Well Water Chemistry in Otsego County

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10 km   20 km   30 km

Acknowledgements

- Funding Sources:
  - Otsego County Conservation Association (well samples; CHRESI database)
  - Research Foundation of State University of New York (student research grants)
  - Vibrant New York program at SUNY Oneonta (well samples)
- Members of the Butternut Valley Alliance and participants in the sampling program
- The loose affiliation of watershed managers who provided the impetus to form Catskill Headwaters Research Institute (USGS, SUNY, OCCA, Otsego County Soil & Water District, NYS DOH, BFS, GASTEM-USA)
- Most of all: **The Water Sampling Team**!!
  - Leandra Baker, now at Barton & Loguidice
  - Fiona Lowry, at Public Health, U of MN Graduate School
  - Molly Reed, now at Plumley Engineering, P.C., Syracuse
  - Leland Cohen and Ryan Pasternak, Water Resources majors at SUNY Oneonta
  - Devin Castendyk, Director of Water Resources program, SUNY Oneonta

Water Well Sampling Sites In Otsego County, NY
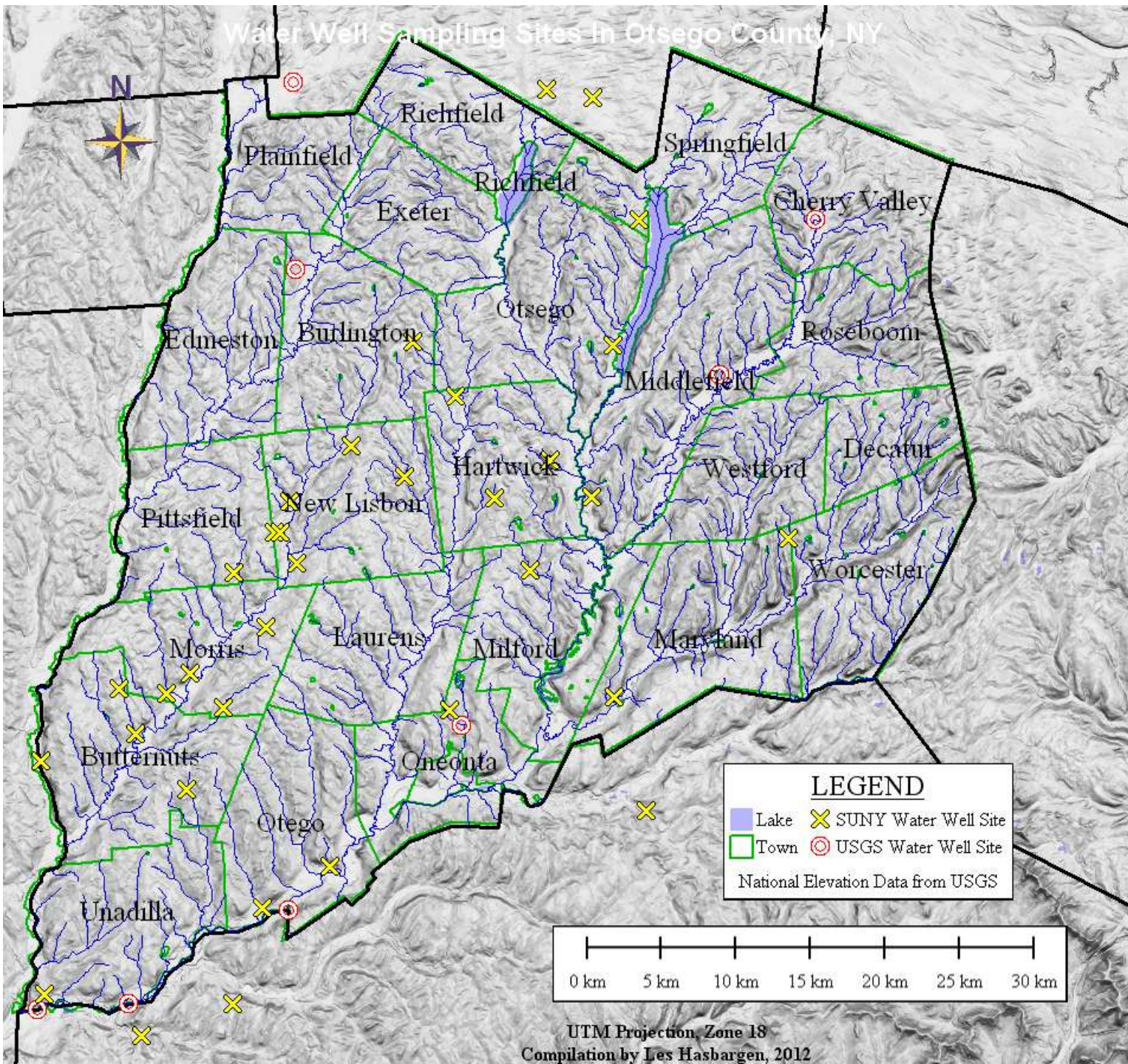
USGS and SUNY Oneonta well sample locations, 2006 through March 2012

Note, this does not include USGS 2009 data

LEGEND

Lake
Town
National Elevation Data from USGS

SUNY Water Well Site
USGS Water Well Site

0 km   5 km   10 km   15 km   20 km   25 km   30 km

UTM Projection, Zone 18
Compilation by Les Hasbargen, 2012

Elements we sampled for…

Na	Y	Dy	Zr	Ga
Ca	Cs	Ge	Tb	Pd
K	Br	Mo	Ho	Ag
Mg	Cu	Fe	Tl	Be
Si	Pb	Ni	Th	Bi
Mn	La	Cd	Sc	Hg
Zn	Li	Yb	Lu	In
Ba	Ce	Sm	Re	Nb
Sr	Nd	Er	Cr	Os
Rb	Eu	Al	V	Pt
Ti	W	Se	Au	Ru
U	Co	Sb	Tm	Sn
As	I	Pr	Hf	Ta
	Gd			Te

See http://www.ptable.com/ for more info on elements

Most common elements are in first column; least common are in far right column. Of these typically 33 are detected in a well (some have more, some less.)

Well Water Concentration
Most Common Inorganic Elements...

Analyte Symbol	Coefficient of Variation (std dev / ave)	Standard Deviation (μg/L)	Min (μg/L)	Max (μg/L)	Median (μg/L)	Average (μg/L)	# Wells with analyte present
Na	0.84	15617	1100	60900	15200	18689	47
Ca	0.87	15459	2100	89800	20000	17748	47
K	2.64	5702	180	35500	710	2157	47
Mg	0.73	3719	366	18100	4360	5114	47
Si	0.30	1445	2700	8800	4700	4838	47
Mn	1.40	79.90	0.3	371	20.9	57.06	47
Zn	1.47	38.85	1.5	228	12.9	26.34	47
Ba	0.89	65.29	1.6	217	55.8	73.57	47
Sr	1.38	225.93	12.8	1390	120	163.50	47
Rb	0.59	0.38	0.113	1.95	0.477	0.64	47
Ti	0.34	0.23	0.3	1.3	0.7	0.70	47
U	1.27	0.16	0.002	0.634	0.03	0.13	47
As	2.16	1.71	0.06	10.3	0.265	0.79	46
Y	1.49	0.06	0.004	0.37	0.0195	0.04	46
Cs	1.11	0.04	0.003	0.139	0.0155	0.03	46
Br	2.52	322.95	4	1800	22	128.09	45
Cu	1.43	65.95	0.3	200	5	46.17	45
Pb	1.40	0.71	0.02	3.46	0.22	0.51	43

Water Well Sampling Sites In Otsego County, NY

Geology beneath Otsego County
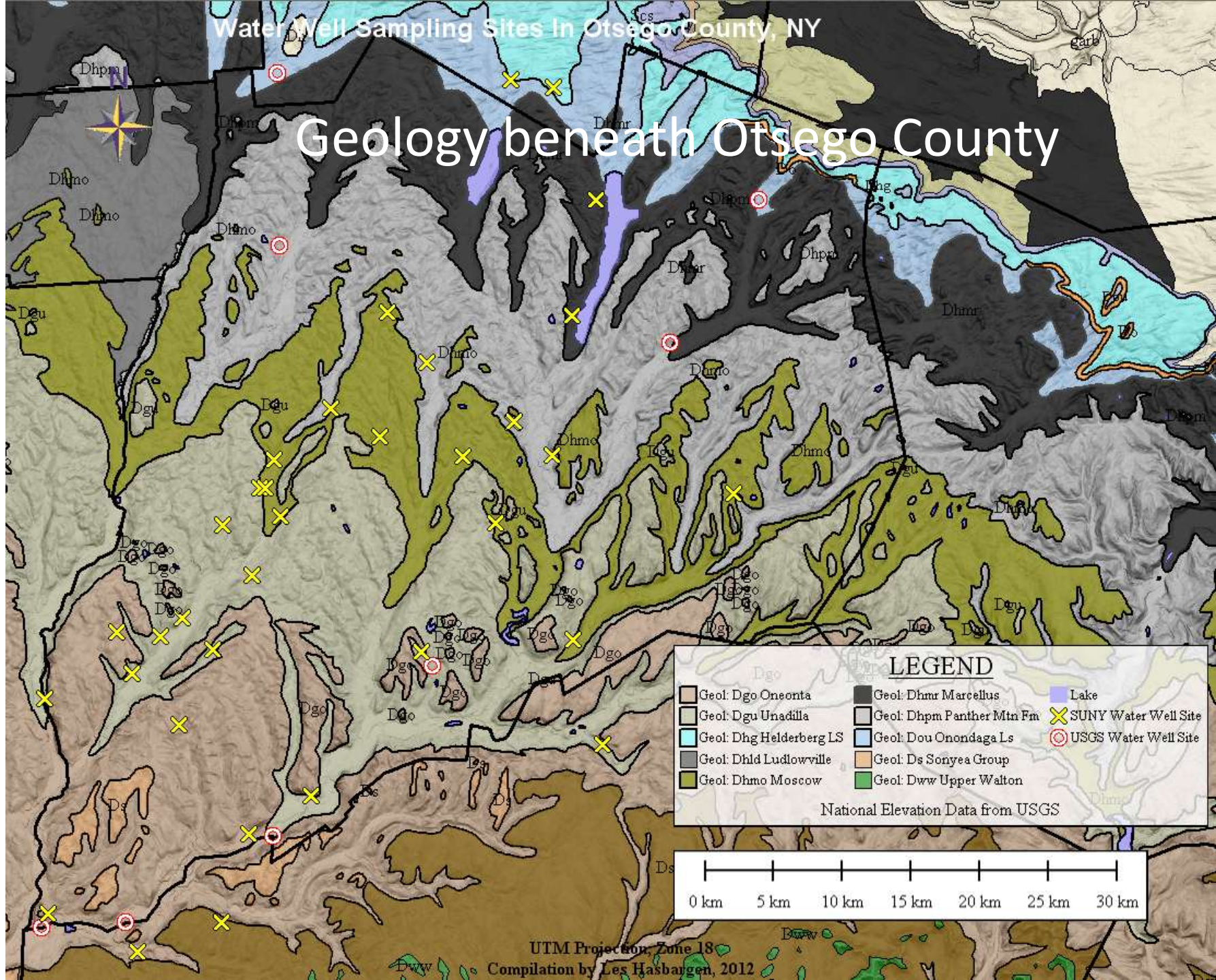
LEGEND

|		
Geol: Dgo Oneonta	Geol: Dhmr Marcellus	Lake
Geol: Dgu Unadilla	Geol: Dhpm Panther Mtn Fm	SUNY Water Well Site
Geol: Dhg Helderberg LS	Geol: Dou Onondaga Ls	USGS Water Well Site
Geol: Dhld Ludlowville	Geol: Ds Sonyea Group	
Geol: Dhmo Moscow	Geol: Dww Upper Walton	

National Elevation Data from USGS

0 km   5 km   10 km   15 km   20 km   25 km   30 km

UTM Projection, Zone 18
Compilation by Les Hasbargen, 2012
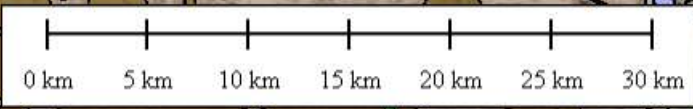
Geology and Water Quality

- The previous map suggests that we have the data to compare water with underlying geology

- A systematic analysis of water and rock relationships has not been conducted yet

- We are hoping to get to this analysis this year, and provide a clearer picture of how these two key pieces of water chemistry are related

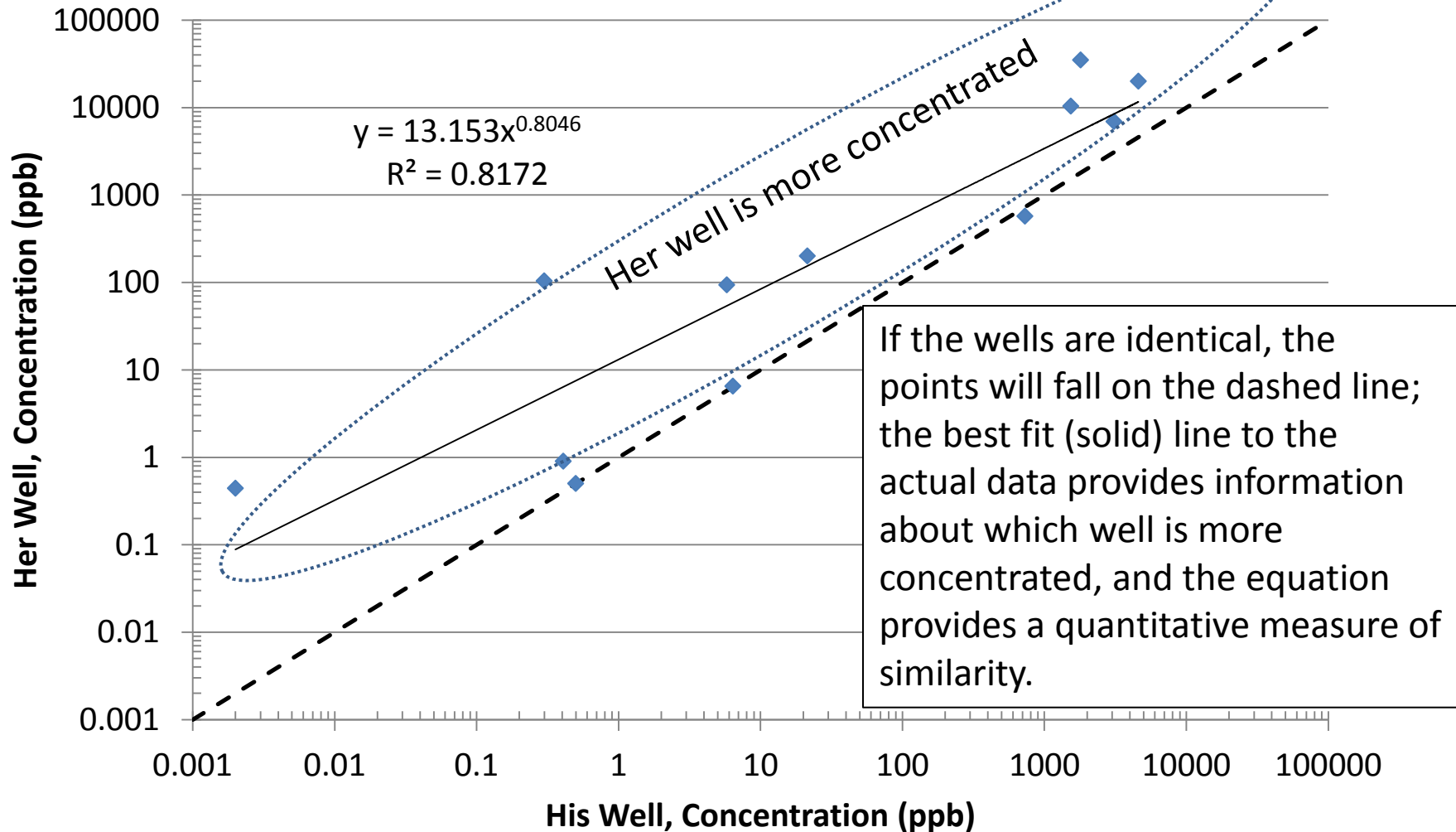# Establishing a Baseline: Comparison between two wells
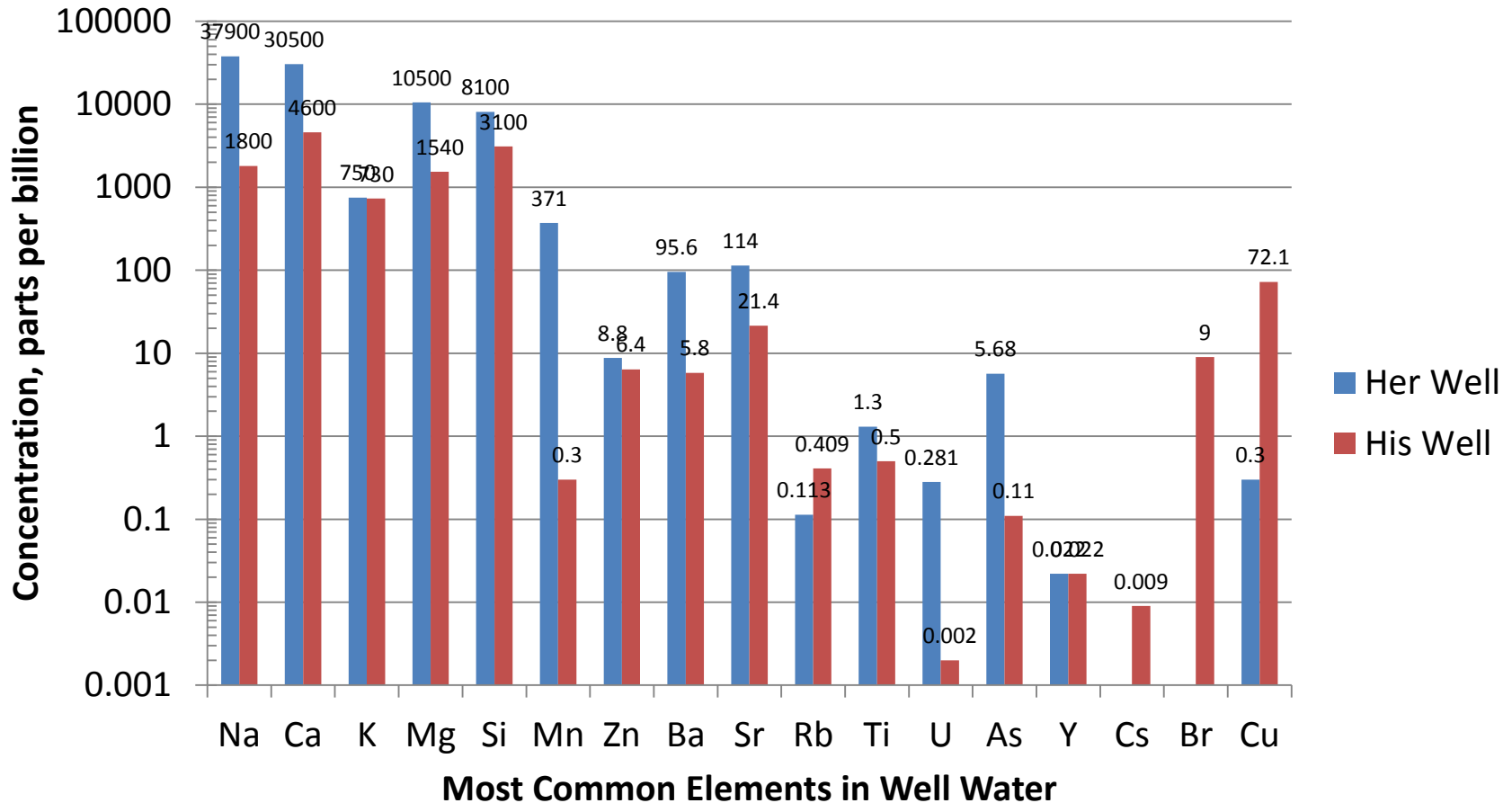
Note: Data are plotted on a logarithmic scale. In the example above, Her Well has much higher concentrations in Na, Ca, Mg, Mn, Ba, Sr, U, and As. His well has more Cs, Br, Cu.
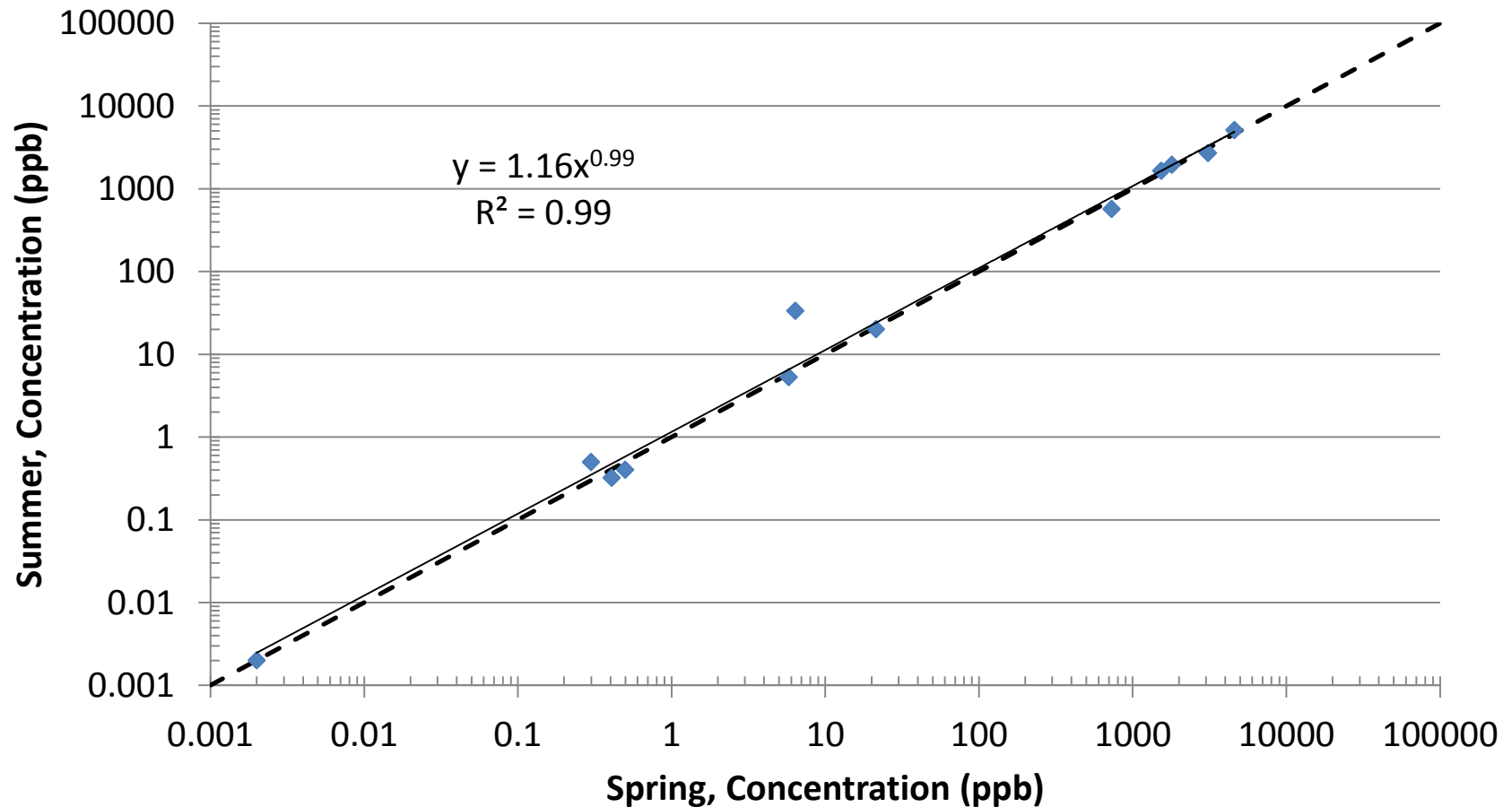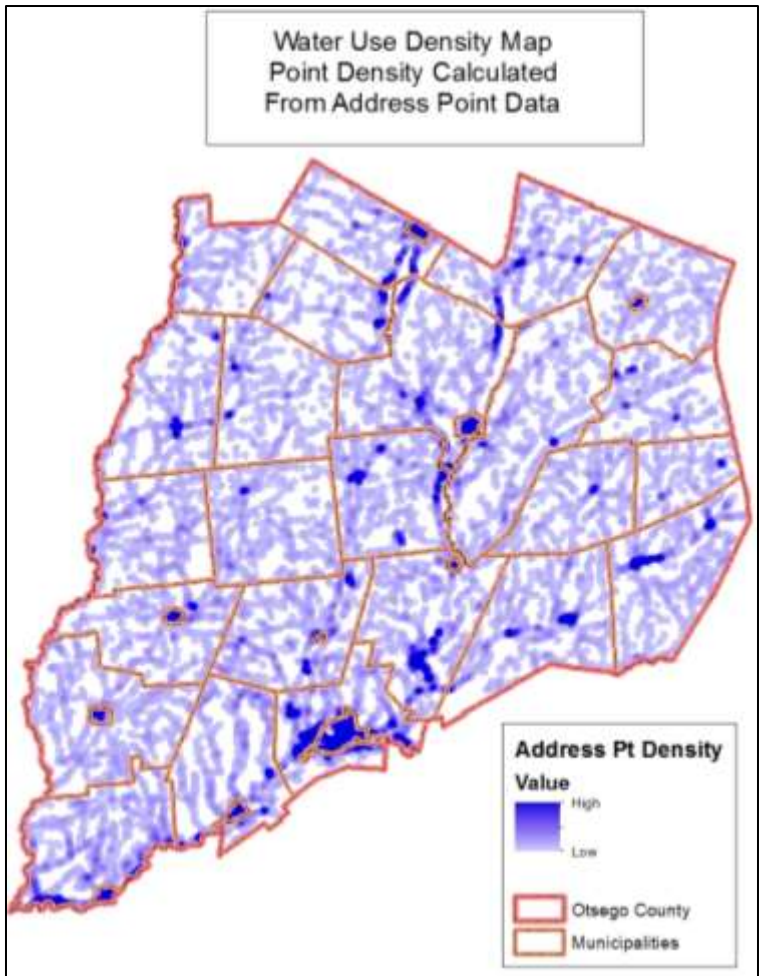
Comparison Between Wells
A Quantitative View

$y = 13.153x^{0.8046}$

$R^2 = 0.8172$

Her well is more concentrated

Her Well, Concentration (ppb)

His Well, Concentration (ppb)

If the wells are identical, the points will fall on the dashed line; the best fit (solid) line to the actual data provides information about which well is more concentrated, and the equation provides a quantitative measure of similarity.
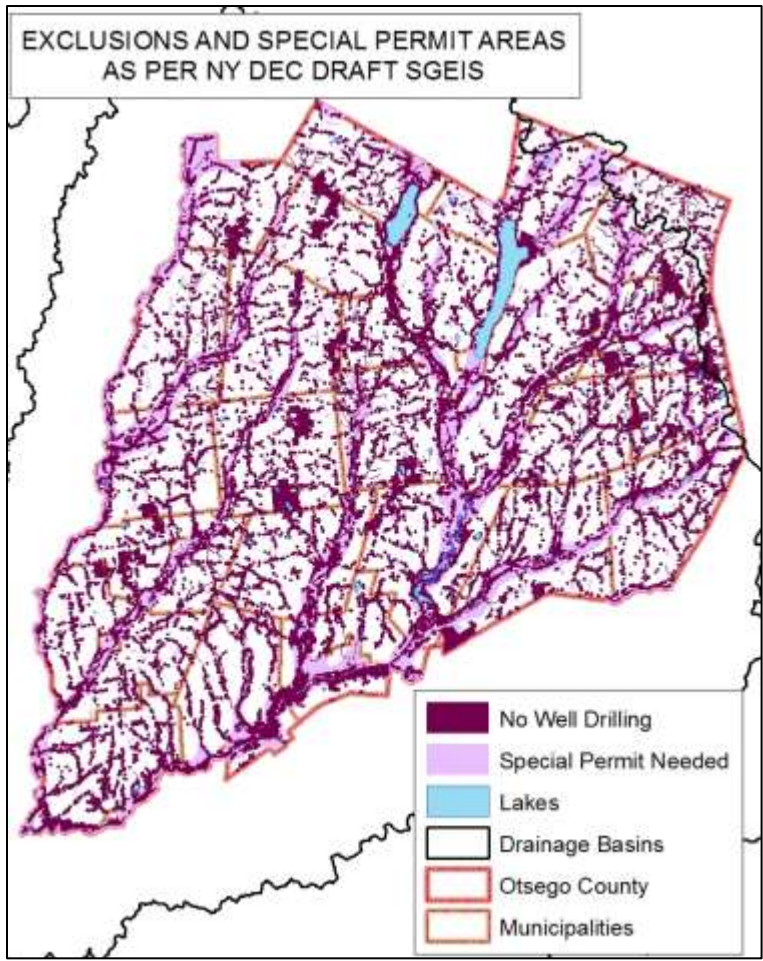
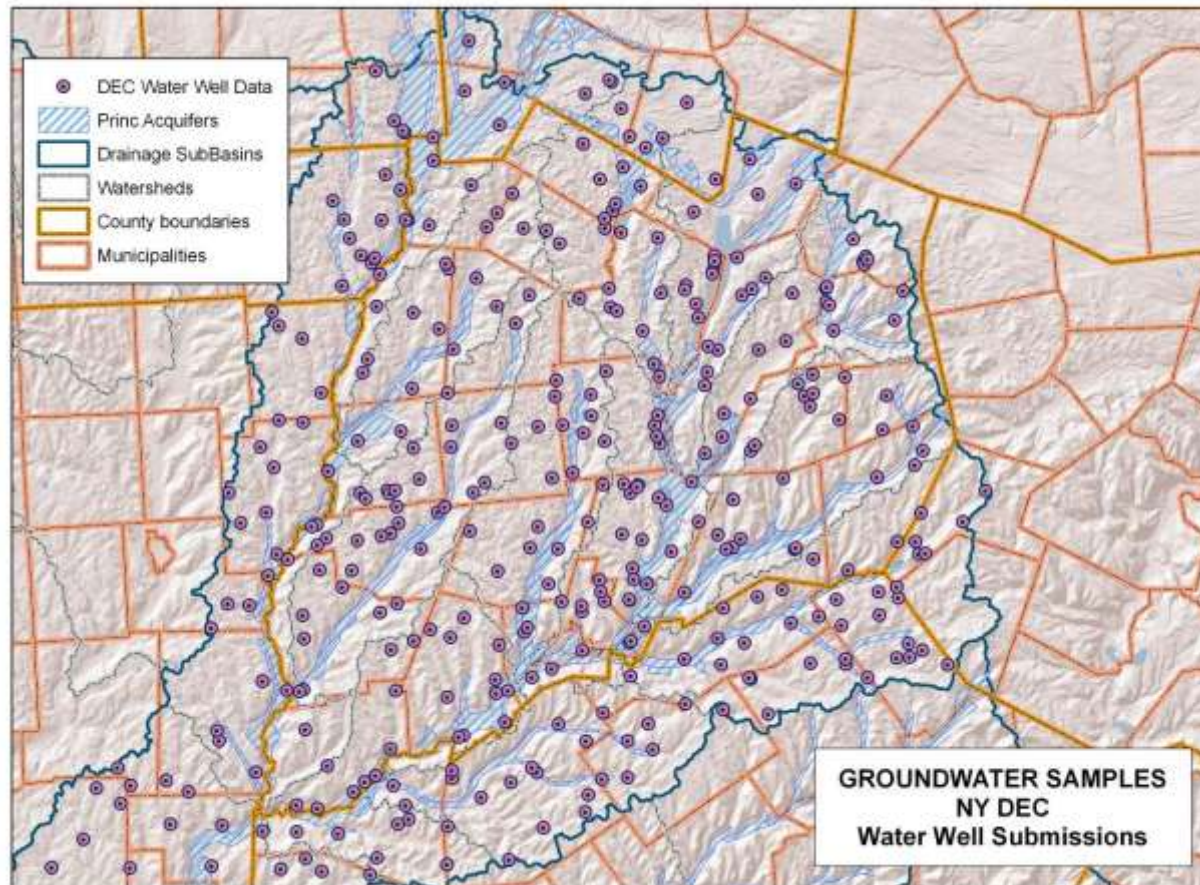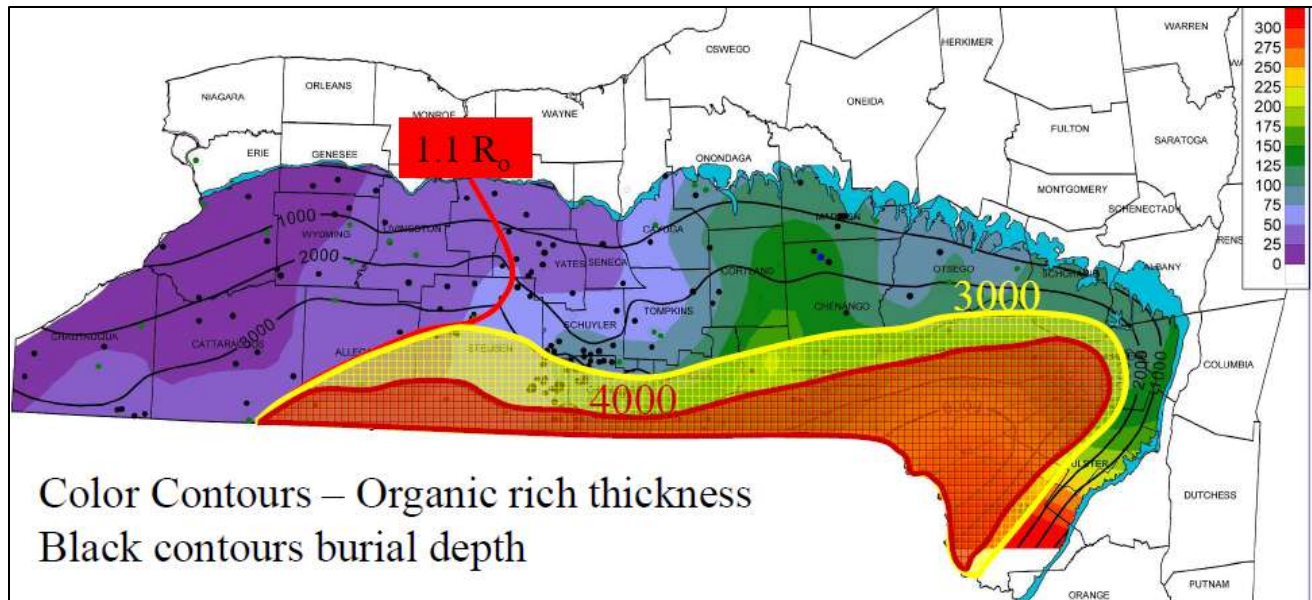# This well was sampled at two different times

Note that the data pretty much fall on the dashed line, with slightly higher concentration in summer. The relation shows an individual well does vary, but the variability is far less than what we see between wells.
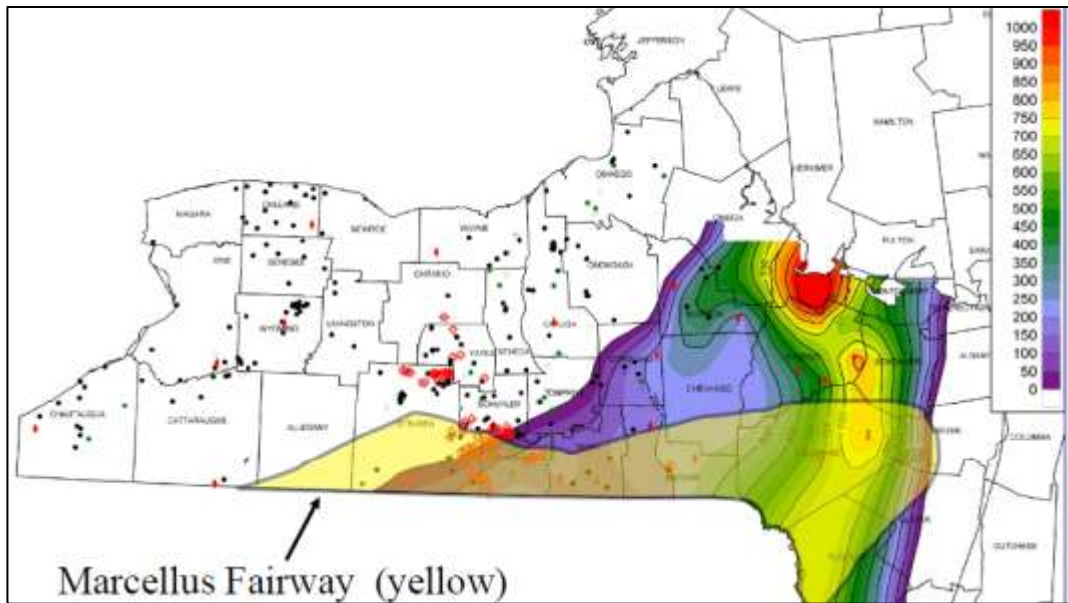
Exclusion and well density maps

Maps by M. Vargha, 2012.

Locations of water wells with well logs from NYS DEC database for wells drilled since 2001.

Color Contours – Organic rich thickness
Black contours burial depth

Marcellus Fairway (yellow)

Combined fairways of Marcellus and Utica gas plays in central New York (modified from Smith and Leone, 2009). Note the thickness of the Utica reaches a maximum along the northern border of Otsego County.
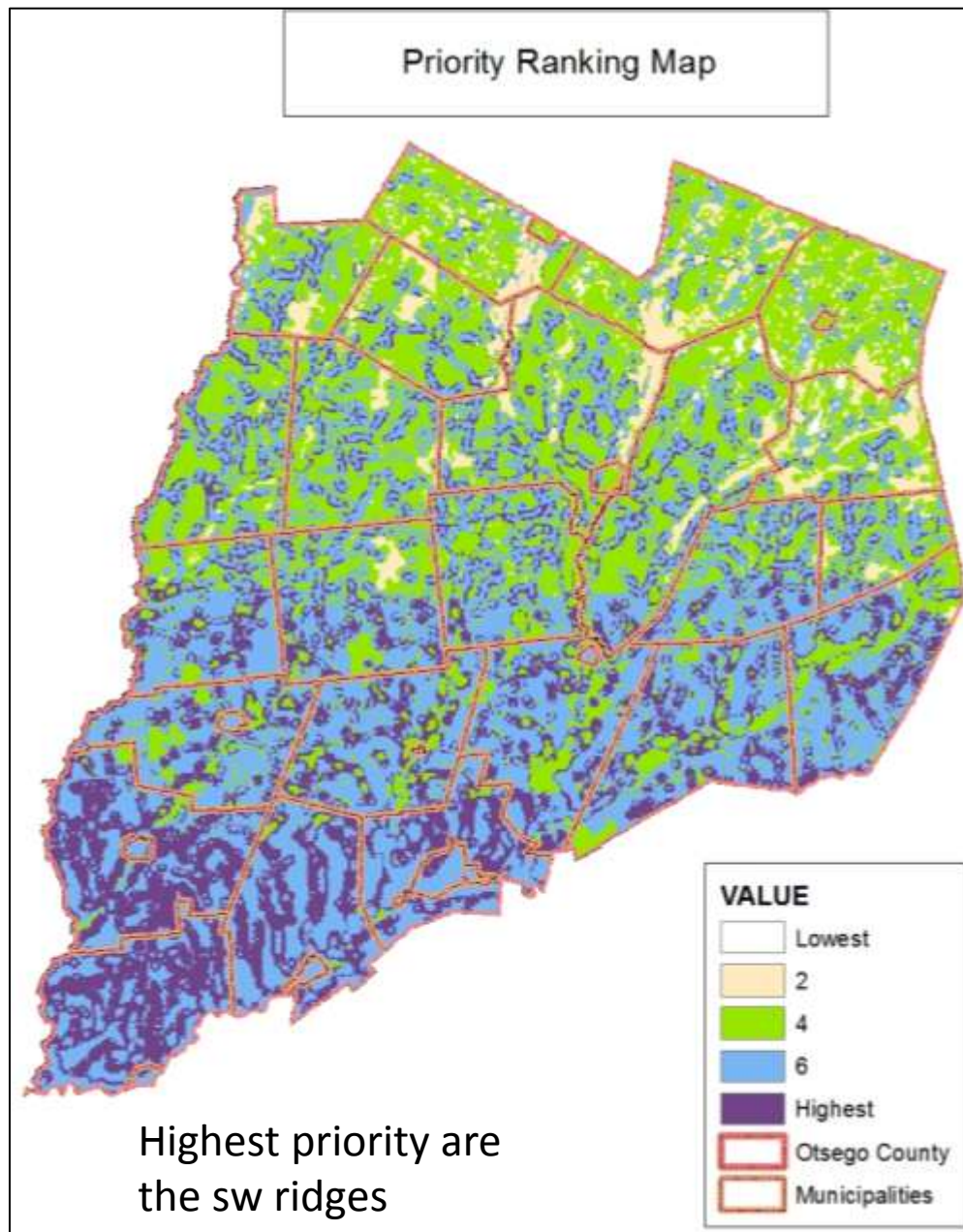
Current Target Map for more well sampling

Layers used to rank areas:

- Exclusion/Special Permit map
  - All areas excluded from drilling = 0
  - All areas needing special permits = 1
- Well Use Density Map
  - All areas with very high well density (city, villages) = 1 (these areas are less likely locations for drilling)
  - All areas with zero density = 0 (more likely locations but no close proximity water use)
  - All areas with high – medium density = 4
  - All areas with medium – low density = 3
- Shale Depth map
  - All areas of outcrop and within 1000 feet of the ground surface = 0
  - All areas between 1,000-2,000'of the ground surface = 1
  - All areas between 2,000-3,000' of the ground surface = 2
  - All areas greater than 3,000' below the ground surface= 3 (also corresponds with the region closest to drilling development in PA)

These three reclassified maps were 'added' together and each cell value becomes the sum of the three maps. The final map has a potential numeric range from 0 to 8, with 8 corresponding to the areas of highest priority for water sampling.

Priority Ranking Map

VALUE

	Lowest
	2
	4
	6
	Highest
	Otsego County
	Municipalities

Highest priority are the sw ridges

Research and Funding Needs

- Learn more about gas concentration and chemistry in wells
- Analyze water chemistry and rock type across county
- Support for GIS Database Manager/Analyst
- New ArcGIS server