Lacey Goldberg (Pennsylvania State University)

Timothy Murtha, PhD (Pennsylvania State University)

Experiential and Visual Impacts of Energy on the Pennsylvania Landscape

Research Supported by
The Hamer Center for Community Design @ Penn State University
www.hamercenter.psu.edu

OUTLINE:

I. Marcellus Shale and the Eastern United States
II. Visual and Experiential Impacts
III. State Parks and Natural Areas
IV. Crowdsourced Scenic/Visual Amenity
V. Predictive Models

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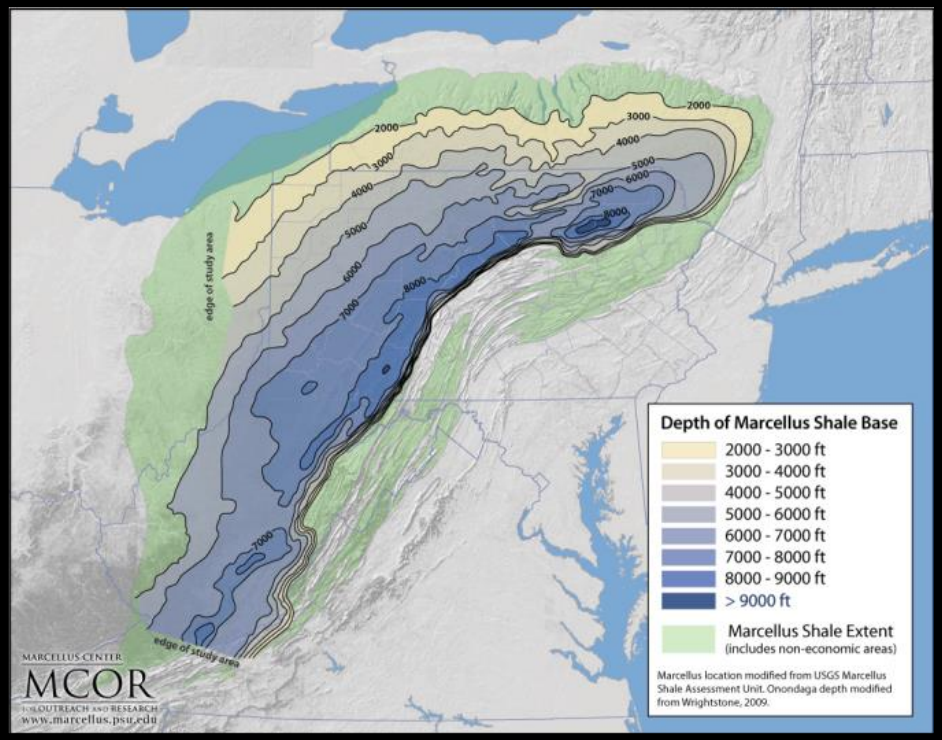
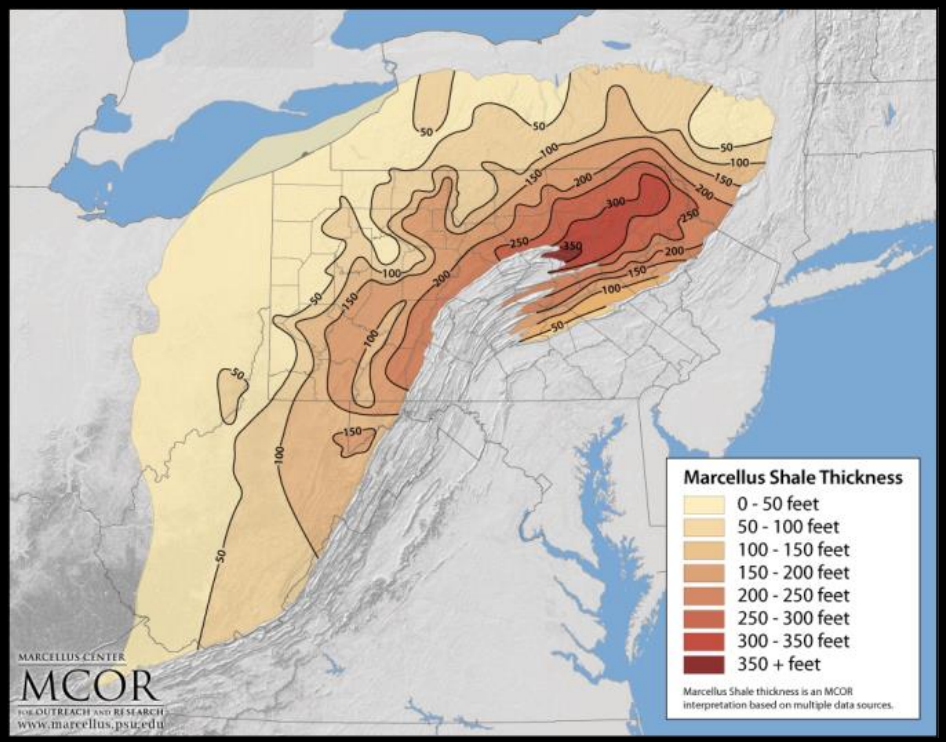
MARCELLUS SHALE



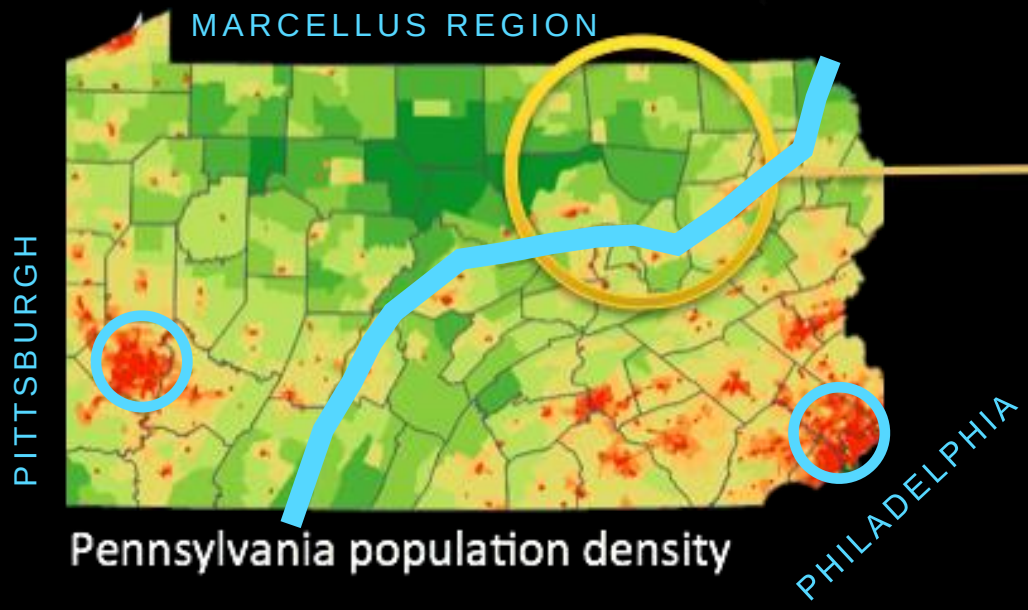


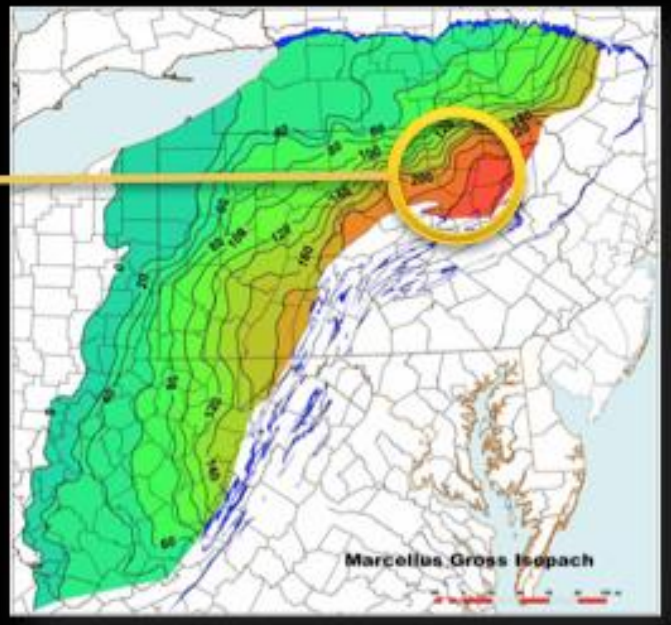
Pennsylvania factors influencing shale gas development and impacts:

1) Largely rural and depopulated
2) Marcellus region watersheds are 91% Forest and Agriculture Landcover (2011 USGS LUCL)
3) Marcellus regional watersheds average 77% forested hectares, while non Marcellus basins average just 48%.
4) There are 3 times as many dirt roads in the Marcellus basins.
5) 400% more developed high intensity residential outside of the Marcellus Region

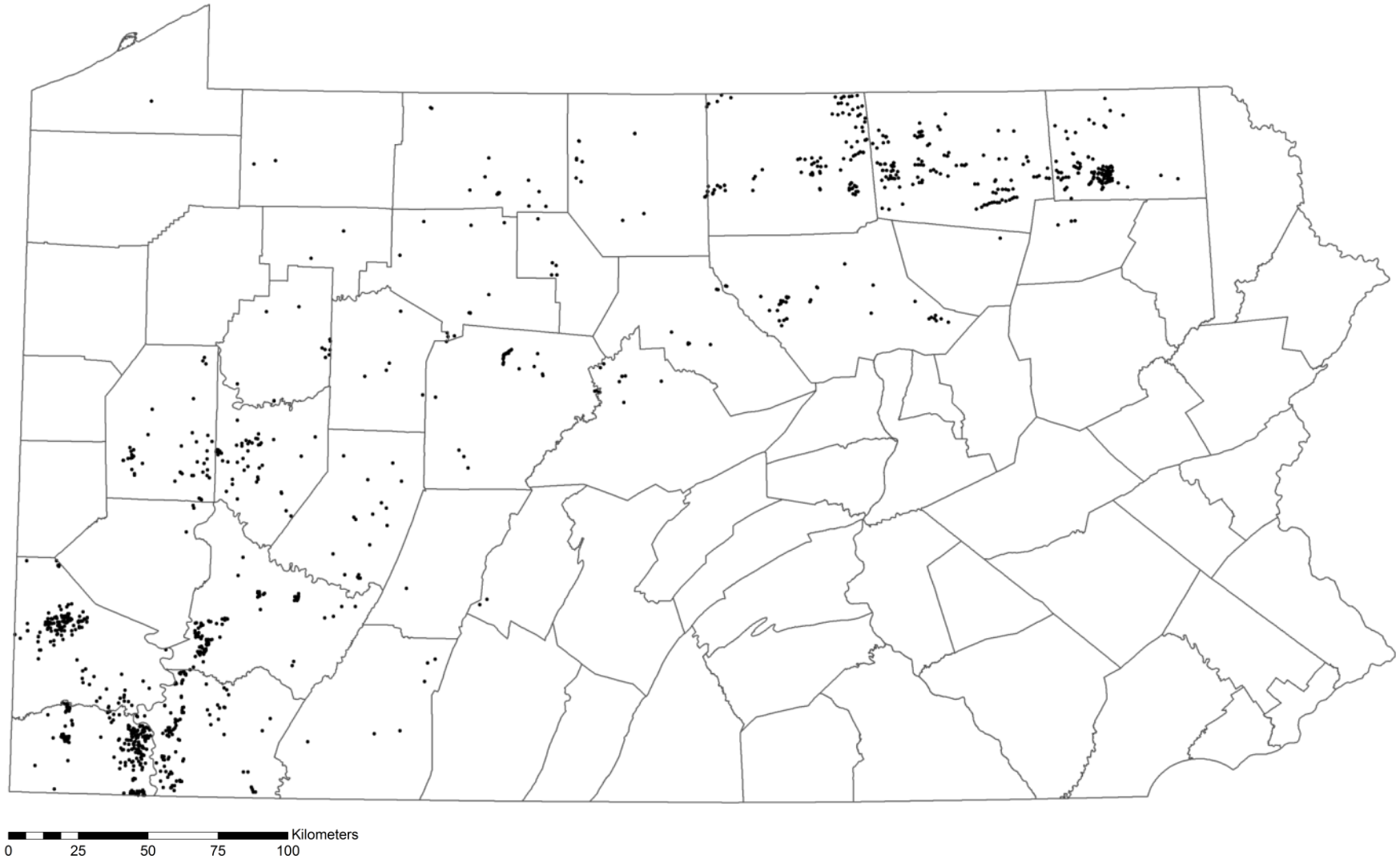
SULLIVAN COUNTY, PA
RURAL SHALE GAS EXPLORATION

6,428 people, 15/square mile
Projected gas wells in Sullivan County—6,000
Lifetime estimated royalty per well– $1.6m
$1.6m x 6,000/6428 = $1.5m/person





June 2013, US Energy Information Administration



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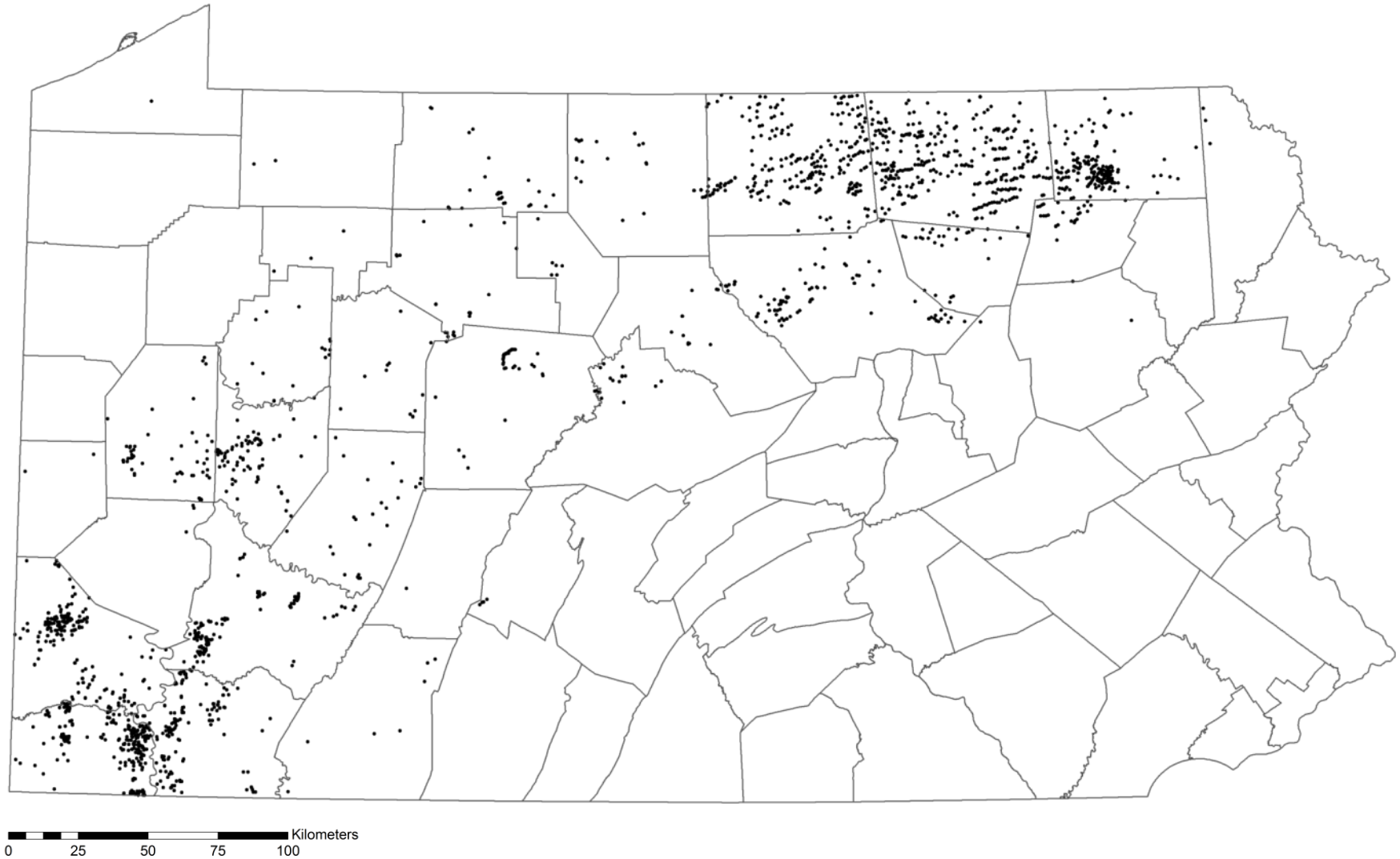

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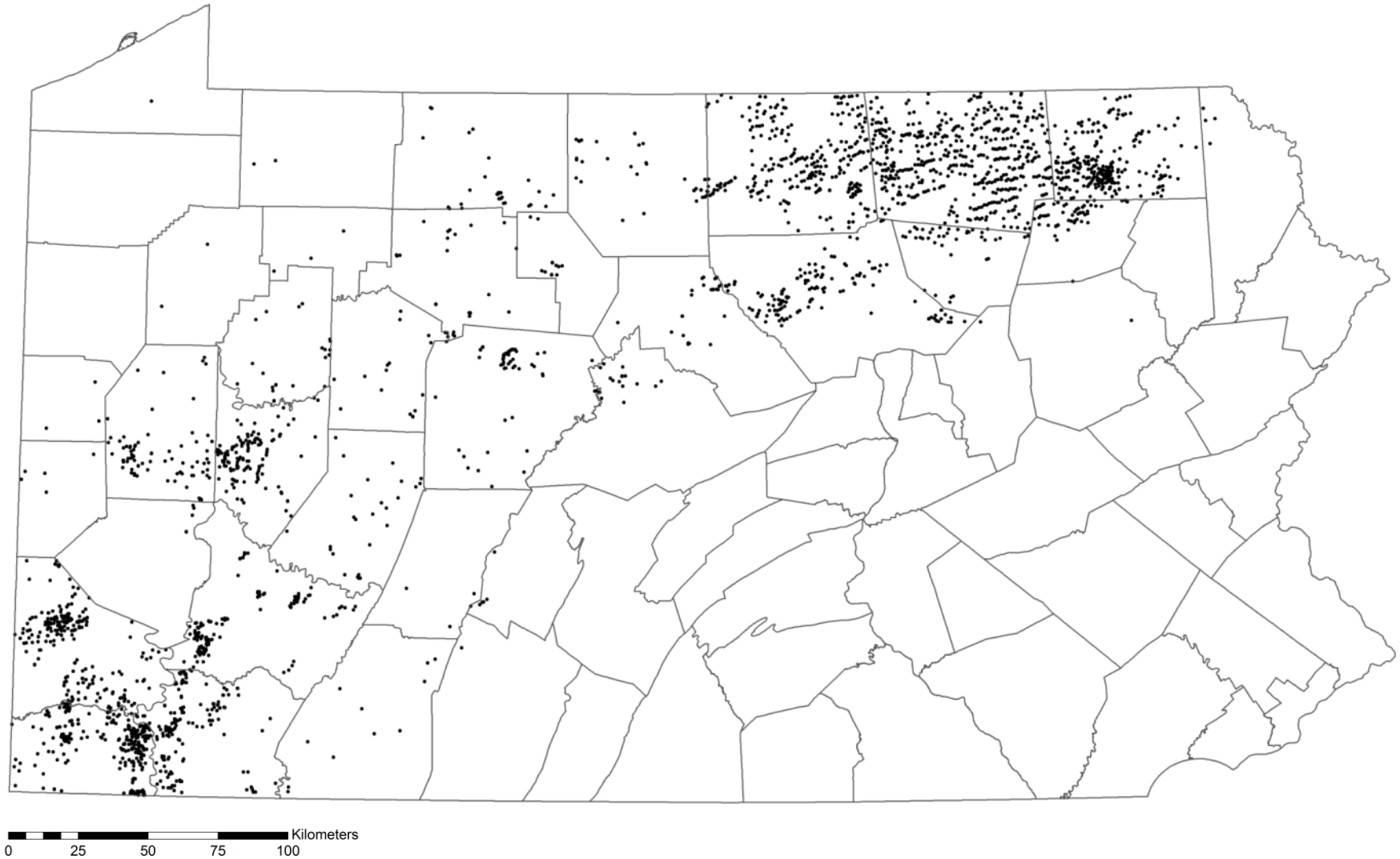

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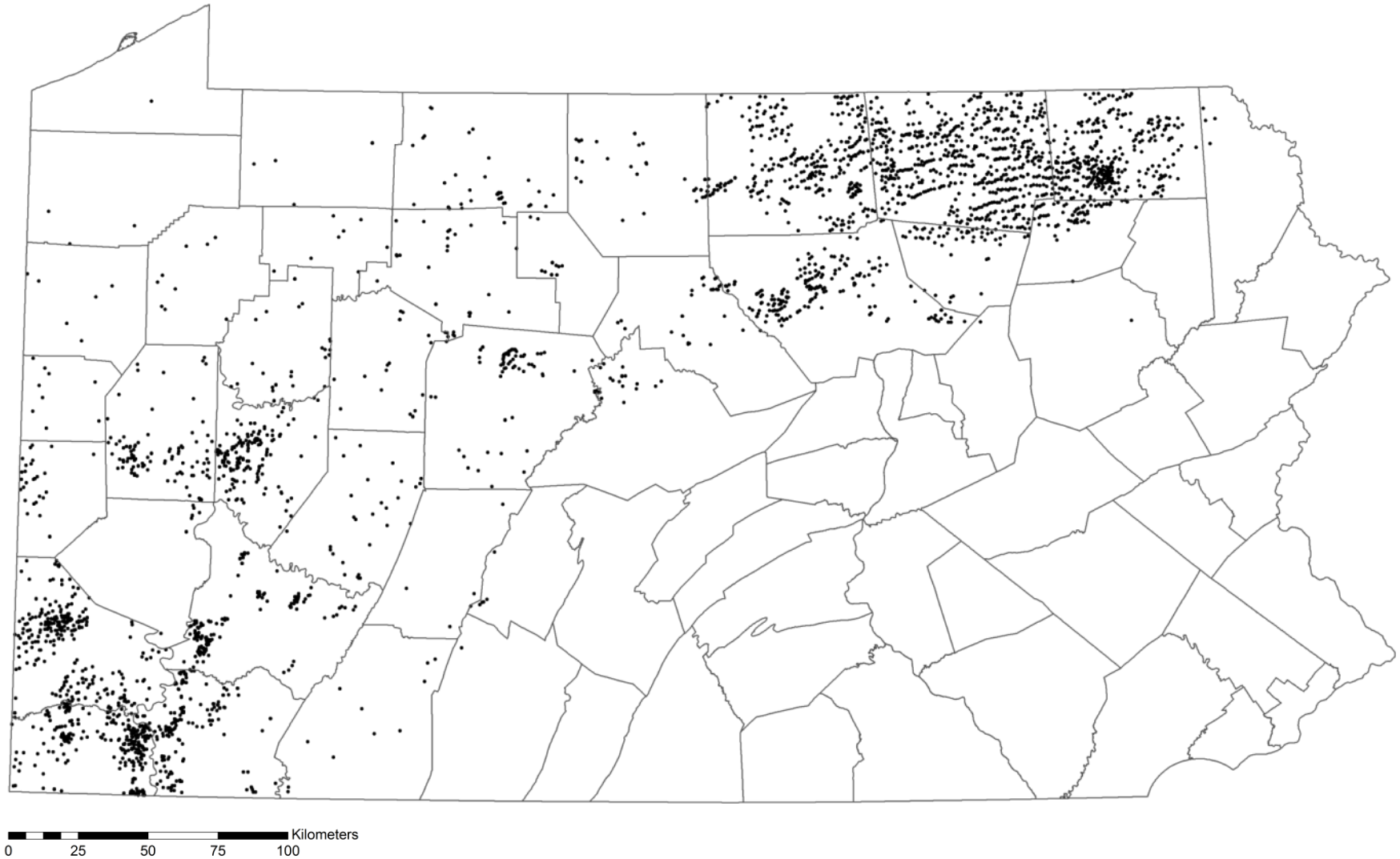

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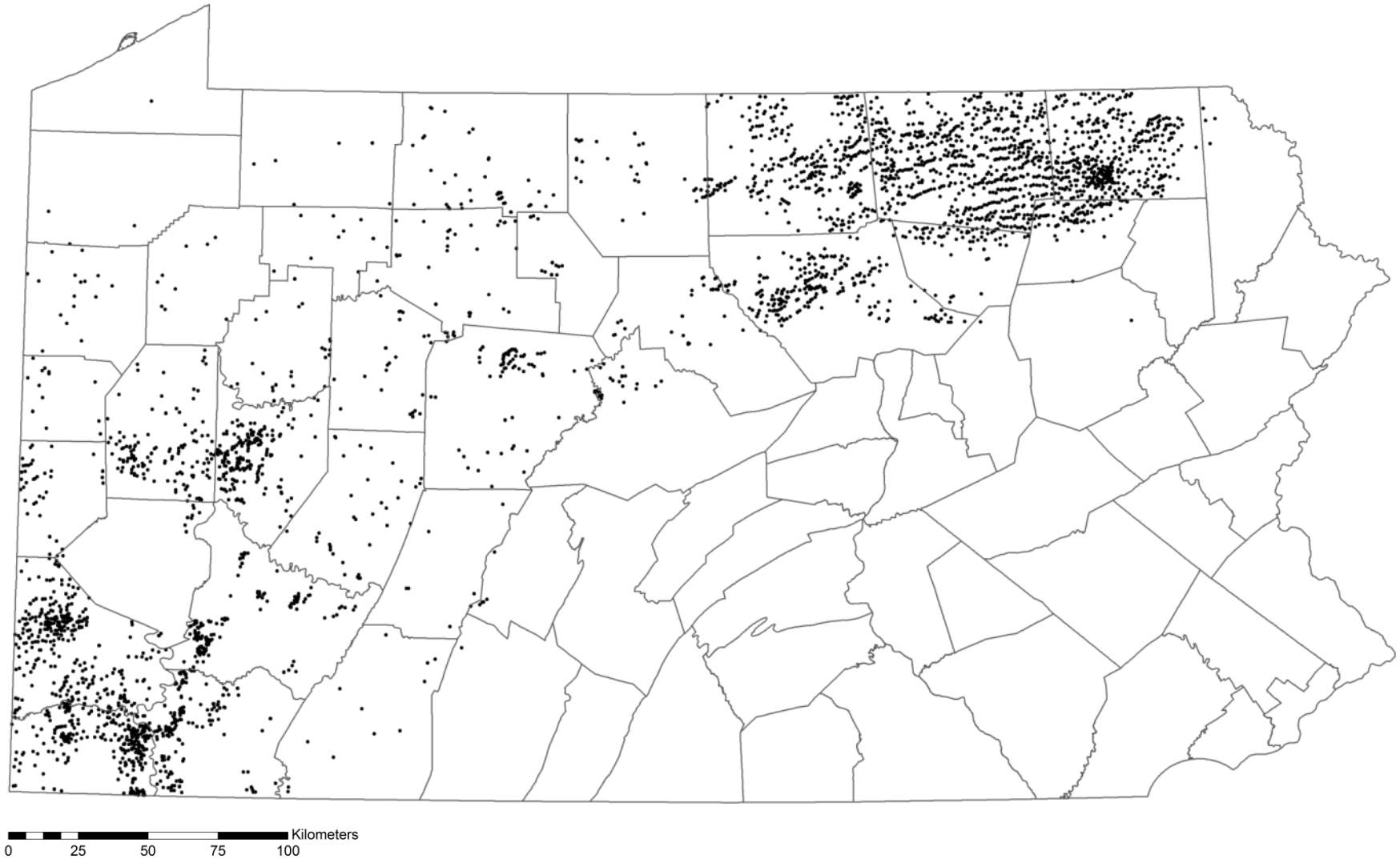

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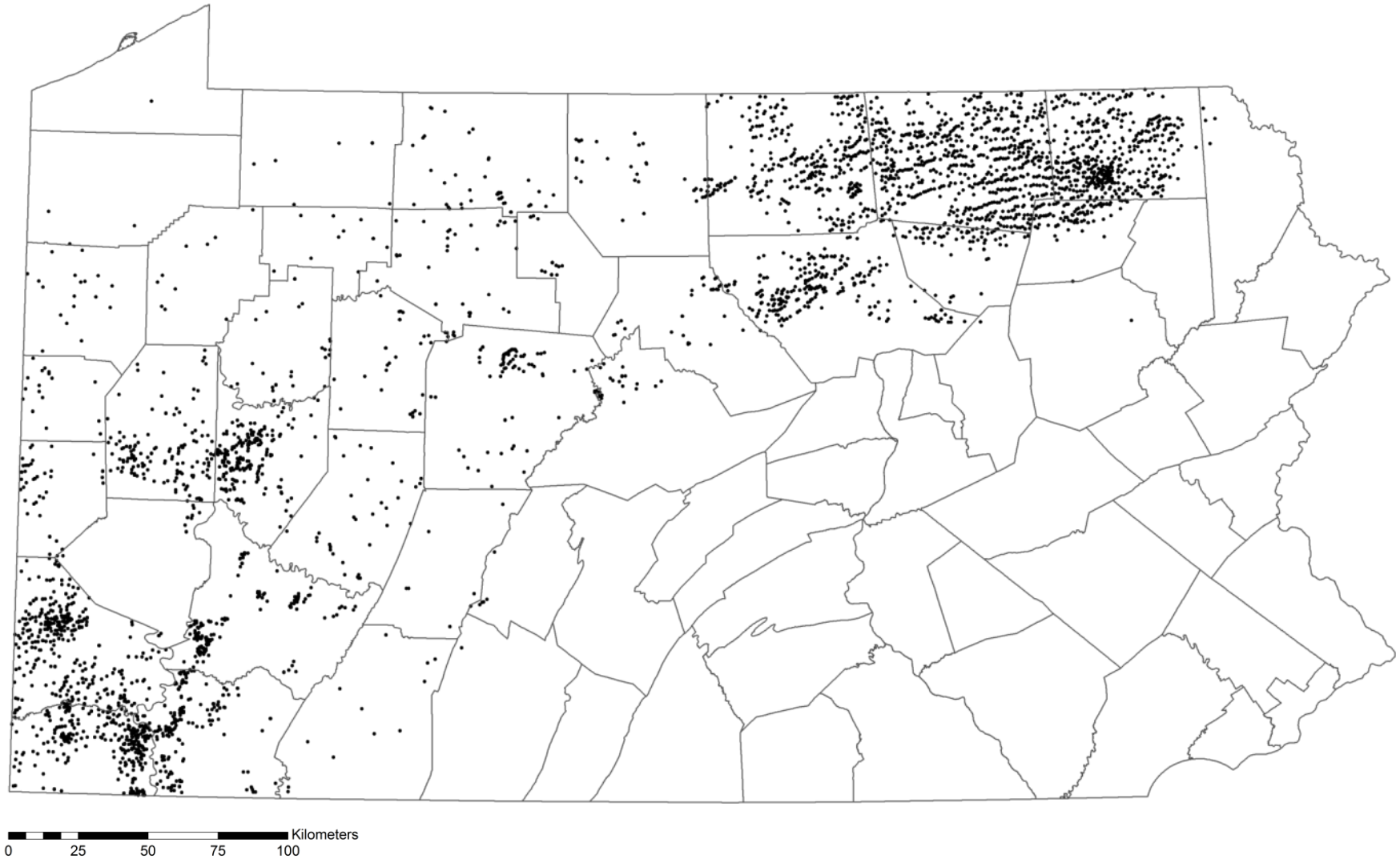

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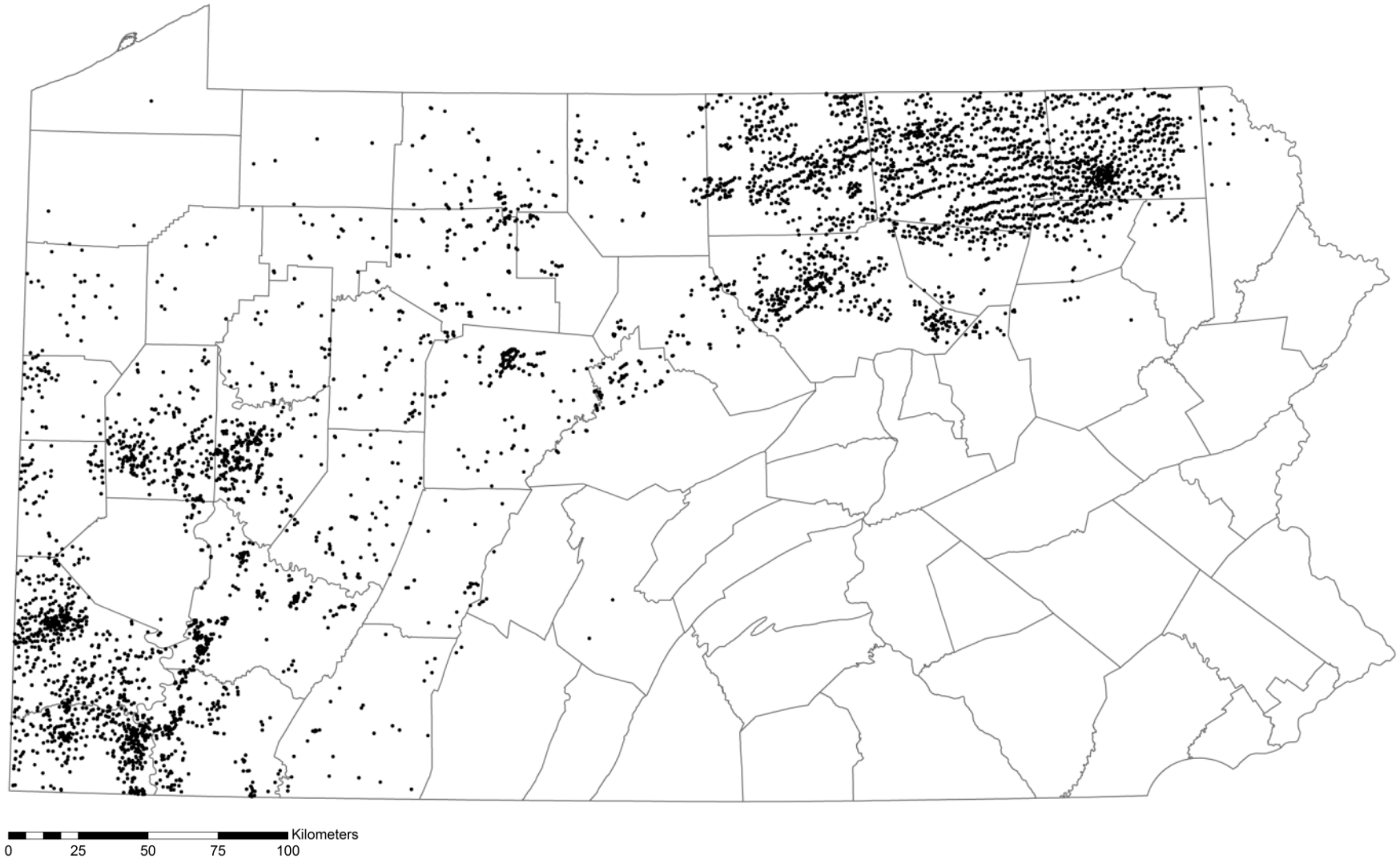

2015

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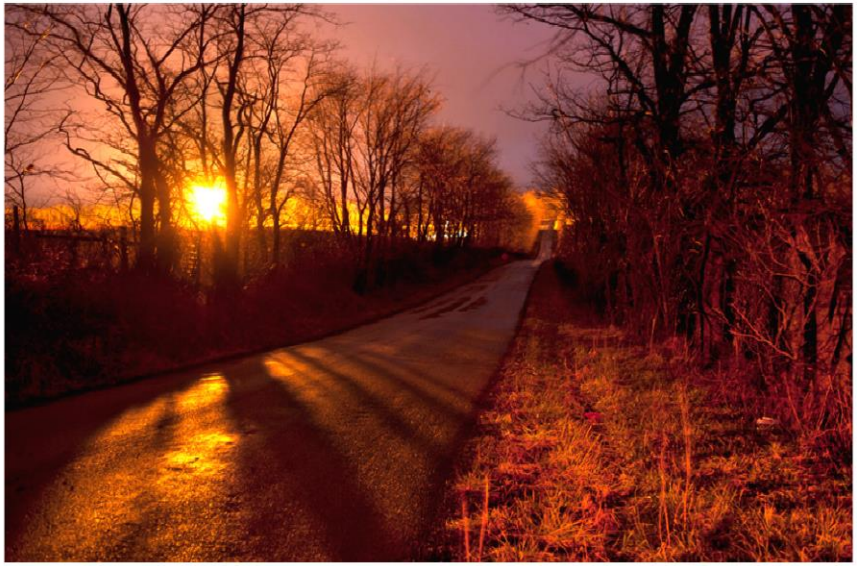
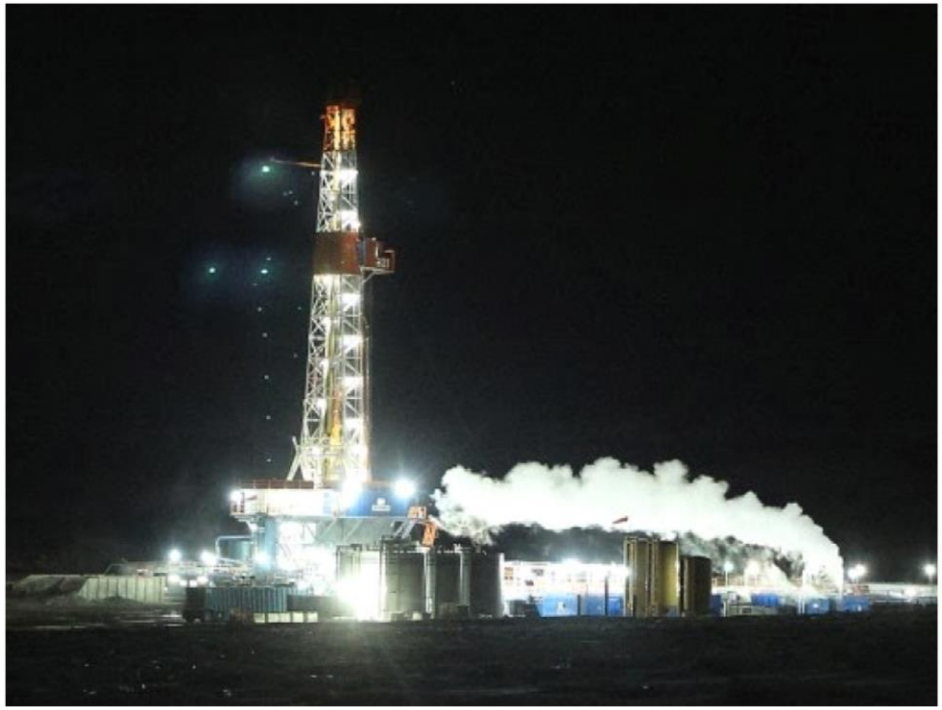
Well Flaring



Nighttime Working Lights and Light Pollution



Traffic and Roads

Rock trucks, tankers, oversized vehicles

Roads

Roads

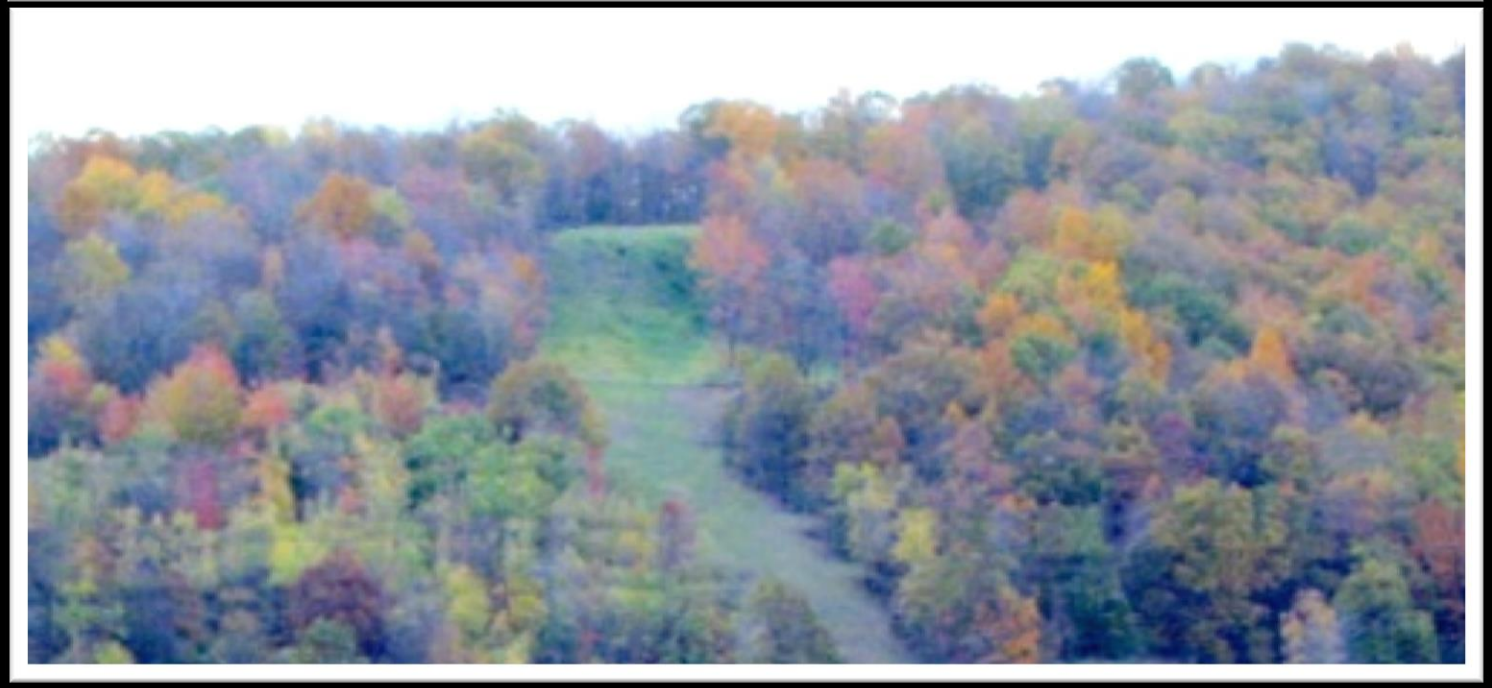
Figure 2.19 State forest road in Moshannon State Forest that was improved for shale-gas development but retained wild character value. Note that the canopy is still closed over the top of the road.

Figure 2.18 State forest road in Moshannon State Forest that was improved for shale-gas development but retained significant wild character value. A gas line ROW is adjacent to the road.

Pipeline clearing


Texas Eastern gas transmission lines in Greene County, Pa.
have been moved above ground in anticipation of longwall
coal mining which will soon be advancing beneath them
©2014 www.marcellus-shale.us

During installation and after “re-vegetation”



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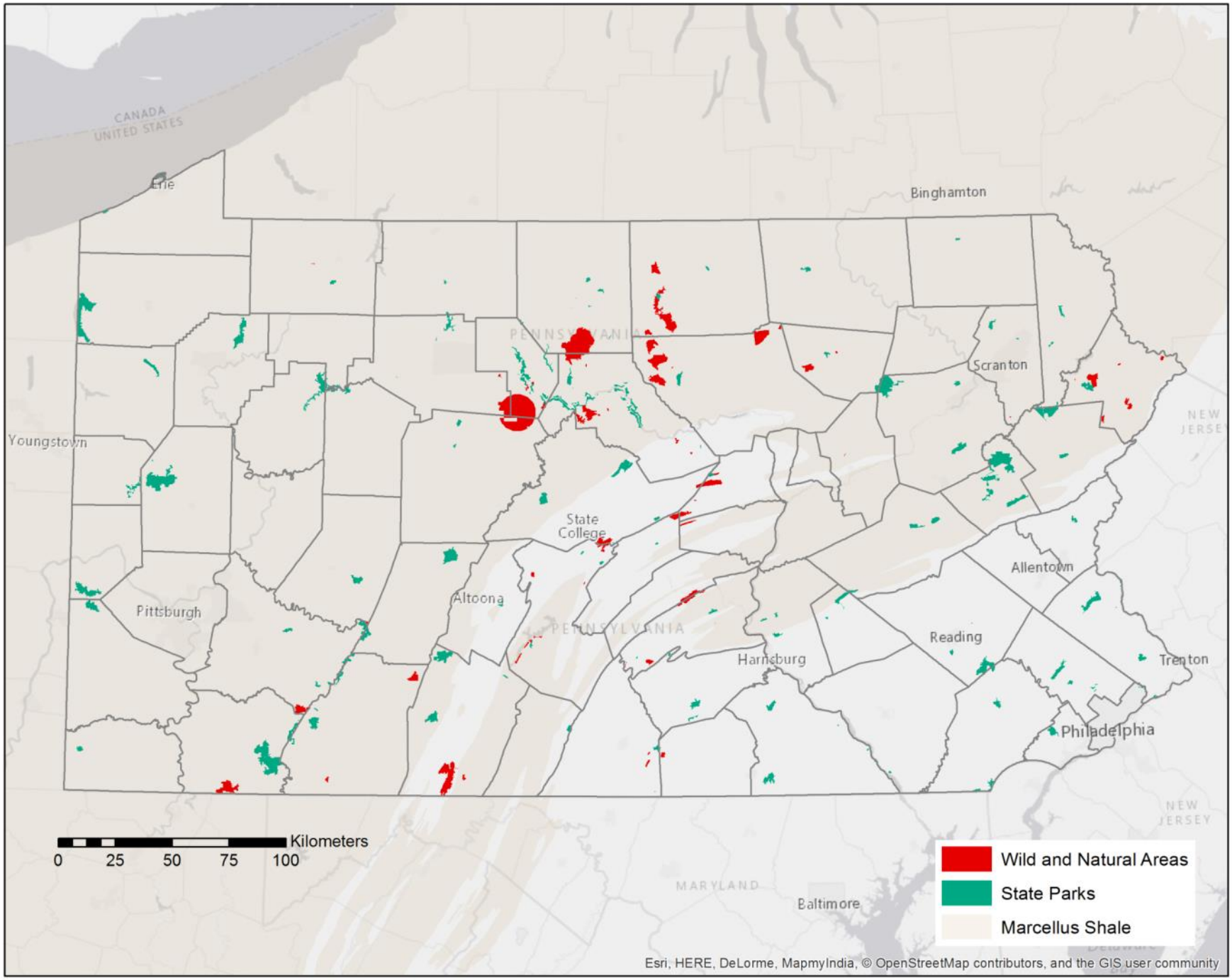
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State College
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Altoona
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PENNSYLVANIA
Reading
Harrisburg
Trenton
Philadelphia
NEW JERSEY
Kilometers
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MARYLAND
Baltimore
Wild and Natural Areas
State Parks
Marcellus Shale
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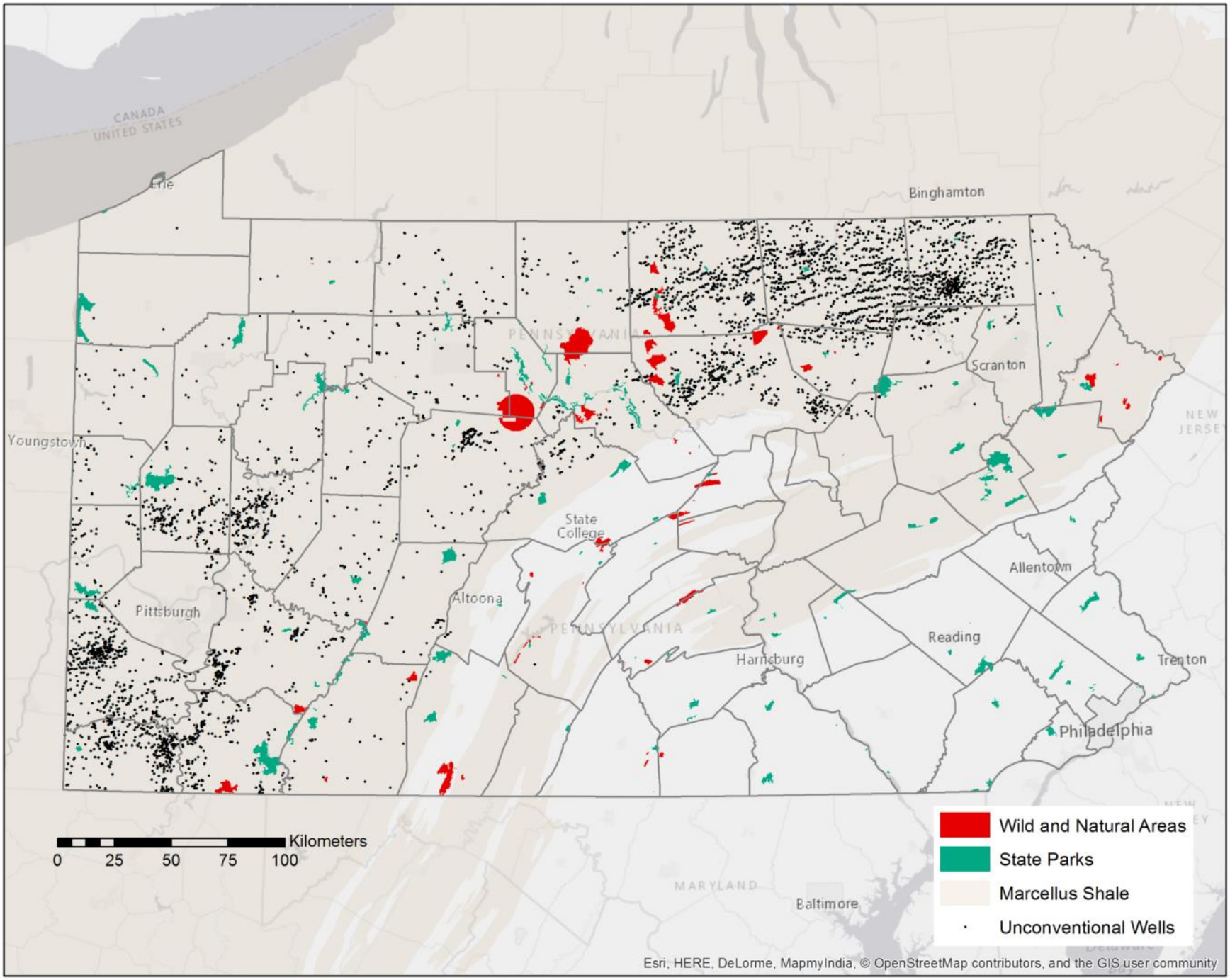
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Marcellus Shale
Unconventional Wells
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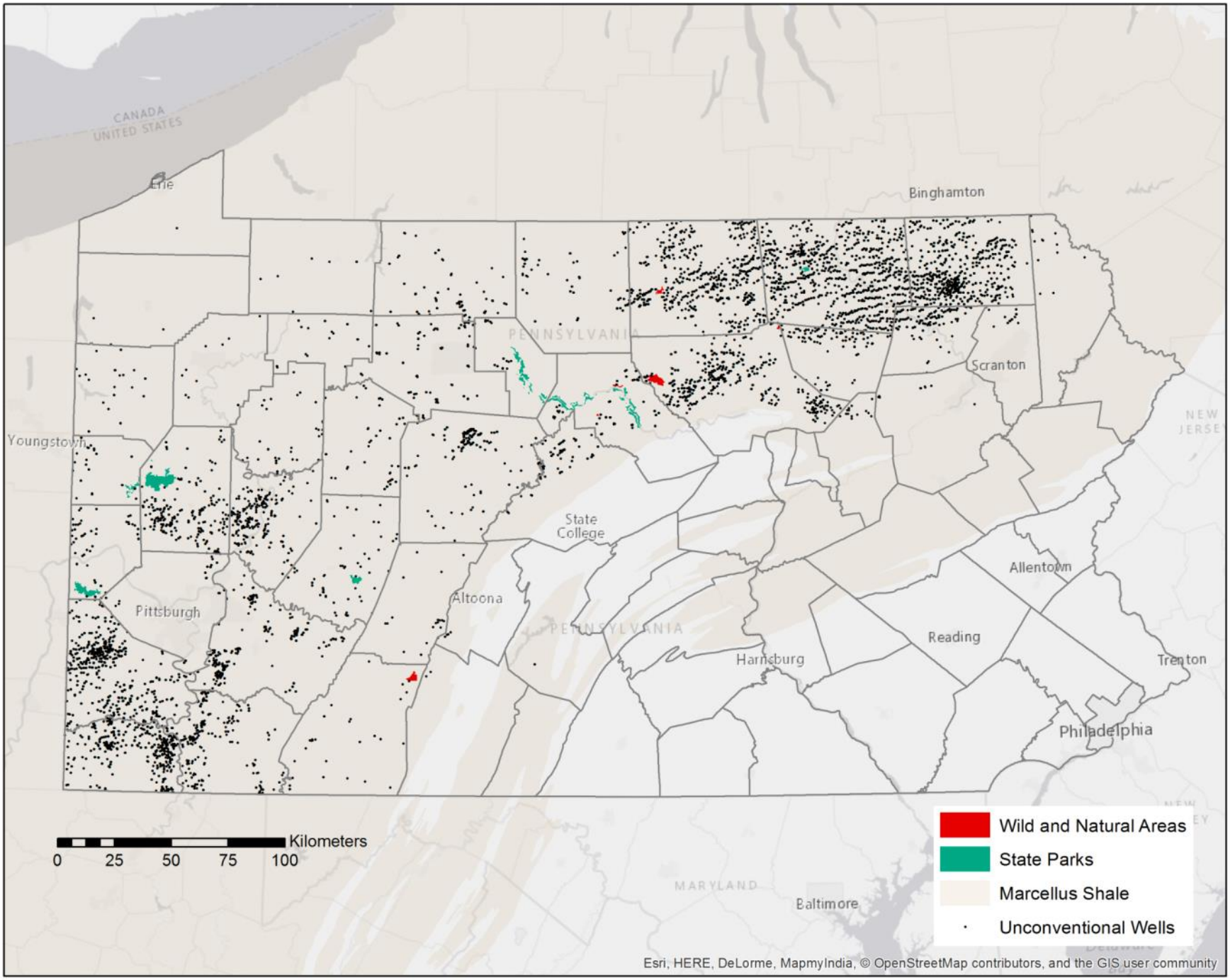
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Wild and Natural Areas
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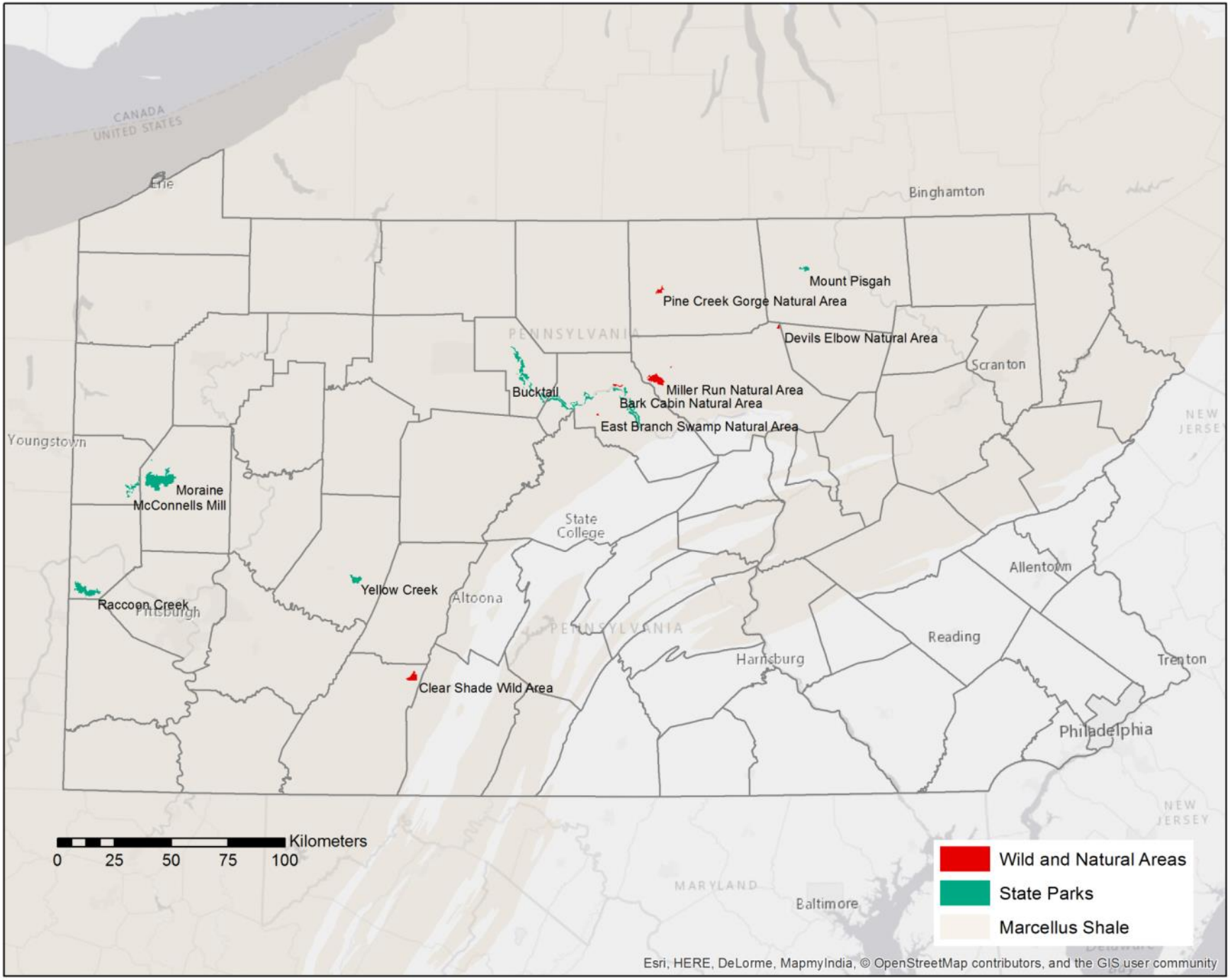
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Devils Elbow Natural Area
Scranton
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Miller Run Natural Area
Bark Cabin Natural Area
East Branch Swamp Natural Area
NEW JERSEY
Youngstown
Moraine
McConnells Mill
State College
Allentown
Yellow Creek
Altoona
Raccoon Creek
Pittsburgh
PENNSYLVANIA
Reading
Harrisburg
Trenton
Clear Shade Wild Area
Philadelphia
NEW JERSEY
Kilometers
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Baltimore
Wild and Natural Areas
State Parks
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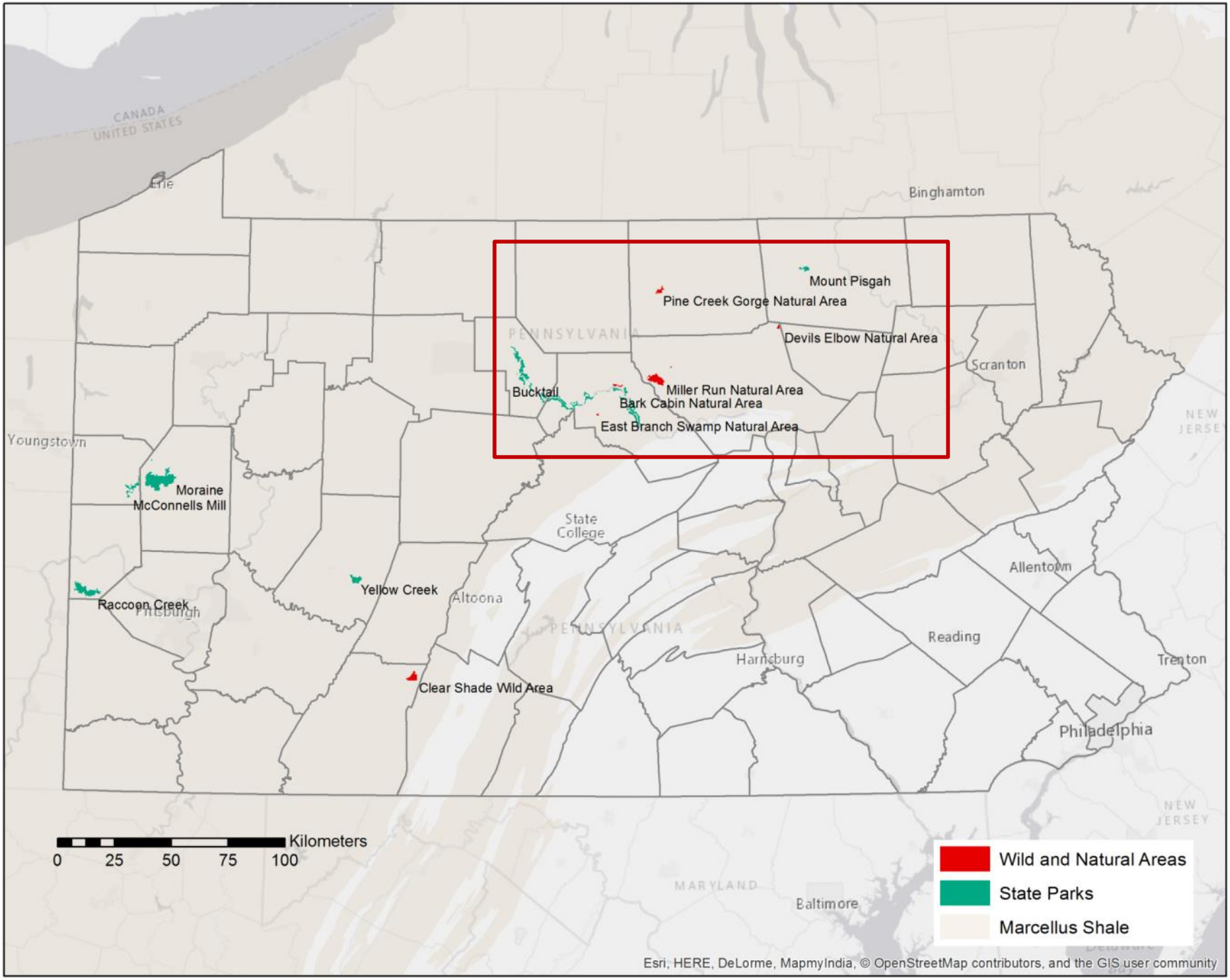
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Mount Pisgah
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PENNSYLVANIA
Devils Elbow Natural Area
Scranton
Bucktail
Miller Run Natural Area
Bark Cabin Natural Area
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Trenton
Clear Shade Wild Area
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Kilometers
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Baltimore
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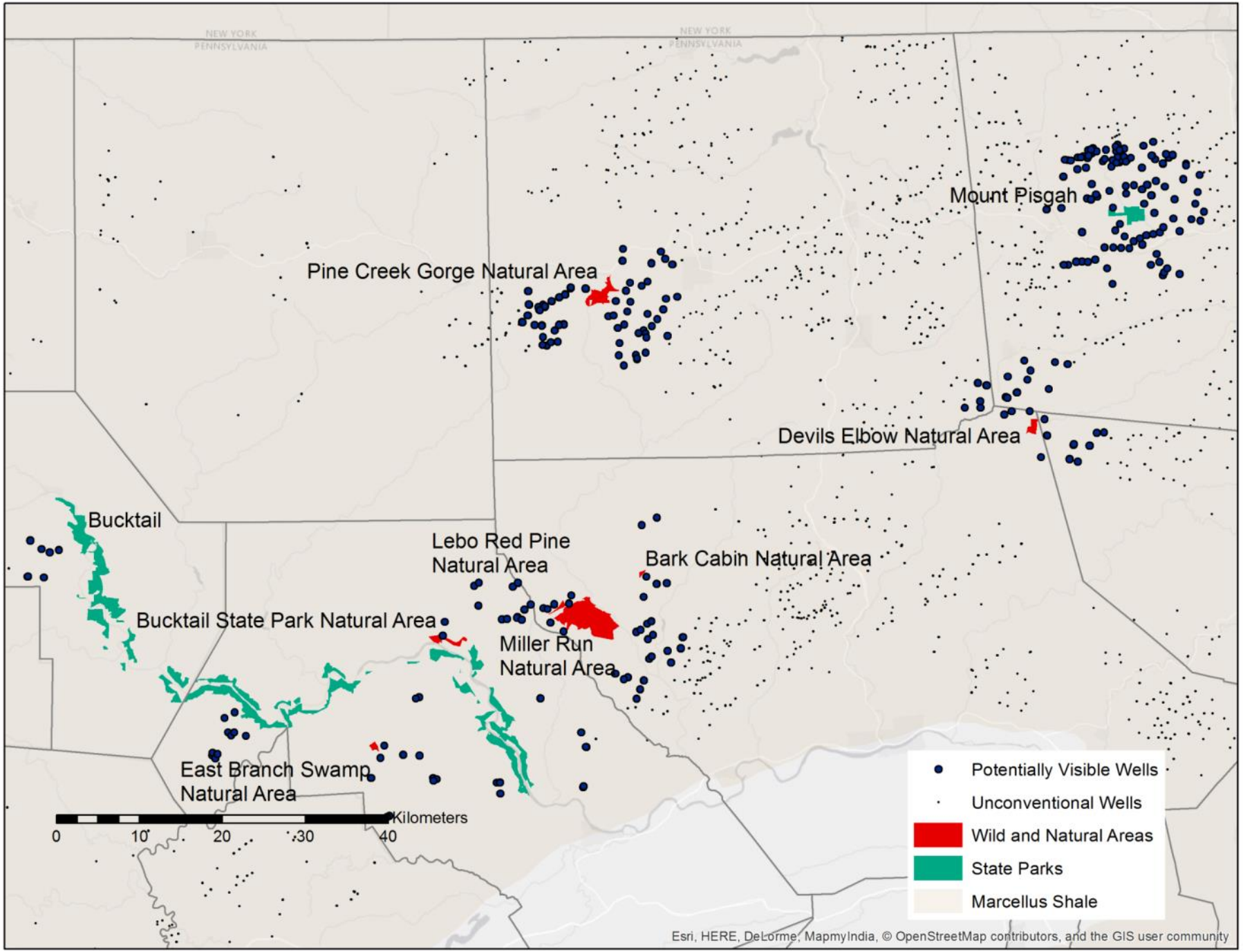
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PENNSYLVANIA
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Pine Creek Gorge Natural Area
Devils Elbow Natural Area
Bucktail
Lebo Red Pine
Natural Area
Bark Cabin Natural Area
Bucktail State Park Natural Area
Miller Run
Natural Area
East Branch Swamp
Natural Area
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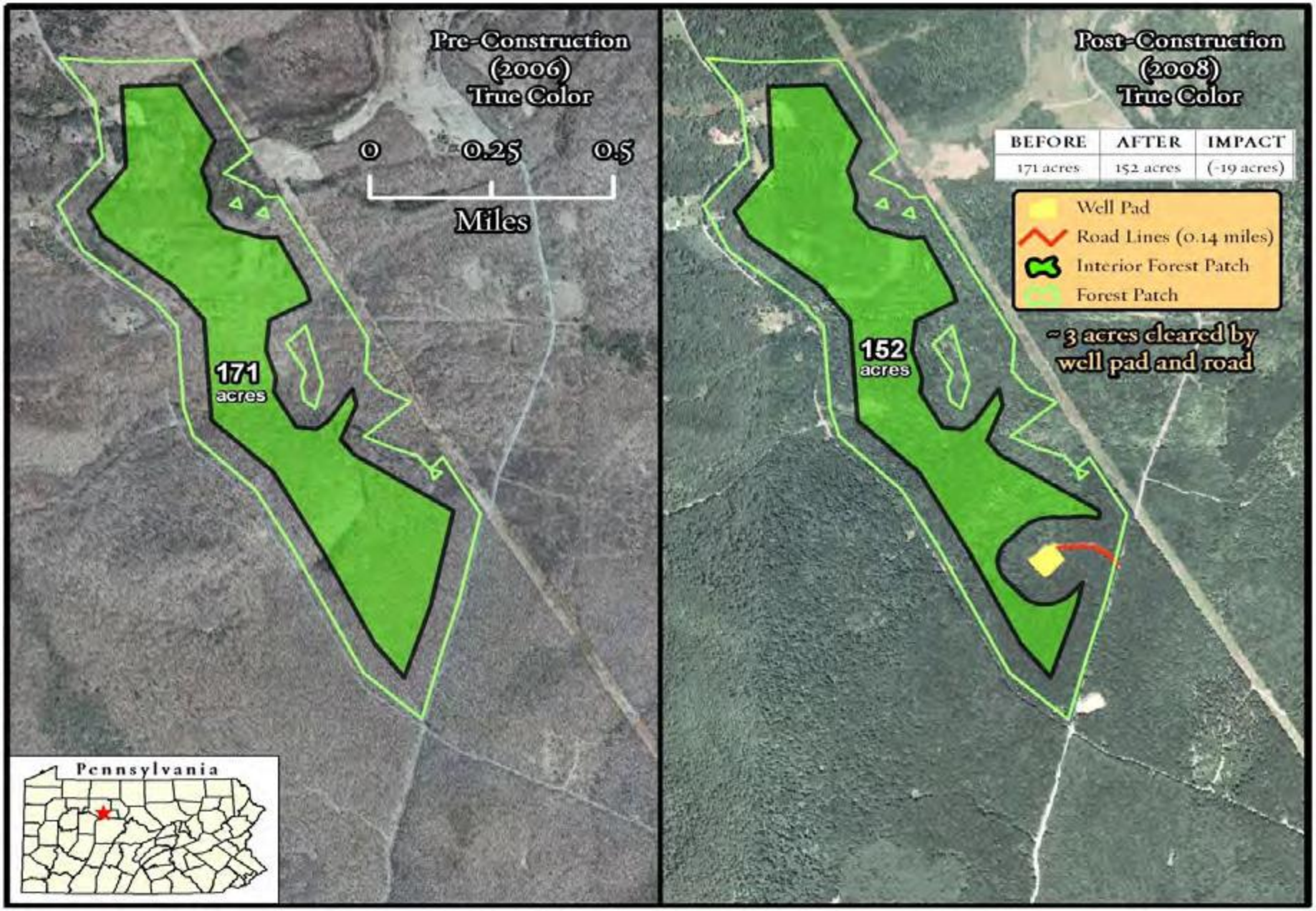
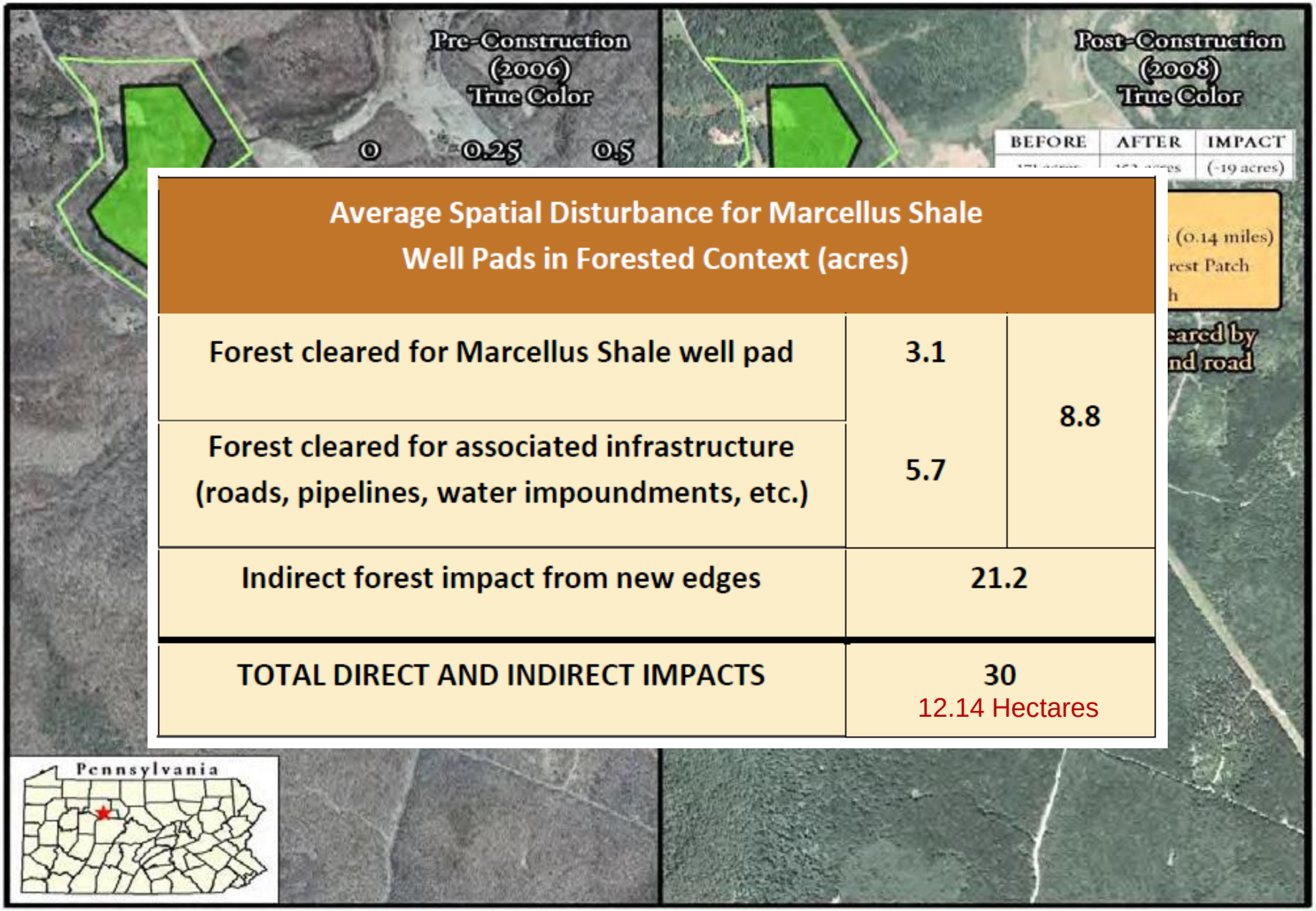
Kilometers
Potentially Visible Wells
Unconventional Wells
Wild and Natural Areas
State Parks
Marcellus Shale
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

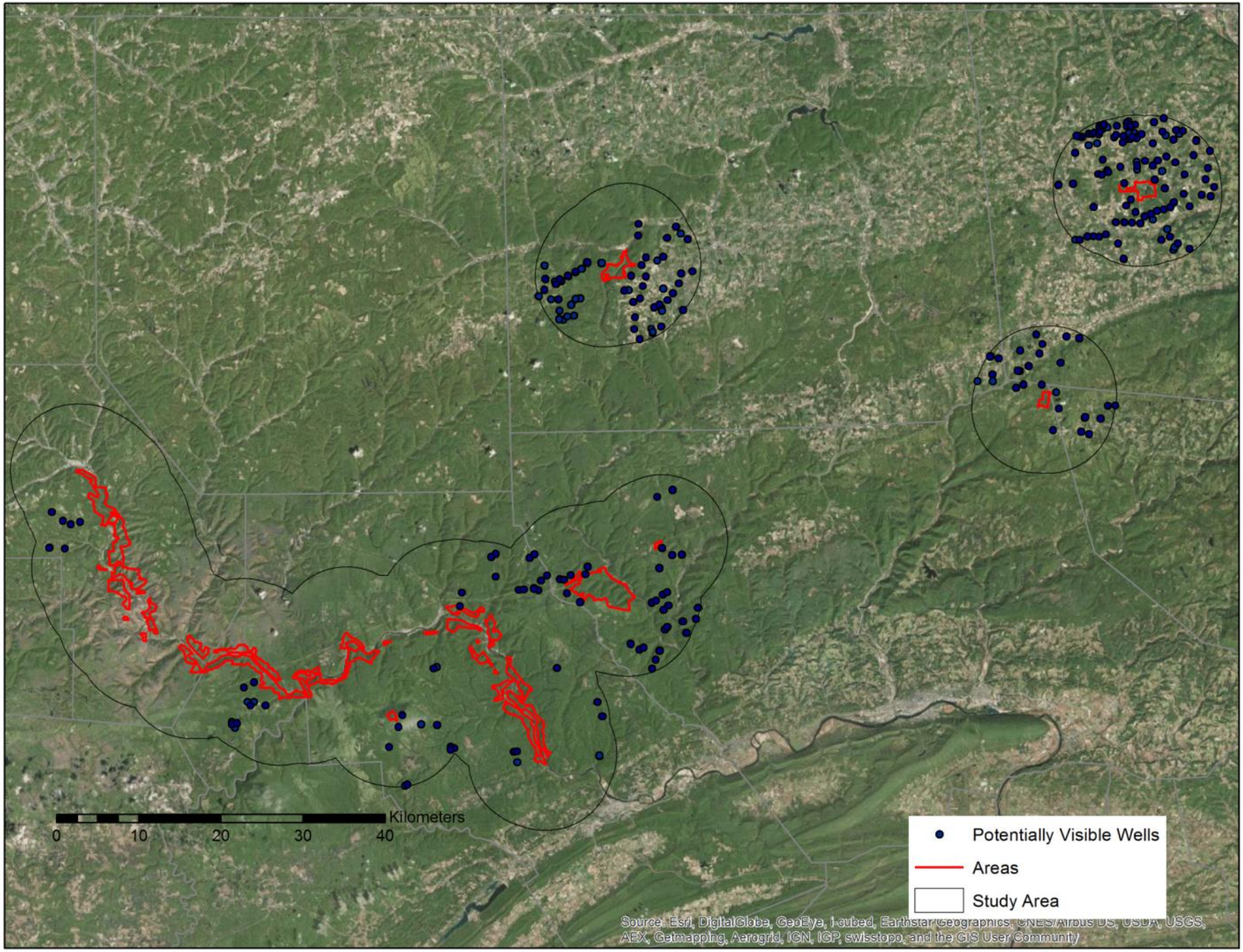


PA Nature Conservancy 2006



Average Spatial Disturbance for Marcellus Shale Well Pads in Forested Context (acres)		
Forest cleared for Marcellus Shale well pad	3.1	8.8
Forest cleared for associated infrastructure (roads, pipelines, water impoundments, etc.)	5.7	
Indirect forest impact from new edges	21.2	
TOTAL DIRECT AND INDIRECT IMPACTS	30 12.14 Hectares	

PA Nature Conservancy 2006


Kilometers
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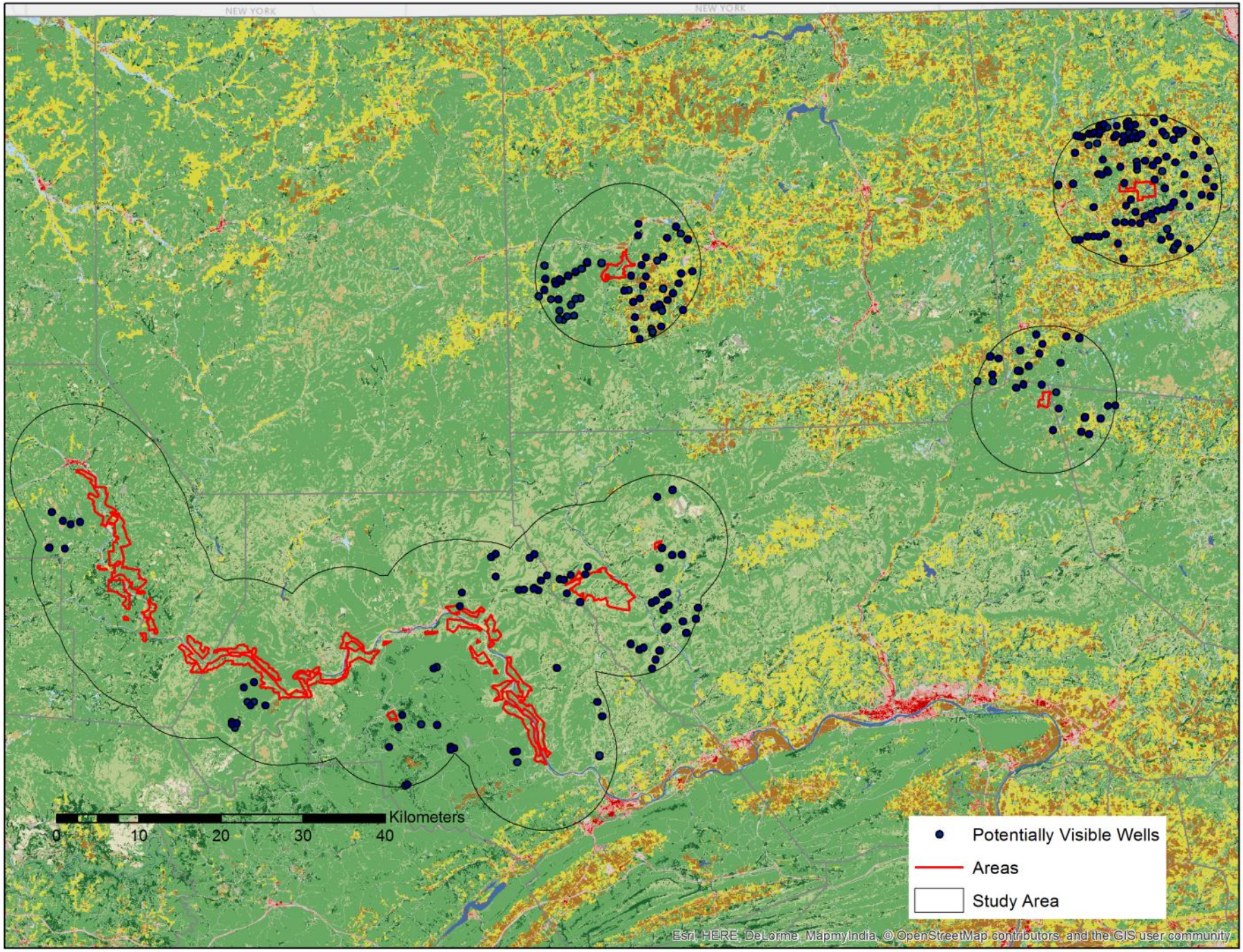
40
Potentially Visible Wells
Areas
Study Area
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community


NEW YORK
NEW YORK
Kilometers
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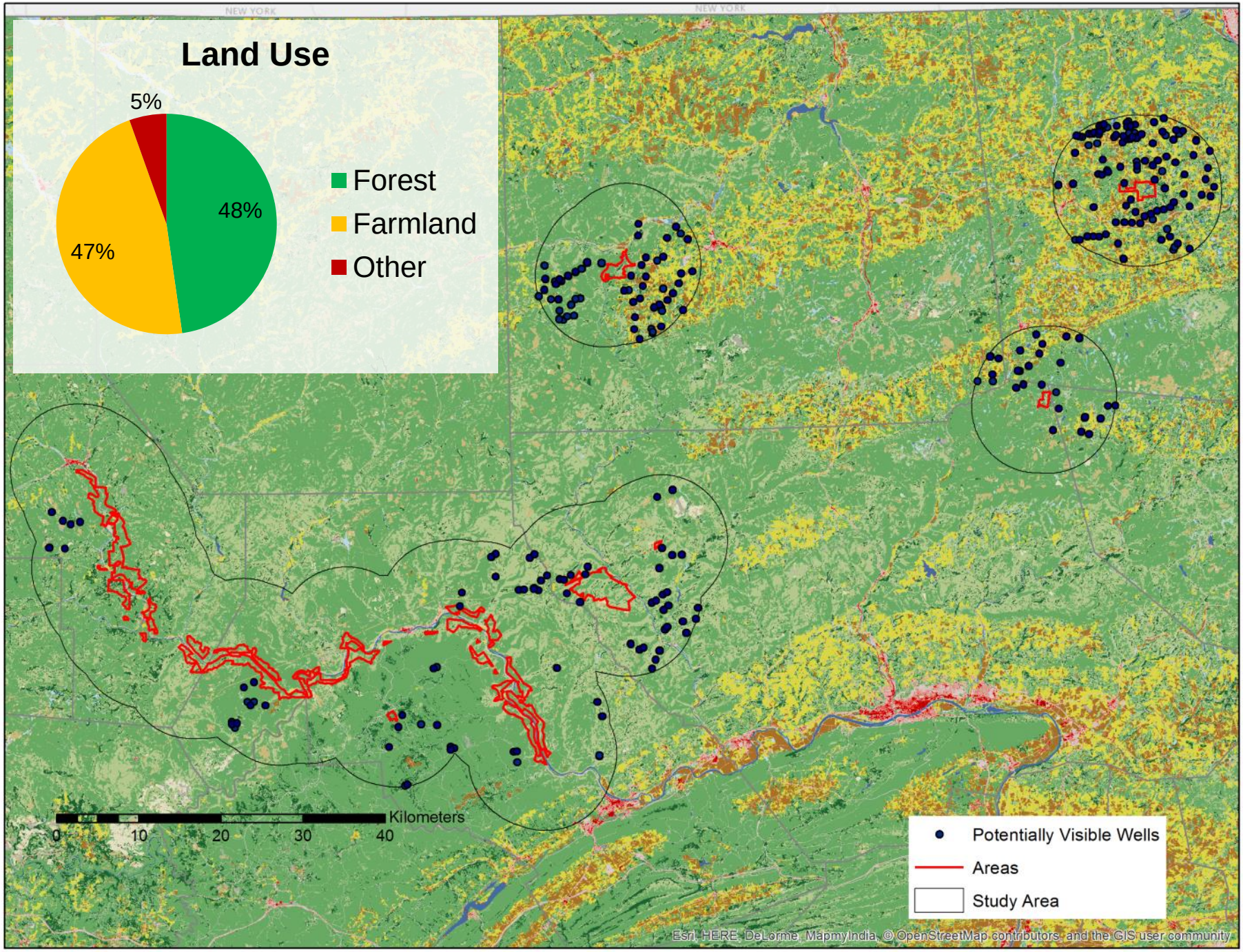
Potentially Visible Wells
Areas
Study Area
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community


Land Use
5%
48%
47%
Forest
Farmland
Other
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Potentially Visible Wells
Areas
Study Area
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Average Spatial Disturbance for Marcellus Shale Well Pads in Forested Context (acres)		
Forest cleared for Marcellus Shale well pad	345	981
Forest cleared for associated infrastructure (roads, pipelines, water impoundments, etc.)	636	
Indirect forest impact from new edges	2363.5	
TOTAL DIRECT AND INDIRECT IMPACTS	3344.5 1353.5 Hectares	

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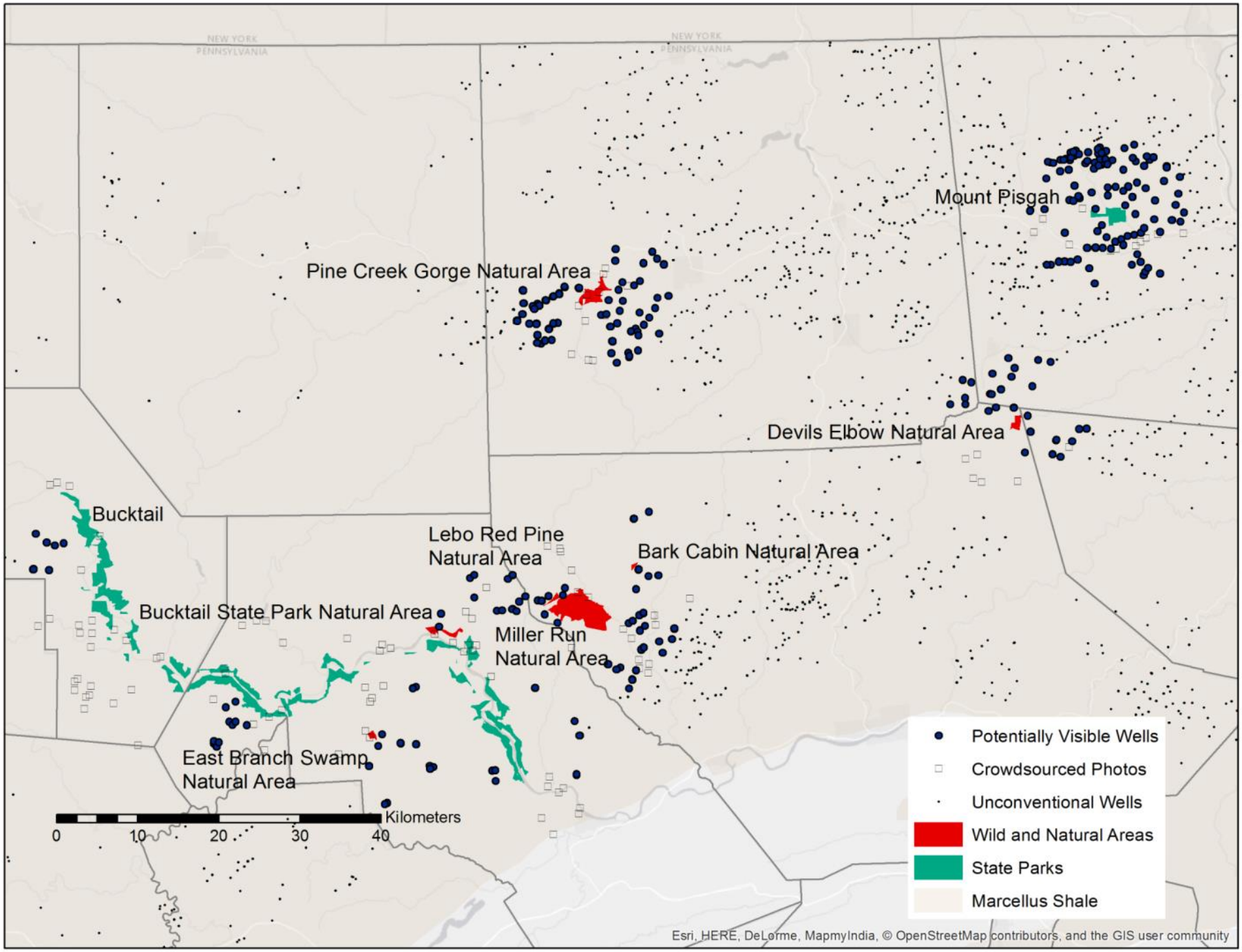
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Bucktail
Lebo Red Pine
Natural Area
Bark Cabin Natural Area
Bucktail State Park Natural Area
Miller Run
Natural Area
East Branch Swamp
Natural Area
Kilometers
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Potentially Visible Wells
Crowdsourced Photos
Unconventional Wells
Wild and Natural Areas
State Parks
Marcellus Shale
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Devil’s Elbow

Bark Cabin

Miller Run

East Branch Swamp

Pine Creek Gorge Natural Area





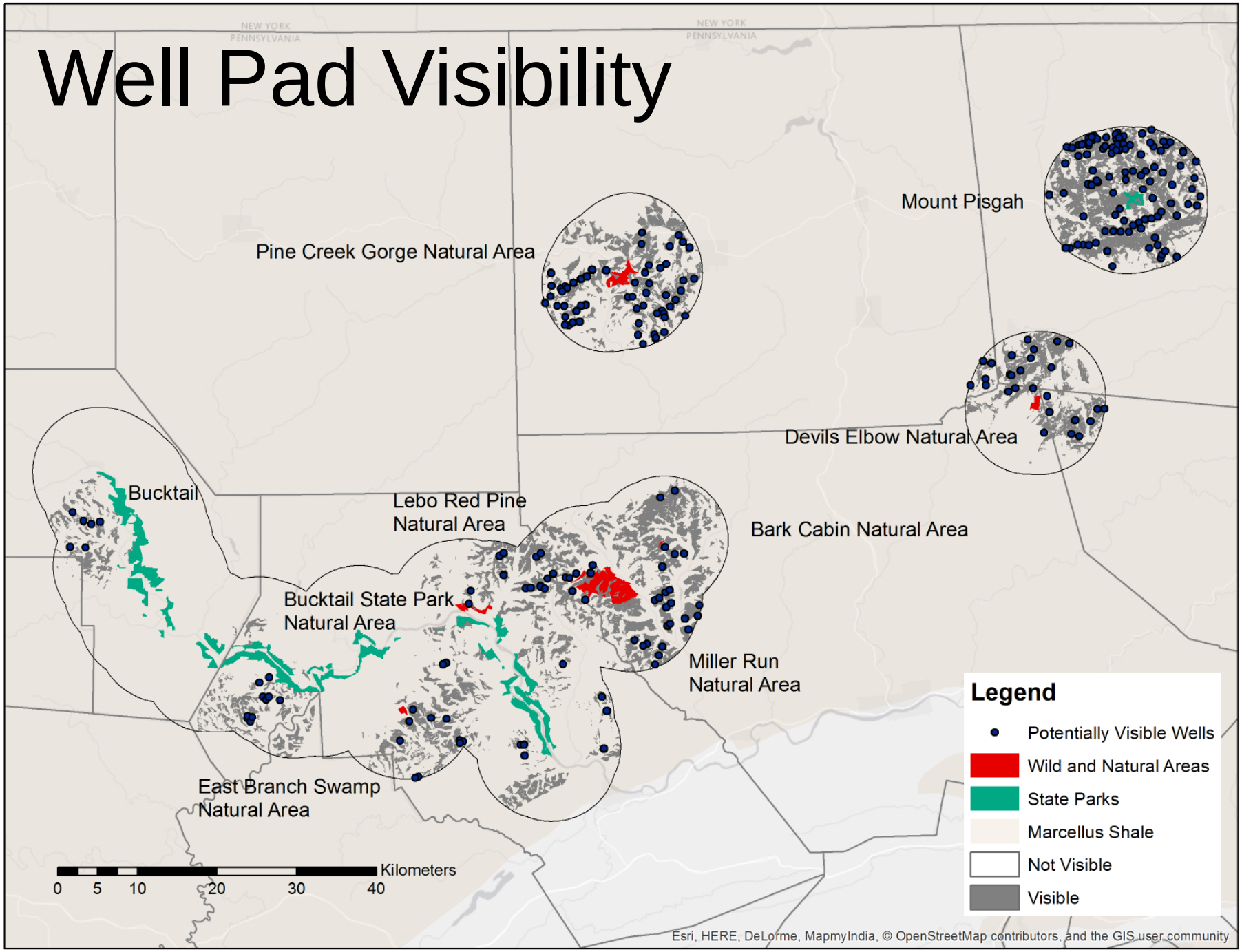
Mt. Pigsah



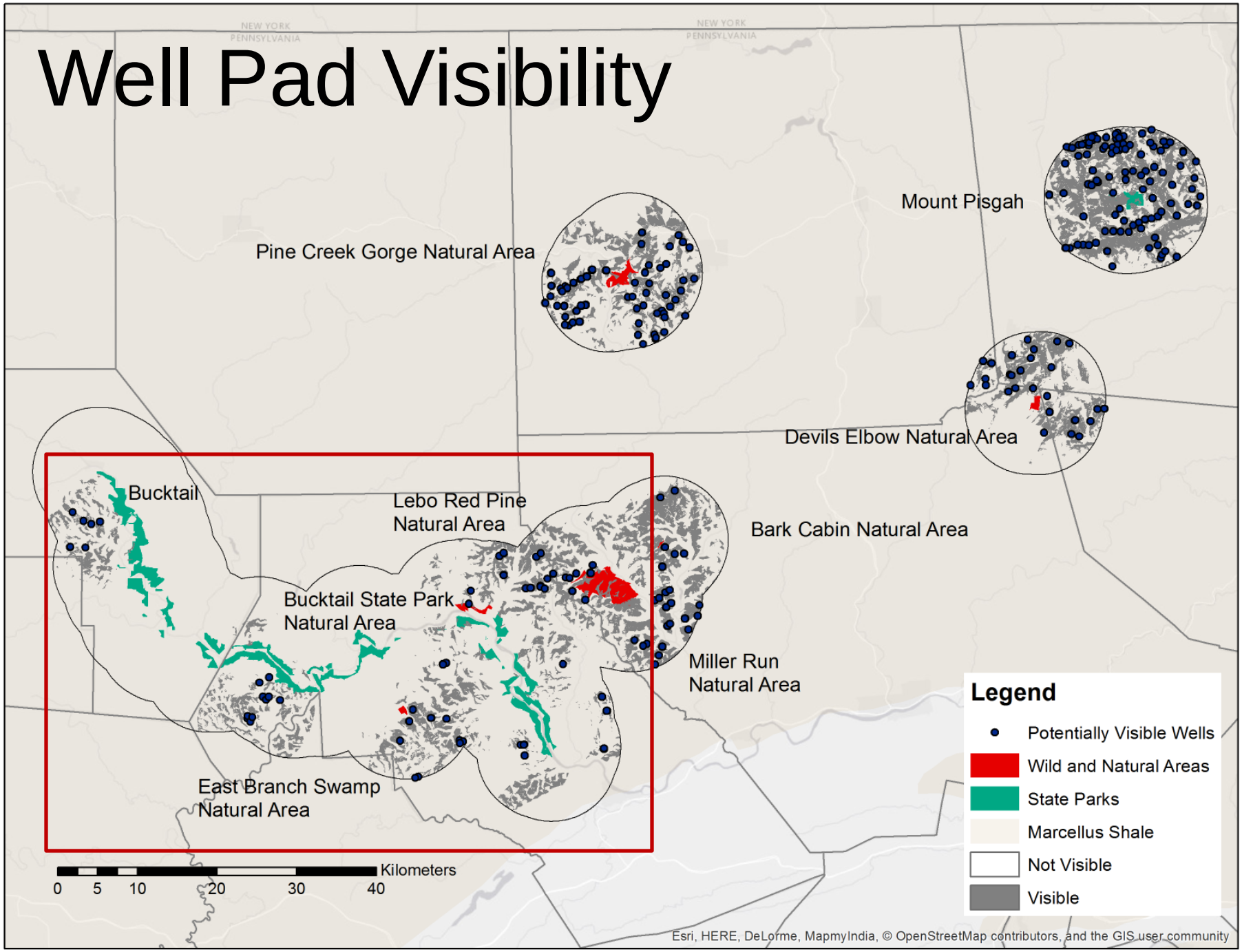


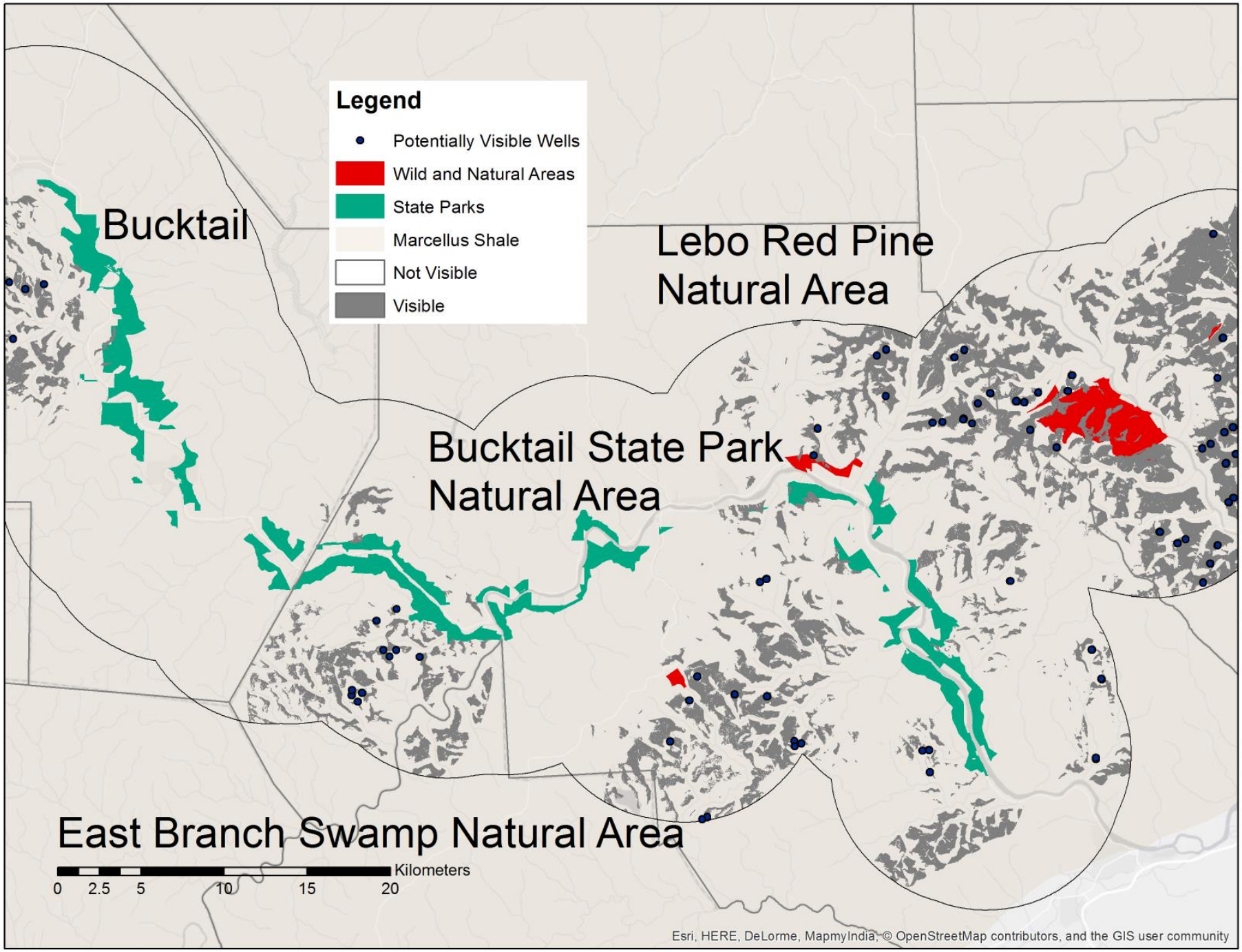

Bucktail State Park

Well Pad Visibility



Well Pad Visibility




Legend
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Wild and Natural Areas
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Lebo Red Pine Natural Area
Bucktail State Park Natural Area
East Branch Swamp Natural Area
Kilometers
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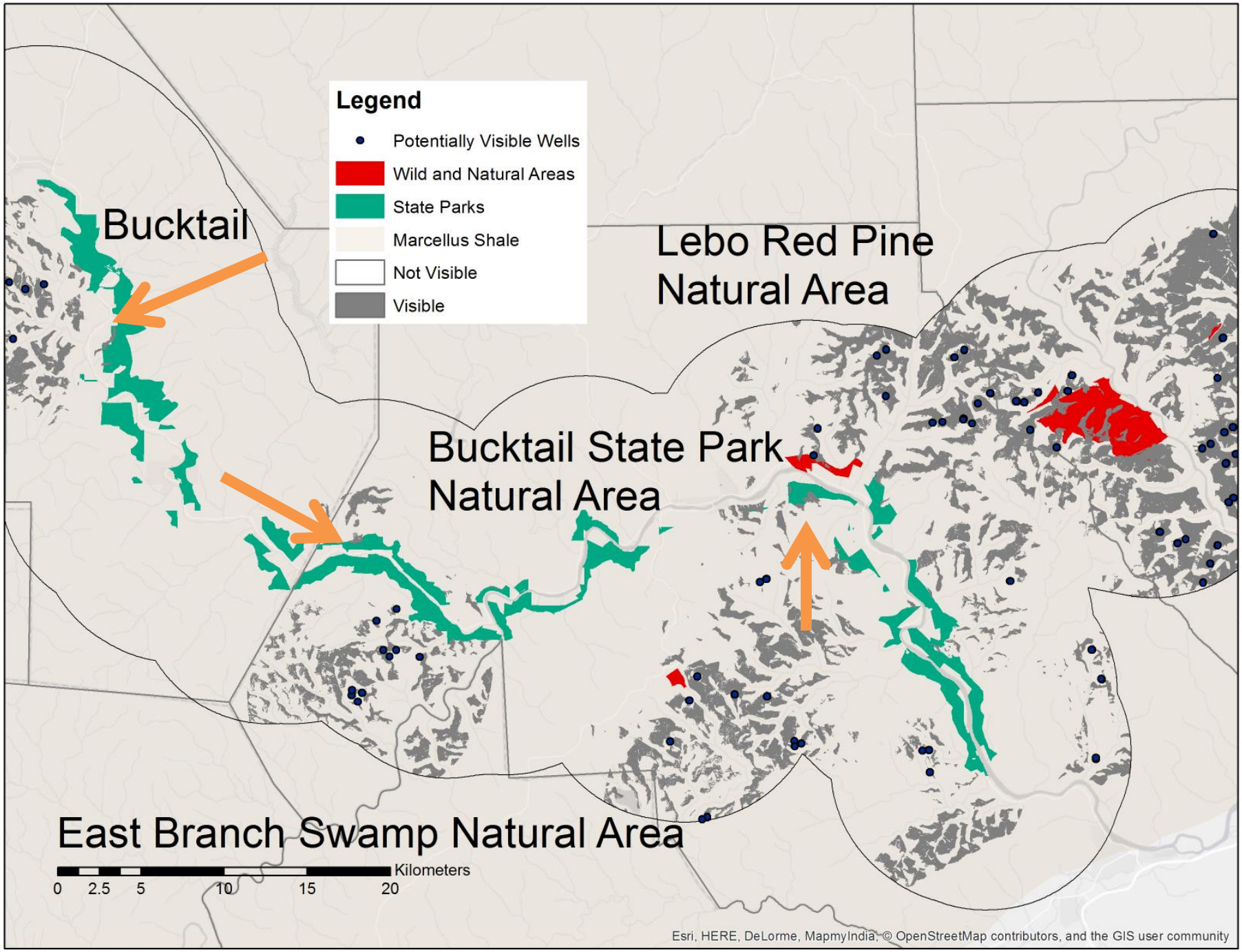
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Wild and Natural Areas
State Parks
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Bucktail
Lebo Red Pine
Natural Area
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Natural Area
East Branch Swamp Natural Area
Kilometers
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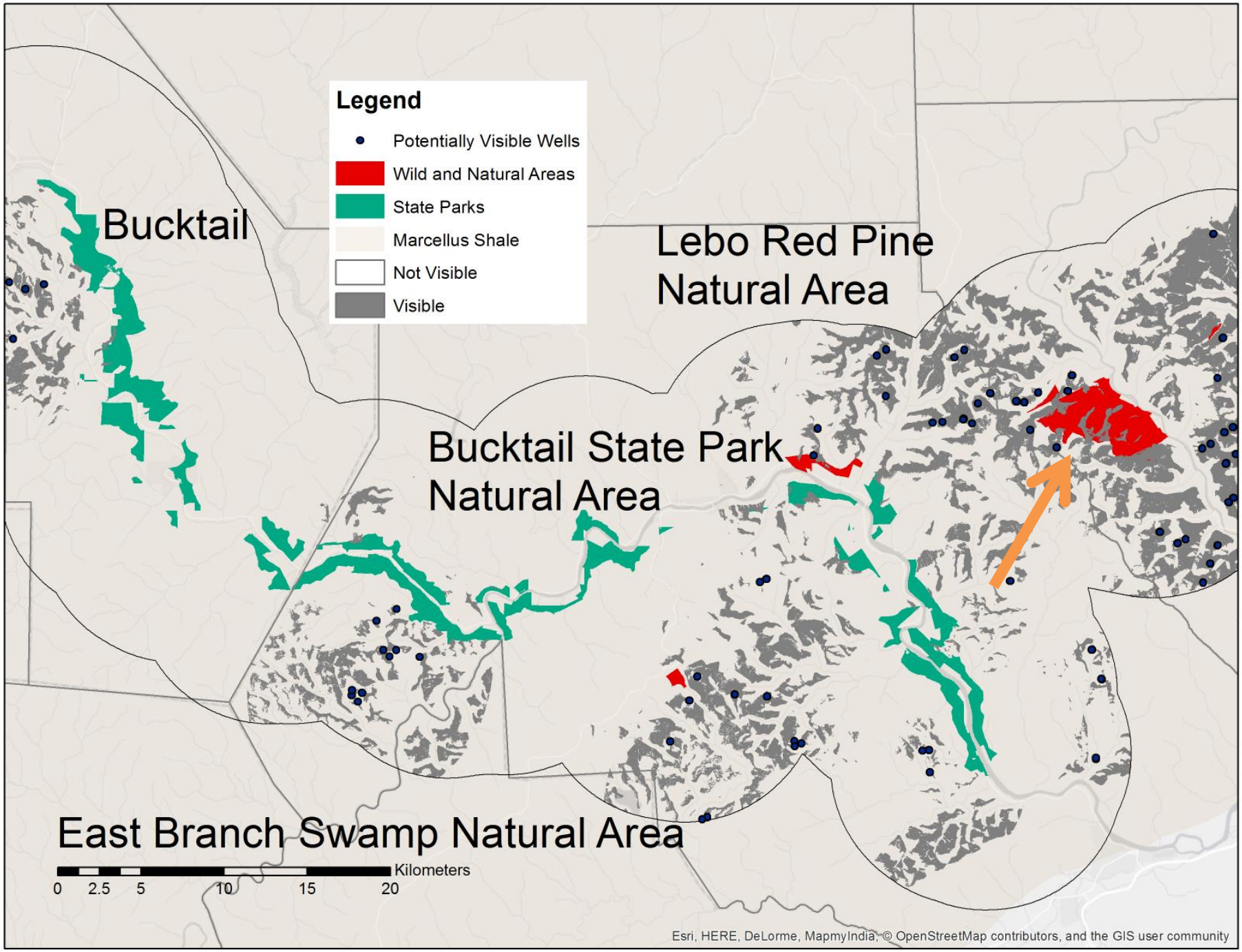
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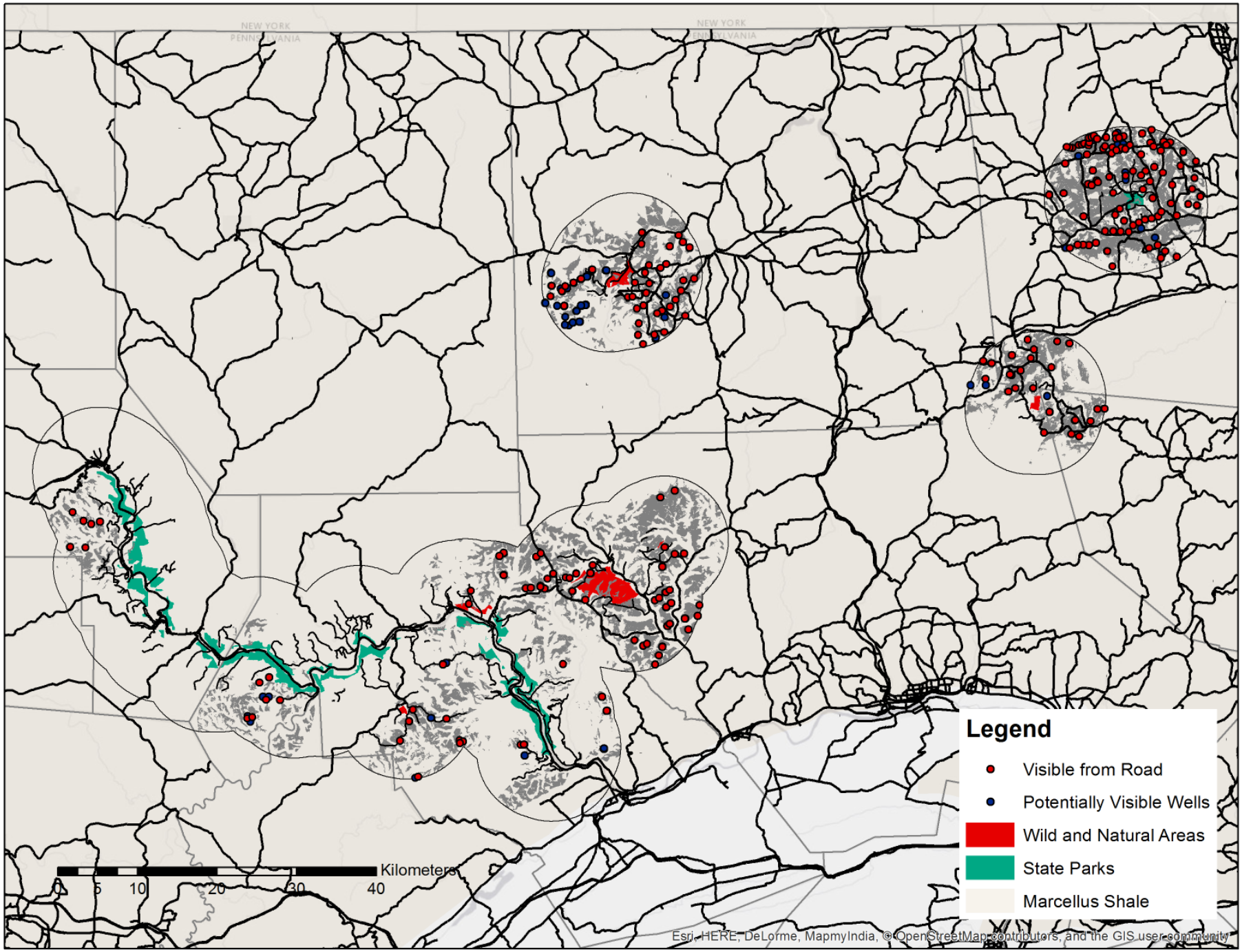
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Legend
Visible from Road
Potentially Visible Wells
Wild and Natural Areas
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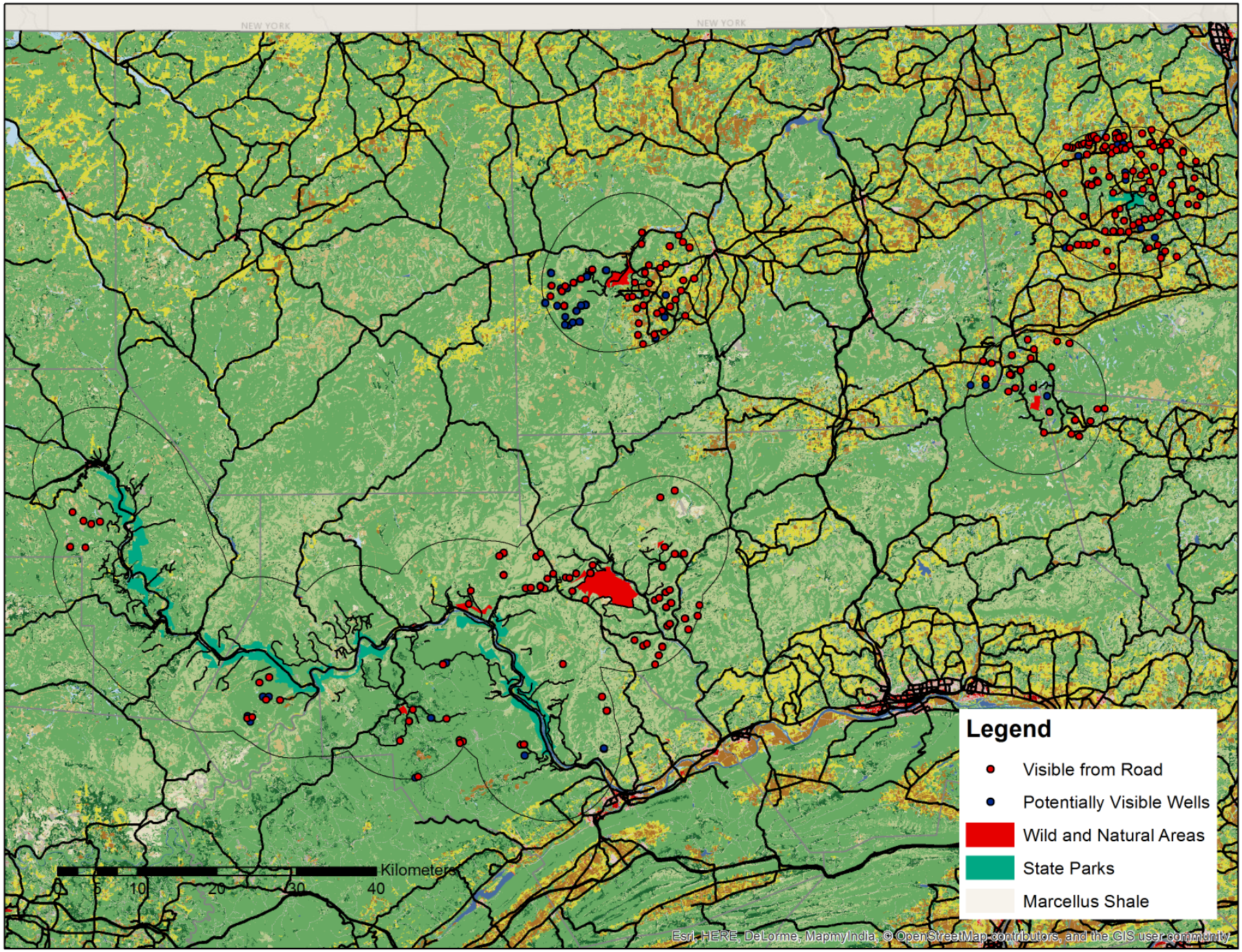
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community


NEW YORK
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Legend
Visible from Road
Potentially Visible Wells
Wild and Natural Areas
State Parks
Marcellus Shale
Kilometers
0 5 10 20 30 40
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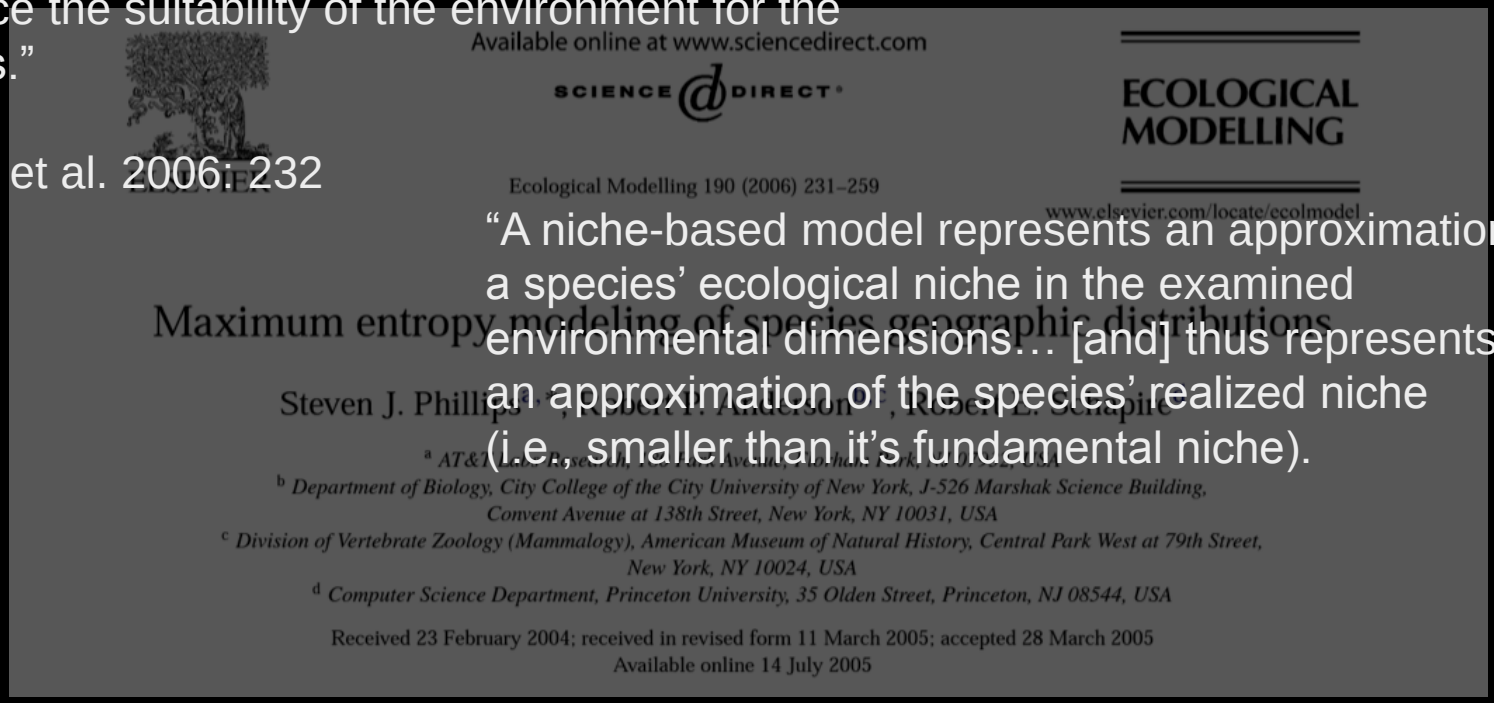
MAXIMUM ENTROPY + MAXENT

"We are interested in devising a model of a species' environmental requirements from a set of occurrence localities, together with a set of environmental variables that describe some of the factors that likely influence the suitability of the environment for the species."

Phillips et al. 2006: 232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ECOLOGICAL MODELLING

Ecological Modelling 190 (2006) 231–259

www.elsevier.com/locate/ecolmodel

Maximum entropy modeling of species geographic distributions

Steven J. Phillips[a], Robert P. Anderson[b], Robert E. Schapire[d]

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[b] Department of Biology, City College of the City University of New York, J-526 Marshak Science Building, Convent Avenue at 138th Street, New York, NY 10031, USA

[c] Division of Vertebrate Zoology (Mammalogy), American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024, USA

[d] Computer Science Department, Princeton University, 35 Olden Street, Princeton, NJ 08544, USA

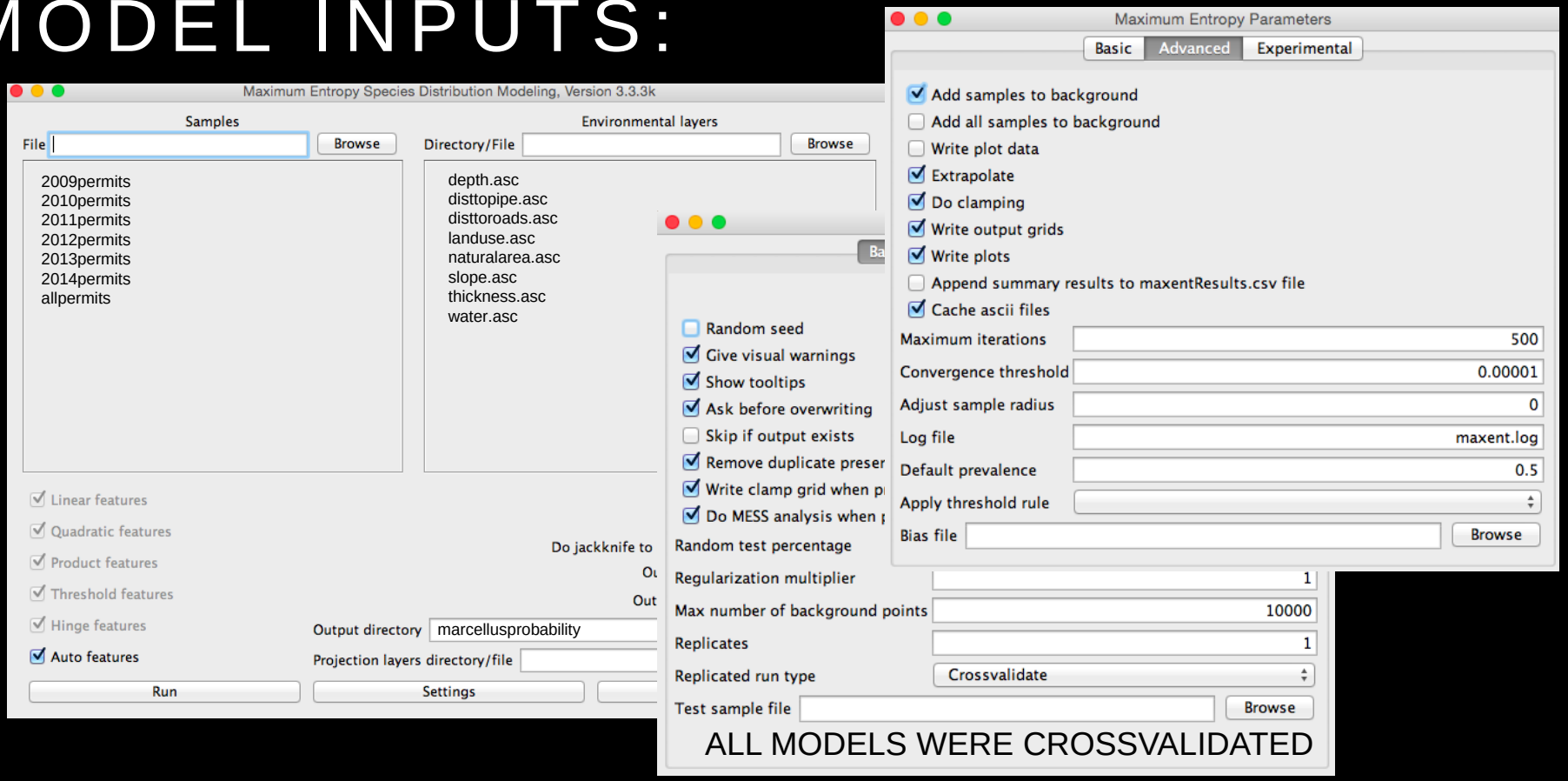
Received 23 February 2004; received in revised form 11 March 2005; accepted 28 March 2005

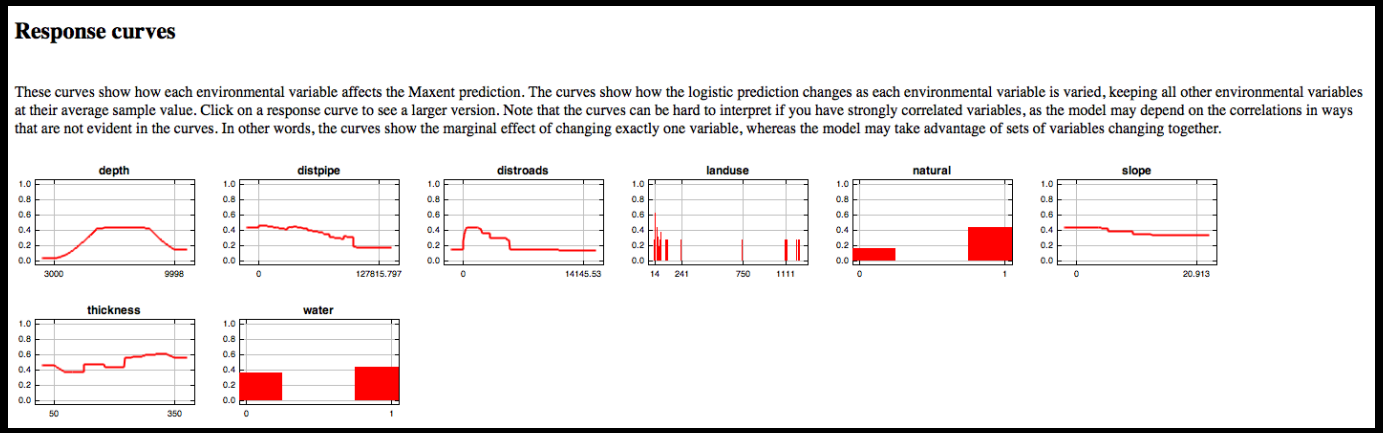
Available online 14 July 2005

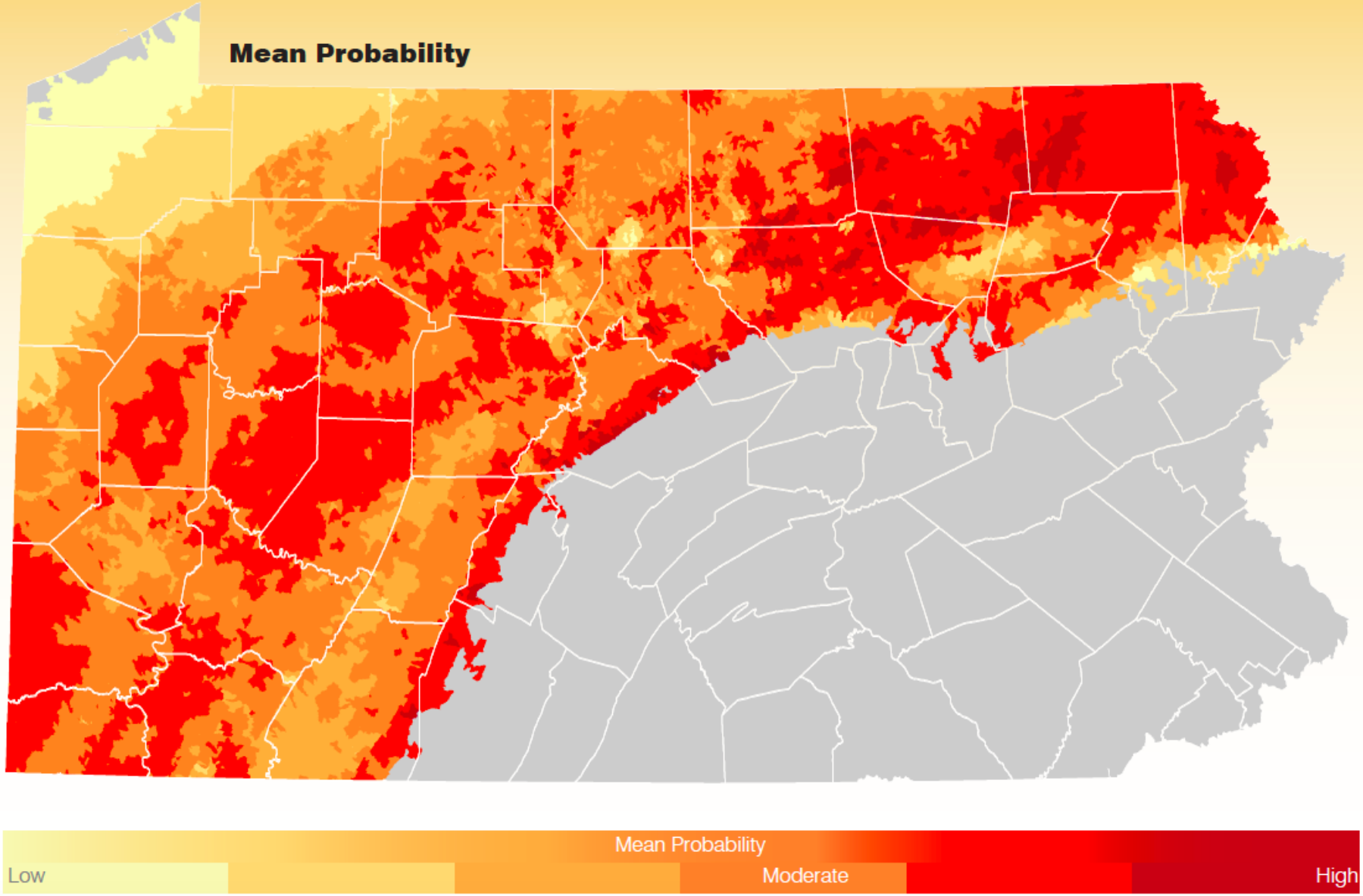
"A niche-based model represents an approximation of a species' ecological niche in the examined environmental dimensions… [and] thus represents an approximation of the species' realized niche (i.e., smaller than it's fundamental niche).

software and articles: http://www.cs.princeton.edu/~schapire/maxent/

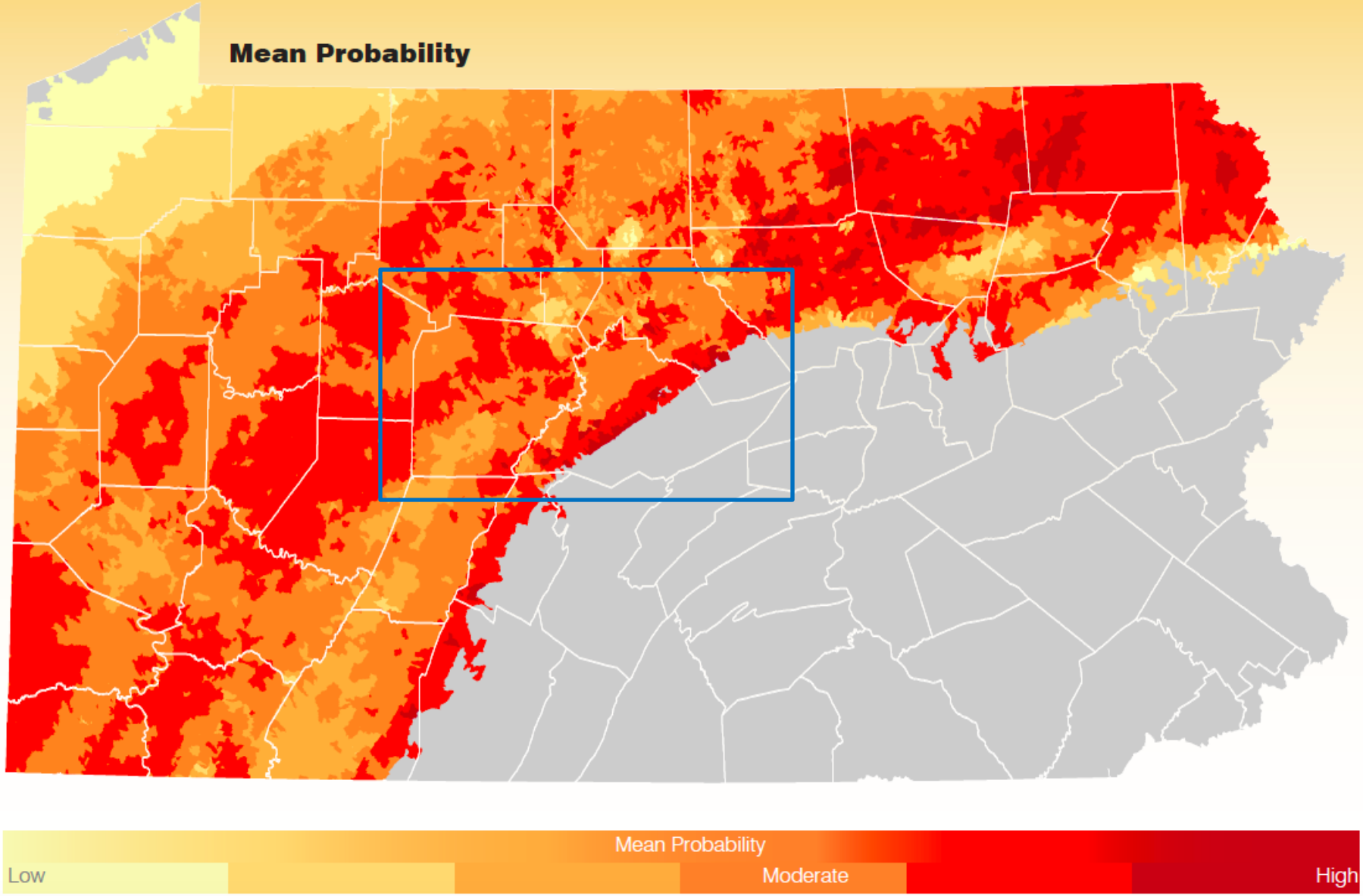
MODEL INPUTS:





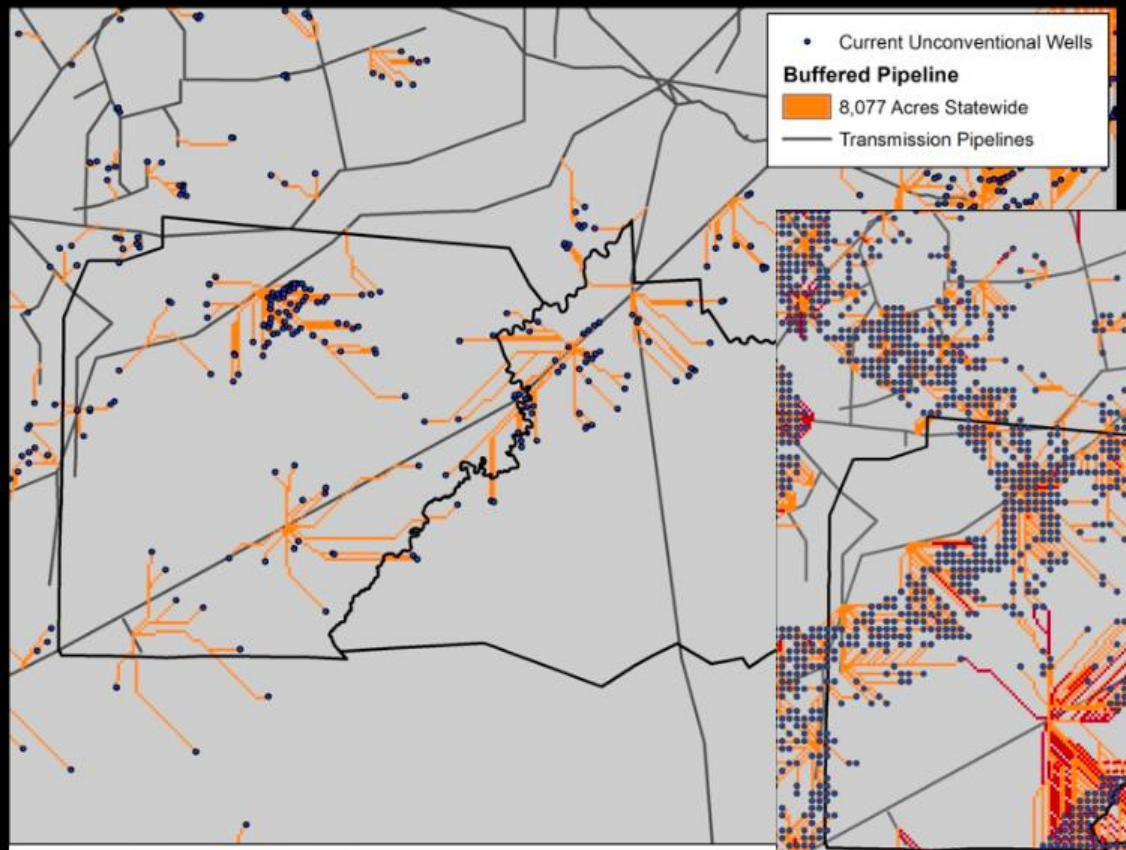


HIGH PROBABILISTIC MODEL FOR FUTURE DEVELOPMENT:
SUMMARIZED BY BASIN (SUB-WATERSHED)

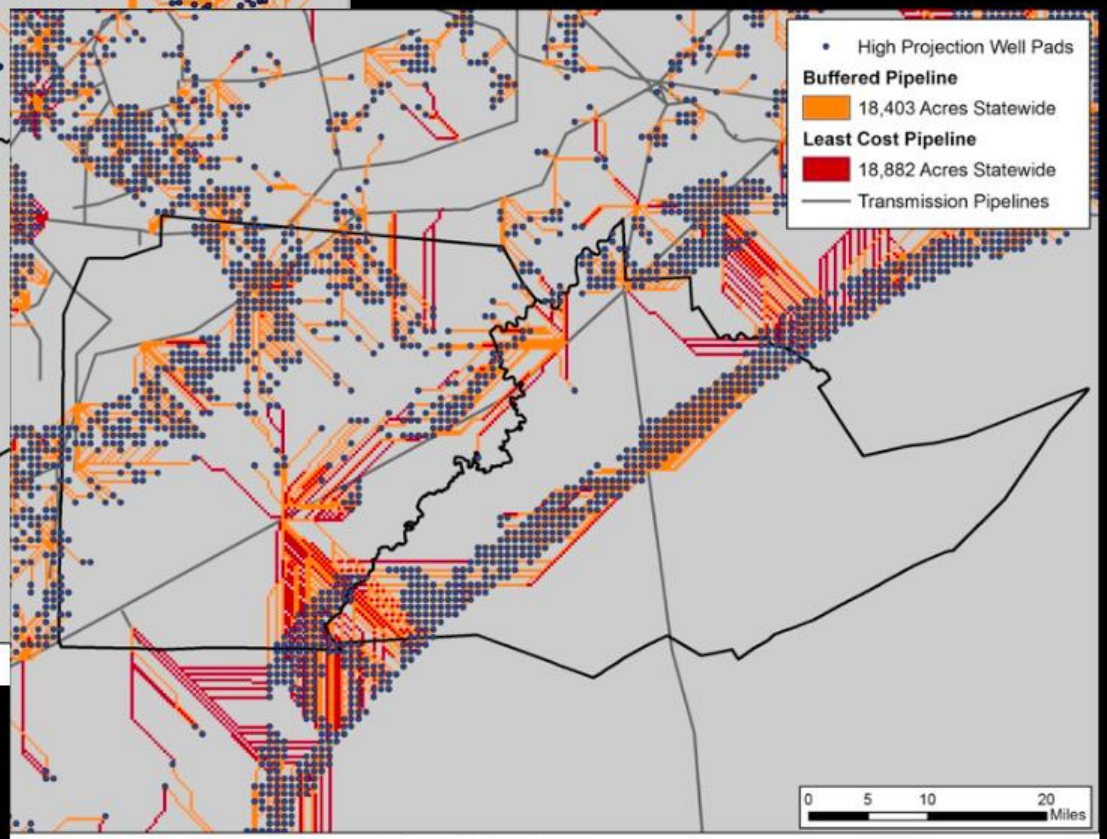


HIGH PROBABILISTIC MODEL FOR FUTURE DEVELOPMENT:
SUMMARIZED BY BASIN (SUB-WATERSHED)

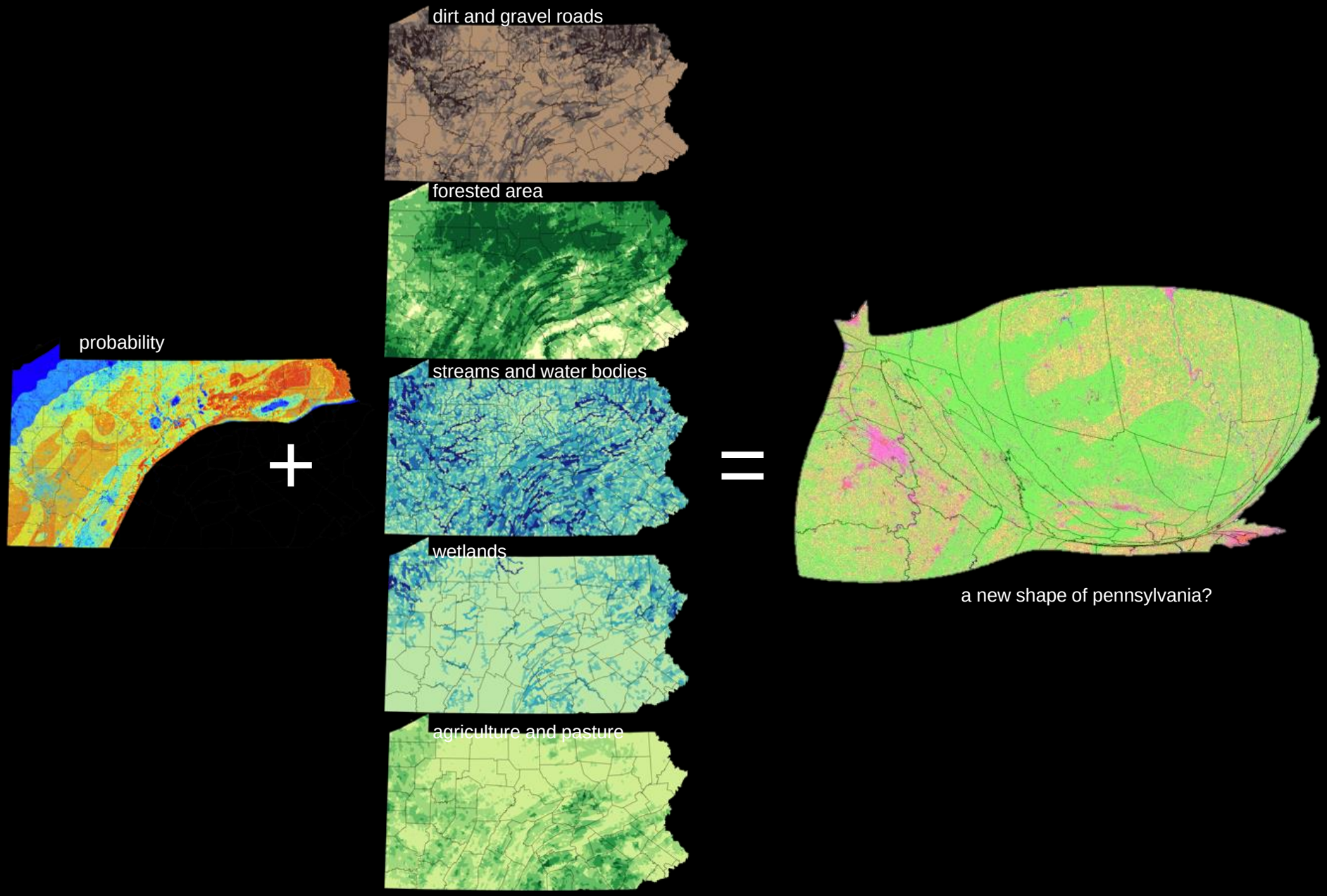
LEAST COST SURFACE MODELS:



Buffered Pipelines for Current Wells



Buffered Pipelines vs Least Cost Pipelines



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THANK YOU

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