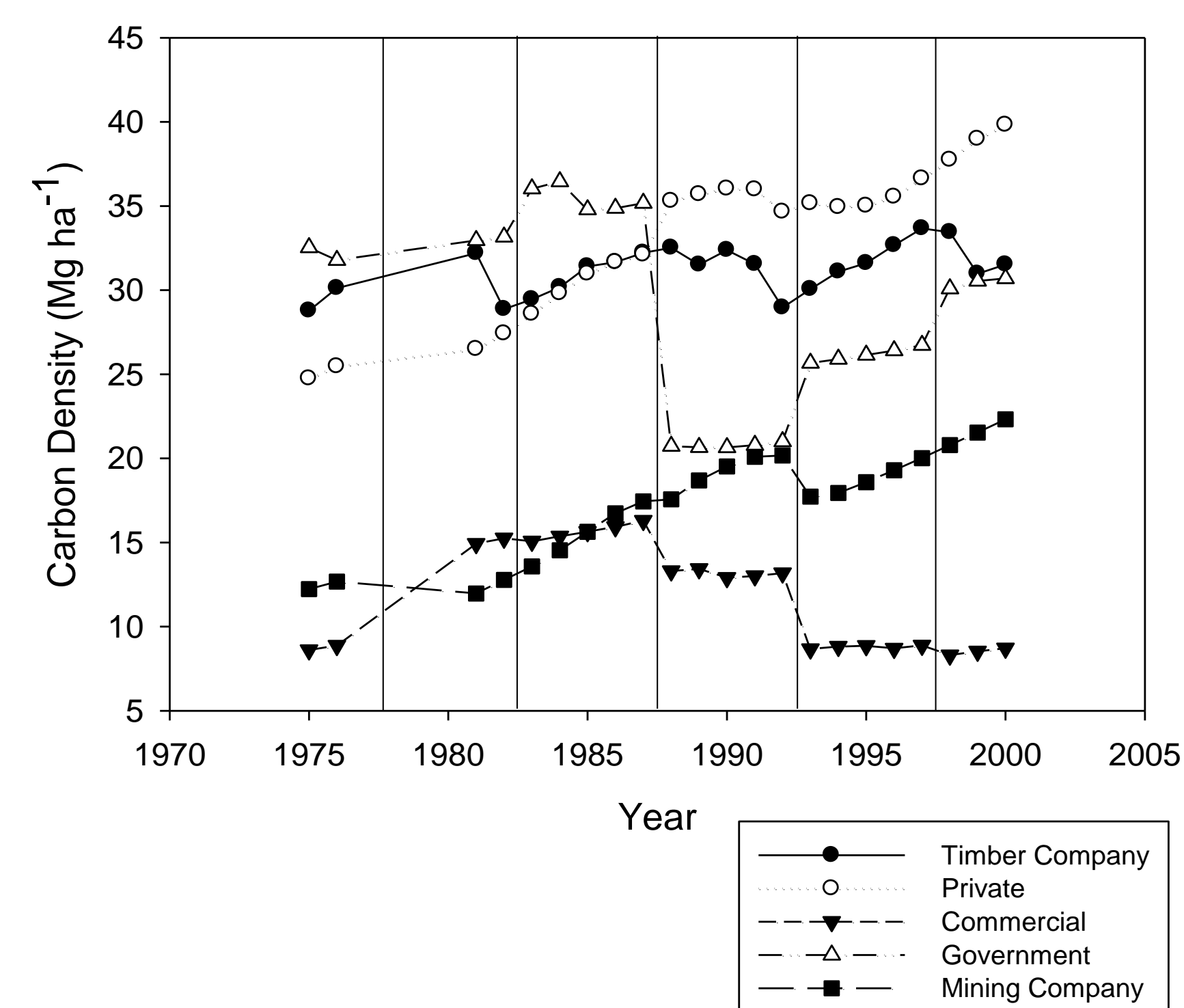
Hypothesis 1 – Changes in land ownership trigger premature anticipatory or subsequent cutting and hence decrease landscape carbon storage.

Hypothesis 2 - Timber companies cut more as pulpwood prices rise, which also decreases landscape carbon storage; other ownership types are indifferent to prices.

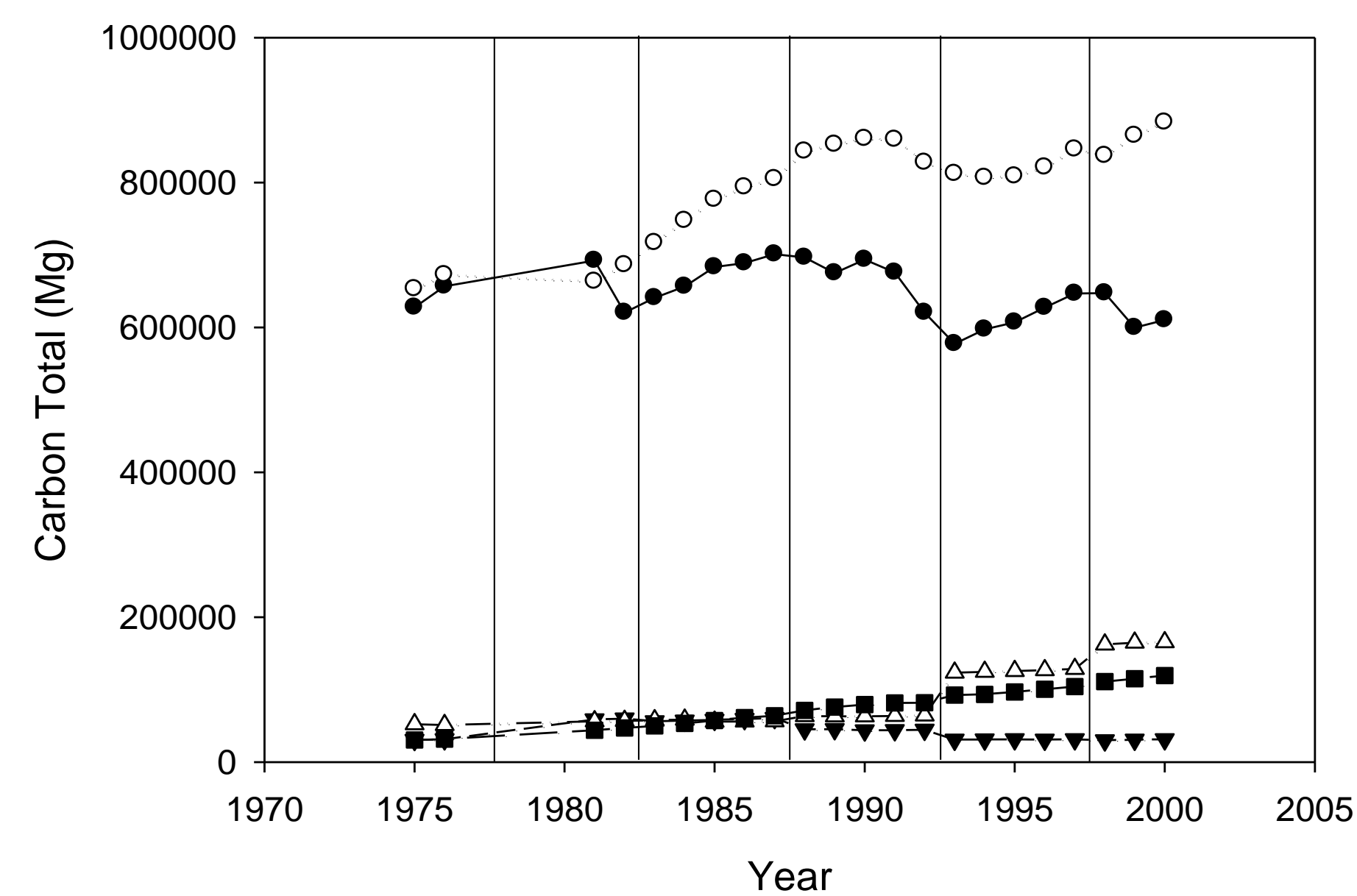
General Patterns



Aggregate Carbon Density by Land Ownership Type



Total Landscape Carbon by Land Ownership Type

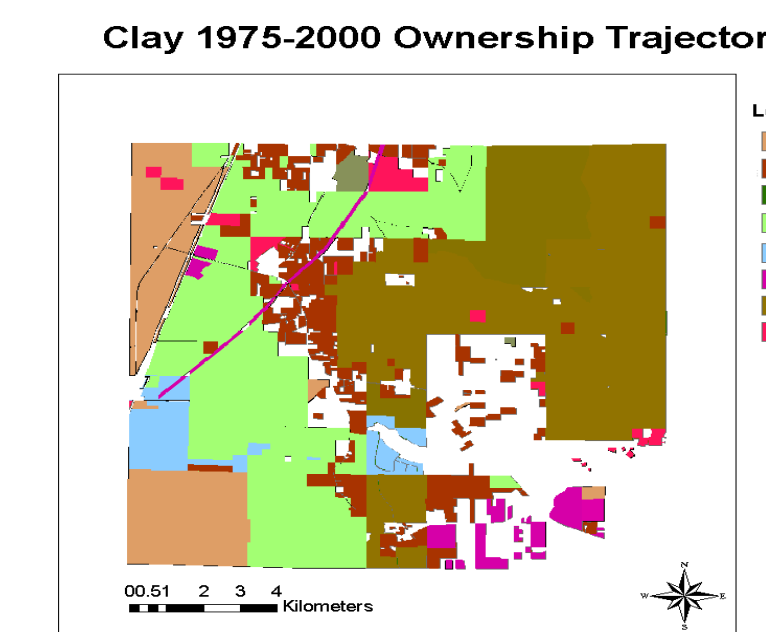


Aggregate Results: Effects of Ownership Type

Private: Density and Total: General increase in carbon density and landscape total with some fluctuation.
Timber Co.: Carbon density and landscape total cyclic (~10-yr?) around mean of about 30 Mg ha⁻¹, 6.5 million Mg.
Commercial: Density and landscape total generally decline over time, especially with sales, but overall total is low across region.
Government: Densities fluctuate with purchases; Totals generally increase over time, again with purchases

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Hypothesis 1



Ownership-type Trajectories: Expression of Change Over Time

For example: CCCTTT would be three periods of Commercial, then a sale to a Timber company that held the land for three periods.

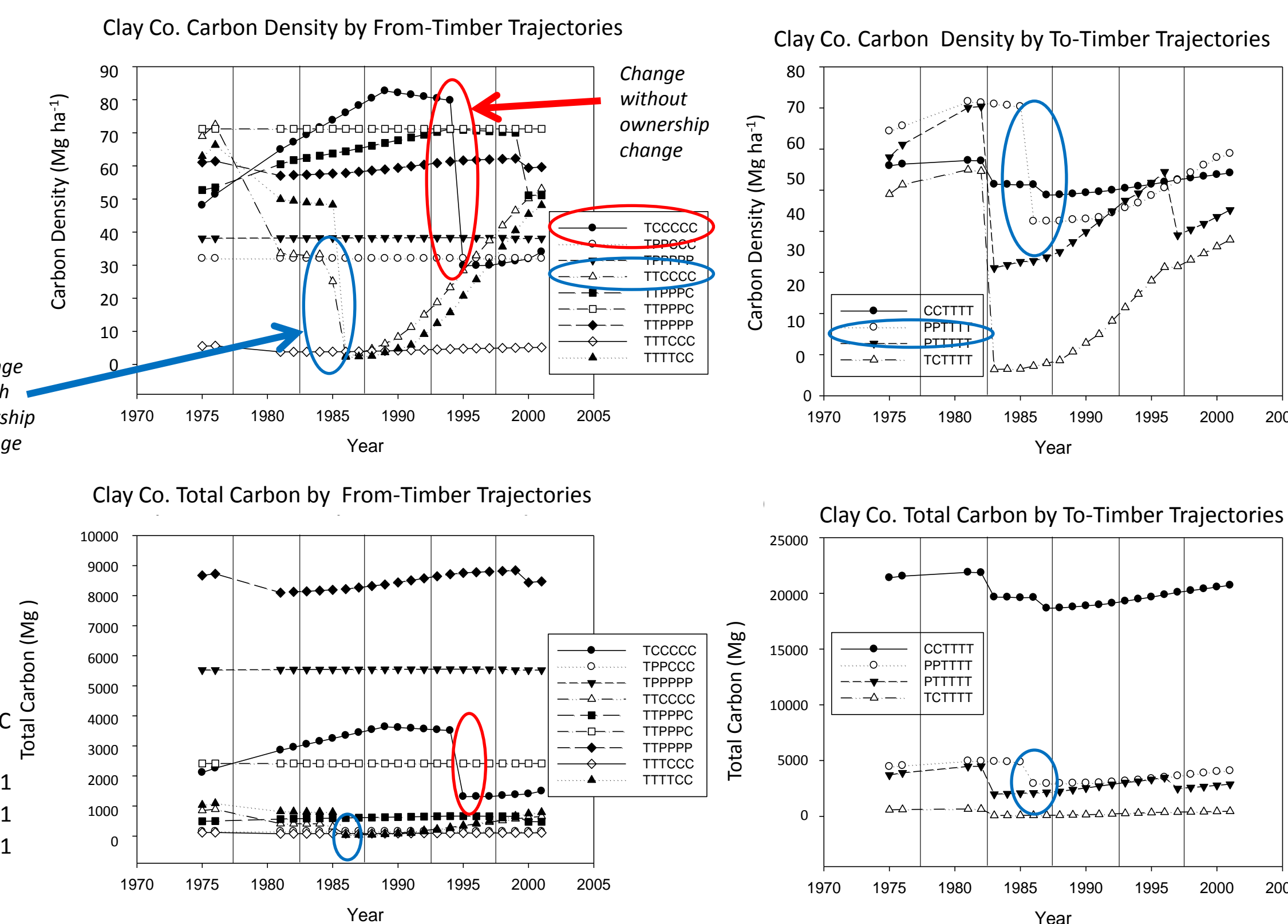
- Classes of trajectories:**
1. Constant, e.g. TTTTTT
 2. To Timber, e.g. CCCTTT
 3. From Timber, e.g. TTTPPP
 4. To Government, e.g. PPTGGG
 5. Private/Comm. e.g. PPCCPP

Trajectory	Sales	Land Area (ha)	% of Total Land	C change with sales	C change without sales	Sales change
PPPPGG	4978.3	8.9				1
PPPPGG	1442.8	2.6				1
PMMMMM	997.7	1.8				1
TTTTMM	989.5	1.8		1		
PPPPPG	684.5	1.2		1	1	
TTTTCC	761.1	0.9		1		1
CCCTTT	358.3	0.6		1		
TMMMMM	338.4	0.6				1
CCCTTT	330.0	0.6				1
TTTTPP	286.5	0.5		1		
PPCCGG	264.7	0.5		1	2	
TTTTPT	244.1	0.4		1		1
PPPPPT	228.4	0.4				1
Subtotal	12570.4	22.1		7	3	12

$\chi^2 = 12.093$; $p = 0.062$

CONSTANT	Sales	Land Area (ha)	% of Total Land
TTTTTT	18190.8	32.7	
PPPPPP	16272.0	29.2	
MMMMMM	2511.6	4.5	
CCCCCC	2230.5	4.0	
GGGGGG	1492.3	2.7	
Subtotal	40697.2	73.1	
TOTAL	53267.5		

Examples



Effects of Ownership-type Changes:

Hypothesis 1 is rejected.

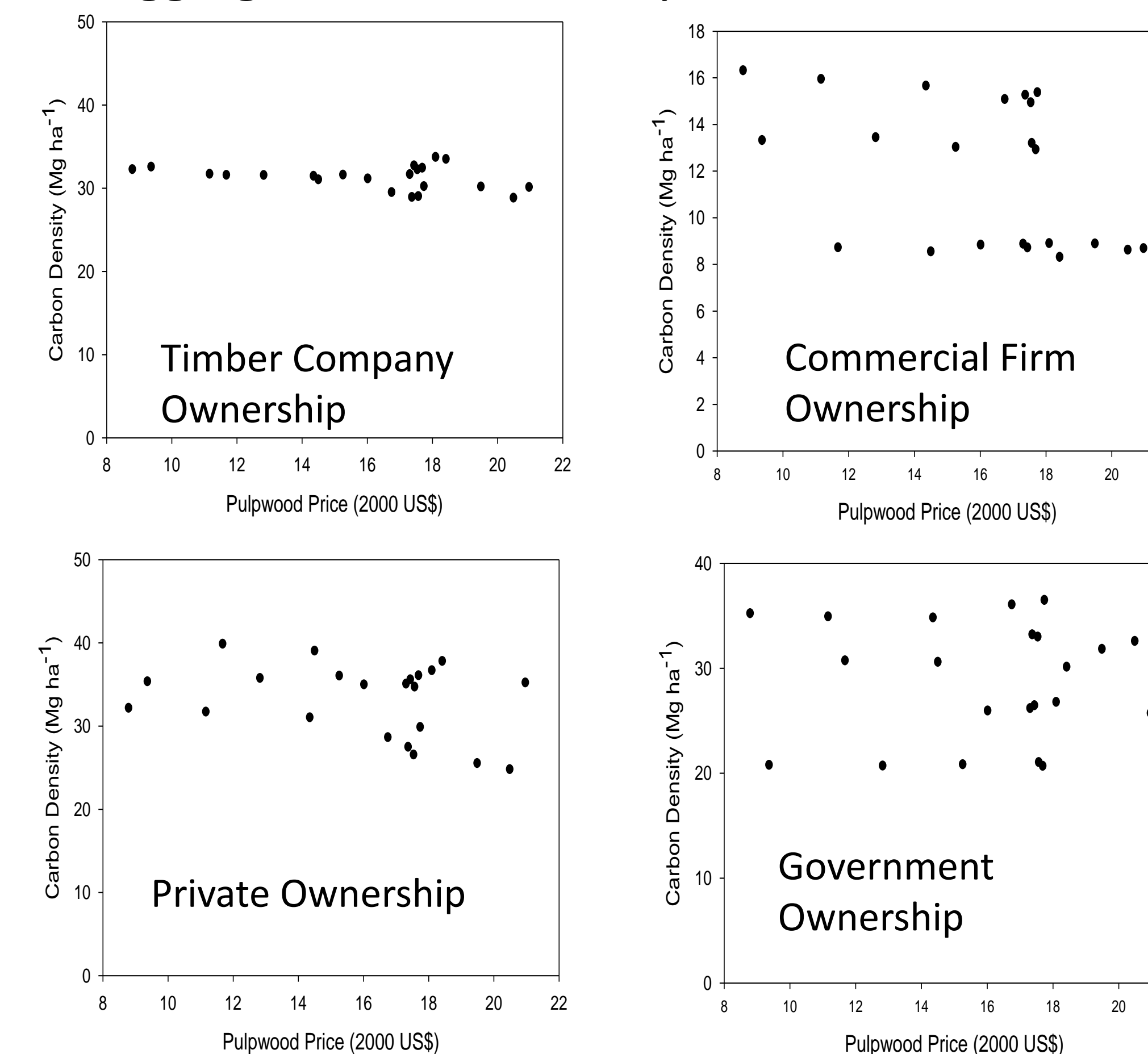
There is no general change in C density or total associated with sales from one Land Owner Type (LOT) to another. Sometimes C did decline, but more often it did not. Most sales were NOT associated with a change in C density or totals.

There is only one case with three changes in LOT in over >99% of the area of the study areas over 25 years. Most of the landscape is dominated by one (21.6% of the total area) or no (73%) change in LOT.

We were surprised by the very low turnover rates observed for parcels in all three study areas.

Hypothesis 2

Aggregate Carbon Density vs. Constant 2000 US\$



Effects of Timber Price:

Carbon storage for nearly all ownership types, and all ownership trajectories was indifferent to pulpwood price. Timber companies hold vast areas of land and cut a small fraction each year regardless of pulpwood prices. Other owners are not, in general, motivated by timber sales.
Hypothesis 2 is rejected.

Discussion and Perspective:

Timber companies maintain a stable (not constant) Carbon density and total landscape C over time. Land in private ownership gradually accumulates carbon. Carbon storage on Government land varies with the kind of lands that are converted from other types. Commercial ownership has small areas, the most sales, and a gradual loss of C over time.

We found no comparable studies of changes in land ownership over time, and no studies that related landscape carbon contents to ownership changes. Because the Southeastern U.S. is dominated by private land ownerships (both individual and industrial), comparisons across regions with different ownership patterns will be interesting.

The US national forest-products industry has undergone significant changes since the 1980's, especially the creation of TIMO and REIT ownerships that may or may not have the same management objectives of the traditional timber companies (e.g., Smith et al. 2009). Most of the conversion of vertically integrated timber companies has occurred since 2000. The results of our study, while standing on their own, may be useful as a baseline for comparing how the recent changes in ownership influence carbon stocks and cycling.

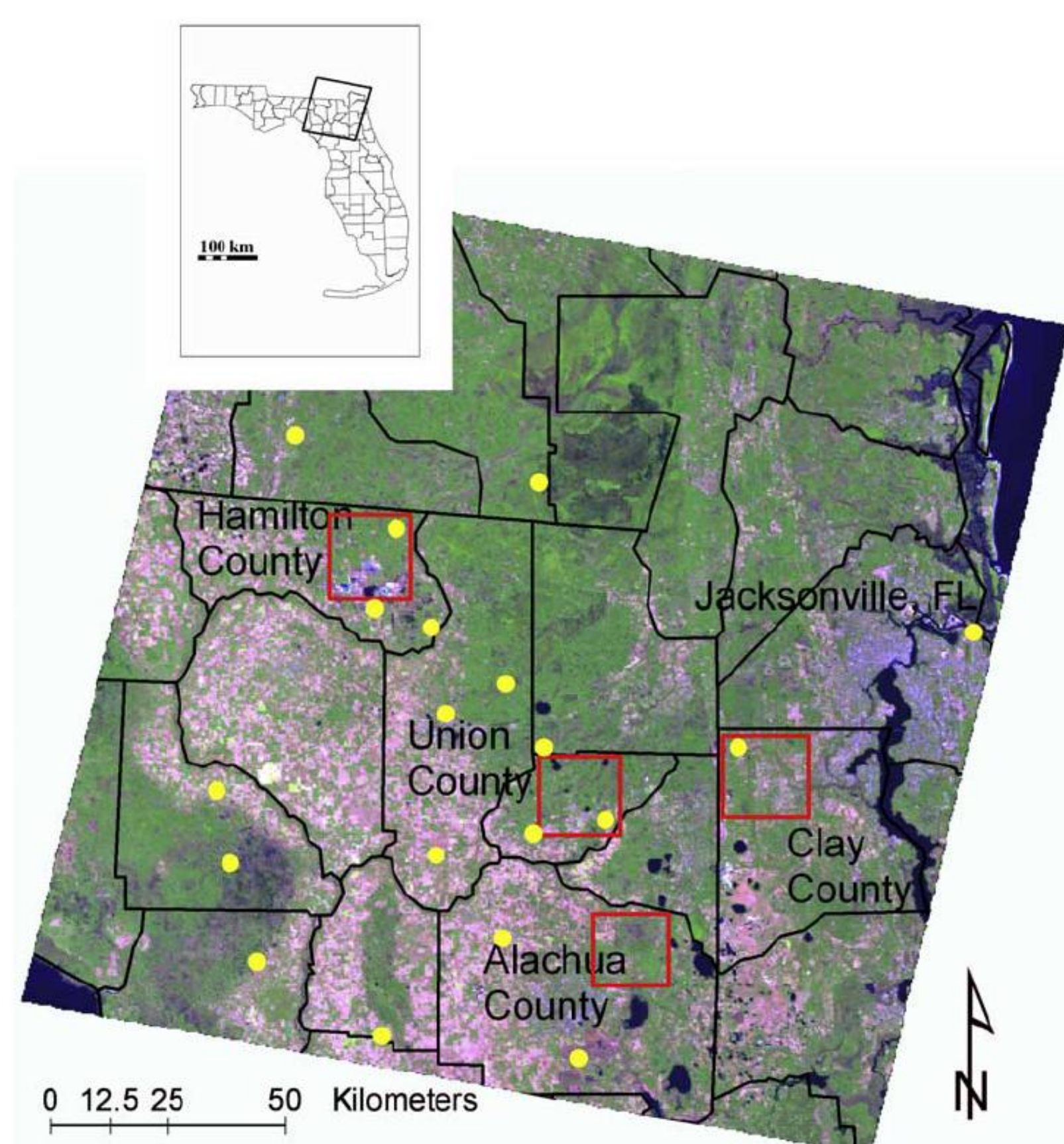
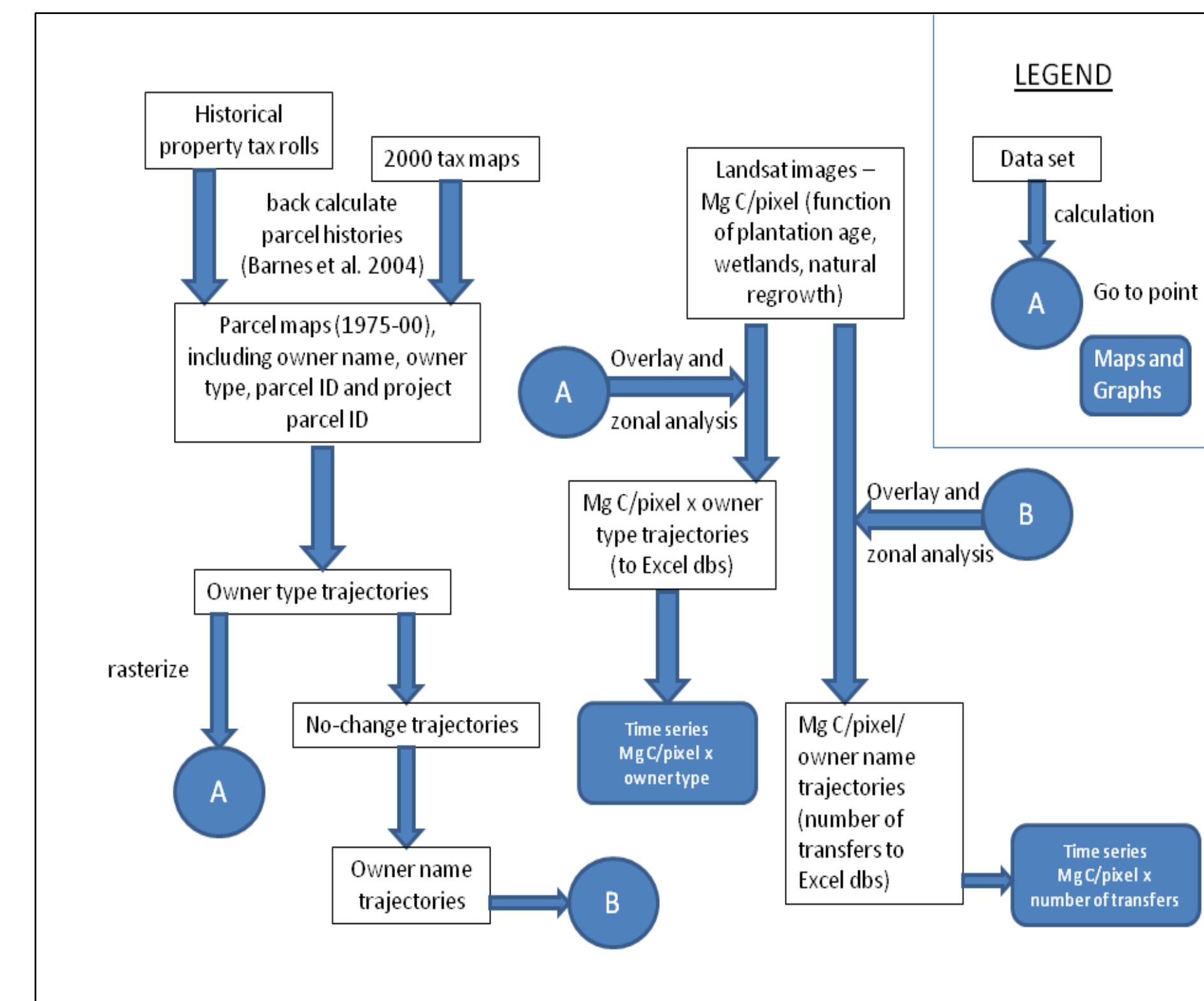
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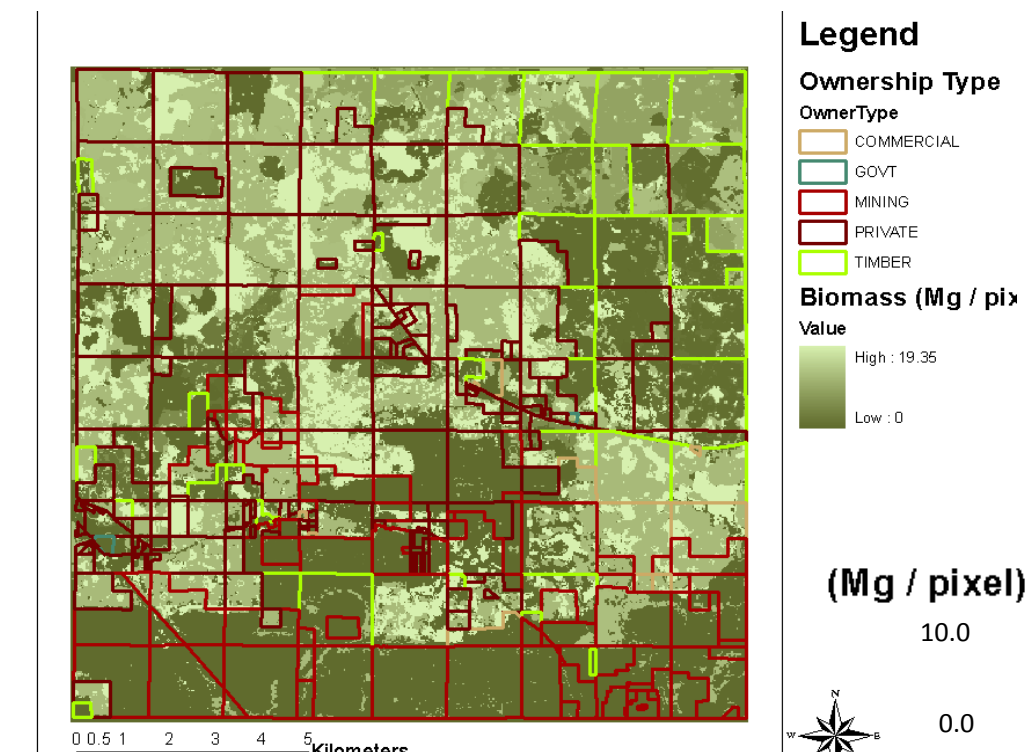
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Hamilton Co. 2000 Ownership and Carbon Density



Commercial: Investment firms, law firms, businesses not normally in timber (LTD, INC, LLC, etc.)
Timber Companies: Known timber companies (e.g., Rayonier, Stone-Smurfit)
Government: City, County, State, University, Military
Mining Companies: Known mining companies (e.g., DuPont)
Private: Everybody else (names, H/W, family trusts, etc.)

