Water Management Baseline

Water Use by Category in the Finger LakesRegion: USGS Water Use County Data
DATA SOURCE: http://water.usgs.gov/watuse/data/2005/index.html

This chart is a modifed version of the USGS' "Water Use County Data". This chart displays only the counties in the region and only the data used for the selected indicators. Other calculations have been added to the chart. The upper chart contains selected portion of the raw USGS data. The the lower chart contains the calculated values for the indicators.

STATE	STATEFIPS	COUNTYFIPS	FIPS	Total population of county, in thousands TP-TotPop	Public Supply, total withdrawals, fresh, in Mgal/d PS-WFrTo	Domestic, deliveries from Public Supply, in Mgal/d DO-PSDel	Irrigation, total withdrawals, fresh, in Mgal/d IR-WFrTo	Total withdrawals, fresh, in Mgal/d TO-WFrTo	
NY	36	037	36037	59.257	4.76	2.98	2.04	11.85	**Genesee County**
NY	36	051	36051	64.205	4.06	5.31	0.91	8.10	**Livingston County**
NY	36	055	36055	733.366	85.12	67.68	2.38	226.85	**Monroe County**
NY	36	069	36069	104.461	6.15	9.00	0.92	14.17	**Ontario County**
NY	36	073	36073	43.387	2.37	2.59	1.27	5.42	**Orleans County**
NY	36	099	36099	34.855	2.31	2.36	0.21	4.65	**Seneca County**
NY	36	117	36117	93.609	7.16	7.58	0.74	459.89	**Wayne County**
NY	36	121	36121	42.693	3.62	2.23	1.32	10.12	**Wyoming County**
NY	36	123	36123	24.756	0.82	0.90	0.15	71.16	**Yates County**
			TOTALS for REGION	1200.59	116.37	100.63	9.94	812.21	

PS-WFrTo	DO-PSDel	IR-WFrTo	TO-WFrTo	**Area of Water Demand/1000 people** (in category)
0.08	**0.05**	**0.03**	**0.20**	**Genesee County**
0.06	**0.08**	**0.01**	**0.13**	**Livingston County**
0.12	**0.09**	**0.00**	**0.31**	**Monroe County**
0.06	**0.09**	**0.01**	**0.14**	**Ontario County**
0.05	**0.06**	**0.03**	**0.12**	**Orleans County**
0.07	**0.07**	**0.01**	**0.13**	**Seneca County**
0.08	**0.08**	**0.01**	**4.91**	**Wayne County**
0.08	**0.05**	**0.03**	**0.24**	**Wyoming County**
0.03	**0.04**	**0.01**	**2.87**	**Yates County**
0.097	**0.084**	**0.008**	**0.677**	**REGION**

Total Number of Impaired Waters (on the NYSDEC 303(d) List)
DATA SOURCE: http://www.dec.ny.gov/chemical/31290.html

This chart contains an accounting of the number of watercourses listed on the NYSDEC 303-d list.

ENTITY	Section of 303(d) List				TOTAL per ENTITY
	Part 1 - Individual Waterbody Segments with Impairment Requiring TMDL Development	**Part 2a -** Multiple Segment/Categorical Impaired Waterbody Segments (atmospheric deposition)	**Part 2b -** Multiple Segment/Categorical Impaired Waterbody Segments (fish consumption)	**Part 2c -** Multiple Segment/Categorical Impaired Waterbody Segments (shellfishing)	
Genesee County	1				**1**
Livingston County	3				**3**
Monroe County	11		14		**25**
Ontario County	2		1		**3**
Orleans County			6		**6**
Seneca County					**0**
Wayne County	1		9		**10**
Wyoming County					**0**
Yates County			1		**1**
REGION	**18**	**0**	**31**	**0**	**49**

% of Beach WQ Samples Exceeding State Thresholds
http://www.nrdc.org/water/oceans/ttw/ny.asp#

This indicator is a reporting of the data collected by the NRDC. The data within the region is averaged.

DATA YEAR 2011

BEACH	COUNTY	MONITORING FREQUENCY (per week)	TOTAL SAMPLES REPORTED	PERCENTAGE of SAMPLES EXCEEDING STATE THRESHOLDS	# DAYS WITH NOTIFICATIONS
Hamlin	Monroe	1	94	18%	3
Ontario	Monroe	7	270	30%	38
Durand	Monroe	7	84	20%	28
Sodus Point Bayside	Wayne	0.5	7	0%	0
			AVERAGE	17%	

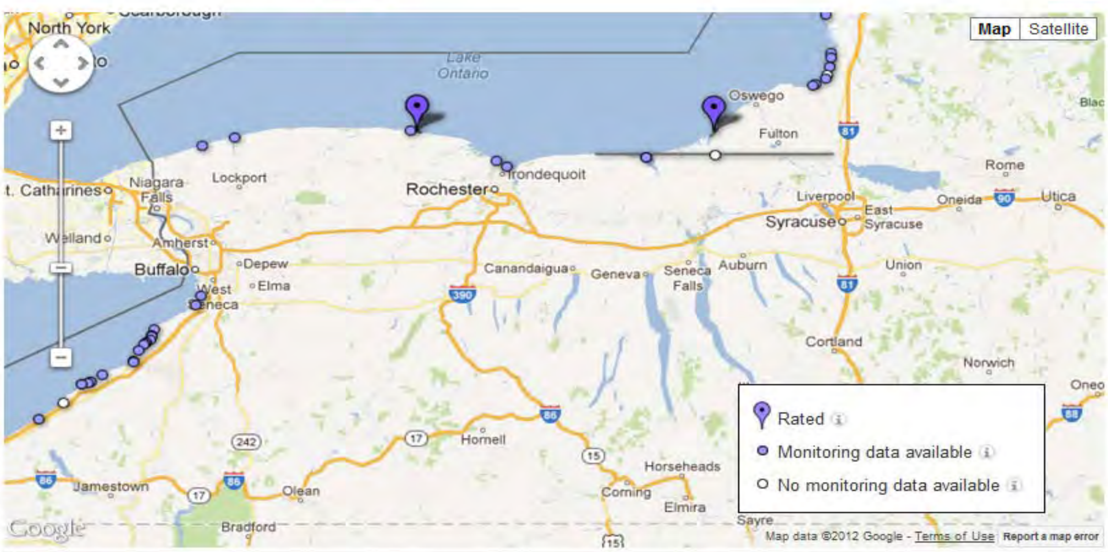
Reported Sources of Beachwater Contamination
(number of closing/advisory days; includes reported sources of advisories and closures that were issued for non-contamination-related reasons, if any)

- 1,612 (88%) stormwater runoff
- 294 (16%) sewage spills/leaks
- 159 (9%) unknown contamination sources
- 33 (2%) other contamination sources
- 15 (1%) wildlife

Totals exceed total days and 100% because more than one contamination source was reported for some events.

Find a beach near you: Enter an address, zip code or state Search

Share this map view: http://www.nrdc.org/water/oc Copy



BETA VERSION: Beach location information is based on the best-available EPA datasets (learn about our beach location methodology). Please feel free to suggest a correction or provide feedback.

Number of Impaired Waters with Established TMDL Requirements Removed From the Program
http://www.dec.ny.gov/chemical/23835.html

This indicator is calculated by identifying the number of waterbodies for which the TMDL requirements have been removed since the baseline consditions was established.

TMDLs Established in the Study Area

	Watercourse	County	Pollutant	Year Implemented
1	Blind Sodus Bay	Wayne	Phosphorus	2007
2	Buck, Long and Cranberry Ponds	Monroe	Phosphorus	2010
3	Silver lake	Wyoming	Phosphorus	2010
4	Lake Ontario		PCBs	2011
5	Port Bay	Wayne	PCBs	2011

3	Number of waterbodies with established TMDLS at baseline

Concentrations of Pollutants in the Finger Lakes
http://people.hws.edu/halfman/FL-Lim/FL-Limnology.htm

The reported statistics are the averages of total Phosphate and Total Nitrate concentrations at the surface and lake bottoms for Honeoye, Canadaigua, Kueka, Seneca, and Cayuga Lakes. Because each lake is inluenced by watersheds in more than one county, this data should not be considered at the county level.

2010 Average Values (± 1σ)	Honeoye	Canandaigua	Keuka	Seneca	Cayuga	Owasco	Skaneateles	Otisco
Secchi Depth (m)	2.5 ± 1.2	7.1 ± 1.8	6.6 ± 1.4	3.9 ± 1.4	4.5 ± 1.7	3.7 ± 1.1	7.5 ± 1.9	3.8 ± 0.6
Total Suspended Solids (mg/L), Surface	6.4 ± 7.1	0.8 ± 0.5	0.8 ± 0.4	1.7 ± 1.0	1.4 ± 0.9	1.9 ± 1.0	0.6 ± 0.3	1.5 ± 0.7
Total Suspended Solids (mg/L), Bottom	2.5 ± 1.2	0.8 ± 0.4	0.9 ± 0.5	0.6 ± 0.3	1.4 ± 0.7	1.2 ± 0.3	0.4 ± 0.2	1.6 ± 0.9
Dissolved Phosphate (µg/L, SRP), Surface	11.0 ± 12.4	0.9 ± 0.8	0.3 ± 0.2	0.7 ± 1.4	0.9 ± 1.6	0.4 ± 0.4	0.3 ± 0.2	0.4 ± 0.3
Dissolved Phosphate (µg/L, SRP), Bottom	15.1 ± 15.8	0.6 ± 0.5	0.4 ± 0.4	1.5 ± 2.0	3.9 ± 2.5	0.9 ± 1.2	0.5 ± 0.9	2.0 ± 3.9
Total Phosphate (µg/L, TP), Surface	52.4 ± 54.4	5.2 ± 2.8	4.3 ± 1.3	6.5 ± 2.1	7.4 ± 4.7	8.1 ± 4.1	3.0 ± 1.4	8.6 ± 2.2
Total Phosphate (µg/L, TP), Bottom	37.1 ± 24.3	2.9 ± 1.0	3.7 ± 1.2	5.8 ± 2.1	9.7 ± 3.0	5.4 ± 2.2	2.3 ± 1.9	11.4 ± 10.3
Nitrate as N (mg/L), Surface	0.1 ± 0.2	0.1 ± 0.0	0.0 ± 0.0	0.2 ± 0.2	1.1 ± 0.5	0.7 ± 0.5	0.6 ± 0.3	0.3 ± 0.2
Nitrate as N (mg/L), Bottom	0.2 ± 0.2	0.2 ± 0.2	0.2 ± 0.2	0.5 ± 0.3	1.3 ± 0.8	0.9 ± 0.7	0.8 ± 0.4	0.3 ± 0.1
Silica (SR µg/L), Surface	1780 ± 848	845 ± 95	424 ± 256	246 ± 106	385 ± 177	719 ± 337	421 ± 171	467 ± 206
Silica (SR µg/L), Bottom	1854 ± 867	1110 ± 172	878 ± 212	371 ± 173	839 ± 192	1255 ± 395	584 ± 162	935 ± 241
Chlorphyll a (µg/L), Surface	37.9 ± 43.0	2.0 ± 1.2	1.9 ± 1.8	4.7 ± 3.2	3.0 ± 1.3	3.7 ± 3.3	1.2 ± 0.9	3.0 ± 1.7
Chlorphyll a (µg/L), Bottom	12.5 ± 7.3	0.3 ± 0.2	0.5 ± 0.4	0.6 ± 0.6	0.2 ± 0.1	0.5 ± 0.4	0.6 ± 0.6	2.2 ± 0.7

Pollutant	Location	Honeoye Lake	Canandaigua Lake	Kueka Lake	Seneca Lake	Cayuga Lake	Average	Units
Phosphates	surface	52.4	5.2	4.3	6.5	7.4	**13.5**	µg/L
	bottom	37.1	2.9	3.7	5.8	9.7		
Nitrate	surface	0.1	0.1	0	0.2	1.1	**0.4**	mg/L
	bottom	0.2	0.2	0.2	0.5	1.3		

Economic Development Baseline

County	H+T Index	Population	% of Total
Genesee	54.46%	60,079	4.94%
Livingston	53.18%	65,393	5.37%
Monroe	50.93%	744,344	61.15%
Ontario	54.89%	107,931	8.87%
Orleans	52.47%	42,883	3.52%
Seneca	57.34%	35,251	2.90%
Wayne	53.37%	93,772	7.70%
Wyoming*	--	42,155	3.46%
Yates*	--	25,348	2.08%
TOTAL FINGER LAKES REGION		**1,217,156**	**100.00%**

Weighted regional average H&T Index by population	**52.07%**

* No data available

Quarterly Census of Employment and Wages (QCEW)
NAICS Based Industry Employment and Wages
New York State, Labor Market Regions, Metropolitan Areas, Local Workforce Investment Areas and Counties
Data for 2012 are preliminary and subject to revision
NAICS Sector = All Sectors
NAICS Industry = All
Area =Finger Lakes Region

Industry Title	Year	Average Employment
Total, All Industries	2010	532,994
Total, All Private	2010	442,814
Agriculture, Forestry, Fishing Hunting	2010	6,121
Crop Production	2010	3,396
Animal Production	2010	2,337
Forestry and Logging	2010	29
Agriculture Forestry Support Activity	2010	360
Mining	2010	610
Mining (except Oil and Gas)	2010	604
Utilities	2010	1,827
Utilities	2010	1,827
Construction	2010	18,114
Construction of Buildings	2010	4,802
Heavy and Civil Engineering Construction	2010	1,855
Specialty Trade Contractors	2010	11,457
Manufacturing	2010	67,065
Food Manufacturing	2010	5,528
Beverage Tobacco Product Manufacturing	2010	1,444
Textile Mills	2010	257
Textile Product Mills	2010	254
Apparel Manufacturing	2010	762
Wood Product Manufacturing	2010	459
Paper Manufacturing	2010	1,661
Printing and Related Support Activities	2010	2,644
Petroleum Coal Products Manufacturing	2010	136
Chemical Manufacturing	2010	8,142
Plastics Rubber Products Manufacturing	2010	4,854
Nonmetallic Mineral Product Mfg	2010	1,501
Primary Metal Manufacturing	2010	452
Fabricated Metal Product Manufacturing	2010	7,977
Machinery Manufacturing	2010	12,401
Computer and Electronic Product Mfg	2010	9,092
Electrical Equipment and Appliances	2010	1,507
Transportation Equipment Manufacturing	2010	3,114
Furniture and Related Product Mfg	2010	682
Miscellaneous Manufacturing	2010	4,074
Wholesale Trade	2010	17,551
Merchant Wholesalers, Durable Goods	2010	10,838
Merchant Wholesalers, Nondurable Goods	2010	4,958
Electronic Markets and Agents Brokers	2010	1,755
Retail Trade	2010	61,576
Motor Vehicle and Parts Dealers	2010	7,108
Furniture and Home Furnishings Stores	2010	1,540
Electronics and Appliance Stores	2010	1,984
Building Material Garden Supply Stores	2010	5,062
Food and Beverage Stores	2010	16,668
Health and Personal Care Stores	2010	3,301
Gasoline Stations	2010	3,398
Clothing and Clothing Accessories Stores	2010	5,031
Sporting Goods Hobby Book Music Stores	2010	2,366
General Merchandise Stores	2010	10,808
Miscellaneous Store Retailers	2010	2,863
Nonstore Retailers	2010	1,447
Transportation and Warehousing	2010	9,147
Air Transportation	2010	268
Truck Transportation	2010	2,678
Transit and Ground Passenger Transport	2010	2,598
Pipeline Transportation	2010	30
Scenic and Sightseeing Transportation	2010	29
Support Activities for Transportation	2010	686

TOTALS	CATEGORY	NOTES
442,817	All Private	Includes Ag and Unclassified
6,122	Ag & Forestry	
436,199	Private, Adjusted	Private less Ag and Unclassified

Couriers and Messengers	2010	1,276			
Warehousing and Storage	2010	1,577			
Information	2010	9,439			
Publishing Industries	2010	2,620			
Motion Picture Sound Recording Ind	2010	526			
Broadcasting (except Internet)	2010	811			
Telecommunications	2010	4,186			
ISPs, Search Portals, Data Processing	2010	723			
Other Information Services	2010	573			
Finance and Insurance	2010	14,555			
Credit Intermediation Related Activity	2010	6,488			
Securities and Commodity Contracts	2010	1,603			
Insurance Carriers Related Activities	2010	6,385			
Funds, Trusts Other Financial Vehicles	2010	79			
Real Estate and Rental and Leasing	2010	7,006			
Real Estate	2010	5,242			
Rental and Leasing Services	2010	1,754			
Lessors, Nonfinancial Intangible Assets	2010	11			
Professional and Technical Services	2010	22,907			
Professional and Technical Services	2010	22,907			
Management of Companies and Enterprises	2010	12,127			
Management of Companies and Enterprises	2010	12,127			
Administrative and Waste Services	2010	25,851			
Administrative and Support Services	2010	24,382			
Waste Management and Remediation Service	2010	1,469			
Educational Services	2010	25,806			
Educational Services	2010	25,806			
Health Care and Social Assistance	2010	78,301			
Ambulatory Health Care Services	2010	19,747			
Hospitals	2010	25,711			
Nursing and Residential Care Facilities	2010	18,240			
Social Assistance	2010	14,605			
Arts, Entertainment, and Recreation	2010	8,092			
Performing Arts and Spectator Sports	2010	1,150			
Museums, Parks and Historical Sites	2010	732			
Amusement, Gambling Recreation Ind	2010	6,209			
Accommodation and Food Services	2010	37,920			
Accommodation	2010	3,777			
Food Services and Drinking Places	2010	34,143			
Other Services	2010	18,306			
Repair and Maintenance	2010	4,661			
Personal and Laundry Services	2010	4,425			
Membership Organizations Associations	2010	8,759			
Private Households	2010	462			
Total, All Government	2010	90,180	90,180	All Government	
Federal Government	2010	5,852			
State Government	2010	14,095			
Local Government	2010	70,233			
Unclassified	2010	496	496	Unclassified	

(P) = Preliminary

Employment information--by place of work--is based on quarterly reports from employers covered under New York State's Unemployment Insurance Law. Data by industry (using the new NAICS classification system) include employment; total annual and average weekly wages; and, the number of establishments. Data are available for New York State, metropolitan areas, and counties (State law prohibits us from disclosing information that would reveal the identity of individual employers). Data are available about six months following the end of the reported quarter--they are less current than non-farm employment estimates.

County	Jobs Created by Sector			
	Government	*Private*	*Agriculture*	*Unclassified*
Genesee	5,823	16,434	879	12
Livingston	6,739	12,609	510	14
Monroe	48,187	318,265	485	336
Ontario	8,301	40,145	612	58
Orleans	4,164	7,875	873	20
Seneca	3,122	7,893	113	13
Wayne	8,141	19,281	1,599	23
Wyoming	4,390	8,335	839	6
Yates	1,315	5,361	212	14
NAICS Category	Total, All Government	Total, All Private (excluding Agriculture & Unclassified)	Agriculture, Forestry, Fishing Hunting	Unclassified

County	Jobs Created by Sector		
	Food Manufacturing	*Alternative Energy*	*Materials Science*
Genesee	557	--	--
Livingston	576	--	--
Monroe	2,800	--	--
Ontario	677	--	--
Orleans	426	--	--
Seneca	451	--	--
Wayne	780	--	--
Wyoming	346	--	--
Yates	328	--	--
Data Source	NYS Department of Labor QCEW (NAICS Categories: "Food Manufacturing" & "Beverage Tobacco Product Manufacturing")	Data Currently Not Available	Data Currently Not Available

Governance Baseline

Inventory of Comprehensive Plans for the Finger Lakes Region

Source: Genesee/Finger Lakes Regional Planning Council*

*This list represents the known status of Comprehensive Plans according to G/FLRPC. It is not necessarily exhaustive.

County	municipality	Product Name	Description	Last Update	Updated in past 5 years?
Genesee	Alabama (T)	Oakfield-Alabama Comprehensive Plan	**Comprehensive Plan**	2005	NO
Genesee	Alexander (T)	Town of Alexander Comprehensive Plan	**Comprehensive Plan**	2003	NO
Genesee	Batavia (City)	City of Batavia Comprehensive Master Plan	**Comprehensive Plan**	1997	NO
Genesee	Batavia (T)	Comprehensive Plan	**Comprehensive Plan**	2007	YES
Genesee	Bergen (T)	Comprehensive Plan for the Town and Village of Bergen	**Comprehensive Plan**	1996	NO
Genesee	Bergen (V)	Comprehensive Plan for the Town and Village of Bergen	**Comprehensive Plan**	1996	NO
Genesee	Bethany (T)	Town of Bethany Comprehensive Plan	**Comprehensive Plan**	2007	YES
Genesee	Byron (T)	Comprehensive Plan	**Comprehensive Plan**	1993	NO
Genesee	Elba (T)	Comprehensive Plan	**Comprehensive Plan**	2007	YES
Genesee	Elba (V)	Comprehensive Plan	**Comprehensive Plan**	1976	NO
Genesee	Genesee County	Genesee County Comprehensive Plan	**Comprehensive Plan**	1997	NO
Genesee	Le Roy (T)	Comprehensive Plan	**Comprehensive Plan**	2002	NO
Genesee	Le Roy (V)	Village of LeRoy Comprehensive Plan	**Comprehensive Plan**	2001	NO
Genesee	Oakfield (T)	Oakfield-Alabama Comprehensive Plan	**Comprehensive Plan**	2005	NO
Genesee	Oakfield (V)	Oakfield-Alabama Comprehensive Plan	**Comprehensive Plan**	2005	NO
Genesee	Pavilion (T)	Town of Pavillion Comprehensive Plan	**Comprehensive Plan**	2003	NO
Genesee	Pembroke (T)	Comprehensive Plan	**Comprehensive Plan**	1997	NO
Genesee	Stafford (T)	Comprehensive Plan	**Comprehensive Plan**	2009	YES
Livingston	Avon (T)	Comprehensive Plan	**Comprehensive Plan**	1995	NO
Livingston	Caledonia (T)	Comprehensive Plan	**Comprehensive Plan**	1964	NO
Livingston	Caledonia (V)	Comprehensive Strategic Plan	**Comprehensive Plan**	2003	NO
Livingston	Conesus (T)	Comprehensive Plan	**Comprehensive Plan**	2005	NO
Livingston	Dansville (V)	Comprehensive Master Plan for Dansville and North Dansville	**Comprehensive Plan**	1970	NO
Livingston	Geneseo (T)	Town and Village of Geneseo Comprehensive Plan	**Comprehensive Plan**	1992	NO
Livingston	Geneseo (V)	Village of Geneseo Comprehensive Plan	**Comprehensive Plan**	2007	YES
Livingston	Lima (T)	Master Plan	**Comprehensive Plan**	1990	NO
Livingston	Lima (V)	Comprehensive Plan	**Comprehensive Plan**	2008	YES
Livingston	Livonia (T)	Comprehensive Plan for Livonia Town and Village	**Comprehensive Plan**	2004	NO
Livingston	Livonia (V)	Livonia Comprehensive Plan	**Comprehensive Plan**	2004	NO
Livingston	Mount Morris (T)	Town and Village of Mount Morris Comprehensive Plan	**Comprehensive Plan**	1997	NO
Livingston	North Dansville (T)	Town of North Dansville/Village of Dansville Comprehensive Master Plan	**Comprehensive Master Plan**	1970	NO
Livingston	Nunda (T)	Town and Village of Nunda Comprehensive Plan	**Comprehensive Plan**	2005	NO

Livingston	Nunda (V)	Town and Village of Nunda Comprehensive Plan	**Comprehensive Plan**	2005	NO
Livingston	Sparta (T)	Comprehensive Master Plan	**Comprehensive Plan**	2003	NO
Livingston	West Sparta (T)	Comprehensive plan	**Comprehensive Plan**	2007	YES
Monroe	Brighton (T)	Comprehensive Plan	**Comprehensive Plan**	2000	NO
Monroe	Brockport (V)	Town of Sweden Village of Brockport Comprehensive Plan	**Comprehensive Plan**	2005	NO
Monroe	Chili (T)	Town of Chili Master Plan Update 2010	**Comprehensive Plan**	2010	YES
Monroe	Churchville (V)	Town of Riga and Village of Churchville 2006 Proposed Comprehensive Plan	**Comprehensive Plan**	2008	YES
Monroe	Clarkson (T)	Comprehensive Plan	Compehensive Plan	2008	YES
Monroe	Gates (T)	Town of Gates Comprehensive Plan	**Comprehensive Plan**	1976	NO
Monroe	Greece (T)	Town of Greece Master Plan	**Master Plan**	1993	NO
Monroe	Hamlin (T)	Town of Hamlin Comprehensive Master Plan	**Comprehensive Plan**	2007	YES
Monroe	Henrietta (T)	Comprehensive Plan	**Comprehensive Plan**	1997	NO
Monroe	Hilton (V)	Comprehensive Plan	**Comprehensive Plan**	1977	NO
Monroe	Irondequoit (T)	Master Plan for the Town of Irondequoit New York	**Master Plan**	2009	YES
Monroe	Mendon (T)	Town of Mendon Comprehensive Plan	**Comprehensive Plan**	2005	NO
Monroe	Ogden (T)	Comprehensive Plan	**Comprehensive Plan**	2003	NO
Monroe	Parma (T)	Comprehensive Plan	**Comprehensive Plan**	1989	NO
Monroe	Parma (T)	Town of Parma Master Plan Update	**Master Plan Update**	1989	NO
Monroe	Penfield (T)	Town of Penfield Comprehensive Plan	**Comprehensive Plan**	2001	NO
Monroe	Perinton (T)	Comprehensive Plan Update	**Comprehensive Plan Update**	2011	YES
Monroe	Pittsford (T)	Comprehensive Plan Update	**Comprehensive Plan**	2009	YES
Monroe	Pittsford (V)	Village of Pittsford Comprehensive Master Plan	**Comprehensive Master Plan**	2002	NO
Monroe	Riga (T)	Town of Riga and Village of Churchville 2006 Proposed Comprehensive Plan	**Comprehensive Plan**	2008	YES
Monroe	Rochester (City)	City of Rochester Comprehensive Plan	**Comprehensive Plan**	2002	NO
Monroe	Rush (T)	Town of Rush Comprehensive Plan - 2010	**Comprehensive Plan**	1993	NO
Monroe	Scottsville (V)	Town of Wheatland Village of Scottsville Comprehensive Plan	**Comprehensive Plan**	2004	NO
Monroe	Spencerport (V)	Comprehensive Plan	**Comprehensive Plan**	2002	NO
Monroe	Sweden (T)	Town of Sweden Village of Brockport Comprehensive Plan	**Comprehensive Plan**	2005	NO
Monroe	Webster (T)	Town of Webster Comprehensive Plan - Second Draft	**Comprehensive Plan**	2008	YES
Monroe	Webster (V)	Comprehensive Plan	**Comprehensive Plan**	2000	NO
Monroe	Wheatland (T)	Town of Wheatland Village of Scottsville Comprehensive Plan	**Comprehensive Plan**	2004	NO

Ontario	Bloomfield (V)	Town of East Bloomfield Village of Bloomfield Comprehensive Plan	**Comprehensive Plan**	1998	NO
Ontario	Bristol (T)	Town of Bristol, NY Comprehensive Plan	**Comprehensive Plan**	2007	YES
Ontario	Canadice (T)	Town of Canadice Comprehensive Plan	**Comprehensive Plan**	1999	NO
Ontario	Canandaigua (City)	City of Canandaigua Comprehensive Plan	**Comprehensive Plan**	2001	NO
Ontario	Canandaigua (T)	Town of Canandaigua Master Plan	**Comprehensive Plan**	2011	YES
Ontario	East Bloomfield (T)	Town of East Bloomfield Village of Bloomfield Comprehensive Plan	**Comprehensive Plan**	1998	NO
Ontario	Farmington (T)	Comprehensive Plan	**Comprehensive Plan**	2003	NO
Ontario	Geneva (T)	Town of Geneva Comprehensive Plan Update 2006	**Comprehensive Plan**	2006	NO
Ontario	Gorham (T)	Comprehensive Plan	**Comprehensive Plan**	2009	YES
Ontario	Hopewell (T)	Town of Hopewell Comprehensive Plan	**Comprehensive Plan**	2006	NO
Ontario	Manchester (V)	Village of Manchester Comprehensive Plan	**Comprehensive Plan**	2005	NO
Ontario	Murray (T)	Town of Naples Master Plan Draft	**Master Plan**	1987	NO
Ontario	Naples (T)	Comprehensive Plan Strategic Plan Report	**Comprehensive Plan Strategic Plan Report**	2002	NO
Ontario	Richmond (T)	Town of Richmond, NY Comprehensive Plan		2004	NO
Ontario	Rushville (V)	Comprehensive Plan	**Comprehensive Plan**	1965	NO
Ontario	Seneca (T)	Comprehensive Plan	**Comprehensive Plan**	2002	NO
Ontario	South Bristol (T)	Comprehensive Plan	**Comprehensive Plan**	2008	YES
Ontario	Victor (T)	Comprehensive Plan	**Comprehensive Plan**	2002	NO
Ontario	West Bloomfield (T)	Town of West Bloomfield Comprehensive Plan	**Comprehensive Plan**	2001	NO
Orleans	Albion (T)	Comprehensive Plan for the Town and Village of Albion and the Town of Barre	**Comprehensive Plan**	1996	NO
Orleans	Albion (V)	Comprehensive Plan for the Town and Village of Albion and the Town of Barre	**Comprehensive Plan**	1996	NO
Orleans	Barre (T)	Comprehensive Plan for the Town and Village of Albion and the Town of Barre	**Comprehensive Plan**	1996	NO
Orleans	Carlton (T)	Comprehensive Plan	**Comprehensive Plan**	1991	NO
Orleans	Clarendon (T)	Comprehensive Plan	**Comprehensive Plan**	1998	NO
Orleans	Gaines (T)	Comprehensive Plan	**Comprehensive Plan**	2001	NO
Orleans	Kendall (T)	Comprehensive Plan	**Comprehensive Plan**	1991	NO
Orleans	Lyndonville (V)	Western Orleans Comprehensive Plan, Towns of Shelby, Ridgeway, and Yates and Villages of Medina and Lyndonville	**Comprehensive Plan**	2003	NO
Orleans	Medina (V)	Western Orleans Comprehensive Plan, Towns of Shelby, Ridgeway, and Yates and Villages of Medina and Lyndonville	**Comprehensive Plan**	2003	NO
Orleans	Murray (T)	Town of Murray Comprehensive Plan	**Comprehensive Plan**	2001	NO
Orleans	Ridgeway (T)	Western Orleans Comprehensive Plan	**Comprehensive Plan**	2003	NO
Orleans	Shelby (T)	Western Orleans Comprehensive Plan	**Comprehensive Plan**	2003	NO

Orleans	Yates (T)	Western Orleans Comprehensive Plan	**Comprehensive Plan**	2003	NO
Seneca	Fayette (T)	Comprehensive Plan	**Comprehensive Plan**	2006	NO
Seneca	Lodi (T)	Comprehensive Plan	**Comprehensive Plan**	2010	YES
Seneca	Ovid (T)	Comprehensive Plan	**Comprehensive Plan**	2012	YES
Seneca	Romulus (T)	Comprehensive Plan	**Comprehensive Plan**	2001	NO
Seneca	Seneca Falls (T)	Comprehensive Plan for the Town and Village of Seneca Falls	**Comprehensive Plan**	2006	NO
Seneca	Varick (T)	Comprehensive Plan	**Comprehensive Plan**	2006	NO
Seneca	Waterloo (T)	Town of Waterloo Comprehensive Plan	**Comprehensive Plan**	2000	NO
Wayne	Arcadia (T)	Comprehensive Plan	**Comprehensive Plan**	2009	YES
Wayne	Clyde (V)	Clyde, Galen, Savannah Comp Plan	Clyde, Galen, Savannah Comp Plan	2009	YES
Wayne	Galen (T)	Clyde, Galen, Savannah Comp Plan	Clyde, Galen, Savannah Comp Plan	2009	YES
Wayne	Huron (T)	Comprehensive Plan	**Comprehensive Plan**	1992	NO
Wayne	Macedon (T)	Comprehensive Plan	**Comprehensive Plan**	1999	NO
Wayne	Macedon (V)	Comprehensive Plan	**Comprehensive Plan**	1998	NO
Wayne	Marion (T)	Town of Marion Master Plan Zoning Map	**Master Plan Zoning Map**	1989	NO
Wayne	Newark (V)	Comprehensive Plan	**Comp plan with Arcadia (t)**	2004	NO
Wayne	Ontario (T)	Town of Ontario Master Plan	**Master Plan**	2006	NO
Wayne	Palmyra (T)	Town and Village of Palmyra Comprehensive Plan	**Comprehensive Plan**	2004	NO
Wayne	Red Creek (V)	Comprehensive Plan	**Comprehensive Plan**	2005	NO
Wayne	Rose (T)	Comprehensive Plan	**Comprehensive Plan**	2004	NO
Wayne	Savannah	Clyde, Galen, Savannah Comp Plan	Clyde, Galen, Savannah Comp Plan	2009	YES
Wayne	Sodus (T)	Comprehensive Plan	**Comprehensive Plan**	2005	NO
Wayne	Sodus Point (V)	Comprehensive Plan	**Comprehensive Plan**	1996	NO
Wayne	Walworth (T)	Comprehensive Plan	**Comprehensive Plan**	2003	NO
Wayne	Williamson (T)	Comprehensive Plan	**Comprehensive Plan**	1998	NO
Wyoming	Arcade (T)	Village and Town of Arcade Comprehensive Plan	**Comprehensive Plan**	1996	NO
Wyoming	Arcade (V)	Village and Town of Arcade Comprehensive Plan	**Comprehensive Plan**	1996	NO
Wyoming	Attica (T)	Comprehensive Plan	**Comprehensive Plan**	2003	NO
Wyoming	Attica (V)	Village of Attica Comprehensive Plan	**Comprehensive Plan**	2003	NO
Wyoming	Bennington (T)	Comprehensive Plan	**Comprehensive Plan**	1997	NO
Wyoming	Castile (T)	Castile Town and Village Comprehensive Plan, Reports 1 and 2	**Comprehensive Plan**	1967	NO
Wyoming	Castile (V)	Castile Town and Village Comprehensive Plan, Reports 1 and 2	**Comprehensive Plan**	1967	NO
Wyoming	Eagle (T)	Town of Eagle Master Plan	**Master Plan**	2011	YES
Wyoming	Gainesville (T)	Comprehensive Plan	**Comprehensive Plan**	1995	NO
Wyoming	Java (T)	Comprehensive Plan	**Comprehensive Plan**	1987	NO
Wyoming	Perry (T)	Comprehensive Plan	**Comprehensive Plan**	1969	NO
Wyoming	Perry (V)	Village of Perry Comprehensive Plan Update 1986	**Comprehensive Plan Update**	1986	NO
Wyoming	Pike (T)	Comprehensive Plan	**comp plan after village disolution**	2009	YES
Wyoming	Sheldon (T)	Comprehensive Plan	**Comprehensive Plan**	2001	NO
Wyoming	Warsaw (T)	Comprehensive Plan	**Comprehensive Plan**	2004	NO
Wyoming	Warsaw (V)	Village of Warsaw Comprehensive Plan	**Comprehensive Plan**	1994	NO
Yates	Barrington (T)	Comprehensive Plan	**Comprehensive Plan**	2009	YES

Yates	Benton (T)	Comprehensive Plan	**Comprehensive Plan**	2001	NO
Yates	Dresden (V)	Comprehensive Plan	**Comprehensive Plan**	2004	NO
Yates	Dundee (V)	Comprehensive Plan	**Comprehensive Plan**	1969	NO
Yates	Italy (T)	Comprehensive Plan	**Comprehensive Plan**	2005	NO
Yates	Jerusalem (T)	Comprehensive Plan	**Comprehensive Plan**	2006	NO
Yates	Milo (T)	Town of Milo Comprehensive Plan	**Comprehensive Plan**	2009	YES
Yates	Penn Yan (V)	Village of Penn Yan, New York: Comprehensive Master Plan	**Comprehensive Plan**	2000	NO
Yates	Potter (T)	Town of Potter Comprehensive Plan	**Comprehensive Plan**	1979	NO
Yates	Starkey (T)	Comprehensive Plan	**Comprehensive Plan**	1994	NO
Yates	Torrey (T)	Comprehensive Plan	**Comprehensive Plan**	2008	YES
				TOTAL	**31**

Agriculture & Forestry Baseline

Finger Lakes Sustainability Plan: *Agricultural and Forestry Indicators*

Context and background

The agricultural and forestry sectors within the Finger Lakes region are critically important sources of economic development and ecological services. Their influence on the region is immediately apparent: the appearance of both working and undeveloped lands (including some 1,518,285 acres of agricultural land and 1,095,243 acres of forest) defines the visual character of the region; the large expanses they occupy contribute to the rural social dynamic; their products are ingrained in the daily lives of residents. Beyond their contribution to the regional character, these two sectors are also essential components of long-term environmental, economic, and social sustainability. From carbon capture, to water quality, biodiversity, and employment, agriculture and forestry bring substantial advantages to the region as it seeks to maximize opportunity and equity while safeguarding its natural resources.

Among those advantages are the breadth and depth of both sectors. Agricultural producers range from large to small operations, growing a wide variety of products for both local consumption and export. While fewer forestry operations exist in the region, the extent of the forest resource is substantial. From grapes and milk to lumber and firewood, their traditional products are staples of the regional economy, and their niche products show promise for continued growth. These producers have a history of adapting to the conditions they face, whether that means matching crop types to soil types or responding to short- and long-term changes in the marketplace. The qualities of diversity and adaptability can only serve to strengthen future efforts toward greater resilience in the face of climate change.

One example of that adaptation is evident in the shift toward a food system that values locally-produced, high-quality foods, fibers, and feed. Renewed attention toward locally-sourced products is creating new opportunities for development while strengthening economic and social connections in both rural and urban communities. Agricultural and forestry operations are increasingly viewed as producing value beyond their respective end products; they are stewards of the land, air, and water, and lynchpins of the regional identity.

Although these sectors may be well-positioned to help the region achieve a sustainable future, they are not without their risks and vulnerabilities. Industry consolidation has created an atmosphere of instability, especially for smaller operations struggling to make ends meet. Uncertainty about the future of the sector continues to prevent new operators from entering the market, and contributes to the conversion of land as aging operators make their exit from it. Although the potential for large new markets, e.g. carbon or pollutant trading, could represent immense opportunity for both the agricultural and forestry sectors, their development has been sluggish at best.

As the public dialogue surrounding climate change and community resilience continues, several indicators within these two sectors will help to indicate regional progress toward sustainable outcomes. This baseline assessment examines the most recent data available to describe the state of agriculture and forestry through the lens of eight such indicators. These indicators were selected from a range of potential measures according to a series of criteria influenced by agency goals and regional priorities. Each indicator shares three basic characteristics: an ability to inform policy and investment; a reliance on existing and publicly available data; and a high degree of replicability, so that trends can be assessed on an ongoing basis.

Agricultural indicators

Selection

The selection of agricultural indicators began with consultation between the project team, regional stakeholders, and national experts in the field of sustainable agricultural development. Conversations and meetings with stakeholder groups reflected their vision of a sustainable agricultural sector, based on the following principles:

- Regionally-produced food takes priority;
- Self-reliant land-based enterprises should be supported;
- Restorative and regenerative practices should be encouraged;
- Biodiversity provided by small and medium sized farms should be valued and fostered;
- Responsible farm stewardship should be encouraged;
- Local agricultural needs and resources should be synchronized; and
- Community identity should be reinforced.

Several organizations and individual professionals in the agricultural sector were also consulted throughout this process, and their input provided valuable insight into the current and future states of agriculture and sustainability. These include, but are not limited to, the following:

- The Sustainable Agriculture Research and Education (SARE) program, a decentralized competitive grant-making and educational program supported by the U.S. Department of Agriculture's National Institute of Food and Agriculture. SARE invests in research and education with the aim of achieving agricultural innovations that improve profitability, stewardship, and quality of life. Representatives of SARE's Northeast region were consulted for this research.
- ATTRA, the National Sustainable Agriculture Information Service. ATTRA is managed by the National Center for Appropriate Technology (NCAT), and funded primarily through a cooperative agreement with the United States Department of Agriculture's Rural Business-Cooperative Service. ATTRA provides technical assistance to agricultural producers, extension services, and others involved in sustainable agriculture.
- Dr. David Wolfe of Cornell University's Department of Horticulture, and Dr. Jeffrey Midler, a Visiting Fellow at the Department of Natural Resources. Dr. Wolfe, the Chair of the Climate Change Focus Group at the Atkinson Center for a Sustainable Future and a professor of plant and soil ecology, led the agriculture and ecosystems sections of the ClimAID report recently released by the New York State Energy Research and Development Authority (NYSERDA).
- Kate Mendenhall and Elizabeth Henderson of the Northeast Organic Farming Association of New York (NOFA-NY). NOFA-NY represents the interests of consumers, gardeners, and farmers working toward a sustainable food system throughout the region, focusing on both the ecological and economic viability of the system.
- Gary Burley, co-owner with his wife Betty, of East Hill Farm in Warsaw, Wyoming County, New York. The Burley family milk and graze over 700 dairy cows on a 1,600 acre farm, of which over 1,200 acres is managed as pasture.
- Marilyn Wyman, Agroforestry Program Coordinator and Extension Educator, Cornell Cooperative Extension, Greene County.

The assistance of these regional experts and the input provided by the stakeholder groups was instrumental in sifting through various potential indicators, both those provided by NYSERDA guidance documents and those that were created throughout the planning process. The selected indicators described below examine the protection or conversion of agricultural land, the development of the local food system, the use of agricultural inputs, and the diversity of agricultural production.

Indicator analysis and baseline conditions

Ag1: Acres of High-Quality Agricultural Land in Non-Agricultural Use

This indicator describes the state of agriculture throughout each of the nine counties in terms of the amount of high-quality agricultural land that is dedicated to non-agricultural purposes. The conversion of this land for non-agricultural uses (e.g. residential, commercial, or industrial development) poses several threats to the sustainability of the agricultural sector and to the region as a whole. These threats include, but are not limited to, the following:

- Decreased supply of agricultural land increases the price of the remaining land, which often prevents new farmers from entering the marketplace. Land conversion can also prevent existing operations from growing, as agricultural land becomes either economically inaccessible (i.e. too expensive) or geographically inaccessible (i.e. too far away from existing farms).
- Decreased supply of agricultural land also harms the long-term viability of the businesses that support agricultural operations (e.g. equipment supply and repair, seed sales, distribution networks, large animal veterinary services), as well as those that are supported by it (e.g. yogurt production, agritourism). In many cases, this cycle reinforces itself; fewer farms require fewer services, and as service availability decreases so too does the viability of the remaining agricultural operations.
- Encroachment of non-agricultural uses into primarily agricultural areas can result in land use conflicts, particularly in areas located outside of Agricultural Districts (which provide greater legal protection of agricultural practices).
- Most conversion of agricultural land will increase impervious land cover; the greater the intensity of conversion (e.g. farmland to strip mall), the greater the increase. Increased impervious cover results in several negative impacts to both the quality and quantity of stormwater runoff.

The analysis of land conversion consists of a spatial comparison between moderate- to high-quality agricultural soils and intensely developed land. The USDA Natural Resource Conservation Service (NRCS) describes the productive capacity of soil types through its Land Capability Classification system, which features eight classes as described below[1]:

- *Class I* soils have slight limitations that restrict their use.
- *Class II* soils have moderate limitations that reduce the choice of plants or require moderate conservation practices.
- *Class III* soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.
- *Class IV* soils have very severe limitations that restrict the choice of plants or require very careful management, or both.
- *Class V* soils have little or no hazard of erosion but have other limitations, impractical to remove, that limit their use mainly to pasture, range, forestland, or wildlife food and cover.
- *Class VI* soils have severe limitations that make them generally unsuited to cultivation and that limit their use mainly to pasture, range, forestland, or wildlife food and cover.

[1] U.S. Department of Agriculture, Natural Resources Conservation Service (USDA NRCS). 2012. National Soil Survey Handbook, Title 430-VI. Available at: http://soils.usda.gov/technical/handbook/. Accessed November, 2012.

- *Class VII* soils have very severe limitations that make them unsuited to cultivation and that restrict their use mainly to grazing, forestland, or wildlife.
- *Class VIII* soils and miscellaneous areas have limitations that preclude their use for commercial plant production and limit their use to recreation, wildlife, or water supply or for esthetic purposes.

For the purposes of this analysis, Class I and II soils are assumed to represent high-quality agricultural land, as these two classes feature the least restrictive growing environment[2]. Non-agricultural uses are represented by areas of low, medium, and high development intensity as determined by the USDA CropScape Cropland Data Layer (CDL)[3]. The CDL is a remotely sensed aerial image of all vegetated and developed land, and is available for each year between 1997 and 2011.

Calculation:

(Class I soils [ac] + Class II soils [ac]) – (Low-intensity developed land [ac] + Medium-intensity developed land [ac] + High-intensity developed land [ac])

Required Data	Definition	Dataset Reference
Land Capability Classes (geospatial)	Location of Land Capability Classes I and II, as defined by USDA soil survey	USDA Web Soil Survey: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm
Developed land (geospatial)	Location of low-intensity, medium-intensity, and high-intensity development, as defined by USDA Cropland Data Layer	USDA CropScape: http://nassgeodata.gmu.edu/CropScape/

Additional comments:

As a measure of agricultural soil suitability, Land Capability Classification was chosen instead of the more common Farmland Classification (e.g. prime farmland, prime if drained, soils of statewide importance, etc.). This is primarily due to the exclusion of developed land within the Farmland Classification system. As defined in the USDA NRCS soil survey handbook, "prime farmland is designated independently of current land use, but it cannot be areas of water or urban or built-up land as defined for the National Resource Inventories."[4] In contrast, the Land Capability Classification does consider the agricultural suitability of much of the developed lands in the region (though generally not those located in the densest of urban core areas).

---

[2] It is noted that other state or local agencies may consider Classes I through IV as "high-quality", as is done within the SEQR Environmental Assessment Form. Classes I and II are chosen here so as to highlight soil types with only slight or moderate limitations for crop or practice selection, as opposed to severe limitations.

[3] USDA National Agricultural Statistics Service (USDA NASS). 2012. Cropland Data Layer. Available at: http://nassgeodata.gmu.edu/CropScape/. Accessed November, 2012.

[4] USDA NRCS (2012), Part 622.04.

Although the Land Capability Classification of a given soil type is unlikely to change, the data available through the CDL would reflect development patterns on an annual basis, allowing for a reliable measure of land use conversion over time.

Baseline condition:

As shown in Agricultural Map 1, much of the soil throughout the Study Area falls within Land Capability Class I or Class II. Class I and Class II soils account for 1,350,102 total acres throughout the nine-county region. This total represents 44% of the land mass across the region.

Agricultural Map 2 illustrates the location of developed lands. Developed land, which includes land developed for roadways and similar infrastructure, accounts for 290,751 acres (9%) of the region's land mass.

By overlaying high-quality agricultural soils with developed land uses, the overlap will demonstrate where those soils have been converted for development since their Land Capability Class was designated[5]. Agricultural Map 3 shows these areas in red. Unsurprisingly, this phenomenon has occurred largely in urban fringe areas, throughout the suburbs and exurbs of the region's cities and villages. As of 2011, 155,968 acres of high-quality agricultural soils have been converted into non-agricultural use. This amount represents 5% of the region's total land mass.

This analysis illustrates the phenomenon commonly known as urban or suburban sprawl; more importantly, when viewed in light of the region's stagnant or declining population from 1997-2011, it illustrates an even more threatening condition: *sprawl without growth*[6]. Further underscoring that point, this analysis actually under-represents the total amount of land conversion that has taken place by limiting the examination to that of only high-quality agricultural land, as opposed to all "greenfield" development.

However, the simplified arithmetic of examining the total amount of developed land over time masks the critically important issue of the quality of the land that is being converted. The analysis presented here acknowledges that the soil types with the fewest restrictions for the purposes of agricultural management are the region's most important agricultural resource. As these acres are consumed by development, agricultural operations are effectively squeezed into a land resource of declining quality.

As agricultural operations look to maintain or increase their production for the sake of growth or mere survival, the use of marginal or otherwise restricted agricultural soils may require a greater reliance on external inputs such as chemicals and fertilizer (see indicator AG-3). Such a shift may also threaten the traditionally diverse production that is a hallmark of this region's agricultural sector, as the limitations of available soils diminish the yield potential for various crop types (see indicator AG-4). In addition, declining availability of high-quality agricultural land may also result in an increase in the price of the remaining marginal land, creating a situation in which producers' most important resource becomes simultaneously more expensive and less productive. In sum, the loss of high-quality agricultural soils poses myriad systemic and potentially permanent threats to the viability of the regional agricultural sector as a whole.

---

[5] The Land Capability Classes was published by the USDA in 1961(see USDA NRCS [2012], Exhibit 622-2). Of the nine counties examined here, six were classified in this system between 1968 and 1978. The vintage of Livingston, Ontario, and Yates Counties' current soil surveys is not clear; for this analysis, they are assumed to have been performed within this same ten year period.

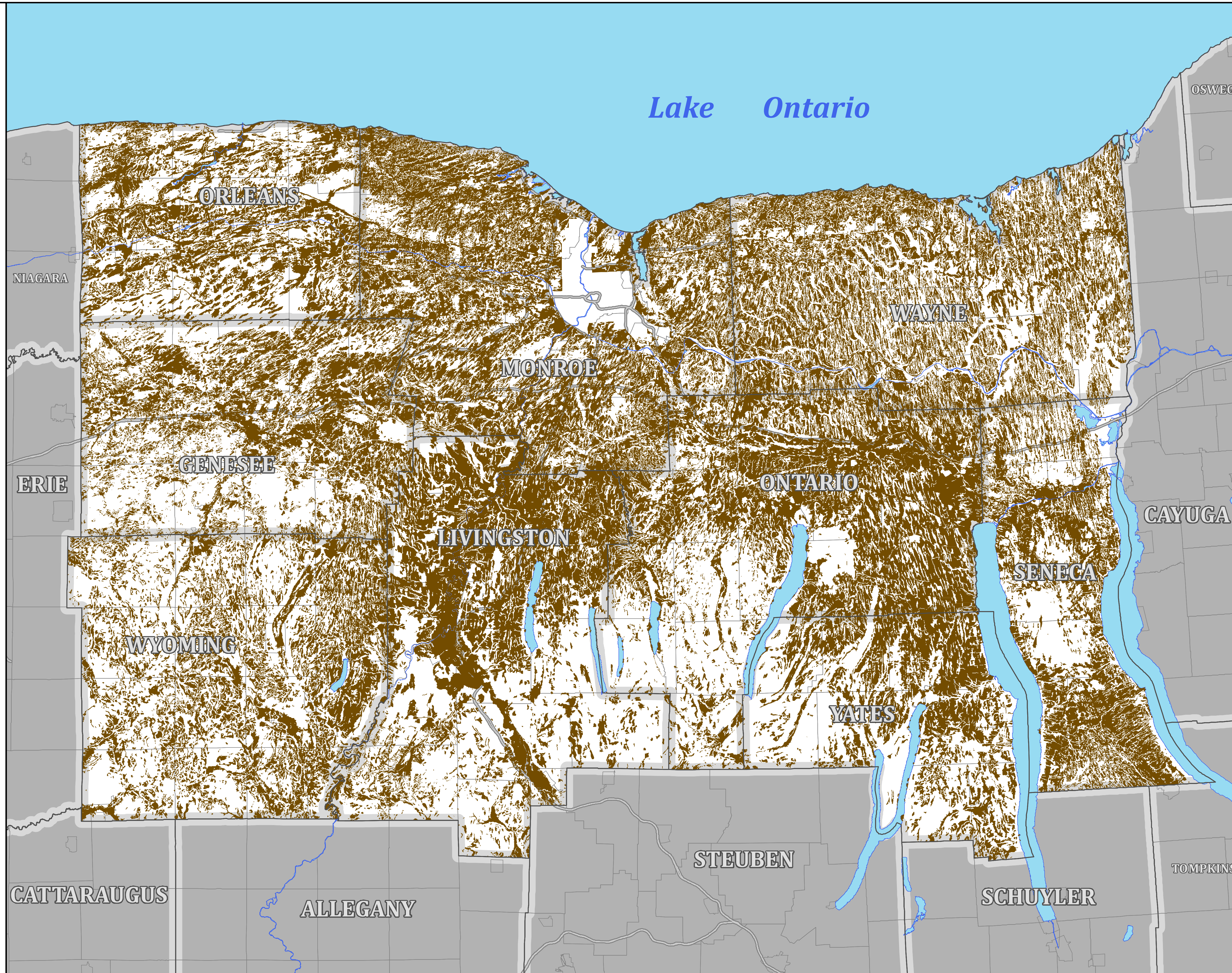
[6] Pendall, Rolf. 2003. Sprawl Without Growth: The Upstate Paradox. Brookings Institution Center on Urban and Metropolitan Policy. October, 2003.

Finger Lakes Regional Sustainability Plan

Agriculture Map 1

Finger Lakes Region High Quality Agricultural Soils

December 2012 Draft



- High Quality Agricultural Soils
- Counties
- Municipalities
- Expressways
- Lakes and Rivers

N S E W

0 2.5 5 10 Miles

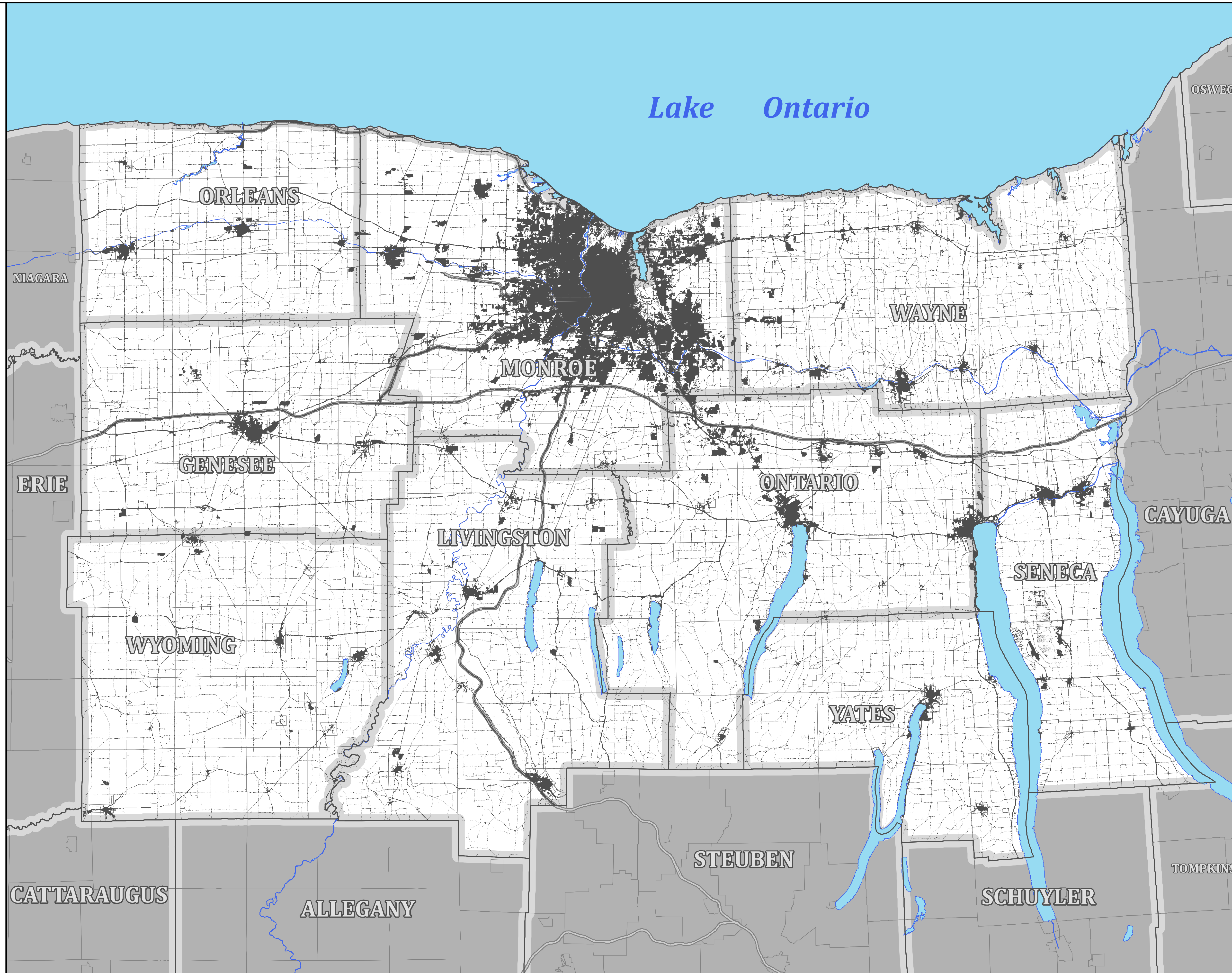
Data Sources: GTC (boundaries, hydrography, roads)
USDA NRCS (Soil Survey Data)

Map Design: C&S Companies and edr Companies

Finger Lakes Regional Sustainability Plan

Agriculture Map 2
Finger Lakes Region Developed Land

December 2012 Draft



Legend

- Developed Land
- Counties
- Municipalities
- Expressways
- Lakes and Rivers

N W E S

Miles: 0, 2.5, 5, 10

Data Sources: GTC (boundaries, hydrography, roads)
USDA NASS (CropScape Cropland Data Layer, 2011)

Map Design: C&S Companies and edr Companies

Finger Lakes Regional Sustainability Plan

Agriculture Map 3

Finger Lakes Region High Quality Agricultural Soils in Non-Agricultural Use

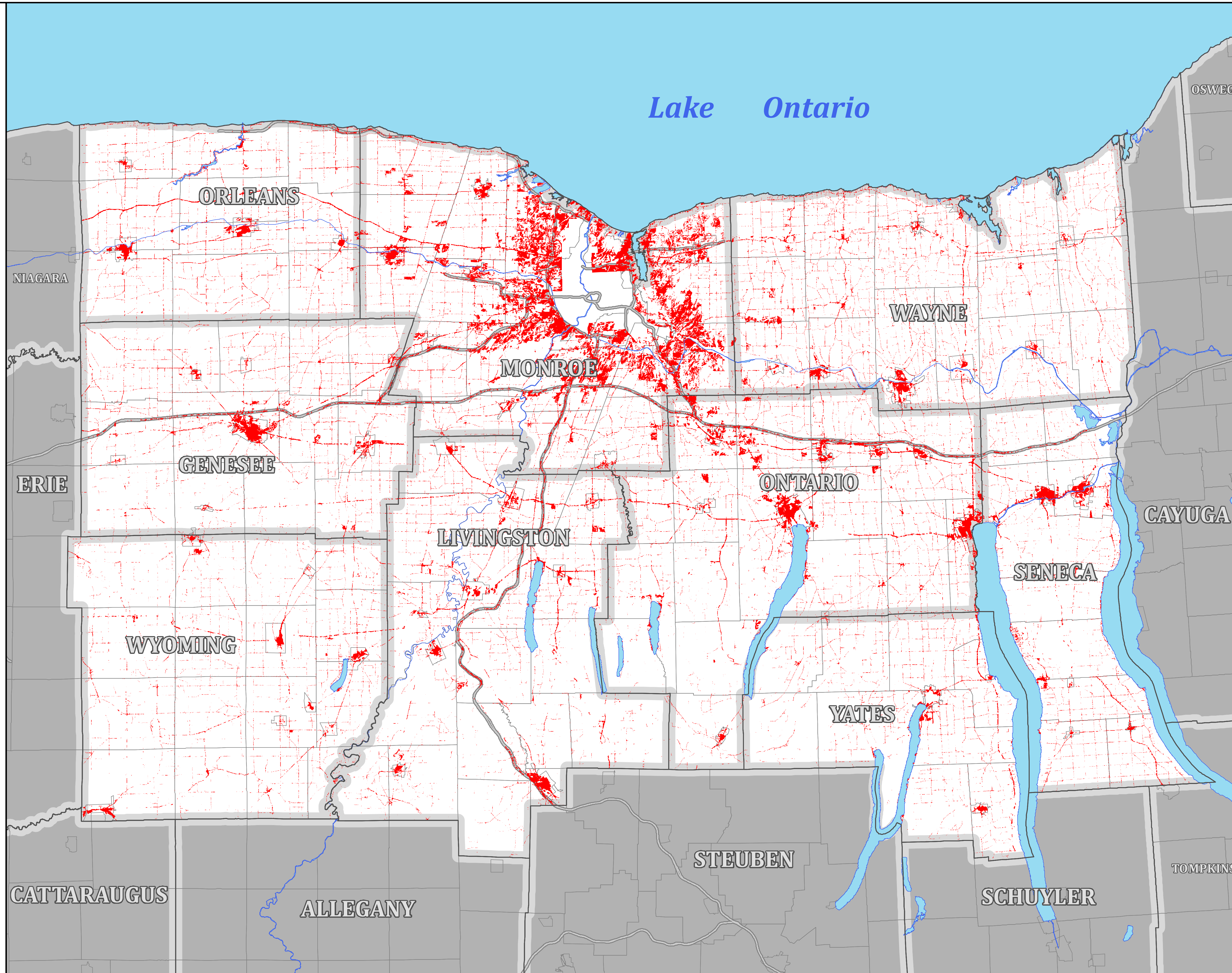
December 2012 Draft

Legend

- High Quality Agricultural Soils in Non-Agricultural Use
- Counties
- Municipalities
- Expressways
- Lakes and Rivers

N E S W

0 2.5 5 10 Miles



Data Sources: GTC (boundaries, hydrography, roads)
USDA NASS (CropScape Cropland Data Layer, 2011)
USDA NRCS (Soil Survey Data)

Map Design: C&S Companies and edr Companies

Ag2: Direct Farm Sales Per Capita

This indicator provides a reliable measure of the access that regional residents have to high-quality, locally-sourced agricultural products, and the degree to which regional producers are connecting directly with their consumers. Direct farm marketing accounts for the distribution of agricultural products through farmers' markets, community-supported agricultural (CSA) operations, pick-your-own operations, roadside stands, and similar venues. For the purpose of sustainability planning, the prevalence and use of such venues provides a variety of benefits to both agricultural producers and the community at large[7,8]:

- Direct farm sales can provide a profitable outlet for agricultural producers, which supports the viability of both individual operations and the sector as a whole.
- Direct marketing can decrease transportation-borne greenhouse gas emissions associated with the shipment of agricultural products, since direct sale outlets are generally located closer to the producer.
- Although each direct marketing venue is different, they are generally dominated by fresh vegetables, fruits, and nuts; combined with their growing representation in urban centers and areas close to urban centers, these venues can increase access to healthy food for traditionally underserved populations.

Throughout the stakeholder engagement process, much discussion was focused on the number of farmers' markets, CSAs, and community food gardens within the region as potential indicators of healthy food access and agricultural economic development. The measurement of direct farm sales per capita is intended to aggregate these constituent measures into a more comprehensive indicator, one that accounts not only for the *presence* of such outlets but also the *consumption* of direct-marketed products. It recognizes that the support of local food producers requires a financial commitment from local residents to incorporate their goods into monthly, weekly, or daily food purchases.

Calculation:

Total value of farm sales direct to consumers (including sales from roadside stands, farmers markets, pick-your-own, door-to-door, etc., but not sales of craft items or processed products) [$] ÷ total population

Required Data	Definition	Dataset Reference
Value of direct sales	Total value of farm sales direct to consumers (including sales from roadside stands, farmers markets, pick-your-own, door-to-door, etc., but not sales of craft items or processed products, such as jellies, sausages, and hams) divided by the number of residents of the county.	USDA Economic Research Service (ERS) Food Environment Atlas: http://www.ers.usda.gov/data-products/food-environment-atlas.aspx
Countywide population estimates	Number of residents per county	USDA Economic Research Service (ERS) Food Environment Atlas: http://www.ers.usda.gov/data-products/food-environment-atlas.aspx

[7] Brown, Cheryl, and Stacy Miller. 2008. The Impacts of Local Markets: A Review of Research on Farmers Markets and Community Supported Agriculture (CSA). American Journal of Agricultural Economics 90(5), pp. 1296-1302.
[8] Low, Sarah, and Stephen Vogel. 2011. Direct and Intermediated Marketing of Local Foods in the United States. U.S. Department of Agriculture, Economic Research Service. Economic Research Report Number 128; November, 2011.

Additional comments:

The most recent publicly available data by which to measure direct farm sales is the USDA's 2007 Census of Agriculture. Considering the growth of local food systems in recent years, this resource is somewhat dated. It does provide a valuable baseline condition, however, and updated data will become available as the results of the 2012 Census of Agriculture are published in the coming years.

In the meantime, it is worthwhile to consider the increase in farmers' markets throughout the region, which have grown from 51 in 2009 to 59 in 2012 (see Figure 1, below)[9].

Figure 1, Number of farmers' markets

County	2007		2012	
	# Farmers' Markets	# Farmers' Markets per 1,000 population	# Farmers' Markets	# Farmers' Markets per 1,000 population
Genesee	3	0.05	3	0.05
Livingston	5	0.08	7	0.11
Monroe	18	0.02	22	0.03
Ontario	7	0.07	9	0.08
Orleans	2	0.05	2	0.05
Seneca	4	0.12	4	0.11
Wayne	7	0.08	4	0.04
Wyoming	3	0.07	3	0.07
Yates	2	0.08	5	0.20
Regional total	*51*	*0.62*	*59*	*0.74*

Source: USDA ERS (2012)

Baseline condition:

The market for direct farm sales throughout the study area appears to be robust relative to that of the state as a whole. As shown in Figure 2, the total value of direct farm sales throughout the region was $11,328,000 in 2007, resulting in direct sales per capita of $9.52. In and of itself, this metric does not appear to reflect much support for direct sales opportunities in the region. However, when the data are disaggregated by county and compared to statewide levels, much more support becomes evident.

[9] USDA Economic Research Service (ERS). 2012. Food Environment Atlas. Available at: http://www.ers.usda.gov/data-products/food-environment-atlas.aspx. Accessed October, 2012.

Figure 2, Direct Farm Sales per capita

County	Population Estimate, 2007	Value of Direct Farm Sales, 2007	Direct Farm Sales per capita, 2007
Genesee	58,159	$535,000	$9.20
Livingston	63,123	$641,000	$10.15
Monroe	730,629	$2,640,000	$3.61
Ontario	103,834	$2,136,000	$20.57
Orleans	42,370	$1,294,000	$30.54
Seneca	34,276	$535,000	$15.61
Wayne	91,529	$1,945,000	$21.25
Wyoming	41,841	$525,000	$12.55
Yates	24,535	$1,077,000	$43.90
Regional total	*1,190,296*	*$11,328,000*	*$9.52*
Statewide total	19,422,777	$76,449,000	$3.94

Source: USDA ERS (2012)

The residents of Monroe County consumed the greatest amount of direct farm sales by value, but the least amount per capita. The $3.61 worth of direct farm sales per capita in Monroe County (the only county in the region purchasing less through direct sale than the statewide average of $3.94) should represent a “floor” relative to future measurements. Considering its outsized population and greater diversity of potential food sales venues as compared to the rest of the region, the per capita measure may never grow to reach the level of the smaller, less diverse counties. However, given the increasing number of farmers’ markets in Monroe County, as well as the growth of the Rochester Public Market and the number of CSAs that serve the city, this number is poised to grow.

On the opposite end of the spectrum, Yates County is also an outlier. While it has the least number of residents, those residents consumed the greatest value of direct sale products per capita by far. In 2007, each resident of Yates County purchased an average of $43.90 worth of agricultural products directly from farmers. This is more than twice the per capita sales found in Wayne, Ontario, Seneca, and Wyoming Counties, more than four times those found in Livingston and Genesee Counties, and more than twelve times the level of Monroe County. The proliferation of CSAs operating in Yates County has likely contributed to the high level of per capita sales; in 2007, Yates County featured 16 CSAs, more than any other county in the region[10].

The regional and countywide data both provide insight into the depth of their respective markets for direct-sale agricultural products. The statewide data, though it may be skewed by the inclusion of larger downstate populations, is nonetheless a valuable marker by which to judge direct sales and local food consumption in the region. Further examination of similarly sized and populated regions throughout the state and elsewhere would provide apt comparisons as well.

[10] USDA ERS (2012).

Ag3: Use of External Inputs

Although the majority of residents may not be aware, the use of external agricultural inputs, including pesticides and fertilizer, is of primary importance to both the financial and ecological sustainability of their region. External inputs have a substantial impact on the viability of conventional agricultural operations, the yield, production cost, and price of agricultural products, and the health of farm workers and consumers. Perhaps most notably, external inputs also influence the quality of the water supply, one of the principal economic drivers (and a defining characteristic) of the nine-county region.

The use of external inputs can be measured from several different perspectives, including input expenditures, acreage treated, and volume applied. Regardless of the approach, the measurement of inputs is inherently complex and nuanced, and no single measurement can capture the entire essence of the issue. For example, the volume of fertilizer (both chemical and manure) applied within a given watershed has perhaps the greatest overall impact on the nutrient loading of that area's surface water; however, the actual extent of nutrient loading is influenced by several circumstantial factors, including but not limited to:

- Type of fertilizer- Fertilizer types differ in the amount of Nitrogen (N), Phosphorous (P), and Potassium (K) they contain. Manure from cows differs from that of sheep; liquid differs from solid; and commercial fertilizers differ from manure fertilizers (and from one another).
- Method of fertilizer application- Several different methods can influence the amount of nutrients that are either consumed by their target plants or are lost to surface runoff. Techniques such as slurry spreading, foliar application, or injection can influence the amount of nutrient that is absorbed by the soil or target plant, and can also influence erodibility and other measures of soil health.
- Season of fertilizer application- Winter spreading, in particular, can increase nutrient loads due to the inability of frozen soil to effectively absorb nutrients. Seasonal weather plays a factor throughout the year, in that the presence and intensity of rainfall or snow melt can increase (or decrease) the amount of nutrients lost to runoff, and can impact operators' decisions on application techniques.

In light of these circumstantial factors, volume of application alone is not a reliable measure of the use of external inputs and their effect on regional sustainability. When paired with such information as surface water nutrient load, it may become a stronger measure of agricultural sustainability. However, even such an analysis as that would only quantify the impact of fertilizers (as opposed to pesticides), and may conflate agricultural input application with industrial, commercial, or residential sources[11].

Like application volume, the number of treated acres provides a second informative, though incomplete, measure to this effect. Most of the same circumstantial factors hidden in application volume also influence application area as a measure of input use and impact. Several others specifically related to characteristics of the landform also come into play, including but not limited to slope, distance to receiving waters, and soil physical characteristics. Nonetheless, it is a reliable measure of the extent to which agricultural producers are applying external inputs to the land resource.

---

[11] In addition, comprehensive county-level data regarding input application volume and nutrient load sources is scarce. One notable exception is the USGS's 2006 publication "County-Level Estimates of Nutrient Inputs to the Land Surface of the Conterminous United States, 1982-2001", by Barbara Ruddy, David Lorenz, and David Mueller. The authors of this study estimate countywide N and P inputs by both farm and non-farm sources over a 20-year period, and distinguish between the nutrients as they result from fertilizer application in general, manure application specifically, and atmospheric deposition.

A third perspective is that of regional expenditures dedicated to chemicals and fertilizer. This indicator attempts to account for both the environmental and economic impacts of external inputs. If viewed as a surrogate measure of input application volumes, it may show increasing, decreasing, or steady use of fertilizer and chemicals. However, the dollar value of input expenditures over time, as a stand-alone metric outside of the context of all other expenditures, could internalize price fluctuation as a result of inflation, therefore limiting its utility as an analog of input application volume.

For the purposes of this analysis, this potential distortion is mitigated by examining input expenditures relative to total operational expenditures. Such a context assumes that inflationary impacts are spread more or less equally among expenditure types, and would not be reflected disproportionately in the price of fertilizer and chemicals. An examination of sector-specific input expenditures relative to other expenditures can help describe regional operators' reliance on pesticides and fertilizers, as well as their vulnerability to non-inflationary price increases, both of which are informative with regard to the long-term resilience of the sector.

Calculation:

(Agricultural chemical expenditures + agricultural fertilizer expenditures) / Total agricultural operation expenditures

Required Data	Definition	Dataset Reference
Value of input expenditures ($)	Total amount spent on pesticide and fertilizer inputs by agricultural operations within the region	USDA 2007 Census of Agriculture: http://quickstats.nass.usda.gov/
Value of total expenditures	Total amount spent on all other expenditure types by agricultural operations within the region	USDA 2007 Census of Agriculture: http://quickstats.nass.usda.gov/

Additional comments:

Though useful for the purposes of this study, the measurement of input expenditures relative to total expenditures is not without its limitations. For example, the aggregated value described in the Baseline Assessment (10.7%) obscures potential differences between input types, including differences in the level of expenditure per type, or the impact of each constituent input on agricultural yields, environmental health, or public health. Disaggregated data (presented below) may mitigate the former, but does not adequately address the latter. In addition, it should be noted that production costs can vary substantially from one year to the next, and that input usage during a given Census of Agriculture year may reflect outlier values. Acknowledging that a single indicator cannot represent the full scope of external input use and all of its impacts on agricultural sustainability, this measurement is best supplemented by an examination of multiple types of data over time.

As with other indicators dependent on the 2007 Census of Agriculture, the data supporting this indicator is the most recent available, although not necessarily reflective of current conditions. The 2012 Census of Agriculture will collect and publish similar data in the near future.

Baseline condition:

Agricultural operations throughout the study area logged $956,396,000 in total expenditures in 2007. This total includes $44,452,000 spent on fungicide, herbicide, insecticide, and other chemicals and $58,329,000 spent on fertilizers, including manure, liming agents, soil conditioners, and other commercial fertilizers. As shown in Figure 3, chemical and fertilizer expenditures combined to account for 10.7% of all agricultural expenditures in that year.

Figure 3, 2007 Expenditures by type

	% of Total 2007 Expenditures[a]											
County	Ag services[d]	Animals	Chemicals	Feed	Fertilizer[b]	Fuel	Interest	Labor	Rent	Seeds & Plants	Supplies & Repairs	Taxes[c]
Genesee	16.7%	3.6%	4.2%	19.6%	5.7%	5.1%	3.8%	19.2%	3.6%	4.6%	10.8%	3.1%
Livingston	17.0%	4.8%	3.2%	22.3%	7.0%	5.9%	5.4%	13.3%	3.2%	5.3%	8.6%	4.0%
Monroe	14.8%	1.0%	5.8%	7.0%	9.0%	7.7%	4.1%	19.9%	4.9%	7.3%	12.3%	6.2%
Ontario	16.4%	2.3%	2.8%	18.3%	6.8%	6.2%	5.7%	18.0%	3.0%	4.8%	11.7%	4.0%
Orleans	15.6%	1.3%	8.2%	4.4%	7.5%	8.5%	3.1%	25.2%	5.3%	6.3%	10.5%	4.1%
Seneca	13.5%	9.4%	4.4%	23.6%	6.4%	5.4%	5.2%	11.4%	2.9%	5.3%	8.5%	4.0%
Wayne	14.9%	1.3%	9.4%	7.0%	5.7%	6.2%	4.2%	30.1%	2.6%	5.4%	9.0%	4.4%
Wyoming	19.9%	4.9%	2.8%	27.0%	3.9%	4.7%	4.4%	14.4%	3.1%	2.5%	9.9%	2.4%
Yates	13.3%	5.1%	3.4%	19.3%	6.5%	6.6%	7.9%	14.1%	2.2%	4.9%	10.9%	5.7%
Regional Total	*16.5%*	*3.7%*	*4.6%*	*18.0%*	*6.1%*	*6.0%*	*4.7%*	*18.3%*	*3.3%*	*4.8%*	*10.1%*	*3.8%*

[a] Not including depreciation
[b] Including but not limited to lime, soil conditioners, and manure
[c] Includes property, real estate, and other taxes, excluding those paid by landlords
[d] Includes customwork, machinery, utilities, and other production expenses
[d] Includes both hired and contract labor

Source: USDA 2007 Census of Agriculture[12]

This value is slightly higher than that which was found in the 2002 Census of Agriculture, though lower than that of 1997. Figure 4 shows production costs as measured in 2002, and Figure 5 shows the same for 1997.

---

[12] USDA NASS. 2012. Quick Stats 2.0. Available at: http://quickstats.nass.usda.gov/. Accessed October, 2012.

Figure 4, 2002 Expenditures by type

County	% of Total 2002 Expenditures[a]											
	Ag services[d]	Animals	Chemicals	Feed	Fertilizer[b]	Fuel	Interest	Labor	Rent	Seeds & Plants	Supplies & Repairs	Taxes[c]
Genesee	19.9%	12.7%	2.9%	15.7%	4.4%	3.8%	4.3%	17.3%	2.6%	3.5%	9.2%	3.5%
Livingston	20.3%	7.7%	2.5%	15.0%	5.6%	4.4%	6.2%	15.2%	3.0%	3.6%	10.9%	5.7%
Monroe	16.9%	0.5%	7.2%	5.2%	7.2%	5.4%	3.0%	21.7%	4.4%	8.2%	12.3%	8.2%
Ontario	19.5%	1.6%	4.0%	16.4%	5.9%	4.3%	5.4%	17.9%	3.3%	5.4%	11.2%	5.1%
Orleans	18.5%	4.6%	9.4%	4.3%	6.9%	3.8%	4.2%	23.5%	2.7%	7.4%	10.0%	4.8%
Seneca	14.0%	8.9%	5.0%	14.1%	6.9%	4.0%	6.6%	14.9%	4.5%	5.2%	9.7%	6.3%
Wayne	17.3%	1.8%	8.0%	9.7%	3.9%	5.1%	3.3%	25.9%	2.4%	5.8%	11.6%	5.1%
Wyoming	20.4%	7.7%	2.6%	23.5%	2.9%	3.0%	5.1%	16.8%	2.2%	2.4%	10.6%	2.9%
Yates	16.3%	5.8%	4.3%	16.6%	5.5%	4.7%	6.9%	10.2%	3.1%	4.7%	13.4%	8.5%
Regional Total	*18.8%*	*6.3%*	*4.6%*	*15.1%*	*4.9%*	*4.1%*	*4.9%*	*18.4%*	*2.9%*	*4.6%*	*10.8%*	*4.8%*

[a, b, c, d] See 2007 Expenditure table, above

Figure 5, 1997 Expenditures by type

County	% of Total 1997 Expenditures[a]											
	Ag services[d]	Animals	Chemicals	Feed	Fertilizer[b]	Fuel	Interest	Labor	Rent	Seeds & Plants	Supplies & Repairs	Taxes[c]
Genesee	13.2%	7.0%	5.1%	20.2%	6.7%	4.3%	5.8%	17.6%	3.8%	4.6%	8.0%	3.7%
Livingston	12.6%	5.1%	4.9%	19.0%	7.8%	5.7%	7.4%	14.3%	4.1%	5.3%	8.3%	5.6%
Monroe	13.8%	2.0%	7.7%	5.2%	8.6%	6.1%	4.7%	24.4%	3.6%	7.6%	9.2%	7.2%
Ontario	14.1%	4.9%	5.0%	14.9%	7.5%	5.1%	8.1%	16.0%	3.8%	6.3%	8.6%	5.8%
Orleans	13.0%	1.0%	11.8%	4.3%	8.0%	5.3%	5.5%	25.5%	4.7%	6.3%	8.5%	6.2%
Seneca	12.2%	5.3%	6.0%	19.6%	8.4%	5.5%	7.9%	13.1%	3.7%	4.9%	8.4%	4.8%
Wayne	13.6%	3.8%	10.2%	9.2%	5.4%	4.7%	6.0%	28.1%	2.6%	4.3%	7.3%	4.8%
Wyoming	13.3%	6.2%	2.4%	34.5%	2.8%	3.6%	7.9%	14.1%	2.2%	2.4%	7.1%	3.5%
Yates	13.8%	6.3%	5.5%	13.8%	6.8%	5.2%	8.8%	14.6%	2.5%	4.7%	10.7%	7.2%
Regional Total	*13.3%*	*4.8%*	*6.2%*	*17.4%*	*6.3%*	*4.8%*	*6.9%*	*18.8%*	*3.3%*	*4.8%*	*8.1%*	*5.0%*

[a, b, c] See 2007 Expenditure table, above
[d] 1997 Agricultural Census does not disaggregate Agricultural Services expenditures

These five-year snapshots should be viewed with regard to general long-term trends, both locally and throughout the surrounding area. For example, inputs accounted for 6.8% of total statewide agricultural expenditures in 1969, and slightly more than 8% in 1974[13]. One notable shift that could influence this measurement in the long-term is the growing number of mixed crop and animal operations. Though it was historically much more common, the practice of mixed operations began to decline throughout the country

[13] USDA. 1977. 1974 Census of Agriculture. Available at: http://usda.mannlib.cornell.edu/usda/AgCensusImages/1974/01/32/1974-01-32.pdf. Accessed December, 2012. [Note: Definition and measurement of “chemicals” changes between Census reports.]

as operations became more specialized[14]. The introduction of innovative cropping systems could also reduce input requirements, as certain types and periods of rotation have been shown to require fewer synthetic fertilizer and herbicide[15]. If recent trends throughout the sector take hold and the adoption of such innovative practices increases, dependence on external inputs could decrease, which could be reflected in a lower input expenditures as a proportion of total production expenditures.

As discussed previously, the measurement of input expenditures should also be viewed in light of the number of acres treated with chemicals and fertilizer. This secondary measure provides further context to describe the use of external inputs in spatial terms. Figure 6 shows acreage of agricultural land per county from 1997-2007, with a sum total of 1,518,285 acres across the region during the most recent Census of Agriculture. Figures 7-9 show the percent of each county's agricultural land that was treated with chemicals and fertilizers during those years[16].

Figure 6, Acres of land in agricultural production, 1997-2007

	Acres used for agricultural production		
County	1997	2002	2007
Genesee	180,879	177,370	183,539
Livingston	209,782	209,496	222,415
Monroe	113,075	106,561	133,041
Ontario	203,242	194,742	198,937
Orleans	153,280	132,947	139,764
Seneca	126,052	127,242	127,972
Wayne	186,635	165,213	168,471
Wyoming	205,036	215,317	218,028
Yates	122,728	115,113	126,118
Regional Total	*1,500,709*	*1,444,001*	*1,518,285*

Source: USDA 2007 Census of Agriculture[17]

[14] Russelle, M. P. et al. 2007. Reconsidering Integrated Crop-Livestock Systems in North America. Agronomy Journal (99): 325-334.
[15] Davis, A.S. et. al. 2012. Increasing Cropping System Diversity Balances Productivity, Profitability and Environmental Health. PLoS ONE 7(10): e47149.
[16] Note: Individual chemical and fertilizer inputs are not mutually exclusive, and therefore cannot be aggregated, and therefore cannot be aggregated as shown. A given acre may be treated with any combination of chemicals or fertilizer, or remain untreated. Aggregated data describing the total acreage treated with any external input is not available at the county level.
[17] USDA NASS. 2012. Quick Stats 2.0. Available at: http://quickstats.nass.usda.gov/. Accessed October, 2012.

Figure 7, Percent of agricultural lands treated, 2007

	% of Agricultural Lands Treated, 2007						
	Pesticides and other non-fertilizer chemicals					Fertilizers	
County	*Fungicide*	*Herbicide*	*Non-Nematicide Insecticide*	*Nematicide*	*Other Chemicals*	*Fertilizer, inc. Manure*	*Manure*
Genesee	7%	45%	35%	1%	0.05%	60%	22%
Livingston	1%	37%	17%	0%	1%	52%	14%
Monroe	6%	54%	18%	0.5%	2%	61%	3%
Ontario	3%	41%	16%	1%	1%	51%	15%
Orleans	11%	37%	28%	2%	3%	55%	5%
Seneca	2%	40%	15%	1%	1%	54%	11%
Wayne	12%	40%	27%	1%	11%	47%	5%
Wyoming	3%	30%	19%	1%	1%	49%	32%
Yates	5%	24%	15%	1%	1%	39%	16%
Regional Total	*5%*	*39%*	*21%*	*1%*	*2%*	*52%*	*15%*

Source: USDA 2007 Census of Agriculture[18]

Figure 8, Percent of agricultural lands treated, 2002

	% of Agricultural Lands Treated, 2002						
	Pesticides and other non-fertilizer chemicals					Fertilizers	
County	*Fungicide*	*Herbicide*	*Non-Nematicide Insecticide*	*Nematicide*	*Other Chemicals*	*Fertilizer, inc. Manure*	*Manure*
Genesee	4%	41%	26%	1%	0%	52%	17%
Livingston	1%	30%	17%	0%	1%	42%	13%
Monroe	3%	41%	18%	0%	1%	59%	3%
Ontario	3%	38%	16%	1%	1%	56%	14%
Orleans	10%	51%	23%	1%	4%	60%	4%
Seneca	2%	37%	10%	0%	1%	55%	10%
Wayne	9%	33%	19%	0%	7%	46%	7%
Wyoming	2%	29%	19%	2%	1%	46%	30%
Yates	5%	24%	16%	0%	1%	39%	16%
Regional Total	*4%*	*36%*	*18%*	*1%*	*2%*	*50%*	*14%*

18 USDA NASS. 2012. Quick Stats 2.0. Available at: http://quickstats.nass.usda.gov/. Accessed October, 2012.

Figure 9, Percent of agricultural lands treated, 1997

	% of Agricultural Lands Treated, 1997*				
	Pesticides and other non-fertilizer chemicals				
County	*Fungicide*	*Herbicide*	*Non-Nematicide Insecticide*	*Nematicide*	*Other Chemicals*
Genesee	12%	46%	30%	3%	0%
Livingston	1%	39%	19%	2%	1%
Monroe	12%	57%	31%	1%	2%
Ontario	4%	43%	18%	0%	1%
Orleans	12%	47%	18%	1%	5%
Seneca	2%	44%	7%	2%	0%
Wayne	16%	41%	25%	0%	11%
Wyoming	2%	24%	16%	1%	1%
Yates	6%	26%	14%	1%	1%
Regional Total	7%	40%	20%	1%	2%

* Regional fertilizer totals for the 1997 Census of Agriculture do not distinguish manure vs. commercial fertilizers, and the total values available from the NASS may not accurately reflect the percent of agricultural land treated with fertilizer.

Ag4: Diversity of production

In terms of agriculture, the Finger Lakes region may be most notable for several signature products, particularly grapes, apples, and dairy products; however, the diversity of the regional agricultural sector goes far beyond these three. Finger Lakes crop operations grow a wide assortment of field crops, vegetables, fruit, and nuts, and animal operations include a variety of dairy and beef cattle, poultry, and specialty animals. The diversity of agricultural production throughout this nine-county region is a reflection of its unique place in the history of agricultural development throughout the nation. Various agricultural products and systems have been brought into the region and further developed to suit the particular needs or characteristics of the regional ecosystem or marketplace, only to have been exported across the country and beyond.

There are a number of potential approaches to the measurement of the diversity of agricultural production. Each must confront the difficulties that arise from the comparison of inherently dissimilar products (e.g. dairy cows vs. broccoli). Therefore, much like the discussion of external inputs, any examination of agricultural diversity must take various indicators into account. Area of production, production volume, and number of operators per product are all valuable measurements for this indicator. For the purposes of this discussion, most of the focus will be given to the latter.

In an effort to distill the diversity of the regional agricultural sector into a single value, this analysis incorporates the Shannon diversity index[19,20]. The Shannon index is commonly applied to analyses of biodiversity due to its ability to account for both the presence and relative abundance of a given subject. In most cases of biodiversity research, acreage is used as the unit of analysis; in such cases, highly diverse ecosystems are generally defined as those with the most even distribution of the greatest abundance of species types.

The Shannon index has been used to describe agricultural diversity throughout academic research, although its application has been chiefly focused on crop diversity alone, and most often employs acreage as the unit of analysis[21]. As it is used here, the index measures the diversity of *operation types*, which include both crop and animal operations. The use of operation types as the unit of analysis, as opposed to acreage or production volumes, is intended to mitigate a number of conceptual and operational hurdles, as well as data limitations, including the following:

- Although crop operations may be most suitably described by their respective acres of production or harvest volume, and animal operations by the size of their inventories, the number of operations featuring a given product type is the lowest common denominator by which *all* agricultural operations can be compared.
- The use of operation types mitigates inter-regional differences with regard to production area and production volume, as well as the potential for outliers in production volume from one year to the next. For example, one area of the region may have soil types that produce greater yields of tomatoes per acre, or a seasonal blight could wipe out half of the region's crop in a given year. By measuring operation types, as opposed to production area or production volume, all of the tomato producers are still counted equally in the measure of production diversity.

---

[19] Spellerberg, I.F., and P.J. Fedor. 2003. A Tribute to Claude Shannon (1916-2001) and a Plea for More Rigorous Use of Species Richness, Species Diversity and the 'Shannon-Wiener' Index. Global Ecology & Biogeography (2003) 12; 177-179.

[20] Hendrickson, J.R., et. al. 2008. Environment and Integrated Agricultural Systems. Renewable Agriculture and Food Systems: 23(4); 304-313.

[21] Reidsma, P., and F. Ewert. 2008. Regional Farm Diversity Can Reduce Vulnerability of Food Production to Climate Change. Ecology & Society: 13(1).

- For the sake of confidentiality, the USDA may not publish the production area and/or production volume of a given specialty product if the number of product operations does not meet certain thresholds. For example, if there are only two emu operations within a county, Census of Agriculture statistics will acknowledge the presence of two operations, but will not divulge the number of acres operated by those two farms or the number of emus raised.

As with all other indicators and their respective caveats, it is acknowledged that the full diversity of agricultural production cannot be described solely in terms of the number of producers growing or raising each product type. There are a number of limitations to this approach that may be mitigated or controlled via other indicators or methods of operationalizing variables. These include, but are not limited to, the following:

- Specialization at the operational level can be masked as individual operations are aggregated. For example, a four-crop operation that is dominated by a single crop yet also grows three specialty crops in very small amounts will be reported as four operation types. While this may represent a certain bias, it does account for the potential of integrated agricultural systems (as opposed to strict monoculture), and minimizes a similar bias that would otherwise be committed by over-representing acreage used for rotated crops.
- The number of operations featuring a given crop or animal does not necessarily correspond to that product's production area, volume, or inventory. For example, the number of equine (horse, donkey, etc.) operations in the region is very high as compared to other animal types; however, the number of equine animals is very low.

This measurement of agricultural diversity examines all vegetable, fruit, tree nut, and field crop operations, in addition to all livestock, poultry, and specialty animal operations. With few exceptions, all product types are reported individually; that is, to minimize bias, few types are combined as aggregates of more than one individual type[22]. In total, roughly 100 different operation types are present within the region.

Calculation:

$$H = -\sum_{i=1}^{n} [P_i * LN(P_i)]$$

Where:

- H = Shannon's index of diversity
- $-\sum_{i=1}^{n}$ = the negative sum of all individual calculations
- P_i = the proportion of the *i*th operation type relative to the total number of operations
- LN = natural log

[22] For this reason, this analysis does not examine horticultural production, which is generally a very small portion of agricultural production on the whole. As a group, horticultural products are frequently reported as grouped totals, e.g. "bedding products", or "short-term woody crops".

Required Data	Definition	Dataset Reference
Total number of agricultural operations	Total number of crop and animal operations with sales	USDA 2007 Census of Agriculture: http://quickstats.nass.usda.gov/
Operation types	For each crop type grown and each animal type raised throughout the region, the number of operations featuring that crop or animal	USDA 2007 Census of Agriculture: http://quickstats.nass.usda.gov/

Additional comments:

A given Shannon index value is not in comparison to any other value (e.g. 1, 10, etc.). A value of zero would represent absolute specialization, wherein every agricultural operation would grow or raise a single product (e.g. wheat). As the index value grows, the diversity of operation types increases. There is no "ceiling" to the index, because the number of operations and the number of products is (theoretically) boundless. Other indices can be calculated to provide a more intuitively scaled comparison, and may be informative in their own way[23]. For the sake of the comparison of two or more Shannon values, other similar or dissimilar regions may be analyzed.

In addition, the diversity of operation sizes is not discussed within the context of this indicator. This issue is of particular importance in examining the ability of smaller producers to compete in the marketplace, the viability of family farms, the adoption of agricultural technologies, and several other issues that are of great importance to the sustainability of the sector.

Baseline condition:

Shannon's index value for the diversity of operations by product type measured 6.97 in 2007, as compared to 6.72 in 2002 (see Figure 10, below). Part of this modest increase is the product of an increasing number of operations. The number of operations selling crops increased from 3,657 in 2002 to 3,928 in 2007. Likewise, the number of operations selling animal products increased from 2,651 to 2,749[24]. The number of operations per product type is identified in Figure 11, below.

[23] The Herfindahl index, though not as commonly used in biodiversity-related studies, may be especially useful for the study of agricultural market concentrations. See, for example, the California Energy Commission's July 2012 report, "Vulnerability and Adaptation to Climate Change in California Agriculture".

[24] As stated previously, some degree of overlap naturally occurs between these two categories. Operations featuring both crops and animals are reported in both subtotals.

Figure 10, Shannon's diversity index by product type

	Shannon's diversity index	
	2002	*2007*
All agricultural operations	6.72	6.97
Crop operations	6.16	6.17
Animal operations	2.98	3.51

Figure 11, Number of operations by product type and county, 2007

	Genesee	Livingston	Monroe	Ontario	Orleans	Seneca	Wayne	Wyoming	Yates	Total Operations per Product Type
Alfalfa									3	3
Alpacas	7	5	13	18	10	4	7	9	1	74
Apples	9	12	42	21	81	21	222	17	22	447
Apricots		4	1	2	5	1	7		3	23
Asparagus	4	5		7	1	6	9	2	4	38
Barley	6	9	2	3	3	13	6	9	36	87
Beans	28	17	22	20	21	17	36	13	50	224
Beef Cows	72	164	39	116	78	110	102	150	95	926
Beets	6	6	1	7	4	2	4	3	4	37
Bison				1	1		2			4
Blackberries				1	2	2	3	4	4	16
Blueberries	4	7	7	1	2	4	17	5	14	61
Broccoli	1		13	3	6		5	2	10	40
Brussels Sprouts		2		2	4		1		4	13
Buckwheat	1	1	1	4	2	9		4	3	25
Cabbage	11	4	22	11	16	2	12		17	95
Carrots	4		1	4	5	2	3	1	3	23
Cauliflower			10	2	7		2	2	12	35
Celery							1			1
Cherries		7	14	15	21	15	121	2	11	206
Chestnuts		2				1	3			6
Chickens	51	88	50	101	64	85	86	100	197	822
Crimson Clover									3	3
Cucumbers	5	2	12	8	20	6	14	4	11	82
Currants			1	1			1		1	4
Daikon					1					1
Dairy Cows	68	76	14	122	37	110	60	181	262	930

	Genesee	Livingston	Monroe	Ontario	Orleans	Seneca	Wayne	Wyoming	Yates	Total Operations per Product Type
Deer	7		7				5	4	2	25
Dry Beans	13	31	16	18	1	3	5	4	12	103
Dry Peas		1	1				1	1		4
Ducks	15	20	5	14	3	9	11	10	25	112
Eggplant	1		15	2	5	2	5			30
Elk			2							2
Emmer or Spelt				2	2	3			15	22
Emus	1						3	2		6
Escarole or Endive					1					1
Garlic	2	3	10	11	6	10	8		9	59
Geese	9	14	2	11	3	8	10	12	10	79
Goats	27	51	31	54	42	26	61	65	67	424
Grain Corn	133	169	91	212	81	148	158	148	279	1419
Grain Sorghum	1			1			3	1	1	7
Grapes	2	9	17	46	8	48	19	2	166	317
Greens		2	3	3	2	2				12
Hay	291	390	187	391	242	292	322	432	511	3058
Haylage	96	100	23	126	50	99	69	211	227	1001
Hazelnuts		2					1			3
Herbs	1		3	2	1		3		2	12
Hogs	19	42	13	29	11	40	22	52	46	274
Horseradish							2			2
Horses	135	231	183	256	186	148	182	228	328	1877
Lettuce	2	2		4	1	2	6		3	20
Llamas	5	6	3	2	10	2	5	4		37
Loganberries						2				2
Melons	5	2	8	15	13	3	10	1	16	73
Mules, Donkeys, or Burros	7	9	12	31	17	19	16	25	11	147
Nectarines		4	1	3	5		18		4	35
Oats	51	43	23	50	26	47	49	69	78	436
Okra					1					1
Onions	6	1	2	5	12	2	20	1	14	63
Ostriches		1					4			5
Other (Specialty)	6	21	8	14	15	9	16	20	33	142

	Genesee	Livingston	Monroe	Ontario	Orleans	Seneca	Wayne	Wyoming	Yates	Total Operations per Product Type
Poultry										
Other Berries				1						1
Other Field Crops	1	7	3	3			2	2	3	21
Other Grass Forage		1			1					2
Other Tree Nuts				5	4					9
Other Vegetables	1	2	5	7	2	7	9	2	9	44
Parsley							1		1	2
Peaches		10	15	8	27	6	80	2	15	163
Pears		8	4	5	9	6	53	1	8	94
Peas	30	20	33	5	22	6	4	12	7	139
Pecans							1			1
Peppers	20	10	55	24	32	9	63	5	45	263
Pheasants	6	6	5	7	2		4	4	2	36
Pigeons or Squab	1	3	2		1			2	16	25
Plums & Prunes		4	3	5	3	3	24		6	48
Popcorn									2	2
Potatoes	13	10	10	16	23	10	45	14	35	176
Pumpkins	31	24	53	43	33	11	43	10	26	274
Quail		2	5				2	3	3	15
Rabbits	10	15	8	30	16	8	11	27	39	164
Radishes				1	1		3			5
Raspberries	1	6	19	16	11	4	19	4	15	95
Red Clover			5	1	2	3	5		8	24
Rhubarb	2	1		2			1		1	7
Rye	8	5	2	15	1	3	5	3	22	64
Sheep	32	45	19	28	32	24	23	26	31	260
Silage Corn	99	102	33	121	52	91	82	233	270	1083
Silage Sorghum	1				4	7	7	6	9	34
Soybeans	56	71	57	156	62	120	113	12	85	732
Spinach	1		5		1		1		1	9
Squash	12	10	18	16	19	12	39	6	20	152
Strawberries	4	1	27	12	15	8	26	8	14	115
Sweet Corn	40	35	61	36	31	21	60	18	41	343
Sweet					1					1

	Genesee	Livingston	Monroe	Ontario	Orleans	Seneca	Wayne	Wyoming	Yates	Total Operations per Product Type
Potatoes										
Timothy				1					3	4
Tomatoes	21	11	57	39	31	22	69	8	38	296
Triticale	3			8	1	3	1		12	28
Turkeys	12	13	13	11	5	5	12	11	18	100
Turnips			3		1					4
Walnuts		2	2			1	6		2	13
Wheat	68	95	68	108	35	61	54	42	131	662

Regional and on-farm production diversity has been shown to maintain the economic health of the sector and its flexibility in the face of shifting markets, and to support the viability of individual operations[25,26,27]. By measuring the diversity of production types, and eventually expanding such an analysis to examine diversity by acreage, production volume, or inventories, the Finger Lakes region can quantify a core strength of one of its primary sectors.

By contrast, many other regions throughout the country are likely to exhibit much less diversity. For the sake of comparison, the nine-county region surrounding DesMoines, Iowa, has a substantially less diverse agricultural sector, dominated by a smaller number of operation types[28]. In 2007, the 4,644 crop operations in that region grew a total of 68 crop types. Of those operations, 66% grew hay, 66% grew corn for grain, and 59% grew soybeans. In the same year, the 3,928 crop operations in the Finger Lakes region grew a total of 90 crop types. Of those, 78% grew hay. However, only 36% grew corn for grain, and no other crop was grown by more than 28% of operators. These comparative differences are clearly expressed in Shannon's index: the index value of crop producers by product for the Finger Lakes region in 2007 was 6.17; the same measure for the DesMoine region was 1.82.

[25] Reidsma and Ewert (2008).
[26] Bradshaw, B. et. al. 2004. Farm-Level Adaptation to Climatic Variability and Change: Crop Diversification in the Canadian Prairies. Climate Change (67): 119-141.
[27] Wetterich, F. Biological Diversity of Livestock and Crops: Useful Classification and Appropriate Agri-Environmental Indicators. Paper presented to the OECD Expert Meeting on Agri-Biodiversity Indicators. Zurich, Switzerland. November 5-8, 2001.
[28] Although any number of comparison regions would be appropriate, this region (composed of Clarke, Dallas, Jasper, Lucas, Madison, Marion, Monroe, Polk, and Warren Counties) was chosen due to the similar population size of the central city (DesMoines) to Rochester.

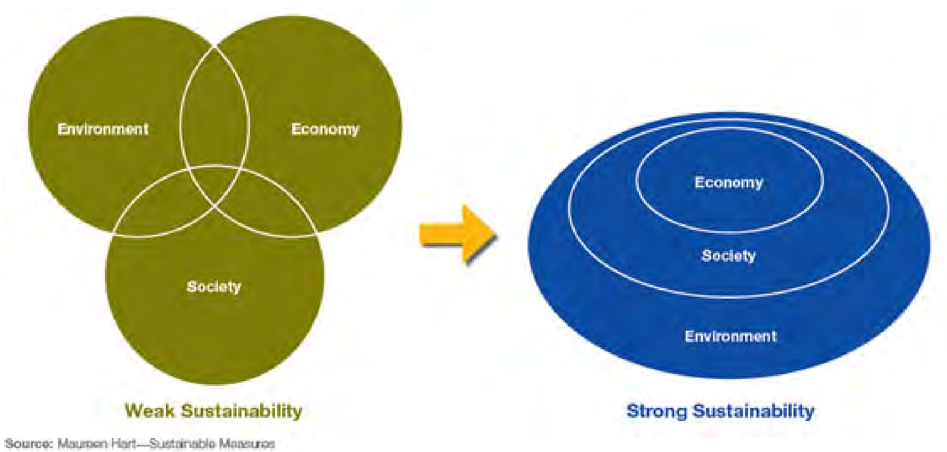
Forestry indicators

Selection

Although not covered by NYSERDA guidance documents, the forestry sector is well ahead of many others in terms of sustainable practices and planning. The development of forestry indicators for this planning initiative was influenced by the work and guidance of the U.S. Forest Service and its international partners in the Montreal Process Working Group, the New York State Department of Environmental Conservation (NYSDEC), and Audobon New York.

The work of the Montreal Process Working Group reflects the understanding that the environmental realm is the foundation of "strong sustainability", because the environment provides natural goods and services that cannot be obtained through any other means. This principle tenet of this vision of sustainability is that the human economy cannot exist without human society, and that human society in turn cannot exist without the environment, which provides the basic necessities of life (namely air, water, food, energy, and raw materials). The Montreal Process Working Group's concept of strong sustainability is depicted in Figure 12, below.

Figure 12, Weak and strong sustainability



The forestry sector currently faces many pressing issues: the loss of ecosystem services; loss of working forests; the maintenance of forest health and vitality; increasing demands for woody biomass to produce bioenergy; climate change adaptation, etc. These issues have strongly interconnected and interdependent economic, social, and environmental linkages. Solutions will require dialog among a broader set of interests, and this activity needs to occur not just within forests, but across landscapes that include towns and farms as well.

The Montreal Process Working Group (which includes forestry representatives from the United States, Argentina, Australia, Canada, Chile, China, Japan, Korea, Mexico, New Zealand, the Russian Federation, and Uruguay) has developed criteria by which the conservation and sustainable management of temperate and boreal forests may be measured. The Montreal Process Criteria and Indicators ("Montreal C&I") are used to monitor and assess national trends in forest conditions and forest management, and provide information essential to the formulation of policies that promote sustainable forest management. Its comprehensive and hierarchical structure constitutes a reference resource for forests in the United States that is unparalleled in terms of its breadth and accessibility.

In addition to the Montreal C&I, the development of indicators for the Finger Lakes forestry sector relied upon the NYSDEC's *Forest Resource Assessment and Strategy, 2010-2015.* With the aid of these resources, the following guiding principles were used to guide the selection of appropriate measures:

- Biological diversity should be maintained;
- The productive capacity of forest ecosystems should be maintained;
- Forest ecosystem health and vitality should be maintained;
- Soil and water resources should be conserved;
- The contribution of forest ecosystems to the global carbon cycle should be maintained;
- The multiple long-term socioeconomic benefits of forest ecosystems should be maintained and enhanced; and
- The legal, institutional, and economic framework of forest conservation and sustainable maintenance should be supported.

The perspective of the following regional and national experts in forest health and sustainability were also instrumental throughout this process:

- Dr. Guy Robertson, U.S. Forest Service (USFS) National Sustainability Program Lead
- Brad Smith, USFS Associate National Program Manager, Forest Inventory & Analysis
- Roger D. Ottmar, Pacific Wildland Fire Sciences Laboratory, USFS Pacific Northwest Research Station
- Sherri Wormstead, Sustainability & Planning Coordinator, USFS Northeastern Area State & Private Forestry
- Charles (Hobie) Perry, Research Soil Scientist, USFS Northern Research Station
- Gloria Van Duyne, Bruce Williamson and Nick Conrad of NYSDEC
- Dr. Graham Cox, Forest and Open Space Program Coordinator, Audubon New York
- Dr. Peter Smallidge, Senior Extension Associate, Cornell University Department of Natural Resources

Indicator analysis and baseline conditions

F1: Percentage of Forest Acreage by Diversity Class Ratio

This indicator provides insight into the overall value of forestry in each of the nine counties. At the most basic level, understanding the sustainability of a sector or industry requires a grasp of the basic resource underpinning it. For the forestry sector, this translates to measuring how much forestland there is in the region in total, and its variation in tree growth stage. Forest stands with trees at varying growth stages provide different economic, ecological, and social benefits, uses, and drawbacks, and thus, are of different value. These benefits and drawbacks include, but are not limited to:

- Diversity of wildlife habitat by providing differing amounts and types of food and cover (nesting, travel, escape, etc.);
- Economic benefits including lumber and fuel; and
- Aesthetic and spiritual benefits for residents and visitors.

The analysis of Forest Acreage by Tree Size Class utilizes a classification breakdown defined by the U.S. Forest Service Forest Inventory and Analysis[29]. These four classes included in this inventory are described below:

- *Small Diameter Forestlands* are forest stands stocked with at least 10% of their capacity for live trees where more than 50% of the trees are saplings (live trees 1-4.9 inches in diameter at breast height)
- *Medium Diameter Forestlands* are forest stands stocked with at least 10% of their capacity for live trees where more than 50% of the trees are poletimber (live trees at least 5 inches in diameter at breast height, but smaller than sawtimber)
- *Large Diameter Forestlands* are forest stands stocked with at least 10% of their capacity for live trees where more than 50% of the trees are sawtimber (live trees at least 11 inches in diameter at breast height for hardwoods and at least 9 inches in diameter for softwoods)
- *Nonstocked Forestlands* are forestlands designated with forestry as their primary land use but are stocked with less than 10% of their capacity for live trees.

Calculation:

To calculate this indicator, the most recent (2011) estimates of acreage of forestland broken down by tree-size class (the first three classes described above) were gathered for each of the nine counties in the region. These area estimates were then converted to percentages of the total acreage in all three classes. These three percentages are then expressed as a ratio.

[29] USFS Forest Service Forest Inventory and Analysis National Program (USFS FIA). 2012. Standard Reports: Area Reports. Available at: http://apps.fs.fed.us/fido/. Accessed November, 2012.

Required Data	Definition	Dataset Reference
Acres of forest land in each county by tree-size class	US Forest Service estimates of forestland acreage occupied by trees classified by trunk diameter (small, medium, and large)	http://apps.fs.fed.us/fido/standardrpt.html Standard Report number 2.4

Additional Comments:

Although the main indicator that is reported here is the estimated ratio of tree size diversity, another important measure that can be derived from this dataset is the total acreage of forestland in the region (see Figure 13). Tracking that measure also speaks to the sustainability of forestry in that, at a more basic level than size class diversity, the simple amount of forested acres in the region has a direct effect on its viability, both ecologically and economically. There are multiple data sources that can be utilized to track this statistic. The reason the data from the U.S. Forest Service Forest Inventory and Analysis was chosen is that their forestry acreage estimates are broken down by size class, which was needed for this indicator. However, for the purposes of simply tracking the total acreage of forested area, two other dataset choices are available: the USGS National Land Cover Dataset[30], and the USDA Cropland Data Layer[31]. Both are publicly available remote sensing datasets that can be processed using geographic information systems (GIS) software to classify land cover types and derive acreage estimates. Due to methodological differences, the total forested acreage statistics from the three data sources will not be exactly the same, and therefore their measurements should not be compared for purposes such as this analysis. When utililizing one of these sources to make acreage estimates, comparisons over time should only be made with measurements taken from the same source.

For the purposes of this analysis, nonstocked forestlands were excluded because the data is not available in all areas of the region. Therefore, percentages of forestland as reported are estimated percentages of total forest land populated with at least 10% stocking of live trees instead of percentages of total land categorized in the Forestry land use category.

---

[30] USGS Multi-Resolution Land Characteristics Consortium (MRLC). 2006. National Land Cover Dataset. Available at: http://www.mrlc.gov/nlcd06_data.php. Accessed December, 2012.
[31] USDA National Agricultural Statistics Service (USDA NASS). 2012. Cropland Data Layer. Available at: http://nassgeodata.gmu.edu/CropScape/. Accessed November, 2012.

The following definitions are used throughout the analysis of this indicator[32]:

- Basal area: Cross-sectional area of a tree stem measured 4.5 feet above ground level. Usually reported per acre of land.
- Stocking: A relative percentage measure of the degree of occupancy of land by trees, measured by basal area of trees per acre of land. In the Eastern United States, 100% is equivalent to seventy-five square feet of basal area per acre for trees at least 5 inches in diameter at breast height.
- Diameter at breast height (d.b.h.): A standard measure of tree size, measured as the diameter of a standing tree outside its bark at 4.5 feet above ground level.

Baseline Condition:

As shown in Figure 13, the diversity of forest habitat types in the Finger Lakes region is skewed toward tree stands dominated by large diameter, and therefore older trees. The acreage of large-diameter forest stands is estimated to be three times higher than medium-diameter acreage and four times larger than the amount of small-diameter acres (63% large, 21% medium, and 16% small). This uneven proportion is one result of the non-sustainable forest management practice of high grading.

Figure 13, Estimate of Acres of Trees on Forest land by Size Class, 2011

County	Large Diameter Acres	Medium Diameter Acres	Small Diameter Acres	Non-stocked Forestland Acres	Forest Land Total Acres
Genesee	65,548	25,380	24,508	2,060	117,496
Livingston	100,583	39,587	6,473	None reported in survey	146,643
Monroe	61,954	25,890	27,192	None reported in survey	115,035
Ontario	110,780	39,230	33,894	13,520	197,424
Orleans	34,713	21,053	6,836	None reported in survey	62,602

[32] United States Forest Service (USFS). 2004. Common Definitions Used by the FIA. Available at http://www.fs.fed.us/ne/fia/methodology/def_ah.htm. Accessed December, 2012

County	Large Diameter Acres	Medium Diameter Acres	Small Diameter Acres	Non-stocked Forestland Acres	Forest Land Total Acres
Seneca	35,239	16,635	None reported in survey	1,559	53,433
Wayne	100,919	14,164	17,511	9,916	142,511
Wyoming	103,203	32,992	19,086	None reported in survey	155,281
Yates	58,867	10,833	33,894	1,225	104,818
Regional Total	*671,806*	*225,764*	*169,394*	*28,280*	1,095,243
Regional Total as a % of Stocked Forestland Acreage	63.0%	21.2%	15.9%	N/A	N/A

F2: Amount of Biomass in Live Trees on Forestlands

Tracking the estimated amount of tree biomass over time will identify how much the region's forests are contributing to the mitigation of greenhouse-gas-induced climate change. This indicator measures one of the greatest benefits associated with forests in the Finger Lakes region by quantifying one of its primary ecosystem services- its ability to capture and store atmospheric carbon[33]. It also provides one measure by which to estimate the potential of regional forest resources to provide a source of fuel[34].

Calculation:

To calculate this indicator, the most recent (2011) estimates of dry weight in short tons of biomass in live trees on forestlands were gathered for each of the nine counties in the region[35]. These area estimates were then added together to get an estimate of biomass dry-weight in the region. This sum is reported as the indicator.

Required Data	Definition	Dataset Reference
Short tons of biomass in live trees	US Forest Service Estimates of dry weight in short tons of live trees on forest land per county	http://apps.fs.fed.us/fido/standardrpt.html Standard Report number 10.1

Additional Comments:

Multiple methods exist for estimating the total carbon contained in forests. However, at this time, it is a very new science and the estimates are often contradictory, and are thus deemed unreliable[36]. As an approximation of carbon storage amounts, live tree biomass is used.

---

33 Gorte, R.W. 2009. Carbon Sequestration in Forests. Congressional Research Service report 7-5700: RL31432. August 6, 2009.
34 Cook, J. and J. Beyea. 2000. Bioenergy in the United States: Progress and Possibilities. Biomass and Bioenergy 18(2000): 441-455.
35 USFS. 2012. Forest Inventory Data Online. Available at http://apps.fs.fed.us/fido/standardrpt.html. Accessed October, 2012.
36 Ingerson, A. and W. Loya. 2008. Measuring Forest Carbon: Strengths and Weaknesses of Available Tools. Science and Policy Brief. Washington, D.C. The Wilderness Society.

Baseline Condition:

As shown in Figure 14, the USFS estimates that in 2011 there were more than sixty million tons of biomass in the forests of the Finger Lakes region. Ontario County had the most with over eleven million tons, while Orleans County had the least with less than three million. Every ton of tree biomass represents hundreds of pounds of carbon that have been captured from the atmosphere and are, thus, not contributing to climate change as greenhouse gas.

Figure 14, Estimated Volume of Biomass in Trees, 2011

County	Short tons of dry-weight biomass in live trees larger than 1 inch in diameter at breast height
Genesee	5,270,724
Livingston	9,029,347
Monroe	6,184,679
Ontario	11,591,094
Orleans	2,919,078
Seneca	3,256,303
Wayne	8,319,484
Wyoming	9,375,560
Yates	4,991,255
Regional Total	*60,937,524*

F3: Number of Breeding Bird Species

One of the important aspects of sustainability involving forests is the diversity of wildlife species living in the region. This indicator quantifies the state of health of forests in the Finger Lakes Finger Lakes region by quantifying biodiversity in the forest habitat. A region with healthy and diverse habitats that supports many different species is more sustainable and resilient in that it is less vulnerable to a harmful invasive species threat. Also, a forest that is home to a variety of species provides greater economic, ecological, and social benefits.

It is difficult to find reliable data on the presence and diversity of populations of most wildlife species. The one source in New York State that is standardized in its measurement and repeated for tracking over time is the New York State Breeding Bird Atlas[37]. Therefore, as a surrogate for overall forest wildlife biodiversity, this indicator tracks the spread of breeding bird species that indicate the presence of high-quality forest interior habitats that are likely to serve as habitats for a diverse plant and animal community.

Calculation:

To calculate this indicator, the most recent (2000-2005) Breeding Bird Atlas statewide survey results were gathered for each of the nine counties. Four species of birds were selected as indicator species for high-quality forest interior habitat. These four species were selected based on criteria including ease of identification (to minimize error on the part of the survey volunteers), and the degree to which their presence in a survey block would indicate the presence of high quality forest interior habitat type. For each species, the number of survey blocks[38] they were observed in during the Breeding Bird Atlas Survey was recorded. These counts serve as the indicator value.

Required Data	Definition	Dataset Reference
Breeding Bird Species Observed Distribution	Number of survey blocks where four high-quality forest habitat indicator species were observed during the most recent NYS Breeding Bird Atlas Survey period (2000-2005) as reported in the NYNHP Nature Explorer database	http://www.dec.ny.gov/natureexplorer/app/location/county

[37] New York State Department of Environmental Conservation. 2007. New York State Breeding Bird Atlas 2000 [Internet]. Release 1.0. Albany (New York): Available at http://www.dec.ny.gov/animals/7312.html.
[38] The Breeding Bird Atlas is a survey conducted by volunteers using uniform size survey blocks. The entire state is covered by 5-kilometer-square blocks. These blocks serve as the unit of reporting for the survey. Each block is reported with a list (and count) of which breeding bird species were observed by the volunteers inside it during the survey.

Additional Comments:

The next New York State Breeding Bird Atlas survey is scheduled to begin in 2020. This will allow for the region to track its biodiversity progress and begin measuring the effectiveness of the strategies in this plan.

Another source considered for measuring biodiversity was the New York Natural Heritage Program's database[39] of significant natural communities and plant and animal community locations. These sources track the location of high-quality examples of natural communities throughout the state, and known locations of rare species respectively. While these certainly are important sources of information regarding biodiversity, they do not present a complete picture. These databases only track species and communities deemed to be either rare or exceptional examples. They are not meant to be an exhaustive survey of all species or communities present. For this reason, they are not appropriate for measuring regional species diversity.

While the Breeding Bird Atlas is a better source for measuring diversity, it is not a perfect one. Even though it is an attempt to document all species, instead of just the rare examples, it is a survey conducted by volunteers. Furthermore, it only measures diversity of bird species by presence or absence, not actual numbers of individuals observed. However, at this time, it is the most reliable and robust surrogate data source for measuring forest habitat quality in the region.

Baseline Condition:

As shown in Figure 15, the Black-and-white warbler, Ovenbird. Scarlet Tanager, and Veery were observed in 54, 289, 428, and 358 survey blocks respectively. These numbers serve as an index for the amount of high-quality forest interior habitat in the region. As these measurements are taken over time when the Bird Atlas Survey is repeated over time, the change in amount of quality forest habitat amount can be tracked over time.

[39] New York State Department of Environmental Conservation. 2012. New York Natural Heritage Program NY Nature Explorer Database. Available at http://www.dec.ny.gov/animals/29338.html Accessed December, 2012

Figure 15: Distribution of Four Selected Forest-Interior-Habitat-Indicator Species Observed in the New York State Breeding Bird Atlas Survey, 2000-2005

Indicator Species	Number of Survey Blocks Where Observed
Black-and-white Warbler (*Mniotilta varia)*	54
Ovenbird (*Seiurus aurocapilla)*	289
Scarlet Tanager (*Piranga olivacea)*	428
Veery (*Catharus fuscescens)*	358

F4: Invasive Species Index

This indicator reflects sustainability of forest resources by quantifying biological threats to the ecosystem. The observation data is updated regularly, and since it is an area of great concern (with large risks like the Emerald Ash Borer), it can be expected to be a strong and reliable measure of forest sustainability. An index was created for this indicator so as to measure both the presence and distribution of invasive species infestation in the region's forests. The New York Invasive Species (NYIS) Clearinghouse tracks the spread of multiple types of invasive species through the state.

One choice for the indicator would be to report the number of tracked species present in the region. Though this indicator choice would be simple, it would be misleading. Many of the species tracked are aquatic or otherwise not applicable to forestry. Just simply reporting the number of species in the region which are a threat to forests would be more precise. However, this indicator choice neglects the measurement of how widespread these species are in the region, a critically important detail. In order to quantify how many applicable invasive species are in the region, and how serious the infestations are with a single numerical measure, it was necessary to design an index. This index evaluates each invasive species present in the region individually. The index values for each species present is finally added together to give the regional index value.

Calculation:

Utilizing the maps of current known species ranges on the NYIS Clearinghouse website[40], the first step in calculating this indicator is to determine how many of the invasive species threatening forests are present in the area. Next, each of these species will get scored individually. For each species present, the number of counties in the region where it is known to be present is determined. Using this information, an index score ranging from one to five is assigned using the following formula:

Index Score = 1 + ([number of counties in the region in which it is present – 1] x 0.5)

This formula is used to calculate an index score for each species present. Finally, all of the scores are added together to determine the overall regional index value.

Example:
Species X and Species Y are the only two invasive species in the region. Species X is only in one county, while Species Y is in five counties.

[40] Cornell University. 2012. New York Invasive Species Clearinghouse. Available at http://www.nyis.info/index.php. Accessed December, 2012.

Species X Index Value = 1 + (1-1)(0.5) = 1 + 0 = 1*

Species Y Index Value = 1 + (4)(0.5) = 1+2 = 3*

Regional Invasive Species Index Value = 1 + 3

Regional Invasive Species Index Value = 4

The index was designed to quantify presence and spread differently. As described above, the first county in which a species is present adds 1 to its index score. Each additional county adds 0.5. This difference is meant to reflect the fact the introduction of a new foreign species threatening forests is arguably more of a problem than the spread of an existing problem species to an additional county within the region. On the other hand, eradicating a species completely from the region, however unlikely, would be more of an accomplishment than just removing it from a single county. The bottom line is that, judging from the point of view of a nine-county region, the mere presence of an invasive species into the region is a very large issue. Once present, though the extent of its distribution is important, much of the damage is already done with the initial introduction. The difference between the weights used in the index formula attempt to reflect this variation.

Required Data	Definition	Dataset Reference
Number of invasive insect and parasite species present in region, and their range	Range of Priority Species tracked by the New York Invasive Species Clearinghouse which are a threat to forest resources	USDA and DEC Species Range Maps found at: http://www.nyis.info/index.php

Additional Comments:

It is acknowledged that not all invasive species pose equivalent threat levels to regional forest resources. The vast difference between various potential impacts is mitigated to some degree by virtue of the selectivity inherent in the NYIS Clearinghouse data source. The Clearinghouse distinguishes between species of high potential threat and those that are merely foreign competitors, such as Norway maple.

Even still, some degree of generalization is required in an effort to achieve a single numeric values by which to describe both the presence and distribution of threatening invasive species on the whole. The nature of the invasive species threat is such that we cannot foresee which species might possibly be introduced into the region, or how problematic they might be. For this reason, any measure must be general and flexible, even if somewhat simplified.

Baseline Condition:

The Regional Index value of 8.5 reflects the presence of three tracked species that exhibit known threats to forest resources (see Figure 16). European Woodwasp (*Sirex noctillo F.)* is present in all nine counties, Hemlock Wooly Adelgid (*Adelges tsugae)* is present in three, and Emerald Ash Borer (*Agrilus planipennis*) or EAB is present in two. EAB is the most problematic of these three. According to the NYIS Clearinghouse, "Slowing [EAB's] spread is imperative."[41] New York State has instituted a quarantine on ash products to attempt to limit their spread and mitigate potential catastrophic damage to the state's high number of ash trees.

Figure 16, Invasive Species Index Values, 2012

County	Emerald Ash Borer	European Woodwasp	Hemlock Wooly Adelgid
Genesee		Yes	
Livingston	Yes	Yes	
Monroe	Yes	Yes	Yes
Ontario		Yes	
Orleans		Yes	
Seneca		Yes	Yes
Wayne		Yes	
Wyoming		Yes	
Yates		Yes	Yes
Regional Index Value (subtotals)	*1.5*	*5*	*2*
Total Regional Index Value	*8.5*		

There are a few invasive species in New York that have not, as of yet, spread to the Finger Lakes region. A clear example is Asian Longhorned Beetle (*Anoplophora glabripennis),* which has been found in areas of New York City and Long Island. An important goal for the region will be to try and keep its index value from rising, in part by doing all it can to avoid the spread of existing invasives in the region, and keeping others like the Asian Longhorned beetle out.

[41]Cornell University. 2012. EAB Home Page. New York Invasive Species Clearinghouse. Accessed December 5, 2012. Available at http://www.nyis.info/index.php?action=eab

Climate Change Adaptation Baseline

Appendix For Climate Adaptation Indicators - References

1. Discussion of climate change and adaptation in Hazard Mitigation Plans

State/County	Status	Climate Change	Link
NY State	Update 2011	No	http://www.dhses.ny.gov/oem/mitigation/plan.cfm
Genesee	2006	No	http://www.gflrpc.org/GeneseeAllHazard.htm
Livingston	2005	No	http://www.gflrpc.org/LivingstonAllHazard.htm
Monroe	Update 2011	No	http://www.monroecounty.gov/File/PUBLIC%20SAFETY/OEM/2010%20Pre-Disaster%20Mitigation%20Plan%20FEMA%20&%20MC%20approved.pdf
Ontario		NA	
Orleans	2006	No	http://www.gflrpc.org/Publications/OrleansAllHazard/MitigationPlan/Index.htm
Seneca		NA	
Wayne	2007	No	http://www.gflrpc.org/Publications/WayneAllHazard/Index.htm
Wyoming	2008	No	http://www.gflrpc.org/Publications/WyomingAllHazard/MitigationPlan/Index.htm
Arcade Township	Update 2012	No	http://www.gflrpc.org/Publications/ArcadeAllHazard/HazardMitigationPlanUpdate/ArcadeHazardMitgationPlanUpdate.pdf
Yates	Update 2011	No	http://www.yatescounty.org/upload/12/4151.pdf

2. Reduction in agricultural economic losses attributable to temperature, drought, flooding

a. Crop losses from Hail (NY State Hazard Mitigation Plan, 2011, Table 3-41, pp. 3-209-3-211)

County	Cash Receipts from Farm Marketing's 2007 (All Crops)	Annualized Loss (Total x Annualized Loss %)
Genesee	$72,247,000	$144,494
Livingston	$44,139,000	$88,278
Monroe	$65,784,000	$131,568
Ontario	$56,467,000	$112,934
Orleans	$87,972,000	$175,944
Seneca	$27,831,000	$55,662
Wayne	$105,346,000	$210,692
Wyoming	$50,845,000	$101,690
Yates	$31,635,000	$63,270

Reference source: http://www.dhses.ny.gov/oem/mitigation/documents/3.8-Hail-Storm-2011.pdf

b. Government payments for agriculture loss and disaster assistance

(Thousands of Dollars, 2011)

	Direct Payments (2011)	Supplemental and Ad Hoc Disaster Assistance 6/	Milk Income Loss Payments
New York	24,300.2	3,351.9	6.6

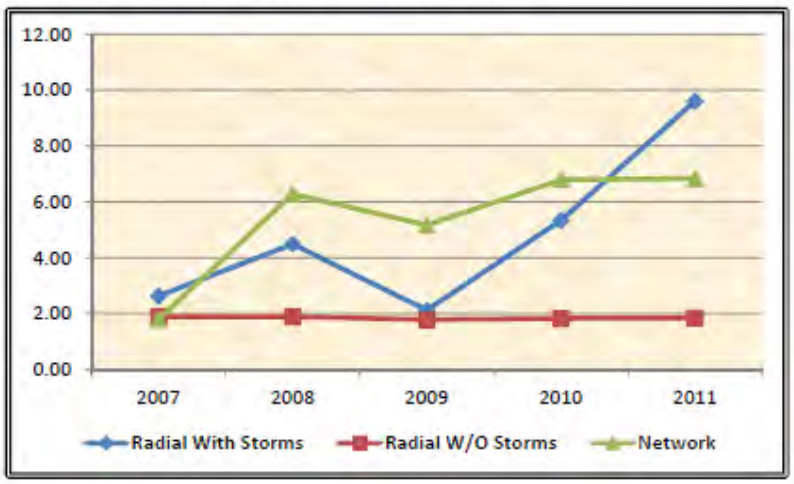
Note: Supplemental and ad hoc disaster assistance programs includes all programs providing disaster and emergency assistance payments to growers. Programs include Crop Assistance Program, Dairy Indemnity Program, Durum Wheat Quality Program, Emergency Assistance Program, Emergency Conservation Program, Emergency Forest Restoration Program, Geographic Disadvantaged Program, Livestock Forage Program, Livestock Indemnity Program, Livestock Indemnity Program 2005/2007, Market Loss Assistance Program - Asparagus, Noninsured Assistance Program, Supplemental Assistance Program (SURE), Trade Adjustment Assistance Program, Tree Assistance Program.

Reference Source: US Department of Agriculture, http://www.ers.usda.gov/data-products/farm-income-and-wealth-statistics.aspx#27428

3. Reduction in # of residents put at risk from loss of at least one critical infrastructure services for more than 1 day per year

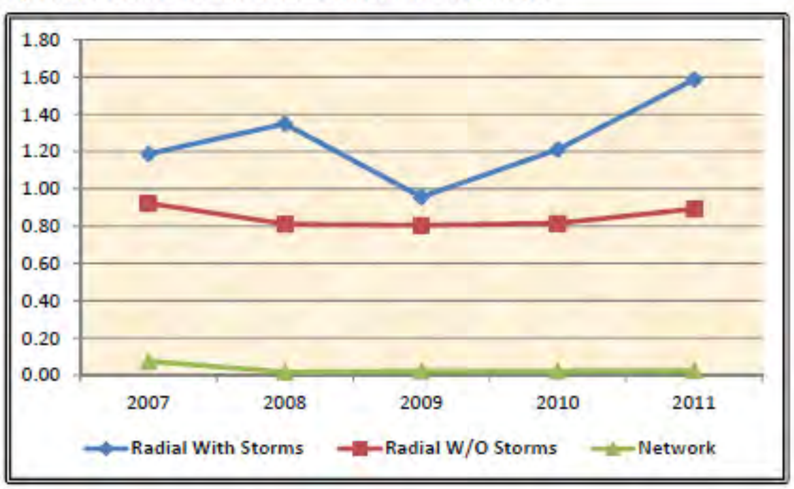
a. Electric service reliability- New York State Energy Planning Board- New York State Transmission and Distribution Systems Reliability Study and Report

Figure 12. New York State CAIDI for Radial and Network



Source: PSC 2011 Annual Reliability Report

Figure 13. New York State SAIFI for Radial and Network



Source: PSC 2011 Annual Reliability Report

Reference Source: http://nyssmartgrid.com/wp-content/uploads/2012/09/reliability-study.pdf, Retrieved 12/14/2012

Electric service reliability – Galvin Electric Initiative – Electricity Reliability: Problems, Progress, and Policy Solutions

Table 1: International Comparison of 2007 Reliability Indices

COUNTRY	SAIDI	SAIFI
United States	240	1.5
Austria	72	0.9
Denmark	24	0.5
France	62	1.0
Germany	23	0.5
Italy	58	2.2
Netherlands	33	0.3
Spain	104	2.2
UK	90	0.8

Source: Council of European Energy Regulators ASBL. (2008). *4th Benchmarking Report on the Quality of Electricity Supply.* Brussels: CEER.

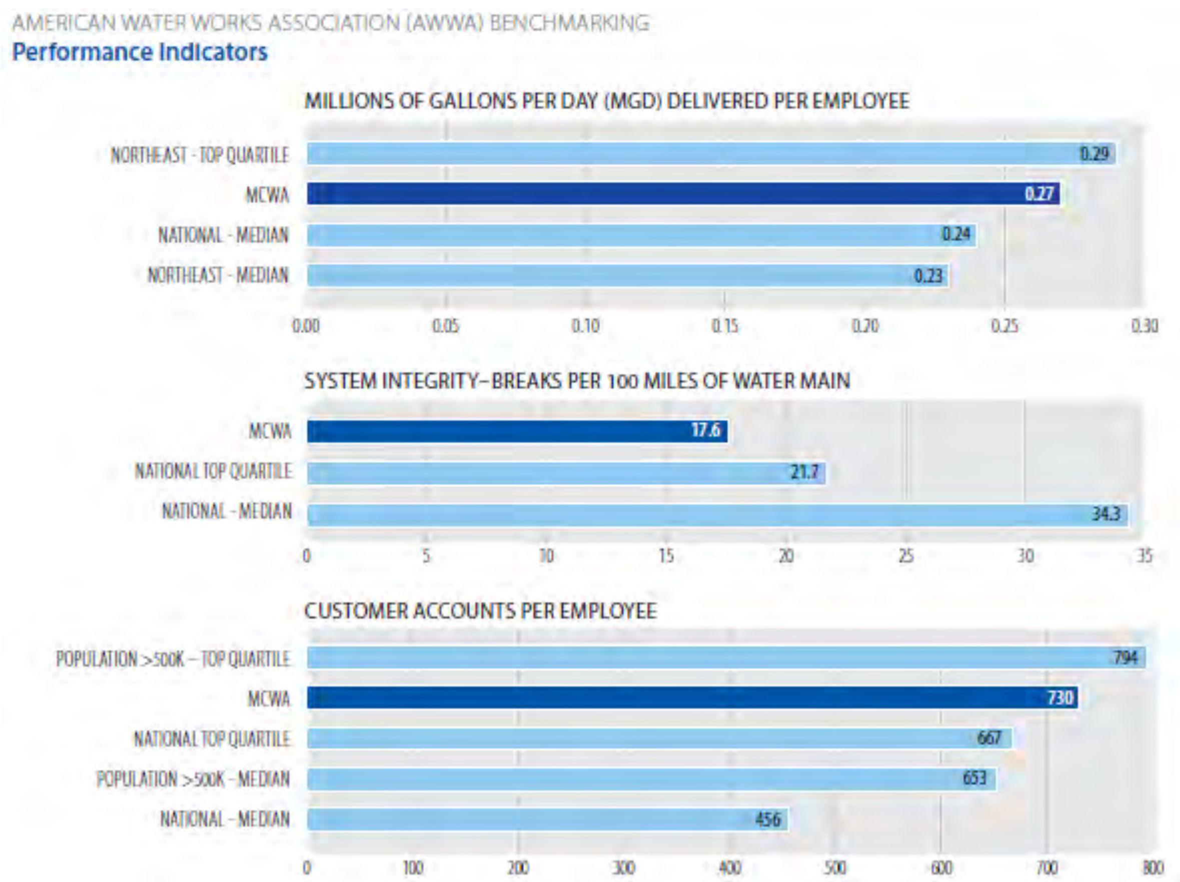
Table 5: Summary of U.S. Regional Reliability Data, Some With and Without Major Events

CENSUS DIVISION	SAIDI (MINUTES)	SAIFI	MAIFI
New England	198	1.44	No Data (ND)
Middle Atlantic	225	1.28	ND
East North Central	498	1.46	ND
West North Central	166	1.31	5.11
South Atlantic	320	1.86	11.1
East South Central	ND	ND	ND
West South Central	134	1.38	ND
Mountain	118	1.22	ND
Pacific	296	1.99	3.4
U.S. Average	**244**	**1.49**	**6.55**
Events		**0.07**	**ND**

Source: Tracking the Reliability of the U.S. Electric Power System: An Assessment of Publicly Available Information Reported to State Public Utility Commissions. (October 2008). LBNL Report 1092E.

Reference source: http://www.galvinpower.org/sites/default/files/Electricity_Reliability_031611.pdf, Retrieved 12/14/2012

b. Water mains – breaks: Monroe County- Breaks Per 100 Miles of Water Mains



Reference Source: Monroe County Water Authority, http://www.mcwa.com/AboutMCWA/HowWeMeasureUp.aspx, Retrieved 12/20/2012

c. Estimated highway infrastructure and landslide repair (total road miles, est road miles in steep areas, estimated per mile repair)

Potential Highway Infrastructure Repair Costs for a Landslide					
Town	Total Road Miles (See Table 5-8)	Estimated Road Miles in Steep Slope Areas	Estimated Per Mile Repair	Potential Highway Infrastructure Repair Cost	
				Landslide Affecting 1.5 % of Steep Slope Roads	Landslide Affecting 15 % of Steep Slope Roads
Barrington	86.6			$2.8 million	$27.5 million
Italy	71.1			$2.3 million	$22.6 million
Jerusalem	151.3	15%	$14.1 million	$4.8 million	$48.0 million
Middlesex	69.5			$2.2 million	$22.0 million
Milo	87.6			$2.8 million	$27.8 million

Reference Source: Yates County Hazard Mitigation Plan, Section 5, p. 23, Table 5-14 (http://www.yatescounty.org/upload/12/4148.pdf)

d. Additional potential data sources and measures

Flight Delays by Extreme Weather

Flight Delays by Cause
New York, NY: LaGuardia (June, 2003 - October, 2012)

Most Recent Month Year to Date View Individual Months View Pie Chart Print Table Download Raw Data

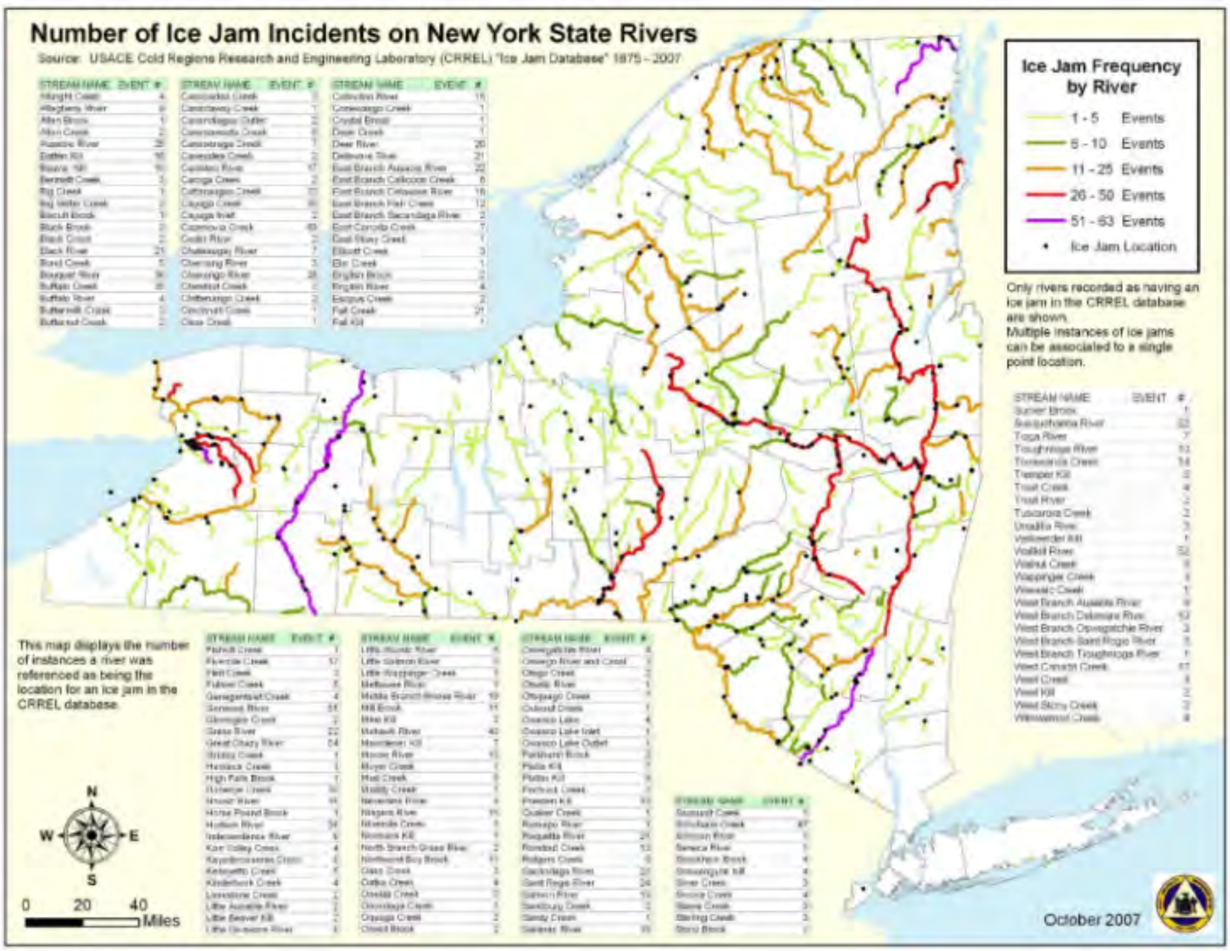
	Number of Operations	% of Total Operations	Delayed Minutes	% of Total Delayed Minutes
Air Carrier Delay	46,581	4.34%	2,859,536	16.68%
Aircraft Arriving Late	57,392	5.35%	3,826,876	22.33%
Security Delay	233	0.02%	9,420	0.05%
National Aviation System Delay	172,401	16.07%	9,473,105	55.26%
Extreme Weather	13,481	1.26%	972,710	5.67%
Total Operations	1,072,689	100.00%	17,141,647	100.00%

A flight is considered delayed when it arrived 15 or more minutes than the schedule (see definitions in Frequently Asked Questions). Delayed minutes are calculated for delayed flights only. Data presented summarizes arriving flights only.
When multiple causes are assigned to one delayed flight, each cause is prorated based on delayed minutes it is responsible for. The displayed numbers are rounded and may not add up to the total.

SOURCE: Bureau of Transportation Statistics, Airline Service Quality Performance 234

Reference Source: http://www.transtats.bts.gov/OT_Delay/OT_DelayCause1.asp?pn=1

Number of Ice Jam Incidents on New York State Rivers



Reference Source: New York Multi-Hazard Mitigation Plan 2011