Ecosystem Accounting

Framework and applications in the southeastern United States

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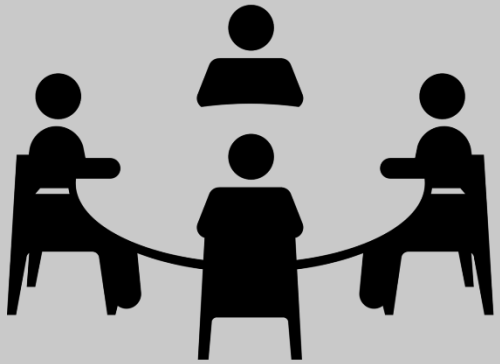
Background and previous work

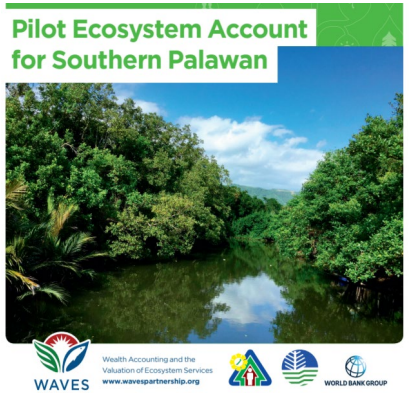
Ecosystems

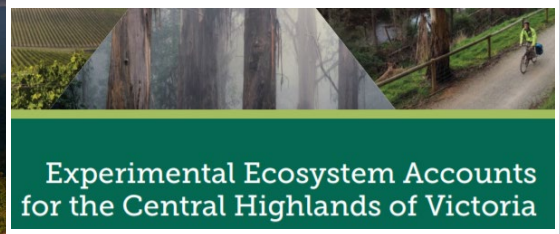
System of National Accounts

Decision making



- Extent
- Condition
- Flows of ecosystem services

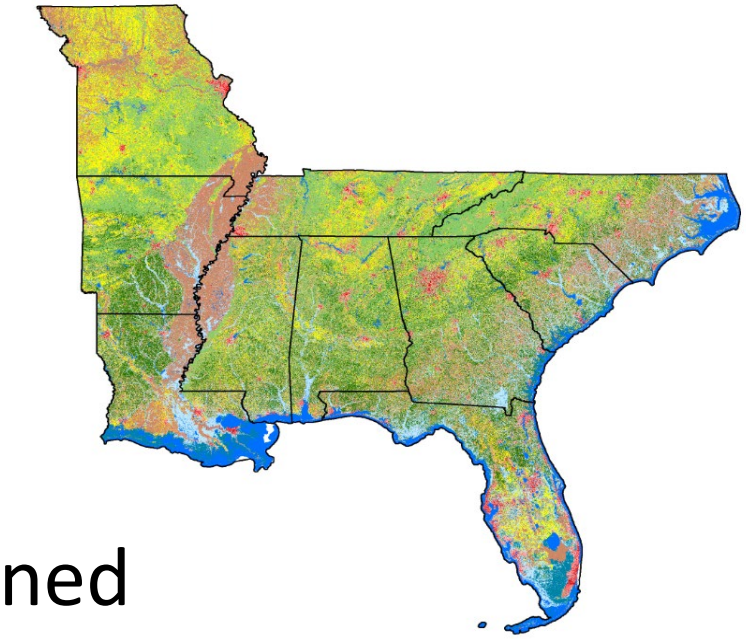




Objectives

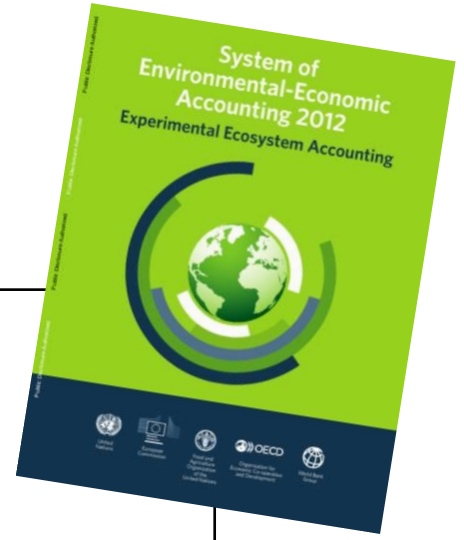
Test ecosystem accounting framework with data available in the US

Develop pilot ecosystem accounts for the southeastern US



Explore the information that can be gleaned from these accounts and challenges in putting them together to guide future research and use

SEEA Experimental Ecosystem Accounts



Ecosystem accounts

Ecosystem services supply-use account

Physical

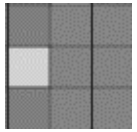
Monetary

Ecosystem condition account

Ecosystem extent account

Key considerations for pilot ecosystem accounts

Data should be publicly available on a national scale

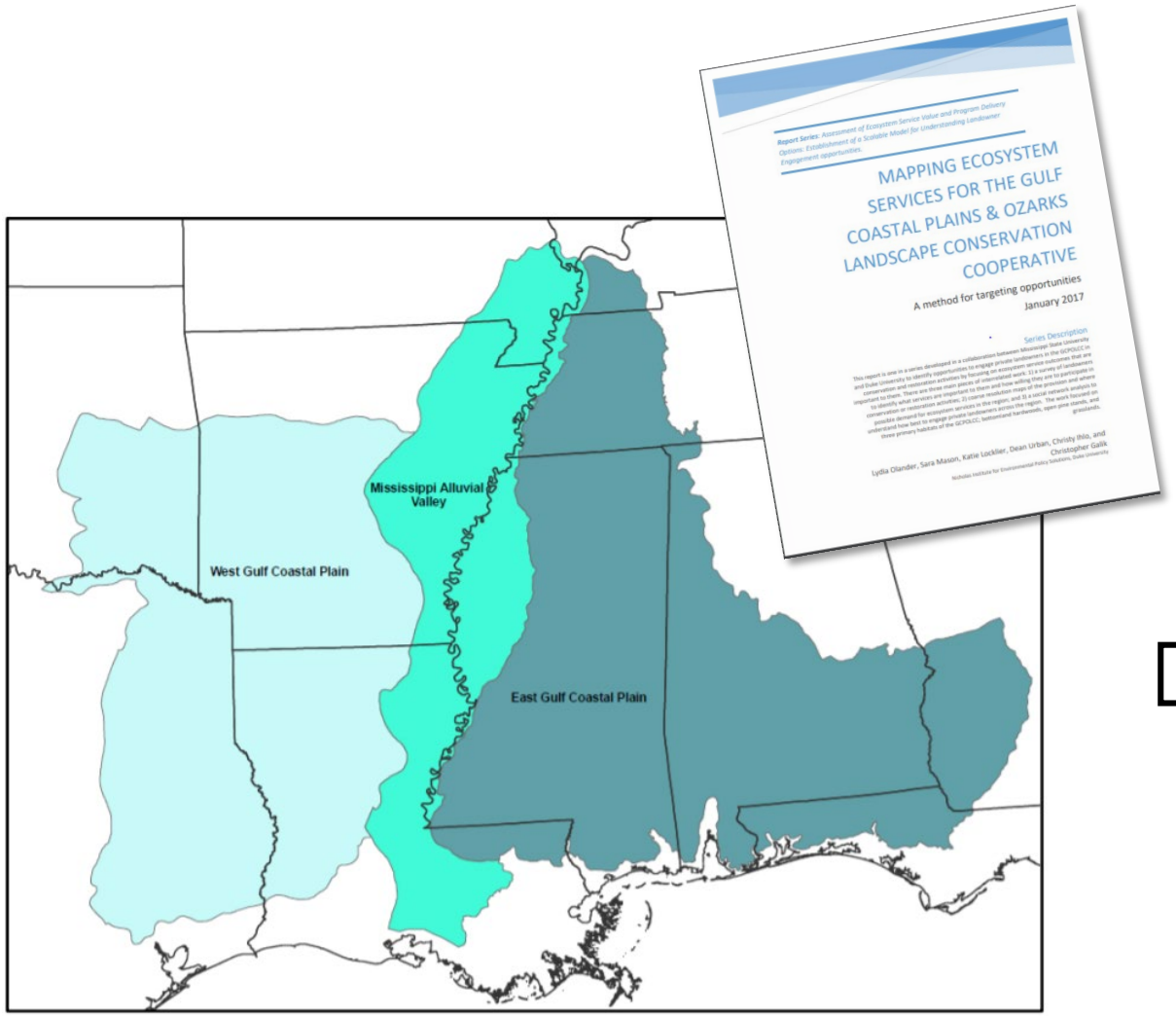


Accounts summarized geographically and by ecosystem type

Analyses should be updateable – tracking over time is essential

Avoid proprietary tools and models

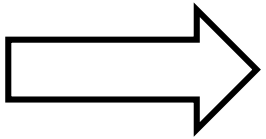
Compiling data for pilot accounts

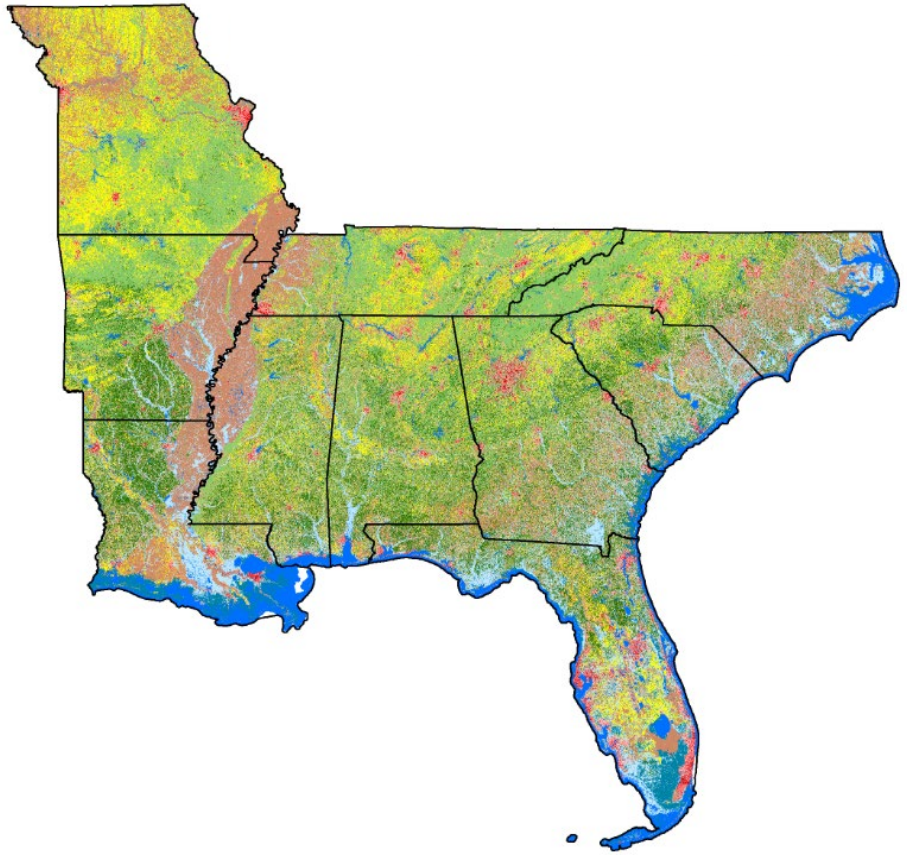


MAPPING ECOSYSTEM SERVICES FOR THE GULF COASTAL PLAINS & OZARKS LANDSCAPE CONSERVATION COOPERATIVE

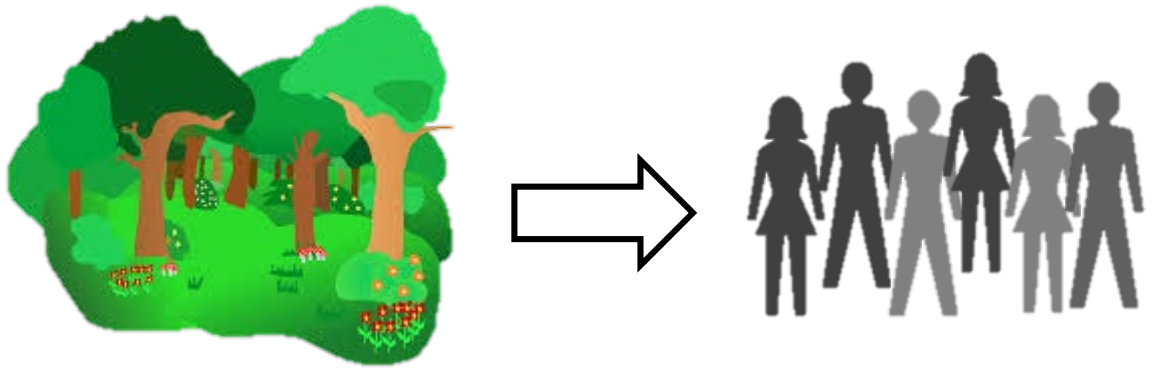
A method for targeting opportunities

January 2017





Physical supply-use accounts



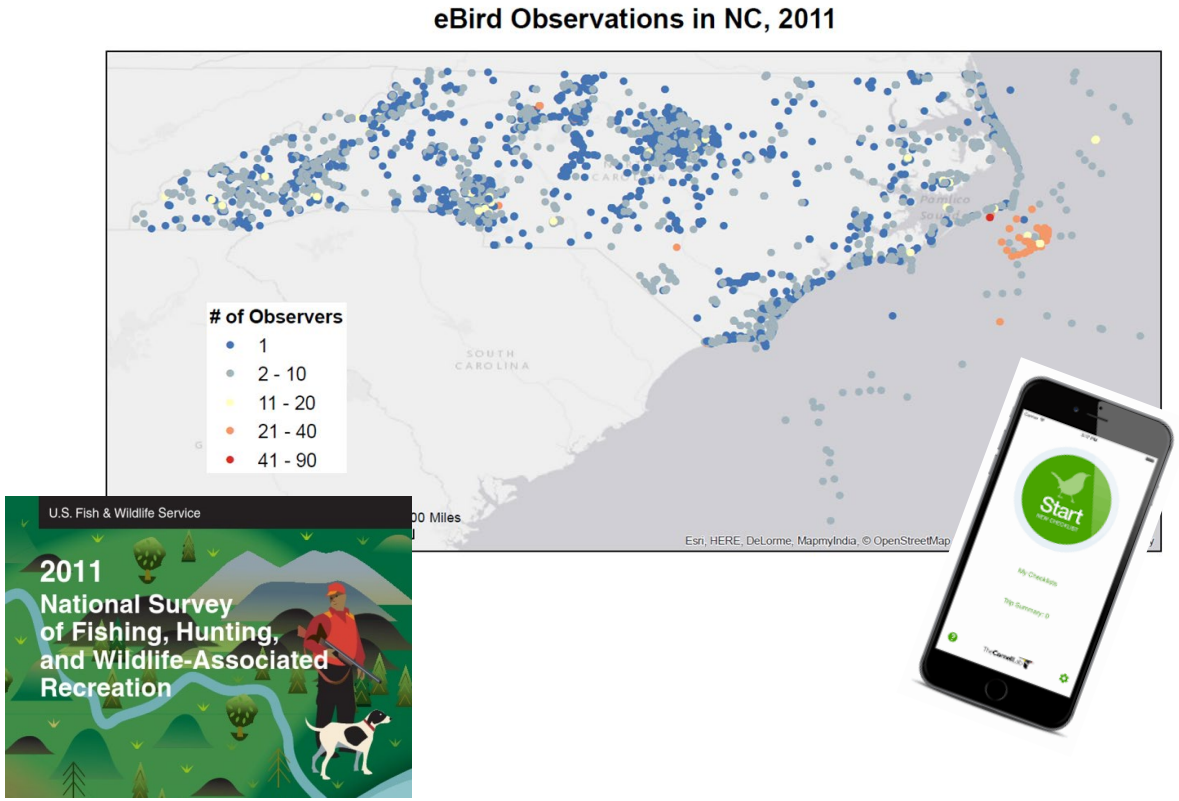
Ecosystem service: transaction from natural ecosystem to people

Challenges:

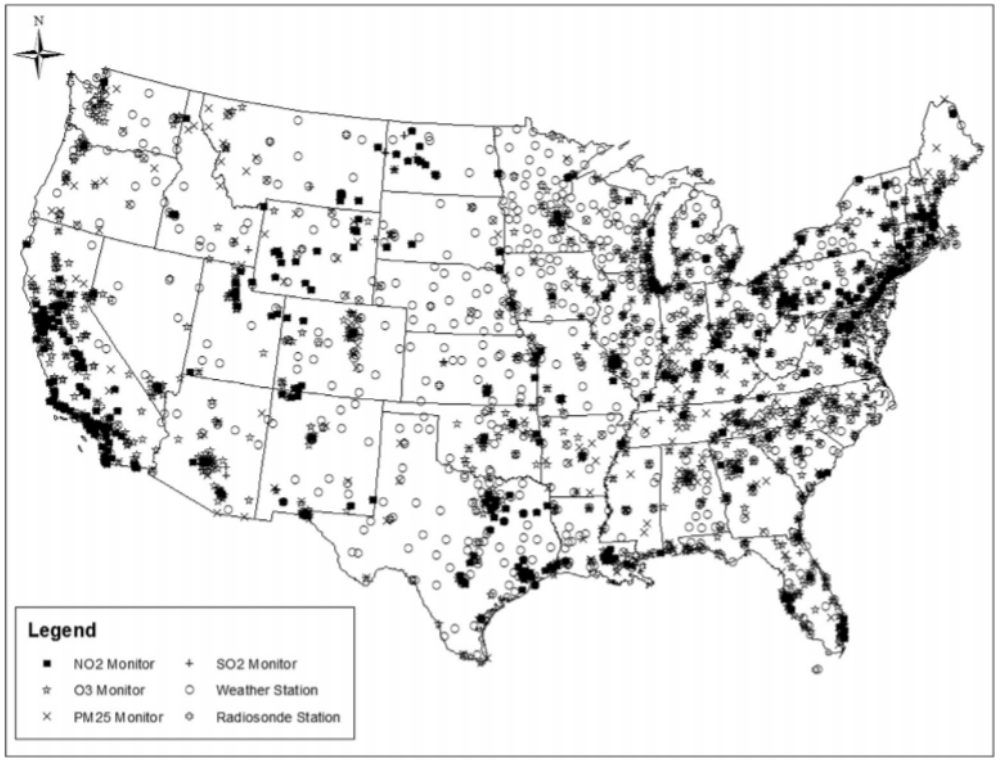
- Defining ecosystem services for accounting
- Many data gaps!

Physical supply-use accounts

Recreational birding
(measured in birding days)



Air quality in developed areas
(concentration of pollutants known to influence health)



Nowak et al. 2014

Physical supply-use accounts: Supply table

			Ecosystem Types (Land Cover)															
			Offshore	Open Water	Developed - Open	Developed - Low	Developed - Medium	Developed - High	Barren	Deciduous Forest	Evergreen Forest	Mixed Forest	Shrub/Scrub	Grassland/Herbaceous	Pasture/Hay	Cultivated Crops	Woody Wetlands	Emergent Herbaceous Wetlands	Total
Recreational birding (thousands of birding days)		2001	2,015	8,471	6,935	5,897	1,850	978	416	6,586	3,441	365	1,075	1,498	2,285	4,614	7,106	3,343	56,874
		2006	518	4,418	8,552	9,451	4,368	1,129	780	6,273	3,433	531	2,208	2,808	2,833	3,658	6,196	2,204	59,360
		2011	1,236	5,207	10,022	7,420	3,553	1,046	1,408	7,173	3,816	692	1,966	1,833	4,050	2,634	4,964	3,695	60,715
Air pollutant concentrations (annual mean, ppb or µg/m^3)	CO	2010			323.66														323.66
		2015			290.10														290.10
	NO2	2010			7.43														7.43
		2015			7.01														7.01
	O3	2010			30.29														30.29
		2015			27.88														27.88
	PM10*	2010			9.41														9.41
		2015			9.54														9.54
	PM2.5	2010			10.89														10.89
		2015			10.35														10.35
	SO2	2010			2.00														2.00
		2015			1.04														1.04

Physical supply-use accounts: Use table

In accounting, ecosystem services are transactions, so

use = supply

			Economic units			
			Households	Industry (11-72)	Government (92)	Total
Recreational birding (thousands of birding days)		2001	56,874	0	0	56,874
		2006	59,360	0	0	59,360
		2011	60,715	0	0	60,715
Air pollutant concentrations (annual mean, ppb or µg/m^3)	CO	2010				323.66
		2015				290.10
	NO2	2010				7.43
		2015				7.01
	O3	2010				30.29
		2015		?		27.88
	PM10*	2010				9.41
		2015				9.54
	PM2.5	2010				10.89
		2015				10.35
	SO2	2010				2.00
		2015				1.04

Condition account

Includes metrics related to:

- Wild pollination
- Purification of runoff water
- Bird species richness
- Air pollutant removal

			Ecosystem Types (Land Cover)															
			Offshore	Open Water - non-freshwater	Open Water - freshwater	Developed - Open	Developed - Low	Developed - Medium	Developed - High	Barren	Deciduous Forest	Evergreen Forest	Mixed Forest	Shrub/Scrub	Grassland/Herbaceous	Pasture/Hay	Cultivated Crops	Woody Wetlands	Emergent Herbaceous Wetlands
Water purification	Area of purifying land cover types between NPS	2001									31,542	20,238	6,959		5,385			25,463	3,379
		2006									31,453	19,780	6,678		5,997			25,427	3,504
		2011									31,005	19,330	6,353		6,192			25,151	3,789
	% of flowpath between NPS sources and	2001			30.6%														
		2006			30.4%														
		2011			29.9%														
Bird biodiversity	Bird species richness (160 species modeled)	2001	158	157		156	149				160	160				160	160	158	148
		2006	158	157		156	150				160	160		145		160	160	159	150
		2011	158	157		156	150				160	160		144		160	160	159	147

...

Temporal change in ecosystem services

Air pollutant concentrations (annual mean, ppb or µg/m^3) in developed areas	CO	2010	323.66	↓
		2015	290.10	
	NO2	2010	7.43	↓
		2015	7.01	
	O3	2010	30.29	↓
		2015	27.88	
	PM10	2010	9.41	↑
		2015	9.54	
	PM2.5	2010	10.89	↓
		2015	10.35	
	SO2	2010	2.00	↓
		2015	1.04	

data from S. Nowak

Ecosystem service supply by ecosystem type

Recreational birding, 2011

Ecosystem type (land cover)	Thousands of birding days
Offshore	1,236
Open Water	5,207
Developed - Open	10,022
Developed - Low	7,420
Developed - Medium	3,553
Developed - High	1,046
Barren	1,408
Deciduous Forest	7,173
Evergreen Forest	3,816
Mixed Forest	692
Shrub/Scrub	1,966
Grassland/Herbaceous	1,833
Pasture/Hay	4,050
Cultivated Crops	2,634
Woody Wetlands	4,964
Emergent Herbaceous Wetlands	3,695
Total	60,715

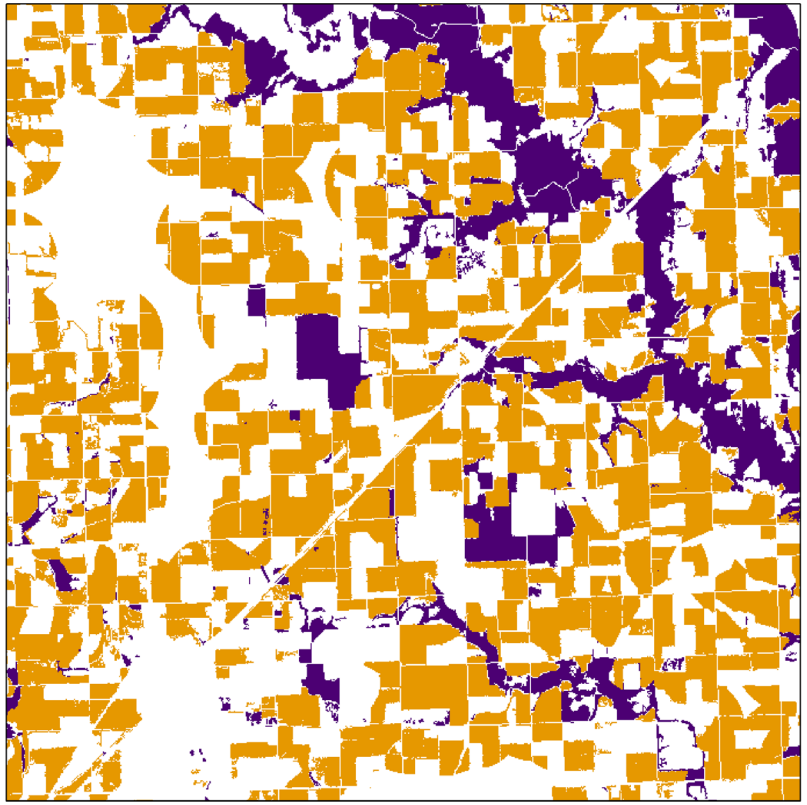
Developed land supplied more than 1/3 of birding days in the southeast

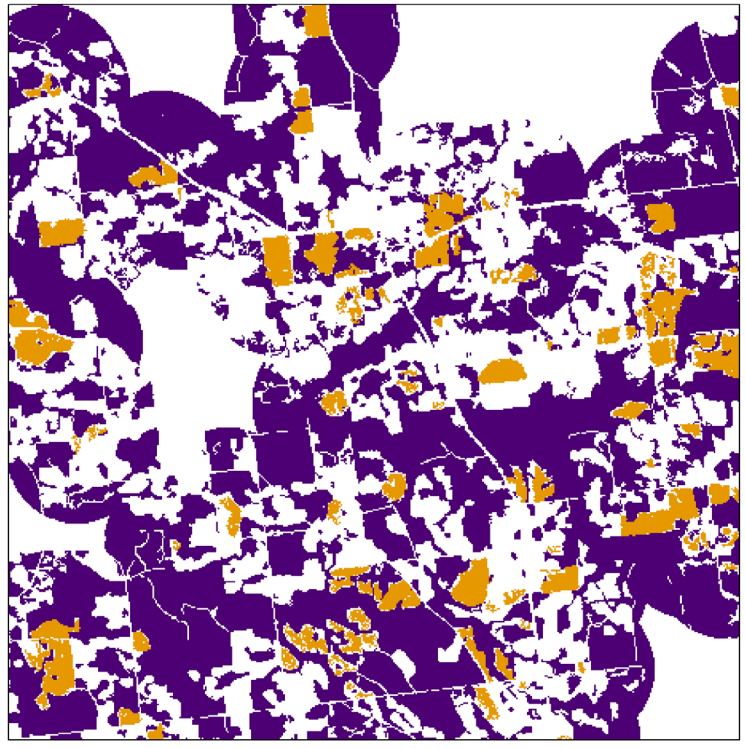
Forests, open water, and wetlands also important ecosystem types for birding in the southeast

Condition metric: cross-state comparison

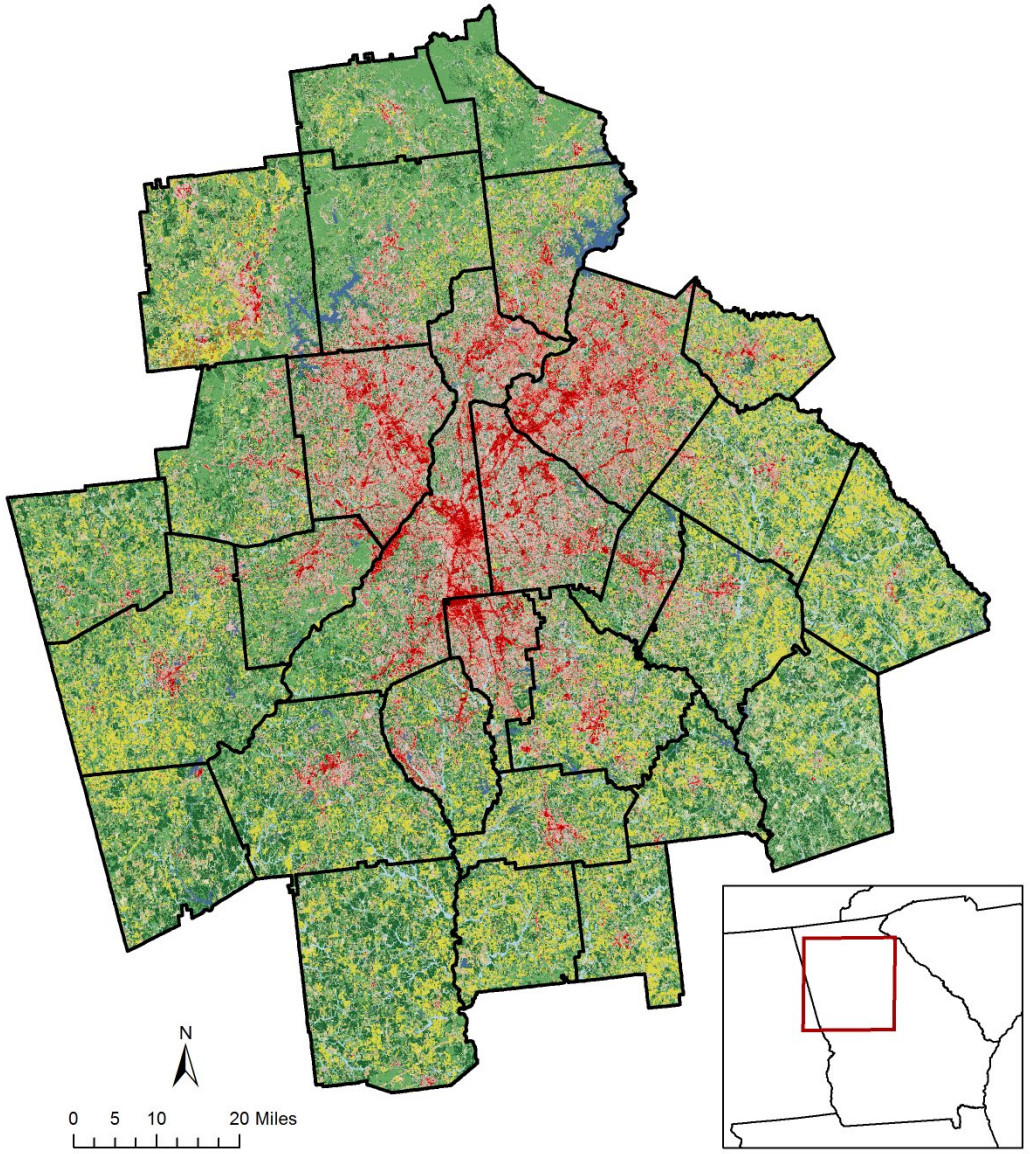
Ratio of pollinator habitat to pollinator-dependent crops

State	Ratio
AL	7.96
AR	0.57
FL	3.22
GA	9.85
LA	1.51
MO	1.25
MS	2.00
NC	5.84
SC	7.95
TN	3.01





Looking closer: metropolitan Atlanta



Metric	% change, 2001-2011
GDP, all industries	8.8%
Population (2000-2010)	24.0%

Looking closer: metropolitan Atlanta

Account	Metric	% change, 2001-2011
Economic accounts	GDP, all industries	8.8%
Population (2000-2010)		24.0%
Land accounts	Developed land cover	17.2%
	Agricultural land cover	-6.3%
	Other land cover	-4.0%
Water accounts	Total water use (million gallons/day, 2000-2010)	-57.8%
	Water productivity ($/100 gallons water use, 2000-2010)	153.3%
	Water quality declines (% of sites monitored, 2002-2012)	56.3%
Ecosystem accounts	Water purification condition metric	-18.2%
	Mean annual concentration, CO (2010-2015)	14.8%
	Mean annual concentration, NO2 (2010-2015)	-25.1%
	Mean annual concentration, O3 (2010-2015)	-3.8%
	Mean annual concentration, PM10 (2010-2015)	-32.5%
	Mean annual concentration, PM2.5 (2010-2015)	-1.7%
	Mean annual concentration, SO2 (2010-2015)	-43.0%

Conclusions & next steps

Ecosystem accounting is possible with data currently available for the US!

Next steps for ecosystem accounts:

- Geographic expansion
- Addition of new ecosystem services and metrics
- Regular updates as new data are released

Thank you!