Map Set 2: Impact on Land Cover

This series of maps displays information related to the potential environmental impacts of *additional* gas development in *Pennsylvania* if all remaining technically recoverable resources in the Interior Marcellus shale were developed using high volume hydraulic fracturing and horizontal drilling with eight wells per well pad.

This map set includes projections of the impacts of construction of natural gas infrastructure development on land cover in Pennsylvania. The analysis only considers development of 3 types of natural gas infrastructure: well pads, access roads, and gathering pipelines. (Water and wastewater infrastructure, equipment storage, and intrastate and interstate gas transmission pipelines are not part of this analysis.)

Note: These maps contain *projections* of natural gas development and associated environmental impacts under a particular set of circumstances and assumptions. They are not *predictions* of development or impacts, and should not be used for commercial purposes, to guide investment decisions, or for short-range planning decisions. Furthermore, the maps should not be used to inform planning or decision making for geographic units smaller than the primary units of analysis (counties or HUC-10 watersheds).

Land Cover Impact Maps

This map set includes projections of the following land cover impacts:

2.1 Land disturbance by county

2.2 Land disturbance by watershed

2.3 Forest cleared by watershed

2.4 Core forest loss by watershed

2.5 Existing developed area versus new clearing for gas infrastructure

2.6 Stream crossings by watershed

For additional documentation and methodology used to create these maps, please download the research report at: www.cna.org/PA-Marcellus

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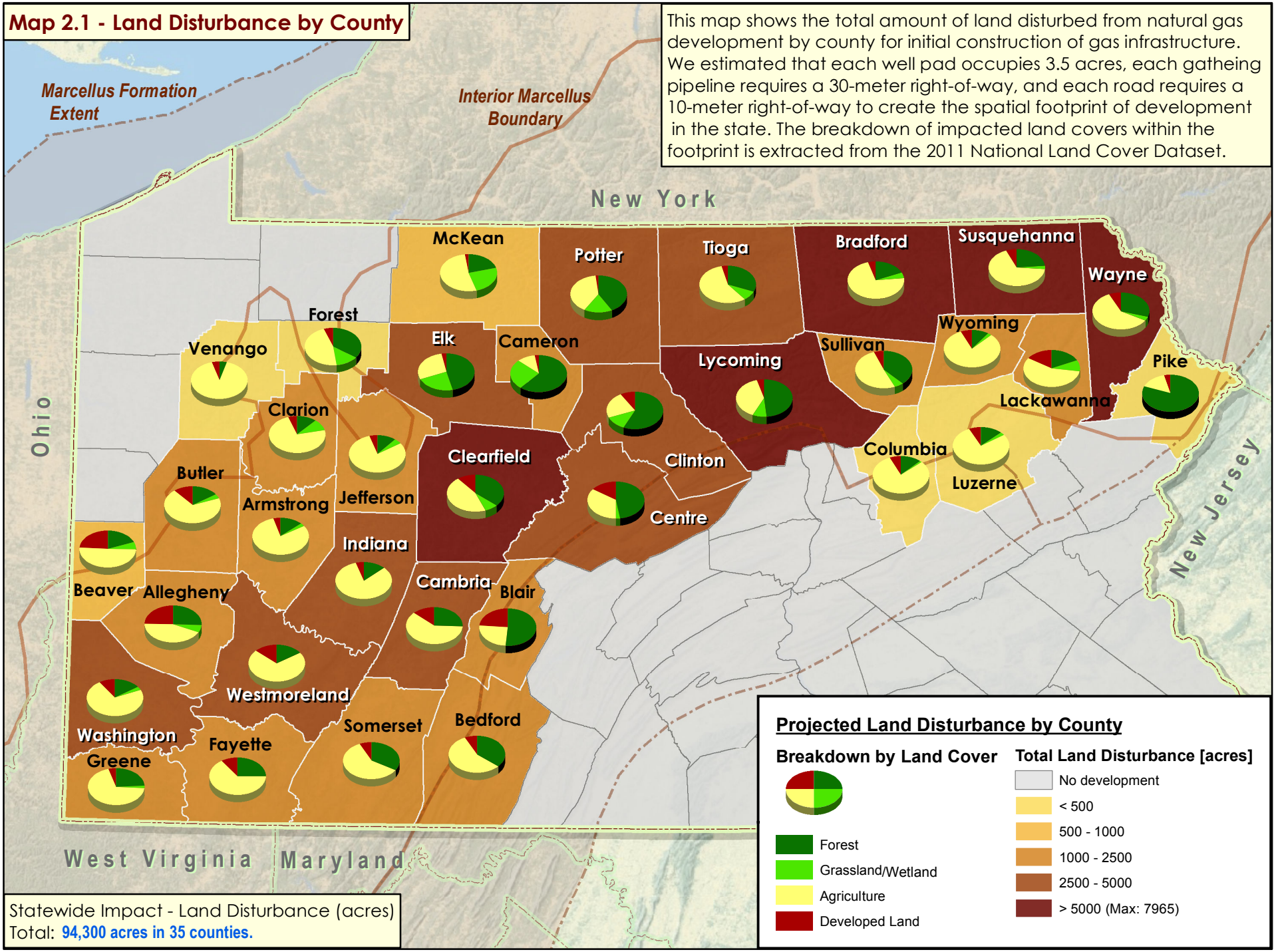
Map 2.1 - Land Disturbance by County

This map shows the total amount of land disturbed from natural gas development by county for initial construction of gas infrastructure. We estimated that each well pad occupies 3.5 acres, each gatheing pipeline requires a 30-meter right-of-way, and each road requires a 10-meter right-of-way to create the spatial footprint of development in the state. The breakdown of impacted land covers within the footprint is extracted from the 2011 National Land Cover Dataset.



Projected Land Disturbance by County

Breakdown by Land Cover

- Forest
- Grassland/Wetland
- Agriculture
- Developed Land

Total Land Disturbance [acres]

- No development
- < 500
- 500 - 1000
- 1000 - 2500
- 2500 - 5000
- > 5000 (Max: 7965)

Statewide Impact - Land Disturbance (acres)
Total: **94,300 acres in 35 counties.**

Miles
0 20 40 80

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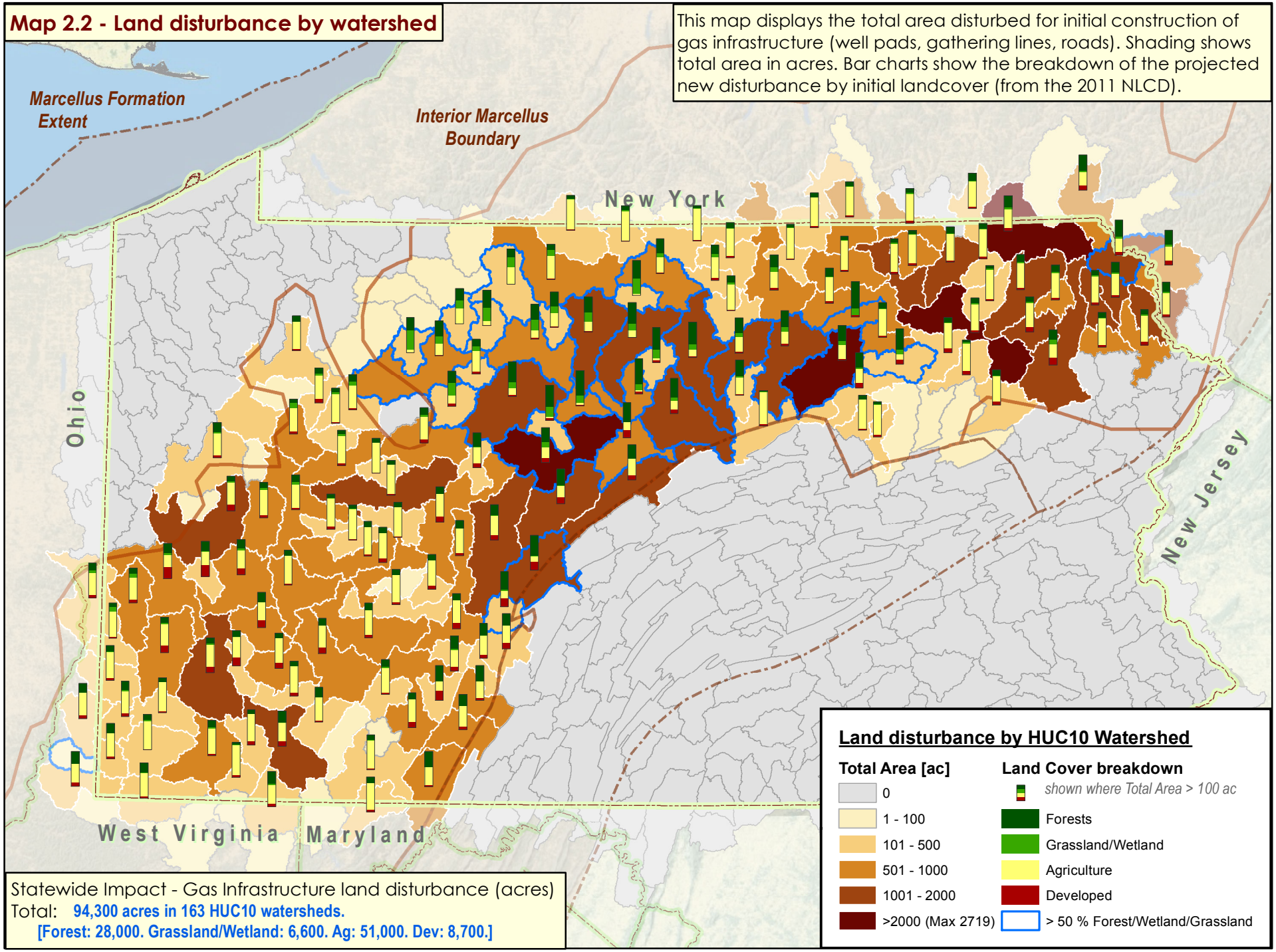
Map 2.2 - Land disturbance by watershed

This map displays the total area disturbed for initial construction of gas infrastructure (well pads, gathering lines, roads). Shading shows total area in acres. Bar charts show the breakdown of the projected new disturbance by initial landcover (from the 2011 NLCD).



Land disturbance by HUC10 Watershed

Total Area [ac]	Land Cover breakdown
0	*shown where Total Area > 100 ac*
1 - 100	Forests
101 - 500	Grassland/Wetland
501 - 1000	Agriculture
1001 - 2000	Developed
>2000 (Max 2719)	> 50 % Forest/Wetland/Grassland

Statewide Impact - Gas Infrastructure land disturbance (acres)
Total: **94,300 acres in 163 HUC10 watersheds.**
[Forest: 28,000. Grassland/Wetland: 6,600. Ag: 51,000. Dev: 8,700.]

Miles
0 20 40 80

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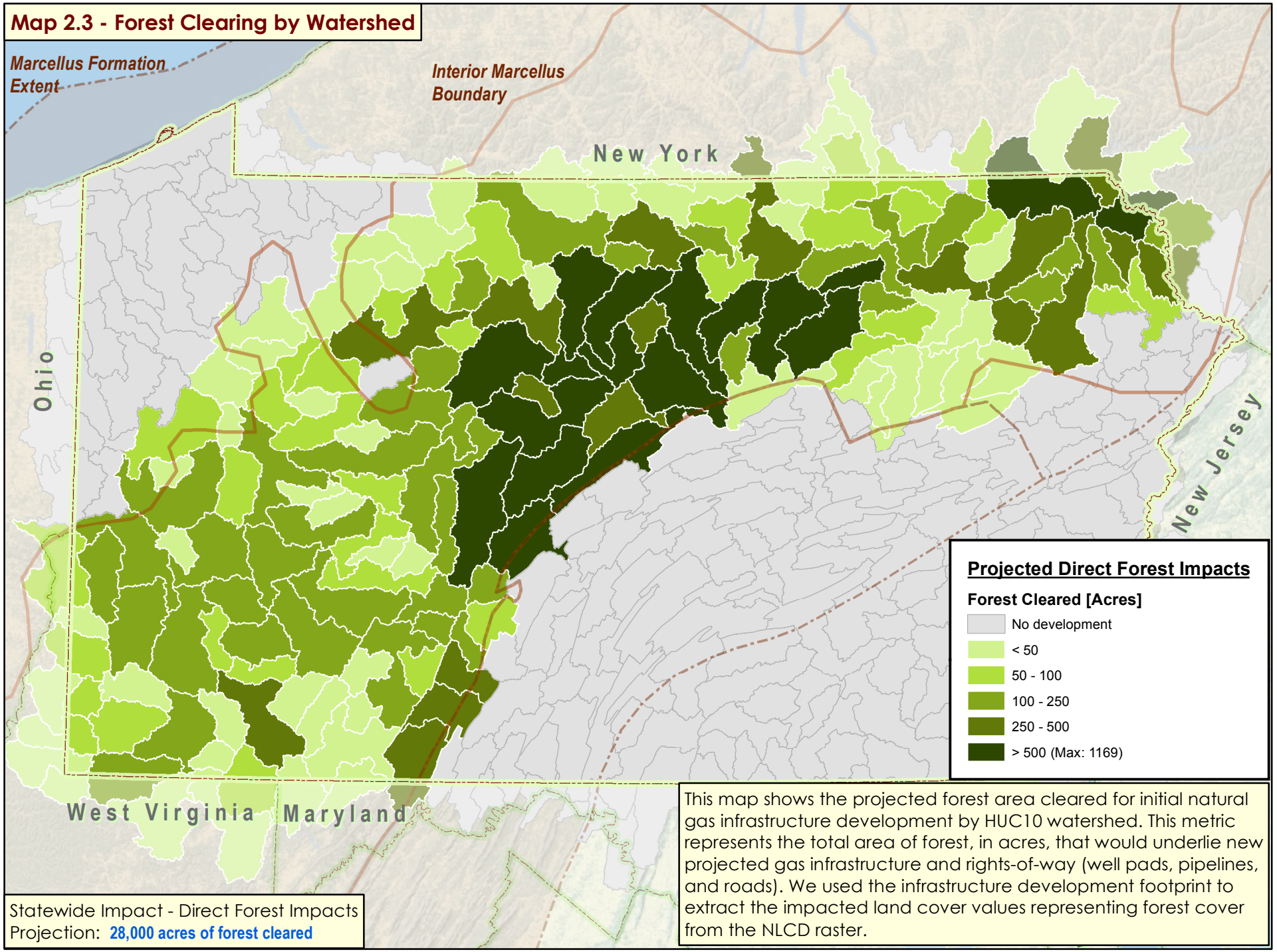
Map 2.3 - Forest Clearing by Watershed



This map shows the projected forest area cleared for initial natural gas infrastructure development by HUC10 watershed. This metric represents the total area of forest, in acres, that would underlie new projected gas infrastructure and rights-of-way (well pads, pipelines, and roads). We used the infrastructure development footprint to extract the impacted land cover values representing forest cover from the NLCD raster.

Statewide Impact - Direct Forest Impacts
Projection: **28,000 acres of forest cleared**

0 20 40 80 Miles

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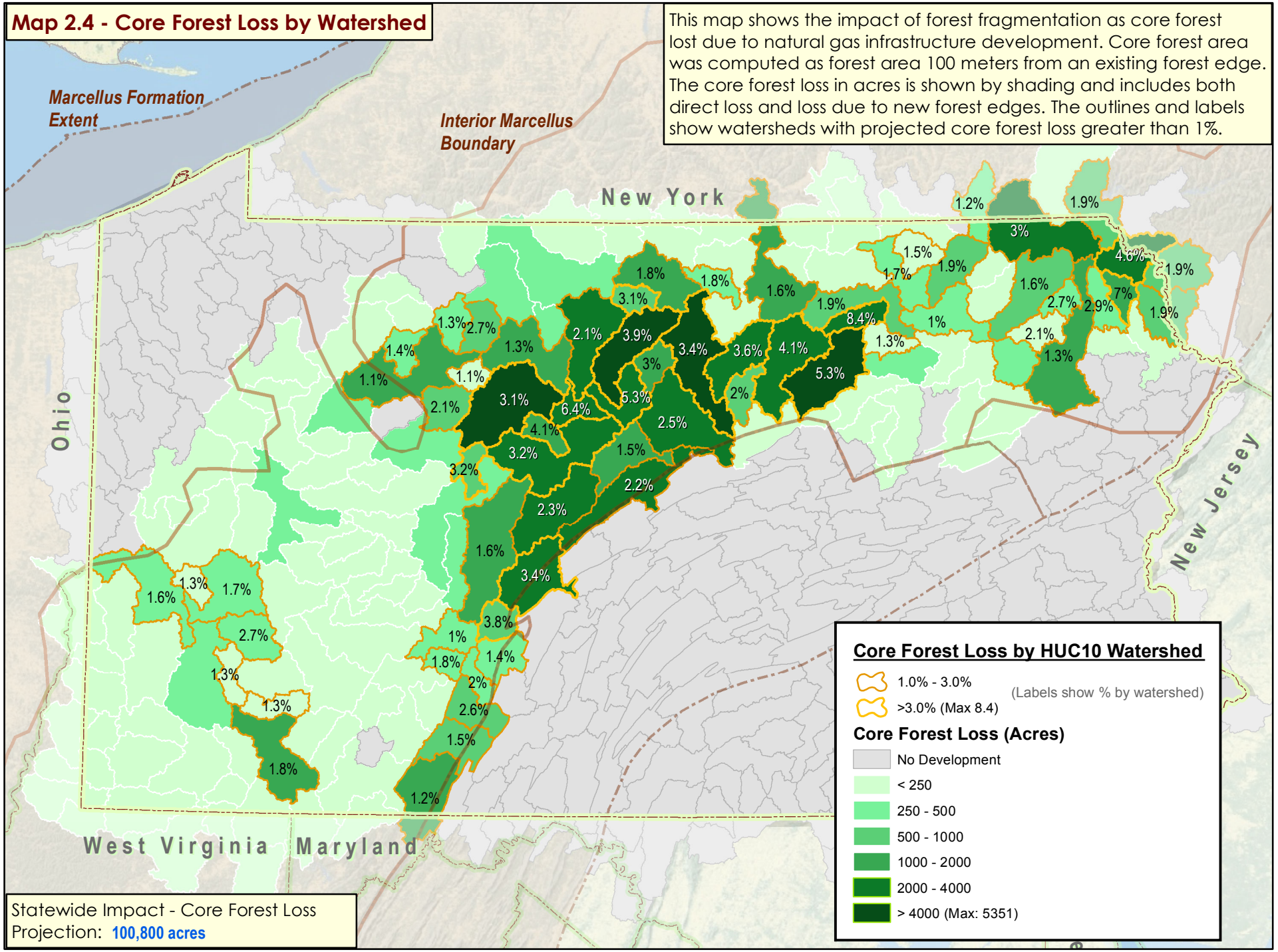
Map 2.4 - Core Forest Loss by Watershed

This map shows the impact of forest fragmentation as core forest lost due to natural gas infrastructure development. Core forest area was computed as forest area 100 meters from an existing forest edge. The core forest loss in acres is shown by shading and includes both direct loss and loss due to new forest edges. The outlines and labels show watersheds with projected core forest loss greater than 1%.



Statewide Impact - Core Forest Loss Projection: **100,800 acres**

0 20 40 80 Miles

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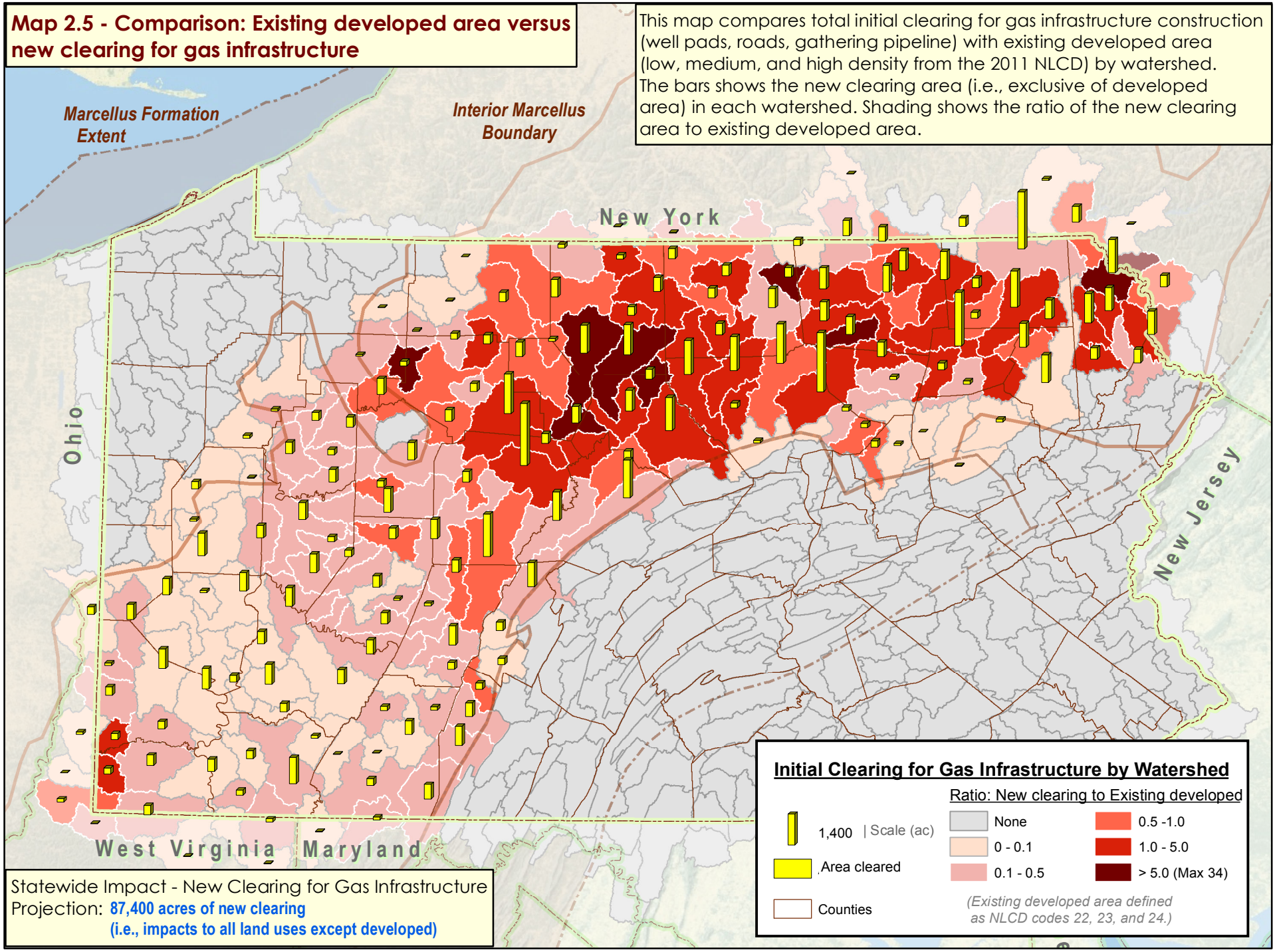
Map 2.5 - Comparison: Existing developed area versus new clearing for gas infrastructure

This map compares total initial clearing for gas infrastructure construction (well pads, roads, gathering pipeline) with existing developed area (low, medium, and high density from the 2011 NLCD) by watershed. The bars shows the new clearing area (i.e., exclusive of developed area) in each watershed. Shading shows the ratio of the new clearing area to existing developed area.



Statewide Impact - New Clearing for Gas Infrastructure Projection: **87,400 acres of new clearing (i.e., impacts to all land uses except developed)**

Miles
0 20 40 80

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Map 2.6 - New Stream Crossings by Gas Infrastructure

This metric shows the number of stream crossings attributed to new pipelines and roads associated with projected gas development. Crossing locations are intersections between gas gathering pipelines or roads and streams in the NHDPlus v2 database, which includes nearly all perennial streams in PA. Most crossings of intermittent or ephemeral streams are not included.