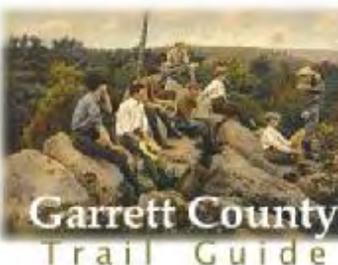


- Legend**
- Chevron
 - Chief Expl_Radler(14%)_Enerplus
 - Texas_Eastern
 - Enerplus_Resources
 - Samson Resources_Unit Petrol
 - Samson Resources
 - XTO Energy
 - Legion Land
 - Lodge Energy
 - Infinity Oil
 - Chesapeake_Statoilhydro
 - Cabot Oil & Gas
 - Burnett_Sonic_Buckhorn_Others
 - AB Resources
 - AB Resources_Chief Explor_Enerplus
 - Belmont Resources

Notes:
 1) Leases encompass 126,961.4 acres:
 --41,320.59 acres - Savage River State Forest
 --85,640.81 acres - Other Properties
 2) Parcels beneath the Savage River State Forest (41,320.59 acres), while included in the 126,961.4 acres, are not shown on the map, as I am unable to ascertain which parts of the Forest are involved.

Garrett County Economic Development map



Marcellus Shale Gas Development in Maryland: A Natural Resource Analysis

Advisory Commission Meeting
February 27, 2012

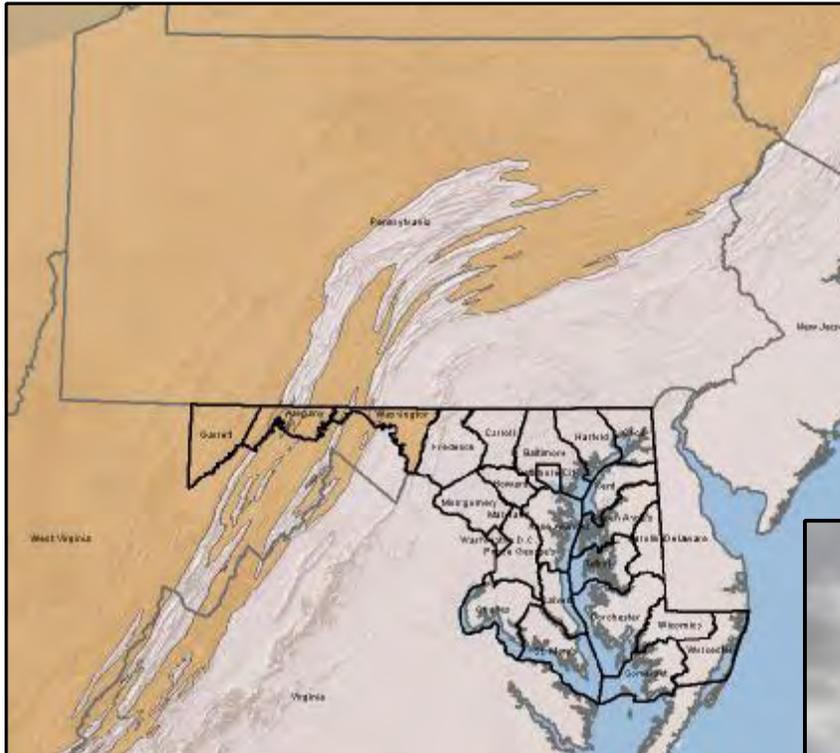
Catherine McCall



Balancing Natural Resources & Human Uses

- Western Maryland has some of the State's most important natural areas and offers diverse recreational opportunities.
 - Hiking, skiing and snowshoeing trails
 - Coldwater fishing, game hunting and whitewater rafting
 - Shale outcroppings, ridgelines and intact forests provide unique habitats for diverse living resources and improve our air quality
- Unique geologic formations support these resources and public recreation activities, provide communities with economic and natural resources and also support emerging energy development industries

Marcellus Formation Range



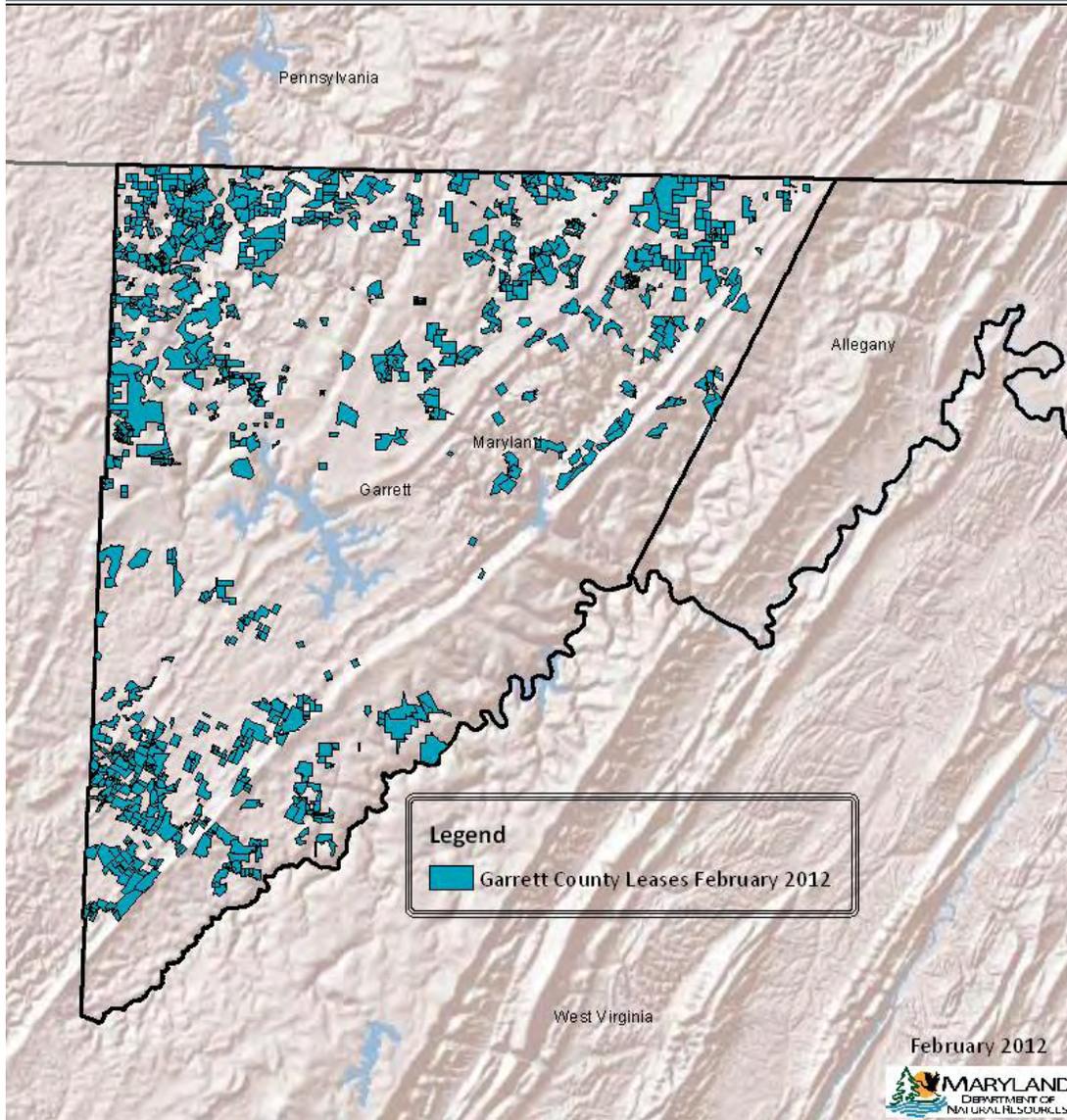


Marcellus Shale Resource Analysis

- 1) To compile and organize data, information and feedback to help identify areas of high use and/or natural resource overlap where Marcellus shale gas development leasing activities are concentrated
- 2) To assess potential natural resource impacts that may either directly or indirectly result from shale gas development and help to inform the identification of both site- and landscape-level Best Management Practices (BMPs)

This *work-in-progress* analysis is an initial step toward identifying the areas that may be most or least impactful to natural resources

Issue-Specific Mapping & Analysis Summary



Garrett County Economic Development - Leases as of February 2012

- Landscape
- Ecological Resources
 - Water Supply
 - Recreation & Visual Impacts
- Pipelines & Roads

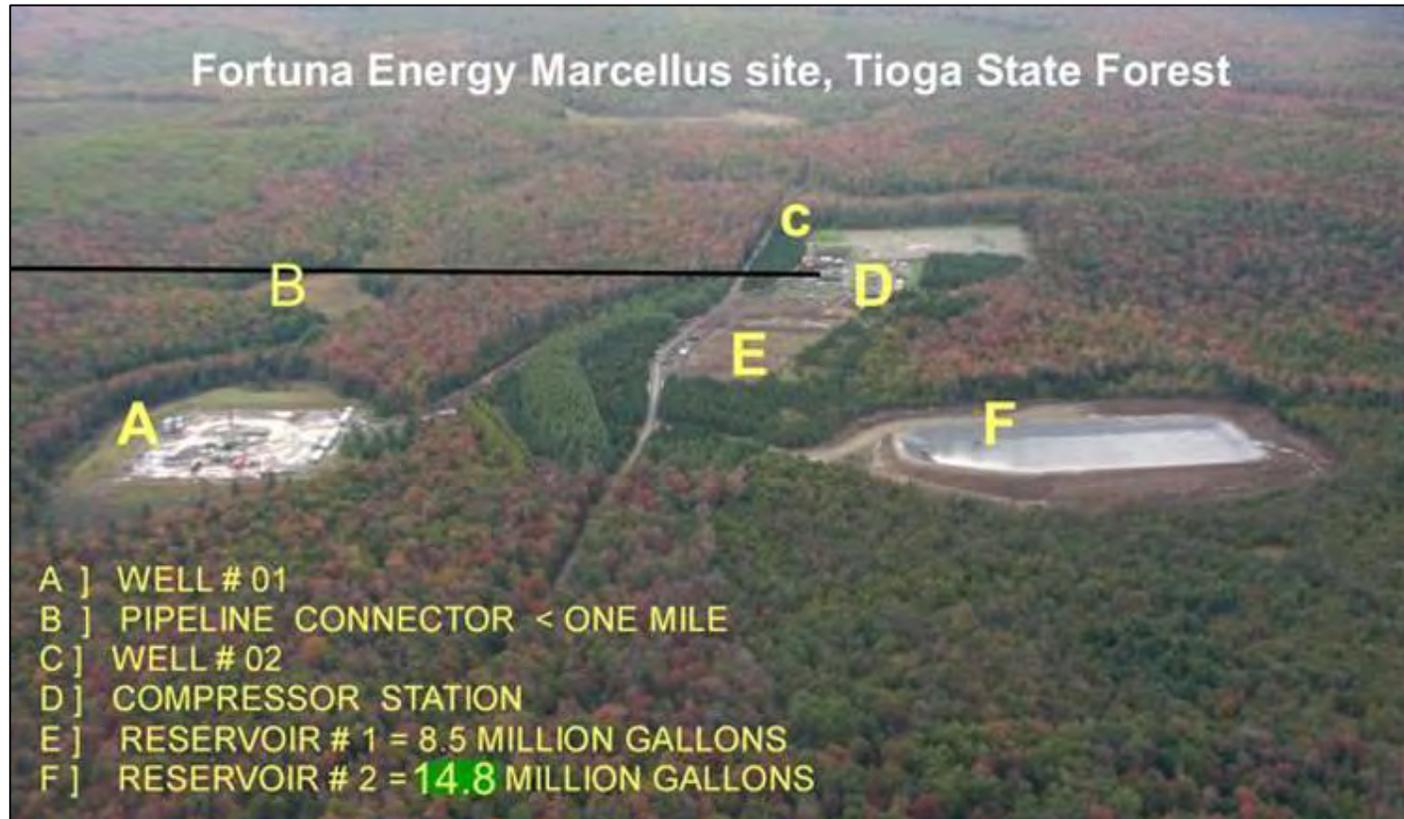
Resource and Habitat Impacts: Direct & Associated

Direct Impacts:

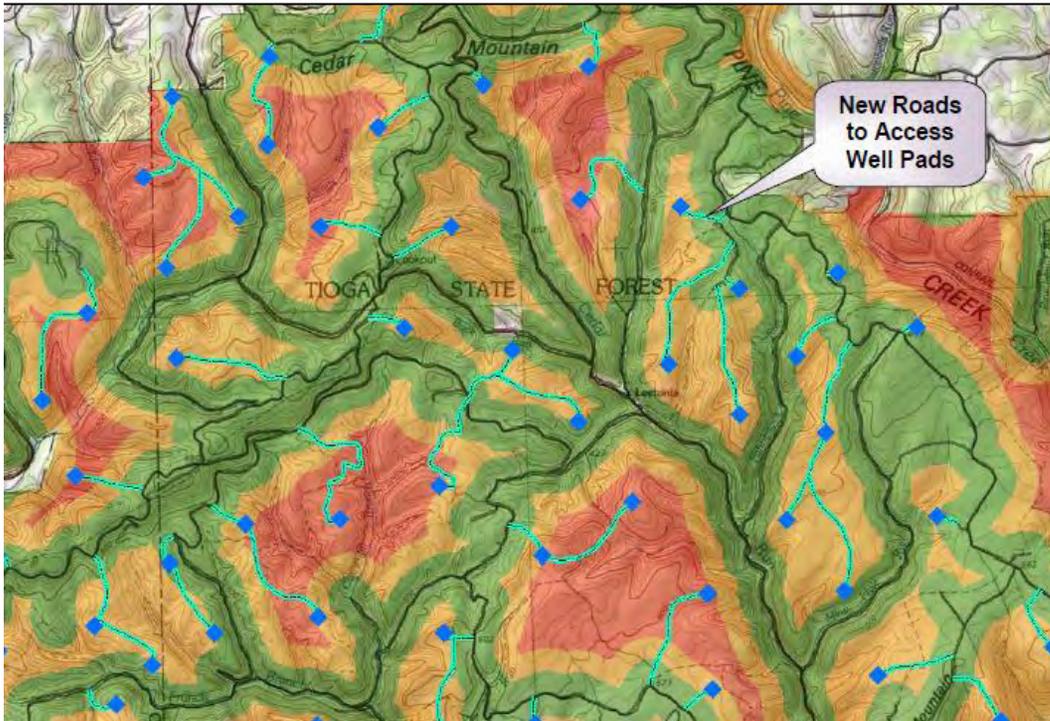
Resource impacts on the actual well pad site footprint, associated infrastructure (e.g. roads, pipelines)

Associated Impacts:

Resource impacts resulting from encroachment, habitat fragmentation and watershed development



Site Acreage Baseline: Direct Impacts



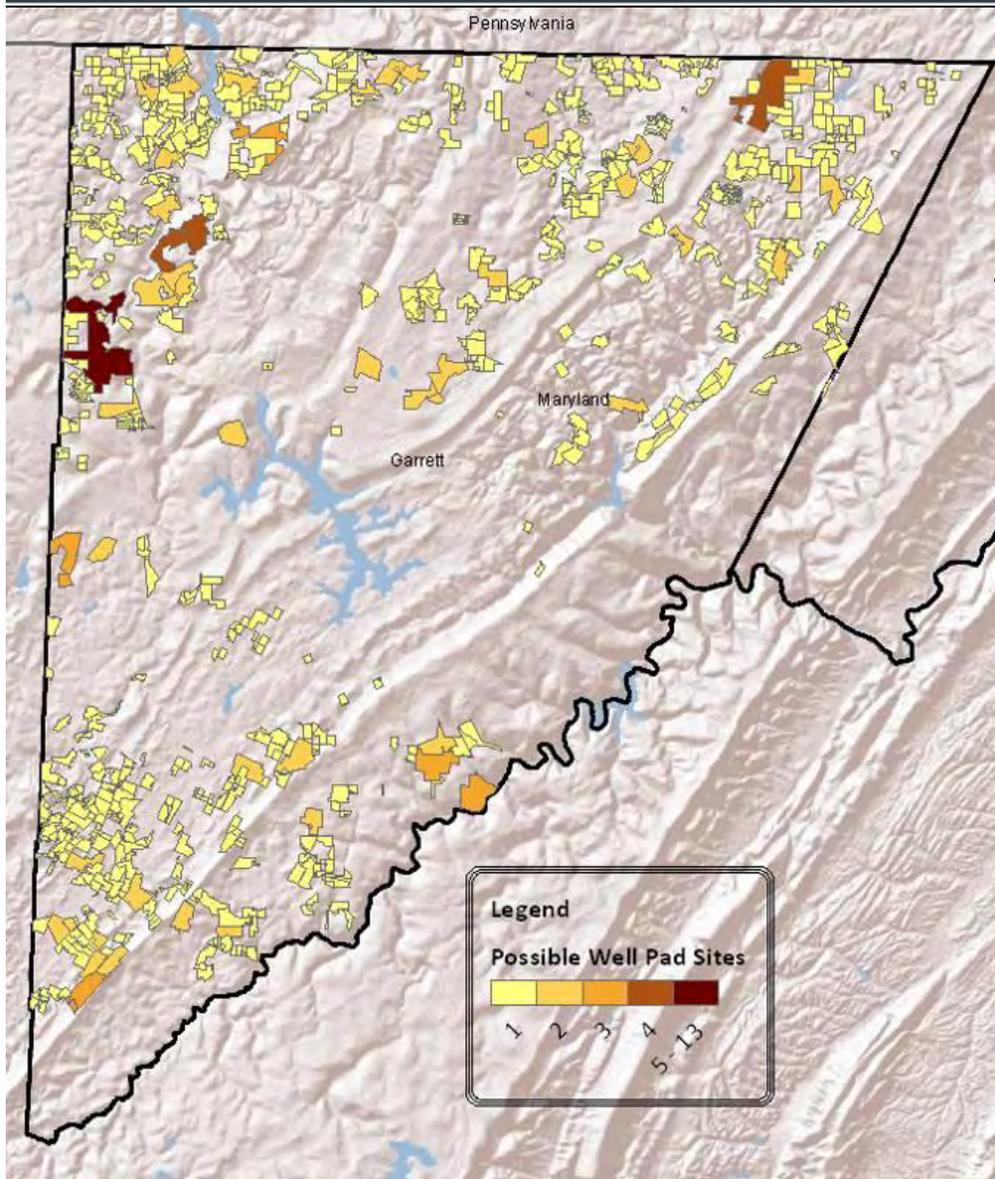
- Footprint of a well pad = 5 acres¹
- Well pad spacing = 240 acres²
- A 1,000 acre leased parcel would have 4 or 5 well pads spaced 240 acres apart
- Based on these guidelines, total acreage impacts from well pads would then be up to 25 acres impacted, not accounting for road development
- Combined with road or pipeline development, these impacts are...

...*Direct Impacts*

¹ DRBC Hearing on Natural Gas Exploratory Wells, 2010 and Sumi 2008

² PA DCNR Guidelines for Administering Oil and Gas Activity on State Forest Lands

Site Acreage Baseline: Direct Impacts



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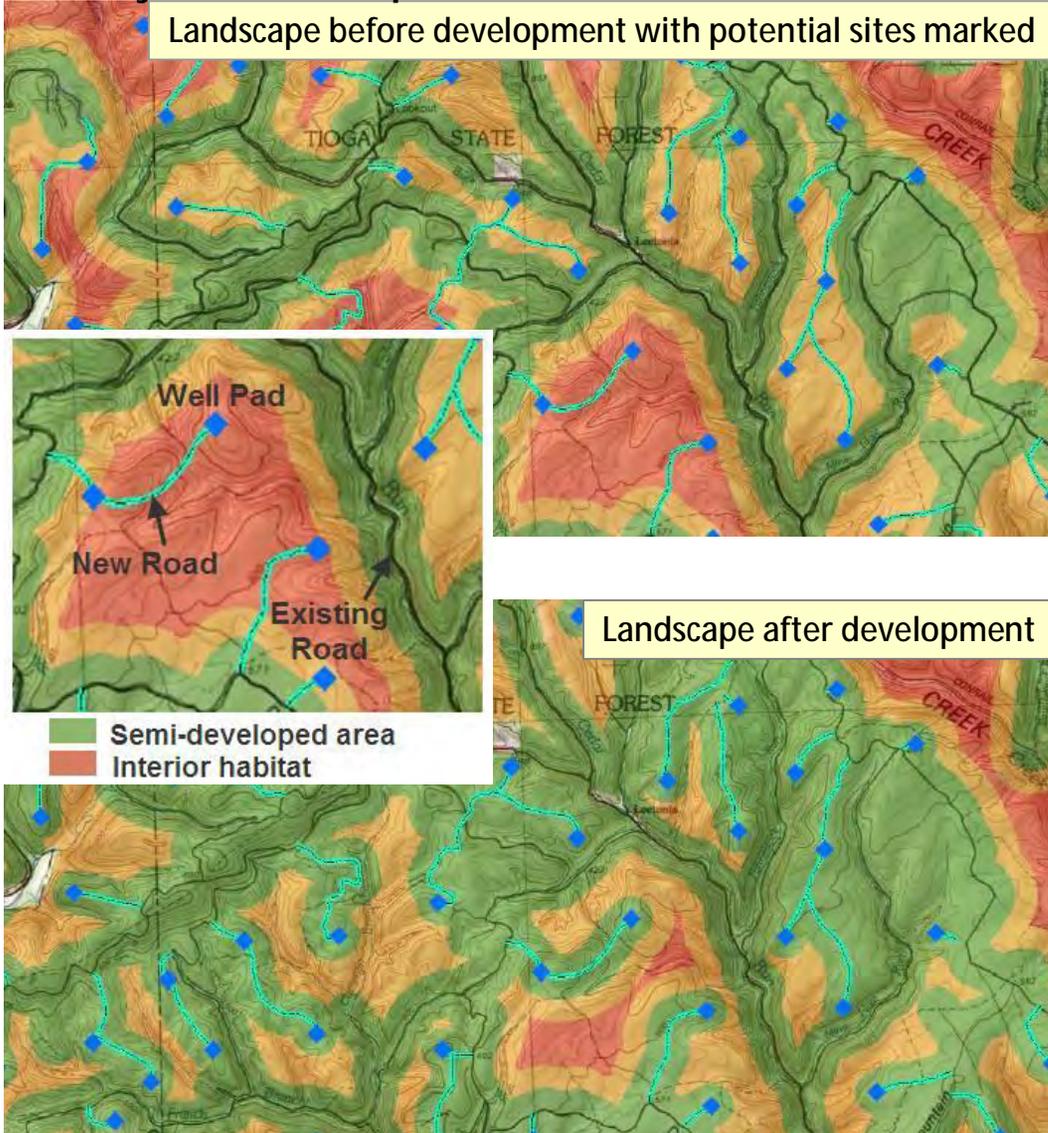
...*Direct Impacts*

¹ DRBC Hearing on Natural Gas Exploratory Wells, 2010 and Sumi 2008

² PA DCNR Guidelines for Administering Oil and Gas Activity on State Forest Lands

Site Acreage Baseline: Associated Impacts

Pennsylvania Example



- Fragmentation to core habitat areas results in less interior habitat, changes in associated communities and changes to public access
- Drainage areas associated with well pads may impact lands far from the actual site. These drainage areas can affect approximately 640 acres¹.
- These resulting changes to natural resource connectivity, public access and drainage areas are...

...Associated Impacts

¹ PA DCNR Guidelines for Administering Oil and Gas Activity on State Forest Lands

Landscape: GreenPrint and Targeted Ecological Areas

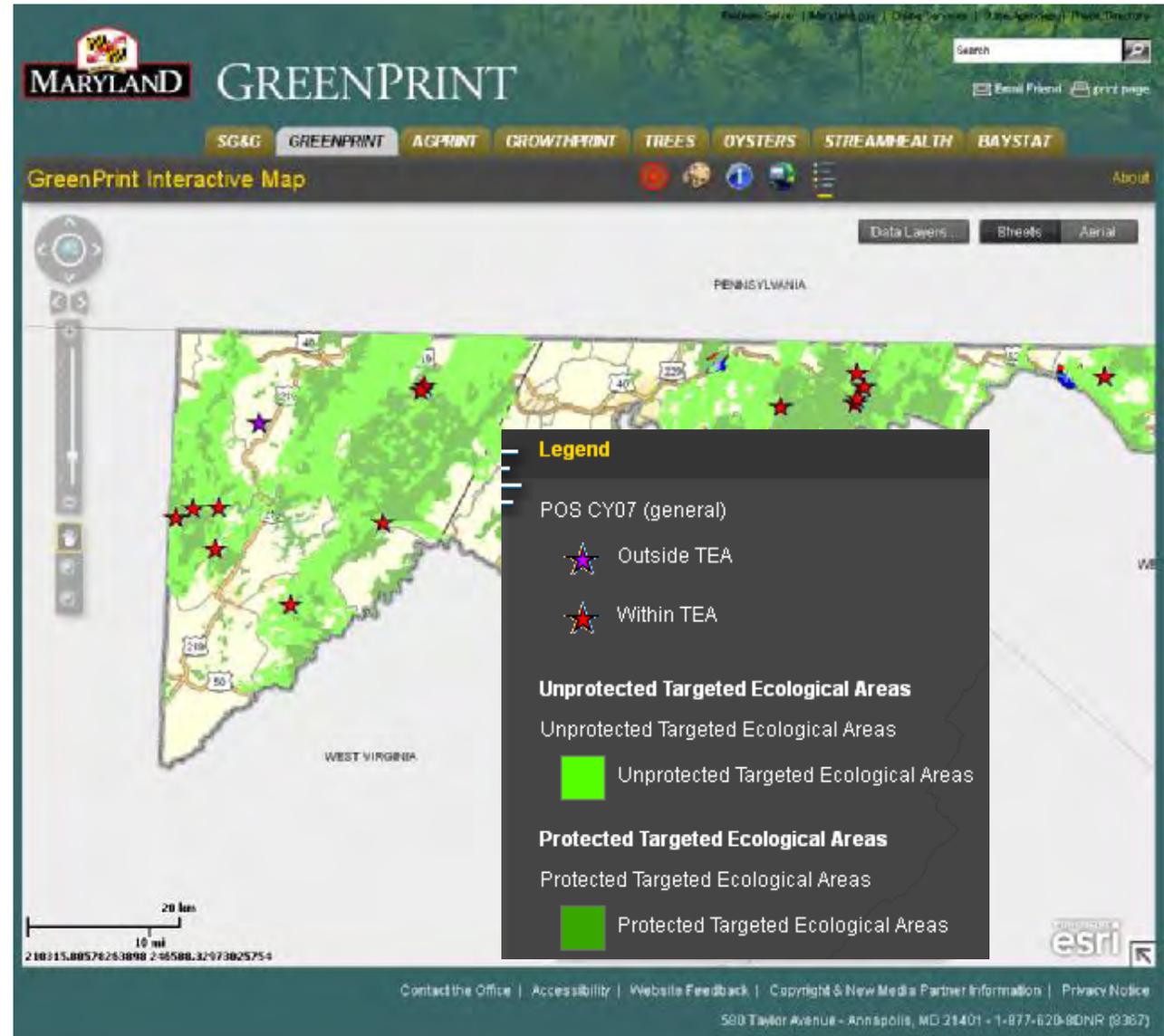
- GreenPrint represents the “Best of the Best” natural resource areas in the state



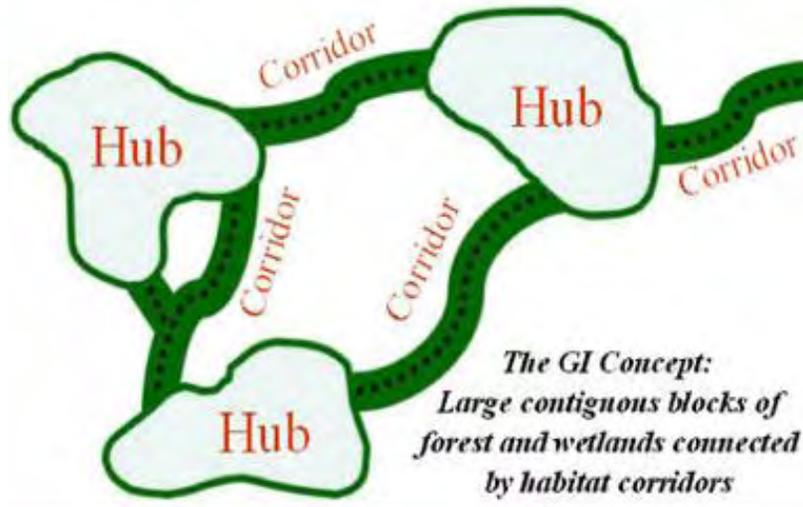
- A variety of GreenPrint natural resource priorities comprise Targeted Ecological Areas (TEAs) where conservation efforts are focused.
- In Garrett County, these include:
 - Green Infrastructure
 - Water Quality Protection
 - Sensitive Communities
 - Aquatic Life Hotspots

Landscape: GreenPrint and Targeted Ecological Areas

- Sets ecological targets and acquisition goals based on Green Infrastructure and other resource priorities
- Tracks success and measures accountability
- Provides a place for coordinating land conservation among all partners



Landscape: Habitat Networks

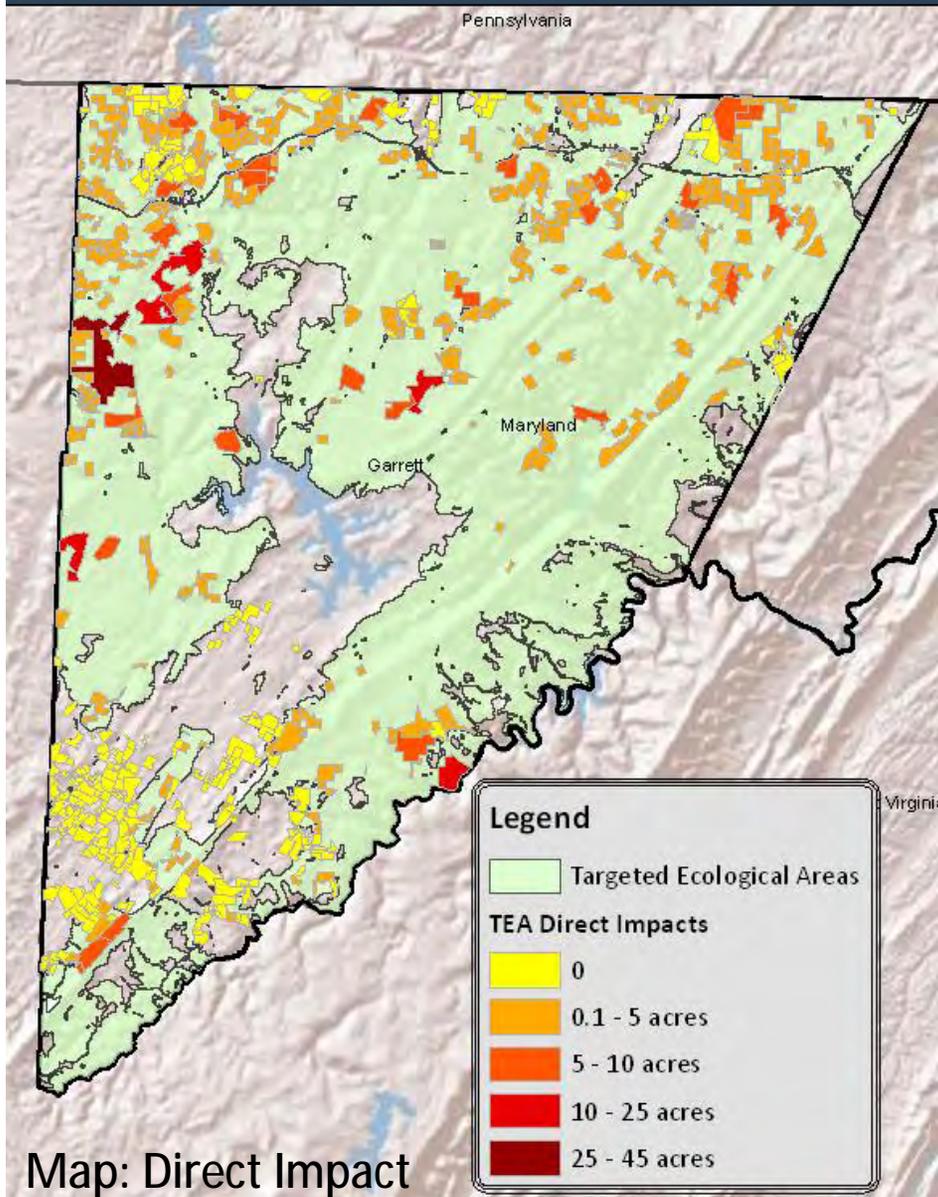


- Hubs – large, intact forest or wetland complexes that support important living resources
- Corridors – linear connections that help wildlife and people move between hubs

Garrett County –
Approximately 425,216 acres in the County
Approximately 290,304 acres of Green Infrastructure.

Some of the most important Green Infrastructure areas in the state are the large expanses of unbroken forest around Savage River and Green Ridge State Forests and the Youghiogheny Wild River in Garrett County

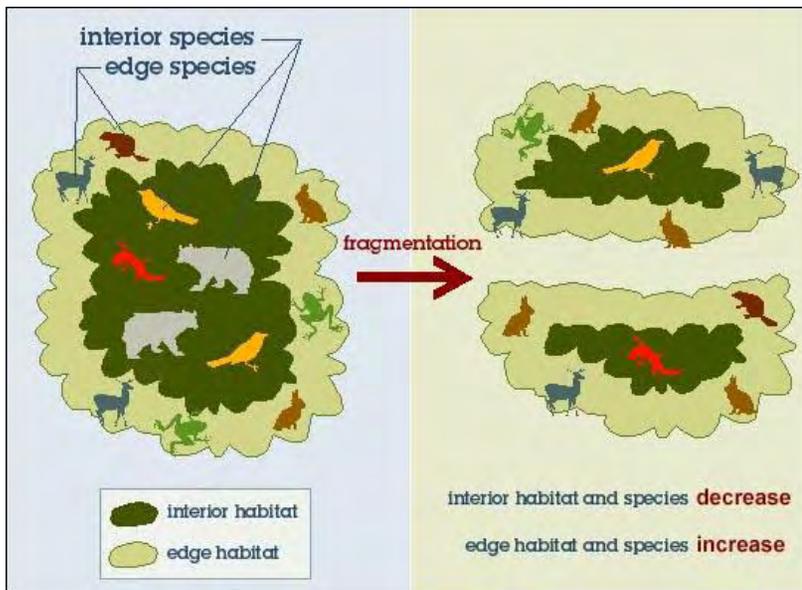
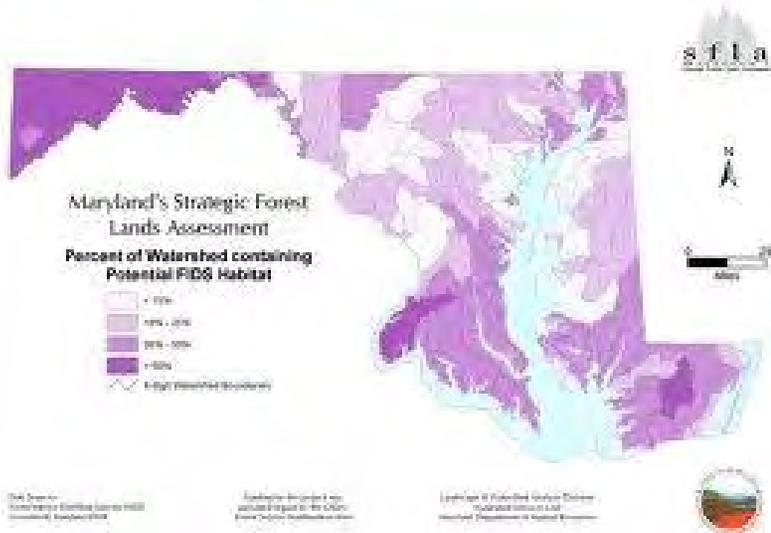
Landscape: Targeted Ecological Areas



Direct Impact: Well site footprints alone may directly impact up to 5,155 acres of TEA landscapes

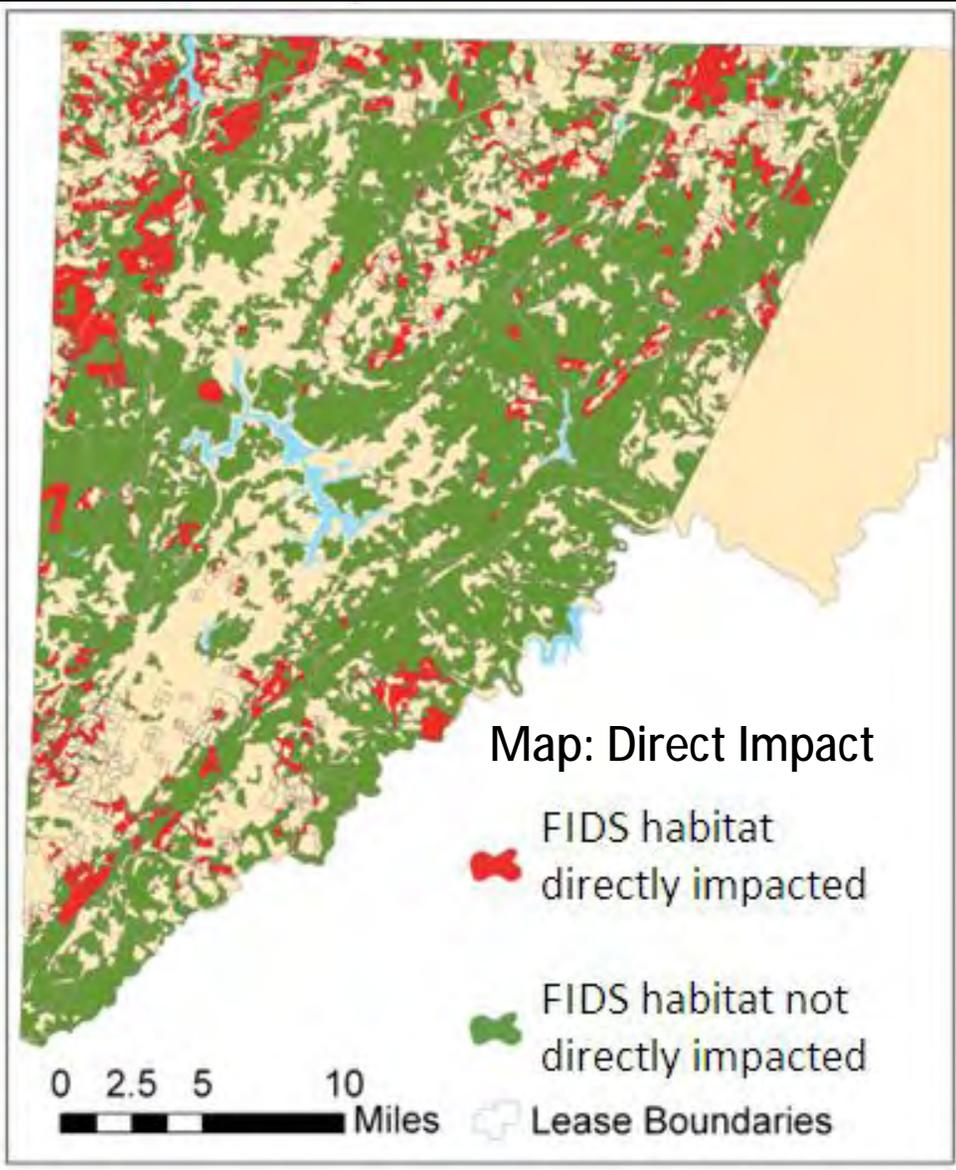
Associated Impacts: More than 42,417 acres of TEAs could be impacted. This potential impact will disproportionately impact currently unprotected TEA areas, resulting in a greater risk to these “best of the best” resources

Ecological Resources: Forest Interior Dwelling Species (FIDS)

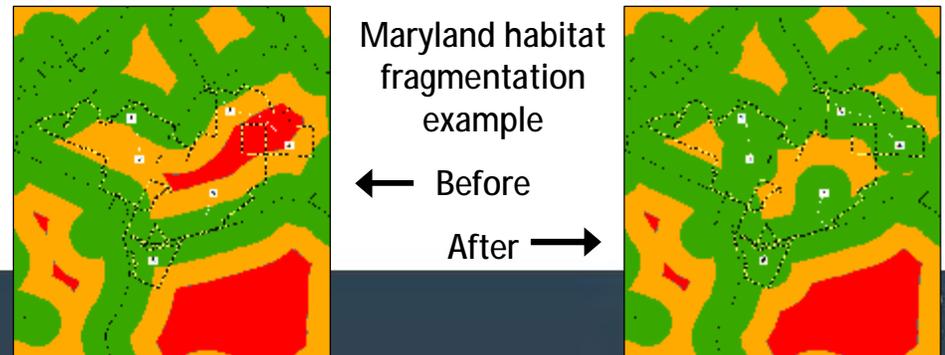


- High quality FIDS habitat is mature hardwood or mixed hardwood-pine forest tracts of at least 100 acres with core interior habitats
- Existing riparian forests 300 feet wide adjacent to wetlands or waterways
 - Utilized as breeding areas
- Increased fragmentation of these areas results in losses of certain species and communities
- Garrett County has some of the best FIDS habitat in the State

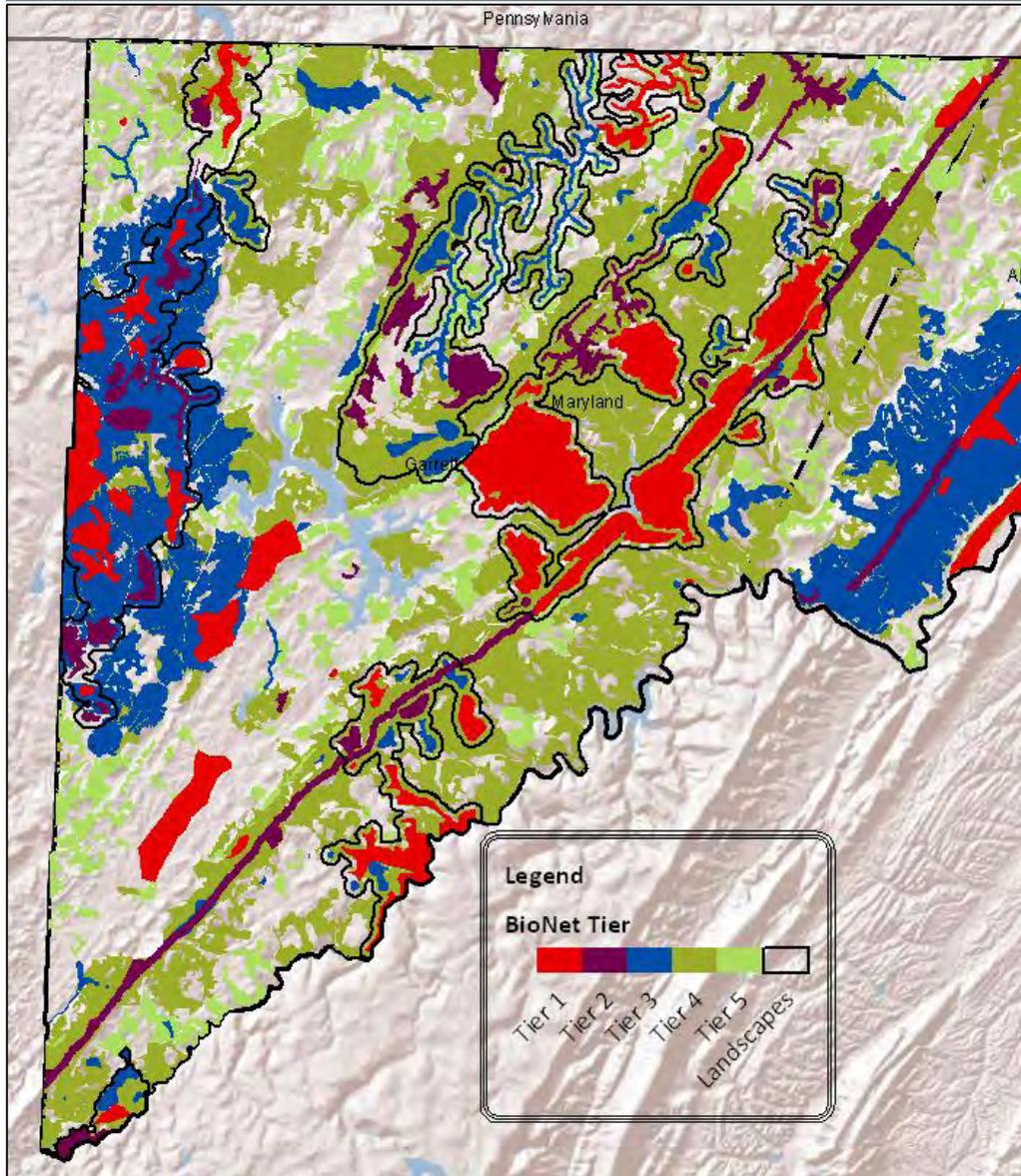
*Examples of FIDS: Warblers, Tanagers, Vireos, Owls
Large mammals also utilize these large habitat areas*



- Direct Impact: Well sites alone may directly impact more than 6,000 acres of FIDS habitat
- Associated Impact: FIDS habitat is impacted by reducing the size of interior habitat available for FIDS species. Fragmentation may impact hundreds of thousands of additional FIDS habitat acres due to associated fragmentation impacts.



Ecological Resources: BioNet



...the most irreplaceable species and habitats
...habitats that concentrate larger numbers
of rare species

BioNet incorporates larger landscapes
required for migratory animals, population
dispersal, and habitat shifts resulting from
climate change

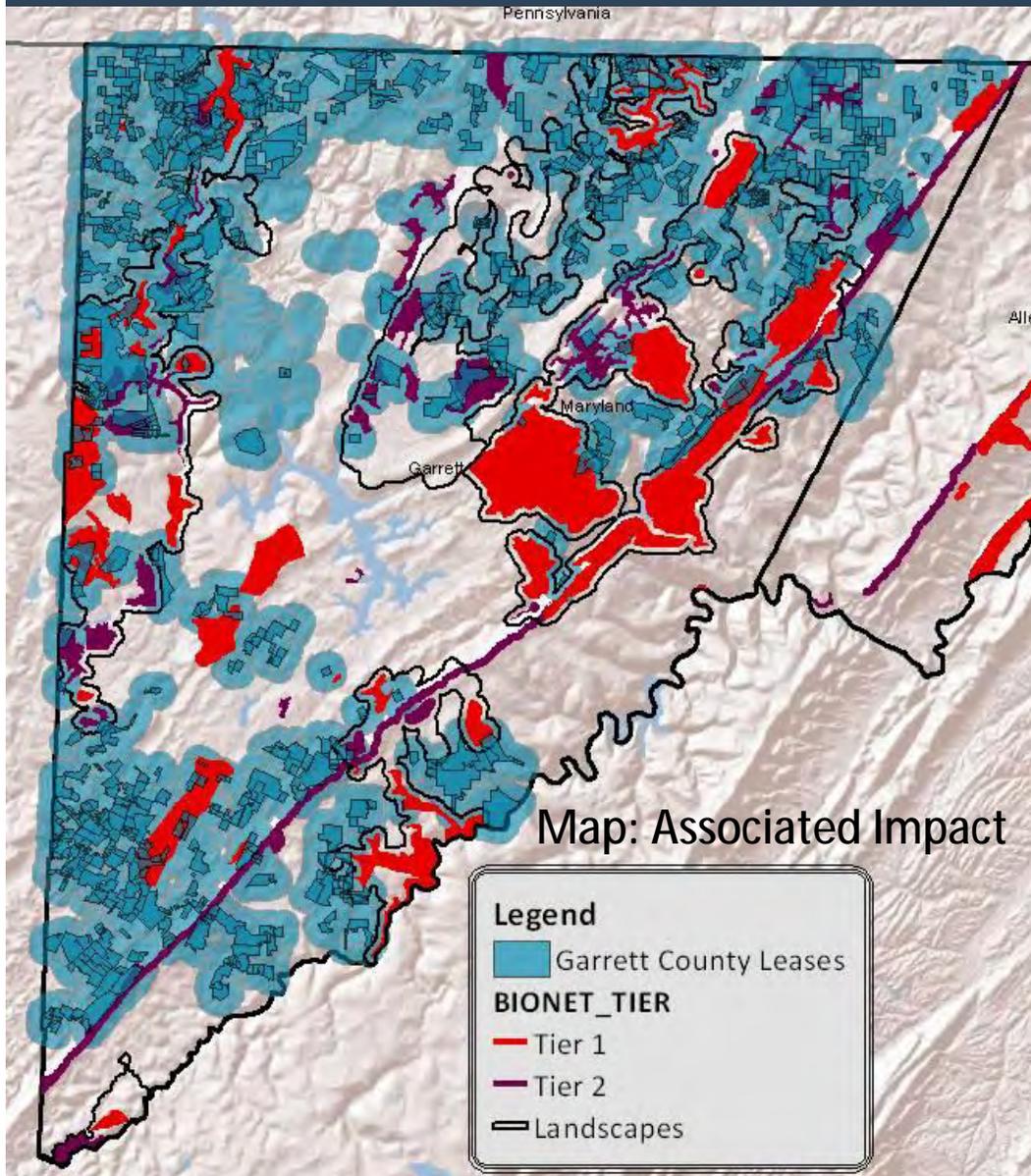
214

Current and historic rare, threatened and
endangered species

83

*Examples of Endangered Species in Garrett
County: northern goshawk, green salamander,
summer sedge, Indiana bat, eastern
hellbenders*

Ecological Resources: BioNet Tiers 1 & 2, Landscapes

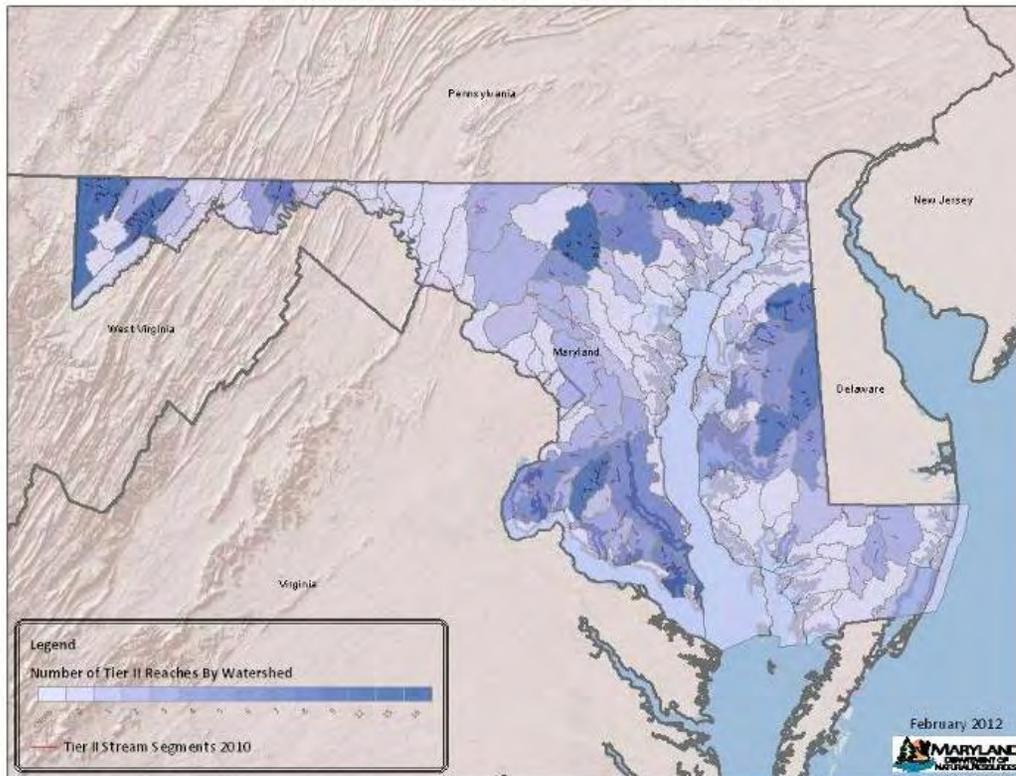


Direct Impact: Well sites may directly impact approximately 7,100 acres of Tiers 1 & 2 and landscape-level BioNet habitat

Associated Impact: Pipeline distribution and roads will impact additional BioNet species, landscapes and communities. Associated impacts to catchments around leases will impact more than 60% of Tiers I and 2 and landscape-level BioNet acreages.

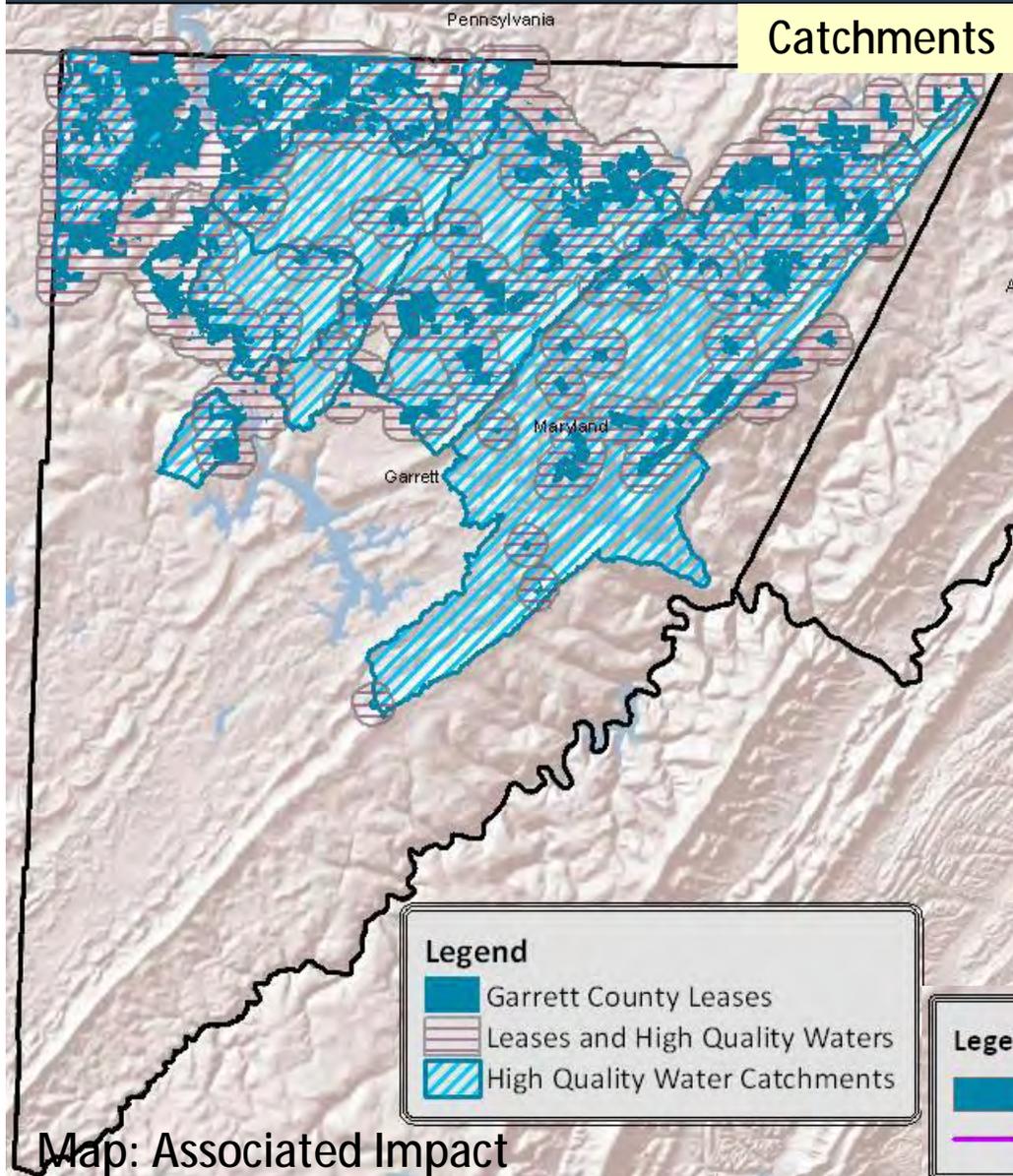
Ecological Resources: High Quality Streams

Marcellus Shale Advisory Commission - February 27, 2012

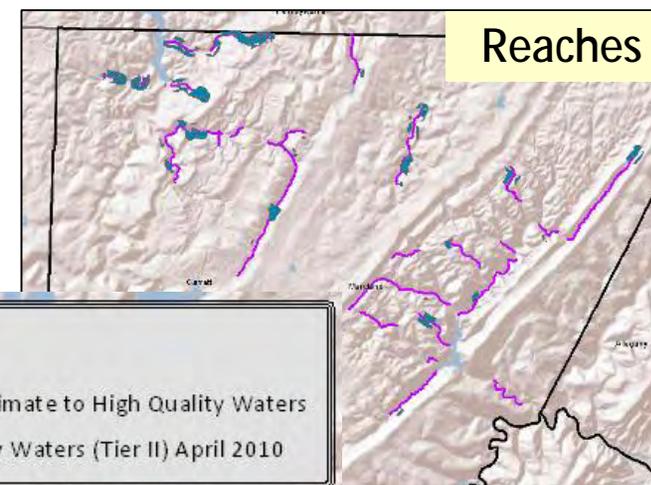


- Tier II streams are high quality streams that have healthy biological communities of fish and aquatic insects
- Maryland is required by the Clean Water Act to protect and maintain these existing high quality streams
- Garrett County has a high number of Tier II streams

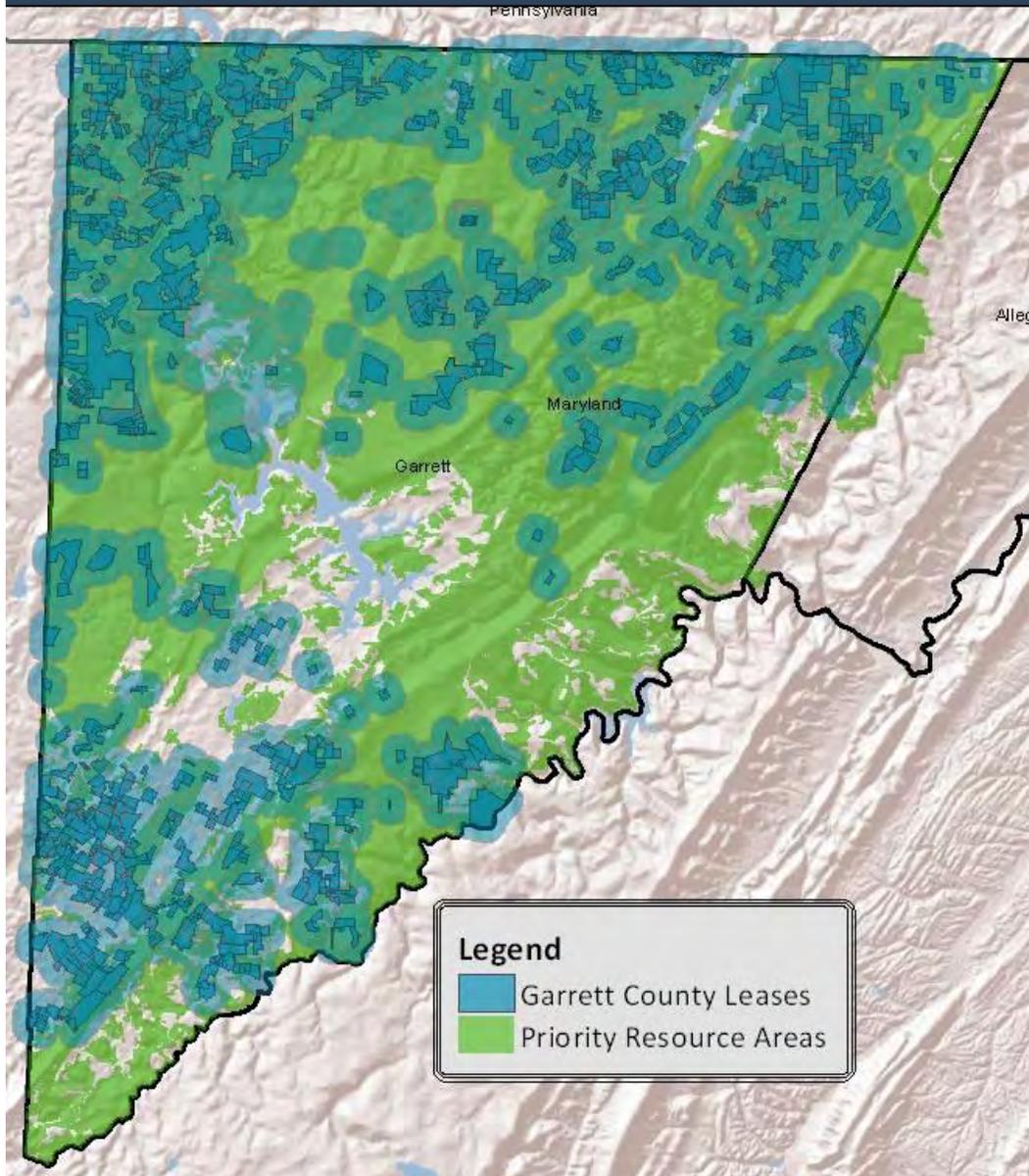
Ecological Resources: High Quality Streams



- Direct impact: Well sites may directly impact 1,802 acres in Tier II catchments. They may also affect approximately 22 of 33 Tier II stream reaches in the County.
- Associated Impact: Each well pad may affect 640 acres in its catchment. This translates to more than 105,585 of 163,019 (65%) total acres of the Tier II catchments potentially being impacted.



Leased Acres & Landscape and Ecological Resource Areas



Summary:

- More than 350,000 acres of Garrett County have at least one priority resource area designation
- Less than 10% of the leased areas do not overlap with any of these areas
- When associated fragmentation and catchment impacts are considered, the impact is even greater.

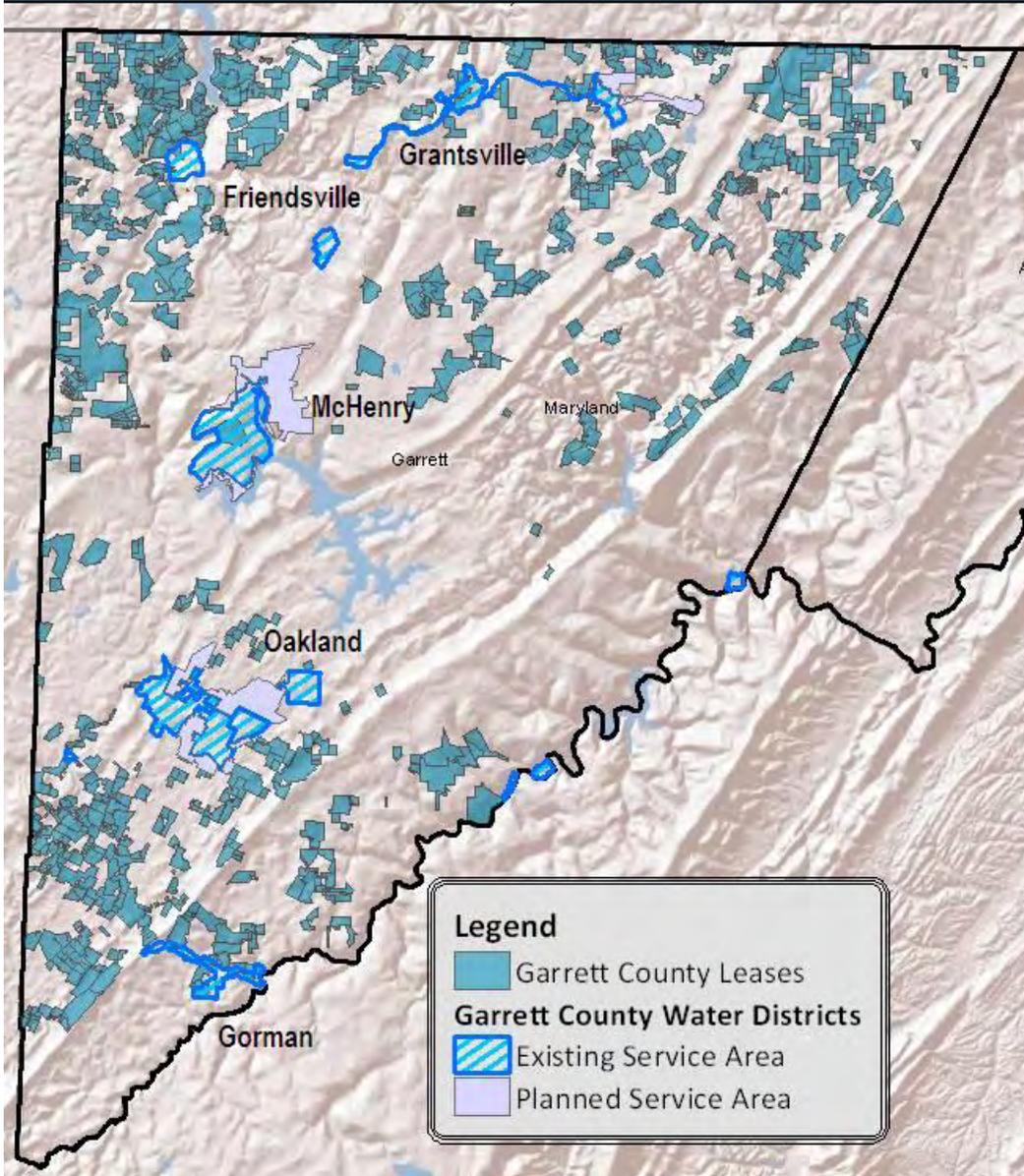
Water Supply

- All eight incorporated municipalities in Garret County offer public water and sewer - some from surface water, some from groundwater

*Accident, Deer Park, Friendsville,
Grantsville, Kitzmiller, Loch Lynn Heights,
Mountain Lake Park, Oakland*

-
- Remaining homes are serviced by wells
 - The average well depth is approximately 200 feet but may range between 60–80 feet and 1,000 feet deep

Water Supply: Public Service Areas

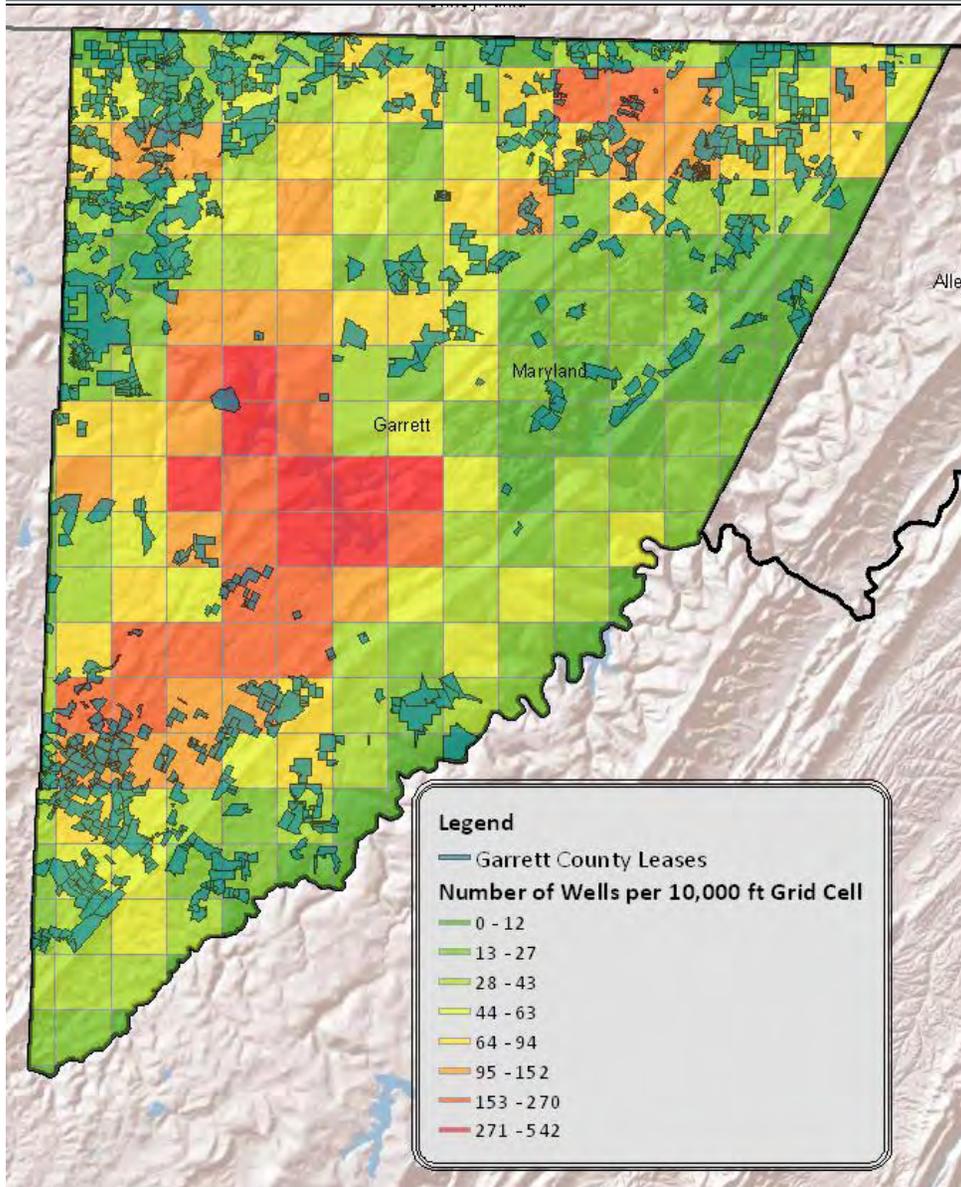


Direct impacts of lease development could potentially affect public water service areas in the following municipalities:

- Friendsville: ~55 acres or 8% Surface water, Youghiogheny River
- Grantsville: ~328 acres or 16%
- McHenry: ~398 acres or 7%
- Gorman: ~200 acres or 22%

These estimates includes both existing and proposed service areas for these municipalities

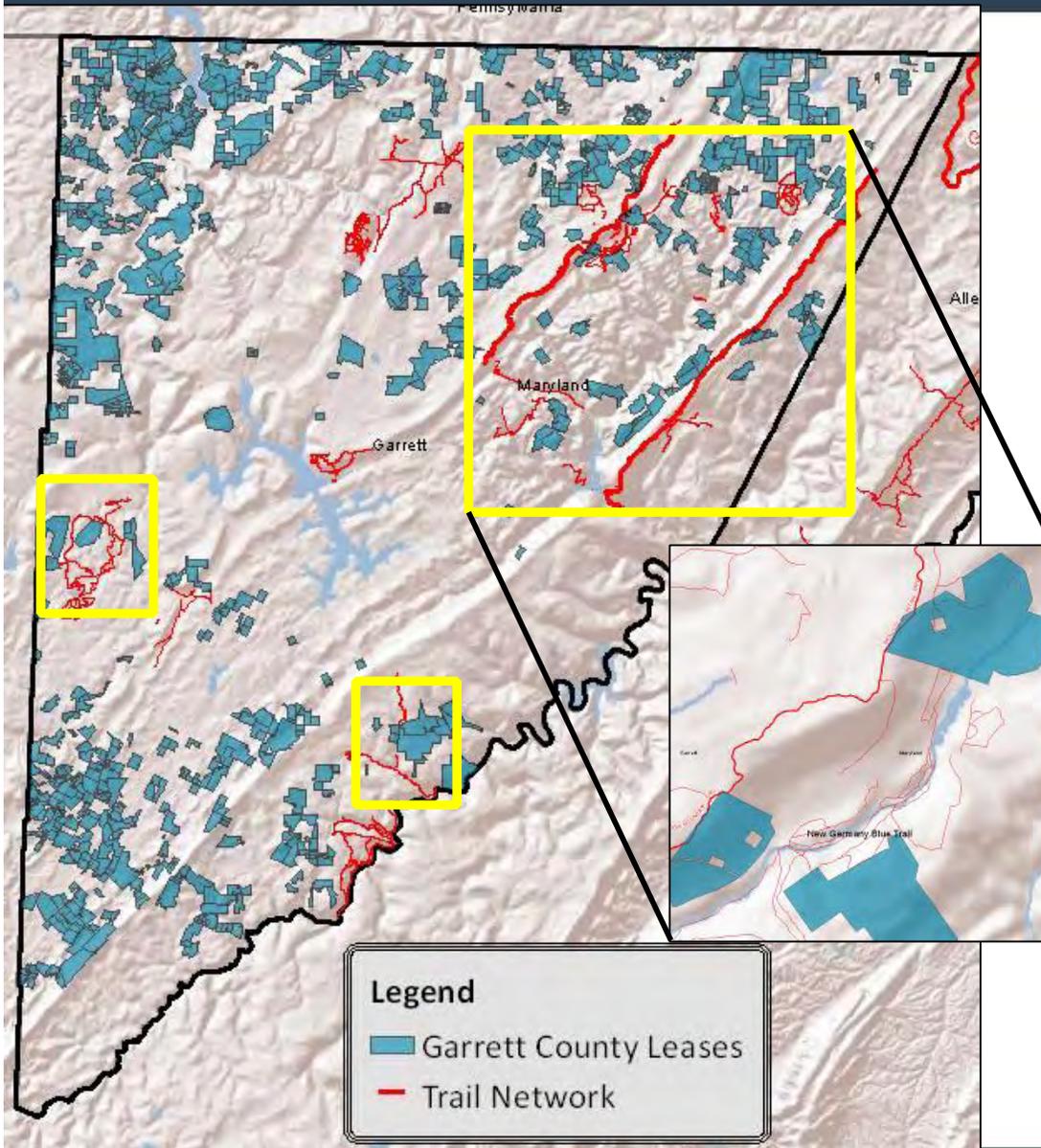
Water Supply: Private Well Concentrations



- Private wells are concentrated most heavily around McHenry, Grantsville and Oakland
- 14,264 well location records are currently available in Garrett County¹
- Approximately 8,250, or 58%, of these well records occur in grid cells that contain Marcellus shale gas leases

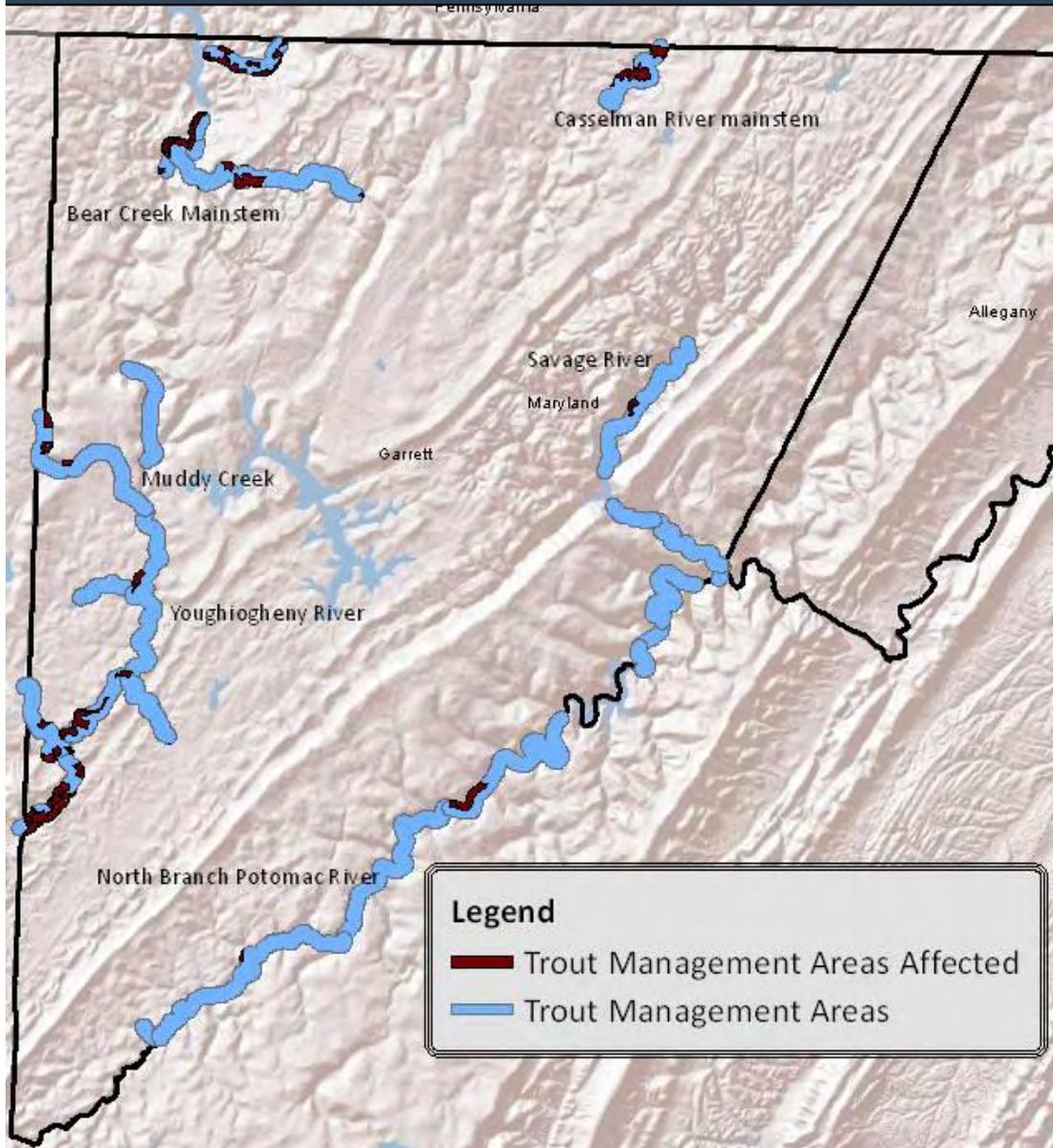
¹Maryland Geological Survey & MDE records

Recreation & Visual Impacts: Trail Networks



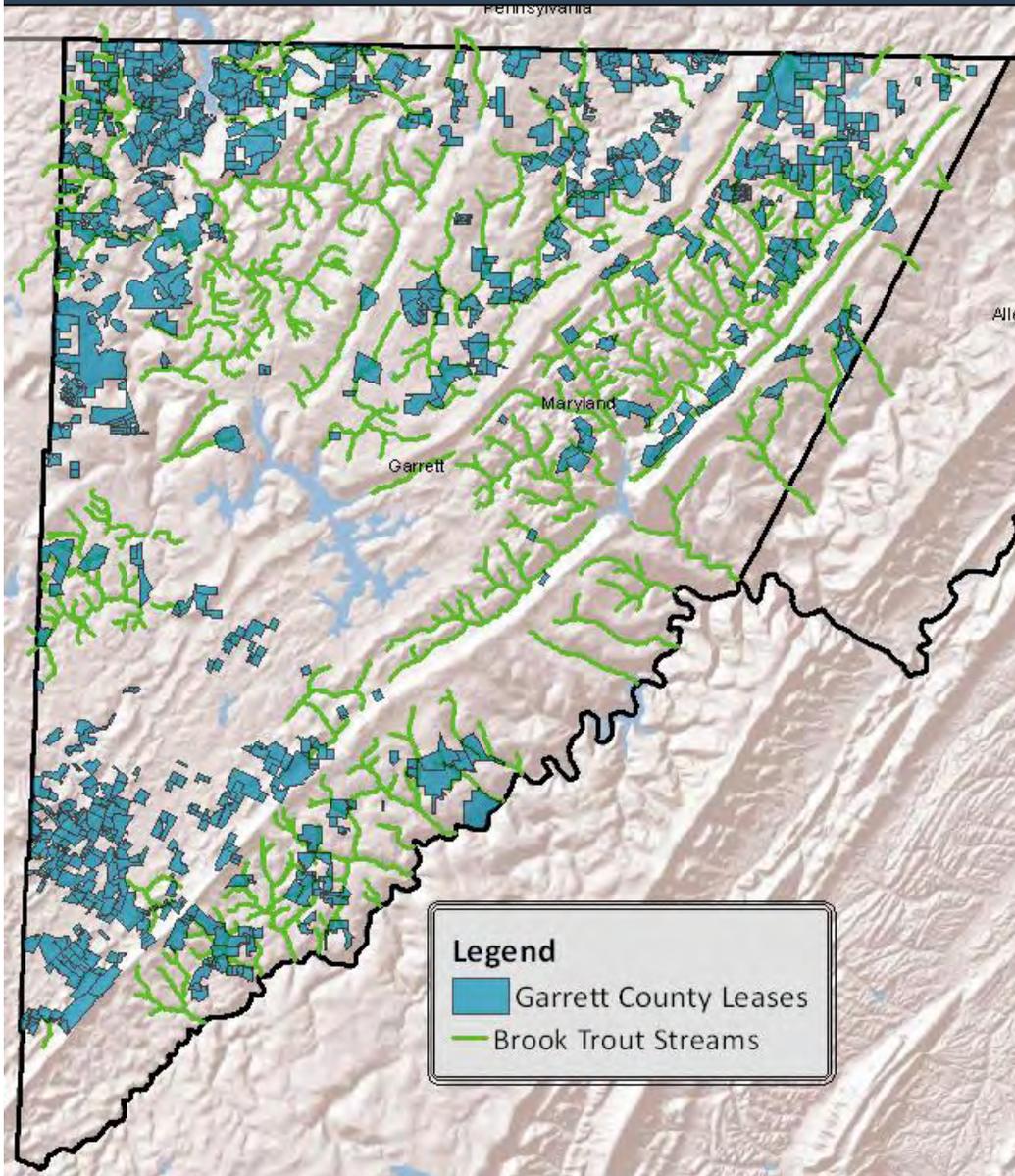
- A number of hiking and snowmobile trails may be bisected by lease development
- The Savage River State Forest trail network is most likely to be affected

Recreation & Visual Impacts: Trout Streams



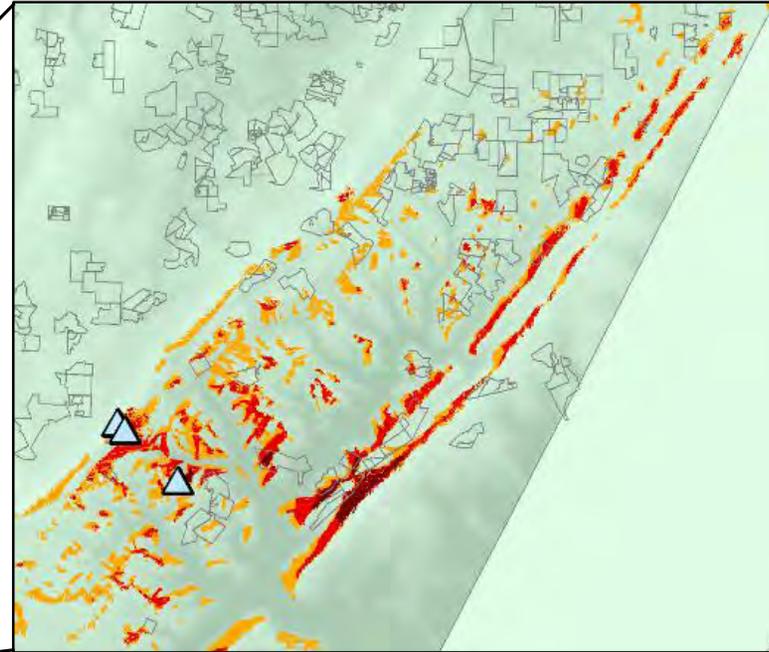
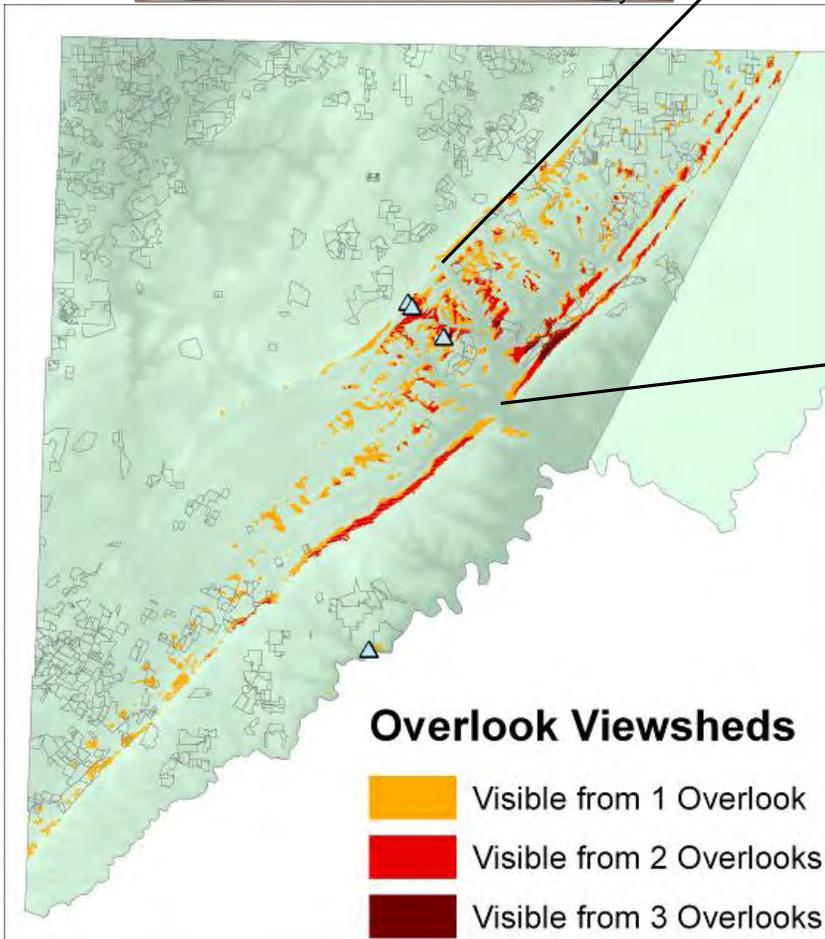
- Direct impact: Shale gas development on nearly 1 of every 4 leases and an associated 22,000+ acres may affect access to or quality of key trout fishing areas and brook trout streams. These areas are put & take, trophy trout, delayed harvest or catch & release areas and habitat for Maryland's only native salmonid.
- Associated Impact: Changes in the surrounding landscape and impacts to the catchments of nearby leases may alter the water quality that support these high-quality, coldwater streams.

Recreation & Visual Impacts: Trout Streams



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Recreation & Visual Impacts: State Forest Overlooks



- Five state forest overlooks in Garrett County
- Rigs may stand 20 feet above forest and be visible for miles
- Development on approximately 20 leases would impact skylines

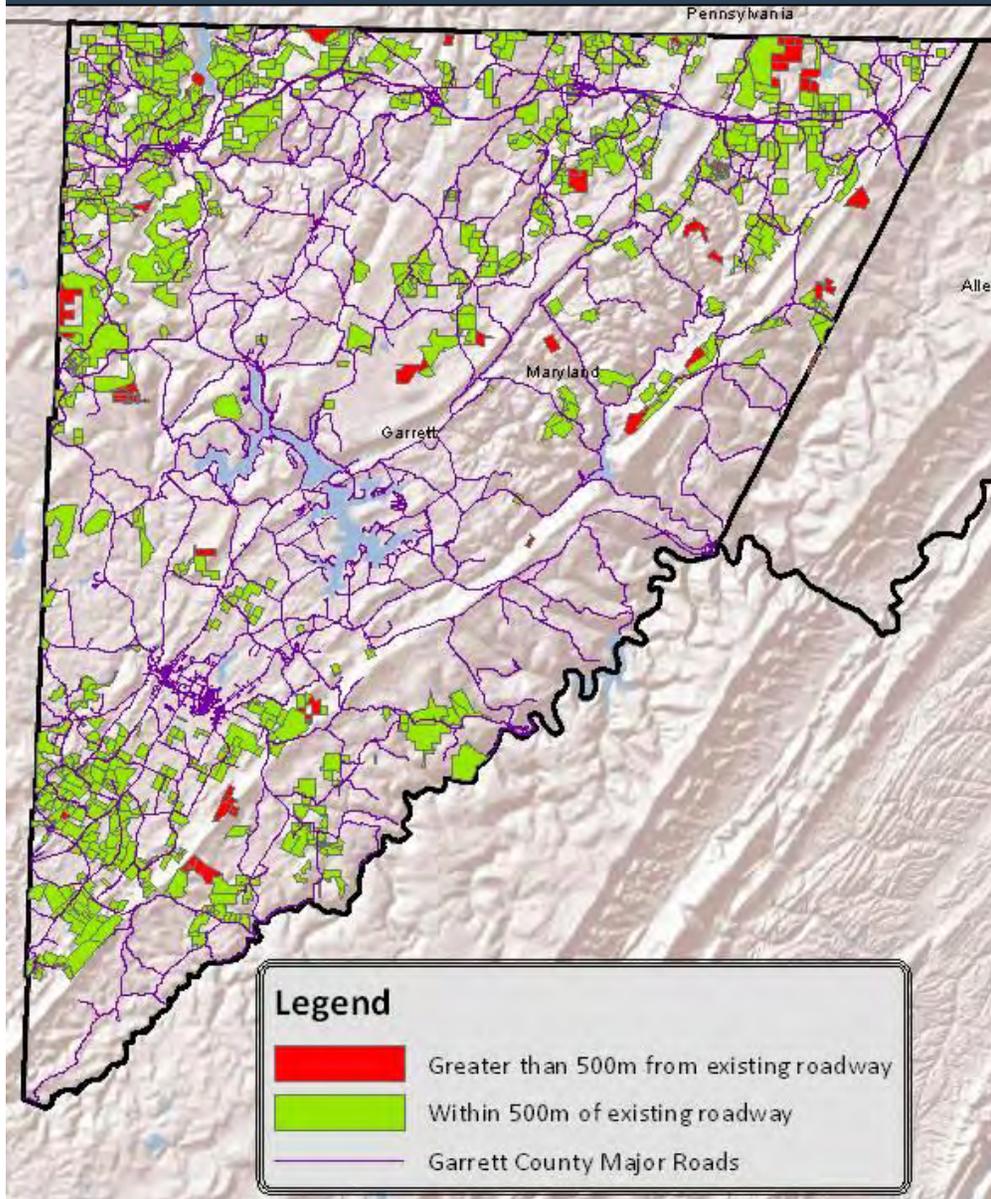
Pipelines & Roads: Distribution and Public Safety

- Proximity of well sites to existing road and pipeline infrastructure affects the potential impacts to natural resources



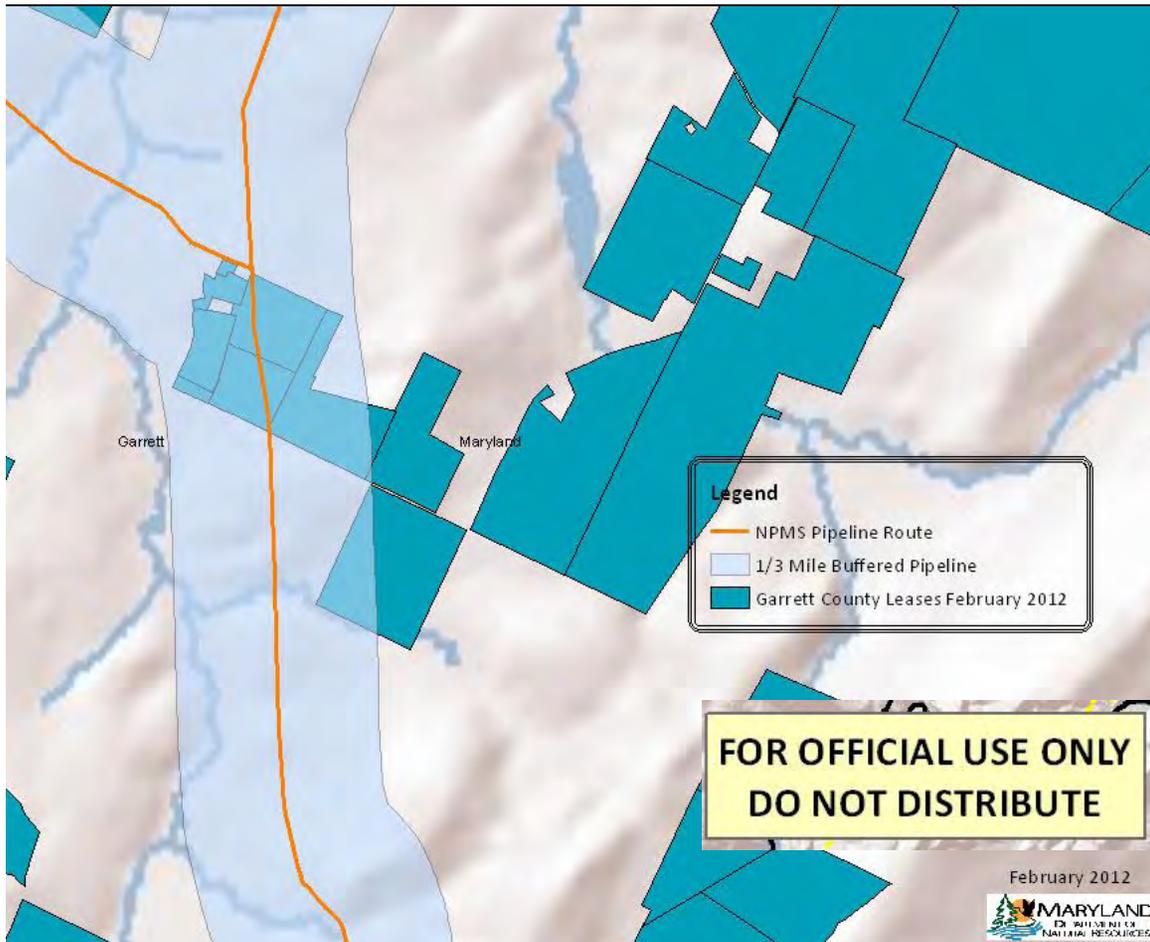
- Increase in truck traffic due to operations and distribution of gas and wastewater affects public safety

Pipelines & Roads: Lease Road Accessibility



- Majority of existing lease areas within 1/3 mile of an existing public road
- The proximity of a lease to existing roads reduces associated resource impacts by utilizing existing road infrastructure

Pipelines & Roads: Proximity to Existing Pipelines



Gas transmission and hazardous liquid pipelines

- 106 leases, or 9%, intersect with existing pipelines over 132 miles.
- 405 leases, or 33%, are located within 1/3 mile of an existing transmission pipeline

Source Data:

Garrett County Economic Development leases February 2012

National Pipeline Mapping System (NPMS) – For Official Use Only

Scale = 1:20,000



Marcellus Shale Resource Analysis

- 1) To compile and organize data, information and feedback to help identify areas of high use and/or natural resource overlap where Marcellus shale gas development leasing activities are concentrated
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Questions?

