



Predicting Opposition to Windfarms Using Census Data

Sarah Mills & Jane Wentrack

University of Michigan, Ford School of Public Policy

Photo by Heritage Sustainable Energy



Photo by Curt Nikisch



Scott Miller / CTV London

Literature Review

- **Farmers** support wind development for economic reasons (Holstead et al 2016, Slattery et al 2012, Brannstrom et al 2011)
- **Residential property characteristics** affect contention (i.e. why someone chooses to live somewhere) (Walker et al 2014, Fast et al 2015)
- Local opposition mobilizes **online** (Reusswig et al 2016, Walker et al 2018)
- Socioeconomic and other **demographic factors** may influence wind siting (Quick et al 2016)

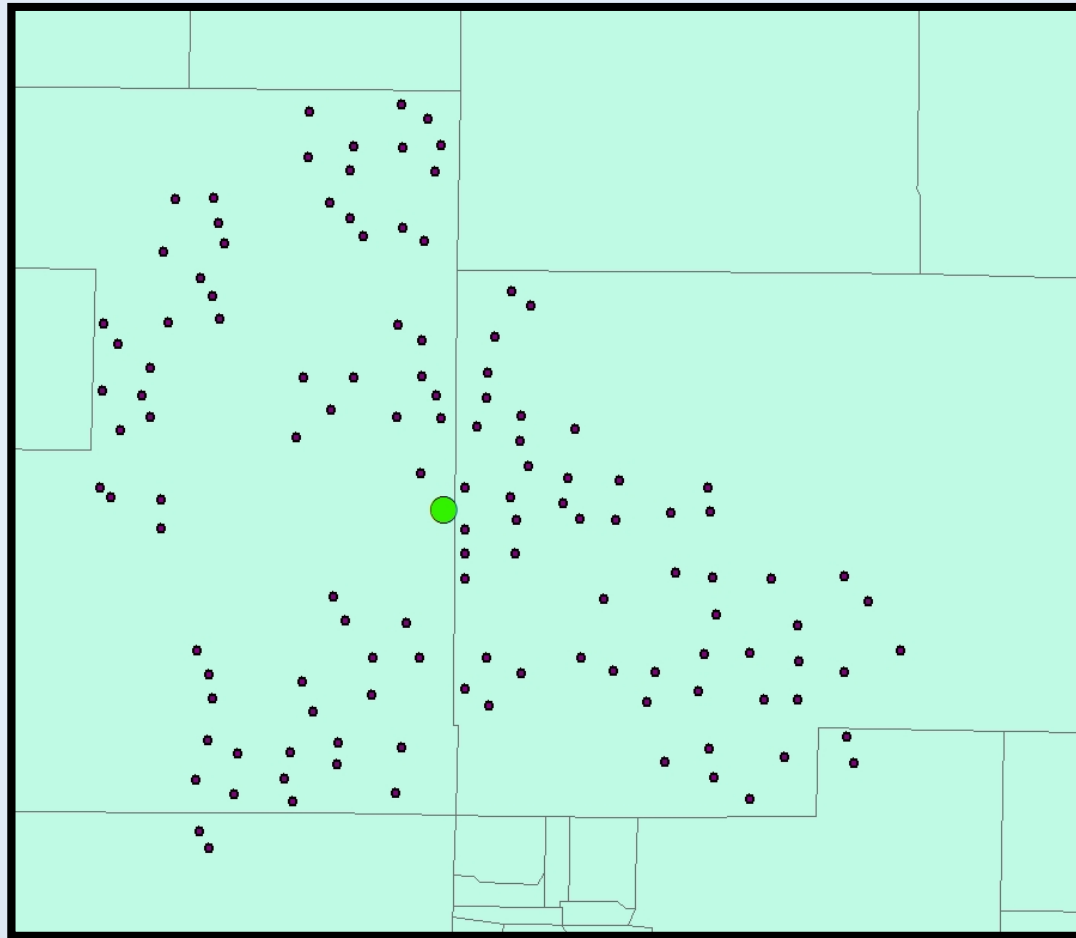
Research Question

- Can you predict where wind development will be contentious using publicly accessible datasets (U.S. Census, etc.)?
- Observable: Existing windfarms in 4 Great Lakes States
 - IL, IN, MI, MN
- 16 independent variables across 4 categories
 - Agricultural characteristics
 - Internet access
 - Residential property characteristics
 - Demographics

16 Independent Variables

Data Source	Independent Variables
USDA Census of Agriculture 2012 (County-level)	% change in # of farms: 2007-2012
	% acres of land in farms
	% pop. with farming as primary occupation
	% operators not residing on farm operated
	# of farms
	Total farm income
	% farms with internet access
U.S. Census American Community Surveys (2012-2016) (Block group-level)	% pop. working at home
	% pop. in farming/fishing/forestry occupations
	% homes vacant
	% pop. with a bachelor's degree or higher
	Pop. density
	% households with retirement income
	Median income 2016
The Guardian election data (County-level)	% pop. that voted for Romney
Zillow Research Data (Zip code-level)	Average home value in 2012

Spatially Locating Windfarms

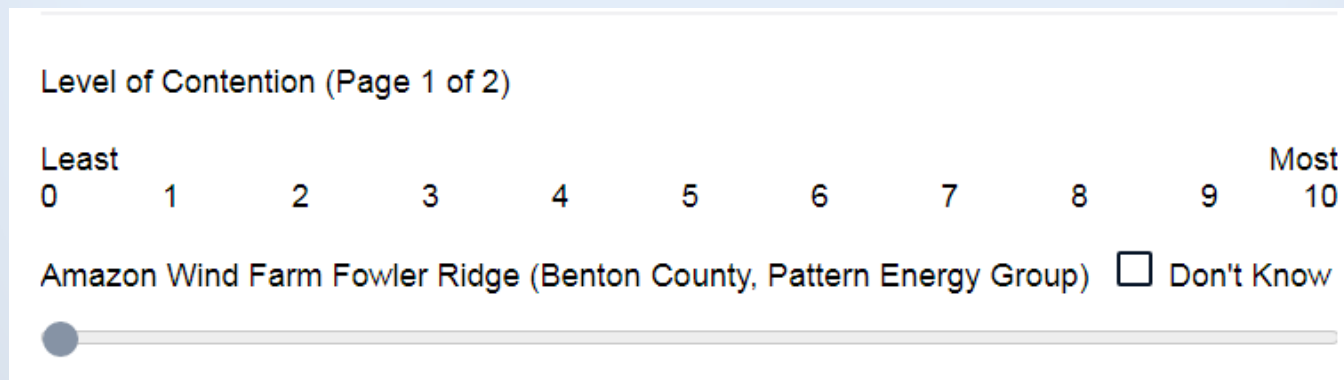


Mean center in ArcGIS used to determine spatial center of wind project

DV: Survey Data

- Data from 46 experts across four states
- 41% response rate
- 69 windfarms

Level of contention: Survey results	
Mean	2.78
Min	0.8
Max	7.67



Results

Category	Factor	Coefficient (final model)	Effect on contention
Agricultural Characteristics	% loss in # of farms: 2007-2012	0.411	↑
	% acres of land in farms	-0.062	↓
	% pop. with farming as primary occupation	-0.052	↓
	% operators not residing on farm operated	-0.086	↓
	# of farms	0.001	↑
	(Natural log of) Total farm income	1.238	↑
	% pop. working at home	-0.129	↓
	% pop. in farming/fishing/forestry occupations	0.090	↑
	Pop. density	_____	_____
Internet Access	% farms with internet access	-0.085	↓
Residential property characteristics	% homes vacant	0.018	↑
	(Natural log of) Average home value in 2012	0.019	↑
	% households with retirement income	_____	_____
Demographics	% pop. that voted for Romney	-0.030	↓
	% pop. with a bachelor's degree or higher	0.050	↑
	Median income 2016	_____	_____

$R^2 = .659$ (Adj. $R^2 = .554$)

Results: Significant variables

Variable	P-value	Effect on contention	Data source
% loss in # of farms	.008	↑	USDA
% acres of land in farms	.035	↓	USDA
% operators not residing on farm operated	.040	↓	USDA
% pop. with farming as primary occupation	.011	↓	USDA
% pop. working at home	.021	↓	U.S. Census

Model better if ag data at sub-county scale

Discussion

- Regression-generated equation to predict contention

Number of wind projects	Difference between predicted and observed level of contention
27 (39%; 39% cum)	+/- < 0.5
19 (28%; 66% cum)	+/- 0.5 – 1
15 (22%; 88% cum)	+/- 1 – 1.5
3 (4%; 92% cum)	+/- 1.5 – 2
3 (4%; 96% cum)	+/- 2 – 3
2 (4%; 100% cum)	+/- 3+

- Wind developers could use to pre-screen locations
- Outliers the result of wind developer activities?

Limitations and future research

- Poor response rate limits observations in IL
- Findings reflect constructed projects only, not proposed ones
- GIS analysis: how to represent the full spatial scale of wind turbines

Conclusions

- Best predictors of contention were all agricultural related
- NOT substitute for on-the-ground knowledge
 - Starting point for determining communities predisposed to wind
 - Development practices likely still matter

Questions / Feedback Most Welcome!

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Sarah Mills

sbmills@umich.edu

www.closup.umich.edu/wind