Impacts of Leasing Additional State Forest for Natural Gas Development
DCNR is entrusted to balance the uses and values of our state forests while protecting the integrity and health of the whole system.

There are proposals and public debate about the merits of a moratorium on natural gas drilling on state forest.

This mapping analysis demonstrates how any additional leasing involving surface disturbance upsets the sustainable balance DCNR is charged to maintain.
The State Forest System in Northcentral PA (shown in green) is home to a diverse assemblage of plant and animal species. As part of its mission, the Bureau of Forestry must maintain biological diversity, provide plant and animal habitat, protect & conserve native wild plants, and analyze impact to the forest’s ecological integrity in order to utilize mineral resources in an environmentally sound manner.
“The mission of the Bureau of Forestry is to ensure the long-term health, viability, and productivity of the Commonwealth's forests and to conserve native wild plants.”

“Managing state forests under sound ecosystem management, to retain their wild character and maintain biological diversity while providing pure water, opportunities for low-density recreation, habitats for forest plants and animals, sustained yields of quality timber, and environmentally sound utilization of mineral resources. Protecting forestlands, public and private, from damage and/or destruction by fires, insects, diseases and other agents. Promoting forestry and the knowledge of forestry by advising and assisting other government agencies, communities, landowners, forest industry, and the general public in the wise stewardship and utilization of forest resources. Protecting and managing native wild flora resources by determining status, classifying, and conserving native wild plants.”
Maintaining the Forest’s Ecological Integrity

Species of Concern
- Native Biological Diversity
- Rare / Declining Spp.

Unique Areas
- Wild & Natural Areas
- Steep, Wet, & Rocky Areas
- Old Growth
- Wild Plant Sanctuaries

Road, Trail, & Stream Buffers
- Aesthetics / Scenery
- Corridors
- Connectivity
- Water Quality

Legend
- DCNR Gas Lease
- Severed Rights
- Ecologically Sensitive
- Other State Forest

Outside the Marcellus Shale Formation

1,500,000 acres
- 700,000 acres
- 702,500 acres
- 97,500 acres

State Forest Land in the Marcellus Shale Region
State Forest Land Currently Leased or Severed
Unleased Land in Ecologically Sensitive Areas
Inaccessible w/o Damaging Ecologically Sensitive Areas

McKean
Potter
Tioga
Bradford
Clearfield
Centre
Cameron
Elk
Lycoming
Sullivan
Outside the Marcellus Shale Formation
Maintaining the Forest’s Ecological Integrity

Not all state forest land is subject to natural gas development. The land outside the Marcellus Shale Formation region is cross-hatched in gray.
Maintaining the Forest’s Ecological Integrity

Much of the State Forest System has already been leased for natural gas. These areas are shown in dark blue.
DCNR does not own mineral rights to approximately 15% of State Forest Land. These acres are unavailable for leasing and are shown in light blue. Although these areas are not available for leasing, they are subject to natural gas development by the private owners who own the subsurface rights.
Maintaining the Forest’s Ecological Integrity

Not all areas are appropriate for natural gas development. The ecologically sensitive areas shown in red are not appropriate for gas development because they contain unique species or features that contribute to native biological diversity or contain rare, threatened, endangered, or declining species.
A series of unique areas have been added in red to the map. These ecologically sensitive areas include wild & natural areas, old growth, wild plant sanctuaries, or steep, wet, and rocky areas. They are also not appropriate for natural gas development.
Maintaining the Forest’s Ecological Integrity

• Species of Concern
• Unique Area
• Road, Trail, & Stream Buffers

Road, trail, and stream buffers are added in red to the map. These ecologically sensitive areas protect water quality, provide wildlife travel corridors, are managed for aesthetics / scenery, and provide habitat connectivity. As such, they are not appropriate for gas development.
Maintaining the Forest’s Ecological Integrity

The remaining fragments of green areas are small in size and intertwined with ecologically sensitive areas – they cannot be developed for gas without crossing and damaging ecologically sensitive areas.
Maintaining the Forest’s Wild Character

Legend
- DCNR Gas Lease
- Severed Rights
- Semi-Developed
- Semi-Primitive
- Off Limits (Primitive)

- Peace, Solitude, Remoteness, Backland Experience - Non-Motorized Recreation
  - Primitive Zones
    - 298,093 acres
- Moderate Probability of Experiencing Solitude - Limited Timber & Gas Activities
  - Semi-Primitive Zones
    - 412,806 acres
- Commonly Encounter Other Recreationists - Motorized Recreation - Timber & Gas Activities
  - Semi-Developed Zones
    - 706,412 acres

Outside the Marcellus Shale Formation

State Forest Land in the Marcellus Shale Formation*

*Delaware State Forest not included.
Maintaining the Forest’s Wild Character

Pennsylvania’s State Forest System contains some of the most remote and wild forest in the Mid Atlantic Region. The largest and most remote areas are found within the Marcellus Shale Formation in the Northcentral portion of the state (shown in green above). Part of the Bureau of Forestry’s mission is to retain this wild character within the forest.
Much of the State Forest System has already been leased for Natural Gas (shown in dark blue). DCNR does not own mineral rights to approximately 15% of State Forest Land. These acres are unavailable for leasing and are shown in light blue. Although these areas are not available for leasing, they are subject to natural gas development by the private owners who own the subsurface rights.
Maintaining the Forest’s Wild Character

The most primitive and undeveloped areas of the State Forest are shown in red above. DCNR has designated these areas as off limits to drilling because they provide peace, solitude, remoteness, and backland experiences for recreation.
Semi-Primitive areas are shown in orange. These areas are moderately remote and contain limited timber and gas activities, but still contribute to the wild characteristics of the forest. Gas development in Semi-Primitive areas can shrink or destroy Primitive areas that are nearby or adjacent.
Maintaining the Forest’s Wild Character

The remaining lands that are not Primitive or Semi-Primitive are shown in dark green as Semi-Developed. Encounters with other recreationists, motorized activity, as well as timber and gas activities can be expected here. However, gas development in these areas will shrink or destroy Primitive or Semi-Primitive areas that are nearby or adjacent.
Impacts on the Wild Character

The next series of slides models change to the forest’s wild character as a result of natural gas development on State Forest land.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Min Size</th>
<th>Remoteness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primitive</td>
<td>500 ac</td>
<td>½ Mile</td>
</tr>
<tr>
<td>Semi-Primitive</td>
<td>250 ac</td>
<td>¼ Mile</td>
</tr>
<tr>
<td>Semi-Developed</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>
An estimated 54 new well pads could be developed within the next 5-10 years in this ~65,000 acre landscape view.

Estimated well pad locations are shown in blue diamonds.
Wild Character before Well Pads

Today’s Wild Character

RED = Primitive
ORANGE = Semi-Primitive
GREEN = Semi-Developed
New Access Roads Required

New Roads to Access Well Pads
Forest’s Wild Character with New Well Pads

Future Wild Character
(result of gas development)

RED = Primitive
ORANGE = Semi-Primitive
GREEN = Semi-Developed
Impact on the Forest’s Wild Character

Change to the wild character of the forest as a result of gas development. Today’s (current) wild character is overlaid with dashed lines. Significant decreases in Primitive (red) and Semi-Primitive (orange) are observed. There is a dramatic increase in semi-developed (green) areas.
The only two remaining primitive areas are labeled, and they are found to be Natural Areas. Slight modification to the roads and well pad site location around the Reynolds Spring Area could have easily destroyed this Primitive Area as a narrow strip of red is all that holds it together.
Change in the Forest’s Wild Character

In this ~65,000 acre landscape view, with 54 new well pads...

<table>
<thead>
<tr>
<th>Zone</th>
<th>Net Gain/Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primitive</td>
<td>-8,171</td>
</tr>
<tr>
<td>Semi-Primitive</td>
<td>-5,374</td>
</tr>
<tr>
<td>Semi-Developed</td>
<td>13,545</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Zone</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primitive</td>
<td>10,179</td>
</tr>
<tr>
<td>Semi-Primitive</td>
<td>21,852</td>
</tr>
<tr>
<td>Semi-Developed</td>
<td>32,493</td>
</tr>
<tr>
<td>Primitive</td>
<td>16,478</td>
</tr>
<tr>
<td>Semi-Primitive</td>
<td>46,037</td>
</tr>
<tr>
<td>Semi-Developed</td>
<td>2,008</td>
</tr>
</tbody>
</table>
Modeling Change in the Forest’s Wild Character

Before After

Additional Natural Gas Development Involving Surface Disturbance would Significantly Damage the Wild Character of the State Forest

In this ~65,000 acre landscape view, with 54 new well pads…

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<th>Zone</th>
<th>Net Gain/Loss</th>
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32,493 Acres
10,179 Acres
21,852 Acres

16,478 Acres
46,037 Acres

2,008 Acres
Private Land Impacts

Gas development on surrounding private land also has a lasting impact on the state forest’s wild character.
Maintaining the Forest’s Wild Character

The red points are private land Marcellus Shale well permits issued in 2008.

Private Land Impacts
Maintaining the Forest’s Wild Character

The blue points are private land Marcellus Shale well permits issued in 2009.
The purple points are private land Marcellus Shale well permits issued in 2010.
The brown lines show major pipelines. Marcellus Shale permit activity is forming a pattern that concentrates around existing pipeline infrastructure.
Gas development on private lands is already surrounding the state forest in some areas causing an uncompensated, lasting change on the forest's wild character.
Marcellus well permits on State Forest Land (SFL) are added in orange on the map. This depicts cumulative impacts across all lands (both state and private).
A joint effort conducted by The Nature Conservancy and The Western Pennsylvania Conservancy evaluated contiguous patches of forestland in the Commonwealth. Some of their results, which identify high-quality patches of large, intact forests and their supporting landscapes, are found on State Forest Land in the Marcellus Shale region.
Much of the State Forest System has already been leased for Natural Gas (shown in dark blue). DCNR does not own mineral rights to approximately 15% of State Forest Land. These acres are unavailable for leasing and are shown in light blue. Although these areas are not available for leasing, they are subject to natural gas development by the private owners who own the subsurface rights.
The red areas added to this map show priority forest patches identified through the Forest Conservation Analysis conducted jointly by The Nature Conservancy and The Western Pennsylvania Conservancy. These areas identify high-quality patches of large intact forest and their supporting landscapes. They represent priority forest conservation areas. As such, they are not appropriate for natural gas development.
Cumulative Assessment & Impacts

The Forest’s Ecological Integrity

The Forest’s Wild Character

Existing Leases & Severed Rights

TNC-WPC Forest Patches

Mapping Today’s Wild Character

Additional Natural Gas Development would Significantly Damage the Wild Character of the State Forest

Modeling Gas Development Impacts

Surrounded by Private Land Impacts

DCNR Gas Lease
Severed Rights
Ecologically Sensitive Areas
- Species of Concern
- Unique Areas
- Road, Trail, & Stream Buffers
Inaccessible w/o Damaging Sensitive Areas
Let's now step back and take a bigger picture look among all the analyses shown – existing leases, severed rights, the forest’s wild character, ecological considerations, and the conservancy’s priority forest patches.
Much of the State Forest System has already been leased for Natural Gas. These areas are shown in dark blue.
DCNR does not own mineral rights to approximately 15% of State Forest Land. These acres are unavailable for leasing and are shown in light blue. Although these areas are not available for leasing, they are subject to natural gas development by the private owners who own the subsurface rights.
When we add the areas that are ecologically sensitive (red)…
Cumulative Assessment & Impacts

DCNR Gas Lease
Severed Rights
Ecologically Sensitive Areas
Primitive Areas

...along with Primitive areas (added in red)...

Legend:
- DCNR Gas Lease
- Severed Rights
- Ecologically Sensitive Areas
- Primitive Areas
Cumulative Assessment & Impacts

DCNR Gas Lease
Severed Rights
Ecologically Sensitive Areas
Primitive Areas
TNC-WPC Forest Patches

…and Priority Forest Patches (added in red) identified by The Nature Conservancy and The Western Pennsylvania Conservancy…
Cumulative Assessment & Impacts

...and consider the impacts from surrounding private lands (added to the map in black diamonds are Marcellus well permits from 2008-2010)...
…we’re left with small, fragmented areas (shown in green) that are not accessible for gas development without crossing and damaging the forest’s wild character or ecological integrity.
There are **zero** State Forest Land acres suitable for gas leasing involving surface disturbance.

### Land Use

<table>
<thead>
<tr>
<th>Acres</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,500,000</td>
<td>in the marcellus shale region</td>
</tr>
<tr>
<td>-700,000</td>
<td>currently under lease / severed rights</td>
</tr>
<tr>
<td>-702,500</td>
<td>unleased in ecologically sensitive areas</td>
</tr>
<tr>
<td>97,500</td>
<td>additional Primitive land</td>
</tr>
<tr>
<td>-27,500</td>
<td>additional TNC-WPC forest patches</td>
</tr>
<tr>
<td>70,000</td>
<td></td>
</tr>
<tr>
<td>-49,600</td>
<td>inaccessible w/o damaging sensitive areas</td>
</tr>
<tr>
<td>20,400</td>
<td></td>
</tr>
<tr>
<td>-20,400</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
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</tbody>
</table>