MAJOR POINT SOURCES OF CO_2 EMISSIONS AND CONCEPTUAL GEOLOGICAL SEQUESTRATION STRATEGIES IN INDIANA

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MAJOR SOURCES OF CO_2 EMISSIONS (METRIC TONS/YEAR)

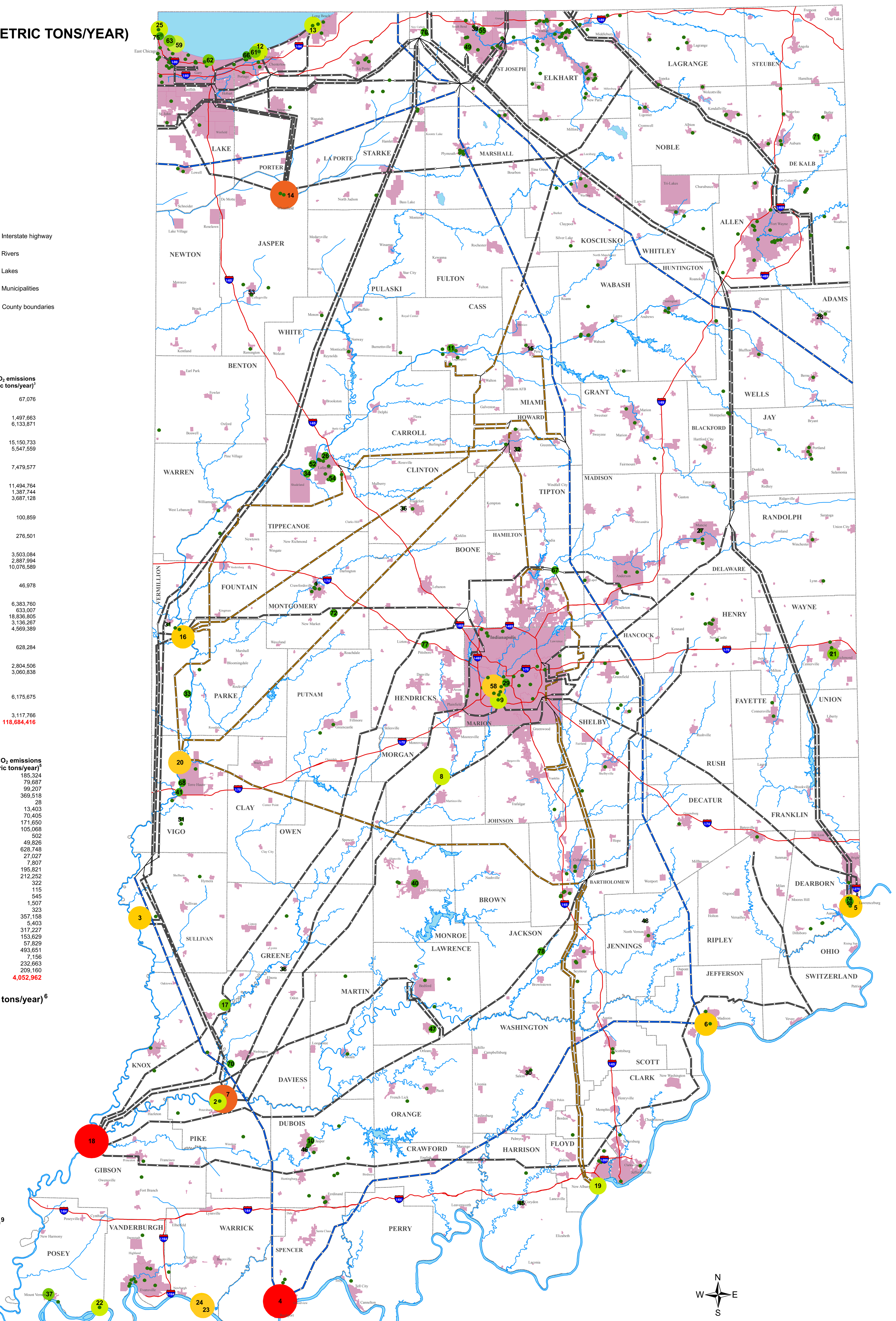
- Less than 100,000
- 100,000 to 500,000
- 500,000 to 1,000,000
- 1,000,000 to 5,000,000
- 5,000,000 to 10,000,000
- 10,000,000 to 15,000,000
- More than 15,000,000

Transmission line capacity
(line capacity smaller than 230,000 volt is not included)

- 765,000 volt
- 345,000 volt
- 230,000 volt
- Interconnection

Other

- Interstate highway
- Rivers
- Lakes
- Municipalities
- County boundaries



SCALE 1:600,000

0 12.5 25 50 75 100 Miles

0 12.5 25 50 75 100 Kilometers

MAJOR SOURCES OF CO_2 EMISSIONS [in metric tons]

(1 metric ton = 1.102 short ton)

1) Coal-burning facilities:

a) Electric power plants

ID	Company / Plant Name[1]	County	Generation capacity (MW)[2]	CO_2 emissions (metric tons/year)[3]
	Crawfordsville Electric Light & Power Co.			
1	Crawfordsville	Montgomery	25	67,076
	Hoosier Energy REC Inc.			
2	Frank E. Ratts	Pike	234	1,497,663
3	Merom	Sullivan	1,080	6,133,871
	Indiana Michigan Power Co.			
4	Rockport	Spencer	2,600	15,150,733
5	Tanners Creek	Dearborn	1,101	5,547,559
	Indiana-Kentucky Electric Corp.			
6	Clifty Creek	Jefferson	1,304	7,479,577
	Indianapolis Power & Light Co.			
7	Petersburg	Pike	1,873	11,494,764
8	Eagle Valley (formerly Pritchard)	Morgan	302	1,387,744
9	Harding Street (formerly Elmer W. Stout)	Marion	698	3,687,128
	City of Jasper			
10	Jasper 2	Dubois	15	100,859
	City of Logansport			
11	Logansport	Cass	43	276,501
	Northern Indiana Public Service Co.			
12	Bailly	Porter	616	3,503,084
13	Michigan City	La Porte	540	2,887,994
14	R. M. Schahfer	Jasper	1,944	10,076,589
	City of Peru			
15	Peru	Miami	35	46,978
	Duke Energy Indiana			
16	Cayuga	Vermillion	1,062	6,383,760
17	Edwardsport	Knox	110	633,007
18	Gibson	Gibson	3,340	18,836,805
19	R. Gallagher	Floyd	600	3,136,267
20	Wabash River	Vigo	1,165	4,569,389
	City of Richmond			
21	Whitewater Valley	Wayne	94	628,284
	Southern Indiana Gas & Electric Co.			
22	A. B. Brown	Posey	531	2,804,506
23	F. B. Culley	Warrick	415	3,060,838
	Southern Indiana Gas & Electric Co. and Alcoa Generating Corp.			
24	Warrick	Warrick	742	6,175,675
	State Line Energy LLC			
25	State Line Energy	Lake	613	3,117,766
	SUBTOTAL		**21,082**	**118,684,416**

b) Industries and institutions

ID	Company Name[4]	County	City	CO_2 emissions (metric tons/year)[5]
26	A.E. Staley Sagamore Operation	Tippecanoe	Lafayette	185,324
27	Ball State University	Delaware	Muncie	79,687
28	Bunge North America (East), LLC	Adams	Decatur	99,207
29	C.C. Perry K Steam Plant	Marion	Indianapolis	369,518
30	Child Craft Industries, Inc.	Washington	Salem	28
31	Colonial Brick Corp.	Vermillion	Cayuga	13,403
32	DaimlerChrysler Corp. Transmission Plant	Howard	Kokomo	70,405
33	Eli Lilly & Company - Clinton Labs	Vermillion	Clinton	171,650
34	Eli Lilly & Company - Tippecanoe Labs	Tippecanoe	Lafayette	105,068
35	F-Jasper 11th Ave	Dubois	Jasper	502
36	Frito-Lay, Inc.	Clinton	Frankfort	49,826
37	GE Plastics Mt. Vernon Inc.	Posey	Mount Vernon	628,748
38	Griffin Industries, Inc. - Newberry	Greene	Newberry	27,027
39	Holy Cross Services Corp.	St. Joseph	Notre Dame	7,807
40	Indiana University	Monroe	Bloomington	195,821
41	International Paper Co.	Vigo	Terre Haute	212,252
42	Jasper Chair Co.	Dubois	Jasper	322
43	Jasper Wood Prod.	Dubois	Jasper	115
44	Jofco Plt 1 & 2	Dubois	Jasper	545
45	Keller Manufacturing Co., Inc.	Harrison	Corydon	1,507
46	Kimball International	Dubois	Jasper	323
47	Lehigh Cement Company	Lawrence	Mitchell	357,158
48	Muscatatuck State Hospital & Training	Jennings	Butlerville	5,403
49	New Energy Corp.	St. Joseph	South Bend	317,227
50	Pernod Ricard USA	Dearborn	Lawrenceburg	153,629
51	Pfizer, Inc.	Vigo	Terre Haute	57,829
52	Purdue University - Wade Utility Plant	Tippecanoe	West Lafayette	493,651
53	Saint Josephs College	Jasper	Rensselaer	7,156
54	Tate & Lyle, Lafayette South	Tippecanoe	Lafayette	232,663
55	University Of Notre Dame Du Lac	St. Joseph	Notre Dame	209,160
	SUBTOTAL			**4,052,962**

2) Major natural-gas burning sources (greater than 100,000 metric tons/year)[6]

ID	Company Name[7]	County	CO_2 emissions (metric tons/year)[8]
56	Duke Energy - Wabash River	Vigo	8,133,539
57	SIGECO - F.B.Culley Generating Station	Warrick	6,006,515
58	DaimlerChrysler Corporation Foundry	Marion	5,486,660
59	Ironside Energy, LLC	Lake	1,041,348
60	Indiana Harbor East	Lake	885,042
61	ISG Burns Harbor, LLC	Porter	735,320
62	US Steel Corp. Gary Works	Lake	707,871
63	Whiting Clean Energy, Inc.	Lake	510,884
64	Mittal Steel (ISG Indiana Harbor West)	Lake	502,018
65	C.C. Perry K Steam Plant	Marion	427,813
66	Portside Energy Corporation	Porter	213,925
67	Duke Energy - Noblesville	Hamilton	208,762
68	Mirant Sugar Creek, LLC	Vigo	189,605
69	GE Plastics Mt. Vernon, Inc.	Posey	183,560
70	Grain Processing Corporation	Daviess	180,875
71	Steel Dynamics / Iron Dynamics	De Kalb	173,962
72	Nucor Steel Corp.	Montgomery	163,076
73	Alcoa Inc. - Warrick Operations	Warrick	140,522
74	PSEG Lawrenceburg Energy Company, Inc.	Dearborn	116,832
75	Cargill, Inc.	Lake	114,686
76	I/N Tek I/N Kote Combined	St. Joseph	106,185
77	Steel Dynamics, Inc., (SDI) Bar Products	Hendricks	105,524
	SUBTOTAL OF LISTED		**26,334,523**
	ALL NATURAL-GAS BURNING SOURCES		**30,402,977**

3) Major wood-burning sources (greater than 100,000 metric tons/year)[9]

ID	Company Name	County	CO_2 emissions (metric tons/year)[10]
78	Rose Acre Farms, Inc., Soybean Processing	Jackson	337,892
	ALL WOOD-BURNING SOURCES		**421,834**

Emission sources	CO_2 emissions (metric tons/year)
Coal-burning electric power plants	118,684,416
Major coal-burning industrial and institutional plants	4,052,962
Natural-gas industrial generators	30,402,977
Wood-burning industries	421,834
Oil-burning industries[11]	96,949
TOTAL	**153,659,138**

1 U.S. Federal Energy Regulatory Commission (FERC). Existing generating plants as of January 1, 2005, unpublished data.
2 Magawatt totals include coal-burning units, but not units burning other fuels, therefore, these numbers may not match plant totals published elsewhere.
3 U.S. Environmental Protection Agency (EPA) emissions data (EPA, 2004). Where emissions data is unavailable through that source, they are calculated from Indiana Department of Environmental Management coal consumption data using an EPA emission factor (EPA, 1998a).
4 Indiana Department of Environmental Management, unpublished data.
5 Calculated from Indiana Department of Environmental Management coal consumption data using an EPA emission factor (EPA, 1998a).
6 Includes top 24 CO_2 emitters (by volume of emissions). Total number of natural-gas burning sources in the state is 417.
7 Indiana Department of Environmental Management, unpublished data.
8 Calculated from Indiana Department of Environmental Management natural-gas consumption data using an EPA emission factor (EPA, 1998b).
9 Major CO_2 emitter (by volume of emissions). Total number of natural wood-burning sources in the state is 21.
10 Calculated from Indiana Department of Environmental Management wood and wood waste consumption data using an EPA emission factor (EPA, 1998c).
11 Calculated from Indiana Department of Environmental Management fuel-oil consumption data using an EPA emission factor (EPA, 1998d).

CONCEPTUAL GEOLOGICAL SEQUESTRATION STRATEGIES FOR CO_2 IN INDIANA

Potential geological sequestration includes four options:

1) Adsorption within coal seams that are too deep or too inferior in quality to mine;
2) Isolation in mature or depleted oil and natural gas reservoirs;
3) Storage in deep, saline-water-filled formations;
4) Adsorption in organic-rich shales.

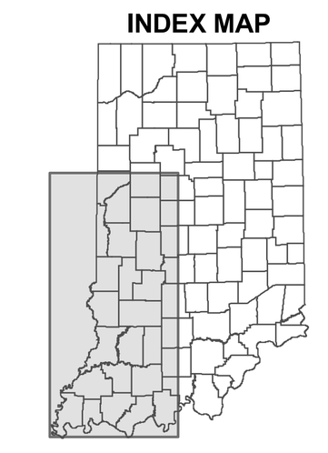
Further evaluation to determine ability of these four conceptual geological sequestration strategies is ongoing.

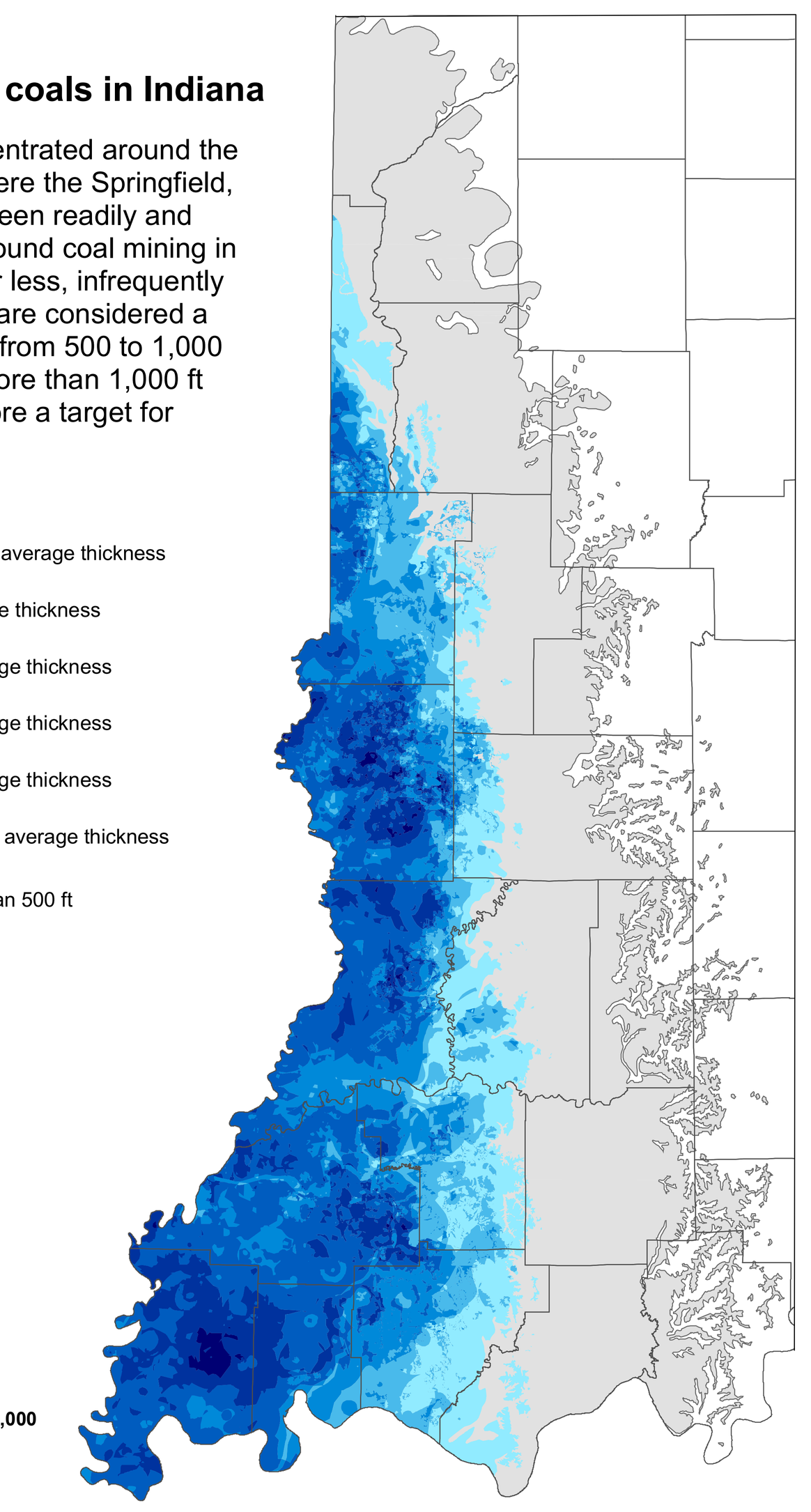
1) CO_2 storage potential for major coals in Indiana

Coal mining in Indiana has been concentrated around the eastern margin of the Illinois Basin where the Springfield, Danville, and other coal seams have been readily and economically accessed. Most underground coal mining in Indiana has been at depths of 300 ft or less, infrequently to 500 ft. Coals from 1.5 to 3.5 ft thick are considered a target for CO_2 sequestration at depths from 500 to 1,000 ft. Additionally, all coals at depths of more than 1,000 ft are considered unminable, and therefore a target for sequestration.

- Less or equal 5 ft cumulative average thickness
- >5 to 10 ft cumulative average thickness
- >10 to 15 ft cumulative average thickness
- >15 to 20 ft cumulative average thickness
- >20 to 25 ft cumulative average thickness
- Greater than 25 ft cumulative average thickness
- Area excluded, depth less than 500 ft

INDEX MAP





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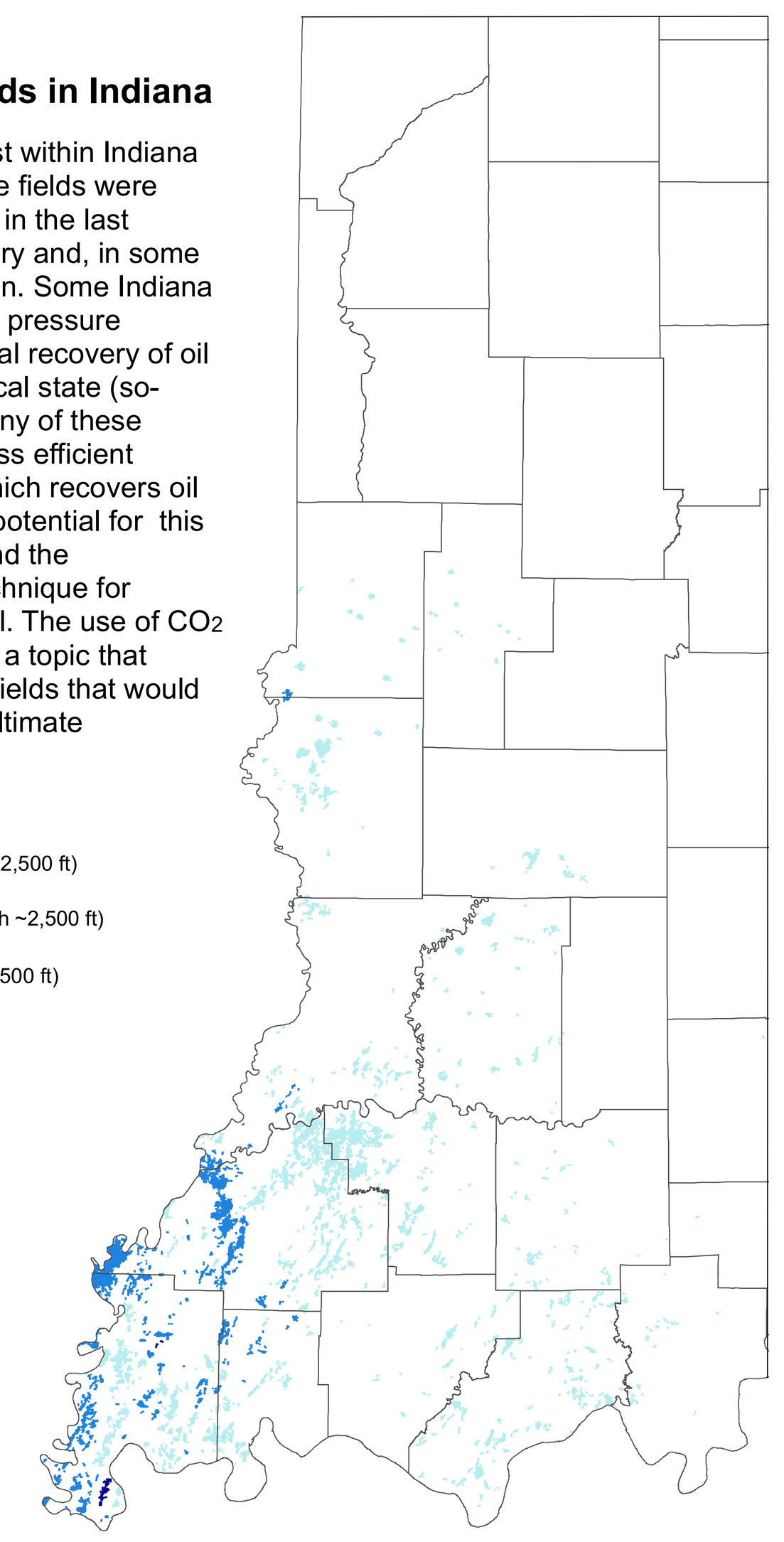
2) CO_2 storage potential in oil fields in Indiana

Many mature and depleted oil fields exist within Indiana and the surrounding Illinois Basin. These fields were developed over decades, and many are in the last phases of their economic life after primary and, in some cases, secondary (waterflood) production. Some Indiana fields may be too shallow to achieve the pressure necessary for the most efficient additional recovery of oil in which CO_2 is injected in the supercritical state (so-called "miscible flooding"). However, many of these fields are appropriate for a somewhat less efficient process termed "immiscible flooding" which recovers oil otherwise left in abandoned fields. The potential for this process is being evaluated in Indiana and the surrounding basin and may be a key technique for recovering a significant amount of the oil. The use of CO_2 to enhance oil production in the basin is a topic that needs further study to identify those oil fields that would offer both an economic benefit and an ultimate repository for CO_2.

- Predominantly immiscible (depth <2,500 ft)
- Predominantly near-miscible (depth ~2,500 ft)
- Predominantly miscible (depth >2,500 ft)



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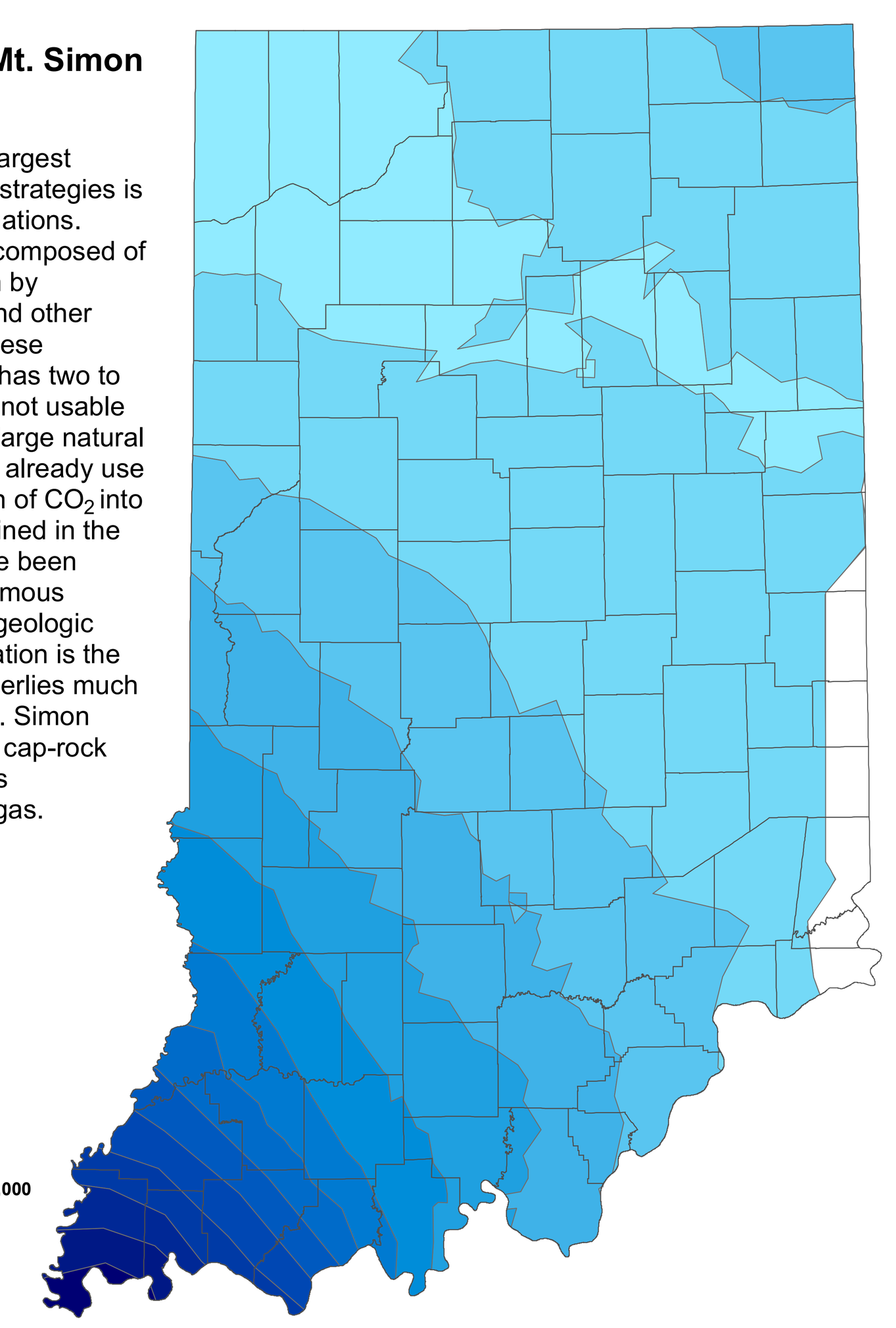
3) CO_2 storage potential in the Mt. Simon sandstones in Indiana

The CO_2 sequestration option having the largest potential volume among the four geologic strategies is injection into deep saline-water-filled formations. These reservoirs or aquifers are typically composed of porous and permeable sandstone overlain by thousands of feet of impermeable shale and other sedimentary rock. The water in some of these formations, at depths of 3,000 to 5,000 ft, has two to three times the salinity of seawater and is not usable as a potable water resource. Many of the large natural gas storage fields located within the basin already use these units for the storage of gas. Injection of CO_2 into these formations, where it would be contained in the same manner that natural gas and oil have been contained for millions of years, offers enormous sequestration potential. One of the major geologic units potentially suitable for CO_2 sequestration is the Mt. Simon Sandstone, a rock unit that underlies much of the Illinois Basin. The geology of the Mt. Simon makes it an excellent storage unit and the cap-rock seal of the Eau Claire Shale has proven its performance as a seal containing natural gas.

Depth [ft]

- Less or equal 3,000
- >3,000 to 4,000
- >4,000 to 5,000
- >5,000 to 6,000
- >6,000 to 7,000
- >7,000 to 8,000
- >8,000 to 9,000
- >9,000 to 10,000
- >10,000 to 11,000
- >11,000 to 12,000
- >12,000 to 13,000
- >13,000 to 14,000
- >14,000 to 15,000
- Greater than 15,000



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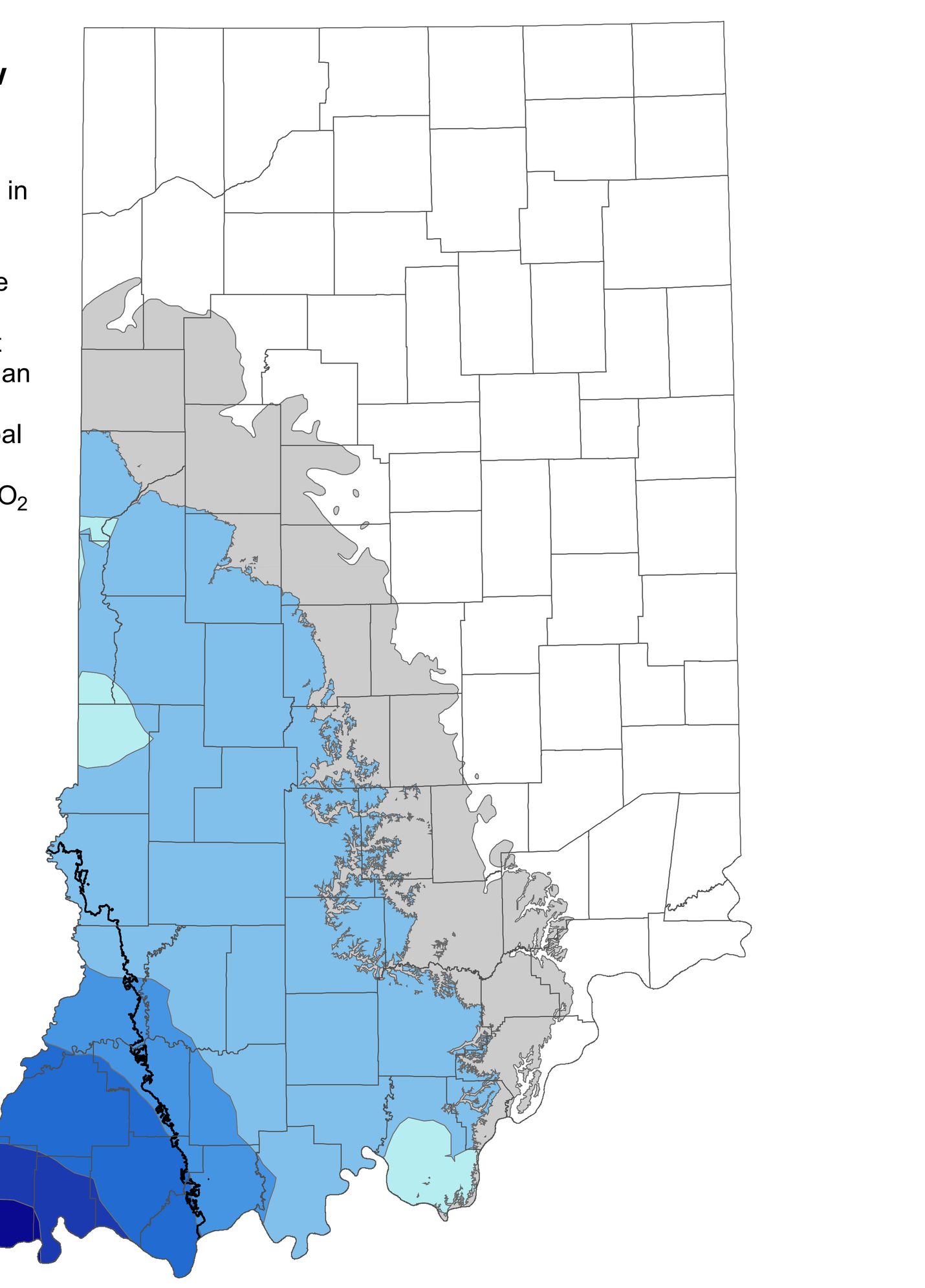
4) CO_2 storage potential in New Albany Shales in Indiana

Some of the shales in Indiana are very rich in organic material, hence the name "black" shales. The organic matter in these shales has the potential to adsorb CO_2 in the same manner as organic matter in coal beds. Because these shales are hundreds of feet thick and lie at great depths, they serve as an additional option for carbon sequestration. And in a similar manner as injection into coal beds, the potential exists for producing additional natural gas or methane as the CO_2 is injected.

Thickness [ft]

- Less or equal 100
- >100 to 150
- >150 to 200
- >200 to 250
- >250 to 300
- Greater than 300
- Area excluded, depth less than 500 ft
- 2,500 ft depth contour line



SCALE 1:1,500,000

Table showing semi-quantitative estimates of CO_2 storage capacities [metric tons].

	Low estimate	Most probable estimate	High estimate
Major coal beds[1]	77,190,900	185,767,000	307,418,000
Oil fields[1]	15,306,979	30,613,956	48,024,955
Mt. Simon Sandstone[2]	15,209,300,000	38,023,250,000	60,837,200,000
New Albany Shales[3]	6,825,000,000	7,800,000,000	12,675,000,000

1 Values for sequestration capacity in coals and oil fields were calculated using methods reported in the Midwestern Geological Sequestration Consortium Phase 1 investigation (2005).

2 Values for sequestration capacity in saline aquifers were calculated using the standardized methods as reported in the 2006 report by the Capacity and Fairways Subgroup of the Geologic Working Group of the DOE Carbon Sequestration Regional Partnerships. Values for e = 1%, 2.5% and 4% for low, most probable, and high estimates, respectively.

3 Values for sequestration capacity in shales were calculated using methods reported in Solano-Acosta and others (2004). Values for scf/ton = 35, 50 and 65 for low, most probable, and high estimates respectively.

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