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Economic Impacts of Industrial Silica Sand (Frac Sand) Mining

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Second in a series

#137 (May 2015): Environmental Impacts of Industrial Silica Sand (Frac Sand) Mining

#138 (June 2015): Economic Impacts of Industrial Silica Sand (Frac Sand) Mining

Introduction

Industrial silica sand has been mined across the United States for more than a century. Until recently, this sand was used primarily for glassmaking, cores for molding metal castings at foundries, metal production, feedstock for household and industrial cleaners, and construction supplies such as concrete. A small share of the sand was used for hydraulic fracturing, a technique used in oil and natural gas production.¹

Over the past few decades, as oil and natural gas production from conventional fields declined, energy producers developed techniques combining hydraulic fracturing and horizontal drilling. Now commonly known collectively as hydraulic fracturing, or “fracking,” those techniques are being used to increase oil and natural gas recovery in rock formations such as shale and tight sandstones that had previously been too expensive to develop. The process consists of injecting water, sand, and trace amounts of chemical additives into these rock formations to break apart the rock, allowing the oil and natural gas to flow freely up to the surface.

The proliferation of hydraulic fracturing for oil and natural gas production has greatly increased the demand for industrial silica sand.

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¹ National Industrial Sand Association, “What is Industrial Sand?” 2011, <http://www.sand.org/what-is-industrial-sand>.

The proliferation of hydraulic fracturing for oil and natural gas production has greatly increased the demand for industrial silica sand. This sand, commonly referred to as “frac sand” because of its use in the hydraulic fracturing process, has become a significant driver of economic growth, resulting in substantial increases in employment in the industrial sand industry. In Wisconsin, the nation’s leading supplier of industrial sand, data from the U.S. Bureau of Labor Statistics (BLS) indicate industrial sand mining employed only 189 people in 2002.² The Wisconsin Economic Development Corporation (WEDC) estimates this number will grow to nearly 3,000 when existing and proposed mines become fully operational, representing a 15-fold increase in employment in the industry in Wisconsin alone.³

This *Heartland Policy Study* will evaluate the potential benefits and costs of industrial silica sand mining with a primary focus on Wisconsin.

Several reports, each with strengths and shortcomings, have attempted to assess the economic benefits and costs of industrial sand mining in the Upper Midwest. Benefits of silica sand mining are often discussed in terms of creating high-paying opportunities for employment, increasing regional

economic activity, generating tax revenues for state and local governments, and improving economic diversity in rural communities that rely heavily on agriculture for household income.

The costs of silica sand mining are often described in terms of opportunity costs to other industries, particularly tourism and agriculture. Silica sand mining has been compared to mining economies in other regions of the country, including mining-dependent areas in the Iron Range of northern Minnesota, as indicating mining can result in “boom or bust” economic cycles and may not be a sound foundation for long-term economic prosperity.

This *Heartland Policy Study* will evaluate the potential benefits (Part 1) and costs (Part 2) of industrial silica sand mining with a primary focus on Wisconsin. The state is the largest producer of industrial silica sand in the nation, accounting for approximately two-thirds of U.S. frac sand production. Wisconsin has strong agricultural and tourism sectors and therefore provides valuable insight into claims industrial sand mining could negatively affect these industries, resulting in negative overall impacts in the rural counties in which mining occurs.

Part 1

Economic Benefits of Industrial Silica Sand Mining

The rapid expansion of industrial silica sand production in response to demand for frac sand has been an engine for economic growth across the Upper Midwest and particularly in Wisconsin, which has experienced significant job growth in the industrial sand mining industry. These are

² Kate Prengaman, “Frac Sand Boom Creates Thousands of Jobs,” *Appleton Post Crescent*, August 20, 2012, <http://archive.postcrescent.com/article/20120820/APC0101/308200091/Frac-sand-boom-creates-thousands-jobs>.

³ *Ibid.*

high-paying jobs, exceeding the average per-capita income in the counties in which they occur by 30 to 82 percent. In addition to thousands of direct jobs, the high earnings associated with frac sand mining jobs generate indirect and induced jobs in rural communities across the state.

Direct Employment

BLS data show industrial sand mining employed only 189 people in Wisconsin in 2002. Although specific employment and payroll data can be unavailable for rural areas to protect the confidentiality of local firms that may dominate a local economic sector,⁴ WEDC estimates the average frac sand processing facility creates 50 to 80 jobs and the average mine creates 10 jobs.⁵ According to Wisconsin Department of Natural Resources (WDNR) data, as of May 1, 2014 there were 121 active and inactive sand mines (63 active mines, 58 inactive), 74 active and inactive sand processing facilities (45 active, 29 inactive), and 27 rail-loading facilities.⁶

WEDC estimates suggest 630 people are currently employed mining industrial silica sand in Wisconsin, and between 2,250 and 3,600 people are employed at industrial sand processing facilities in the state, putting estimates for current employment between 2,880 and 4,230 people. This represents a 15- to 22-fold growth in industrial sand employment in the 12-year period between 2002 and 2014. These estimates are conservative, as they do not include the number of people employed at the 27 rail-loading facilities located in the state or the indirect jobs created.

If all the permitted mine sites and processing facilities in Wisconsin were fully operational, the industry would directly support 4,900 to 7,100 jobs.

If all the permitted mine sites and processing facilities were fully operational, the industry would support an estimated 1,200 mining jobs and 3,700 to 5,900 jobs at processing facilities, for a total of 4,900 to 7,100 jobs directly supported by the sand mining industry, exclusive of rail-loading facilities.

Indirect Employment

WEDC estimates consider only direct employment; they do not take into account earnings or the “multiplier effect” – the number of indirect jobs and induced jobs created by industrial silica sand mining.

⁴ Thomas Power and Donovan Power, “The Economic Benefits and Costs of Frac-Sand Mining in West Central Wisconsin,” prepared for the Wisconsin Farmers Union, Wisconsin Towns Association, and Institute for Agriculture and Trade Policy, May 2013, http://www.iatp.org/files/2013_05_30_FracSandMining_f.pdf.

⁵ Wisconsin Department of Natural Resources, “Silica Sand Mining in Wisconsin,” January 2012, <http://dnr.wi.gov/topic/Mines/documents/SilicaSandMiningFinal.pdf>.

⁶ Wisconsin Department of Natural Resources, “Locations of Industrial Sand Mines and Processing Plants in Wisconsin,” January 16, 2015, accessed February 28, 2015, <http://dnr.wi.gov/topic/Mines/ISMMMap.html>.

Indirect jobs are created and supported by companies hiring workers to provide goods or services to industrial sand companies, such as firms that manufacture conveyor belts, sand processors, and heavy machinery. Induced jobs are created and supported by people employed in direct and indirect jobs spending their paychecks in the general economy at restaurants, grocery stores, movie theaters, auto dealerships, etc. These additional jobs, indirect and induced, are known as the multiplier effect.

Multipliers can be difficult to assess statistically, and they are sometimes misunderstood or misused through double-counting or confusing multipliers with other economic measures such as turnover and value-added. Using IMPLAN (an economic modeling software for conducting economic impact analyses) to generate the multipliers resolves many of these concerns.⁷

To examine further the total economic impact of silica sand mining operations in Wisconsin, including earnings; direct, indirect, and induced employment; and the projected generation of state and local tax revenue during the construction and operations phases, we examine two economic impact analyses, one from Wood County, Wisconsin, and the other prepared on behalf of AllEnergy Sands for a proposed mine located in Trempealeau County, Wisconsin.

Wood County Economic Impact Analysis

In response to significant interest in silica sand mining in Wood County, Wisconsin, county policymakers in 2011 commissioned Economic Modeling Specialists Inc. (EMSI) to conduct an

Economic Modeling Specialists Inc. evaluated the frac sand mining industry's impact on job creation, earnings, and tax revenue generation for the state and local governments in Wood County, Wisconsin.

economic impact study examining the likely impact of developing and expanding the frac sand mining industry in Wood County.⁸ The analysis took into account quarrying the unprocessed sands from deposits, hauling unprocessed sands to processing plants, processing the sands, and shipping finished products to users outside Wood County.

EMSI evaluated the industry's impact on job creation, earnings, and tax revenue generation for the state and local governments, including the City of Marshfield, Wood County, Mid-State Technical College, and the Marshfield School District. It described the impact on employment, earnings, and tax revenue generation over three phases: construction, expansion and operations, and full operation. For the sake of brevity, this *Heartland Policy Study* will discuss only the construction and full-operations phases.

⁷ Steven Deller, "Contribution of Agriculture to the Wisconsin Economy: Updated for 2012," *2014 AAE Staff Paper Series*, University of Wisconsin-Madison, 2014, <http://wp.aae.wisc.edu/wfp/wp-content/uploads/sites/5/2014/09/Impact-of-Agriculture-2012-FINAL.pdf>.

⁸ Hank Robison, Timothy Nadreau, *et al.*, "The Economic Impact of Frac Sand Mining, A Look at Jobs and Earnings in Wood County, Wisconsin," Economic Modeling Specialists Inc., September 30, 2011, <http://wisconsinsand.org/assets/downloads/Econ-Impact-in-Wood-County.pdf>.

Construction Phase

Construction of sand mining and processing facilities requires significant capital investment. During the first 18 months of construction, processing plant and rail construction (used for shipping processed sand) were projected by EMSI to account for an initial investment of \$86 million: \$65.2 million for plant construction and \$20.8 million for upgrading existing rail lines and constructing new ones. EMSI projects these initial investments in construction will generate significant multipliers.

To better capture the new income that would be created in Wood County by developing and expanding the frac sand mining industry there, EMSI converted spending figures for plant construction into earnings for industrial sand employees.⁹ The conversion was made because earnings figures more accurately depict local economic impacts than do spending figures. Direct earnings for plant construction were found to be \$30.3 million. Multiplier impacts on a variety of industries were projected to generate an additional \$7.6 million in earnings, for a total effect of \$37.9 million, as shown in Figure 1. In total, the initial construction phase, including plant and rail construction (not shown in Figure 1), was expected to generate \$49.95 million in additional earnings in the county.

Figure 1

Earnings Impacts of \$65.2 Million Spending on Plant Construction

NAICS Code	Industry description	Initial Effects	Multiplier Effects	Total Effects
212322	Frac-Sands Processing	\$0	\$0	\$0
212322	Frac-Sands Mining	\$0	\$0	\$0
482112	Frac-Sands Ore Haulage	\$0	\$0	\$0
21	All other Mining	\$0	\$45,754	\$45,754
11	Agriculture, Forestry, Fishing and Hunting	\$0	\$46,908	\$46,908
22, 23	Utilities, Construction	\$30,273,845	\$659,760	\$30,933,605
31–33	Manufacturing	\$0	\$1,072,492	\$1,072,492
42, 44, 45	Trade	\$0	\$1,366,327	\$1,366,327
48, 49	Transportation and Warehousing	\$0	\$336,029	\$336,029
51, 52, 53	Finance, Insurance, Information, Real Estate	\$0	\$708,988	\$708,988
54, 55, 56	Professional, Management, Administrative Services	\$0	\$990,697	\$990,697
61, 62, 71	Education, Health Care, Arts, Misc. Services	\$0	\$1,226,670	\$1,226,670
72, 81	Accommodation, Food, Misc. Services	\$0	\$588,082	\$588,082
90	Government	\$0	\$538,954	\$538,954
<i>TOTAL</i>		<i>\$30,273,845</i>	<i>\$7,580,661</i>	<i>\$37,854,506</i>

Direct earnings for plant construction were found to be \$30.3 million. Multiplier impacts on a variety of industries were projected to generate an additional \$7.6 million in earnings, for a total effect of \$37.9 million.

Source: Hank Robison, Timothy Nadreau, *et al.*, *supra* note 8, Table 1.1, p. 1.

⁹ *Ibid.*

EMSI projected Wood County would experience significant direct, indirect, and induced employment from the initial construction phase. During the first year, 616 full-year jobs were projected to be created across a variety of industries. (See Figure 2.) The projected jobs would carry over into year two, but because the construction period is estimated to be 18 months, the

jobs number from year one was halved, accounting for 308 jobs during the construction phase. Although these jobs would not be permanent, they would have a significant impact on the state and local economy throughout the construction period.

Figure 2

Plant Construction			
NAICS Code	Industry description	Year 1	Year 2
212322	Frac-Sands Processing	0	0
212322	Frac-Sands Mining	0	0
482112	Frac-Sands Ore Haulage	0	0
21	All other Mining	0	0
11	Agriculture, Forestry, Fishing and Hunting	1	1
22,23	Utilities, Construction	480	240
31-33	Manufacturing	14	7
42, 44,45	Trade	28	14
48,49	Transportation and Warehousing	6	3
51, 52, 53	Finance, Insurance, Information, Real Estate	11	5
54, 55, 56	Professional, Management, Administrative Services	19	10
61, 62, 71	Education, Health Care, Arts, Misc. Services	32	16
72,81	Accommodation, Food, Misc. Services	18	9
90	Government	8	4
<i>TOTAL</i>		<i>616</i>	<i>308</i>

Construction spending will generate a wide variety of employment opportunities across a diverse spectrum of industries.

Source: Hank Robison, Timothy Nadreau, *et al.*, *supra* note 8, Table 1.4, p. 3.

Operations Phase

After the processing plants and mines reach the full-operations phase, EMSI projects the direct earnings from jobs in the industry would be \$44.9 million, with an estimated earnings multiplier of 1.3 – meaning for every \$1,000 in labor earnings in the frac sand mining industry, another \$310 would be generated in the county economy.¹⁰ Total earnings impacts were projected to be \$58.7 million when direct, indirect, and induced earnings are taken into consideration.

EMSI projected frac sand mining, processing, and hauling would directly employ 598 people with average annual earnings of approximately \$75,000 per worker, including employee benefits. Those earnings are significantly higher

than the average per-capita income of Wood County residents, exceeding the average earnings of \$41,307 by nearly 82 percent.¹¹ The high pay associated with these jobs results in a higher

¹⁰ Thomas Power and Donovan Power, *supra* note 4.

¹¹ Wisconsin Department of Workforce Development, “Wood County Summary,” accessed March 9, 2015, http://worknet.wisconsin.gov/worknet/jsprofile_results.aspx?menuselection=gp&area=141.

multiplier of 1.55, meaning for every two jobs in the frac sand industry, one additional job is projected to be created in the general economy of the county.¹²

The indirect and induced jobs pay an average of \$42,000 per year, significantly higher than the average yearly earnings of \$26,463 paid in Wood County for jobs supported by the tourism industry, for example.¹³ In total, EMSI estimates the full-operations phase of frac sand mining in Wood County would employ 929 people in direct, indirect, and induced jobs. Unlike employment during the construction phase, these jobs are permanent in nature. (See Figure 3.)

Figure 3

Phase 3 Operations Job Impacts by Year

NAICS CODE	Industry Description	Year 8	Year 9	Year 10
212322	Frac-Sands Processing	374	374	374
212322	Frac-Sands Mining	112	112	112
482112	Frac-Sands Ore Haulage	112	112	112
21	All other Mining	0	0	0
11	Agriculture, Forestry, Fishing and Hunting	4	4	4
22,23	Utilities, Construction	15	15	15
31-33	Manufacturing	11	11	11
42,44,45	Trade	71	71	71
48,49	Transportation & Warehousing	4	4	4
51,52,53	Finance, Insurance, Information, Real Estate	37	37	37
54,55,56	Professional, Management, Administrative Services	37	37	37
61,62,71	Education, Health Care, Arts, Misc. Services	75	75	75
72,81	Accommodation, Food, Misc. Services	64	64	64
90	Government	11	11	11
<i>TOTAL</i>		929	929	929

After all construction is complete and full operations begin in year eight, frac sand mining, hauling, and processing in Wood County will support 929 jobs.

Source: Hank Robison, Timothy Nadreau, *et al.*, *supra* note 8, Table 3.2, p. 7.

Tax Revenues

Tax revenues for the construction phase are expected to total \$1.46 million in the first year, growing to \$2.6 million per year in Year 8, when all sand processing facilities are in the full-operations phase. (See Figure 4.) It will be up to local policymakers to determine the best

¹² Thomas Power and Donovan Power, *supra* note 4.

¹³ Wisconsin Department of Tourism, "County Total Economic Impact," data from 2012–2013, accessed March 8, 2015, <http://industry.travelwisconsin.com/research/economic-impact>.

use of the new projected revenues: property tax relief, offsetting expenses for infrastructure upkeep, new local government projects and programs, support for recreational programs such as summer sports leagues and after-school programs, or other options of the local community's choosing.

Figure 4

New Tax Revenues from Frac Sand Development

CHANGE IN TAX REVENUES	1	2	3	4	5	6	7	8	Year n*
City of Marshfield	\$426,277	\$398,719	\$548,285	\$618,348	\$688,411	\$758,474	\$772,759	\$752,012	\$752,012
Wood County	\$220,751	\$206,479	\$283,933	\$320,216	\$356,499	\$392,781	\$400,179	\$389,435	\$389,435
Mid-State Technical College	\$77,072	\$72,090	\$99,132	\$111,799	\$124,467	\$137,135	\$139,718	\$135,966	...
Marshfield School District	\$434,365	\$406,284	\$558,687	\$630,080	\$701,472	\$772,865	\$787,421	\$766,280	\$766,280
Other	\$306,862	\$287,024	\$394,691	\$445,128	\$495,564	\$546,000	\$556,283	\$541,348	\$541,348
<i>TOTAL</i>	<i>\$1,465,327</i>	<i>\$1,370,596</i>	<i>\$1,884,728</i>	<i>\$2,125,571</i>	<i>\$2,366,413</i>	<i>\$2,607,255</i>	<i>\$2,656,358</i>	<i>\$2,585,041</i>	<i>\$2,585,041</i>

Once full operations begin, frac sand mining will generate \$2.6 million per year for government units in Wood County, the majority directed to the City of Marshfield and Marshfield School District.

Source: Hank Robison, Timothy Nadreau, *et al.*, *supra* note 8, Table 4.3, p. 9.

Conclusion: Wood County Analysis

A brief follow-up report – with the benefit of three years of hindsight to compare projected impacts with real-world observations – was published by EMSI in January 2015. Jason Angell, director of planning and economic development for Marshfield, confirmed the analysis provided an accurate range of results and the county economy is tracking with the report's findings: Unemployment is down and the county's population has grown.¹⁴

Only three of the four industrial silica sand processing plants modeled in the EMSI report were constructed. As a result, 170 people were employed at sand processing plants in Wood County in September 2014, about 22 percent fewer than the 217 jobs projected in the EMSI analysis. The number of people employed in sand mining and hauling may be affected to a similar degree, though this is merely speculation and not supported by available data.

¹⁴ Amanda Ryan, "A Spot-On Assessment: The Impact of Frac Sand Mining in Wisconsin," January 15, 2015, <http://www.economicmodeling.com/2015/01/27/a-spot-on-assessment-ems-measures-impact-of-frac-sand-mining-in-wisconsin/>.

AllEnergy Sand Economic Impact Analysis

EMSI's analysis for Wood County shows industrial silica sand operations increase direct, indirect, and induced employment, and those jobs pay substantially better than other jobs in the county. Similar results were obtained in a March 2014 economic impact analysis prepared by Logan Kelly, Ph.D., a professor of economics at the University of Wisconsin-River Falls, using the IMPLAN economic modeling software to examine the county and statewide impact of the construction of a proposed industrial silica sand mine in Trempealeau County, Wisconsin to be operated by AllEnergy Sand.¹⁵

Construction of the AllEnergy Sand mine is expected to take five months to complete, at an estimated total cost of \$47.6 million. Throughout the construction of the mine, 65 people will be employed directly in Trempealeau County (see Figure 5), with average earnings of approximately \$39,224. In addition, 14 indirect jobs and 10 induced jobs will be created in the county, with average earnings of \$39,609 and \$33,209, respectively. Statewide, construction of the mine will create 160 direct jobs, with average earnings of \$61,100; 63 indirect jobs, with average earnings of \$54,290; and 84 induced jobs, with average earnings of \$42,545.

Kelly found normal mine operations after construction would generate 71 permanent jobs in the county through direct, indirect, and induced employment. Average annual earnings for the direct jobs were projected to be \$48,711, 30 percent above the Trempealeau County average per-capita income. Statewide, an additional 131 permanent jobs would be created with average earnings in direct employment of \$76,559 per worker, exceeding the statewide average per-capita income of \$42,121 by 81 percent.

Figure 5

Summary of Economic Impact of Construction Phase

Statewide			
Impact Type	Employment	Labor Income	Output
Direct	160	9,775,694.31	23,825,398.95
Indirect	63	3,420,317.69	9,519,789.99
Induced	84	3,573,794.76	10,586,232.41
Total Effect	307	16,769,806.76	43,931,421.35
County			
Impact Type	Employment	Labor Income	Output
Direct	65	2,549,570.60	8,249,999.64
Indirect	14	554,527.82	1,883,582.08
Induced	10	332,093.69	1,213,119.83
Total Effect	88	3,436,192.11	11,346,701.54

During the five-month construction period of the AllEnergy Sand mine in Trempealeau County, a total of 225 direct, 77 indirect, and 94 induced jobs will be created at the state and county levels, assuming multiplier effects of 1.91 and 1.35, respectively.

Source: Logan Kelly, *supra* note 15, Table 1, p. 3.

¹⁵ Logan Kelly, "ALL Energy Fracture Mine Economic Study," Center for Economic Research, University of Wisconsin-River Falls, March 2014, https://www.heartland.org/sites/default/files/all_energy_fracture_sand_mine_economic_study_2014.pdf.

Figure 6

Impact of Normal Operations by Sector

Statewide			
Description	Employment	Labor Income	Output
Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	45.5	3,482,787.96	30,328,778.76
Architectural, engineering, and related services	6.5	391,037.06	696,497.58
Food services and drinking places	6.0	114,153.41	323,095.70
Securities, commodity contracts, investments, and related activities	4.7	229,859.36	704,929.20
Support activities for other mining	4.4	64,643.97	1,192,966.36
Management of companies and enterprises	3.5	382,274.13	732,579.59
Transport by truck	3.3	195,808.85	485,321.56
Monetary authorities and depository credit intermediation activities	2.8	196,450.16	884,062.01
Wholesale trade businesses	2.6	196,796.83	502,137.95
Private hospitals	2.5	165,023.82	340,989.30
County			
Description	Employment	Labor Income	Output
Mining and quarrying sand, gravel, clay, and ceramic and refractory minerals	38.4	1,973,885.24	24,999,791.92
Architectural, engineering, and related services	2.4	101,315.15	212,462.35
Food services and drinking places	2.0	26,721.98	94,931.77
Transport by truck	1.9	91,899.19	255,389.28
Monetary authorities and depository credit intermediation activities	1.1	60,431.85	334,288.70
Securities, commodity contracts, investments, and related activities	1.1	15,916.06	125,892.57
Civic, social, professional, and similar organizations	0.9	15,621.15	28,032.56
Management of companies and enterprises	0.9	46,159.92	132,322.83
Services to buildings and dwellings	0.8	12,364.49	36,879.72
Private hospitals	0.7	43,554.65	94,801.88

Many conversations about direct employment in the industrial silica sand mining industry tend to focus on jobs in the active mining, transporting, and processing of sand. However, professional services such as architectural and engineering jobs are required to ensure mining operations are constructed and operated in an environmentally responsible manner.

Source: Logan Kelly, Ph.D., *supra* note 15, Table 6, p. 7.

During the first full year of operations, the mine is projected to create 42 direct jobs in Trempealeau County with a total labor income of approximately \$2 million, resulting in average annual incomes of \$48,771 per worker. (See Figure 6.) This figure exceeds the county-wide average per-capita income of \$37,494 by 30 percent.¹⁶

These jobs are estimated to have an employment multiplier of 1.69 at the county level, resulting in the creation of 19 indirect and 10 induced jobs with average annual incomes of \$52,015 and \$32,361, respectively, bringing the total

number of jobs supported by the AllEnergy facility to 71. (See Figure 7.) Statewide, the full operation of the mine will create 44 direct jobs, with labor compensation of \$3.4 million, resulting in average annual earnings of \$76,559 per worker, exceeding the statewide average per-capita income of \$42,121 by 81 percent. These jobs are estimated to have a multiplier of 2.97, resulting in the creation of 47 indirect jobs and 39 induced jobs across the state with annual average earnings of \$51,787 and \$42,483, respectively. This statewide multiplier is slightly higher than the statewide multiplier of 2.2 documented in other reports, but it is generally

¹⁶ Wisconsin Department of Workforce Development, "Trempealeau County Summary," accessed March 8, 2015, http://worknet.wisconsin.gov/worknet/jsprofile_results.aspx?menuselection=gp&area=121.

consistent with the findings of other economic analyses conducted on this subject.¹⁷

Reclaiming the mine will begin one year after normal operations commence and will be an ongoing process. Reclamation is projected to directly add seven jobs statewide and four jobs in the county, with average earnings of \$55,018 and \$46,791, respectively. Multiplier effects are estimated to result in six jobs statewide and two jobs at the county level. Mine reclamation is thus projected to result in 13 direct, indirect, and induced jobs at the state level and six at the county level.

Normal operations of the mine will generate approximately \$1.3 million in annual tax revenue and, after the first full year of the mine’s operation, reclamation will generate another \$61,000. These figures are estimates of total tax revenue, including Social Security, Medicare, and other federal taxes, so not all of this revenue will be realized by state and local governments.

Economic Diversification

A report commissioned in part by the Wisconsin Farmers Union (WFU) suggests the high wages paid by jobs in mining and transportation are likely to compete successfully for local workers with the necessary skills for these jobs. That could make it more difficult and costly for other local businesses to hire equally qualified workers, which could raise their costs and make it more difficult for them to earn a profit, potentially undermining the diversity and vitality of the local economy.¹⁸ While it is true industrial sand jobs will likely draw qualified employees from other businesses, the WFU analysis fails to acknowledge the vast majority of sand-producing counties already lack economic diversity.

¹⁷ Thomas Power and Donovan Power, *supra* note 4.

¹⁸ Thomas Power and Donovan Power, *supra* note 4.

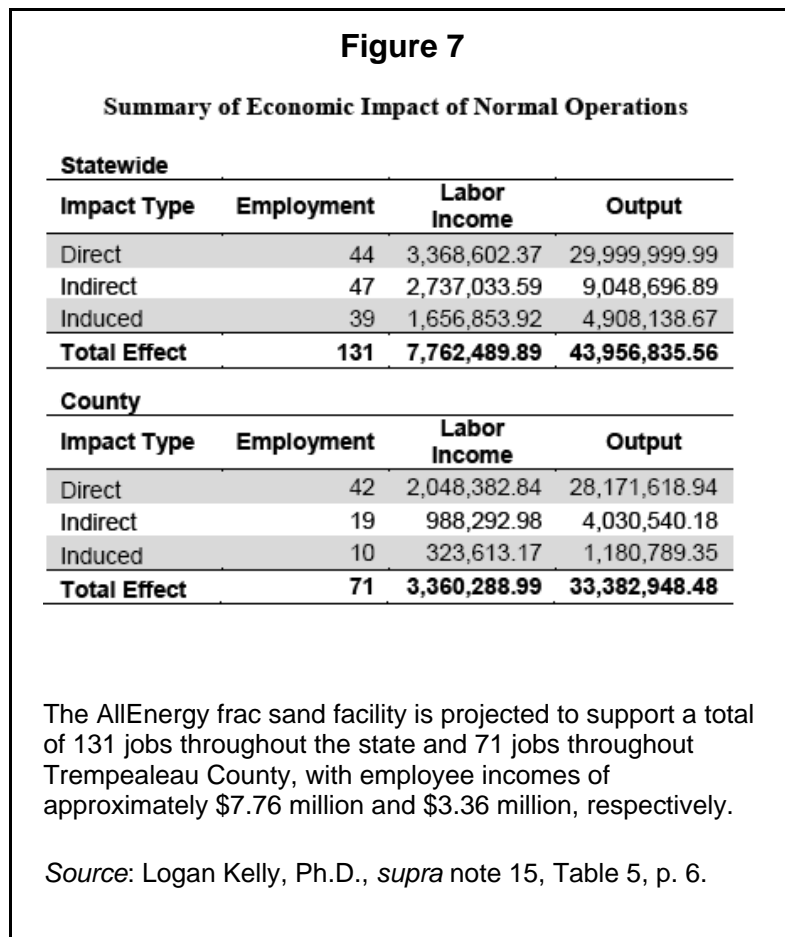


Figure 8			
County	Total Jobs	Agriculture Jobs	Agriculture as a % of All Jobs
Barron County	28,781	8,231	28.6
Buffalo County	8,435	3,046	36.1
Burnett County	6,820	848	12.4
Chippewa County	31,660	4,388	13.9
Clark County	16,905	7,696	45.5
Columbia County	29,006	4,528	15.6
Crawford County	10,460	1,488	14.2
Dunn County	21,245	3,881	18.3
Eau Claire County	70,107	4,481	6.4
Green Lake County	9,769	1,463	15.0
Jackson County	11,513	2,543	22.1
Monroe County	24,727	4,281	17.3
Outagamie County	124,258	11,593	9.3
Pepin County	3,266	1,035	31.7
Pierce County	14,369	2,378	16.6
Polk County	20,122	3,693	18.4
Portage County	43,167	5,551	12.9
Trempealeau County	16,829	4,778	28.4
Waupaca County	25,734	4,427	17.2
Wood County	50,781	4,616	9.1
Total	567,954	84,945	19.4
Data compiled from the University of Wisconsin-Extension <i>County Impact Reports</i> demonstrate silica sand-producing counties rely heavily on agriculture as a source of employment. Several frac sand counties depend on agriculture for more than 20 percent of the jobs in the county. Clark County relies on agriculture for 46 percent of the jobs in the county, suggesting this area lacks economic diversity.			

Wisconsin relies heavily on agriculture as a source of employment, with this sector accounting for 11.9 percent of all jobs in the state.¹⁹

Rural communities in western Wisconsin are even more dependent on agriculture as a source of employment than the statewide average: Six sand-producing counties (Barron, Buffalo, Clark, Jackson, Pepin, and Trempealeau) derive more than 20 percent of their total employment from this sector, and Clark County relies on agriculture for 46 percent of the total jobs in the county. (See Figure 8.)

Of the 20 sand-producing counties, in only three (Eau Claire, Outagamie, and Wood) does agriculture represent less than the statewide average of 11.9 percent of all jobs.²⁰

These figures confirm agriculture is and will continue to be an important part of the Wisconsin

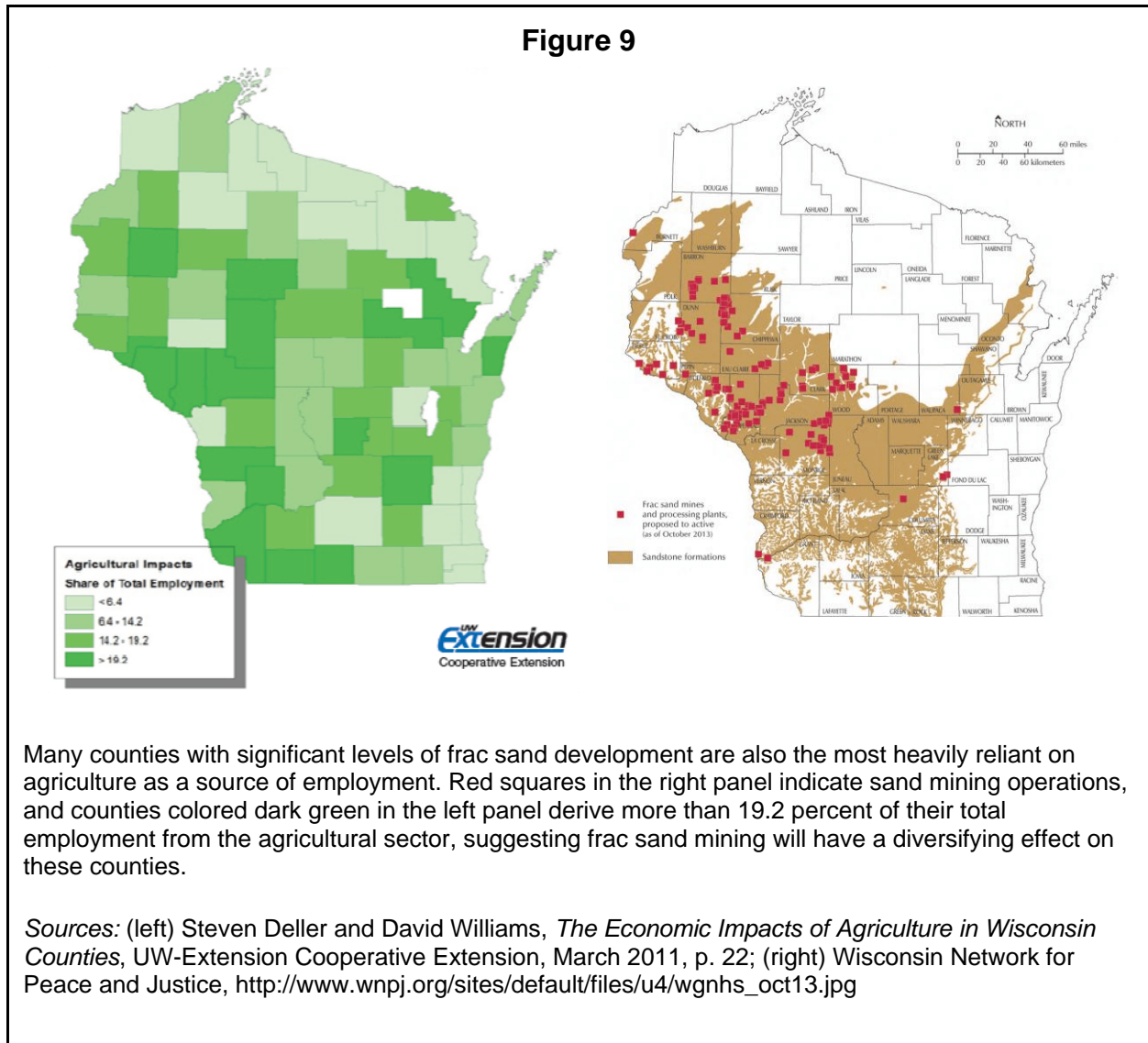
economy. They also indicate western Wisconsin, including many sand-producing counties, already lacks economic diversity.

Agriculture is a volatile industry, as commodity prices fluctuate from year to year based on unpredictable factors such as weather conditions, insects, crop disease, market forces, and crop yields around the world. When commodity prices are low, farmers and others employed in the

¹⁹ Steven Deller, *supra* note 7.

²⁰ University of Wisconsin Extension, *County Impact Reports*, accessed March 11, 2015, <http://www.uwex.edu/ces/ag/wisag/>.

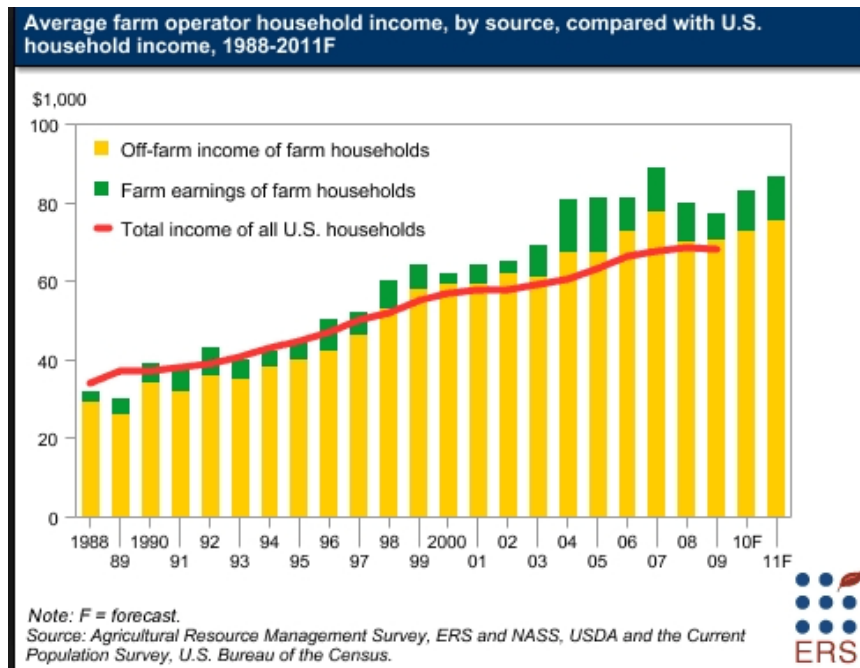
agricultural sector have less money to spend on other goods, which affects retail and other establishments in rural communities. Industrial sand mining presents an opportunity for economic diversification in some of the counties most dependent on agriculture. (See Figure 9.)



Jobs in industrial sand mining may become increasingly important in rural communities. A growing number of farm households already rely on income from nonfarm sources. In recent years, 85 to 95 percent of average U.S. farm household income has come from off-farm sources such as employment earnings, other business activities, and unearned income.²¹ (See Figure 10.)

²¹ Economic Research Service, "Average farm household income continues to exceed average U.S. household income," U.S. Department of Agriculture, 2011, <http://www.ers.usda.gov/data-products/chart-gallery/detail.aspx?chartId=10378>.

Figure 10



On-farm earnings are subject to considerable fluctuation based on a variety of factors, but in general farmers increasingly depend on nonfarm income for financial wellbeing.

Source: Economic Research Service, *supra* note 21.

This trend is especially pronounced among family farms. For the 82 percent of U.S. farming operations with annual sales of \$100,000 or less, U.S. Department of Agriculture (USDA) data show off-farm income typically accounts for all but a negligible amount of farm household income.²² For the majority of U.S. farm households, the availability of off-farm income is more important for financial wellbeing than are returns on farm production.

The lack of economic diversity in many rural communities means there are few opportunities outside the agricultural sector or with earnings comparable to those for industrial silica sand mining jobs. The increasing importance of nonfarm employment could make jobs at industrial sand facilities an especially attractive option for farm operators with experience with heavy machinery.

²² United States Department of Agriculture, "Family Farm Income," Farm Bill Forum Comment Summary and Background, accessed March 11, 2015, http://www.usda.gov/documents/FARM_FAMILY_INCOME.doc.

Part 2

Economic Costs of Industrial Silica Sand Mining

The potential economic costs of industrial sand mining are often described in terms of opportunity costs to other sectors of the economy, particularly tourism and agriculture, and concerns industrial silica sand mining could jeopardize western Wisconsin's existing economic vitality.²³ Other potential economic costs of industrial sand mining have been most thoroughly discussed in a previously cited study by Thomas Power and Donovan Power for the Wisconsin Farmers Union, Wisconsin Towns Association, and Institute for Agriculture and Trade Policy, titled "The Economic Benefits and Costs of Frac-Sand Mining in West Central Wisconsin."²⁴

The Power study draws comparisons to previous mining experiences in Wisconsin and mining-dependent areas of the country, such as the Iron Range of northern Minnesota and coal-producing communities in Appalachia, in an attempt to provide historical context the researchers say is relevant in determining whether industrial sand mining will be a foundation on which long-term economic prosperity can be built.

The potential economic costs of industrial sand mining are often described in terms of opportunity costs to other sectors of the economy, particularly tourism and agriculture.

The Power study also addresses economic leakages as they pertain to mining in rural areas, with the report suggesting many of the earnings from high-paying industrial sand jobs will be spent outside the counties in which mining is occurring.

Below, we examine the impact of sand mining on tourism in sand-producing counties and evaluate the potential economic costs discussed in the Power report.

Impact on Tourism

Perhaps the most commonly perceived economic cost of industrial silica sand mining in Wisconsin is the concern that the presence of sand mining operations will make areas less attractive to tourists. Tourism is a major source of employment in Wisconsin. Data from the Wisconsin Department of Tourism indicate the tourism sector supported 185,495 direct, indirect, and induced jobs in 2014, accounting for 7.9 percent of all employment in the state.²⁵ Tourism is estimated to have generated \$1.44 billion in state and local tax revenues.

²³ Kate Prengaman, "Report: 'Little Impact' on Wisconsin From Frac Sand Mining Jobs," Wisconsinwatch.org, May 16, 2013, <http://wisconsinwatch.org/2013/05/little-impact-from-frac-sand-jobs/>.

²⁴ Thomas Power and Donovan Power, *supra* note 4.

²⁵ Wisconsin Department of Tourism, "The Power of Tourism," 2014, <http://industry.travelwisconsin.com/uploads/medialibrary/e4/e42c3872-f898-46f9-9c35-6aab8fef44c3-power-of-tourism-fact-sheet-2014.pdf/>.

Groups opposed to mining often portray mining as incompatible with tourism and recreation.²⁶ Among the primary concerns cited are traffic congestion and noise from increasing numbers of trucks hauling sand, the potential loss of scenic beauty from hills and farm fields being converted to mining, and the potential degradation of local air and water quality.

While truck traffic, noise, and land use changes could alter tourism patterns or affect tourism revenue, these concerns have been based on speculation and anecdotal evidence, not tourism data or other empirical evidence.

While truck traffic, noise, and land use changes could alter tourism patterns or affect tourism revenue, to date these concerns have been based on speculation and anecdotal evidence, not tourism data or other empirical evidence.

To evaluate the impact of industrial silica sand mining on tourism in sand-mining counties, we obtained tourism data from the Wisconsin Department of Tourism for the years 2010 through 2014 to analyze trends in Wisconsin's 20 silica sand-producing counties. These data show a majority of sand-producing counties experienced growth in all tourism metrics between 2010 and 2014. The analysis below "unpacks" each of the six metrics reported by the Wisconsin Department of Tourism, as shown in Figure 11.

Direct Visitor Spending

Direct visitor spending increased in all of the state's 20 silica-sand producing counties between 2010 and 2014, with 95 percent (19 of 20 counties) registering double-digit growth as a percentage of total visitor spending. These data suggest industrial sand mining and related activities have not been a deterrent to travelers visiting sand-producing counties and generating income for tourism-related industries.

Burnett County, the only sand-producing county that did not experience double-digit growth as a percentage of total visitor spending, saw a 2.4 percent increase, from \$21.9 million in 2010 to \$22.5 million in 2014. Monroe County saw the state's largest percentage increase in visitor spending at 26.3 percent, jumping from \$58.7 million in 2010 to \$79.6 million in 2014. Chris Hardie, executive director of the Black River Falls Chamber of Commerce, attributed Jackson County's 14.7 percent increase to additional construction and industrial projects for nearby frac sand mines and natural gas pipelines in the area.²⁷

²⁶ Kate Prengaman, "Conference Draws 50 Frac Sand Protestors," *Wisconsinwatch.org*, October, 2, 2012, <http://wisconsinwatch.org/2012/10/conference-draws-50-frac-sand-protesters/>.

²⁷ Associated Press and Tribune Staff, "Department of Tourism says visitor spending up across state," *La Crosse Tribune*, May 2, 2015, http://lacrossetribune.com/news/local/department-of-tourism-says-visitor-spending-up-across-state/article_611193d5-35c7-5990-8fb9-3ce7cb8043f4.html.

Figure 11

Tourism Impacts																		
Wisconsin and Silica Sand Producing Counties - Alphabetical																		
County	Direct Visitor Spending			Total Employment-Direct, Indirect, Induced			Total Labor Income*			State and Local Taxes			Per Capita Income*			Tourism Jobs		
	Millions		%	Total		%	Millions		%	Millions		%	Dollars		%	Jobs		%
	2010	2014	Change	2010	2014	Change	2011	2014	Change	2010	2014	Change	2011	2014	Change	County*	Tourism 2014	% of Total Jobs
Wisconsin	\$9,197.3	\$11,419.1	19.46%	180,608	187,643	3.7%	4,292.2	\$4,829.9	11.13%	\$1,202.1	\$1,412.3	14.89%	\$23,765.54	\$25,739.51	8.31%	2,752,732	187,643	6.82%
Barron County	\$76.9	\$94.7	18.82%	1,377	1,407	2.2%	\$26.6	\$30.4	12.34%	\$9.2	\$10.7	14.00%	\$19,343.01	\$21,590.90	11.62%	28,781	1,407	4.89%
Buffalo County	\$8.5	\$10.8	21.19%	173	189	8.5%	\$3.3	\$3.7	11.33%	\$1.1	\$1.3	16.89%	\$19,179.61	\$19,781.87	3.14%	8,435	189	2.24%
Burnett County	\$21.9	\$22.4	2.42%	422	366	-15.4%	\$6.6	\$6.6	0.25%	\$2.9	\$2.9	-0.09%	\$15,568.11	\$18,017.74	15.73%	6,820	366	5.37%
Chippewa County	\$66.2	\$77.6	14.72%	1,296	1,313	1.4%	\$26.2	\$29.3	10.70%	\$8.2	\$8.9	8.16%	\$20,217.79	\$22,331.60	10.46%	31,660	1,313	4.15%
Clark County	\$22.1	\$27.1	18.68%	354	356	0.7%	\$6.1	\$6.5	6.37%	\$2.5	\$2.9	13.57%	\$17,296.99	\$18,343.88	6.05%	16,905	356	2.11%
Columbia County	\$88.3	\$115.4	23.50%	1,585	1,700	6.7%	\$29.8	\$33.9	11.85%	\$11.9	\$13.6	12.43%	\$18,821.38	\$19,909.92	5.78%	29,006	1,700	5.86%
Crawford County	\$33.0	\$41.2	19.91%	681	714	4.6%	\$11.7	\$11.7	0.11%	\$4.9	\$5.5	10.71%	\$17,160.71	\$16,395.20	-4.46%	10,460	714	6.82%
Dunn County	\$36.5	\$46.4	21.21%	809	864	6.4%	\$14.9	\$17.2	13.51%	\$5.0	\$6.0	16.26%	\$18,382.81	\$19,891.35	8.21%	21,245	864	4.07%
Eau Claire County	\$166.8	\$214.8	22.34%	3,879	4,055	4.3%	\$81.2	\$90.9	10.60%	\$23.2	\$27.1	14.41%	\$20,938.39	\$22,404.07	7.00%	70,107	4,055	5.78%
Green Lake County	\$28.9	\$35.3	18.13%	687	763	9.9%	\$12.0	\$15.3	21.38%	\$4.6	\$5.4	15.94%	\$17,500.73	\$20,047.03	14.55%	9,769	763	7.81%
Jackson County*	\$30.7	\$36.1	14.74%	556	545	-2.1%	\$8.9	\$9.2	3.13%	\$4.2	\$4.5	5.77%	\$15,951.99	\$16,819.35	5.44%	11,513	545	4.73%
Monroe County	\$58.7	\$79.6	26.28%	1,055	1,203	12.3%	\$19.7	\$24.6	19.92%	\$8.1	\$9.8	17.68%	\$18,704.63	\$20,492.62	9.56%	24,727	1,203	4.86%
Outagamie County	\$260.1	\$315.8	17.62%	6,217	6,287	1.1%	\$137.3	\$154.0	10.84%	\$36.5	\$40.7	10.45%	\$22,080.56	\$24,486.69	10.90%	124,258	6,287	5.06%
Pepin County	\$4.5	\$5.7	20.54%	97	101	4.5%	\$1.7	\$1.8	6.64%	\$0.6	\$0.7	14.72%	\$17,755.83	\$18,167.35	2.32%	3,266	101	3.10%
Pierce County	\$21.8	\$25.0	12.96%	406	416	2.2%	\$7.6	\$8.2	7.10%	\$2.7	\$3.0	10.10%	\$18,730.88	\$19,715.38	5.26%	14,369	416	2.89%
Polk County	\$70.1	\$79.5	11.76%	1,070	1,061	-0.9%	\$19.7	\$20.3	3.24%	\$7.5	\$8.5	11.95%	\$18,380.44	\$19,160.86	4.25%	20,122	1,061	5.27%
Portage County	\$92.5	\$111.6	17.12%	2,074	2,073	-0.1%	\$40.5	\$42.4	4.36%	\$13.2	\$14.7	10.16%	\$19,551.21	\$20,453.51	4.62%	43,167	2,073	4.80%
Trempealeau County	\$20.8	\$24.2	14.12%	389	371	-5.0%	\$7.0	\$7.3	3.63%	\$2.5	\$2.8	9.12%	\$17,981.79	\$19,587.40	8.93%	16,829	371	2.20%
Waupaca County	\$71.2	\$87.4	18.47%	1,274	1,303	2.2%	\$21.4	\$23.9	10.23%	\$9.2	\$10.5	12.34%	\$16,810.33	\$18,305.76	8.90%	25,734	1,303	5.06%
Wood County	\$75.2	\$86.6	13.21%	2,158	2,166	0.4%	\$50.3	\$57.3	12.22%	\$10.2	\$11.1	7.56%	\$23,320.85	\$26,463.90	13.48%	50,781	2,166	4.27%

Data from the Wisconsin Department of Tourism show the majority of sand-producing counties experienced growth in all major tourism metrics between 2010 and 2014.

Notes

* Jackson County data were not available for 2010, so 2011 data were used.

* Total labor income data were not available for 2010, so 2011 data were used.

* County job estimates derived from University of Wisconsin Extension, *County Impact Reports*, <http://www.uwex.edu/ces/ag/wisag/>. Statewide job data from Bureau of Labor Statistics, "County Employment and Wages in Wisconsin—Third Quarter 2013," April 16, 2014, http://www.bls.gov/regions/midwest/news-release/countyemploymentandwages_wisconsin.htm.

* Per-capita income was calculated from 2011 total employment data because total labor income data were not available for the year 2010.

Total Employment

Total tourism-related employment increased in 75 percent of the sand-producing counties. The Wisconsin Department of Tourism data include direct, indirect, and induced jobs.

When comparing tourism employment with the number of jobs produced by industrial sand operations, the jobs created through the multiplier (indirect and induced) must be used to provide an “apples-to-apples” comparison. For example, sand mining in Wood County is projected to create 598 direct jobs and another 331 indirect and induced jobs, for a total increase of 929 jobs. Tourism supported 2,166 jobs in Wood County in 2014.

When comparing the number of jobs generated directly by silica sand mining operations to the total number of jobs supported by tourism (598 jobs compared to 2,166), the total impact of sand mining is impressive, accounting for 28 percent as many jobs as tourism. Including the indirect and induced jobs generated by silica sand operations for an apples-to-apples comparison shows the industrial sand industry supports nearly half (43 percent) as many jobs as the tourism industry in Wood County.

Total Labor Income

Figure 11 shows total labor income increased in all sand-producing counties between 2011 and 2014. Figures from 2011 are used in this metric because total labor income was not reported by the Wisconsin Department of Tourism in 2010. Tourism-related employment increased in only 75 percent of sand-producing counties, but all sand-producing counties experienced gains in the per-capita income earned by the people holding tourism-related jobs.

All sand-producing counties experienced gains in the per-capita income earned by the people holding tourism-related jobs.

Because of the high wages paid by the industrial sand industry, its contribution to total labor earnings for the sand-producing counties is, as a percentage of total earnings, larger than its effect on employment. For example, in Trempealeau County, the AllEnergy facility would support total

earnings of approximately \$3.4 million for 71 employees in direct, indirect, and induced jobs. (See Figure 7 on page 11.) In 2014, tourism supported 371 jobs with total labor compensation of \$7.3 million in the county. Although the AllEnergy facility would support approximately 19 percent as many jobs as the tourism industry in the county, the mine would support total earnings of approximately 49 percent as much as the tourism-supported jobs.

State and Local Taxes

State and local tax revenues generated by tourism-supported industries increased in 95 percent of industrial sand-producing counties, with a very modest decline of 0.09 percent in Burnett County. Monroe County experienced the largest increase in tourism-related revenue, as state and local taxes increased by more than 17 percent, from \$8.1 million in 2010 to \$9.8 million in 2014.

Per-Capita Income

Per-capita income for tourism-supported jobs increased in 95 percent of sand-producing counties, with Crawford County the only one experiencing a decline. The per-capita income data begin in 2011 because that is the first year total labor income data were available.

The increase in per-capita income for tourism-supported jobs in sand-producing counties should come as little surprise. As reported earlier, direct visitor spending and total labor income increased in all 20 counties, suggesting businesses earned more money, hired new workers, and paid their workers higher wages during this period.

Although incomes earned by employees in tourism-related jobs in silica sand-producing counties increased between 2011 and 2014, they generally remained significantly lower than state and county averages, with annual tourism-related incomes ranging from approximately \$16,400 in Crawford County (the county with the lowest annual per-capita tourism income) to approximately \$26,400 in Wood County (the county with the highest annual per-capita tourism income).

The tourism industry typically supports low-paying jobs with incomes significantly lower than those of industrial sand mining jobs.

The incomes earned by employees in tourism-supported jobs were much lower than incomes in silica sand-related jobs: Incomes in sand industry jobs were approximately three times higher than for tourism industry jobs in Wood County. In Trempealeau County, silica sand industry jobs paid approximately two-and-one-half times more than tourism jobs.

Tourism Jobs

Figure 11 shows the tourism sector supported 27,253 direct, indirect, and induced jobs in Wisconsin's 20 industrial silica sand-producing counties. The Wisconsin Department of Tourism reported tourism supported 7.9 percent of all Wisconsin jobs in 2013.^{28,29} The silica sand-producing counties historically have tourism employment below the statewide average.

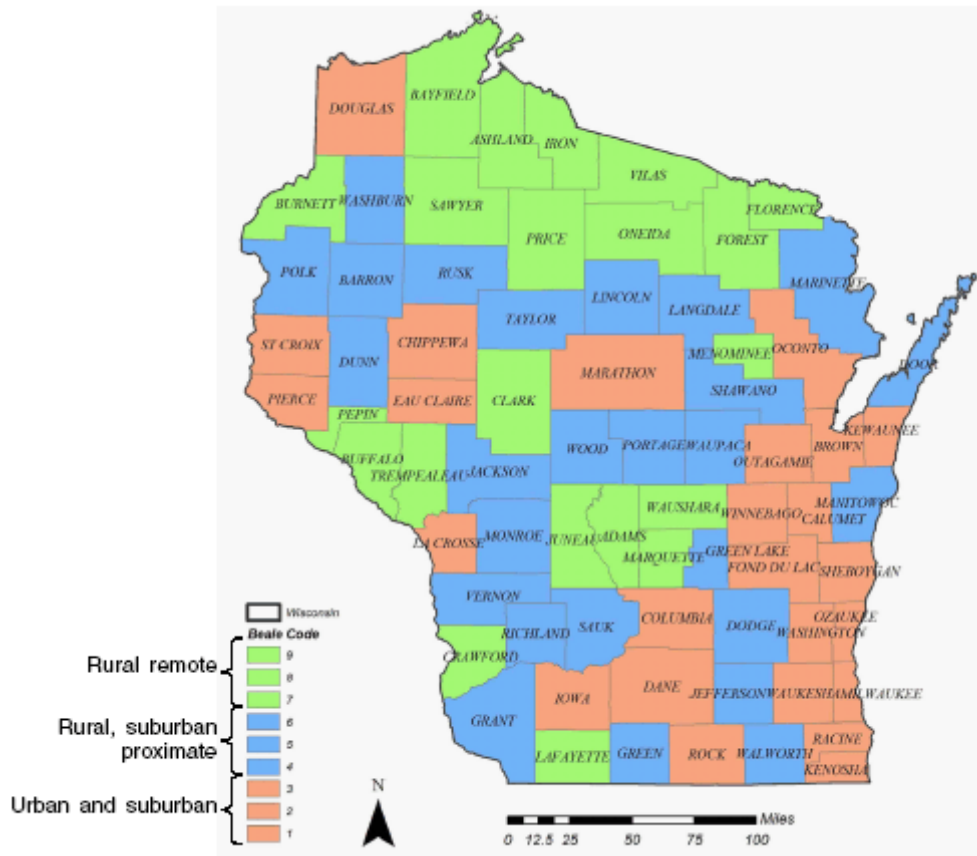
The data also show the tourism industry typically supports low-paying jobs with incomes significantly lower than those of industrial sand mining jobs. These findings are supported by academic research investigating the impact of tourism in rural Wisconsin counties as they relate to employment and earnings.

²⁸ Wisconsin Department of Tourism, *supra* note 25.

²⁹ The total percentage of tourism jobs in the state of Wisconsin is slightly lower in Figure 11 (6.82 percent compared to 7.9 percent) than reported by the Wisconsin Department of Tourism. This is likely a result of changes in employment and workforce participation rates for the month used to calculate total employment in the state.

David Marcouiller of the University of Wisconsin-Madison has investigated the economic impacts of tourism in Wisconsin by examining tourism earnings and employment in three geographic categories: urban and suburban, rural/suburban proximate, and rural remote.³⁰ (See Figure 12.)

Figure 12



Among the 20 sand-producing counties in Wisconsin, five (Chippewa, Columbia, Eau Claire, Outagamie, and Pierce) are considered urban and suburban; nine (Barron, Dunn, Green Lake, Jackson, Monroe, Polk, Portage, Waupaca, and Wood) are considered rural/suburban proximate; and six (Buffalo, Burnett, Clark, Crawford, Pepin, and Trempealeau) are considered rural remote.

Source: David Marcouiller and Xianli Xia, *supra* note 30, Figure 1, p. 552.

Marcouiller’s work demonstrates rural counties benefit far less from tourism than urban and suburban counties, as travel and tourism industry earnings were highly concentrated in the

³⁰ David Marcouiller and Xianli Xia, “Distribution of Income from Tourism-Sensitive Employment,” *Tourism Economics* 14 (3) (2008): 545–565, <http://urpl.wisc.edu/people/marcouiller/publications/TE.pdf>.

25 urban and suburban counties. Urban counties (indicated in peach on the map) accounted for more than three-quarters of all wage and salary income and roughly 72 percent of all travel and tourism sector jobs in the state, presumably because of the greater amenities and opportunities for recreation and leisure activities such as sporting events, restaurants, museums, and performing arts. (See Figures 13 and 14.) On the other end of the scale, the 21 counties of rural remote Wisconsin (indicated in green on Figure 12) generated only 6 percent of the state's tourism wages and salary income and slightly less than 7 percent of the travel and tourism sector jobs.

Food preparation/serving and sales occupations were the two largest sectors for travel and tourism employment and wages in the state, accounting for roughly 74 percent of the jobs and 60 percent of the wage and salary income in the 10 sectors that define travel and tourism. Wage and salary income was concentrated in the 25 urban and suburban counties of Wisconsin.³¹

Marcouiller notes analysis of tourism employment must account for more than simply numbers of jobs: The *type* of jobs created – measured by wage rates, permanence, career opportunities, and required skill levels – is also important.

Tourism provides important opportunities for first-time workers, young people with little work experience, relatively unskilled individuals, those seeking supplemental income, the retired, or persons working for nonmonetary reasons.³² In addition, the valuable experience gained at these jobs can create significant career-ladder opportunities for dedicated tourism employees, including positions in management, financial operations, professional entertainers, and other technical occupations.

When compared with traditional primary industries in rural America such as agriculture, forestry, and mining, tourism generates predominantly lower-income job opportunities.

That said, academic research has found tourism jobs tend to be relatively low-wage, seasonal, and part-time and often impede the regional developmental objective of high-wage job creation.³³ When compared with traditional primary industries in rural America such as agriculture, forestry, and mining, tourism generates predominantly lower-income job opportunities.³⁴

³¹ *Ibid.*

³² *Ibid.*

³³ *Ibid.*

³⁴ David Marcouiller, "'Boosting' Tourism as Rural Public Policy: Panacea or Pandora's Box?" *Journal of Regional Analysis and Planning* 37 (1) (2007): 28–31, <http://www.jrap-journal.org/pastvolumes/2000/v37/F37-1-marcou.pdf>.

Figure 13

Employment (total number of jobs) by tourism sector and geographic location in Wisconsin (2002).

Tourism-sensitive sector name	NAICS code	Urban and suburban ¹ (Beale Codes 1–3)		Exurban, suburban proximate ² (Beale Codes 4–6)		Rural remote ³ (Beale Codes 7–9)		Wisconsin total Employment (jobs)
		Employment (jobs)	Employment (%)	Employment (jobs)	Employment (%)	Employment (jobs)	Employment (%)	
Gasoline Stations	447	14,050	59.8	6,651	28.3	2,801	11.9	23,501
Clothing and Clothing Accessories Stores	448	15,939	86.6	1,612	8.8	851	4.6	18,402
Miscellaneous Store Retailers	453	14,597	75.8	3,313	17.2	1,356	7.0	19,266
Air Transportation	481	4,718	94.9	186	3.7	67	1.3	4,971
Scenic and Sightseeing Transportation	487	279	71.8	83	21.4	26	6.8	389
Performing Arts and Spectator Sports	711	5,998	81.1	1,122	15.2	278	3.8	7,398
Museums, Parks and Historical Sites	712	1,781	79.6	361	16.1	95	4.3	2,238
Amusement, Gambling & Recreation	713	21,559	68.0	7,514	23.7	2,645	8.3	31,718
Accommodation	721	18,390	58.1	9,603	30.4	3,646	11.5	31,638
Food Services and Drinking Places	722	131,334	73.9	36,523	20.6	9,835	5.5	177,692
<i>All tourism-sensitive sectors</i>		<i>228,645</i>	<i>72.1</i>	<i>66,968</i>	<i>21.1</i>	<i>21,599</i>	<i>6.8</i>	<i>317,212</i>

Note: ¹Urban counties include those classified as metropolitan. In Wisconsin, there are 25 counties in this category (see Figure 1). ²Exurban, suburban proximate counties include those non-metropolitan counties that are either proximate to metropolitan counties or include small urban cities. In Wisconsin, there are a total of 26 counties in this category (see Figure 1). ³Rural, remote counties are those counties that are totally rural or rural and not directly adjacent to a metropolitan county. In Wisconsin, there are a total of 21 counties in this category (see Figure 1).

Employment in tourism jobs in Wisconsin is highly concentrated in urban counties, and just 6.8 percent of tourism employment is in rural remote counties. Jobs in food services and drinking places dominate the travel/tourism sector, accounting for roughly 74 percent of the state's tourism jobs.

Source: David Marcouiller and Xianli Xia, *supra* note 30, Table 4, p. 556.

Figure 14

Wages and salaries paid by travel/tourism sectors and geographic location in Wisconsin (2002).								
Tourism-sensitive sector name	NAICS code	Urban and suburban ¹ (Beale Codes 1–3)		Exurban, suburban proximate ² (Beale Codes 4–6)		Rural remote ³ (Beale Codes 7–9)		Wisconsin total Wages (US\$)
		Wages (US\$)	Wages (%)	Wages (US\$)	Wages (%)	Wages (US\$)	Wages (%)	
Gasoline Stations	447	204,685,934	63.0	84,528,423	26.0	35,737,787	11.0	324,952,144
Clothing & Clothing Accessories Stores	448	233,065,942	85.7	22,705,672	8.3	16,262,386	6.0	272,034,000
Miscellaneous Store Retailers	453	246,466,327	77.8	51,359,787	16.2	18,916,201	6.0	316,742,314
Air Transportation	481	178,837,827	94.8	7,200,733	3.8	2,595,344	1.4	188,633,903
Scenic & Sightseeing Transportation	487	5,134,912	70.5	1,636,385	22.5	512,745	7.0	7,284,041
Performing Arts and Spectator Sports	711	327,070,575	95.5	12,171,486	3.6	3,409,096	1.0	342,651,156
Museums, Parks and Historical Sites	712	39,853,802	81.8	7,046,321	14.5	1,795,496	3.7	48,695,619
Amusement, Gambling & Recreation	713	306,759,495	67.4	109,045,151	24.0	39,207,706	8.6	455,012,351
Accommodation	721	267,934,889	61.6	123,712,114	28.4	43,589,556	10.0	435,236,559
Food Services and Drinking Places	722	1,297,156,829	76.9	304,321,840	18.1	84,247,281	5.0	1,685,725,950
<i>All tourism-sensitive sectors</i>		<i>3,106,966,531</i>	<i>76.2</i>	<i>723,727,910</i>	<i>17.8</i>	<i>246,273,597</i>	<i>6.0</i>	<i>4,076,968,037</i>

Distribution of tourism income

Note: ¹Urban counties include those classified as metropolitan. In Wisconsin, there are 25 counties in this category (see Figure 1). ²Exurban, suburban proximate counties include those non-metropolitan counties that are either proximate to metropolitan counties or contain small urban cities. In Wisconsin, there are a total of 26 counties in this category (see Figure 1). ³Rural, remote counties are those counties that are completely rural or rural and not directly adjacent to a metropolitan county. In Wisconsin, there are a total of 21 counties in this category (see Figure 1).

Wages and salaries of tourism jobs are highly concentrated in urban counties, and just 6 percent of the wages generated by tourism employment are earned in rural remote counties. Among the 10 industries of the travel/tourism sector, gasoline stations had the highest percentage of wages in rural remote counties, with 11 percent of all earnings at gasoline jobs in the state occurring in rural counties. In terms of overall travel/tourism sector jobs, food service and drinking places paid the most total wages in rural remote counties.

Source: David Marcouiller and Xianli Xia, *supra* note 30, Table 3, p. 555.

The research discussed above and our analysis of Wisconsin Department of Tourism data have important implications for economic planning by local citizens and policymakers in counties with silica sand mining potential. These counties often engage in debate over whether to prohibit

Tourism data show growth in direct visitor spending, total employment, total labor income, state and local tax revenue, and worker per-capita income in a majority of frac sand-producing counties, suggesting industrial sand development and tourism can coexist.

or restrict sand mining for fear it will have a negative effect on the local tourism industry. In fact, tourism data show growth in direct visitor spending, total employment, total labor income, state and local tax revenue, and worker per-capita income in a majority of frac sand-producing counties, suggesting industrial sand development and tourism can coexist.

It is also important for policymakers to note 75 percent of industrial sand-producing counties in Wisconsin are considered rural remote or rural/suburban proximate areas, which are far less likely to reap economic benefits from the tourism and travel industries than urban counties. Policymakers in counties with sand-producing potential should exercise caution when considering whether to promote tourism by restricting economic opportunities in the traditional primary industries in rural America, including agriculture, forestry, and mining.

Impact on Agriculture

Agriculture is critically important to the western Wisconsin economy, and some observers have raised concerns the short- and long-term viability of agriculture would be hurt by industrial sand mining.

Competition for Land

In the short term, silica sand mining may compete with agriculture for land use. The high value of frac sand and the royalties associated with mining make it likely some landowners would opt to lease their land for mineral development instead of continuing to farm it. This has several potential implications for agriculture, such as taking land out of production, increasing local property values, and increasing the rates farmers who lease farmland must pay to do so.

Consider a hypothetical situation. A retired landowner who has traditionally leased his farmland to a neighboring farmer for crop production is approached by a sand mining company that wants to lease his land to develop industrial sand resources on the property. The neighboring farmer's lease has expired, but he wants to extend it. The landowner instead decides to lease his land to the sand mining company. The neighboring farmer thus must farm fewer acres or find replacement acreage.

If the farmer decides to find replacement acreage, he can buy land, thereby ensuring his tillable acreage for the foreseeable future, or rent land from another landowner. The price to buy

farmland might be higher than in the past because other landowners may be hoping to be approached by mining operations, or because other farmers who have lost acreage under similar circumstances are looking for farmland to buy. Similarly, the price to lease farmland may be higher than in the past because other farmers who have lost acreage are competing to secure more acres.

This hypothetical situation would increase land values in sand-mining areas, raising the cost of inputs (land) for farmers. These effects are likely to be local in nature.

The increase in land values can benefit farmers as well. If a farmer owns his land and is approached by a sand mining company that wants to lease it, the potential earnings from leasing the mineral rights to the mining company would exceed the expected returns from keeping the land in agricultural production. The farmer could use the higher earnings to buy new farming implements or more farmland, perhaps of less interest to sand mining companies. Clearly, one of the key factors determining whether one reaps the benefits or bears the costs of sand mining is land ownership.

One of the key factors determining whether a farmer reaps the benefits or bears the costs of sand mining is land ownership.

Productivity of Land

Some people have expressed concern that it may take decades or even centuries for land used for industrial sand mining to return to its previous productivity. We discuss this at length in *Heartland Policy Study No. 37*, released in May 2015.³⁵ As we note in that report, studies have found crop yields at reclaimed sand mine sites were 73 to 97 percent of original volumes within three years of reclamation, indicating frac sand mining may not cause long-term declines in farmland productivity.

It is also important to note industrial sand mines are not located exclusively on prime agricultural land. Active and proposed mines in Wisconsin are sited on agricultural land, forested land, and steep slopes. Even if all the agricultural land that has been permitted for mining is mined and then never again used for agricultural purposes, the share of farmland lost to mining would be negligible compared to the number of acres lost to residential and commercial development. Moreover, several hundred thousand acres of cropland are left idle in Wisconsin or used for cover crops or soil improvement and thus not harvested, pastured, or grazed. Additional acres are enrolled in Conservation Reserve, Wetlands Reserve, Farmable Wetlands, or Conservation Reserve Enhancement programs.³⁶

³⁵ Isaac Orr and Mark Krumenacher, "Environmental Impacts of Industrial Silica Sand (Frac Sand) Mining," *Heartland Policy Study No. 137*, The Heartland Institute, May 2015.

³⁶ *USDA Census of Agriculture, 2012 Census, Volume 1, Chapter 1: State Level Data, Wisconsin, Volume 1, Complete Report, All Tables*, accessed March 16, 2015, http://www.agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_State_Level/Wisconsin/.

Competition for Rail

A short-term economic cost that is likely to persist into the long term results from competition between agriculture and the industrial sand industry over the number of railcars available for transporting products to market.

Due to the volumes of sand required to hydraulically fracture a well – each well uses between 2,500 and 10,000 tons of sand³⁷ – frac sand is often transported on trains of 100 cars or more. The fall grain harvest in Wisconsin increases agricultural demand for railcars, creating a temporary shortage of railcars. This conflict will likely persist until new railcars are brought online to meet demand.

Historical Analysis of Economic Growth in Mining-Dependent Areas

Wisconsin has a long tradition of mining, as copper, gold, iron, lead, and zinc have all been mined in the state throughout its history.

The Power report cited above draws on the history of metal mining in Wisconsin and economic data from a series of mining-dependent communities across the United States to provide context for what may occur as a result of silica sand mining in west-central Wisconsin. We summarize that

report's findings and explore their applicability to industrial sand mining.

Wisconsin has a long tradition of mining, as copper, gold, iron, lead, and zinc have all been mined in the state throughout its history. The Power report notes mining generated significant economic activity for short periods of time but did not lay the foundation for prosperity in the communities in which it took place.

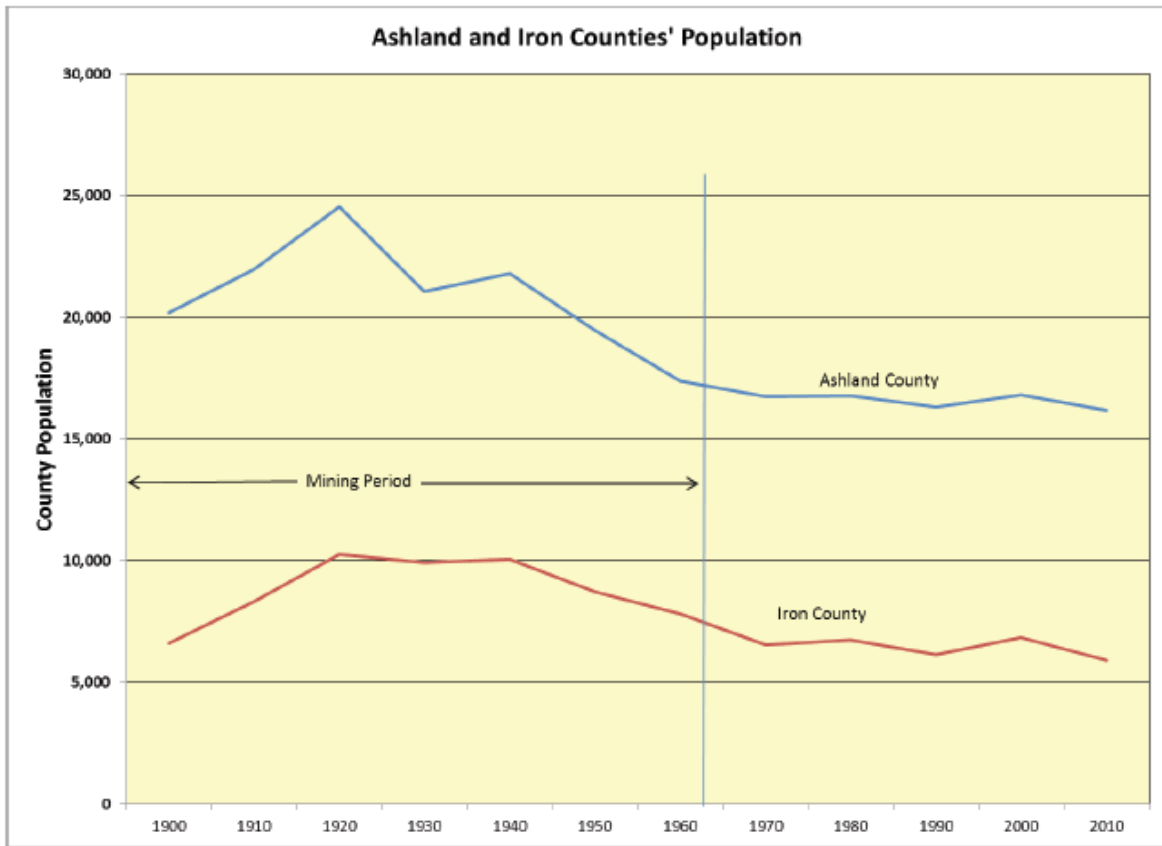
Lead and zinc mining in southwestern Wisconsin began in the 1820s and began declining in the 1840s. Lead and zinc mining was revived from the 1880s until the 1940s, but populations in the communities where mining took place fell during this period. These early mining operations decreased as the easily extracted ore deposits were exhausted.³⁸

Iron mining began in Ashland and Iron Counties in the mid-1880s and continued until 1965, but a steep decline in those counties' population began in 1920 even as mining continued in Ashland County for another 45 years. (See Figure 15.)

³⁷ Mike Ivey, "DNR Reports No Slowing In Wisconsin Frac Sand Mining Despite Oil Slump," *The Capitol Times*, January 11, 2015, http://host.madison.com/news/local/writers/mike_ivey/dnr-reports-no-slowing-in-wisconsin-frac-sand-mining-despite/article_99ed073f-6d8d-599d-9771-57688e1e76c9.html.

³⁸ Wisconsin Historical Society, "Mining in Northern Wisconsin," accessed March 13, 2015, http://www.wisconsinhistory.org/turningpoints/tp-029/?action=more_essay.

Figure 15



Around 1920, the county of Ashland, Wisconsin, experienced a dramatic decline in population, even though mining continued in the county for another 45 years. The decline was not the result of a shortcoming of the mining industry, but instead coincides with the decline of the timber industry in northern Wisconsin, as reported by the U.S. Forest Service.

Source: Thomas Power and Donovan Power, *supra* note 4, Figure C, p. 11.

At first glance, the dramatic decline in population in Ashland County appears counterintuitive, as the high wages and jobs associated with mining should not lead to a rapid decline in population. But an analysis by the U.S. Forest Service indicates the 1920s ushered in the end of the lumber era in northern Wisconsin, which was likely partially responsible for the decline in population.³⁹

The second period of steep decline beginning in 1940 is likely representative of declining ore grades, which reduced the profitability of mining operations, eventually leading to the closure of

³⁹ United States Forest Service, *History of Chequamegon-Nicolet National Forest*, accessed March 13, 2015, http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5109506.pdf.

the mine in 1965. The Power report concluded, “Eighty years of iron ore mining in the Gogebic Range did not allow these counties to either stabilize their population or grow it.”⁴⁰

To explore the contemporary local impact of reliance on mining in the United States, the Power report examined the economic performance of all U.S. counties where mining (excluding oil and gas extraction) was the source of 20 percent or more of labor earnings at some time in the 1980s, and then followed those counties through 2008.⁴¹

Industrial sand mining differs from traditional metal mining because silica sand is an abundant resource unlikely to be exhausted in the short term.

The Power report found mining-dependent areas – coal mining communities in Appalachia, lead mining in the Ozarks, coal mining in the Four Corners (Arizona, Colorado, New Mexico, and Utah), and copper and iron mining in the Upper Peninsula of Michigan and Iron Range in

Minnesota – were characterized by high levels of unemployment, slow rates of income and employment growth, high poverty rates, and stagnant or declining populations. The researchers concluded, “It is clear that over the last several decades, dependence on mining did not provide a reliable path to prosperity that allowed mining communities to perform better than other American communities. In fact, mining-dependent communities lagged significantly behind the average for the rest of the nation.”⁴²

Are these findings applicable to industrial silica sand mining in Wisconsin and other states in the Upper Midwest? Industrial sand mining differs from traditional metal mining because silica sand is an abundant resource unlikely to be exhausted in the short term. Moreover, mining-dependent communities in Minnesota and Appalachia often rely on mining for 20 percent or more of their total employment earnings. That is unlikely to be the case for industrial sand mining regions. For example, in Wood County, Wisconsin, total labor earnings from direct, indirect, and induced jobs are projected to be approximately \$58.7 million, about 3.14 percent of total labor compensation, far below the threshold for being considered dependent on mining.⁴³

In addition, the metal mining-dependent communities cited in the Power report were built around geographically concentrated ore bodies, so mineworkers constituted a higher proportion of the population living near the mining sites. Industrial sand deposits, by contrast, are spread out over a wide geographic region, so this type of mining is unlikely to become the backbone of a concentrated community, instead supplementing economic activity in a geographically dispersed group of communities.

⁴⁰ Thomas Power and Donovan Power, *supra* note 4, page 10.

⁴¹ Thomas Power and Donovan Power, *supra* note 4.

⁴² Thomas Power and Donovan Power, *supra* note 4, page 15.

⁴³ Wisconsin Department of Workforce Development, “2013 Wood County Workforce Profile,” 2014, http://worknet.wisconsin.gov/worknet_info/downloads/CP/wood_profile.pdf.

Addressing Economic Leakage from Mining Communities

Several reports weighing the costs and benefits of industrial sand mining address “economic leakage,” the possibility capital or income may leave the communities in which mining occurs rather than staying in them.⁴⁴ The potential for leakage provides an important basis for decision-making: Local residents who might be negatively affected by mining activity, such as increased truck traffic and noise, want assurances they and their communities will also benefit from industrial sand production.

The likelihood and extent of economic leakage depend on how interconnected the businesses in a given community are to one another. This interconnectedness creates the multiplier effect. For example, a farmer may buy feed for his cattle in a neighboring town or at the local co-op. If he buys from the neighboring town, that is considered leakage from his community. If he buys from the local co-op, it is considered a “linkage,” and that money continues to circulate within the local economy.

The linkages, or economic multiplier, also will be influenced by the size of the local economy. Larger economies generally have more businesses, and a given dollar is able to circulate more times before leaking out than is true in smaller economies. Two communities with similar population and geographic size may have quite different multipliers, depending on their economic structures.⁴⁵

The Power study notes mines tend to have limited linkages with the local economy, especially if the mine is located in a rural area. With limited commercial infrastructure, the local economy cannot provide mine operators with the equipment or supplies they need and often cannot supply the food, clothing, and other needs of mining employees’ households. As a result, the income generated by a mine leaks out of the community.

The rural nature of most counties in which industrial sand mining occurs means there is bound to be significant economic leakage of earnings.

These are legitimate concerns, but they must be put in context. The rural nature of most counties in which industrial sand mining occurs means there is bound to be significant economic leakage of earnings. That is not unique to mining, but rather affects all sectors of the economy in these areas. Any commercial activity of any size will rely on workers, investors, and supplies made outside the county.

This need not raise concerns about fairness so long as local residents and workers are compensated for their roles in the new economic activity. For example, property should not be taken through eminent domain without full compensation – perhaps not even then without the

⁴⁴ *Investopedia*, “Leakage,” accessed April 15, 2015, <http://www.investopedia.com/terms/l/leakage.asp>.

⁴⁵ Eugene Lewis, “Economic Multipliers: Can a Rural Community Use Them?” *Coping with Growth*, October 1979, https://research.wsulibs.wsu.edu/xmlui/bitstream/handle/2376/4883/wrep_24_1979_economic_multipliers_can_a_rural_community_use.pdf?sequence=1.

voluntary consent of property owners. Repairing damage to roads or other infrastructure should be financed entirely by the frac sand mining companies.

Conclusion

Industrial silica sand mining has experienced dramatic growth since the technological breakthrough of hydraulic fracturing and horizontal drilling transformed uneconomic oil and gas deposits into profitable drilling operations. Silica sand production more than doubled between 2005 and 2014, increasing from 31 million metric tons in 2005 to more than 75 million in 2014. Sand for hydraulic fracturing, or “frac sand,” now accounts for 72 percent of all industrial silica sand mined in the United States.

The industrial sand industry can provide high-paying jobs in counties that otherwise may have few opportunities for family-supporting jobs.

The dramatic increase in production has led to the creation of thousands of jobs in the Upper Midwest. In Wisconsin, the nation’s largest producer of frac sand, the Wisconsin Economic Development Corporation estimates the industry employs 2,880 to 4,230 people, a 15- to 22-fold increase in industrial sand employment since 2002. If all permitted

mine sites and processing facilities were fully operational, the industry would directly employ between 4,900 and 7,100 people.

These are high-paying jobs with total earnings consistently above the average wages in Wisconsin and exceeding by 30 to 82 percent the average per-capita income in mining counties and communities. Earnings from industrial sand mining employment are two to three times greater than those for tourism-supported jobs.

Industrial sand mining presents rural counties an opportunity to diversify their economies, which are often heavily reliant upon agriculture. In Wisconsin, 85 percent of industrial sand-producing counties rely more on agriculture for employment than the state average. Without economic diversity, fluctuations in crop and livestock prices have a much greater effect on local rural economies. As off-farm employment has become increasingly important for small farmers, the industrial sand industry can provide high-paying jobs in counties that otherwise may have few opportunities for family-supporting jobs.

Fears that industrial sand mining will negatively affect tourism in rural counties are not supported by data collected by the Wisconsin Department of Tourism. Tourism spending, employment in tourism-supported jobs, total labor income, and state and local taxes generated from tourism-supported activities have increased in a majority of industrial sand-producing counties. Direct visitor spending and tourism-supported employment increased in industrial sand-producing counties by 100 percent and 75 percent, respectively.

Academic research on patterns of Wisconsin tourism have found 72 percent of the state's tourism jobs are located in urban or suburban counties, with rural remote areas accounting for just 7 percent. Rural remote counties are less able to benefit from tourism than urban counties because they offer fewer amenities. These findings have important implications for state and local policymakers, as some groups who advocate restricting or banning industrial sand mining may not realize the limitations of the tourism industry in providing high-paying jobs to rural areas.

Claims that industrial sand mining will negatively impact agriculture are based on the unsupported suggestion that farmland used for industrial sand mining will take decades or even centuries to return to productive farmland. Studies have shown up to 97 percent of original crop yields have been obtained in just three years following reclamation of sand mines. Although industrial sand mining may increase local land prices as landowners consider mining as

an alternative to leasing farmland, it is important to keep this concern in perspective: The amount of land used for industrial sand mining is far less than the acreage already set aside for conservation programs or taken out of agriculture by residential and other uses.

Industrial sand mining has been a significant driver of economic growth across the Upper Midwest. If done in an environmentally responsible manner, it can be an important source of employment and earnings for decades to come.

In a May 2013 report, Thomas Power and Donovan Power sought to draw comparisons between industrial sand mining in Wisconsin and mining in metal mining-dependent area of the country, such as the Iron Range of northern Minnesota and coal mining towns of Appalachia. Such comparisons are problematic: By definition, mining-dependent communities rely on mining for 20 percent or more of their total employment earnings, which is unlikely to be the case for industrial sand mining regions. Wood County, Wisconsin, for example, would rely on industrial sand mining for only 3.14 percent of total labor compensation. Industrial sand mining is unlikely to become the economic backbone of the counties in which it occurs, but it can complement the economies of areas relying heavily on agriculture.

Industrial sand mining has been a significant driver of economic growth across the Upper Midwest. If done in an environmentally responsible manner, it can be an important source of employment and earnings for decades to come.

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