Welcome!

The Shale Network

The ShaleNetwork will create a central and accessible repository for geochemistry and hydrology data collected by watershed groups, government agencies, industry stakeholders, and universities working together to document natural variability and potential environmental impacts of shale gas extraction activities.

PENNSTATE 1855

DICKINSON COLLEGE

UNIVERSITY OF PITTSBURGH VERITAS VIRTUS 1787

CUAHSI HIS Sharing hydrologic data

Alliance for Aquatic Resource Monitoring ALLARM est. 1986

Educate. Engage. Empower.

The Shale Network Workshop

Susan L. Brantley, Kathy Brasier, Dave Yoxtheimer, Chuck Anderson, Maggie Peacock, Paul Grieve (Penn State)

Candie Wilderman, Julie Vastine (Dickinson College, ALLARM)

Jorge Abad, Radisav Vidic, Cesar Simon (Pitt University)

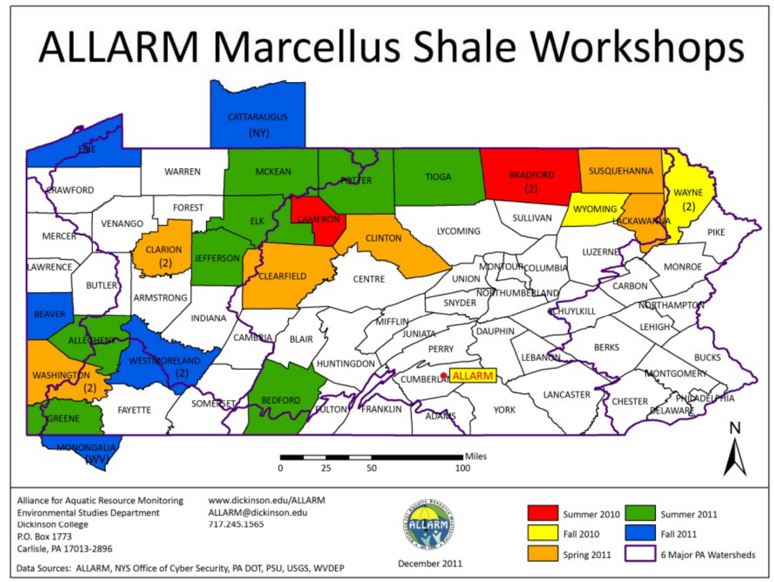
Rick Hooper, Jennifer Arrigo (CUAHSI)

April 23 2012

Many thanks to Debbie Lambert and Tracy Bernier as well




- Founded in 1986, based out of Dickinson College.
- Empowers communities with scientific tools to monitor, protect, and restore PA waterways.
- Developed a volunteer-based Marcellus Monitoring protocol in 2010 for early detection
- Has trained ~700 volunteers in PA, NY, MD and WV, in collaboration with CCDs, TU, MWA, Sierra Club, PASA, and Mon River Quest.



Educate. Engage. Empower.

Alliance for Aquatic Resource Monitoring

blogs.dickinson.edu/marcellusmonitoring/

Volunteer-based Marcellus Monitoring

Weekly Baseline Monitoring

- Conductivity
- Stream Stage
- Visual Monitoring
  - Land disturbances
  - Spills & discharges

Signature Chemical Analysis

- Barium
- Strontium



CUAHSI

Consortium of Universities for the Advancement of Hydrologic Science, Inc.

- 110 US University members
- 9 affiliate members
- 20 International affiliate members

(as of March 2012)

Receives support from the National Science Foundation to advance hydrologic science and education in the U.S.

Goals of the Workshop

- To explain to you what we are doing – at a very early stage of our effort
- To learn from you what you are doing
- To learn *together* how to make our efforts more meaningful and important for people

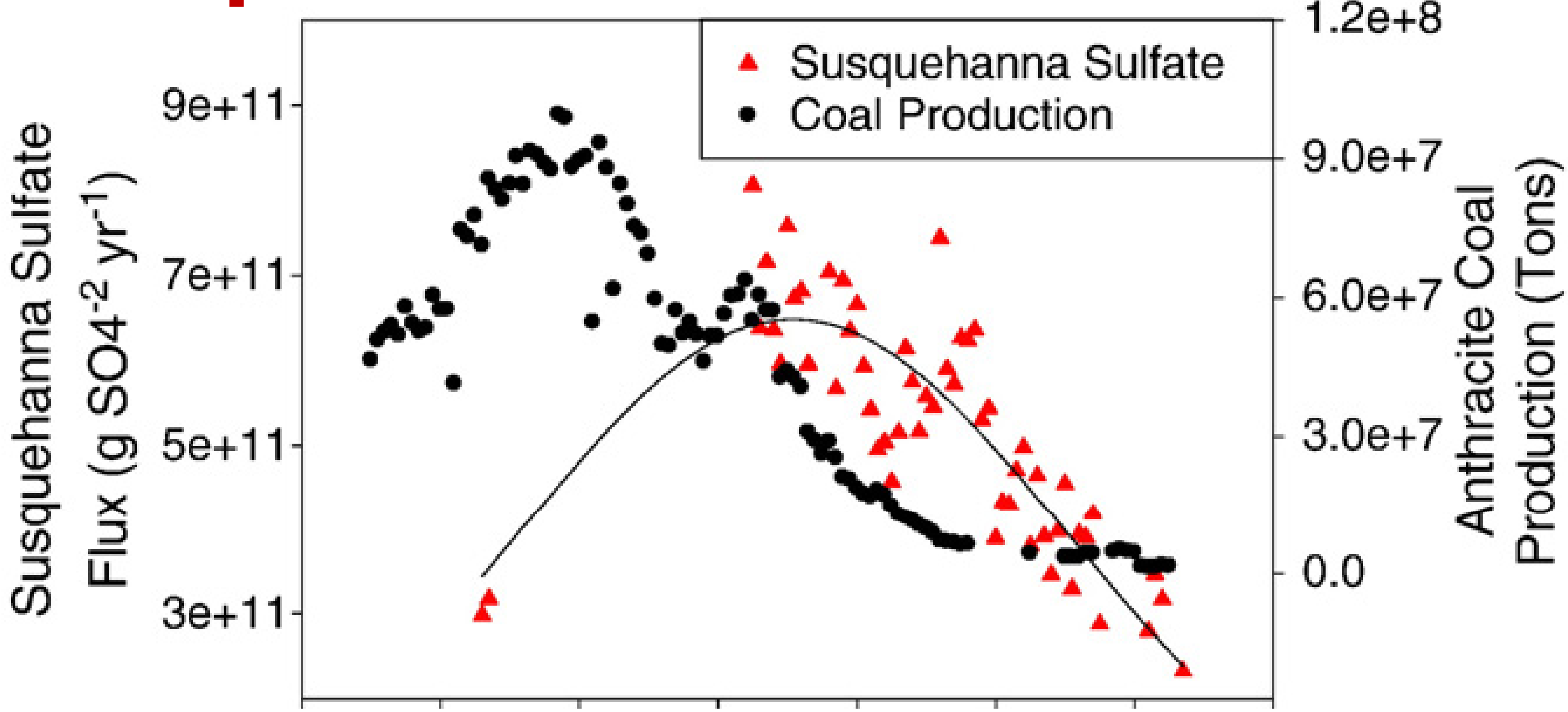
Today's Agenda

- 8:00-9:40 We tell you about what we are doing
- 9:40-10:05 We provide you with coffee
- 10:05 – 10:30 We walk to 316 Hammond Building
- 10:30-12:30 We teach you about HydroDesktop
- 12:45 -1:45 Lunch and Discussion of our Charge
- 1:45 - 2:45 We break up into Small Groups
- 3:00 – 4:00 Small Groups Report Back, General Discussion
- 4:00 – 4:30 Wrap up Comments
- 4:30 Assessment

Welcome

AND YOU

Pennsylvania rivers retain an imprint of coal extraction…



Will there be an imprint from shale gas exploitation as well?

Raymond and Oh, 2009

See http://www.lhup.edu/rmyers3.marcellus.htm for Marcellus events

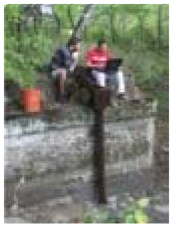
What the EPA is worried about

- **Water Volume:** Will large withdrawals of water impact drinking water resources?
- **Fracking fluids:** If hydraulic fracturing fluids are spilled, how will this impact drinking water resources?
- **Hydrofracturing itself:** What are the possible impacts of the injection and fracturing process on drinking water resources?
- **Flowback and Produced Waters:** If flowback and produced waters are spilled, how will this impact drinking water resources?
- **Wastewater Treatment and Disposal:** What are the possible impacts of inadequately treated hydraulic fracturing wastewaters on drinking water resources?

EPA/600/R-11/122
November 2011

According to Center for Rural Pennsylvania, ~300 watershed groups in PA are collecting data
…but the data is not being organized together in online archive

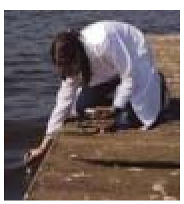
Gaging Stations



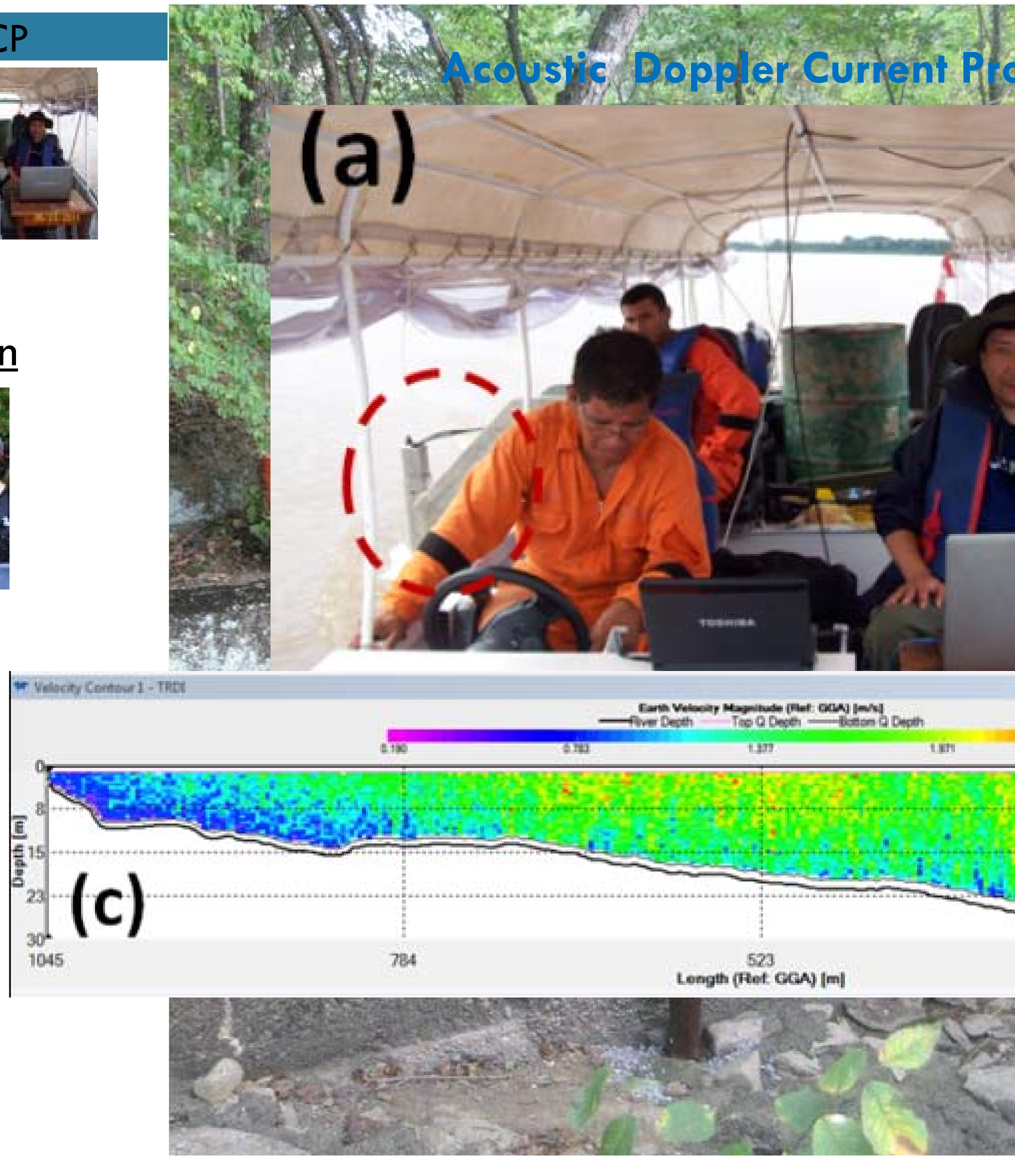
ADCP

Dissolved Oxygen

ph



Temperature



	A	B
1	Gage readings	
2	**Date**	**Discharge**
3		**ft^3/s**
4	9/9/2010	7.45E-06
5	9/10/2010	2.85E-05
6	9/11/2010	6.45E-05
7	9/12/2010	0.000102717
8	9/13/2010	0.000138043
9	9/14/2010	0.000156522
10	9/15/2010	0.000179755
11	9/16/2010	0.004967935
12	9/17/2010	3.152966225
13	9/18/2010	0.067862365
14	9/19/2010	0.066663451
15	9/20/2010	0.066303533
16	9/21/2010	0.06333981
17	9/22/2010	0.063270109
18	9/23/2010	0.062588315
19	9/24/2010	0.060337772
20	9/25/2010	0.061331929
21	9/26/2010	0.063260598
22	9/27/2010	0.060701359
23	9/28/2010	20.98470109
24	9/29/2010	2.638239387
25	9/30/2010	16.56539064
26	10/1/2010	28.55469067
27	10/2/2010	0.071512772
28	10/3/2010	[illegible]

Our Hypothesis

A database of water quality and quantity in areas of shale gas production will pull people together and provide the understanding needed to make good decisions.

A list of our goals as a network

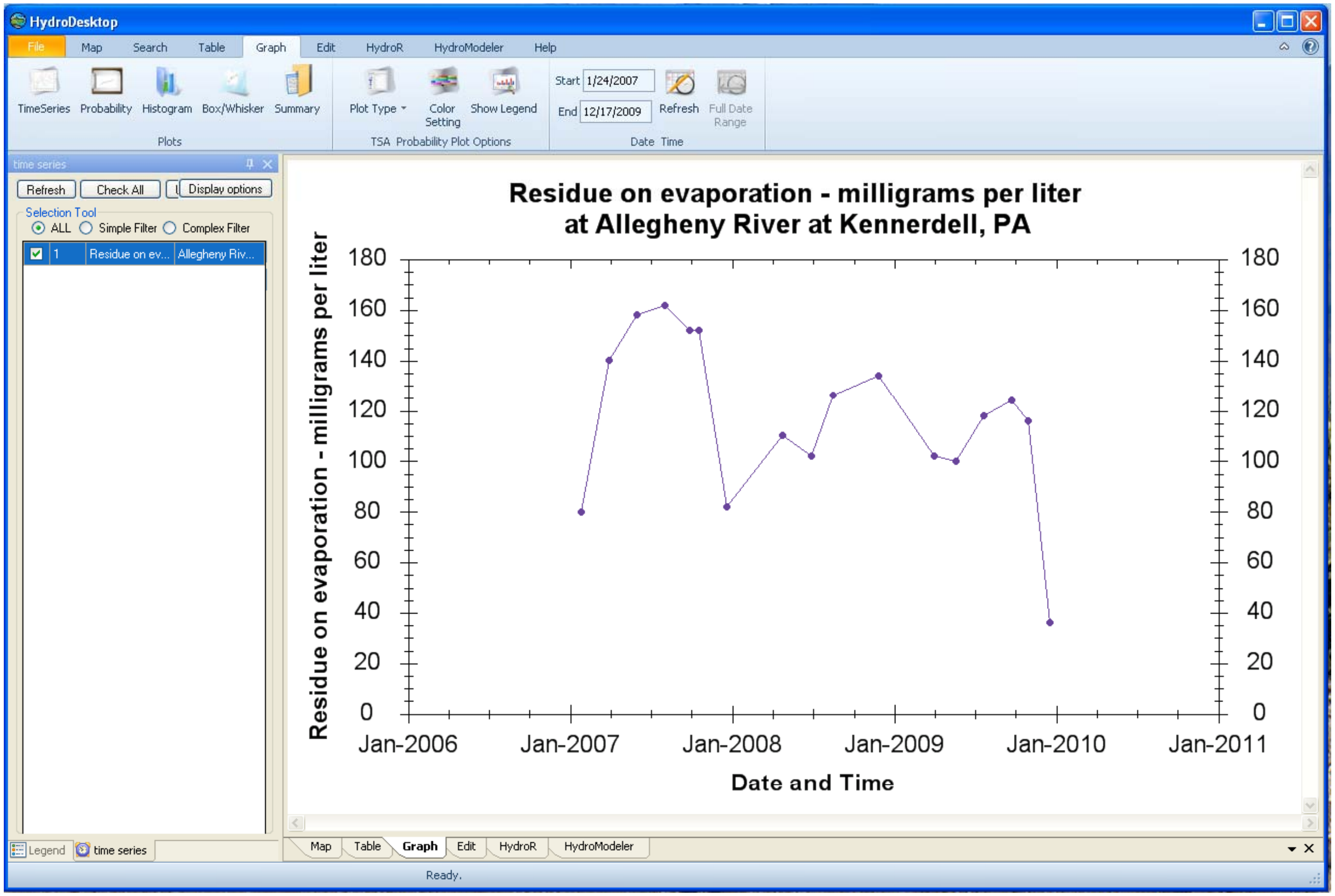
- Goal 1, To identify groups collecting water data in region of shale-gas extraction
- Goal 2, Create a sustainable network of the groups by hosting an annual meeting
- Goal 3, Work with CUAHSI to create a database that can establish background and can document impacts
- Goal 4, Train two graduate students in database development and use for communities
- Goal 5, Facilitate community groups in collecting, organizing, and interpreting their data
- Goal 6, Evaluate hydrogeochemical data using GIS in relation to population and economic data

Our Short History (we are 6 months old)

- Funded in October 2011
- Planned and tested HydroDesktop through fall
- Began finding data from various sources
- Data wranglers -- Maggie Peacock, Cesar Simon, Paul Grieve – began organizing data for entry into the database
- Working closely with CUAHSI to understand how to organize data and present it
- Data wranglers have been uploading data right through this weekend!
- The data is in the **Shale Network database** and is described at www.shalenetwork.org (Chuck Anderson, Jorge Abad)

Data are just numbers. What makes data useful? It is the *metadata*

4	9/9/2010	7.45E-06
5	9/10/2010	2.85E-05
6	9/11/2010	6.45E-05
7	9/12/2010	0.000102717
8	9/13/2010	0.000138043
9	9/14/2010	0.000156522
10	9/15/2010	0.000179755
11	9/16/2010	0.004967935
12	9/17/2010	3.152966225
13	9/18/2010	0.067862365
14	9/19/2010	0.066663451
15	9/20/2010	0.066303533
16	9/21/2010	0.06333981
17	9/22/2010	0.063270109
18	9/23/2010	0.062588315
19	9/24/2010	0.060337772
20	9/25/2010	0.061331929
21	9/26/2010	0.063260598
22	9/27/2010	0.060701359
23	9/28/2010	20.98470109
24	9/29/2010	2.638239387
25	9/30/2010	16.56539064
26	10/1/2010	28.55469067
27	10/2/2010	0.071512772
28	10/3/2010	17.89469357



<u>Data</u> are just numbers. What makes data useful? It is the *<u>metadata</u>*

- The **data** is the number that was measured (concentration, flow rate, etc.)
- **Metadata** is all the other stuff you need to know to understand how to think about that number
- **Metadata** answers all the questions, *Who? What? Where? When? How?* (how the sample was taken, what type sensor was used, where measurement was made, units, time, quality information, analytical technique, etc.)
- **Metadata is what you need *<u>to make knowledge from numbers</u>***

Shale Network Database

This talk is all about the **metadata** – the information that makes the Shale Network database useful

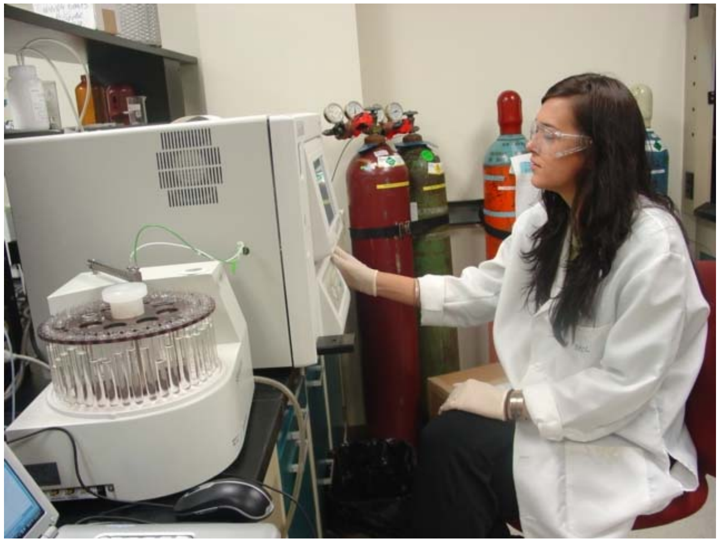
Who? What? Where? When? How?

Who?

Who provides the data?

Citizen scientists

Universities, Colleges, Government Agencies, Industry, Non-profits, Etc.



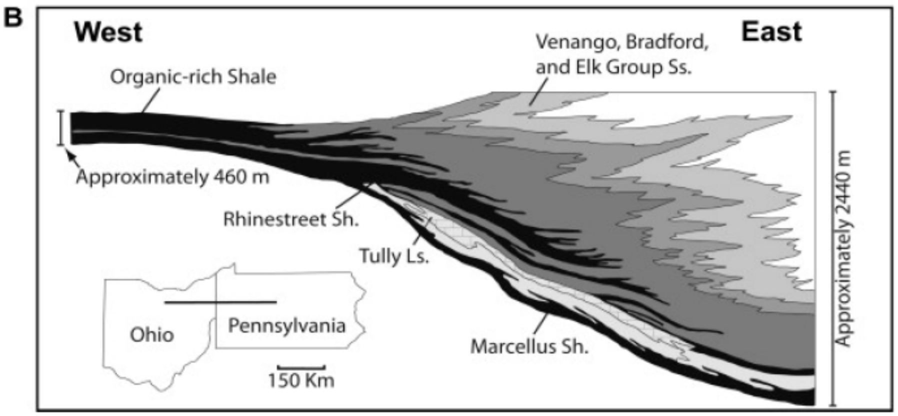
We invite you to be part of the "Who": Please share data with the Shale Network

- The Shale Network is open to people who monitor water quality, who research water issues, who facilitate water monitoring in areas of shale gas development, or who are members of organizations engaged in these activities. All members must be willing to share water quality or quantity data with the Network. To join, register at http://www.shalenetwork.org/user/register
- Once you register, you can share data with us directly online and we will upload it
- (If you do not want to be an official member, we will still accept data in any appropriate form)

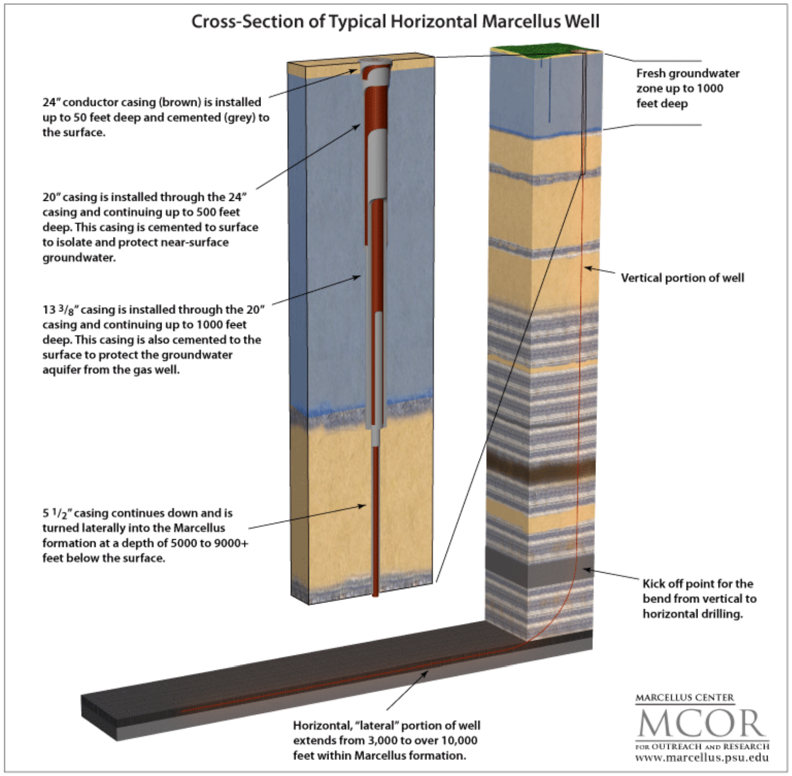
What?

What are we including? Water data
What water types are we including?

Surface water, ground water, injection water, flowback water, production water, wastewater effluent.



Osborne et al., 2010



What types of measurements are we including in the database?

- Water quantity: discharge rates or stage height, etc
- Sensor data (water quantity, water quality)
- Analyses of collected samples: ISCO or grab samples
- Samples can be collected on a sporadic or regular basis

But what analyses are included?

- Hmmm….

In early 2011, these parameters were required by DEP for wastewater treatment plants accepting Marcellus wastewaters *

Table 1. Required parameters in early 2011 for testing by wastewater treatment plants accepting Marcellus flowback wastewaters (PA Depart. of Environmental Protection (PA DEP))

Acidity, alkalinity, aluminum, ammonia, arsenic, barium, benzene, beryllium, biochemical oxygen demand, boron, bromide, cadmium, calcium, chemical oxygen demand, chlorides, chromium, cobalt, copper, ethylene glycol, gross alpha, gross beta, hardness, iron dissolved and total, lead, lithium, magnesium, manganese, MBAS (surfactants), mercury, molybdenum, nickel, nitrite-nitrate, oil and grease, pH, phenolics, radium226, radium228, selenium, silver, sodium, specific conductance, strontium, sulfates, thorium, toluene, TDS, Kjeldahl nitrogen, TSS, uranium, zinc

*In PA, municipal treatment plants are no longer able to accept Marcellus wastewaters

What is in the rock and water?

Shale elemental composition

Abundances of trace metals and major elements in the Marcellus shale, Huntingdon, PA
Analyses are reported in ppm or wt% as indicated. Data from Liermann et al. (2011).

TRACE METAL	ABUNDANCE	MAJOR ELEMENT	ABUNDANCE
Co	37 ppm	SiO_2	55%
Cu	18 ppm	Al_2O_3	16%
Mo	103 ppm	Fe_2O_3	6.9%
Ni	155 ppm	FeS_2	2.0%
U	4.4 ppm	K_2O	4.5%
V	291 ppm	MgO	1.6%
Zn	142 ppm	CaO	0.51%
Fe (tot)	5.6%	Na_2O	0.10%
Fe^{II}	0.79%	MnO	0.41%
Fe^{III}	4.8%	P_2O_5	0.12%
C	1.3%	TiO_2	0.89%
S	1.0%	Total oxide	86%

Shale mineral composition

The shale's average composition is 20% quartz silt, 50% clay minerals, 5% pyrite, and 25% calcite with varying amounts of feldspars, dolomite, siderite, gypsum, pyrite, marcasite, and barite (Hosterman 1993). The clays consist of 15% chlorite, 70% illite, and 15% mixed illite-smectite; no kaolinite is present, unlike some other Devonian black shales in the Appalachian basin (Hosterman 1993).

Flowback water elemental composition

Element/Species												
units	ng mL-1	ng mL-1	ng mL-1	ng mL-1	ng mL-1	ng mL-1	ng mL-1	ng mL-1	ng mL-1	ng mL-1	ng mL-1	ng mL-1
ID	V	Cr	Co	Cu	Zn	Sr	Zr	Mo	Cd	Ba	U	Pb
M 01	<DL	0.167	24.2	3.71	152	109	0.028	<DL	0.249	38.4	0.130	0.323
M 02	<DL	<DL	5.70	<DL	43.0	38.6	<DL	<DL	<DL	41.6	<DL	0.077
M 03	<DL	<DL	24.5	3.80	98.6	108	<DL	<DL	<DL	38.2	0.123	0.337
M 04	<DL	<DL	24.6	3.96	105	108	<DL	<DL	<DL	38.2	0.121	0.367
M 05	<DL	<DL	24.8	3.65	103	109	<DL	<DL	<DL	38.6	0.123	0.325
T-1A	0.05	0.087	5.81	0.637	53.5	48.3	0.025	<DL	0.078	41.6	0.011	0.037
T-2A	<DL	0.161	24.8	3.76	102	109	<DL	<DL	0.253	38.6	0.124	0.336
T-3A	0.02	0.171	24.8	3.67	100	108	0.017	<DL	0.247	38.4	0.124	0.323
T-4A	0.05	0.110	12.9	1.77	76.2	61.7	0.021	<DL	0.153	40.9	0.041	0.134
T-5A	0.06	0.159	24.7	3.68	140	109	0.021	<DL	0.258	38.7	0.123	0.325
G 01	0.02	0.163	25.0	3.87	280	108	<DL	<DL	0.252	38.5	0.123	0.366
G 03	<DL	<DL	389	60.5	838	583	<DL	<DL	0.802	<DL	1.59	76.1
G 04	0.05	0.035	16.8	0.106	252	37.0	0.015	<DL	0.004	29.8	0.001	0.424
G 05	<DL	<DL	50.2	47.9	214	1503	<DL	<DL	<DL	33.8	0.032	5.80
G 06	<DL	<DL	175	140	832	89.4	<DL	<DL	<DL	52.2	0.782	516
BE 810.5	342	115	25.5	111	209	171	104	60.1	<DL	1505	10.3	46.7
BE 832	288	125	18.3	104	150	203	123	58.3	1.92	1309	10.5	24.3
BE 850	291	115	22.7	125	212	231	104	83.3	1.91	1276	14.7	24.5
BE 874	274	104	22.2	110	50.5	165	109	44.3	1.22	1188	7.09	26.1
BE 892	413	109	23.2	159	454	162	104	117	6.18	1211	15.4	24.7
BE 896	308	56.9	11.2	143	77.0	348	36.8	64.2	0.338	1586	8.57	21.7
BE 910	565	83.1	23.7	201	1323	158	66.3	242	19.7	753	40.9	31.4
Production water	<DL	<DL	1.06	1716	4508	4426000	<DL	<DL	<DL	6858000	<DL	6.18

What is in the fracking fluids?

- A report released by the U.S. House Committee on Energy and Commerce summarized that gas and oil companies use 750 different chemicals in their fracking fluids. 29 of these chemicals are known or possible carcinogens, regulated under the Safe Drinking Water Act for their risks to human health, or listed as hazardous air pollutants under the Clean Air Act.
- We found data for 11 of these chemicals above detection limits at one or more sample sites so we added those to the database.

What constituents have we put into ShaleNetwork database so far*?

- pH, Na, K, Mg, Ca, Sulfate, Chloride, Bromide, NH_4, Nitrate, Nitrite, Total N, Acidity, Alkalinity, BOD, COD, Hardness, TDS, Specific conductance, TSS
- Al, As, Ba, Be, B, Cd, Cr, Co, Cu, Fe, Pb, Li, Mg, Mn, Hg, Mo, Ni, Pb, Se, Ag, Sr, Th, U, Zn
- Gross alpha, Gross beta, Ra-226, Ra-228
- Acetophenone, Benzene, Bis(2-ethylhexyl) phthalate, Ethylbenzene, Ethylene glycol, Methanol, Methylene blue active substances, Napthalene, Oil and grease, Phenolics, Toluene, Xylenes

*As of April 22, 2012

No specific measurements are required and much of the metadata can be left blank (*everyone does not have to provide everything)*

However, some metadata are ***required*** for input into the database (e.g. **latitude*, longitude*, date of sampling, sample medium, data source, what was measured, units,**etc.)

**except for "fuzzy locations", discussed later*

What about data quality?

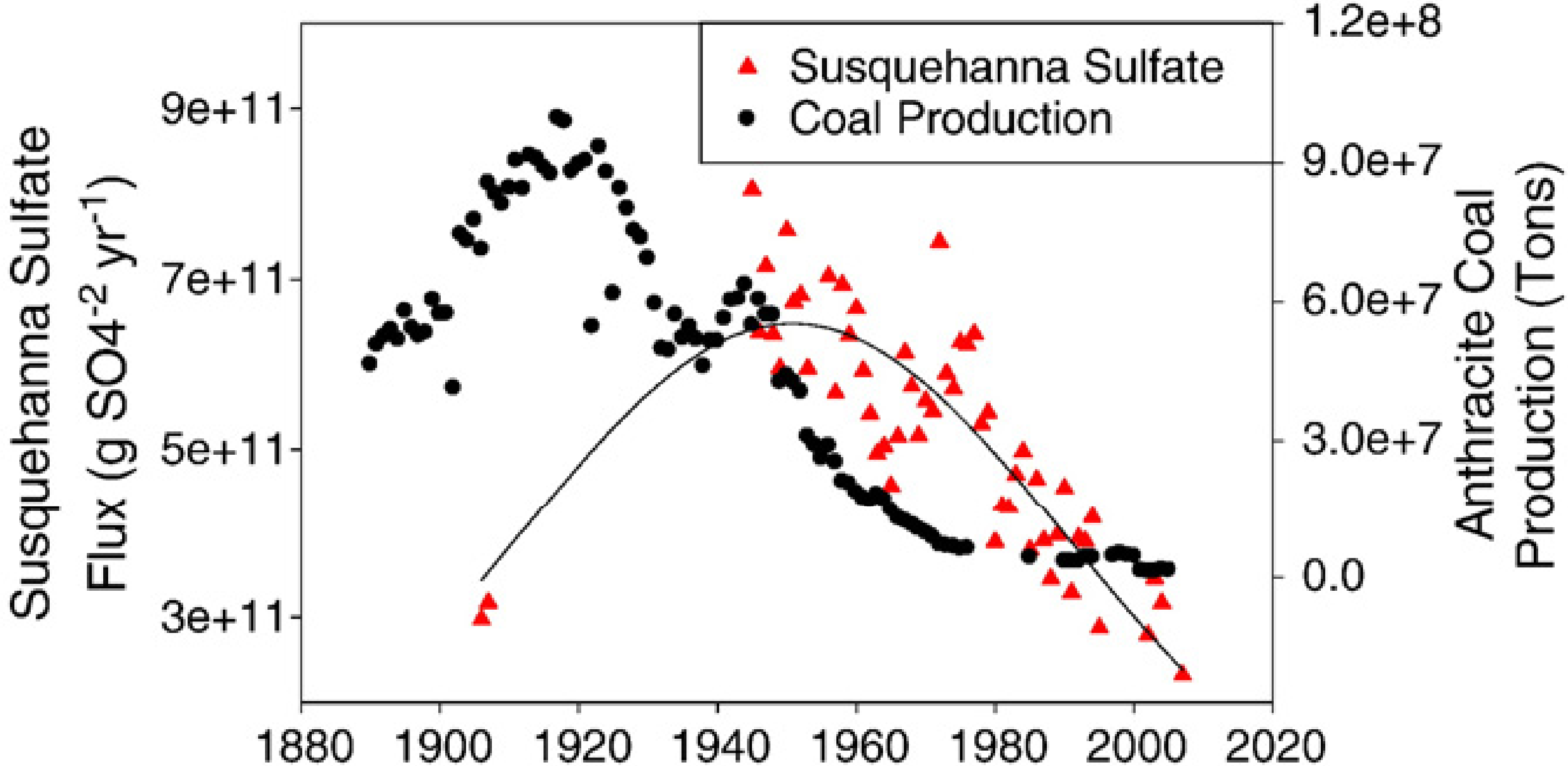
- We seek data from any group using established data protocols -- from industry sources, government sources, university sources, nonprofits, citizen scientists
- Our basic philosophy is that even published peer-reviewed or gov't data has problems associated with it, so as much as possible we want to put data online with appropriate metadata for researchers to assess…THE BEST WAY TO ASSURE DATA QUALITY IS TO PUT IT ONLINE FOR SCRUTINY
- The metadata includes as much information as possible about data quality
- If problems are found in data we will note it and possibly remove the problematic data
- Publications will be noted where they are available; likewise, use of ALLARM protocol will be noted for citizen groups (and some such protocol will be required)

CUAHSI ODM is consistent with the practice of other data systems where QualityControlLevelCode =

- <u>"0" - Raw Data</u> (Raw data is defined as unprocessed data and data products that have not undergone quality control. Depending on the data type and data transmission system, raw data may be available within seconds or minutes after real-time. Examples include real time precipitation, streamflow and water quality measurements.)
- <u>"1" – Quality Controlled Data</u> (Quality controlled data have passed quality assurance procedures such as routine estimation of timing and sensor calibration or visual inspection and removal of obvious errors. An example is USGS published streamflow records following parsing through USGS quality control procedures.)
- <u>"2" –Derived Products</u> (Derived products require scientific and technical interpretation and include multiple-sensor data. An example might be basin average precipitation derived from rain gages using an interpolation procedure.)
- <u>"3" –Interpreted Products</u> (These products require researcher (PI) driven analysis and interpretation, model-basedinterpretation using other data and/or strong prior assumptions. An example is basin average precipitation derived from the combination of rain gages and radar return data.)
- <u>"4" –Knowledge Products</u> (These products require researcher (PI) driven scientific interpretation and multidisciplinary data integration and include model-based interpretation using other data and/or strong prior assumptions. An example is percentages of old or new water in a hydrograph inferred from an isotope analysis.)
- <u>"5" -- ALLARM protocol</u> (Indicates the sampling team was trained by ALLARM to use the ALLARM protocol)

When?

We are seeking new data but we are also data mining (looking for old data) so we can look for baseline



Susquehanna River sulfate fluxes and Pennsylvania anthracite coal production. The Susquehanna River sulfate fluxes are modeled from USGS data and were fit with a curve in order to predict fluxes for periods where there are no records.

Raymond and Oh, 2009

Example of data mining: chemistry of brines that have been produced in traditional oil and gas wells in PA (may help us understand flowback)

Sample	Temperature (°C)	Conductivity (µS/cm)	Total dissolved solids, measured (g/L)	Total dissolved solids, calculated (g/L)	Density (g/ml)	Eh (V)	pH (units)	Li (mg/L)	Na (mg/L)	K (mg/L)	Mg (mg/L)	Ca (mg/L)	Sr (mg/L)	Ba (mg/L)	Mn (mg/L)
ED–82–01	13	190,000	213	202	1.134	0.150	6.2	38.1	56,700	190	2,520	18,000	691	171	17.7
–02	19	192,000	—	207	1.142	.110	6.6	46.3	58,300	192	2,500	18,800	1,490	843	16.6
–03	24	188,000	223	207	1.142	.150	6.45	45.5	58,500	193	2,520	19,000	1,470	815	15.8
–04	15	183,000	259	186	1.129	.133	6.5	35.1	52,100	130	2,410	17,100	1,290	1,020	21.1
–05	14	204,000	259	248	1.163	.134	6.45	47.3	63,500	190	2,880	24,700	2,340	1,840	26.7
–06	16	199,000	—	253	1.168	.100	6.5	47.8	63,700	200	2,850	25,100	2,420	2,010	27.7
–07	14	204,000	—	299	1.201	.021	6.2	61.3	71,900	352	3,140	34,400	6,080	698	68.2
–08	11	128,000	—	116	1.093	–.001	6.8	20.2	30,600	290	1,650	11,000	404	174	25.5
–09	14	196,000	—	244	1.159	.180	6.3	43.3	61,900	200	2,970	24,500	1,420	7.1	18.6
–10	14	167,000	—	172	1.115	.010	6.8	23.4	47,400	126	2,150	14,900	578	623	15.3
–11	15	185,000	222	205	1.138	.095	6.5	47.2	58,900	180	2,600	17,700	936	668	13.3
–12	13	195,000	—	12	1.006	.055	7.3	.3	3,400	44	195	1,580	22	17.0	1.1
–13	16	114,000	—	93	1.068	.055	6.9	2.1	25,000	177	1,570	8,150	129	2.4	3.3
–14	24	144,000	—	132	1.089	.089	6.4	6.1	35,000	189	2,110	12,700	117	.8	10.9
–15	13	75,000	—	57	1.037	.129	6.5	2.0	15,200	51	910	3,930	124	355	4.1
–16	11	134,000	128	109	1.079	.055	6.9	7.2	30,000	85	2,050	11,800	152	2.8	11.7
–17	13	112,000	100	91	1.062	.033	7.1	4.3	24,000	64	1,510	8,680	141	ND	7.5
–18	15	138,000	129	116	1.083	.044	6.8	6.2	31,000	83	2,180	12,600	151	ND	11.1
–19	—	18,100	—	10	1.004	.372	6.75	.4	3,000	49	100	920	5	6.8	2.2
–20	10	93,000	73	72	1.047	–.001	6.6	.6	19,800	41	1,150	5,780	191	ND	4.5
–21	19	87,900	68	67	1.043	.072	6.6	1.4	17,400	73	1,040	6,110	39	ND	4.5
–22	22	157,000	—	152	1.106	.095	6.2	19.1	37,600	948	2,050	16,600	477	ND	43.3
–23	22	102,000	88	82	1.052	.117	6.7	1.2	21,800	66	1,400	6,490	137	51.7	.7
–24	—	99,700	—	—	—	—	—	—	—	—	—	—	—	—	—
–25	—	128,000	—	—	—	—	—	—	—	—	—	—	—	—	—
–26	—	101,000	—	—	—	—	—	—	—	—	—	—	—	—	—
–27	13	195,000	—	257	1.179	.055	6.3	86.8	42,400	4,860	4,150	41,600	1,610	ND	49.4
–28	13	201,000	—	246	1.175	.010	5.9	63.2	59,900	1,650	2,750	26,900	1,030	3.8	64.9
–29	14	—	—	310	1.212	—	—	71.5	78,900	1,730	3,790	36,300	1,430	3.5	80.0
–30	10	185,000	217	210	1.135	.078	6.5	52.2	51,100	1,400	2,160	22,000	893	3.2	44.9
–31	8	205,000	—	263	—	.033	6.46	63.8	65,300	1,580	3,120	30,100	1,160	3.9	71.1
–32	—	188,000	—	—	—	—	—	—	—	—	—	—	—	—	—
–33	—	188,000	—	—	—	—	—	—	—	—	—	—	—	—	—
–34	—	191,000	—	—	—	—	—	—	—	—	—	—	—	—	—
–35	—	154,000	—	—	—	—	—	—	—	—	—	—	—	—	—
–36	15	208,000	286	259	1.181	.218	5.49	157	70,700	2,360	1,370	25,500	3,810	919	96.5
–37	28	118,000	106	101	1.067	—	5.63	105	24,400	978	797	8,930	4,400	1,510	6.2
–38	23	196,000	245	230	1.154	.141	6.14	277	61,300	2,580	1,580	17,600	8,930	3,890	5.6
–39	26	211,000	—	302	1.212	.177	5.65	315	79,900	3,180	2,050	23,800	13,100	4,370	5.7
–40	27	211,000	354	343	1.222	.205	5.53	315	83,300	3,890	2,390	28,400	12,800	3,680	5.8

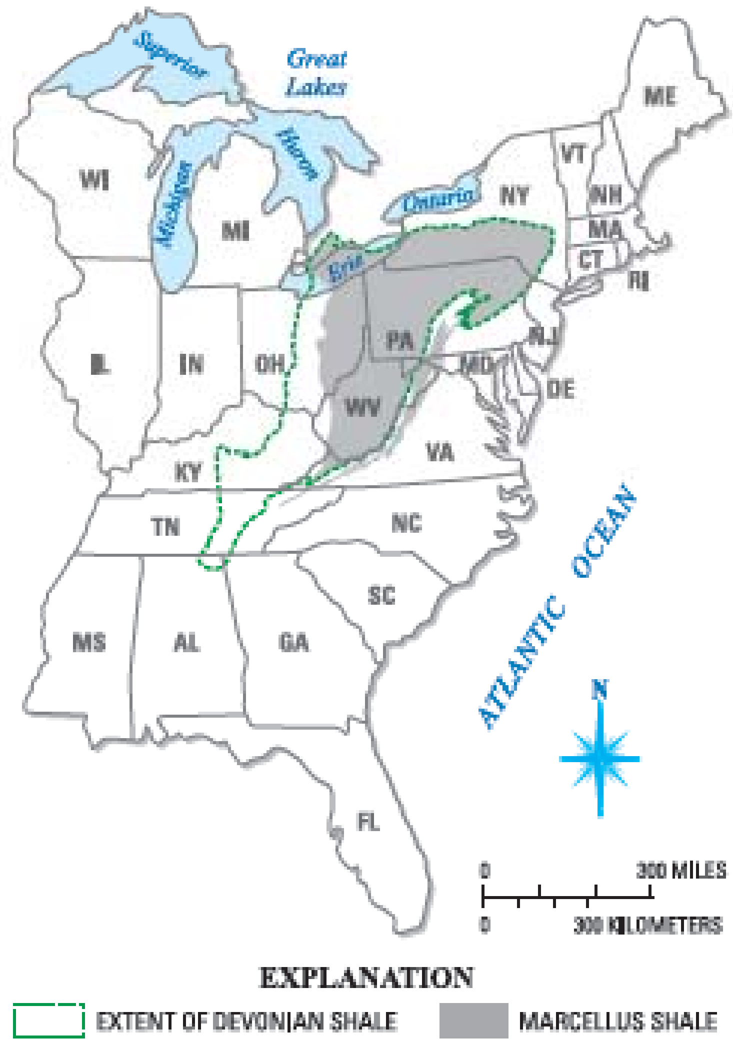
[1]ND, not detected.
[2]Tr, trace.

Dresel and Rose, 2010. Chemistry and Origin of Oil and Gas Well Brines in Western Penssylvania. Pennsylvania Geological Survey. 42-45

Where?

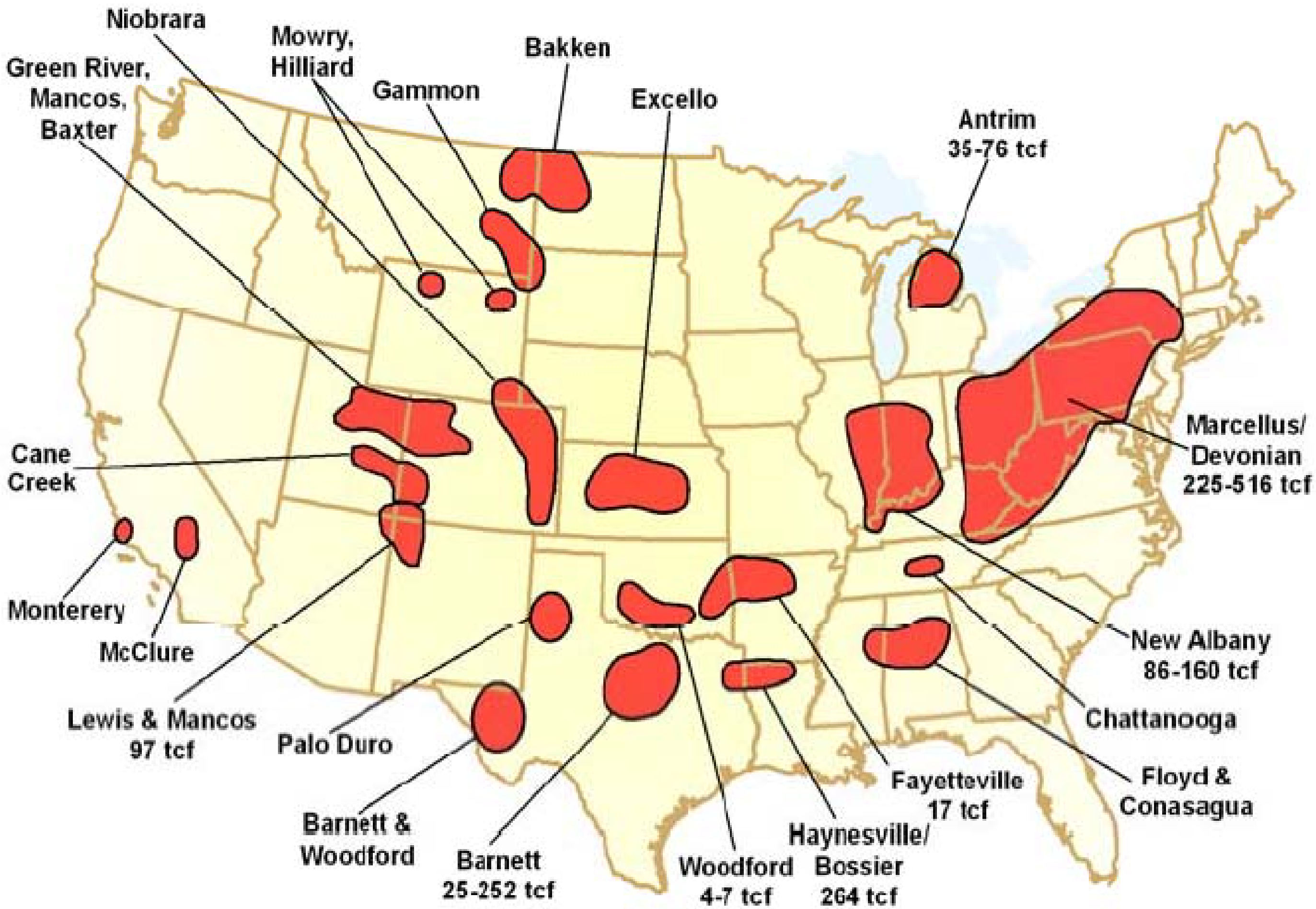
Where are the data being measured?

Our initial focus is on regions that are developing the Marcellus shale



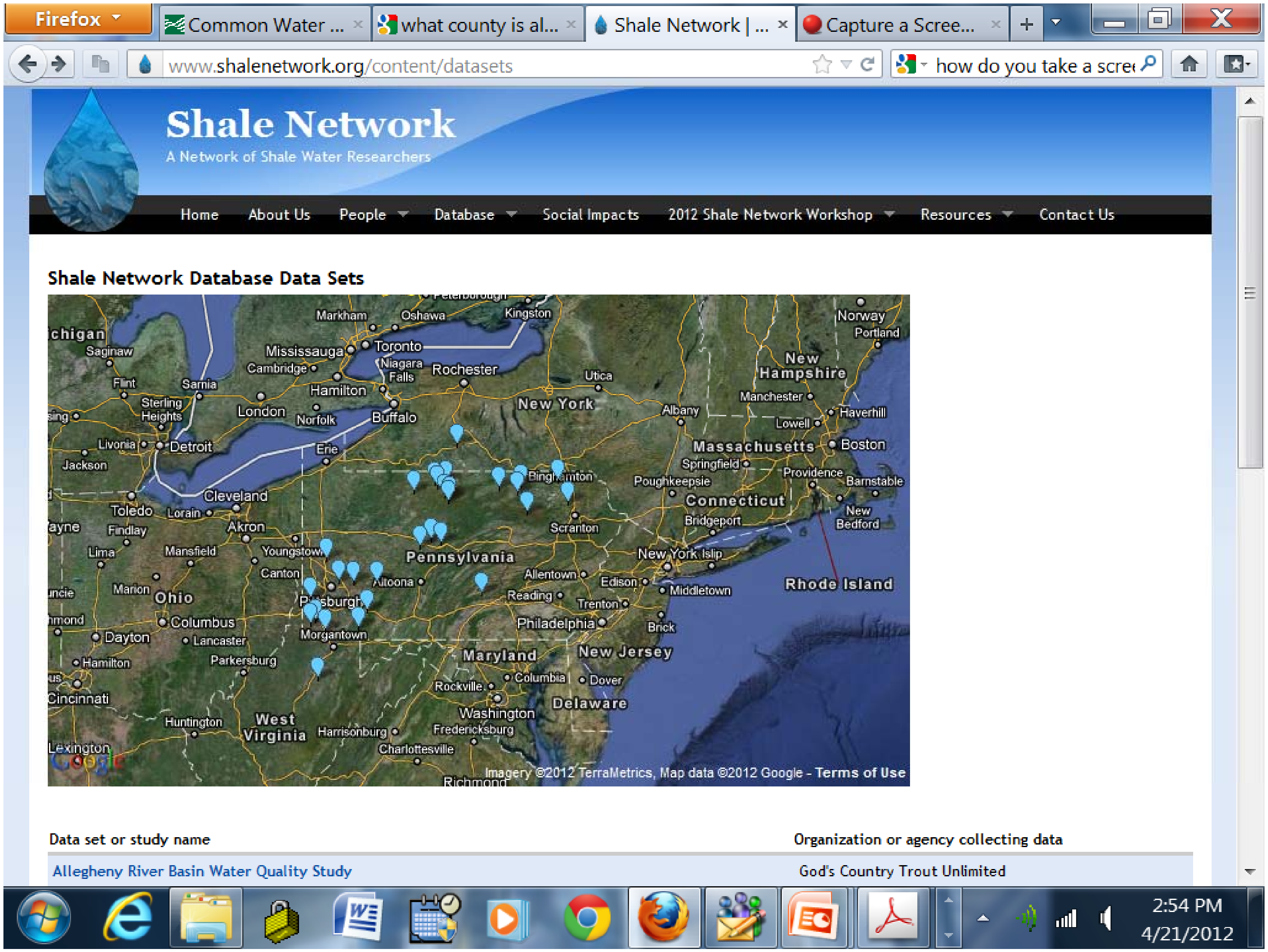
Soeder and Kappel, 2009

But there are many gas shale plays in the U.S.A. and compilation of data from all these gas-producing regions would be of eventual interest (but would require lots of work)



Arthur et al., 2008

Our home page www.shalenetwork.org will always show the datasets we have uploaded



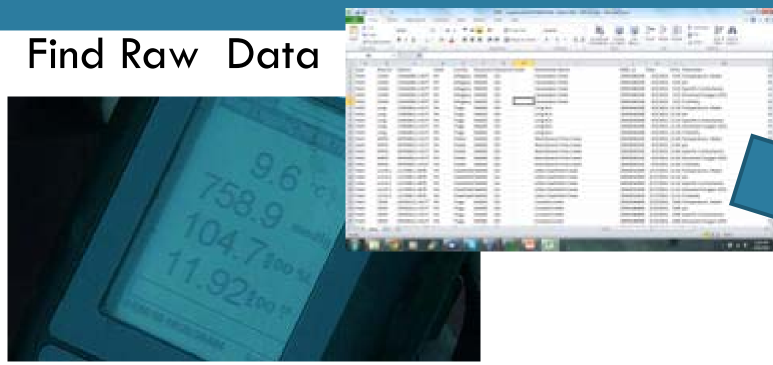
We can hide the locations for samples: fuzzy locations

- We have found that some groups (homeowners whose wells have been analyzed, industry, citizen scientists who want to keep their sample sites secret) do not want to publish sample or sensor locations online
- Our philosophy so far has been to put such data into the database as a "fuzzy datapoint": every data point must have an associated latitude and longitude but this location can be the midpoint of an area (e.g. Bradford County) instead of an exact location…and this fuzziness must be indicated in the metadata
- We hope that future studies will require release of data with fuzzy locations, rather than no release of data

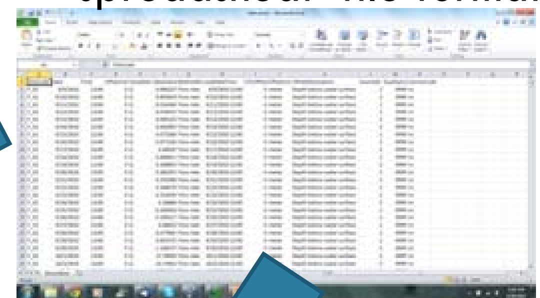
How?

How do our data wranglers organize and upload data into the database?

Find Raw Data

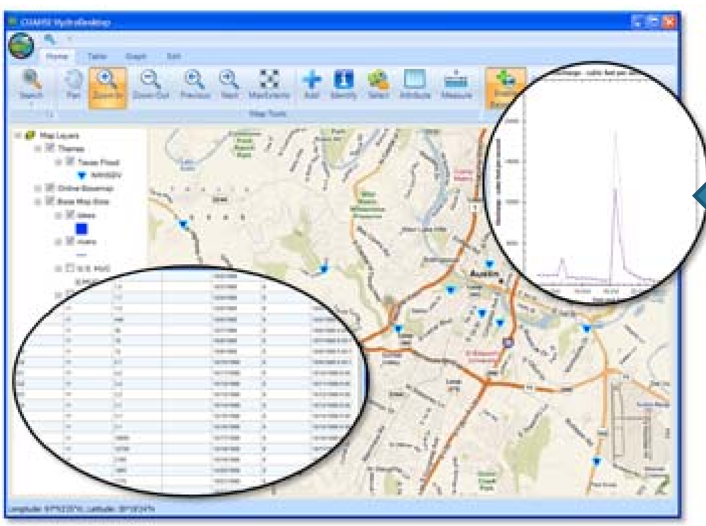


Put it into a specific spreadsheat file format



Upload the data to a Hydroserver (the computer that hosts the data so anyone can get to it online)

Register the data so that it can be harvested by Hydrodesktop (the online tool that enables people to find the data)



How will this change into the future?

- We have a team of Data Wranglers (*Maggie Peacock, Paul Grieve, Cesar Simon, Andy Lowie*) who will continue to put data in
- We are building an Excel spreadsheet for citizen scientists or others to organize their data, if they would like, so that it is easy to publicize online
- We have built an online tool at *www.ShaleNetwork.org* that allows registered ShaleNetwork members to upload their data (in any form) so that we can register it online

I don't want to put data into ShaleNetwork database .. how can I still share data?

- Talk to Jennifer Arrigo or Cesar Simon or Jorge Abad about setting up your own HydroServer
- Talk to us and we will coordinate with you to make choices about uploading your data so that it will be most useful
- We are more interested in helping put data online than we are in insisting that it go into the ShaleNetwork database: we want to help. (For example, we have interacted to help Wilkes Univ create their own database.)

What problems do we have?

- Finding data to put in…we need good data!
- Determining all the metadata (where was the data collected; how was it collected, etc.)
- Determining the correct vocabulary to describe data and metadata (this is harder than it sounds)
- Making the database useful
- We need to start to make choices about locations and parameters
- We need to fix some things in our uploads
- For example, it is possible to determine whose data has been uploaded but we do not think that data attribution is good enough yet
- This is only a three year project and the need is long term

Why?

Summary: A list of our goals and our progress

- Goal 1, To identify groups collecting water data in region of shale-gas extraction (starting with Marcellus): See our homepage at shalenetwork.org
- Goal 2, Create a sustainable network of the groups by hosting an annual meeting: Welcome to our first annual meeting!
- Goal 3, Work with CUAHSI to create a database that can establish background and can document impacts: See ShaleNetwork data by using HydroDesktop
- Goal 4, Train two graduate students in database development and use for communities: Please be sure to meet Cesar Simon (Pitt Univ) and Paul Grieve (Penn State)
- Goal 5, Facilitate community groups in collecting, organizing, and interpreting their data: So far we have begun to work with Youghiogheny Riverkeepers and God's Country
- Goal 6, Evaluate hydrogeochemical data using GIS in relation to population and economic data

Marcellus flowback waters have a signature that you can see in the database

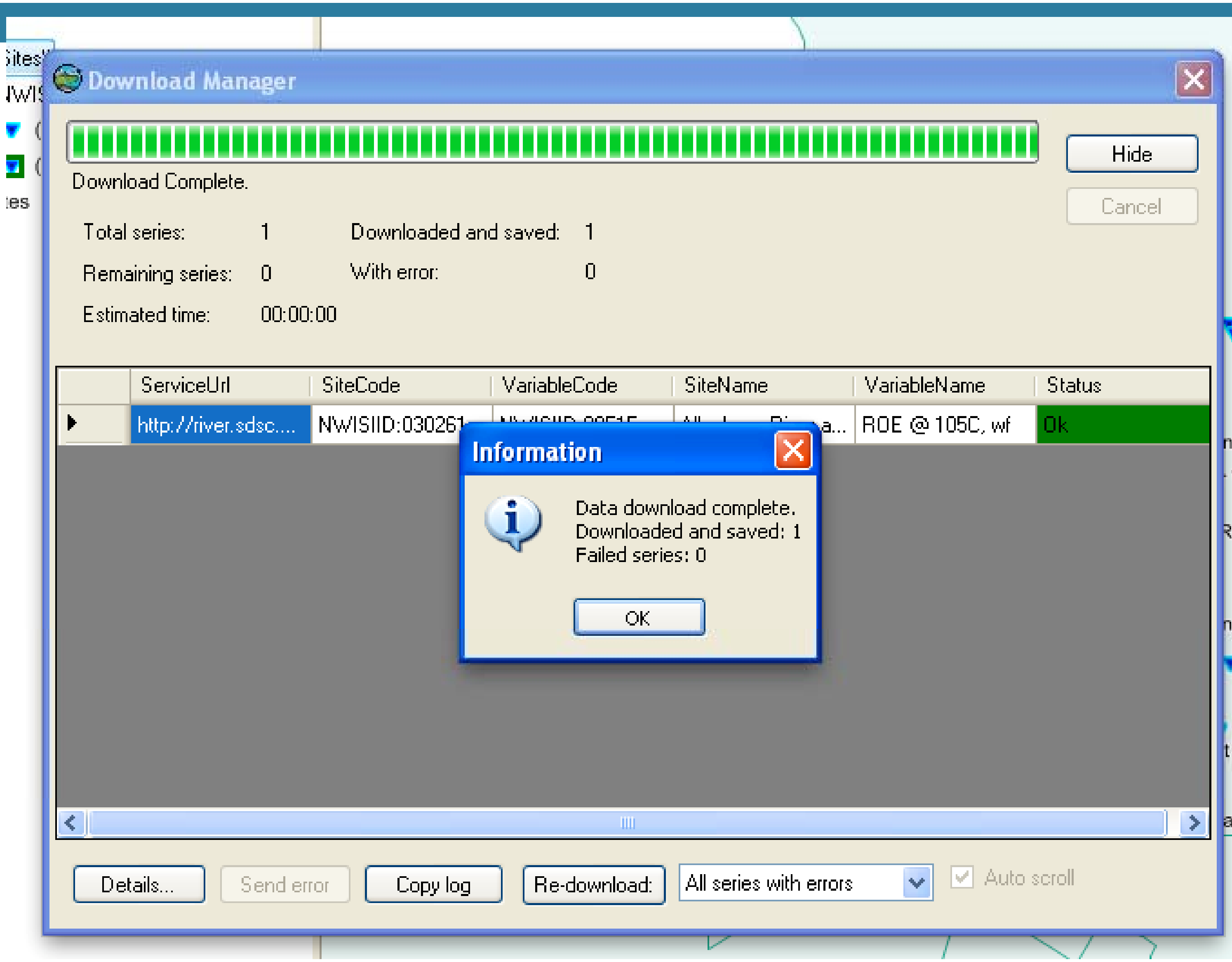
- High TDS, Specific Conductance
- Often have very high Na, Ca, Cl, Ba, Sr, Br
- Can have high NORMs (e.g., Ra)
- Compared to AMD, relatively low concentrations of constituents relative to H^+, Fe and SO_4
- Near-neutral pH

Based on data in database, conversations with Carl Kirby, Art Rose, Dave Yoxtheimer, publications, PADEP data, our own measurements

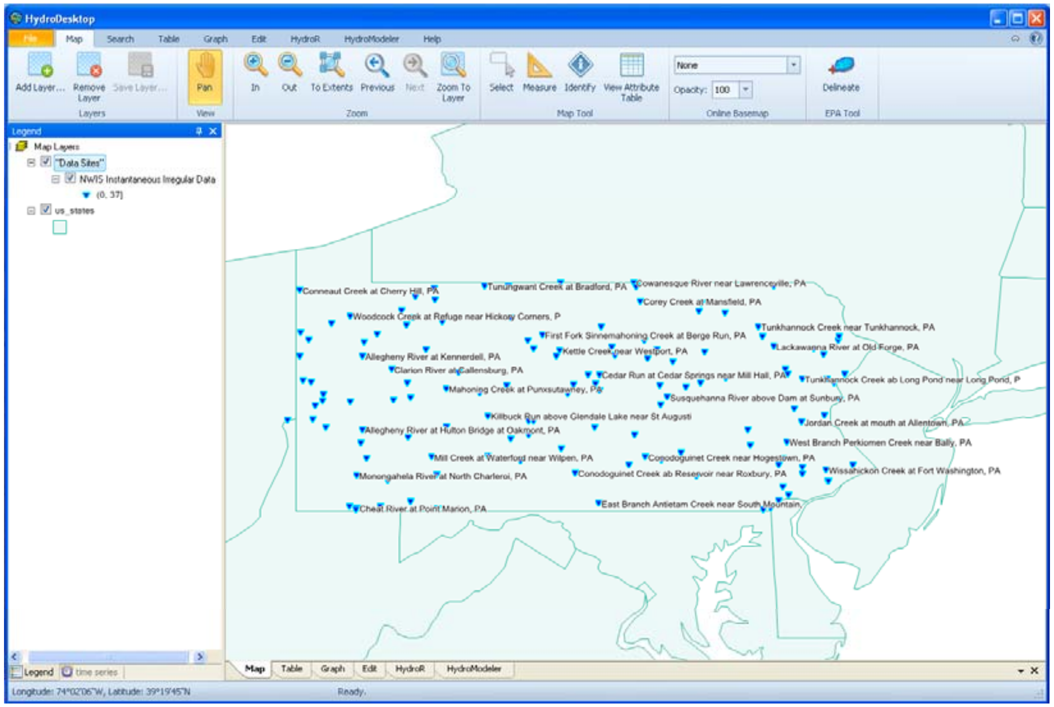
How will people access the database?

- We are partnering with CUAHSI to provide access to the database.
- CUAHSI maintains HydroDesktop, an online program that allows anyone to access and play with databases of water quality and quantity

Anyone can download ShaleNetwork data using HydroDesktop, regardless of whether they are a member of ShaleNetwork



Why are we using HydroDesktop?



We want to

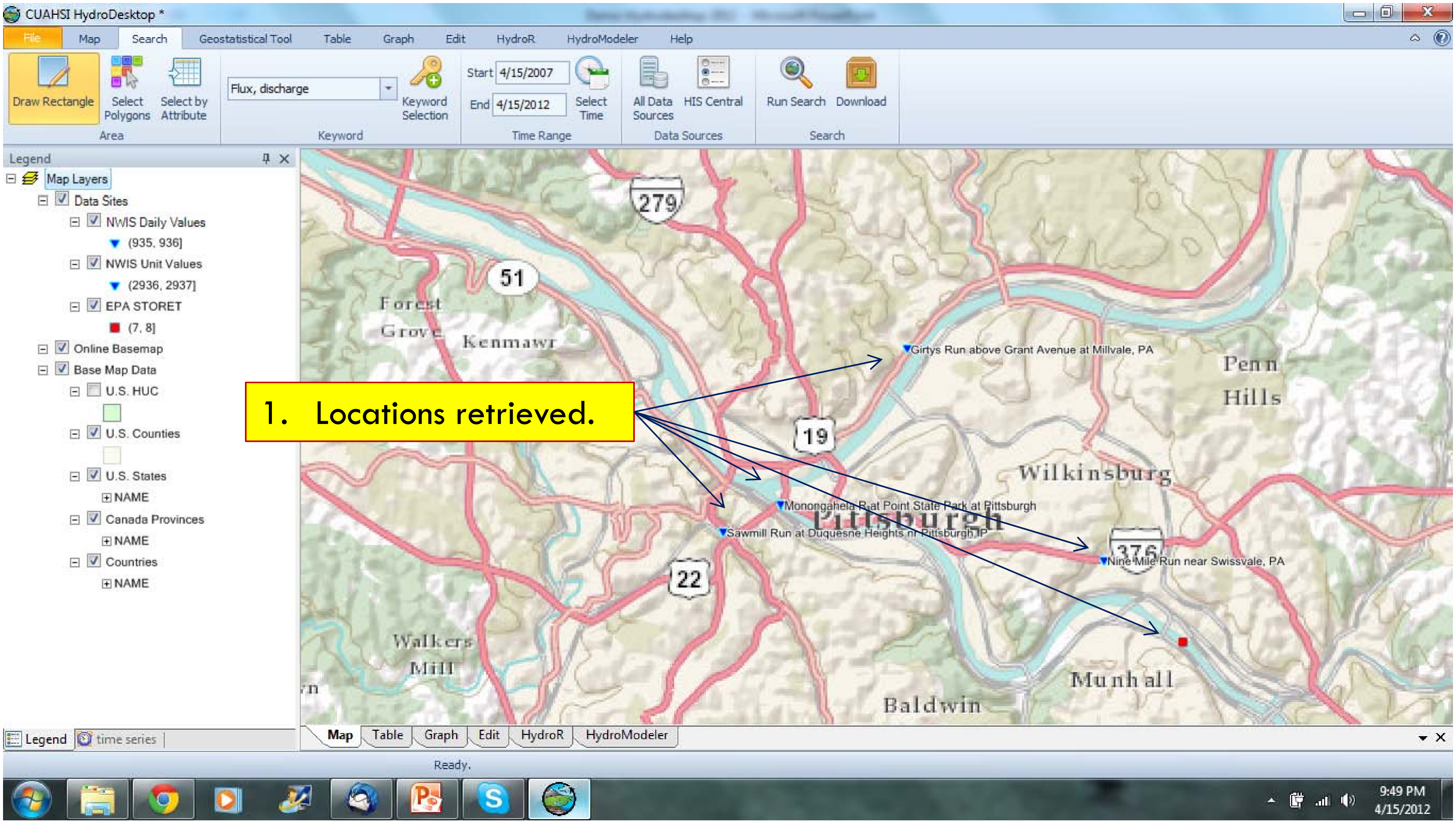
put our data where other data is located

We want to use our limited funds for data wrangling, not writing computer programs

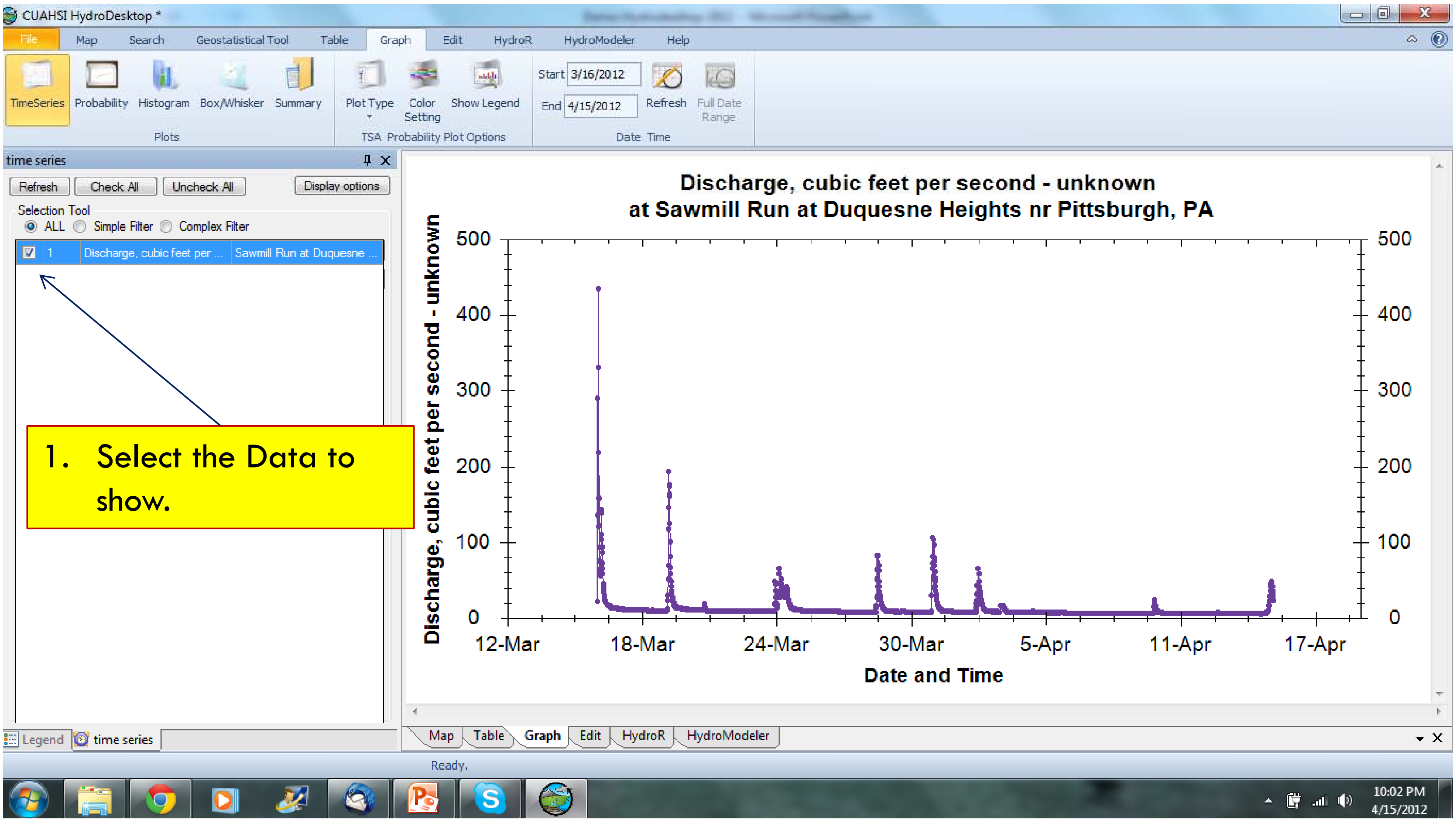
We want to create something that can last beyond one NSF grant of 3 years

SEARCH DATA

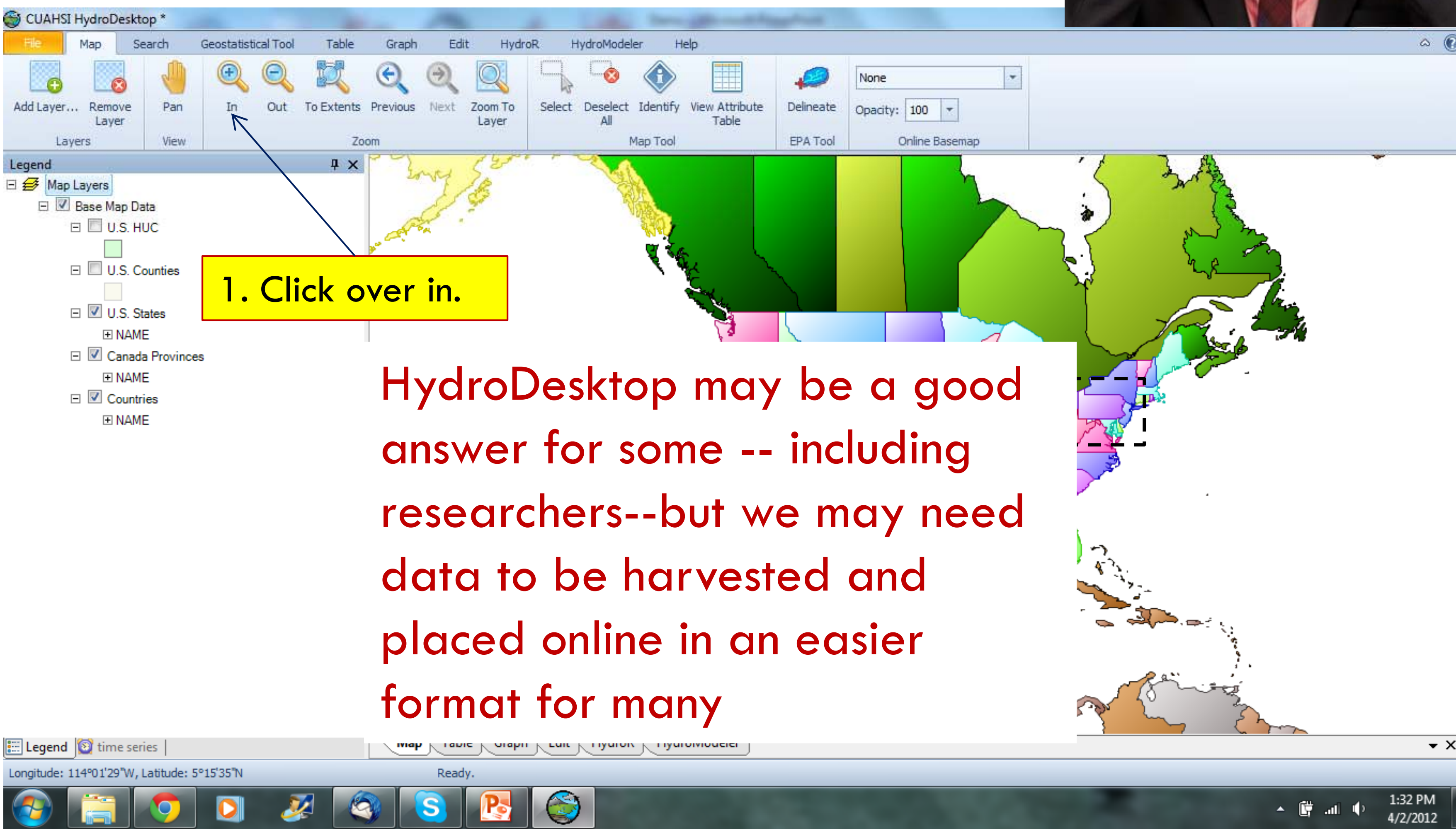
HydroDesktop is powerful



HydroDesktop will graph data for you



HydroDesktop is easy if you know GIS but it is not easy for everyone



HydroDesktop may be a good answer for some -- including researchers--but we may need data to be harvested and placed online in an easier format for many

Closing Remarks

Our Idea of the Shale Network

- A network of data (we welcome all appropriate data …you can access the data with HydroDesktop)
- A network of sites (sites where water quality or quantity data have been measured, see map at ShaleNetwork.org)
- A network of developing knowledge (online information will enable understanding)
- A network of people (people willing to share data…Please join us by registering at http://www.shalenetwork.org/user/register. We will have an online forum and we welcome input)

Thank you!

- The ShaleNetwork team includes Penn State (Sue Brantley, Maggie Peacock, Kathy Brasier, Dave Yoxtheimer, Chuck Anderson, Paul Grieve, X. Niu), Dickinson College (Candie Wilderman, Julie Vastine), Pitt University (Jorge Abad, Radisav Vidic, Cesar Simon), CUAHSI (Rick Hooper, Jennifer Arrigo, Yoori Choi, Kim Schreuders)
- We especially thank our staff, Debbie Lambert and Tracy Bernier for all the hard organizational work!

Please register to become a member of the ShaleNetwork and please share data

- The Shale Network is open to people who monitor water quality, who research water issues, who facilitate water monitoring in areas of shale gas development, or who are members of organizations engaged in these activities. All members must be willing to share water quality or quantity data with the Network. To join, register at http://www.shalenetwork.org/user/register
- Once you register, you can share data with us directly online and we will upload it
- (If you do not want to be an official member, we will still accept data in any appropriate form)