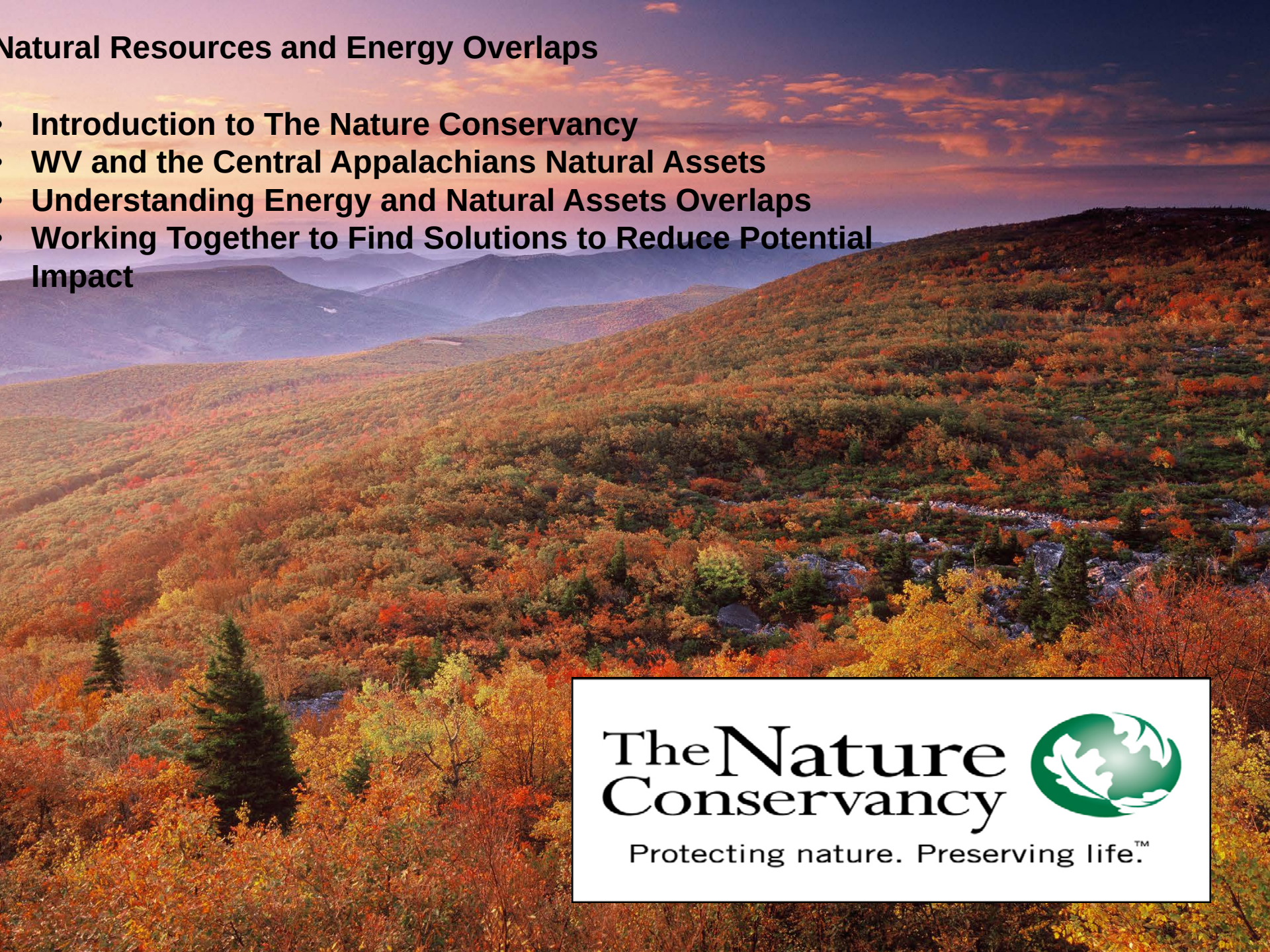
Natural Resources and Energy Overlaps

- Introduction to The Nature Conservancy
- WV and the Central Appalachians Natural Assets
- Understanding Energy and Natural Assets Overlaps
- Working Together to Find Solutions to Reduce Potential Impact



The Nature Conservancy

Protecting nature. Preserving life.™

The Nature Conservancy

Protecting nature. Preserving life.™

Who We Are

We're working with you to make a positive impact around the world in more than 30 countries, all 50 United States and your backyard.

- ❑ Since 1951
- ❑ 3600+staff, 700+ Scientists
- ❑ >1 million members

We've protected

- ❑ >119 million acres of land
- ❑ >5000 miles of rivers
- ❑ >100 marine conservation projects

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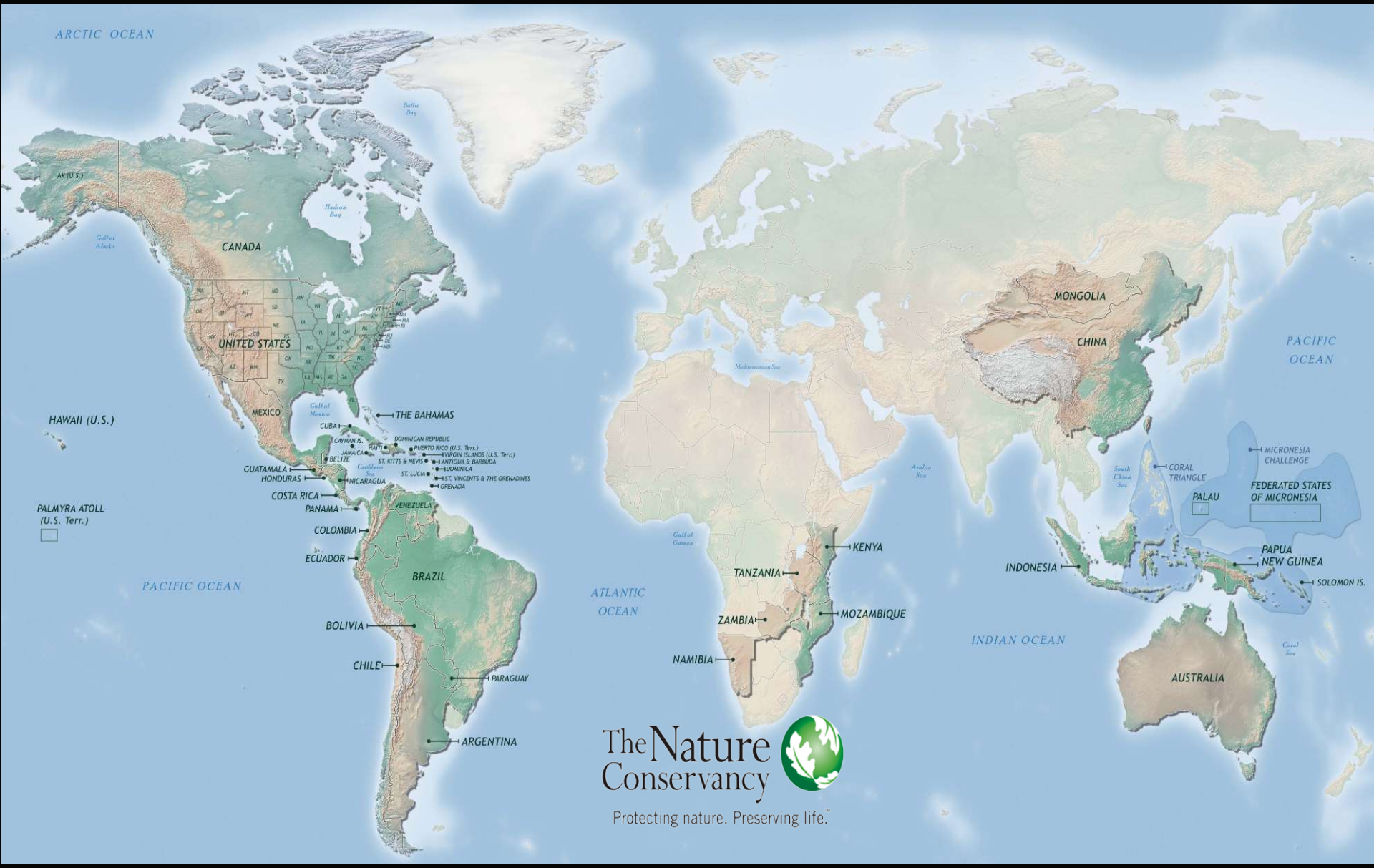
Where We Work



Why We're Successful

Everything we do is rooted in good science — aided by our hundreds of staff scientists.

We pursue **non-confrontational, pragmatic solutions** to conservation challenges.

We partner with indigenous communities, businesses, governments, multilateral institutions, and other non-profits.

We have the support of more than 1 million members who enable us to continue working on a scale that matters and implement solutions that endure.

The Nature Conservancy West Virginia

98.6k ACRES TRANSFERS

When priority land becomes available, the Conservancy can step in quickly to purchase it while partner agencies secure funding or approvals. Once we transfer the rights, we can redeploy our funds to additional conservation projects.

7.3k ACRES CONSERVATION EASEMENTS

A conservation easement is a voluntary, legally binding agreement that permanently limits certain types of uses or prevents development on a piece of property.

2.3k ACRES COOPERATIVE MANAGEMENT AGREEMENTS

When we can't secure important lands or easements outright, sometimes the Conservancy can work directly with landowners to enhance habitat on their property.

4.8k ACRES PRESERVES

The Nature Conservancy maintains 14 preserves across the state that exemplify West Virginia's ecological heritage.

5.2k ACRES ASSISTS

When outside projects meet our conservation priorities, The Conservancy can help other agencies protect land by providing critical support like short-term loans, staff time, and expertise.

275 MI RIVERS & STREAMS PROTECTED

260k SPRUCE TREES PLANTED

INFORMATION STAND

120k ACRES PROTECTED IN WEST VIRGINIA

THE NATURE CONSERVANCY HAS MADE MORE LAND AVAILABLE TO THE PUBLIC IN WEST VIRGINIA THAN ANY OTHER PRIVATE GROUP FOR: HIKING, CAMPING, FISHING, HUNTING, BIRDWATCHING, BACKPACKING, NATURE STUDY, FAMILY OUTINGS

THE CONSERVANCY HAS PROTECTED LAND ALL OVER WEST VIRGINIA

The Nature Conservancy

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223 RARE SPECIES PROTECTED

1.7k ACRES OF INVASIVES TREATED YEARLY

FRESHWATER SYSTEMS

The rivers, lakes and streams that make up our freshwater systems support clean drinking water, recreation and food for millions.

INTACT FORESTS

West Virginia's forests provide refuge to an impressive number of plant and animal species, help to clean our water, and filter our air. Contiguous blocks of intact forest are more resilient and adaptable in the face of climate change.

CONSERVATION PIONEERS 1st

The Nature Conservancy was the first organized land trust in the state and has protected more land in West Virginia than any other private group.

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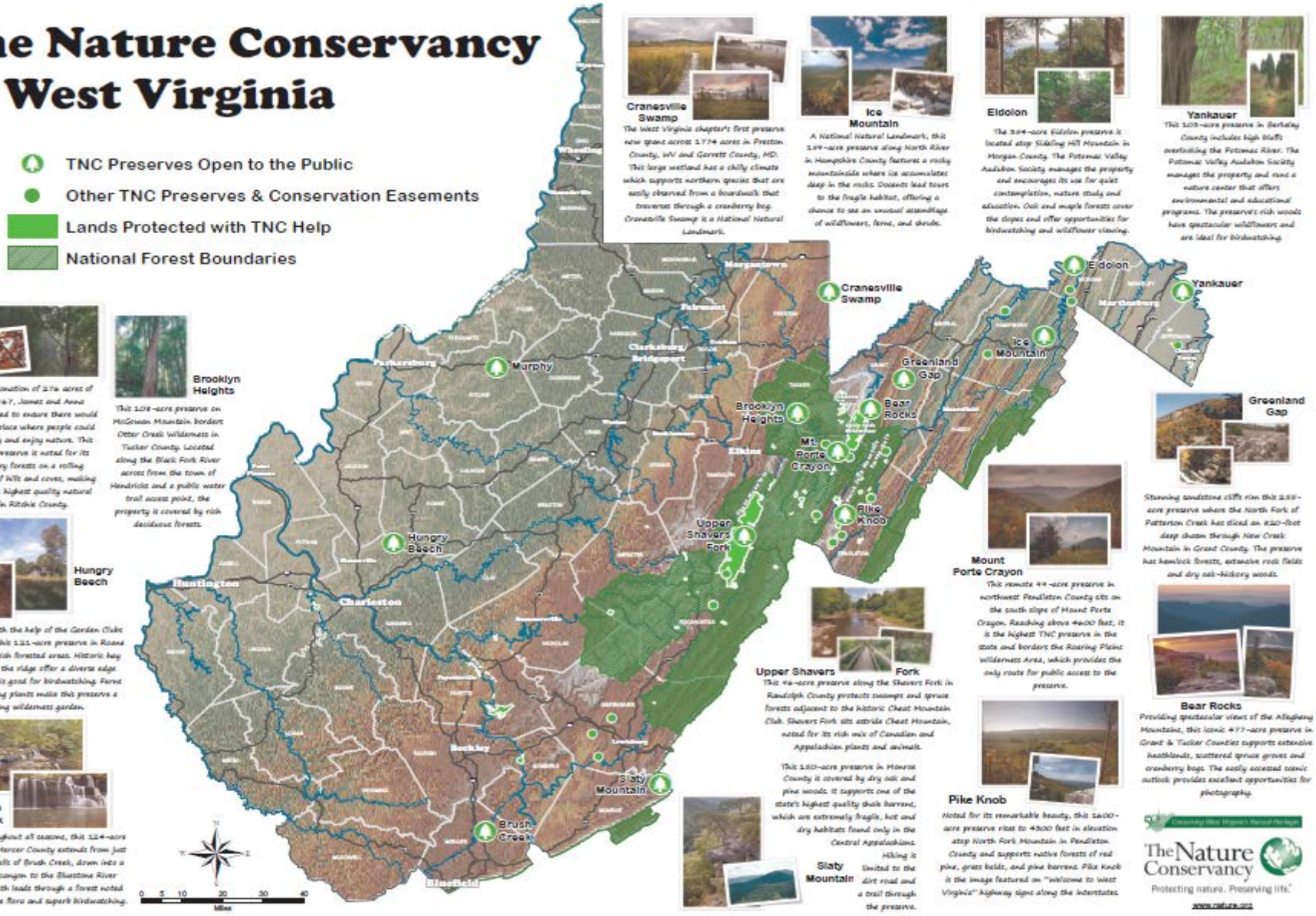
The Nature Conservancy in West Virginia



Cranesville Swamp
The West Virginia chapter's first preserve now spans across 1774 acres in Preston County, WV and Garrett County, MD. This large wetland has a chilly climate which supports northern species that are easily observed from a boardwalk that traverses through a cranberry bog. Cranesville Swamp is a National Natural Landmark.

Ice Mountain
A National Natural Landmark, this 149-acre preserve along North River in Hampshire County features a rocky mountainside where ice accumulates deep in the rocks. Docents lead tours to the fragile habitat, offering a chance to see an unusual assemblage of wildflowers, ferns, and shrubs.

Eldolon
The 384-acre Eldolon preserve is located atop Sliding Hill Mountain in Morgan County. The Potomac Valley Audubon Society manages the property and encourages its use for quiet contemplation, nature study and education. Oak and maple forests cover the slopes and offer opportunities for birdwatching and wildflower viewing.

Yankauer
This 108-acre preserve in Berkeley County includes high bluffs overlooking the Potomac River. The Potomac Valley Audubon Society manages the property and runs a nature center that offers environmental and educational programs. The preserve's rich woods have spectacular wildflowers and are ideal for birdwatching.

Murphy
With their donation of 274 acres of land in 1967, James and Anna Murphy wanted to ensure there would always be a place where people could quietly study and enjoy nature. This 274-acre preserve is noted for its oak-hickory forests on a rolling topography of hill and cove, making it one of the highest quality natural areas in Ritchie County.

Brooklyn Heights
This 108-acre preserve on McGowan Mountain borders Otter Creek Wilderness in Tucker County. Located along the Black Fork River across from the town of Hendricks and a public water trail access point, the property is covered by rich deciduous forests.

Hungry Beech
Protected with the help of the Garden Clubs of the state, this 121-acre preserve in Roane County has rich forested areas. Historic hay fields along the ridge offer a diverse edge habitat that is good for birdwatching. Ferns and flowering plants make this preserve a spring wilderness garden.

Brush Creek
Scenic throughout all seasons, this 124-acre preserve in Mercer County extends from just below the Falls of Brush Creek, down into a dramatic canyon to the Bluestone River Gorge. A path leads through a forest noted for its diverse flora and superb birdwatching.

Upper Shavers Fork
This 96-acre preserve along the Shavers Fork in Randolph County protects swamps and spruce forests adjacent to the historic Cheat Mountain Club. Shavers Fork sits astride Cheat Mountain, noted for its rich mix of Canadian and Appalachian plants and animals.

Slaty Mountain
This 180-acre preserve in Monroe County is covered by dry oak and pine woods. It supports one of the state's highest quality shale barrens, which are extremely fragile, hot and dry habitats found only in the Central Appalachians. Hiking is limited to the dirt road and a trail through the preserve.

Mount Porte Crayon
This remote 44-acre preserve in northwest Pendleton County sits on the south slope of Mount Porte Crayon. Reaching above 4400 feet, it is the highest TNC preserve in the state and borders the Roaring Plains Wilderness Area, which provides the only route for public access to the preserve.

Pike Knob
Noted for its remarkable beauty, this 1600-acre preserve rises to 4300 feet in elevation atop North Fork Mountain in Pendleton County and supports native forests of red pine, grass balds, and pine barrens. Pike Knob is the image featured on "Welcome to West Virginia" highway signs along the interstates.

Greenland Gap
Stunning sandstone cliffs rim this 2,338-acre preserve where the North Fork of Patterson Creek has sliced an 820-foot deep chasm through New Creek Mountain in Grant County. The preserve has hemlock forests, extensive rock fields and dry oak-hickory woods.

Bear Rocks
Providing spectacular views of the Allegheny Mountains, this iconic 473-acre preserve in Grant & Tucker Counties supports extensive heathlands, scattered spruce groves and cranberry bogs. The easily accessed scenic outlook provides excellent opportunities for photography.

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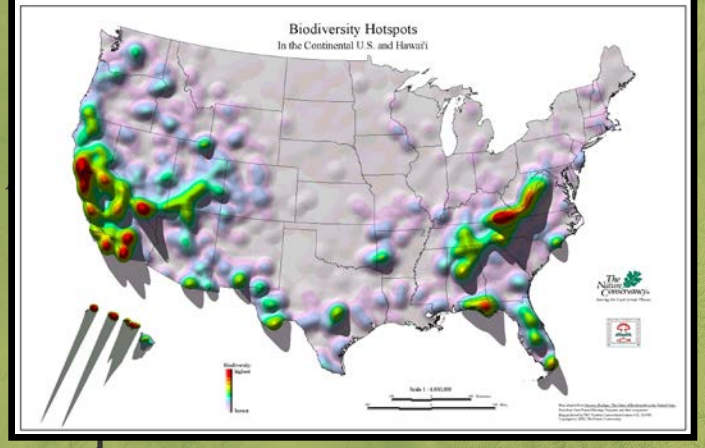


Central Appalachians

Pennsylvania

Indi

Pittsburgh

Harrisburg

Philadelphia

New Jersey

Maryland

Delaware

Delaware Bay

West Virginia

Washington D.C.

Annapolis

Frankfort

Charleston

Kentucky

Chesapeake Bay

Richmond

Virginia

Roanoke

Atlantic Ocean

0 25 50

Miles

N

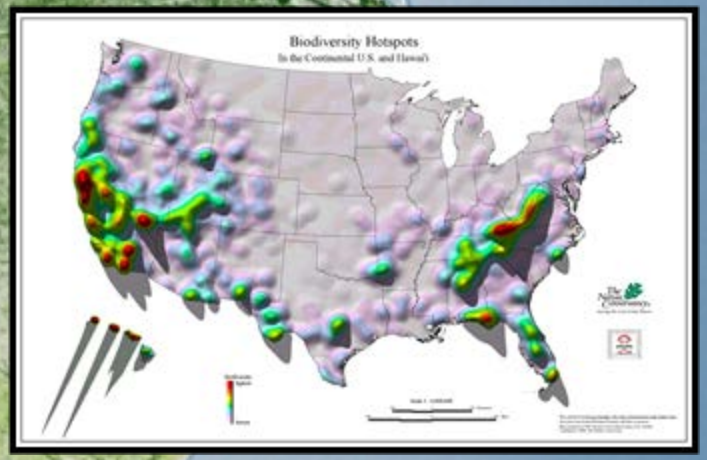
W E

S

Knoxville

North Carolina

Tennessee


Biodiversity Hotspots
In the Continental U.S. and Hawai'i

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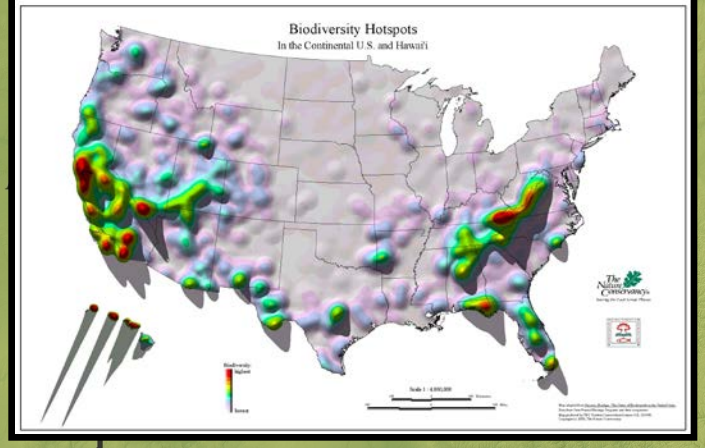
Outstanding Nature-Sustaining People



PENNSYLVANIA

INDI

Pittsburgh

delphia

NEW JERSEY

MARYLAND

DELAWARE

Delaware Bay

WEST VIRGINIA

Washington D.C.

Annapolis

Frankfort

KENTUCKY

Chesapeake Bay

Richmond

VIRGINIA

Atlantic Ocean

Roanoke

0 25 50

Miles

N

W E

S

Knoxville

NORTH CAROLINA

TENNESSEE

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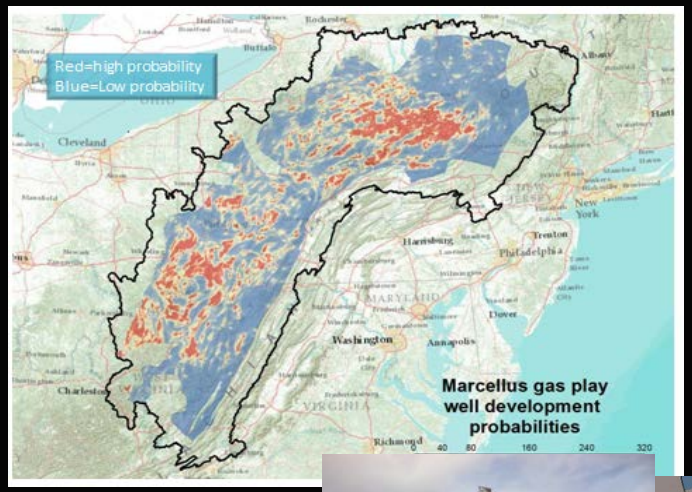
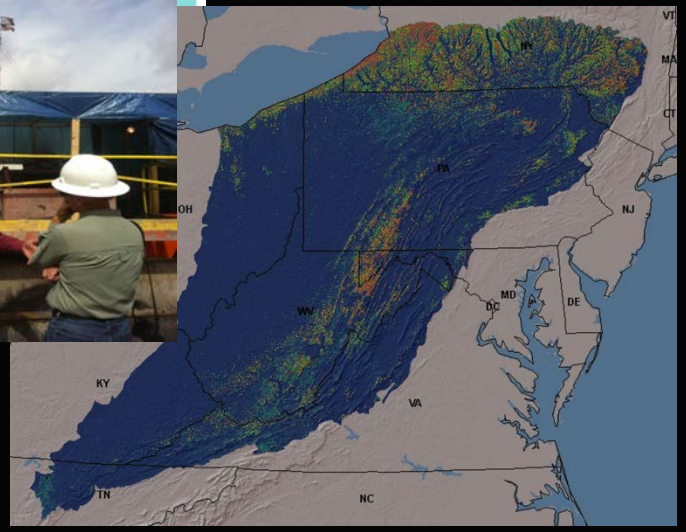
Natural Habitat Loss and Fragmentation

Development By Design





Balancing Development and Conservation

TNC Approach:

- Identify Important Natural Assets
- Visualize future energy development
- Highlight potential overlaps/conflicts between energy development and other important values
- Initiate dialogue among industry, policy makers, NGOs and public on how to balance development and nature
- Bottom line goal: Avoid critical habitats and ensure effective minimization and offsets at the local and regional scale when avoidance can't be achieved.

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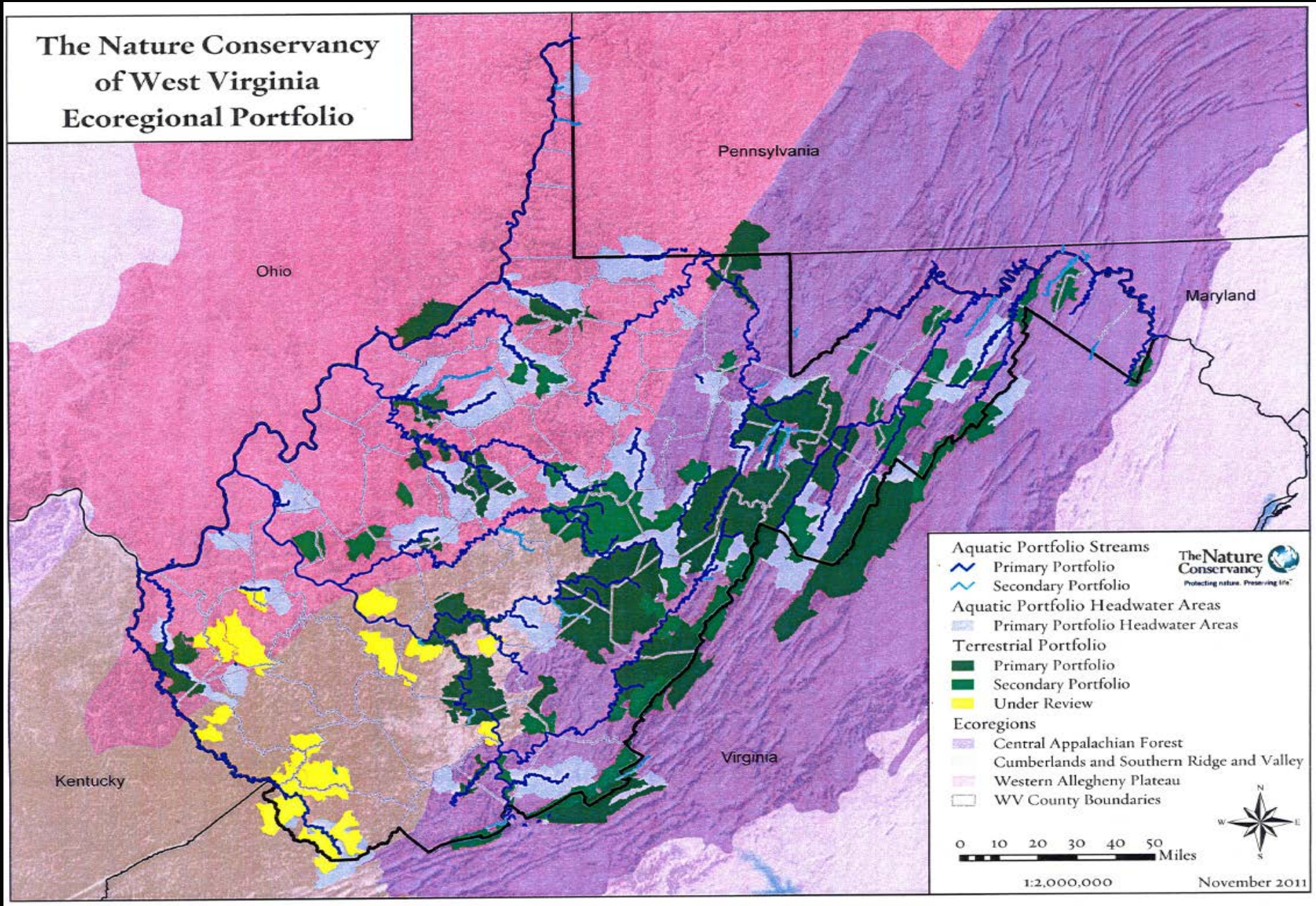
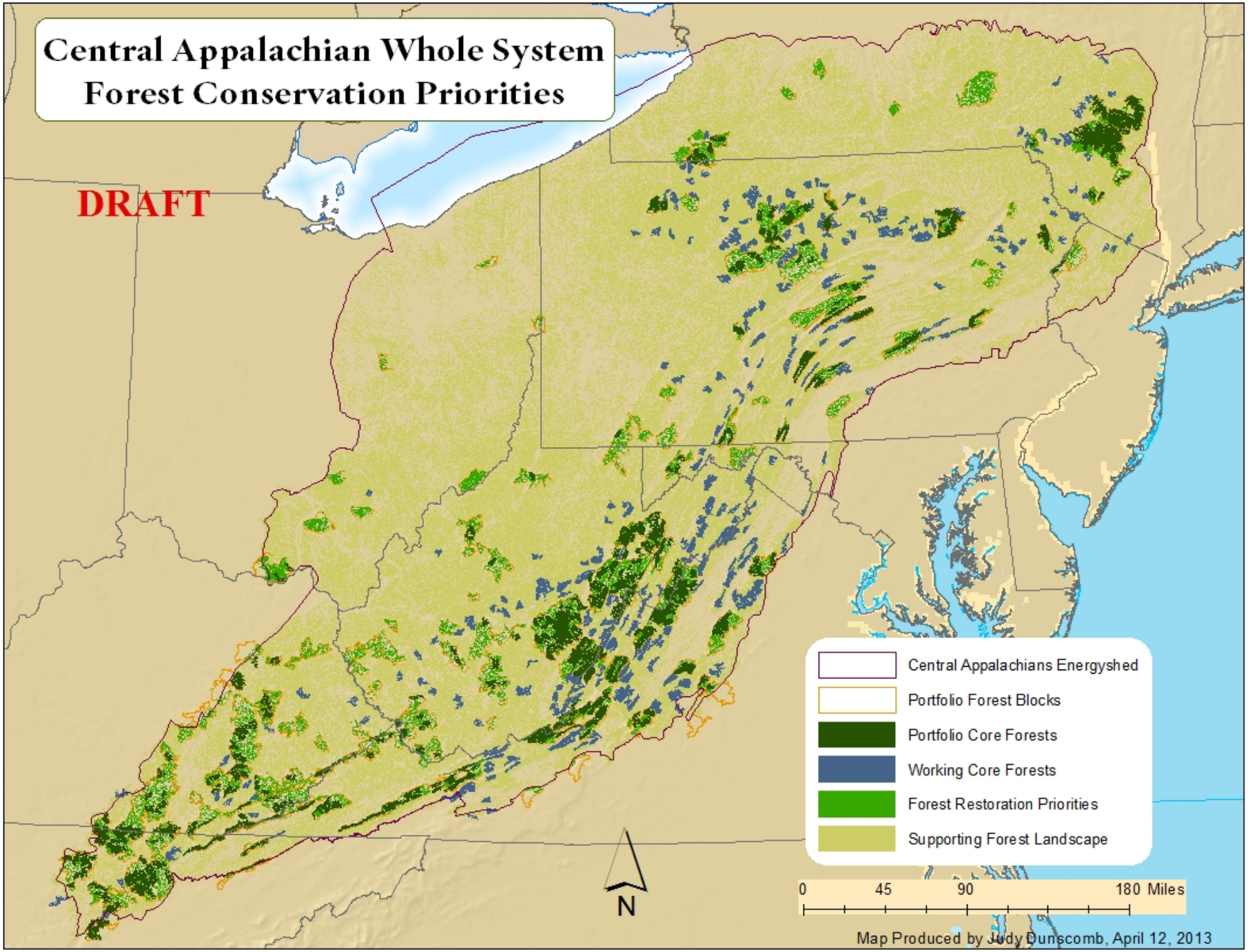
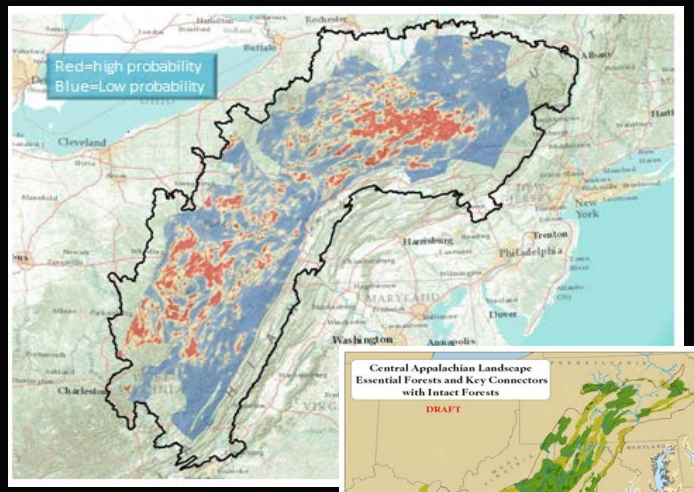
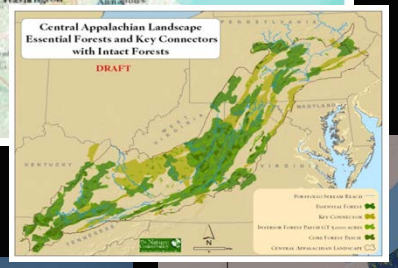
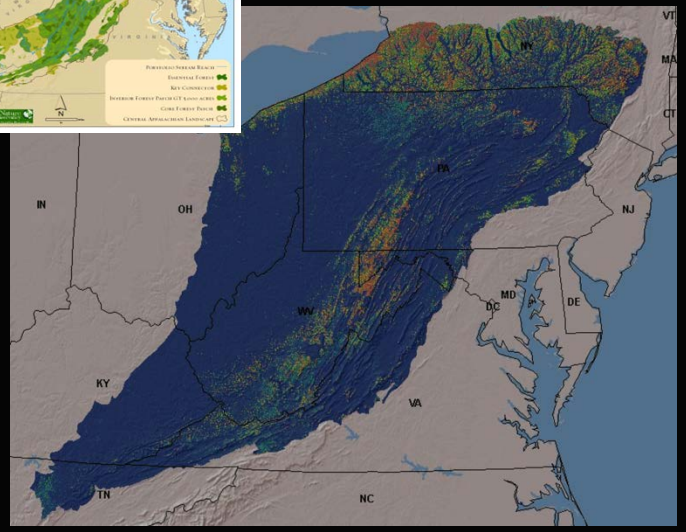



Central Appalachian Whole System
Forest Conservation Priorities
DRAFT
Central Appalachians Energyshed
Portfolio Forest Blocks
Portfolio Core Forests
Working Core Forests
Forest Restoration Priorities
Supporting Forest Landscape
N
0
45
90
180 Miles
Map Produced by Judy Dunscomb, April 12, 2013

- Reducing Energy Impacts: Identifying Overlaps







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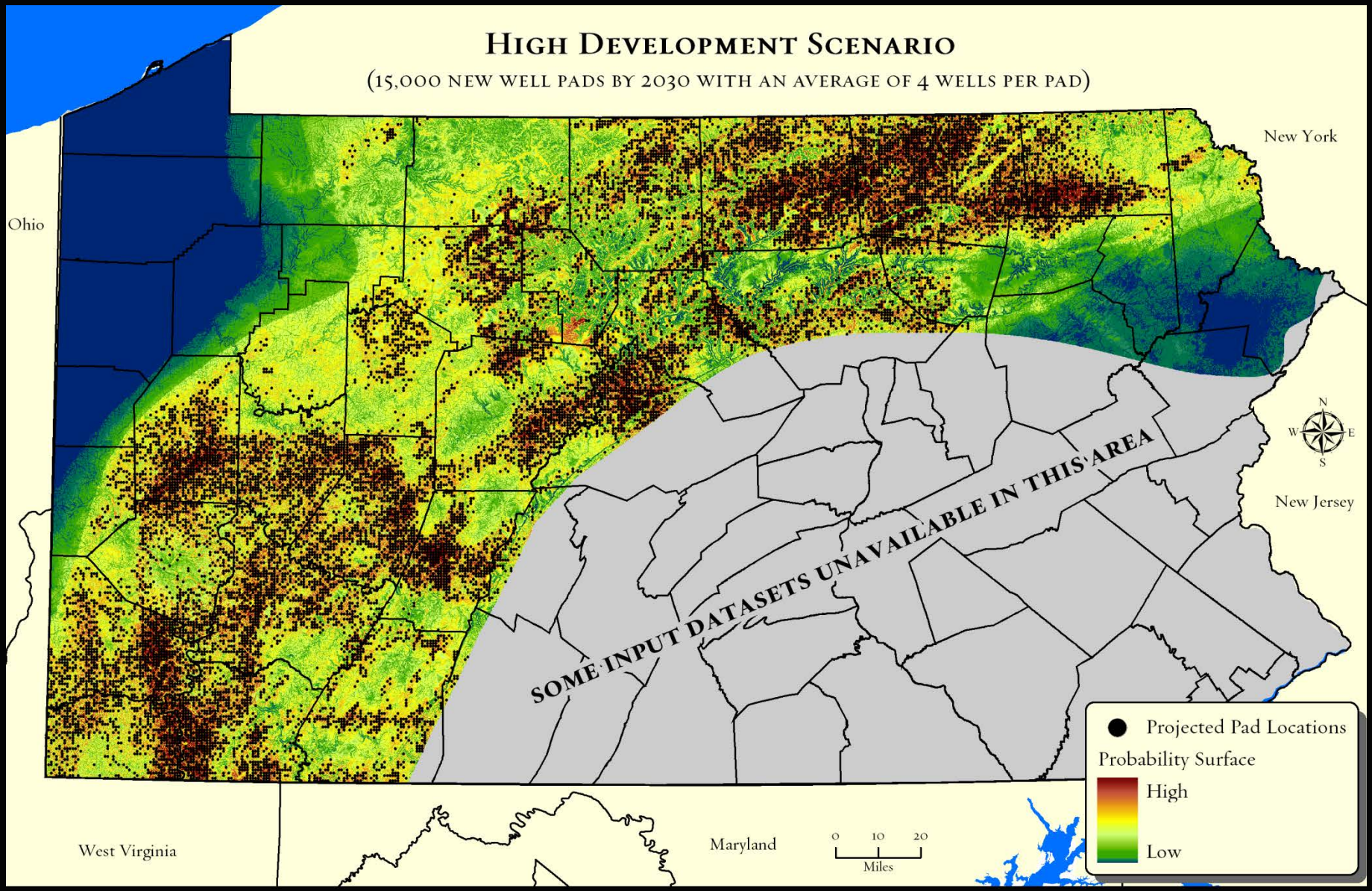
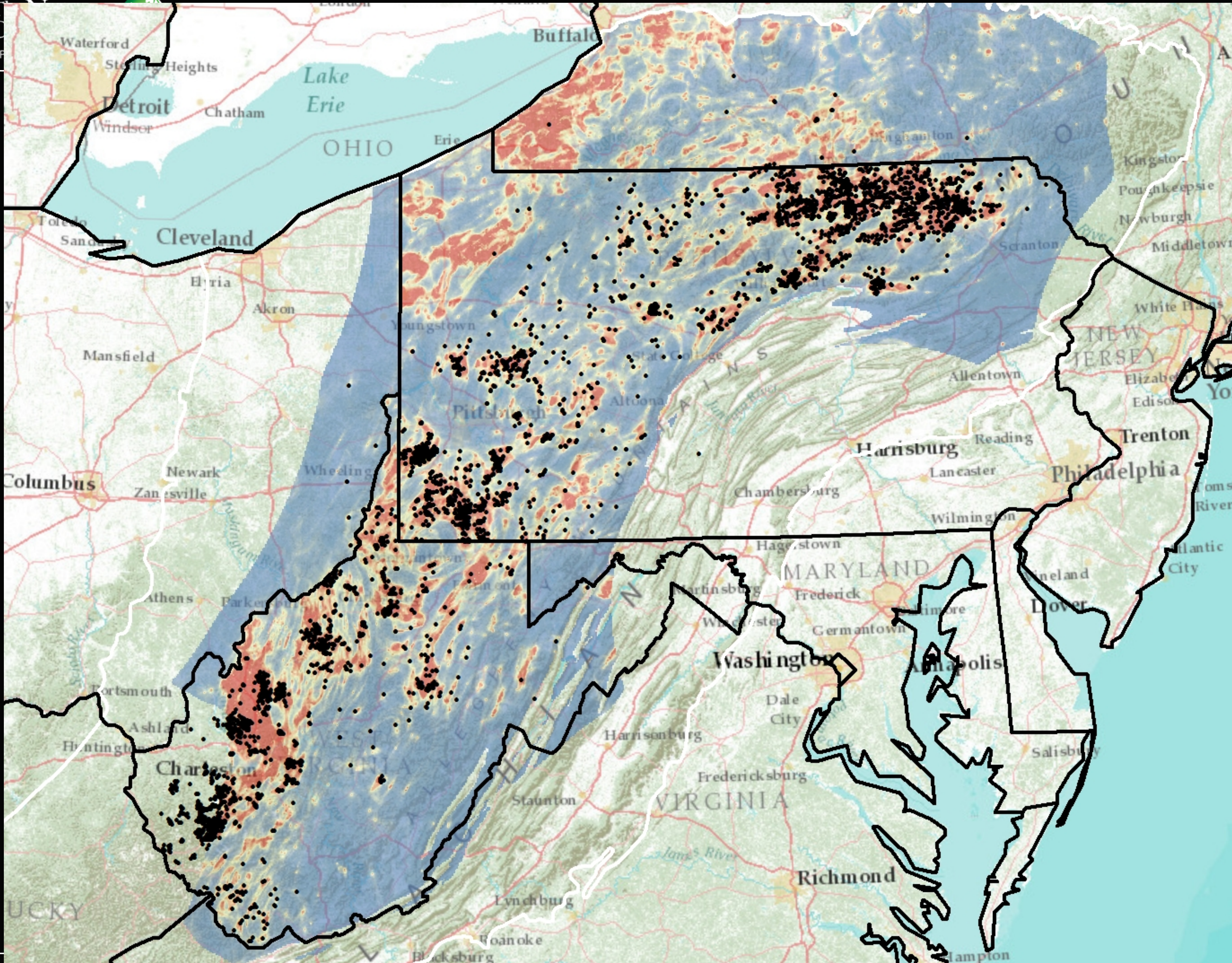
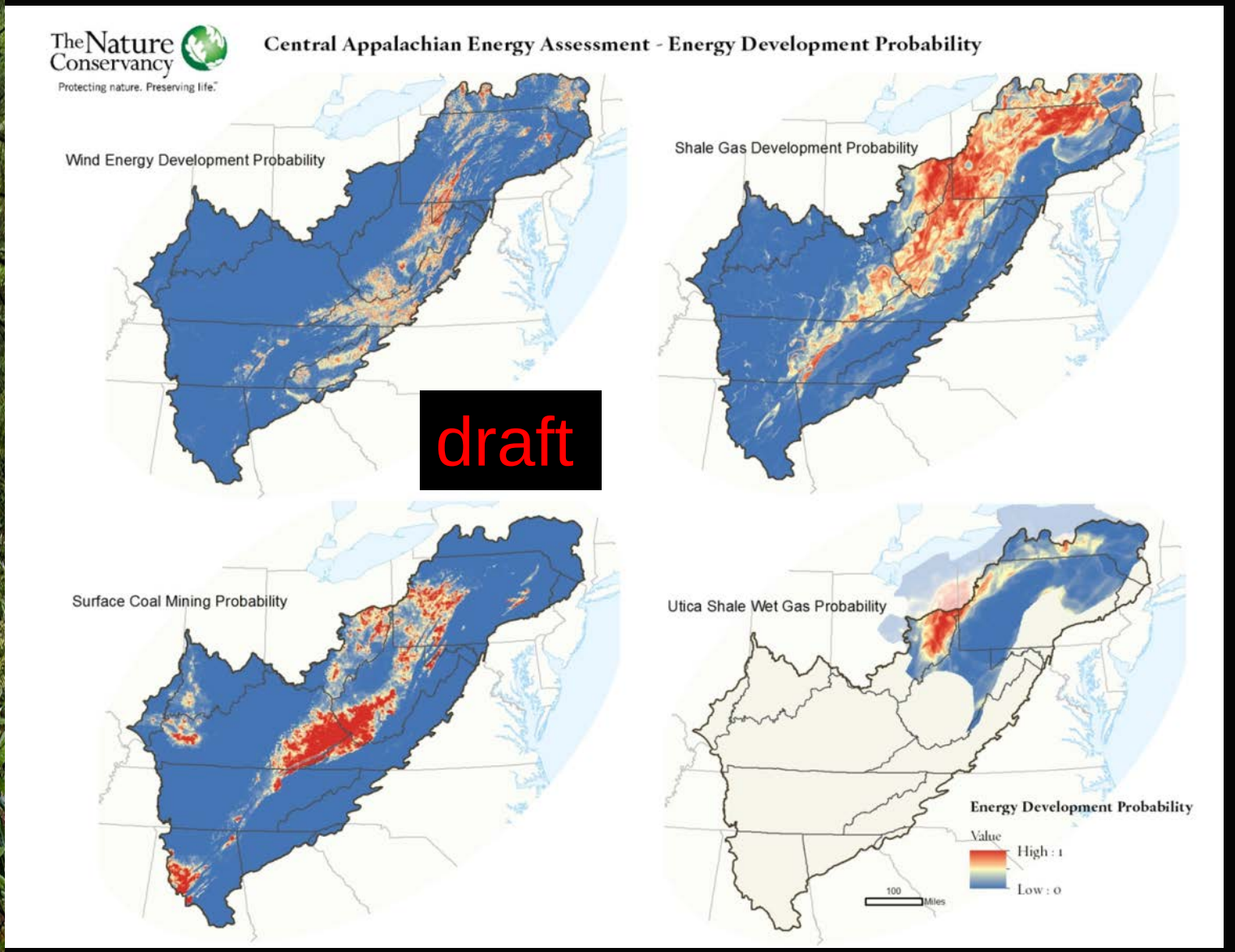
Pennsylvania Energy Impacts Assessment





Buffalo
Waterford
Sterling Heights
Detroit
Windsor
Chatham
Lake Erie
OHIO
Erie
Binghamton
Kingston
Poughkeepsie
Newburgh
Middletown
Toledo
Sandusky
Cleveland
Scranton
Elyria
Akron
White Plains
Youngstown
Mansfield
State College
NEW JERSEY
Allentown
Elizabeth
Edison
Altoona
Pittsburgh
Trenton
Reading
Harrisburg
Lancaster
Philadelphia
Newark
Wheeling
Columbus
Zanesville
Toms River
Chambersburg
Wilmington
Hagerstown
Atlantic City
MARYLAND
Vineland
Frederick
Martinsburg
Athens
Parkersburg
Dover
Germantown
Washington
Annapolis
Portsmouth
Dale City
Ashland
Huntington
Harrisonburg
Charleston
Salisbury
Fredericksburg
VIRGINIA
Staunton
Richmond
Lynchburg
Roanoke
Blacksburg
Hampton

Energy Potentials Models



Intact Forest Overlap

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Central Appalachian Energy Assessment - Risk to Forest Cores

Wind Energy Development Risk

Shale Gas Development Risk

Surface Coal Mining Development Risk

Risk from all Sources

Energy Development Probability
- Highest Risk
- Some Risk
- Low Risk
- No Risk

100 Miles

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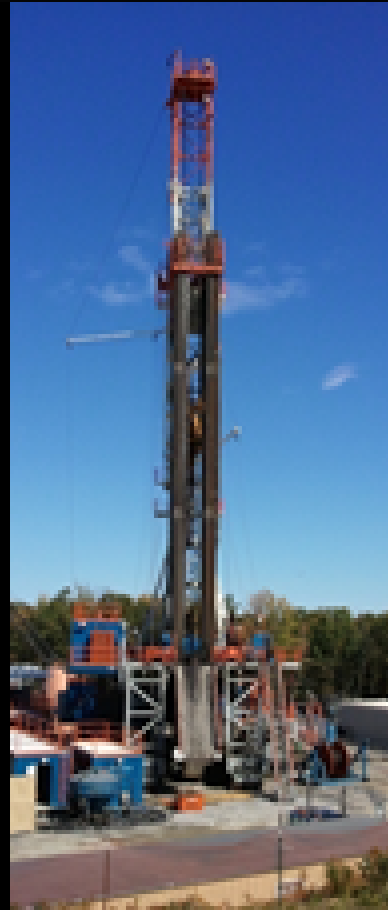
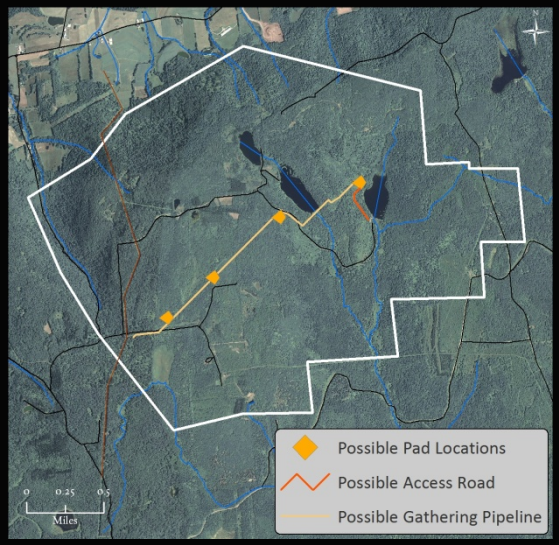
Appalachian Shale Gas Infrastructure Planning Tool

Tamara Gagnolet, Energy Program Manager, PA
Austin Milt, University of Tennessee in Knoxville
Nels Johnson, Deputy State Director, PA
Thomas Minney, Central Appalachian Whole System Director
The Cadmus Group, Inc.

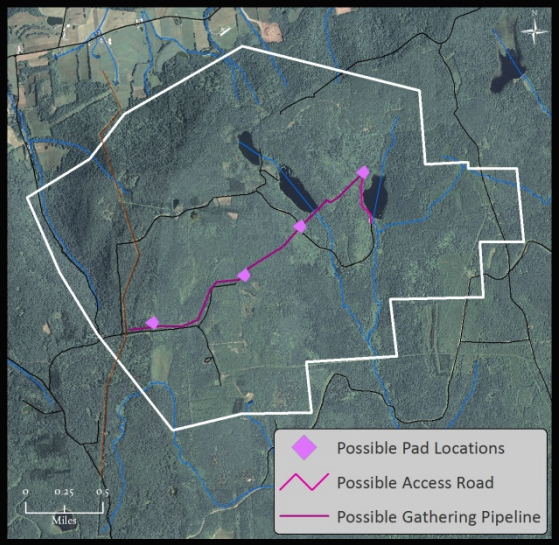


Comparing Layouts

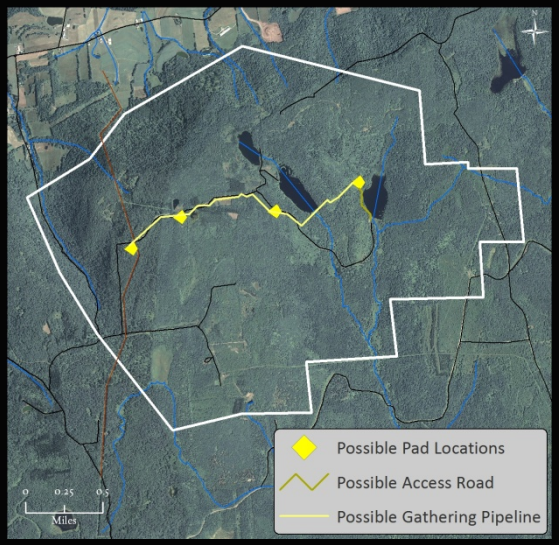
Layout A



Layout B



Layout C



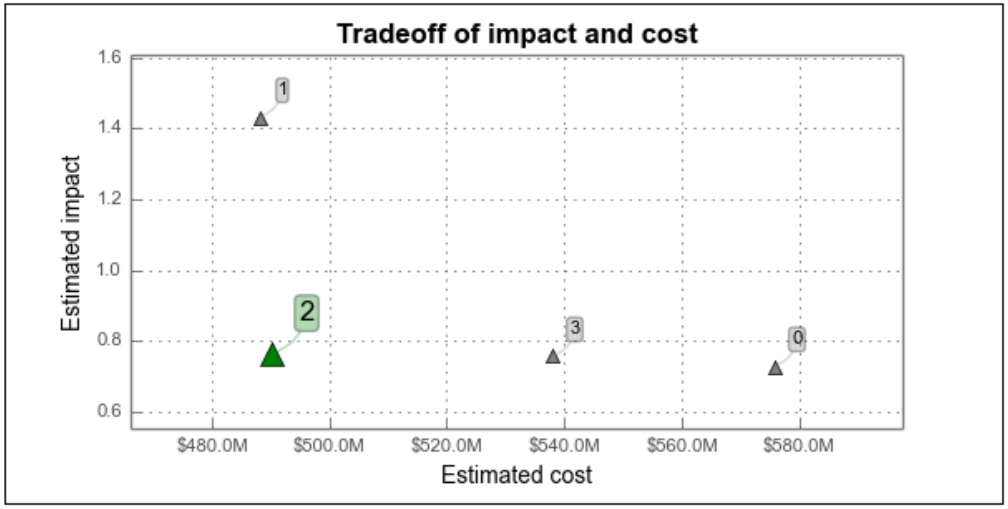
For each proposed infrastructure layout, the tool:

- Calculates environmental impact metrics
- Estimates development costs

RESULTS BY LAYOUT

Open Results By Metric

	Estimated impact	Estimated cost
Layout 2	0.765	$4,903,027
Layout 3	0.757	$5,379,061
Layout 0	0.729	$5,757,427
Layout 1	1.432	$4,881,105



Layout 2

Layout characteristics

Number of well pads	4
Miles of pipeline	2.034
Miles of road	0.386

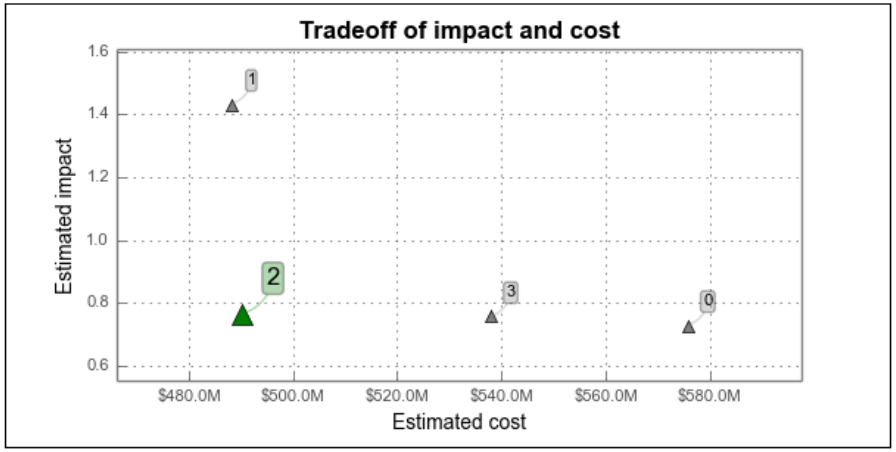
Estimated impacts: 0.765

		Value
Cultural	Risk to cultural features	1688.170
Forest	Forest acreage lost	103.000
	Interior forest acreage lost	103.000
	Forest fragmentation index 1	22096.586
	Forest fragmentation index 2	0.103
Species	Risk to rare species	71.250
Streams	Average slope	3.711
	Sediment yield (metric tons per year)	33.564
	Number of stream crossings	1.000

RESULTS BY METRIC

Open Results By Layout

	Metric
Impact	Risk to cultural features
	Forest acreage lost
	Interior forest acreage lost
	Forest fragmentation index 1
	Forest fragmentation index 2
	Risk to rare species
	Average slope
	Sediment yield (metric tons per year)
	Number of stream crossings
	Risk to surface water
Cost	Slope
	Stream crossing
	Unit
	Forest clearing & timber
	Linear cut/fill
	Areal cut/fill

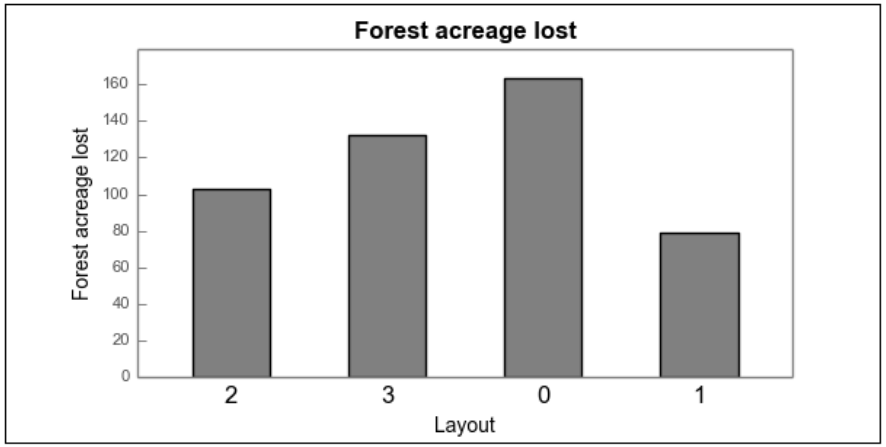


IMPACTS

Impact: Forest acreage lost

Description: total forested area removed (m^2)

	Value
Layout 2	103.000
Layout 3	132.000
Layout 0	163.000
Layout 1	79.000



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Recommended Conservation Practices for Appalachian Shale Energy Development

Tamara Gagnolet, Energy Program Manager
Emily Posthumus, Energy Development Research Specialist
Scott Bearer, Senior Scientist

Pennsylvania Chapter & Central Appalachians Whole System

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Summary Documents by Topic

- **State of the research** – characterizes existing body of literature
- **Evidence of impact** – summarizes impacts documented in scientific literature
- **Existing conservation practices and scientific support** – summarizes existing practices and support from the literature
- **Recommended conservation practices**

Recommended Conservation Practices

The Nature Conservancy's recommended conservation practices:

- Address **all phases of development**
- Are intended to **avoid and minimize risk** to species in Appalachian forests, streams, wetlands, and lakes.
- May need to be **adjusted or increased** to achieve ecological outcomes on a case-by-case basis and to incorporate new information, consider operational feasibility, and comply with more stringent regulatory requirements that may exist.
- Are intended to **influence how future development happens in the landscape**.

Landscape scale planning **is the foundation** for all recommendations.

Recommended Conservation Practices

Focus on surface and wildlife impacts and recommendations.

Topics Covered

- Landscape Scale Planning
- Ecological Buffers
- Road Development
- Stream Crossings
- Water Withdrawals
- Timing of Activities
- Noise
- Artificial Lighting

Topics In Development

- Pipeline Development
- Invasive Plant Management
- Reclamation

Topics Not Covered

- Air Quality
- Risks of Spills
- Public Health and Safety

The Nature Conservancy

Appalachian Shale Energy Development: Recommended Conservation Practices

ROAD DEVELOPMENT

© Kurt Mason

The construction and maintenance of roads to transport materials, equipment, and resources accounts for a large part of shale oil and gas development. Roads have the potential to degrade ecosystems through habitat loss and fragmentation; air, noise, and light pollution; the spread of invasive species; and increased erosion and sedimentation. These effects can impact the behavior and distribution of wildlife and affect water quality in the region. Proper location, design, and maintenance of roads can help lessen impacts on fish and wildlife habitats.

STATE OF THE RESEARCH

Extensive research exists regarding road design and maintenance, including studies specific to the Appalachian region. Studies show that poorly located, constructed, and maintained unpaved forest roads can be considerably damaging to forest and stream ecosystems. The major effects of roads include habitat loss and fragmentation; increased noise and visual disturbance; direct mortality, barriers to movement, and changes in the behavior of wildlife; spread of invasive plant species; and the degradation of stream systems.[1-9]

Wildlife responses to disturbances associated with roads vary as well, according to species, sex, and age. Studies show many groups of wildlife being affected in some way by the presence of roads, including small and large mammals, birds, reptiles, amphibians, fish, and plants. Many studies have found a negative relationship between road density and species richness in reptiles, amphibians, large mammals, and fish.[8,10-14]

Road development can alter stream habitat, increase erosion, change runoff patterns, and impact overall watershed health.[15,17-19] Improperly designed,

Shale development brings new roads and truck traffic to the Appalachian region. © Tamara Gagnolet, The Nature Conservancy

TNC RECOMMENDED CONSERVATION PRACTICES

Based on scientific literature and conservation practices used by other agencies and organizations, The Nature Conservancy recommends:

- ☑ Plan at the landscape level. Use existing corridors and forest edges to minimize forest fragmentation.
- ☑ When developing new roads, avoid and minimize the placement of roads in ecologically important habitats and areas subject to severe erosion.
  - In the Appalachians, these areas include large forest patches (>1,000 acres), slopes >10%, floodplains, rocky outcrops, scrub oak/pitch pine barrens, seeps, bogs, and fens.
  - In addition, infrastructure should not be located within 330 feet of rivers, streams, wetlands and lakes or key nesting, feeding and hibernation habitats for mammals, birds, reptiles and amphibian.
- ☑ Construct and maintain proper road drainage and erosion control consistent with U.S. Forest Service Environmentally Sensitive Road Maintenance Practices for Dirt and Gravel Roads. Keep corridors narrow and preserve canopy cover to reduce edge effects.
- ☑ Conduct proper maintenance activities, including inspections, surface repairs, ditch and culvert cleaning, and invasive species management.
- ☑ Minimize traffic by restricting road access, particularly during times of the year when wildlife are most sensitive to road mortality.

These recommendations are intended to avoid and reduce impacts of shale development on Appalachian habitats and wildlife. These practices may need to be adapted to incorporate new information, consider operational feasibility, and comply with more stringent regulatory requirements that may exist.

Questions?

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