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"Managing Climate Change and Securing a Future for the Midwest's Industrial Base"

Representing the MRCSP Today:
David Ball (Battelle)
Dr. Stephen Greb (Kentucky Geological Survey)
Dr. Mark Sperow (West Virginia University)
Dr. Neeraj Gupta (Battelle)

Presentation to:
DOE Regional Carbon Sequestration Partnerships
Annual Program Review Meeting
November 16, 2004
DOE Cooperative Agreement No. DE-FC26-03NT41981

MRCSP Mission

be the premier resource in its Region for identifying the technical, economic, and social considerations associated with CO_2 sequestration and creating viable pathways for its deployment.

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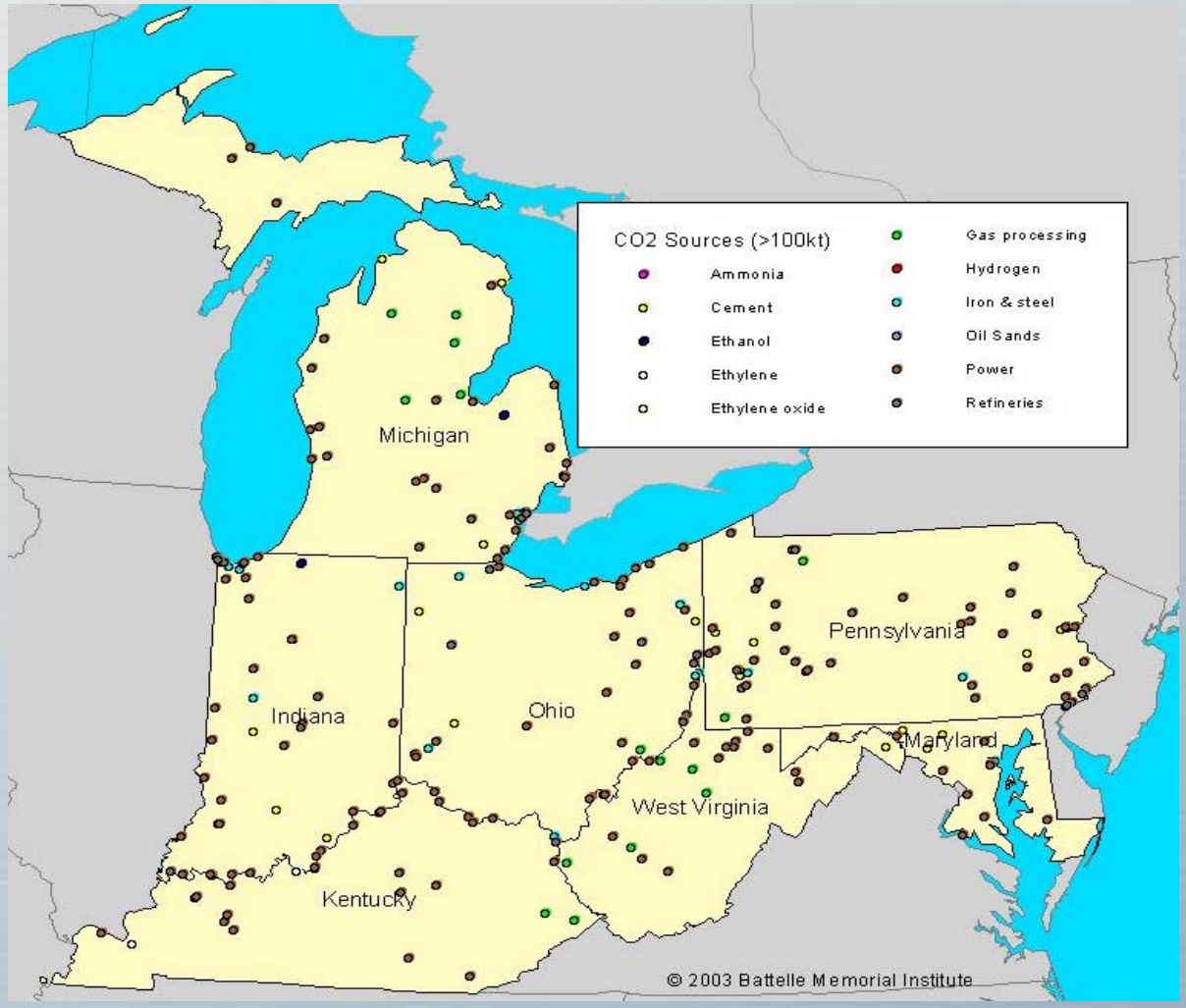
Snapshot of the MRCSP

- **Who:** 38-member team led by Battelle:
  - Leading research organizations in our Region
  - Major energy and agricultural entities operating in our Region
  - Key government and non-government organizations
- **What:** Assessing carbon sequestration opportunities
  - Technical and economic potential
  - Public acceptance
  - Regulatory Issues
- **Where:** Seven-State Region:
  - IN, KY, MD, MI, OH, PA, WV

Snapshot of our Region



The Nation's Engine Room

- Population: 50.8 million (one in six Americans)
- Gross Regional Product: $1,534 billion (16% of U.S. economy)
- 21.5 % of all the electricity generated in the U.S.
- 77% of the Region's electricity is generated from coal

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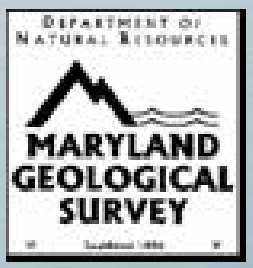
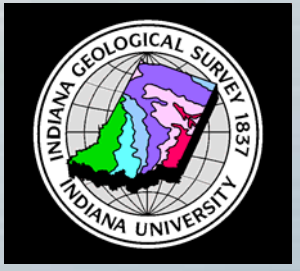
Industry Partners

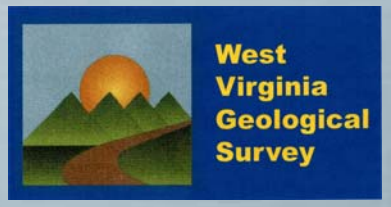
U.S. Department of Energy/NETL

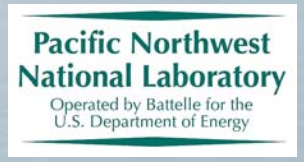
Ohio Coal Development Office

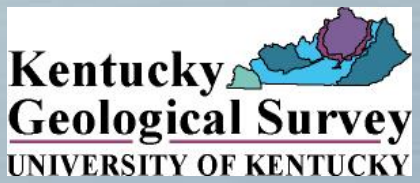
Research Partners



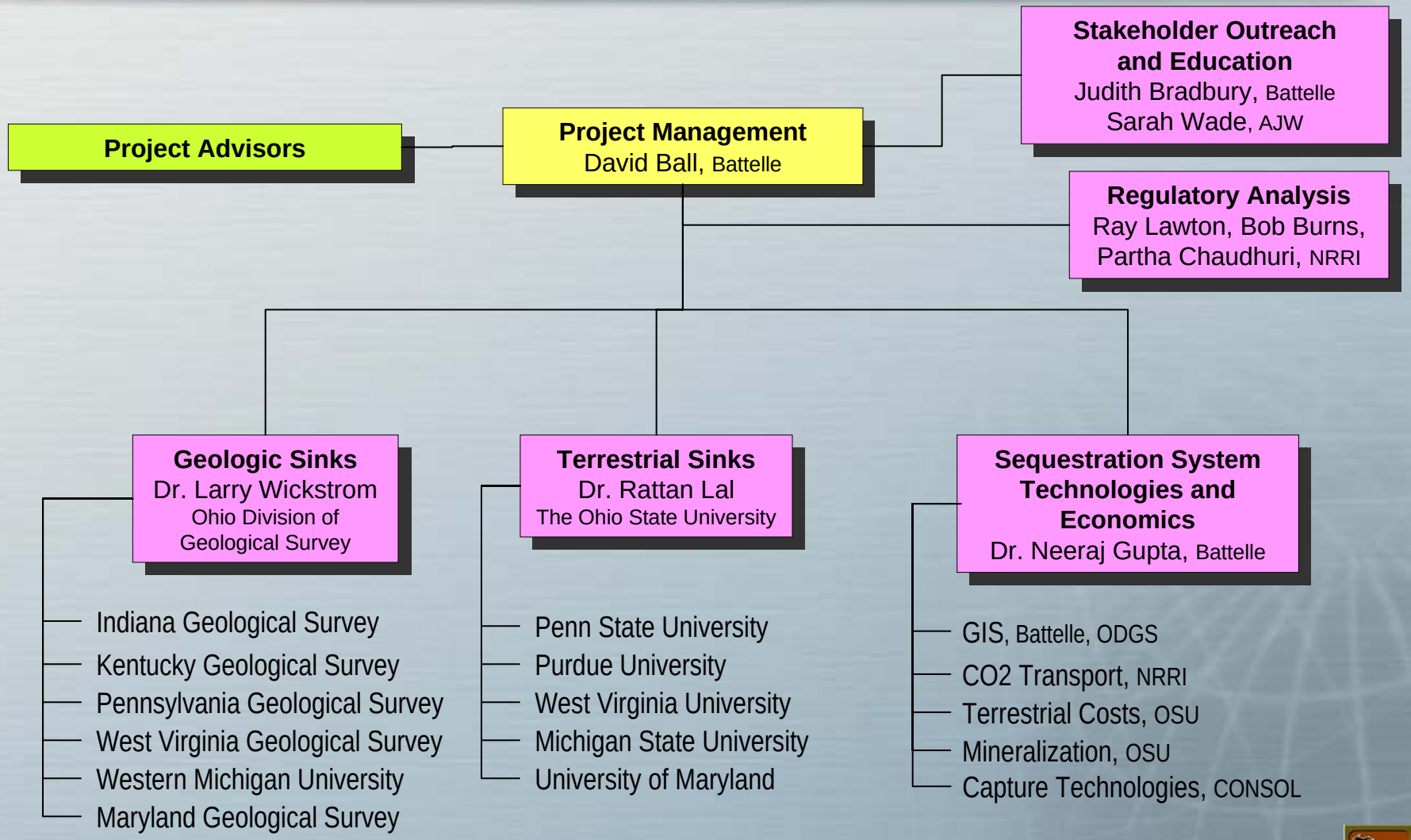








Phase I Project Organization



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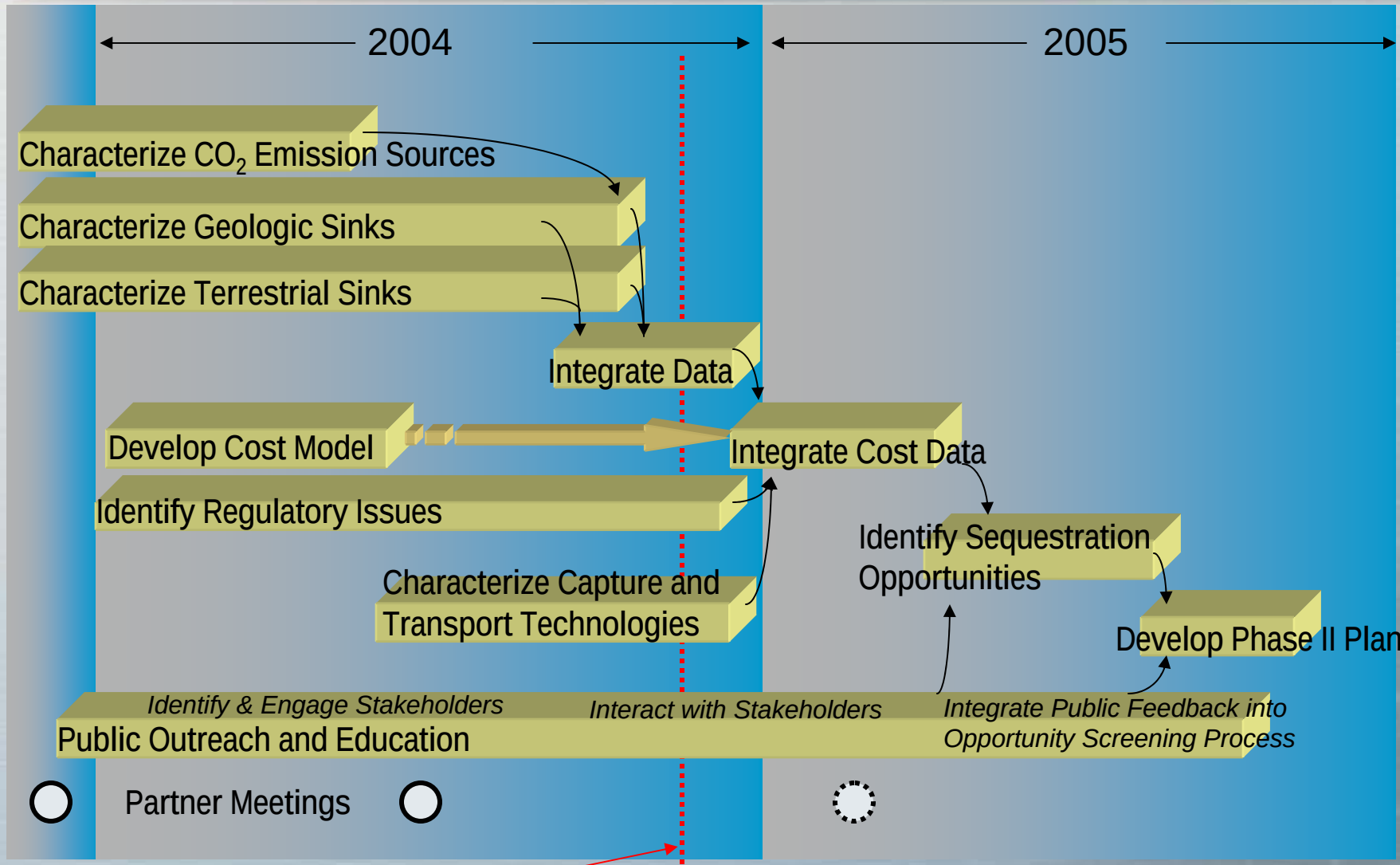
Phase I Project Plan



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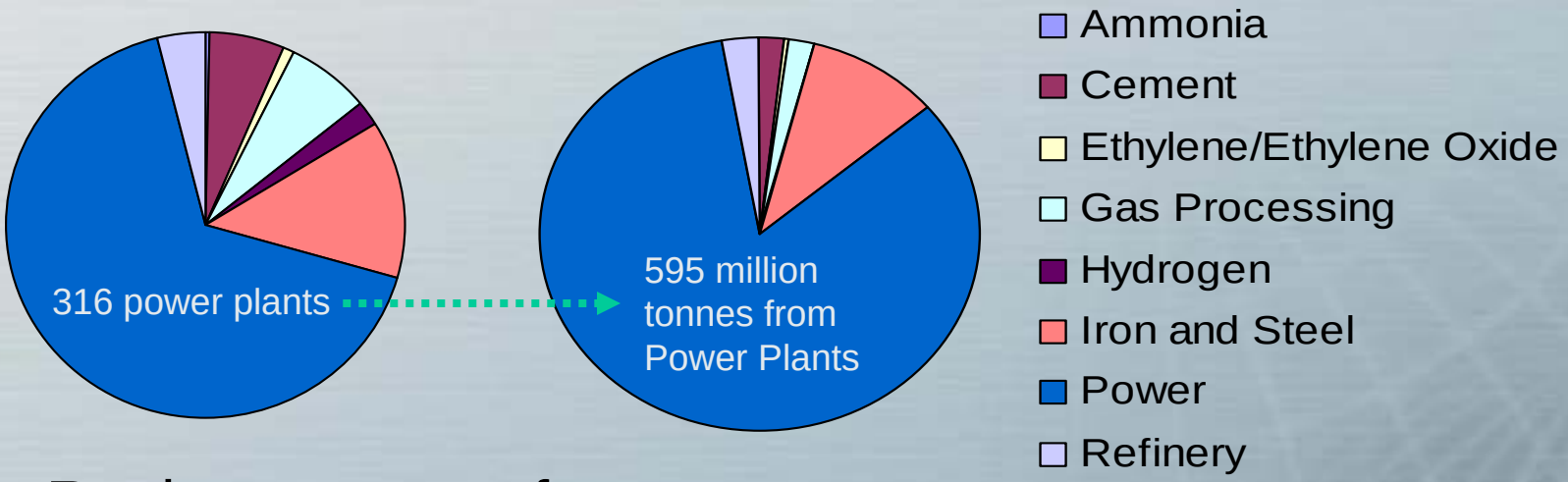
CO_2 Emissions in our Region

Our focus is on large point sources (>100,000 tonnes CO_2/yr)

474 Point Sources ⇨ 715 Million Tonnes CO_2 annually



Our Region accounts for:

- Over 26% of CO_2 emissions from power plants nationwide
- Our Region's point sources alone account for over 12% of total CO_2 emissions nationwide

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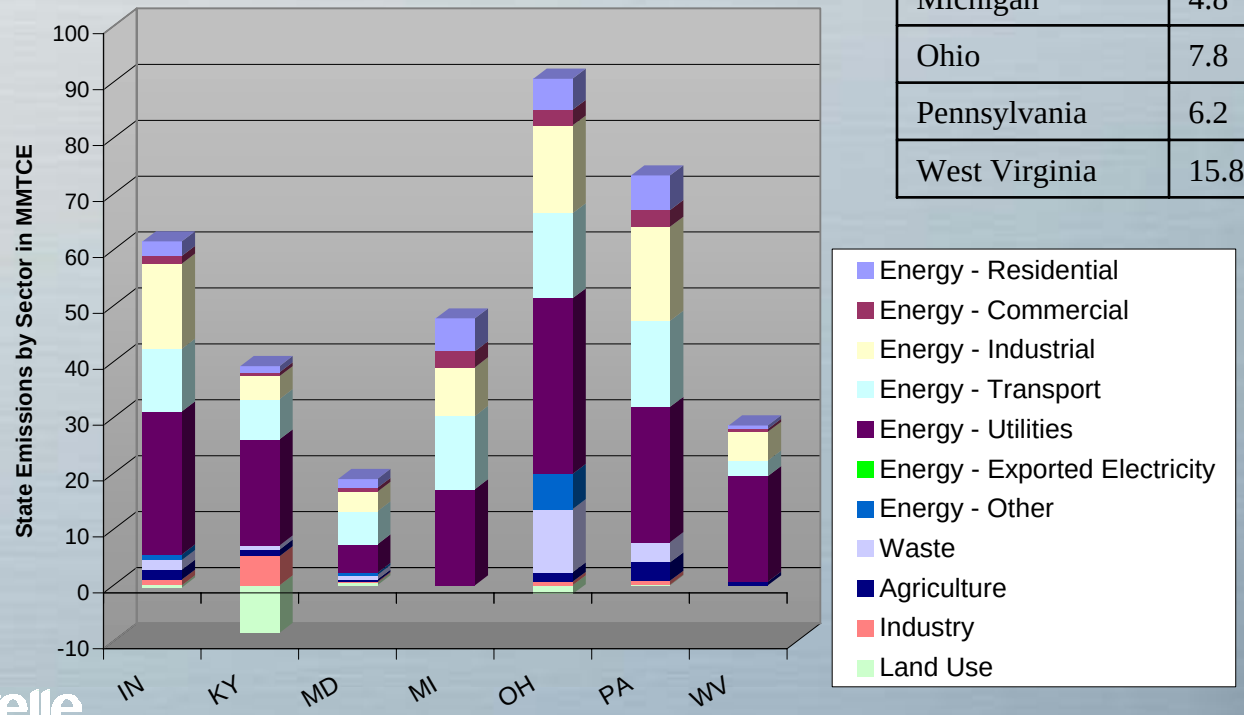
CO_2 Emissions in our Region

Carbon emissions may pose a significant future liability for the MRCSP region

State	GHG Emissions per Capita	GHG Intensity*
Indiana	10.0	337
Kentucky	8.8	323
Maryland	3.6	111
Michigan	4.8	156
Ohio	7.8	252
Pennsylvania	6.2	203
West Virginia	15.8	740

*Tonnes of Carbon Equivalent per $M GSP

Greenhouse Gas Emissions Makeup by State



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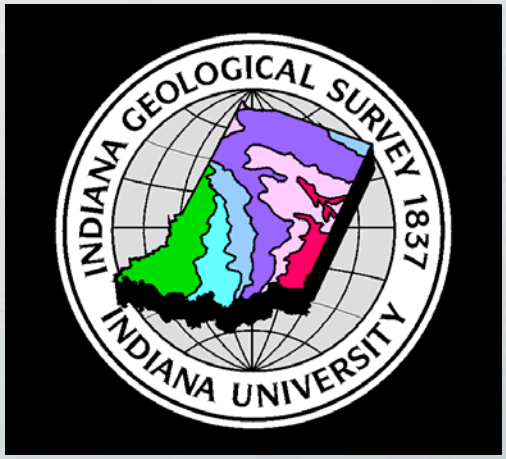
Characterizing our Region

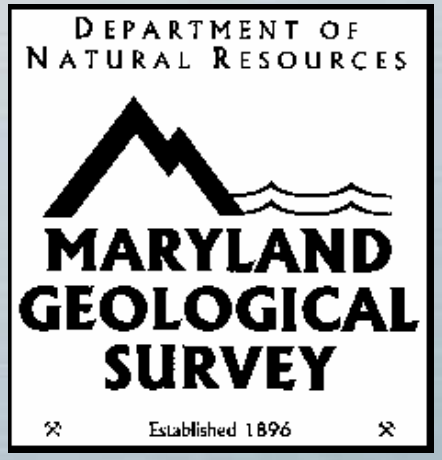
- Geological sequestration opportunities
  - Dr. Stephen Greb (Kentucky Geological Survey)
    - for Dr. Larry Wickstrom (Ohio Geological Survey)
- Terrestrial sequestration opportunities
  - Dr. Mark Sperow (West Virginia University)
    - for Dr. Rattan Lal (The Ohio State University)

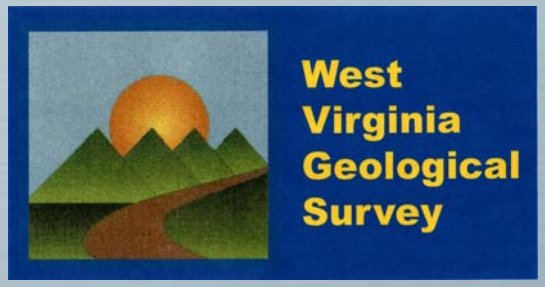
MRCSP Geologic Team Principles

- **Task Leader: Larry Wickstrom, Ohio Division of Geological Survey**
- **John Rupp – Indiana Geological Survey**
- **Stephen Greb – Kentucky Geological Survey**
- **Gerry Baum – Maryland Geological Survey**
- **John Harper – Pennsylvania Geological Survey**
- **Michael Hohn – West Virginia Geological and Economic Survey**
- **William Harrison III – Western Michigan University**

Team Partners are the Major Geologic Data Sources in this Region







A partnership of regional expertise

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MRCSP Geologic Characterization

- **Ambitious multi-state, multi-basin project**
- **Three major types of potential CO_2 injection reservoirs**
  - **Deep saline reservoirs**
  - **Oil and gas fields (active and depleted)**
  - **Coal seams and organic shales**
- **At least 9 regional potential injection reservoirs and several reservoirs of local importance**
  - ***The first time many of these horizons have been compiled into a relational GIS database***

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MRCSP Geologic Characterization

- **The main objective of this project is to evaluate the potential capacity for geologic sequestration of carbon dioxide in the member states.**
  - **Identify promising locations**
  - **Potential reservoir capacities**
  - **Potential for enhanced recovery (CBM, shale gas, conventional oil and gas)**

✦ ***Data and results generated will have a wide variety of applications***

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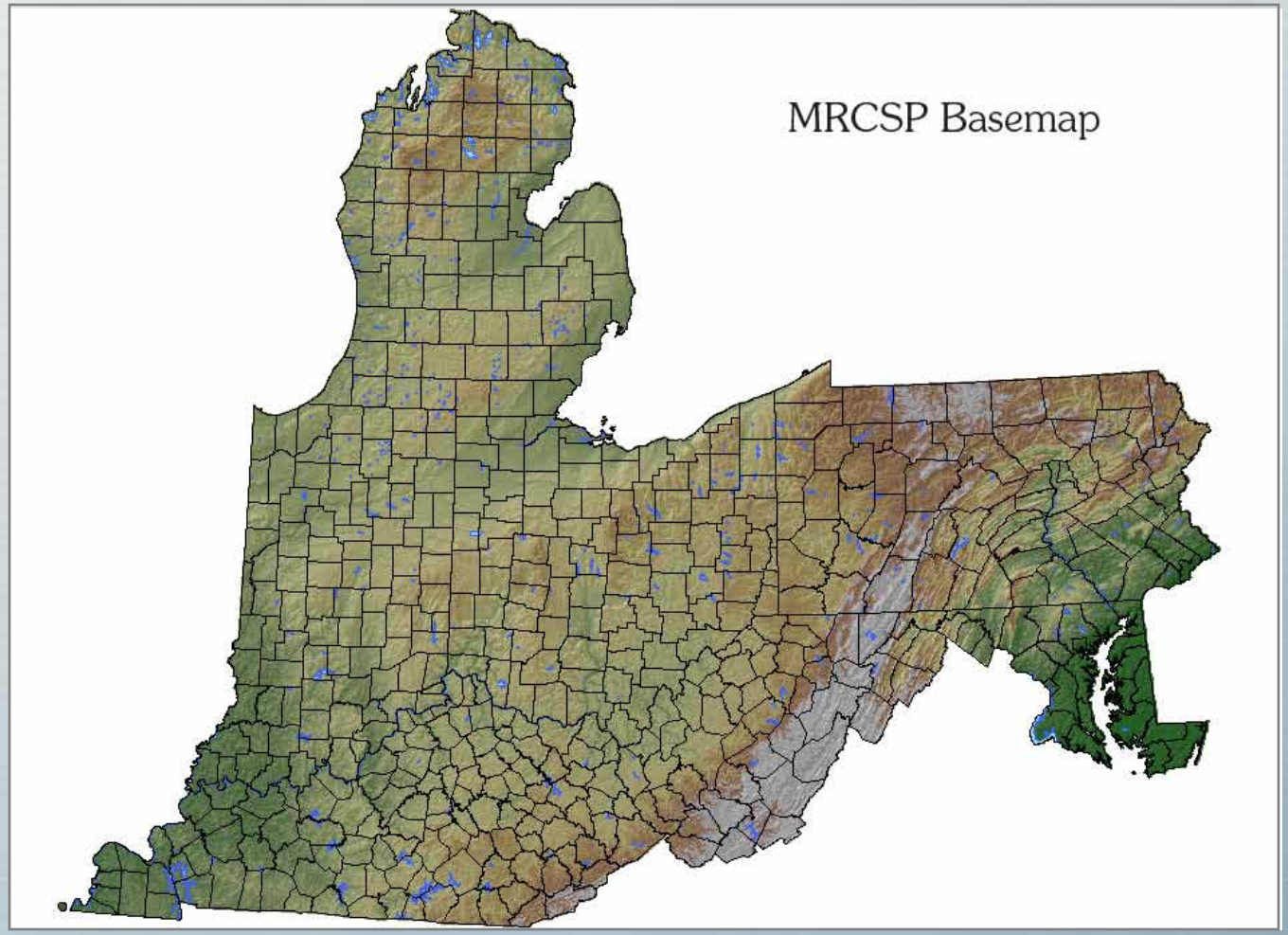
Where We Are



- **Diverse geology leads to diverse geologic sequestration options**

A region in which CO_2 sequestration will be environmentally and economically important

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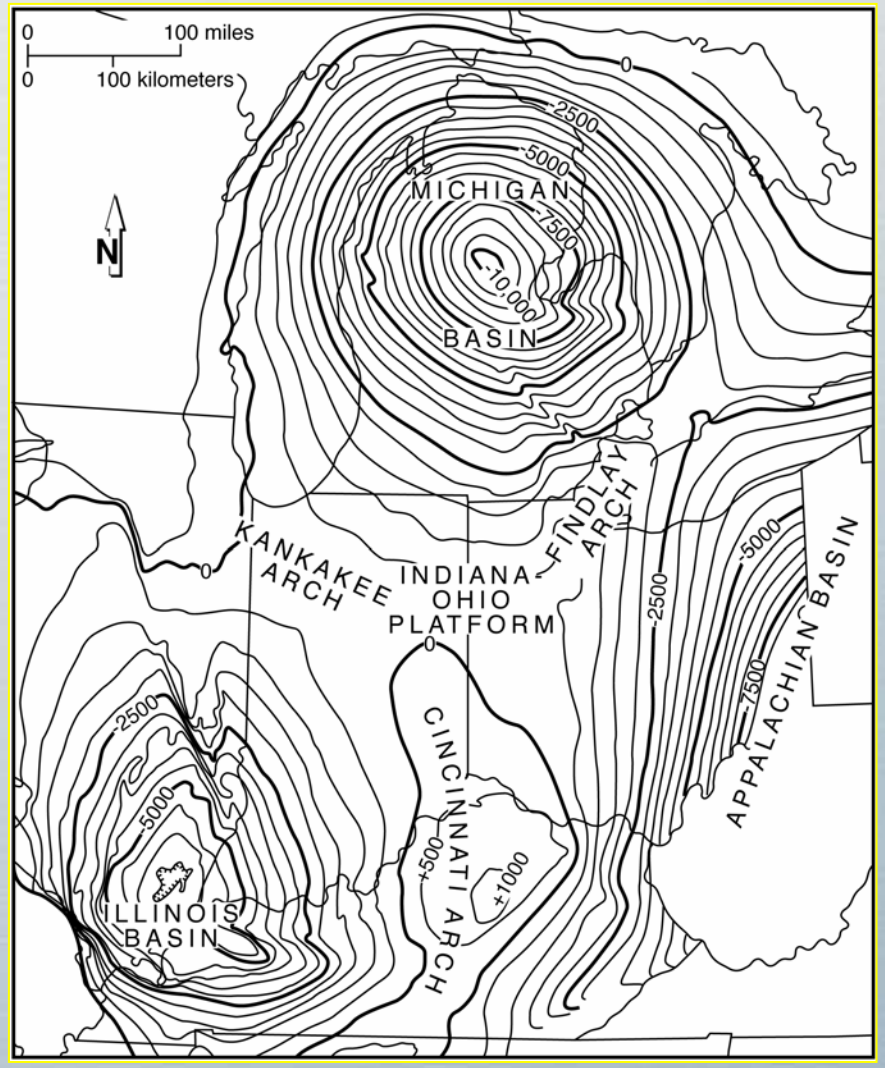
Multiple Basins



- **All or parts of three large sedimentary basins**
  (only flanks/arches of Illinois basin)
- **Deep buried rifts at depth**
  - ***Significant potential for large-volume sedimentary reservoirs in which CO_2 could be injected with good containment at depth***

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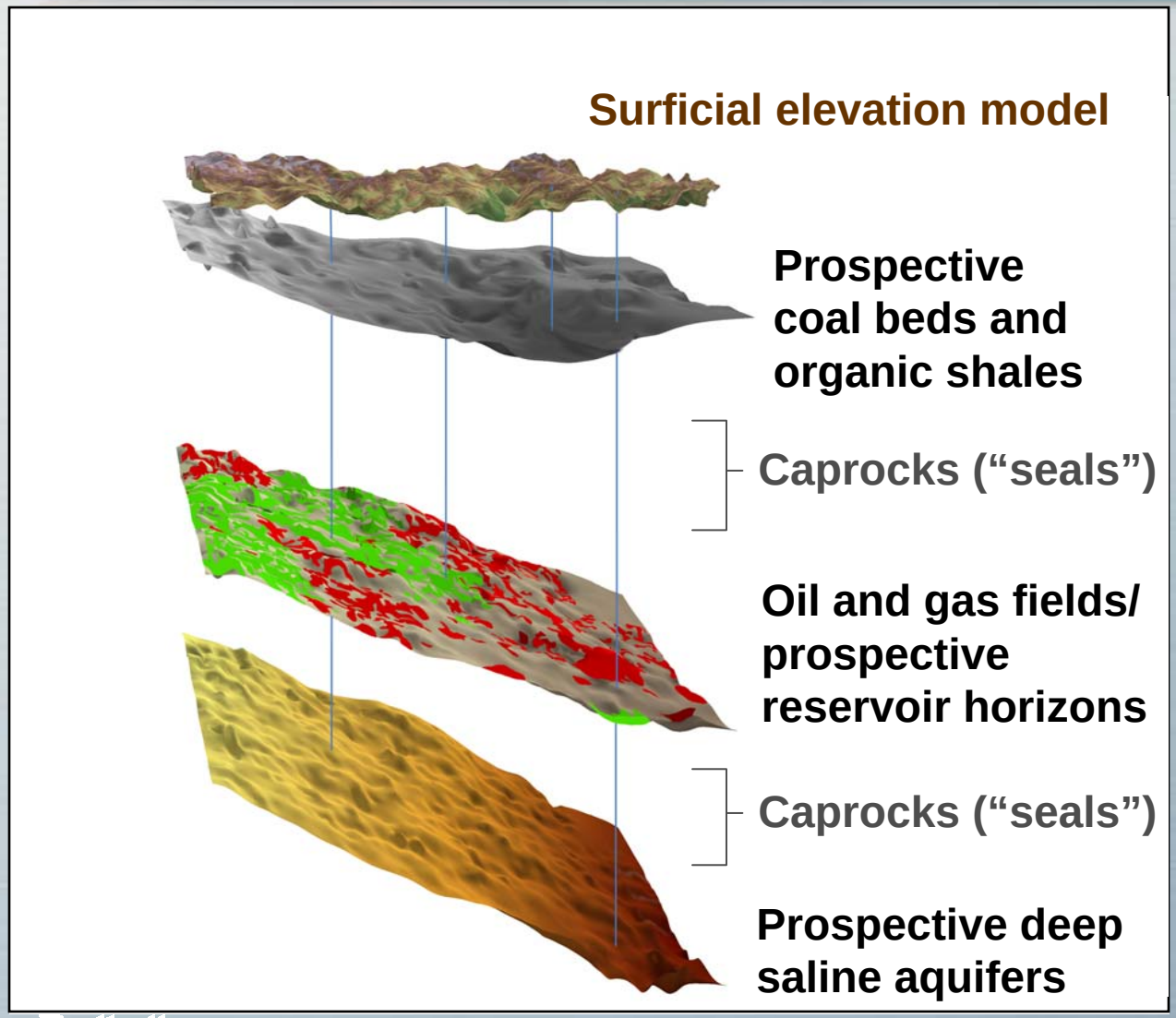
What We are Looking At



- At any one location, multiple horizons are analyzed
- Different types of potential reservoirs

✦ *Results will be compared to emissions sources*

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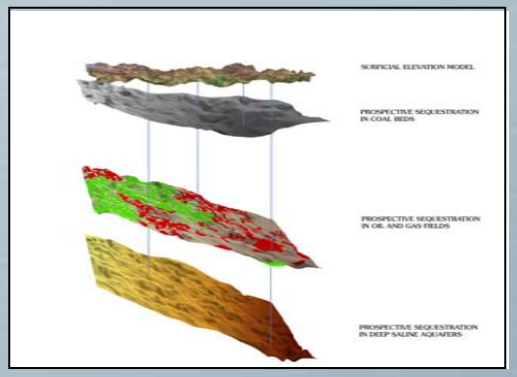
Prospective Storage Units, Caprocks, and Other Features

Storage

- Basal Sandstone
- Rose Run/Theresa Sandstones
- St. Peter Sandstone
- “Clinton”/Tuscarora Sandstones
- Lockport Dolomite *(in some areas)*
- Oriskany/Ridgeley Sandstones
- Devonian shales *(in some areas)*
- Upper Devonian sandstones
- Wastegate (MD)

Caprock/seals

- Precambrian structure
- Top basal sand to top of Knox
- Knox to base Silurian
- HuntonGrp/”Big Lime” *(in some areas)*
- Devonian shales *(in some areas)*



Other

- Oil and gas fields
- Gas storage fields
- Salt mines/solution mines
- Coal beds (deep, unmineable)
- Class I and II injection wells
- Abandoned coal mines
- Major structural features/faults
- Seismic risk

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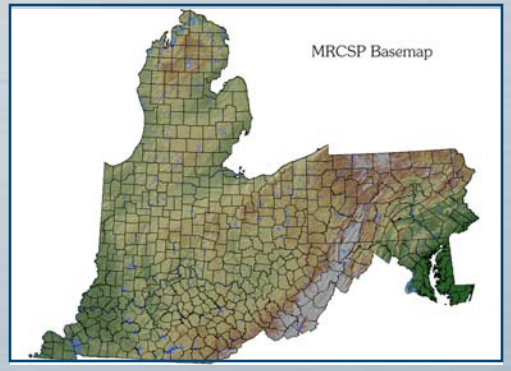
MRCSP Map & Data Collection: Reservoir and Caprock Characteristics

- **Structure (depth) and thickness maps**
- **Porosity, salinity, temperature data – grids**
- **Oil and gas field locations, production data**
- **Coal –**
  - **Total thickness of coal greater than 500’ deep**
  - **Depth to base of coal-bearing units**
  - **Number of coal beds**
  - **Selected regional coals (USGS National Assessments)**

MRCSP: From Data to Products

- Each state compiles their own geologic data for a given layer
- That layer is turned into the state responsible for the regional mapping. Iterative process to allow each state input to final map products
- All maps then turned into Ohio
- Ohio to prepare all calculations and web-enable all map products, queries, calculations, etc.



MRCSP Geologic Tasks are on Track

MRCSP - Geology Data Layers - S

11/9/2004

	Precambrian Structure - MAPS	Structural Features - MAPS	Basal Sandstone	Basal Sand to Top Copper Ridge	Rose Run/ Theresa	St Peter Sandstone	Knox to base Sil	"Clinton"/ Tuscarora	Niagaran thru Onondaga LS	Niag Reef
	OH	OH	OH	IND	OH	IND	OH	PA	IND	
Indiana	100%	100%	100%	100%		100%	100%		100%	
Kentucky	100%	100%	100%	100%	90%	90%	80%		100%	
Maryland		0%							0%	
Michigan	100%	0%	100%	100%		80%			80%	
Ohio	100%	100%	100%	100%	100%		100%	100%	100%	
Pennsylvania	100%	100%	100%	100%	100%		100%	100%	100%	
West Virginia	100%	100%	100%	100%	100%		100%	100%	100%	
Mapping complete	1st Draft		1st draft	Partial draft		50%		1st Draft	Partial draft	
IMS implementation	1st Draft									

KEY

- Complete/submitted
- Partial completion
- Nothing submitted/mapped as yet
- Not applicable to that state

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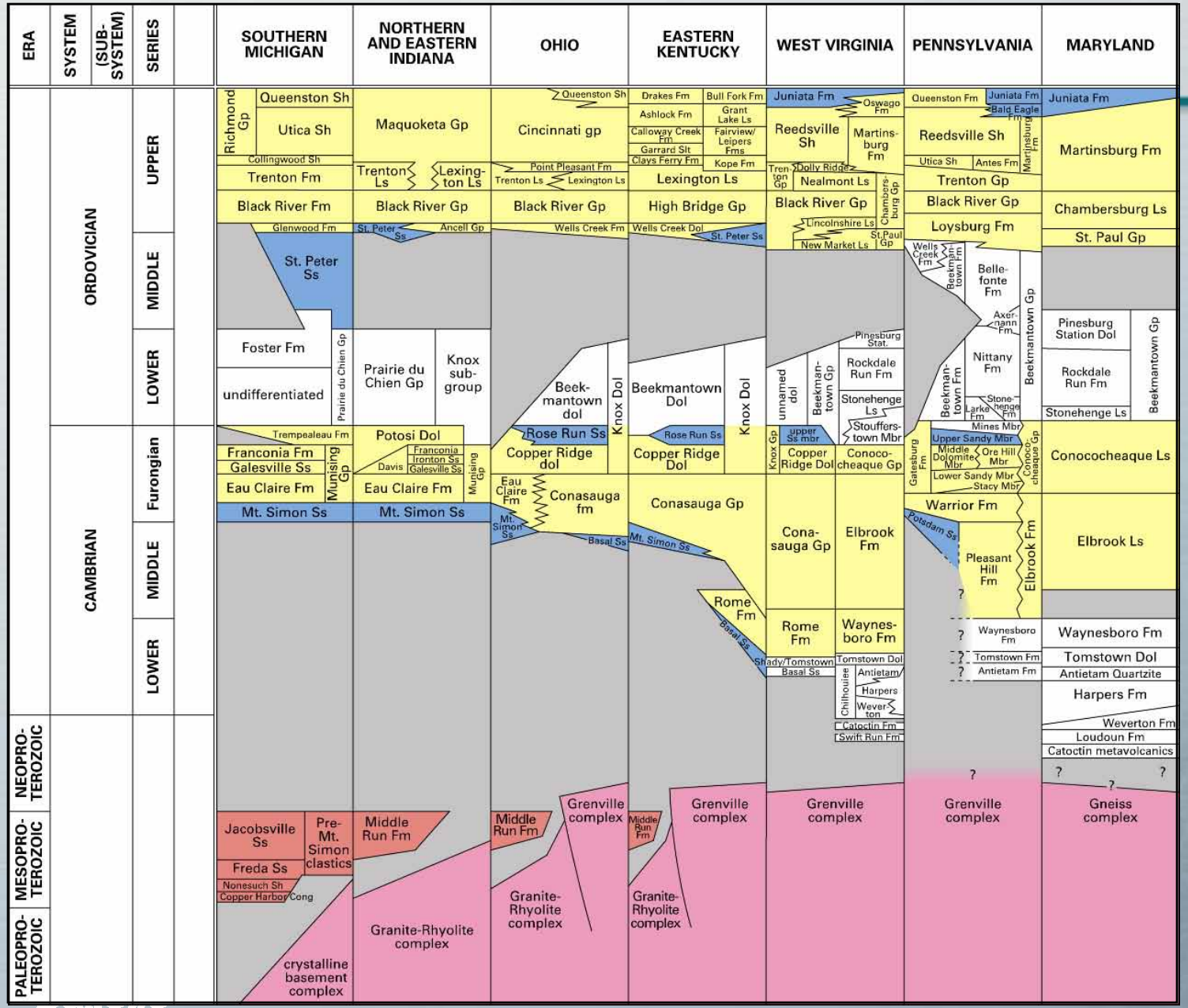
MRCSP Regional Correlations



Precambrian thru Ordovician

Legend

- **Potential CO_2 sinks/ reservoirs**
- **Caprock-containment interval**
- **Unconformity**
- **Sink or seal (*depends on location)***
- **Basal sandstone, prospective reservoir**
- **Basal seal**

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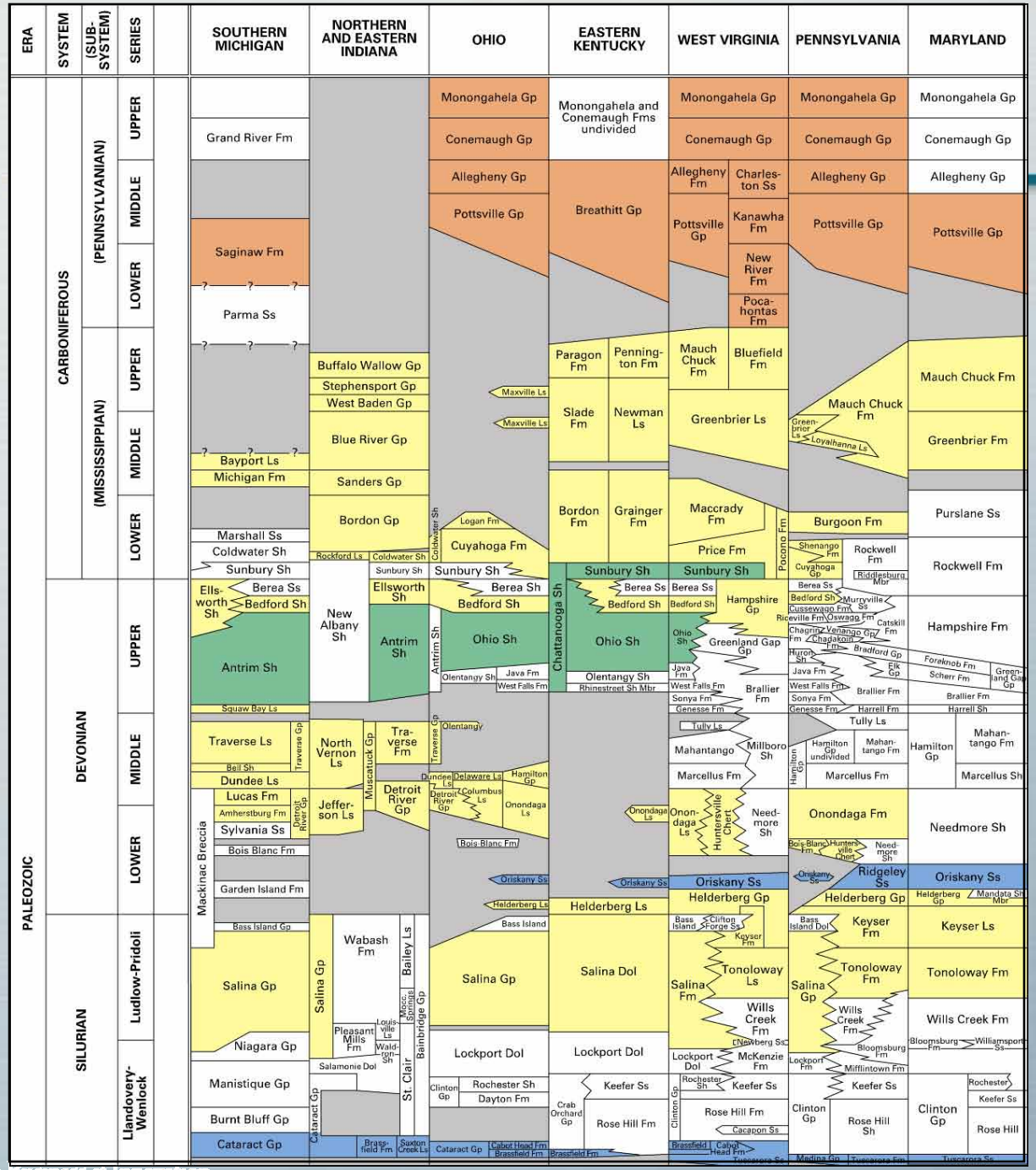
MRCSP Regional Correlations (ctd.)

Silurian thru Pennsylvanian



Legend

- **Coal-bearing units**
- **Organic shales**
- **Potential CO_2 sinks/ reservoirs**
- **Caprock-containment interval**
- **Unconformity**
- **Sink or seal (*depends on location)***

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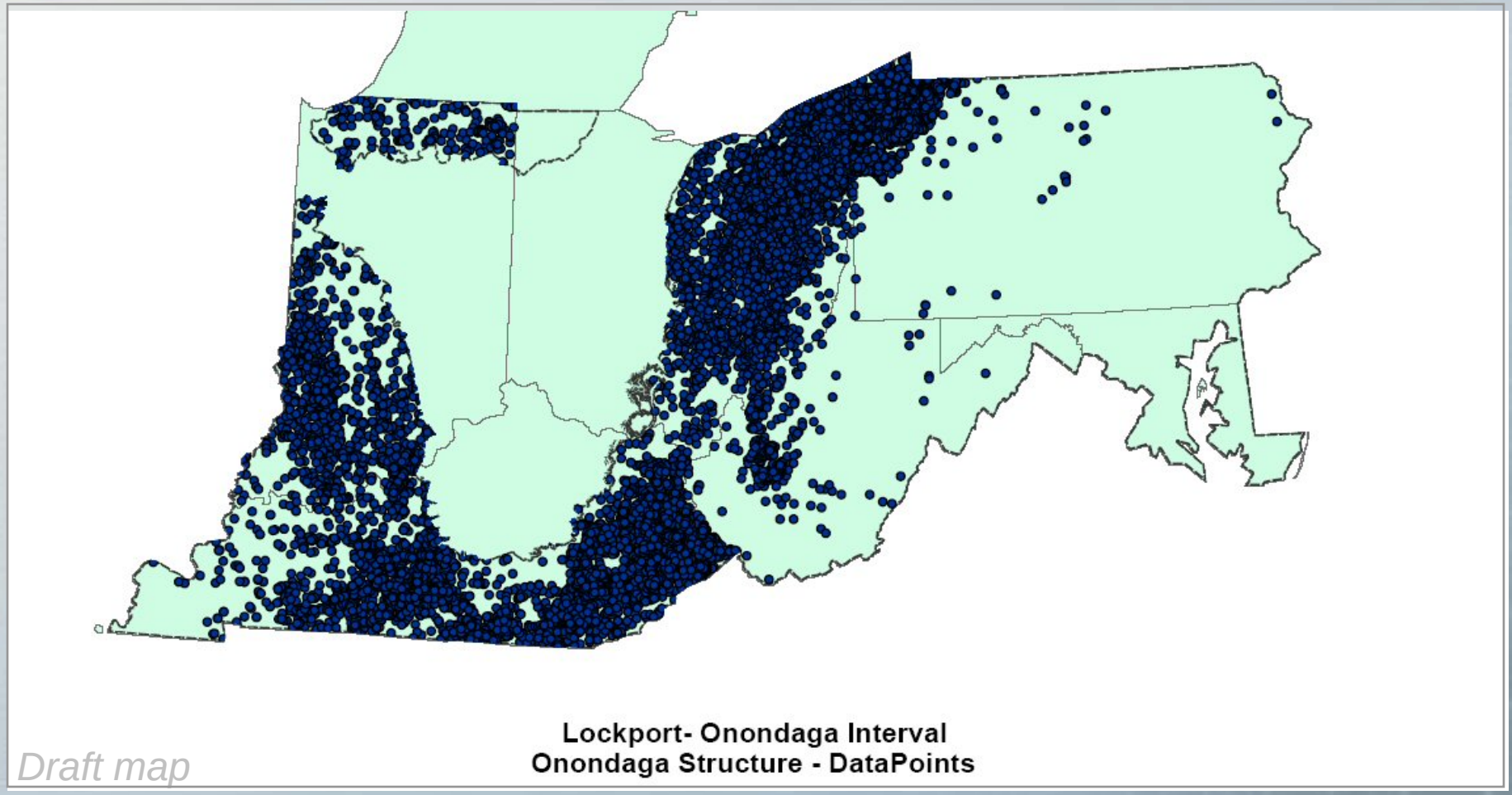
Large Amounts of Data, but Density Varies



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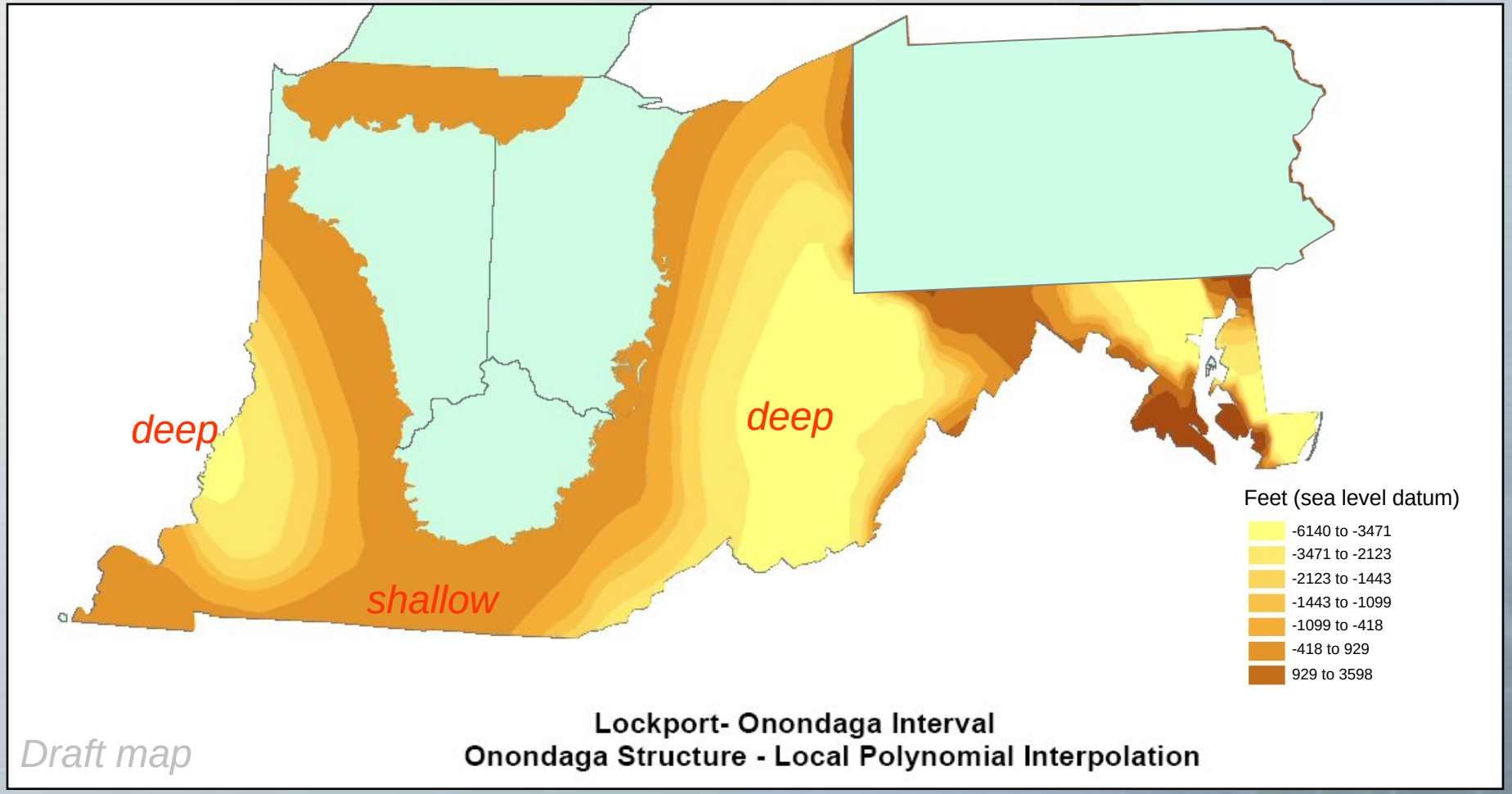
Regional Mapping: Potential Carbonate Sinks/Reservoirs



- ***First regional look at several of the study intervals in a GIS database***

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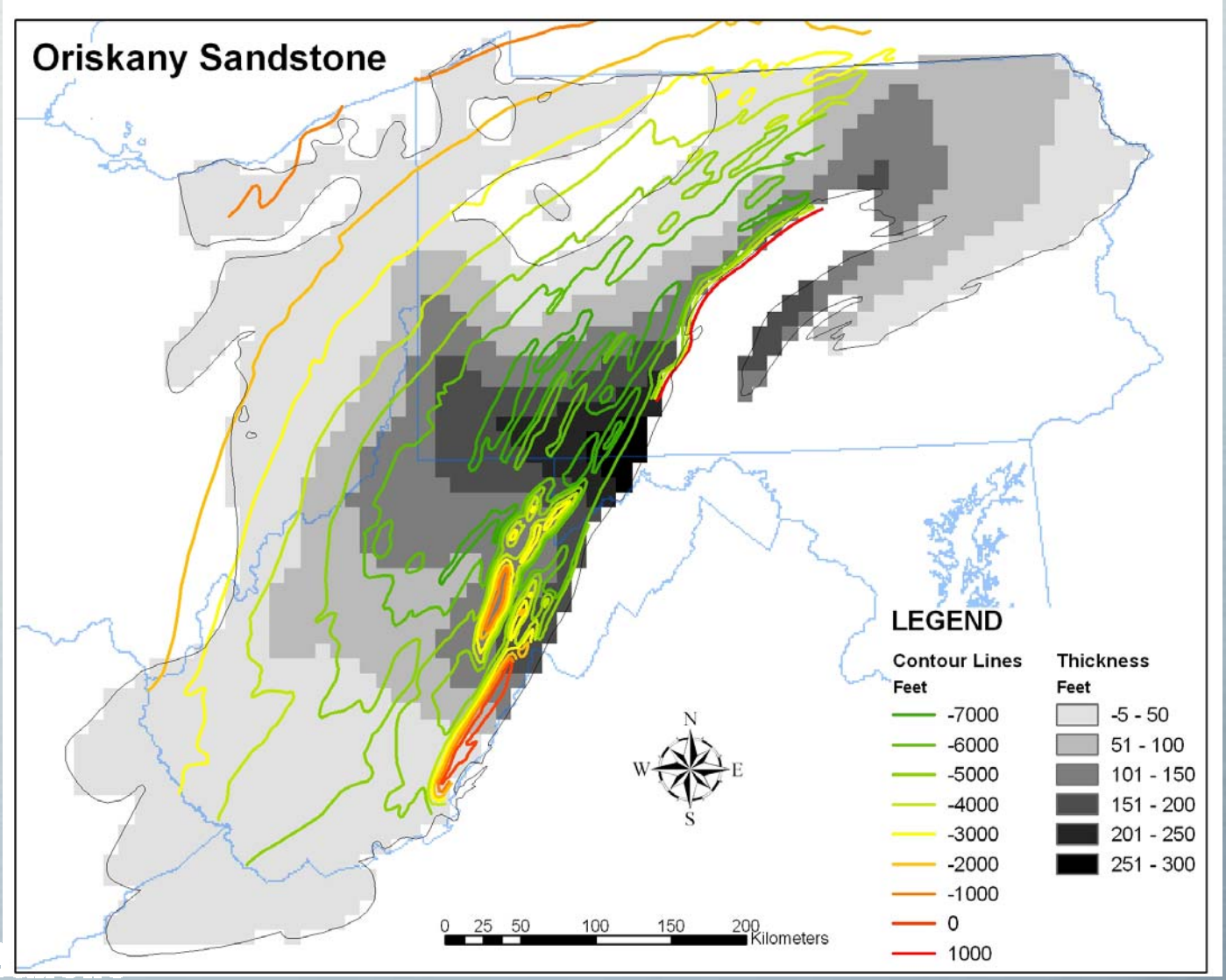
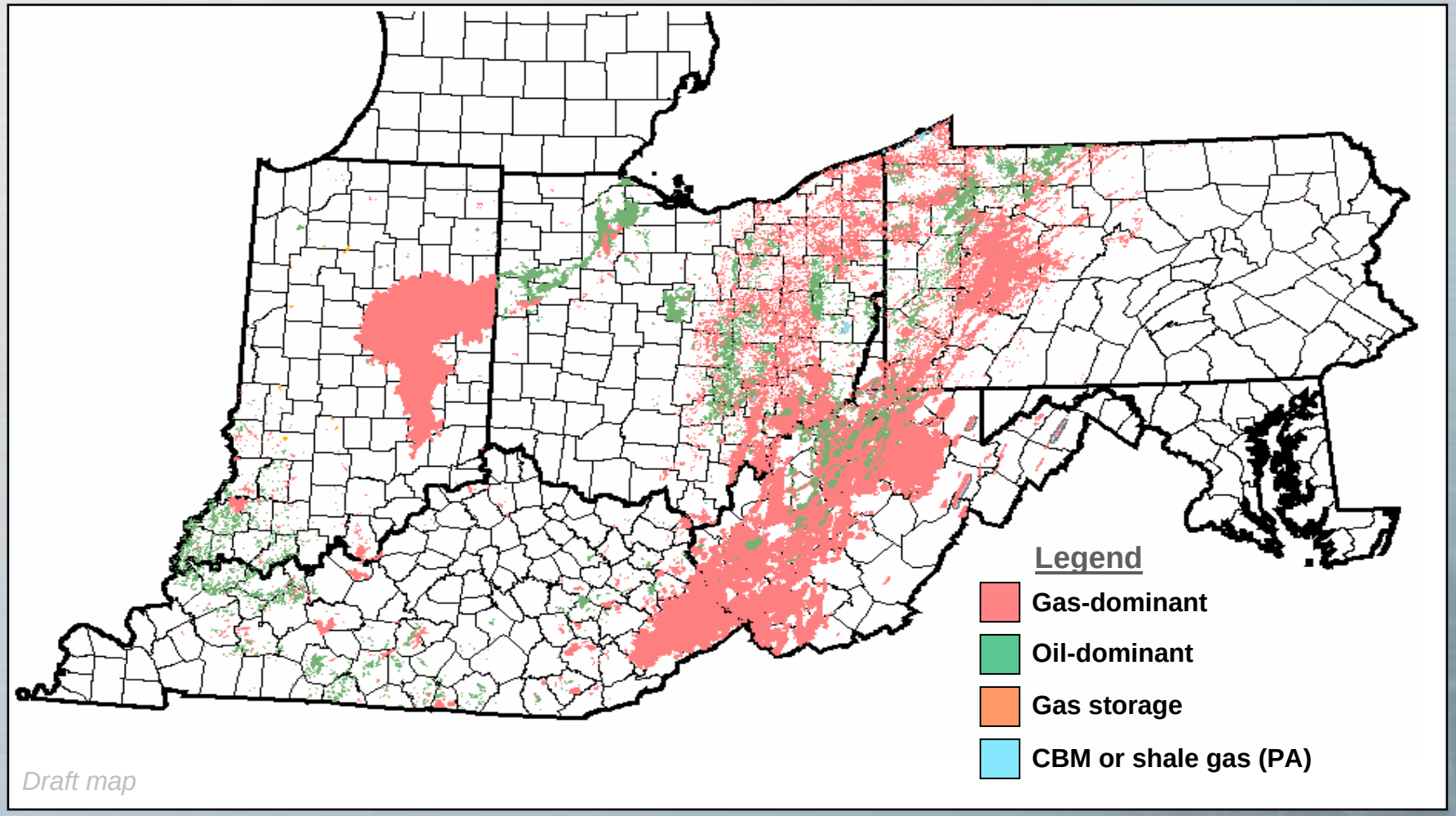
Regional Mapping:
Potential Sandstone Sinks/Reservoirs



Example comparison of unit structure (colors) and unit thickness (gray scales).

Such comparisons may aid in finding suitable areas for geologic sequestration.

MRCSP: Many Oil and Gas Fields



✦ ***First time this data will be available to the public in a GIS database across the region***

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CO_2 Sequestration Potential Calculations: Established and Refined from MIDCARB

Saline Aquifers (metric tonnes)

$$Q = ((7758 * (f * a * h)) * CO_2s)/(1000 * 18.75)$$

Oil and Gas Fields (metric tonnes)

$$Q = rco2 * h * a * f * (1-sw)/2200$$

Coal (metric tonnes)

$$Q = CCO2CH4 * (\rho coal * a * 0.3048 * h * Gcoal) / (1000 * 18.95)$$

All calculations and methods are available on the MRCSP geology ftp site:

ftp://ftp.dnr.state.oh.us/Geological_Survey/MRCSP/

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Example Calculations: Ohio's Deep Oil-and-Gas Reservoirs

Oil and Gas Reservoirs								
Depth greater than 2500'								
Formation or play	Dominant Lithology	Average Poro	Average Thickness	Average Depth	Reservoir	CO2 Sequestration Potential		
	SS/LS/DOL/SH	percentage	ft, inches	feet	acres	metric tons		
						80%	50%	20%
Berea	SS/LS/DOL/SH	9	13' 9"	3910	264,650	172,532,801	107,833,001	43,133,200
Chagrin	SH	7	123' 6"	3140	9,143	37,434,610	23,396,632	9,358,653
Devonian Shale	SH	7	191' 9"	2908	9,143	19,965,404	12,478,378	4,991,351
Ohio Shale	SH	7	234'	2913	741	1,421,392	888,370	355,348
Big Lime	SS/DOL	8	15' 8"	2724	148,016	69,664,626	43,540,391	17,416,156
Clinton	SS	8	20' 2"	3484	3,020,369	2,141,391,364	1,338,369,603	535,347,841
Trenton	LS	10	16' 4"	3813	3,212	684,664	427,915	171,166
Knox	DOL/SS	9	23'	5304	420,079	400,012,042	250,007,527	100,003,011
TOTALS						**2,843,106,903**	**1,776,941,815**	**710,776,726**

Calculations made at different capacities

Multiple querry options:

Sequestration potential will be able to be calculated by state, county, unit, user-defined areas, etc.

- ***Built-in flexibility to suit different user's needs***

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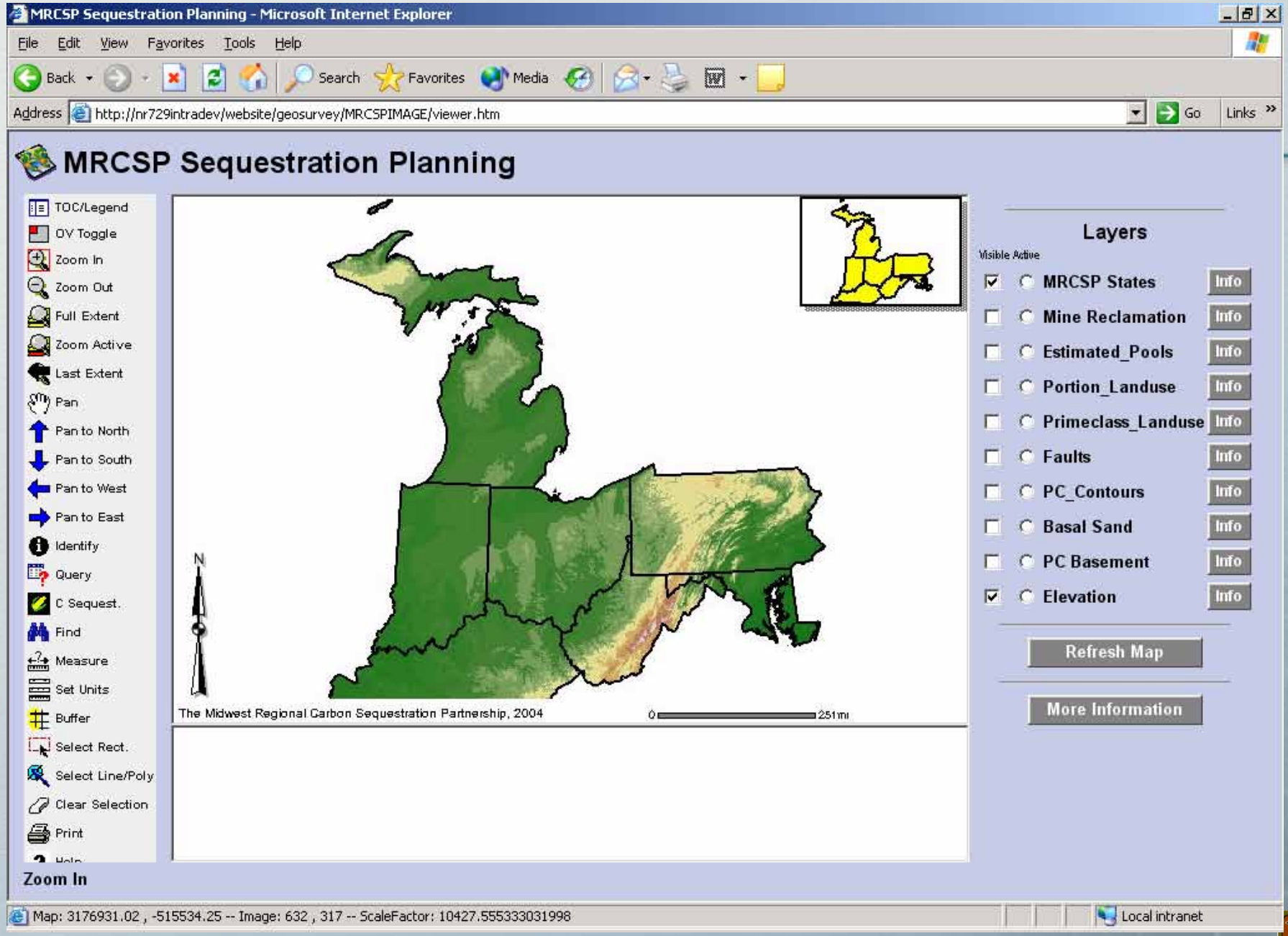
MRCSP: Building an IMS

- ***Interactive base map available via Web - soon***
- ***User tailored***
  - ***Scale***
  - ***Visible layers***
  - ***Calculations***
- ***Data definitions (metadata)***



Testing the look and feel of the IMS

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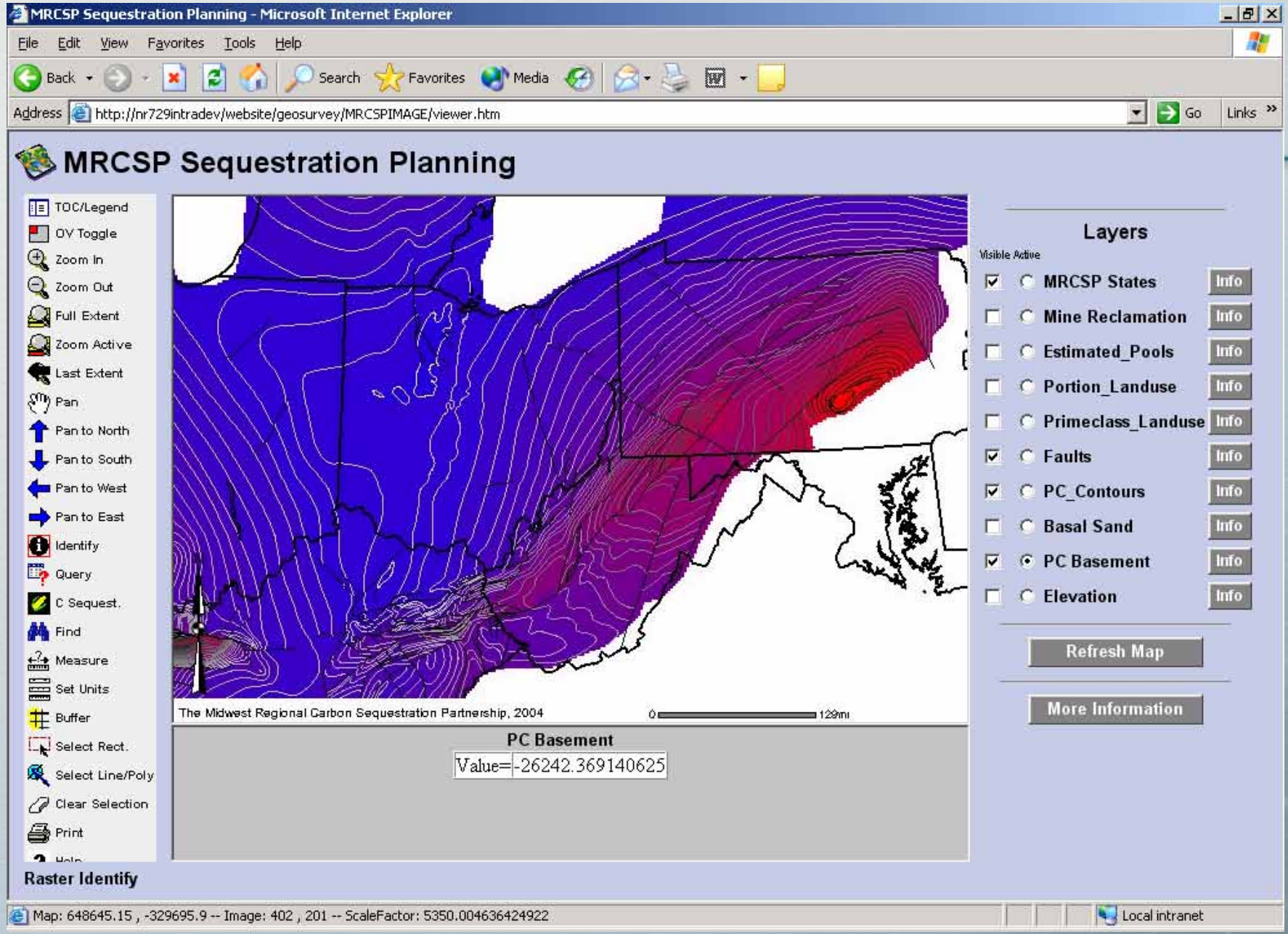

Visualizing the data

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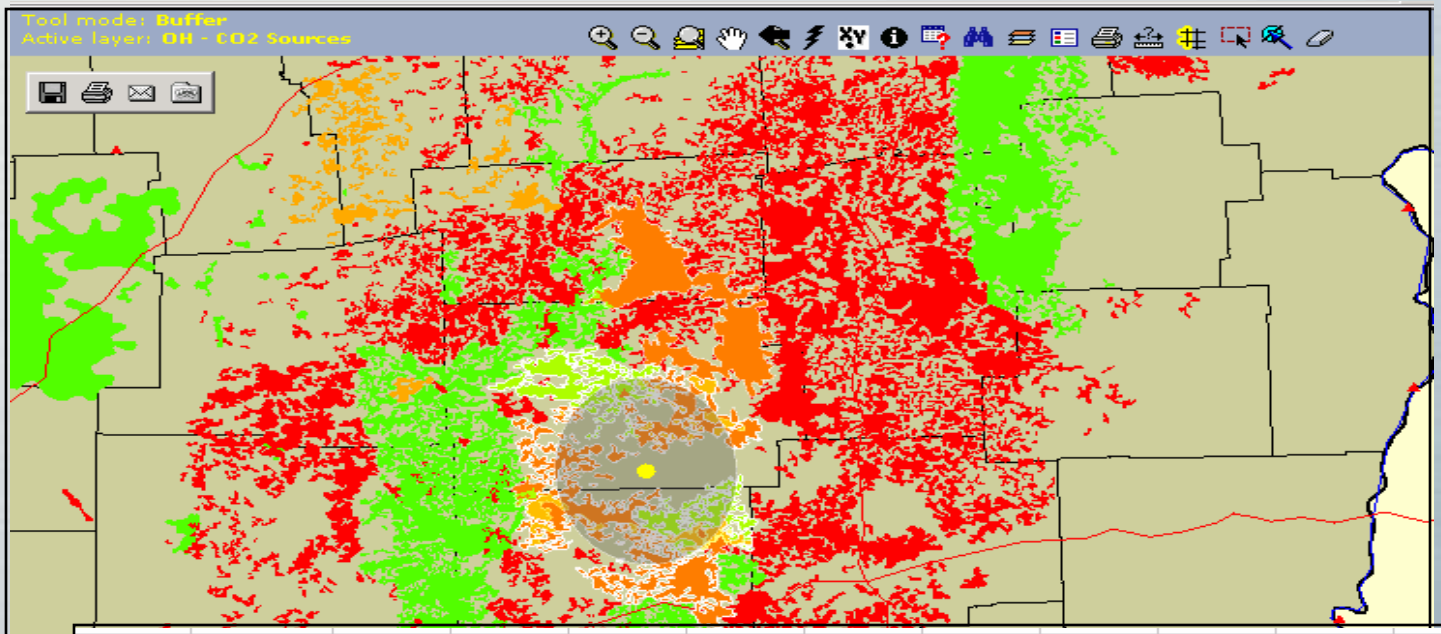
MRCSP IMS: Example Application



Oil-and-gas fields within a 10 mile radius of a coal-fired utility (the Conesville Plant, Ohio)

FMTN_CODE	FIELD_NAME	AVGPRODEPT	NETTHICK	TEMP_	PRES	POROSITY	DISCOVERY_YEAR	WATER_SATURATION	NUMBER_OF_WELLS	RESERVOIR_ACRES	CO2_DENSITY	SEQUESTRATION_VOLUME	PRODUCTION_TYPE
CLNN	MONROE-COSHOCTON CON	3338	12	100	1600	0.055	1917	40	3444	117511	1939291.2	41019848.68	OIL
CLNN	MORGAN RUN	4017	25	100	1200	0.08	1972	27	53	3720	1009720.8	2492725.277	OIL
CLNN	PHILO CONSOLIDATED	4650	18	100	1400	0.065	1928	30	1869	164960	1763308.8	108284985.8	OIL
											Total	151,797,560	
										20% volume		30,359,512	Metric tons

Querry for CO_2 sequestration available in 3 Clinton oil fields near the plant = 30 Mmt @ 20%

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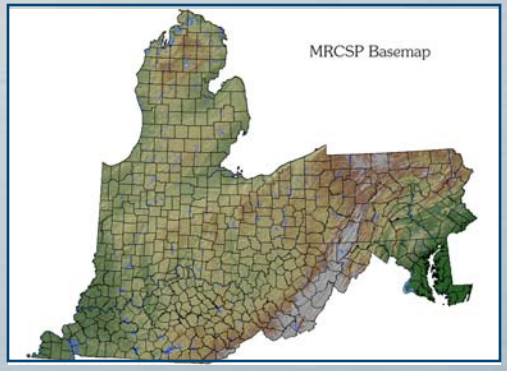
Summary for Geological

- The MRCSP has an abundance of the 3 primary reservoir types
  - **Deep saline formations**
  - **Oil and gas fields (active and depleted)**
  - **Coal seams and organic shales**



- Mapping their distribution is the primary key to existing and future geosequestration from large CO_2 sources in the region.
- We have established our mapping and calculations methodologies, collected large volumes of data.
- We are now mapping the data and developing the IMS service.

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Terrestrial Sequestration

- Dr. Mark Sperow (West Virginia University)

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PARTNERSHIP

MRSCP Land-Uses Analyzed and Team

- Non-eroded Cropland – The Ohio State University: Rattan Lal
- Eroded Cropland – Purdue University: William McFee and Larry Biehl
- Marginal Land – Pennsylvania State University: Sjoerd Duiker
- Mineland – West Virginia University: Mark Sperow
- Wetland and Marshland – University of Maryland: Brian Needelman
- Modeling all Land Classifications – Michigan State University: Peter Grace

MRCSP Land-use, Area, and Potential C Storage

Land-Use	Area (Mha)	C Storage (MMTC yr^{-1})
Non-Eroded Cropland	10.7	3.7
Eroded Cropland	1.6	3.1
Marginal Land	6.5	26.9
Mineland	0.6	1.5
Wetland/Peatland	3.4	3.9
Total	22.8	39.1

MRCSP CO_2 Emissions[1]
715 MMT **(195** MMTCE[2]**)**

MRCSP CO_2 Offset Potential
20% of Emissions

[1] Emissions include only large sources (>100 Kt CO_2).

[2] MMTCE = Million Metric Tons of Carbon Equivalent

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Introduction

- Analysis addresses biophysical potential for C sequestration
- Assess C pools: soils, above-ground biomass, and litter layer
  - 20 year time period analyzed
  - Soil C estimates for the 0 – 30 cm layers
- C accumulation rates derived from literature and modeling
- Common databases for land classifications and soils
  - 1992 National Land Cover Dataset
  - STATSGO
- County boundaries derived from common GIS source
- Specific databases used as required
  - CTIC – tillage intensity by region
  - Unique database for wetland and marshland area
  - GIS and Tabular to define mineland area
- Cropland C estimates based on reduced tillage intensity
- Marginal and mine land C estimates based on afforestation

1992 NLCD Landcover Adjusted to Account for Mineland Area after 1992

		TOTAL	WATER	URBAN	MINE	FOREST	PASTURE	CROP	WETLAND
IN	ORIG	9,376,123	105,912	315,074	22,207	1,763,442	1,770,614	5,141,073	164,136
	ADJ	9,376,123	105,825	315,063	30,201	1,761,721	1,768,645	5,136,906	164,114
KY	ORIG	10,461,312	190,097	191,360	52,262	6,229,925	2,147,310	1,412,998	182,449
	ADJ	10,461,312	189,918	191,337	67,871	6,214,748	2,147,216	1,412,891	182,418
MD		2,738,712	225,942	200,797	29,081	1,058,915	632,247	354,547	221,371
MI		15,069,929	431,339	475,354	68,260	6,169,621	1,371,366	3,602,932	2,558,347
PA		11,733,011	135,322	482,408	125,363	7,643,828	2,644,374	581,759	98,199
OH	ORIG	10,681,297	120,732	562,199	25,898	3,360,629	2,315,073	4,085,227	149,196
	ADJ	10,681,297	120,044	562,014	63,401	3,341,938	2,303,281	4,079,240	149,036
WV	ORIG	6,268,806	51,012	81,981	73,253	5,238,932	688,709	118,158	15,263
	ADJ	6,268,806	50,163	80,654	183,473	5,135,223	685,512	117,174	15,126
TOTAL	ORIG	66,329,190	1,260,356	2,309,173	396,324	31,465,292	11,569,693	15,296,694	3,388,961
TOTAL	ADJ	66,329,190	1,258,553	2,307,627	567,651	31,325,994	11,552,641	15,285,449	3,388,611

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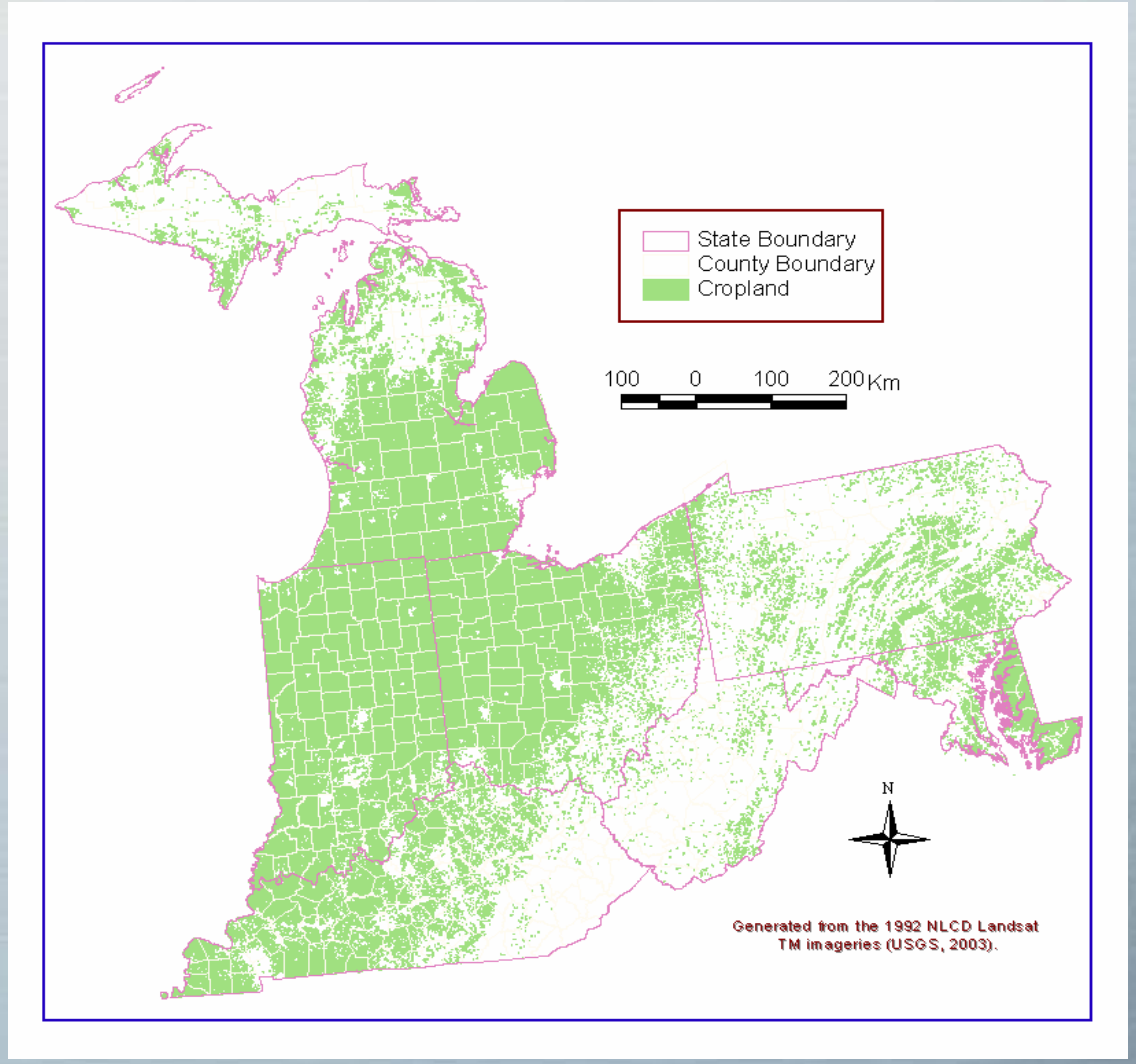
Distribution of Non-eroded Cropland



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Potential SOC Sequestration Over 20 Years and Annually for Non-eroded Croplands

Scenario	IN	KY	MD	MI	OH	PA	WV	**MRCSP**	Stdev
Area (Tha)	5,137	1,412	355	3,603	4,085	118	117	15,285	
	----------Million Metric Tons ----------								
100% NT[1]	23.5	5.2	1.5	19.7	21.4	2.3	0.2	73.9	23.7
75% NT	17.7	3.9	1.1	14.8	16.1	1.7	0.2	55.4	17.7
	---------- Million Metric Tons yr^{-1} ----------								
Annual Potential	1.2	0.3	0.08	1.0	1.1	0.1	0.01	3.7	

[1] NT = No Till

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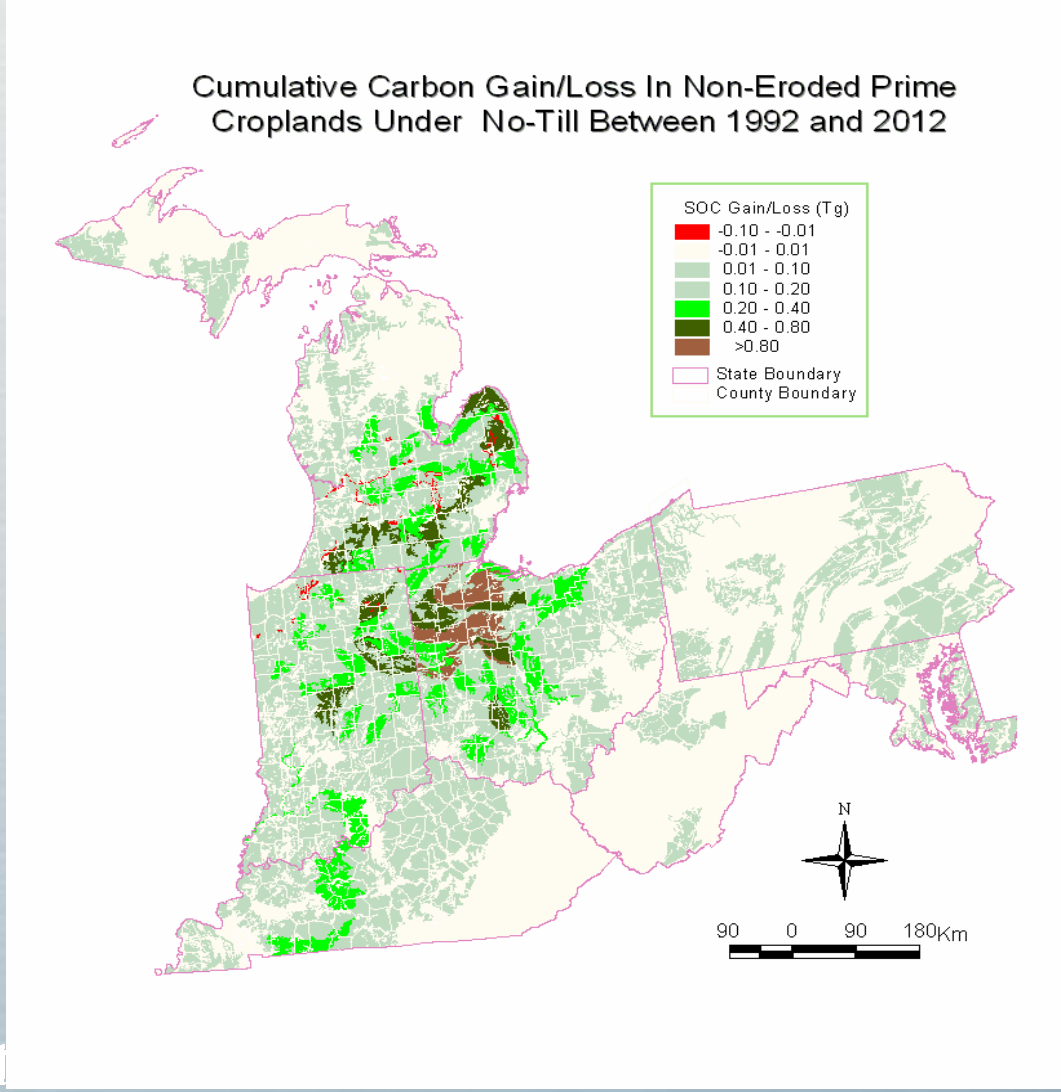
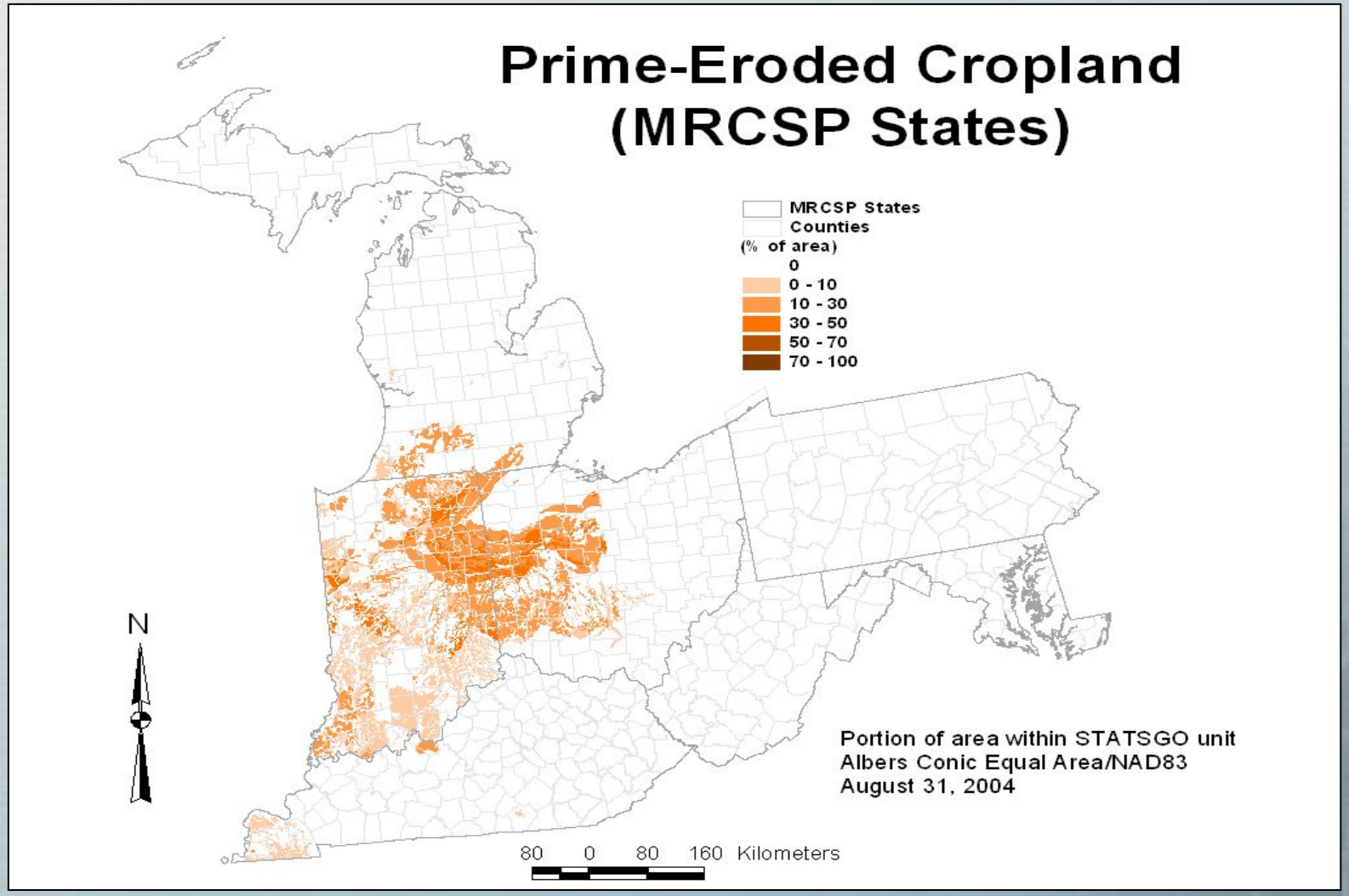
C Sequestration Potential on non-eroded Cropland in 20 Years



Area	15.3 Mha
Total C	74 MMT

Area of Prime-Eroded Cropland



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Potential SOC Sequestration over 20 Years and Annually for Prime Eroded Cropland

State	IN	KY	MD	MI	OH	PA	WV	MRCSP
Area (Tha)	933	39	0	80	513	0	0	1,565
	Cumulative C Sequestered (Million Metric Tons)							
Scenario 1	7.2	0.2		0.6	4.3			12.3
Scenario 2	36.1	1.1		3.2	21.4			61.8
	---------- Million Metric Tons yr^{-1} ----------							
Annual Potential	1.8	0.06		0.2	1.1			3.1

Scenario 1: SOC may be restored to 60% of native with shift to conservation practices

Scenario 2: All SOC may be recovered under good management or set-aside (return to grass/legume)

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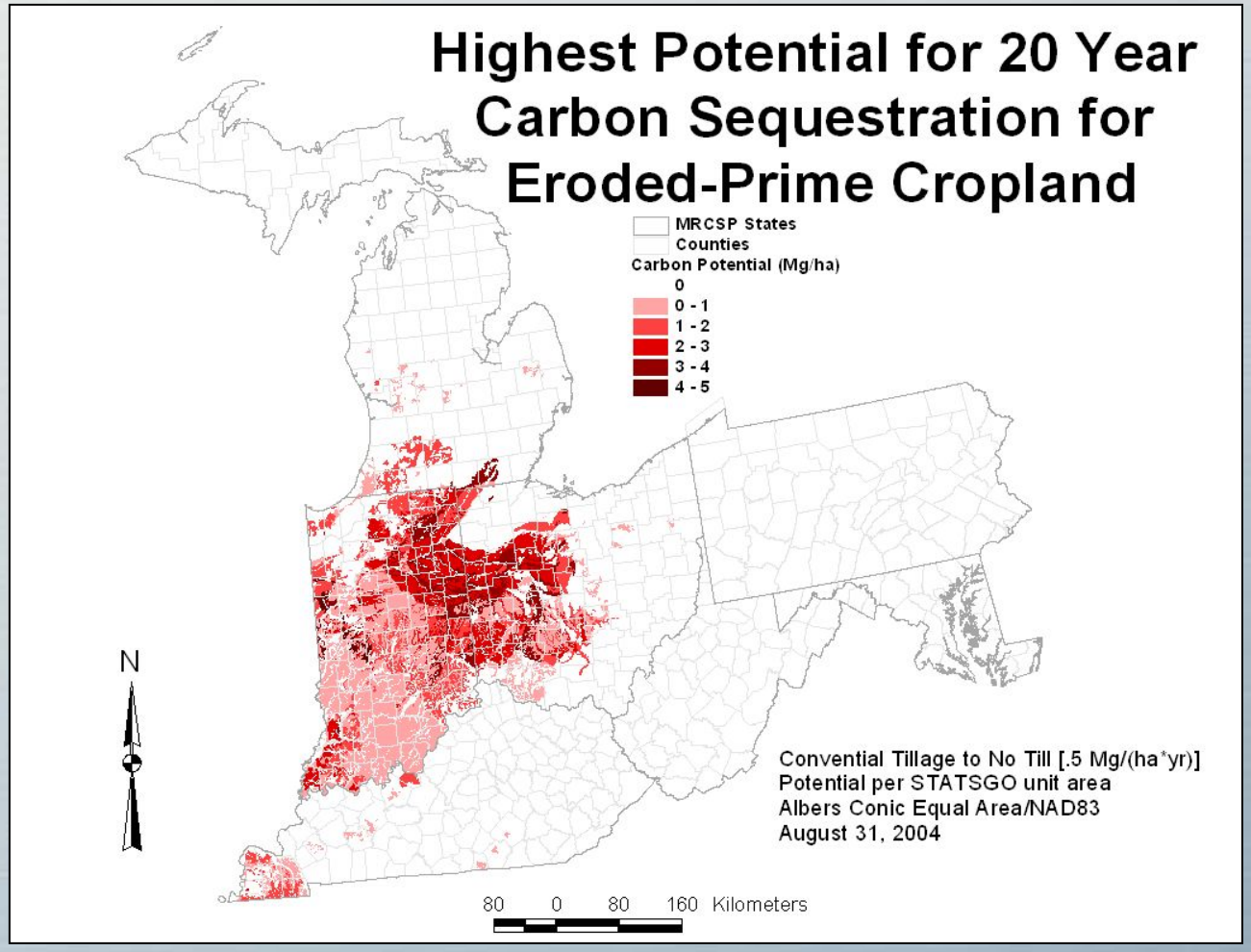
C Sequestration Potential on Eroded Cropland in 20 Years



Area	1.6 Mha
Total C	62 MMT

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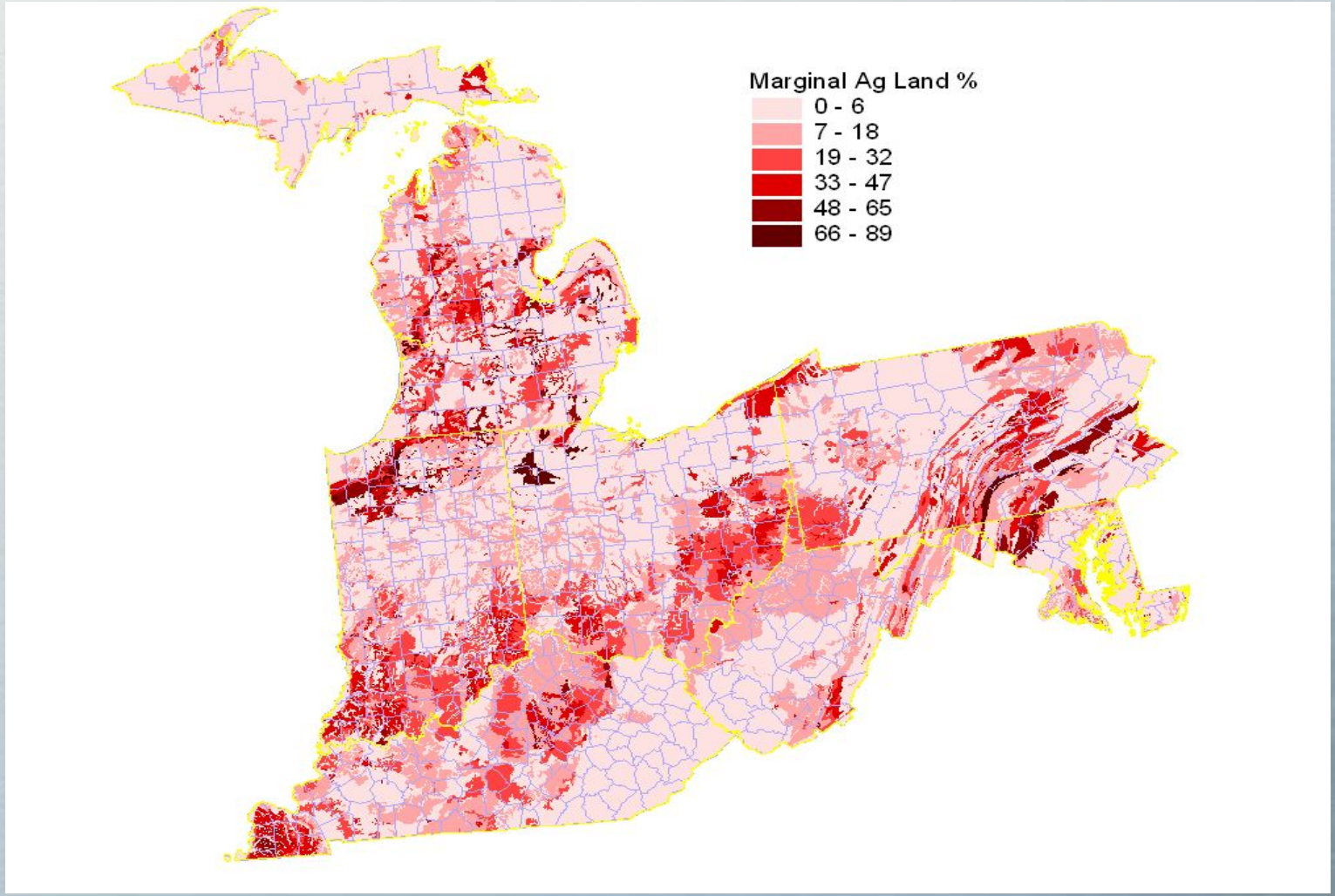
Distribution of Marginal Land



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Potential C Accumulation Over 20 Years and Annually on Marginal Land from Afforestation

State	IN	KY	MD	MI	OH	PA	WV	MRCSP
Area (Tha)	1,238	1,012	246	1,230	1,156	1,181	481	6,543
	---------- Million Metric Tons ----------							
	105.3	91.6	20.8	87.9	95.3	96.8	41.5	529.2
	---------- Million Metric Tons yr^{-1} ----------							
Annual Potential	5.3	4.6	1.0	4.4	4.8	4.8	2.1	26.9

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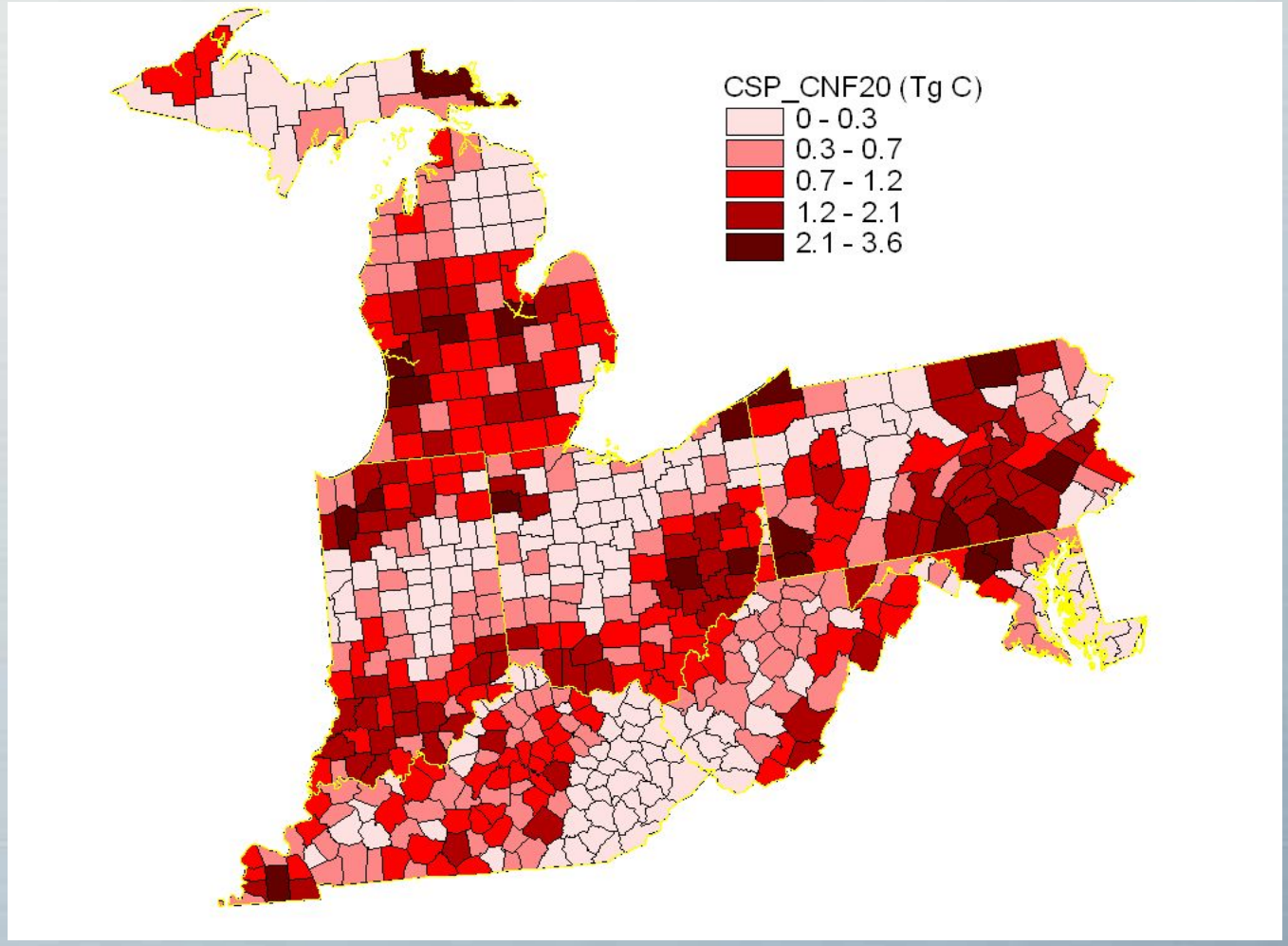
20 Year C Potential on Marginal Lands from Coniferous Forest



Area	6.5 Mha
Total C	529 MMT

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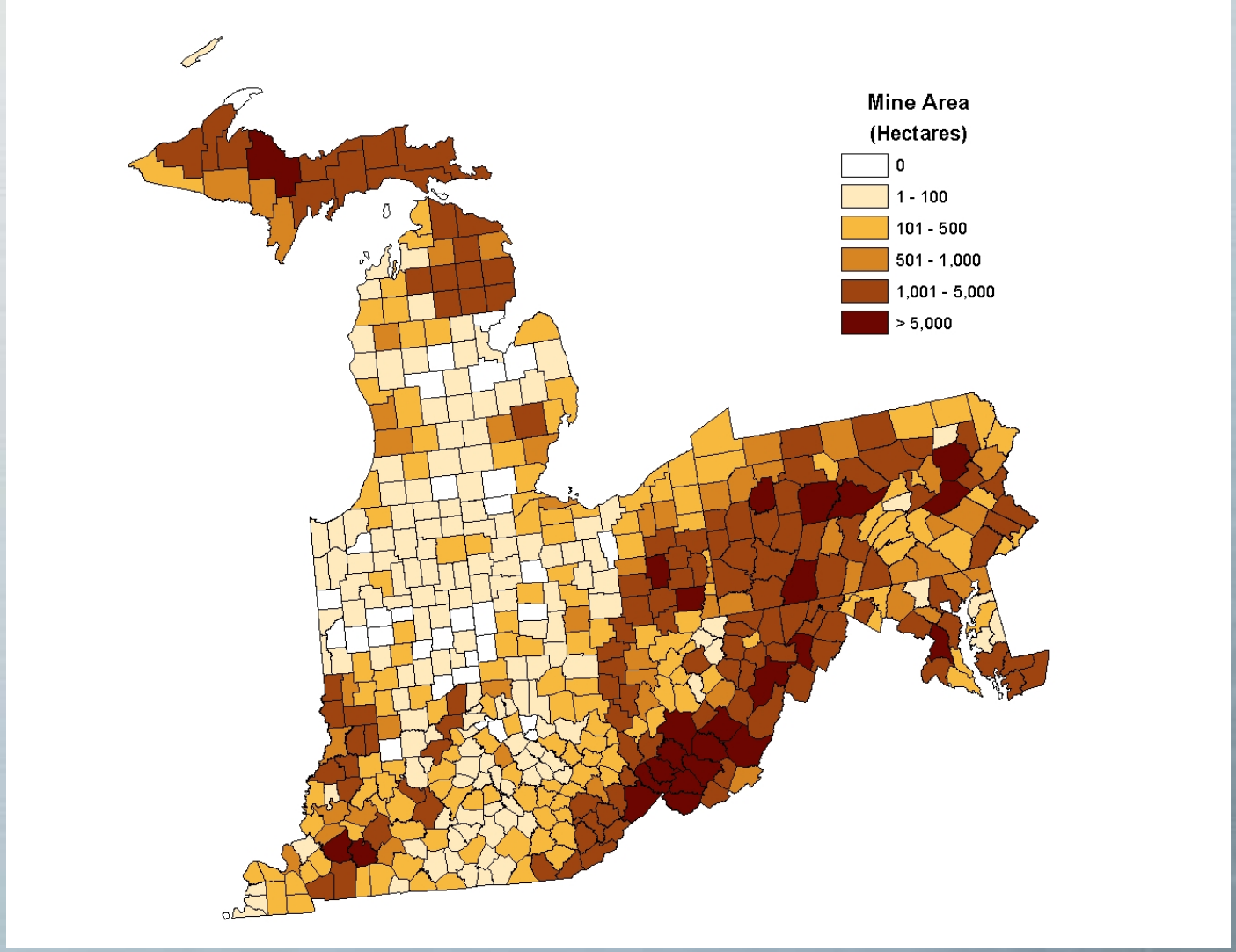
Area of Mineland



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Potential C Accumulation over 20 Years and Annually on Reclaimed Minelands

	IN	KY	MD	MI	OH	PA	WV	Total
Area (Tha)	30.2	67.8	29.1	68.3	125.4	63.4	183.5	567.7
		---------- Million Metric Tons ----------						MMT
Total Forest	1.6	3.5	1.4	3.6	3.6	5.1	10.74	29.5
Forest Biomass	0.9	2.1	0.5	1.6	2.0	2.8	6.70	16.6
Forest Litter	0.1	0.2	0.1	0.3	0.2	-0.3	0.36	0.9
Forest Soil	0.6	1.3	0.7	1.7	1.4	2.6	3.69	12.0
Pasture Soil	0.8	1.8	0.8	1.9	1.7	3.4	4.83	15.1
Cropland Soil	0.6	1.8	0.3	1.4	2.3	3.7	1.0	10.9
		---------- Million Metric Tons yr^{-1} ----------						
Annual Potential	0.08	0.2	0.1	0.2	0.2	0.3	0.5	1.6

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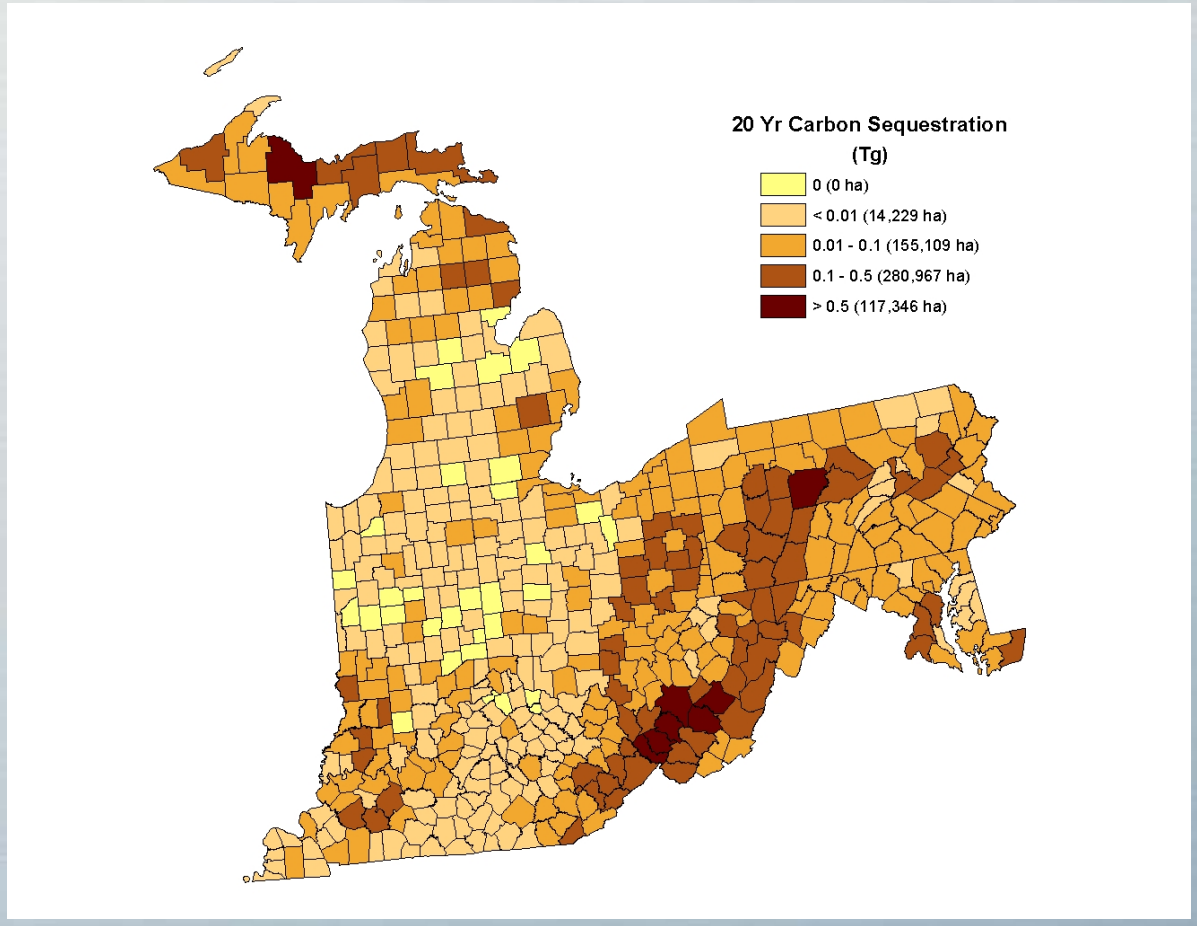
C Accumulation on Minelands over 20 Years



Area	0.6 Mha
Total C	29.5 MMT

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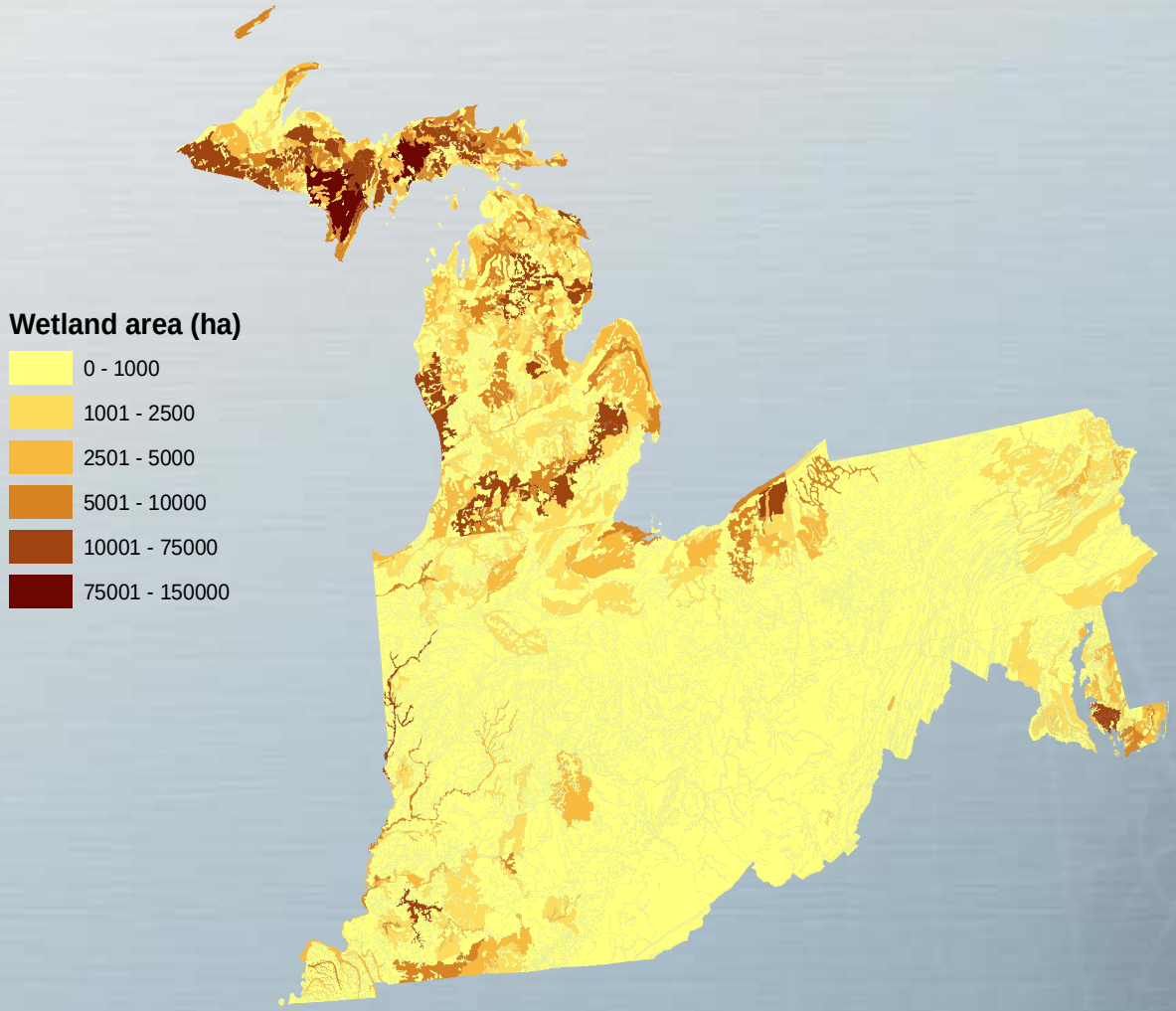
Area of Wetlands



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Wetland C Sequestration Potential Over 20 Years and Annually

Land use	Tidal Marshes	Peatlands	Crop to wetland	Total
Area (THa)	82	196	100 to 435	378 to 713
		---------- Million Metric Tons ----------		
Total Potential	4.1 – 9.3	0.9 – 1.4	16 - 68	5 – 10.7[1] 21 – 78.7[2]
		---------- Million Metric Tons yr^{-1} ----------		
Annual Potential	0.2 - 0.5	0.05 - 0.07	0.8 to 3.4	0.26 to 0.53[1] 1.1 to 3.9[2]

1 Without cropland conversion to wetland
2 With cropland conversion to wetland

Note: Current wetland carbon pool is estimated to be **656** MMT on 3.4 Mha.

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SOCRATES Modeling Results – Annual Potential C Sequestration

Category	IN	KY	MD	MI	OH	PA	WV	Total
	----------Million Metric Tons yr^{-1}----------							
Cropland	2.5	0.8	0.2	1.7	2.3	0.27	0.04	7.8
Eroded Cropland	0.27	0.05	0.00	0.02	0.1	0.00	0.00	0.45
Marginal Cropland	2.98	2.4	0.61	0.94	2.8	2.6	1.1	13.5
Marginal Pasture	3.2	1.8	0.3	3.4	2.1	0.9	0.3	12.0
Mineland	0.15	0.37	0.19	0.27	0.16	0.70	0.42	2.3
Total	9.1	5.4	1.3	6.3	7.5	4.5	1.9	36.0

Economics

- Hierarchy of costs to increase C through activities addressed
  - 1. Non-Eroded Cropland – tillage intensity change
  - 2. Mineland – afforestation (additional costs incurred)
  - 3. Marginal Land – afforestation
  - 4. Eroded Cropland – grass/legumes yield highest C
  - 5. Wetland – restoration of cropland to wetland
- Refined analyses required to define actual costs to compare to benefits

Conclusions for Terrestrial

- Analysis considers only biophysical potential of increased C in soils, biomass and litter
- C accumulations estimated through modeling, so actual C sequestration may be somewhat lower or higher
- MRCSP region represents significant CO_2 offset potential
  - MRCSP Total Annual C Accumulation: **39.1** MMT
  - MRCSP region may offset **20%** of CO_2 emissions
  - MRCSP 20 Year C Accumulation: **773** MMT
- Activities represent options for early deployment at minimum cost
- Economic analyses will be focus of upcoming activities

Tying it All Together

- Like all the other Partnerships we are also evaluating other important issues:
  - What impact will federal state and local regulations play in implementing sequestration projects
    - National Regulatory Research Institute, lead
  - What capture and transport technologies will be important to implementation and what will they cost
    - CONSOL Energy, lead (BP & B&W review)
- Public Outreach and Education
  - Helping the public in our region to make informed decisions about sequestration and getting their feedback to help us plan for implementation
- Economic analysis and selection of Phase II project recommendations

Regulatory Analysis

- What are we doing?
  - Considering CO_2 transport, geological storage, and terrestrial sequestration opportunities.
  - Collecting and analyzing appropriate regulations at the federal, state (7 states), and local level
  - Talking to state and local officials about regulatory issues
  - Evaluating case studies and other benchmark projects nationwide.

Regulatory Analysis (Con'd)

What have we learned so far?

- Federal pipeline regulations regulate CO_2 as non-hazardous under 49 CFR 195
- It remains unclear whether non-EOR CO_2 wells will be Class I, II, or V.
- Indiana, Maryland, Ohio, and West Virginia have primacy in our Region for Class I injection wells.
- In at least one of our states, authority over CO_2 pipelines is coordinated by one agency (also condemnation authority)
  - Reduced time and cost to obtain ROWs.
- Most terrestrial sequestration to date is by private contract
- Regulatory barrier to terrestrial sequestration is the lack of verification and monitoring protocols.
  - Proxies are being developed.

Characterization of Capture Technologies

What are we doing?

- Completed comprehensive literature survey
- Developed list of candidate capture technologies
  - Commercially available systems
  - Developing technologies
- Applying economic considerations: capex, opex, energy penalty, cost per ton of CO_2 avoided
- Will develop matrix of regional source categories (type and size), and most-appropriate capture technologies

Amine CO2-removal unit installed on a natural gas processing plant

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Public Outreach Efforts

- Two-pronged effort:
  1. Share information with the public
  2. Solicit public input at all stages
- Past and current activities include:
  - Developing general information materials
  - Developing a public contact database
  - Opening lines of communication
  - Supporting DOE's programmatic Environmental Impact Statement
- Future plans include:
  - A response web site
  - More focused and interactive discussions in late 2004 and 2005

Outreach Results

What are we doing?

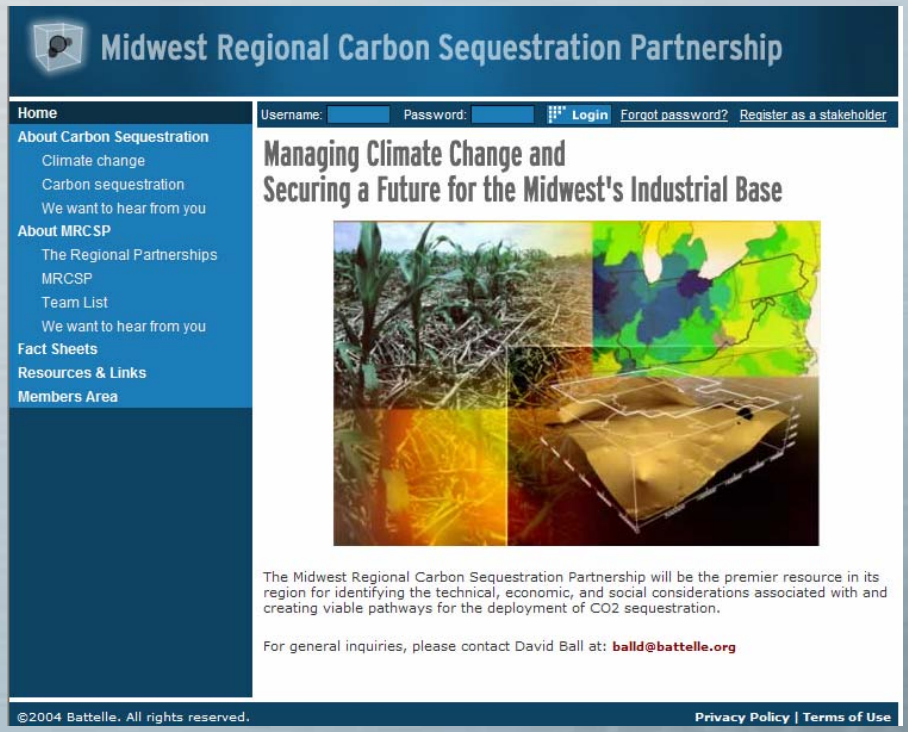
- Initial mailing sent to 130 stakeholders in support of PEIS meeting in Columbus.
- Our stakeholder list has since been expanded to over 300.
- We are expanding our web site (www.mrcsp.org) to include a response capability (hopefully active in November pending DOE approval).

What have we learned?

- Initial feedback is that the public is not cognizant nor actively concerned about sequestration issues in general
  - provides an opportunity for presenting the issues in a constructive, problem-solving mode
- Public interest is expected to intensify as we get to specific projects.

Outreach: A Path Forward

- Response web site:
  - Enhance our educational efforts
  - Cost effectively engage a wide cross section of the public.
- Results will help us screen candidate Phase II projects.
- We also believe its value extends into a possible Phase II and beyond.



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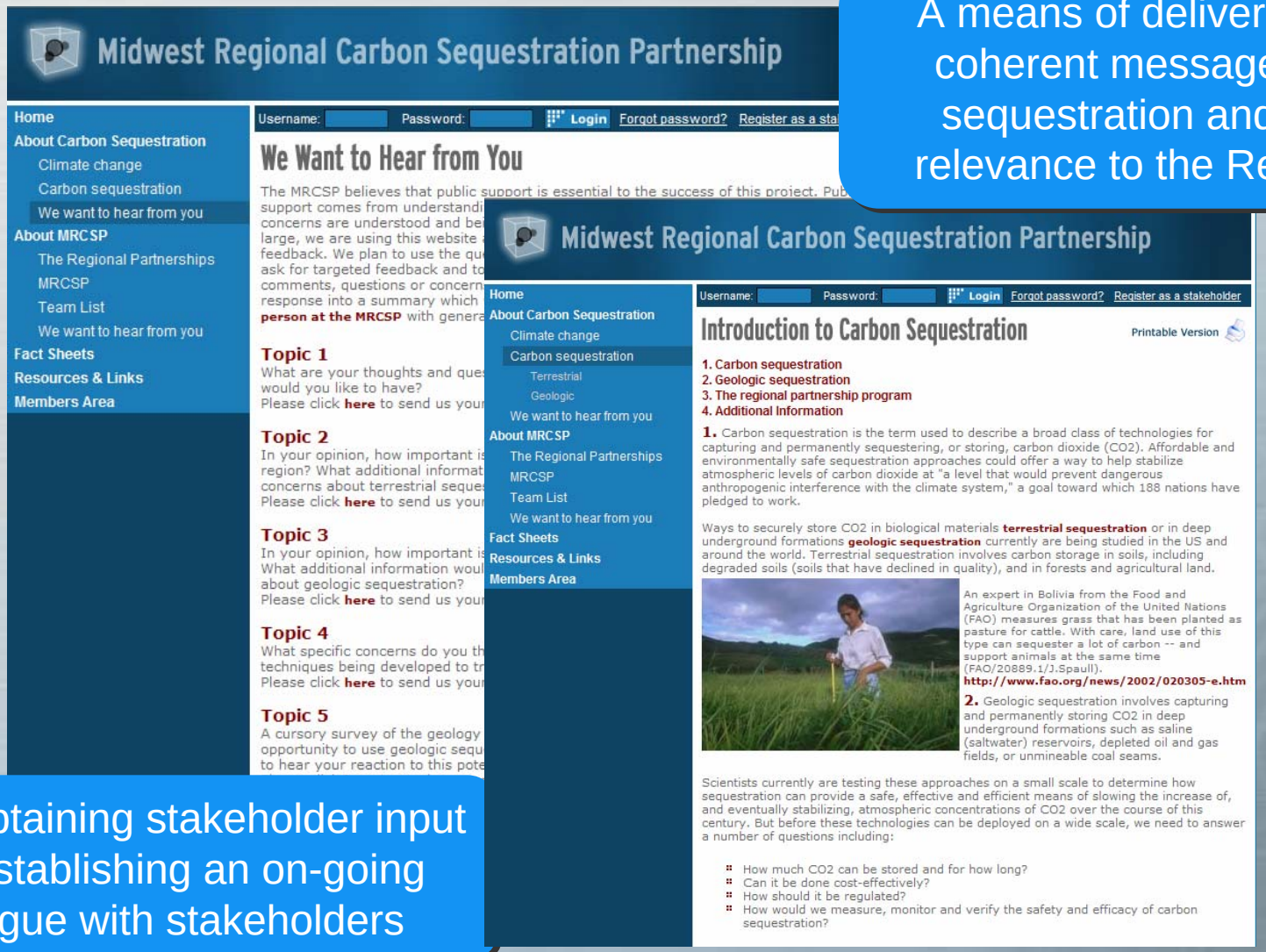
Response Website

A means of delivering a coherent message on sequestration and Its relevance to the Region



While obtaining stakeholder input and establishing an on-going dialogue with stakeholders

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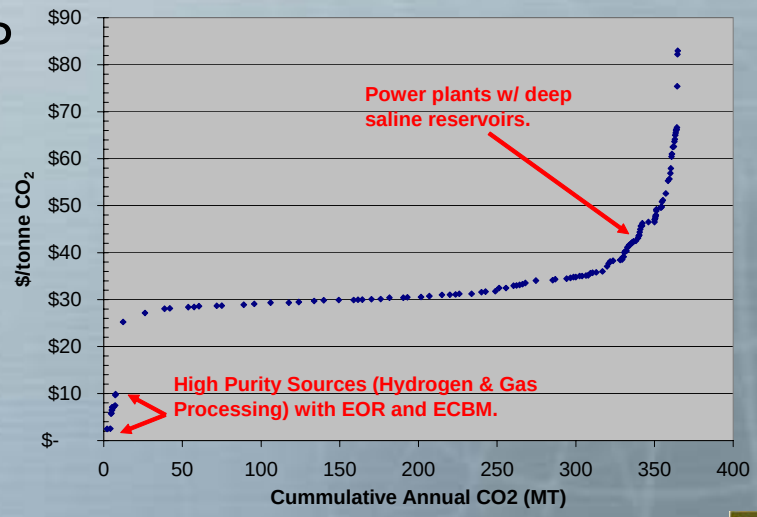
Phase I: Delivering Important Knowledge on How Sequestration Technologies Will Be Used in Our Region

- An assessment of the MRCSP's terrestrial sequestration resource and options for exploiting this natural resource
- An assessment of the MRCSP's geologic sequestration resource and options for exploiting this natural resource
- MRCSP sequestration GIS system
- Key task reports on regulatory environment, stakeholder views, economics for the MRCSP
- An Integrated Assessment of the MRCSP Region's Sequestration Potential: Summary Report of Phase 1 of the Midwest Regional Carbon Sequestration Partnership



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Preliminary Phase I Findings

- The MRCSP region is endowed with a large and potentially valuable sequestration resource
  - Many millions of tons of C in terrestrial potential
  - Many gigatons of CO_2 in geologic potential
- Accessing this resource is likely a positive cost activity
  - But the cost range may be low enough such that fossil fuels (and the region's economy) can thrive in a CO_2 emissions constrained future.
- The public is largely unaware of sequestration technologies
  - This is an opportunity to help shape acceptance of sequestration.
  - We see no support for the assertion that the public does not support sequestration technologies
- We see no showstoppers that would fundamentally constrain deployment of sequestration technologies in the Region.
- The challenge in the next phase is to turn this theoretical natural resource into more of a "proven reserve."

Phase II: Moving into the Field

- MRCSP and its partners remain committed to a Phase II process that is:
  - Transparent and open
  - Designed to address a broad cross section of the Region's sequestration potential
  - Responsive to DOE's expedited RFP schedule and the needs of our partners.

			Candidate Phase II Project #1	Candidate Phase II Project #2		Candidate Phase II Project #n
Evaluating Proposed Phase 2 Projects	Projected Cost for Phase II	$				
	Likelyhood of getting >20% non-federal cost share (majority cash)	H, M, L				
	$ / ton of CO2 sequestered in Phase II project	$/ton CO2				
	Innovativity of Phase II research (is hit helping to define the state of the art)	H, M, L				
	Ability to build upon pre-existing infrastructure	yes / no				
	Degree of public / stakeholder support for proposed project	H, M, L				
	Strength of DOE support for proposed project	H, M, L				
	Degree of support / partnership with state and federal regulators	H, M, L				
	Capable of addressing multiple reservoirs	yes / no				
	Safety / risks of proposed project	H, M, L				
Impact of Phase II Research Results on the Region	Size of offset potential for region	gigatons of CO2				
	Cost of potential offsets	$				
	Time to commercial implementation of these offsets	Years				
	Cabable of addressing the needs of majority of Region's point source emmission needs	H, M, L				
	Does it help attract new business or substantial new research projects into the Region	yes / no				
	Degree to which project would help to define new science based regulations	H, M, L				

Our goal is to select a portfolio of Phase II projects that address the broad sequestration needs of our Region and our members over the years to come.

We are on schedule and budget to meet that goal.

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Summary: MRCSP will Deliver Robust Carbon Management Strategies

- Bring together internationally recognized research leaders to help define practical carbon management solutions
- Define the real world potential for carbon sequestration in the Region and what it will take to realize it
- Help the Region take a first step towards the avoidance an economic liability of potentially major proportion
- Position the Region as a leader in developing robust carbon management solutions

Sequestration technologies are needed to protect core economic assets in the Region in a greenhouse gas constrained world

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