SPEAKING FOR THE TREES: PREVENTING FOREST FRAGMENTATION IN PENNSYLVANIA'S MARCELLUS SHALE REGION THROUGH PIPELINE SITING

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INTRODUCTION

As the epicenter of the Marcellus gas region, Pennsylvania has seen a "boom in exploration" since 2008.[1] While the hydro-fracturing industry continues to grow, its environmental effects remain in question. The infrastructure required, including well pads, access roads, pipelines and other structures, raises a number of environmental concerns. Constructing

1. Michael Morris, *Buyer's Remorse over Your Pennsylvania Gas Lease? The Pennsylvania Supreme Court Upholds Meager Royalty Payments and Protects the Profitability of Marcellus Gas Drilling in* Kilmer v. Elexco Land Services, Inc., 23 VILL. ENVTL. L.J. 25, 25 (2012).

these requires clearing areas of trees, thereby dividing the forest landscape. This leads to forest fragmentation, defined as "the process of breaking up large patches of forest into smaller pieces."[2] If Pennsylvania continues to develop this industry without fully assessing the impacts, it risks lasting damage to its forests. Though all Marcellus infrastructure impacts the forest, state regulation subjects pipelines in particular to relaxed standards. Moving forward, Pennsylvania needs a thorough pipeline siting process, which adequately addresses forest fragmentation.

I. PENNSYLVANIA'S MARCELLUS SHALE DEPOSIT AND ITS DEVELOPMENT

Pennsylvania has a history favoring natural resource extraction. The Marcellus development continues this tradition. The Commonwealth has already seen Drake Well, which launched the modern petroleum industry,[3] and an expansive coal industry. Coal's legacy in Pennsylvania shows the importance of fully understanding environmental impacts before expansive development. Since Pennsylvania lacked "the technology or knowledge to anticipate the lasting environmental impact," it has invested nearly 500 million dollars in remediating the damage caused by the coal industry, including polluting 2,400 miles of streams.[4] These costs have only continued to grow since 1967.[5] In February 2014, Pennsylvania received 52 million dollars to clean abandoned mine sites and possibly address mine fires.[6] The coal industry has created dangerous conditions for the environment and citizens.[7] This not only includes the polluted streams, but also underground mine fires and open shafts.[8] Pennsylvania should avoid

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2. Leah Gainey, *Fragmentation Leaves 70% of Forests Within 1km of Human Interaction*, CELESTIAL GREEN VENTURES (Mar. 24, 2015), http://www.celestialgreenventures.com/biodiversity/fragmentation-leaves-70-of-forests-within-1km-of-human-interaction/ [https://perma.cc/Y8CV-FWMD]; *see also Forest Fragmentation*, CHESAPEAKE BAY PROGRAM GLOSSARY, http://www.chesapeakebay.net/glossary [https://perma.cc/5YD2-H8BD] (defining forest fragmentation as "a form of habitat fragmentation occurring when large patches of forest are cut down in a manner that leaves smaller patches of trees standing") (last visited Feb. 8, 2016).

3. John A. Harper, *Why the Drake Well?*, *in* 29 PA. GEOLOGY 2 (1998), http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_006821.pdf [https://perma.cc/8K7F-NN8K].

4. Kristen Allen, *The Big Fracking Deal: Marcellus Shale – Pennsylvania's Untapped Resource*, 23 VILL. ENVTL. L.J. 51, 51–52 (2012).

5. *Id.*

6. *Casey: PA to Receive over $52M to Clean up Abandoned Coal Mines, Funds Could Aid in Mine Fires in Northeastern PA*, ROBERT P. CASEY, JR. U.S. SENATOR FOR PA., (Feb. 25, 2014), http://www.casey.senate.gov/newsroom/releases/casey-pa-to-receive-over-52m_to-clean-up-abandoned-coal-mines-funds-could-aid-mine-fires-in-northeastern-pa [https://perma.cc/Q53U-6X8Z].

7. *Id.*

8. *See Bureau of Abandoned Mine Reclamation,* PA. DEP'T OF ENVTL. PROT., http://www.portal.state.pa.us/portal/server.pt/community/abandoned_mine_reclamation/13961 [https://perma.cc/EN89-H9PZ] (last visited Feb. 4, 2016).

making similar mistakes with the Marcellus shale industry, which continues to expand.

The Marcellus shale region, "the largest known shale deposit in the world," encompasses a number of states.[9] It runs from New York to Virginia and from Pennsylvania to Ohio[10] and contains an estimated 489 trillion cubic feet of natural gas.[11] In New York and Pennsylvania, the oil and gas industry discovered this deposit in the 1930s.[12] However, the industry only recently developed the necessary technology to efficiently reach the Marcellus layer.[13] This layer sits about 5,000 to 8,500 feet, or about a mile to a mile and a half, below the ground.[14] In addition, the market demand for natural gas has increased and Pennsylvania's deposit now is worth an estimated 500 billion dollars.[15] Given its newfound appeal, in 2003 a Texas company, Range Resources, extracted the first Marcellus natural gas from Pennsylvania's Washington County.[16] Since then, the industry continued expanding, eventually reaching its boom in 2008. Pennsylvania has seen development both on private and public land, including the state forest system.

Each year since 2009, the Pennsylvania Department of Environmental Protection ("DEP") has issued a report of the number of wells permitted and drilled. In the last two years, both numbers far exceeded over a thousand new wells. In 2014, Pennsylvania permitted 3,204 wells and the natural gas companies drilled 1,374.[17] According to a DEP database,

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9. TIMOTHY CONSIDINE ET AL., AN EMERGING GIANT: PROSPECTS AND ECONOMIC IMPACTS OF DEVELOPING THE MARCELLUS SHALE NATURAL GAS PLAY 2 (2009), http://www.personal.psu.edu/mgj2/blogs/paforest/EconomicImpactsofDevelopingMarcellus.pdf [https://perma.cc/JR7T-NZVV].

10. *Id.*

11. Morris, *supra* note 1, at 25.

12. John A. Harper, *The Marcellus Shale – An Old "New" Gas Reservoir in Pennsylvania*, 38 PA. GEOLOGY 2, 3 (2008), http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_006811.pdf [https://perma.cc/2UGH-2MCK].

13. Allen, *supra* note 4, at 54.

14. PA. DEP'T OF ENVTL. PROT., MARCELLUS SHALE DEVELOPMENT: FACTSHEET, (Nov 2015), http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-109791/8100-FS-DEP4217.pdf [https://perma.cc/997V-N5BT].

15. Allen, *supra* note 4, at 52.

16. Harper, *supra* note 12, at 9.

17. *See* DEP OFFICE OF OIL AND GAS MANAGEMENT: YEAR TO DATE PERMITS ISSUED BY WELL TYPE, PA. DEP'T OF ENVTL. PROT., http://www.depreportingservices.state.pa.us/ReportServer/Pages/ReportViewer.aspx?/Oil_Gas/Permits_Issued_Count_by_Well_Type_YTD [https://perma.cc/E98W-W3JU] (last visited Mar. 7, 2016) (to generate report input start date of Jan. 1, 2014 and end date Dec. 31, 2014 and select Unconventional Wells Only) (on file with the Vermont Journal of Environmental Law).

between January 2000 and December 2014, 8,816 wells were drilled in the state.[18]

Additionally, the Commonwealth has agreed to a number of leases, including some in state forests. These leases span about 369,914 acres[19] and the Department of Conservation and Natural Resources ("DCNR") reports that the state has leased 138,866 acres of state forestlands.[20] This expansive production has made Pennsylvania one of the nation's leading natural gas producers.[21]

The U.S. Energy Information Administration's ("EIA") reports for the years 2011 and 2012 shows the likelihood that Pennsylvania will continue to extract natural gas for a number of years. The EIA reported that Pennsylvania production levels rose by 72 percent from 2011 to 2012, making it the third-highest producer among the states and likely to become the second-highest once 2012 through 2013 figures are released.[22] The production growth will likely continue as natural gas demand continues to rise. The EIA predicts that by 2040 natural gas will be a leading source of electricity in the United States.[23] Given this prediction and the rising production levels, it seems that Pennsylvania will only continue to develop, leasing new lands and granting new well permits. For this reason, the Commonwealth must seriously address the potential environmental impacts of the Marcellus development, including forest fragmentation.

II. FOREST FRAGMENTATION

Forest fragmentation is just one of the many environmental criticisms the Marcellus shale industry has faced. The United States Geological Survey ("USGS") defines fragmentation as occurring "when large areas of natural landscapes are intersected and subdivided by other, usually

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18. *See* DEP OFFICE OF OIL AND GAS MANAGEMENT: WELLS DRILLED BY COUNTY, PA. DEP'T OF ENVTL. PROT., http://www.depreportingservices.state.pa.us/ReportServer/Pages/ReportViewer.aspx?/Oil_Gas/Wells_Drilled_By_County [https://perma.cc/LG9X-KBRA] (last visited Mar. 7, 2016) (to generate report input start date of Jan. 1, 2000 and end date of Dec. 31, 2014) (on file with the Vermont Journal of Environmental Law).

19. PA. DEP'T OF CONSERVATION & NAT. RES., NATURAL GAS DEVELOPMENT AND STATE FORESTS 1 (2014), http://dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_20029363.pdf [https://perma.cc/335A-UNAF].

20. *Id.*

21. Mike Kopalek, *Pennsylvania Is the Fastest-Growing Natural Gas-Producing State*, U.S. ENERGY INFO. ADMIN. (Dec. 17, 2013), http://www.eia.gov/todayinenergy/detail.cfm?id=14231 [https://perma.cc/8VMM-B5RS].

22. *Id.*

23. U.S. ENERGY INFO. ADMIN., ANNUAL ENERGY OUTLOOK 2015 (2015), http://www.eia.gov/forecasts/aeo/pdf/0383(2015).pdf [https://perma.cc/TK38-KNKA].

anthropogenic, land uses leaving smaller patches to serve as habitat for various species."[24] Fragmentation of eastern forests has accelerated a decline in forest habitat that began in the seventeenth century.[25] Today about forty percent of eastern deciduous forests consists "of small, isolated woodlots in suburbia and farmlands."[26] Fragmentation can occur in a number of ways. Although agriculture is a prime contributor in Pennsylvania, roads, pipelines, and other developments also lead to fragmentation.[27]

Fragmentation divides the forest into different sections: the interior, or core forest, and the edge forest. Edge forest is the 300 feet or 100 meters from the border, often "interfacing with fields or suburban uses."[28] Core or interior forest includes all of the remaining forest, at least 300 feet or 100 meters from any forest edge.[29] By changing the character of large forest segments, forest fragmentation affects the environment through habitat loss, edge effects, invasive plants, and loss of connectivity.

Natural gas development in the Marcellus region can disrupt the forest habitat because it requires infrastructure such as well pads, access roads, water impoundments, and pipelines. This disrupts forest habitat and creates significantly more edge habitat. Pennsylvania should consider the potential environmental impacts of pipelines before further developing the region without law and regulations that address forest fragmentation.

A. Environmental Effects

1. Habitat Loss and Edge Effects

Adding a road, well pad, pipeline, or other structure reduces habitat for species that rely on core forest. In dividing the forest, human development increases the ratio of edge to core forest,[30] leading to "edge effects." For example, a road requires clear cutting trees, creating a forest border on each

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24. E. T. SLONECKER ET AL., U.S. GEOLOGICAL SURVEY., LANDSCAPE CONSEQUENCES OF NATURAL GAS EXTRACTION IN BRADFORD AND WASHINGTON COUNTIES, PENNSYLVANIA, 2004–2010 9 (2012), http://pubs.usgs.gov/of/2012/1154/of2012-1154.pdf [https://perma.cc/Z8NJ-ZUVB].

25. RICHARD H. YAHNER, EASTERN DECIDUOUS FOREST: ECOLOGY AND WILDLIFE CONSERVATION 89 (Milton W. Weller ed., 1995).

26. *Id.*

27. LAURIE GOODRICH ET AL., WILDLIFE HABITAT IN PENNSYLVANIA: PAST, PRESENT, AND FUTURE 1, 94 (2002), http://www.fish.state.pa.us/promo/grants/swg/nongame_plan/pa_wap_sections/appx2habitat_pt2.pdf [https://perma.cc/67QS-D9XR].

28. *Id.* at 103.

29. *Id.*

30. DAVID B. LINDENMAYER & JERRY F. FRANKLIN, CONSERVING FOREST BIODIVERSITY: A COMPREHENSIVE MULTISCALED APPROACH 26 (2002).

side of the road. This creates edge forest along the entire road, extending 300 feet from each border. Edge and core forests are different habitats that serve different purposes and support different species.[31] Additionally, an edge exposes the forest to a number of different elements, including "light, wind, humidity, and exposure to predators."[32] Beyond new predators, edge effects also allow for weeds to invade and affect the plant species distribution.[33] These changes create a different environment with new species and "microclimatic conditions," like light and wind.[34] This alters the "habitat structure,"[35] possibly the most important aspect of any habitat.

Development also affects the size of the core forest. As seen, a road or pipeline will create a new border and edge forest. As the edge forest expands, many square feet of core forest are lost. This loss of core forest affects the number and diversity of species. Certain "forest-interior species" only thrive in core forests.[36] They face a loss of habitat and increased competition as their density increases.[37] For these reasons, edge effects can have a lasting, negative impact on a large portion of forest habitat. Studies have shown that forest size affects the population and number of species present. Some studies have found that a smaller island habitat usually supported a smaller number of species than a larger island.[38] Smaller islands also supported smaller populations, therefore making a species more susceptible to decline and extinction.[39]

Though islands and landlocked forests have different environments, similar effects have been seen in forested environments. For example, in Pennsylvania, the size of the forest relates to the number of bird species present during spring migration. A larger core forest will have a greater variety of species.[40] Thus, the size of a core forest has significant impacts for the species that depend on it. In decreasing core forest, forest fragmentation can lead to fewer species with lower populations.

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31. YAHNER, *supra* note 25, at 103.
32. SLONECKER ET AL., *supra* note 24, at 10.
33. LINDENMAYER & FRANKLIN, *supra* note 31, at 26.
34. *Id.*
35. Fred L. Bunnel, *What Habitat is an Island?*, *in* FOREST FRAGMENTATION: WILDLIFE AND MANAGEMENT IMPLICATIONS 1, 22 (James A. Rochelle et al. eds., 1999).
36. L. Fahrig, *Forest Loss and Fragmentation*, *in* FOREST FRAGMENTATION: WILDLIFE AND MANAGEMENT IMPLICATIONS 87, *supra* note 36, at 91.
37. *Id.*
38. *Id.*
39. *Id.* at 104.
40. *Id.* at 110–11.

2. Invasive Species

Another threat caused by forest fragmentation is the introduction of invasive species. Since fragmentation affects the quality and conditions of habitat, it also allows for different species to survive in the edge forest.[41] This includes "pioneer or early-successional species."[42] Pioneer species create the foundation of new ecosystems when new habitats form.[43] For this reason, invasive species can significantly alter the forest habitat and negatively impact the native species.[44] They often compete and hybridize with native species, threatening biodiversity.[45] This presents one of Pennsylvania's greatest challenges to both forest health and regeneration.[46] A National Parks Service study found that invasive species have thrived in certain Pennsylvanian forests. Gettysburg National Military Park contains twenty-two percent "exotic plant species" and Valley Forge National Historic Park contains thirty-four percent.[47] This includes only plant species, but edge effects also open forests to other wildlife.[48] Forest fragmentation gives invasive species the opportunity to alter the forest ecosystem as it creates new edge forest.

3. Loss of Connectivity

When a road or well pad disrupts forest habitat, it does more than just change the habitat of that area. It also affects the connectivity between different forest habitats. Forest "[c]onnectivity exists when organisms can move freely among separate patches of habitat."[49] Fragmentation prevents connectivity for some species. For example, certain species will not cross roads.[50] This limits their movement, especially for smaller species like amphibians.[51] However, it can also limit some larger mammals who need a large forest-interior habitat. This includes animals like the black bear and

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41. YAHNER, *supra* note 25, at 103.
42. *Id.*
43. Ulrich Lüttge et al., *Evo-Devo-Eco and Ecological Stem Species: Potential Repair Systems in the Planetary Biosphere Crisis*, 74 PROGRESS IN BOTANY 191, 205 (2013).
44. YAHNER, *supra* note 25, at 117.
45. *Id.*
46. GOODRICH ET AL., *supra* note 27, at 92.
47. YAHNER, *supra* note 25, at 104.
48. ROBERT A. SMALL & DAVID J. LEWIS, U.S. DEP'T OF ARGIC., FOREST LAND CONVERSION, ECOSYSTEM SERVICES AND ECONOMIC ISSUES FOR POLICY: A REVIEW 15 (2009), http://www.fs.fed.us/openspace/fote/pnw-gtr797.pdf [https://perma.cc/T7LH-8H7V].
49. Bunnel, *supra* note 36, at 17.
50. YAHNER, *supra* note 25, at 91.
51. Samuel A. Cushman, *Effect of Habitat Loss and Fragmentation on Amphibians and Prospectus*, 128 BIOLOGICAL CONSERVATION 231, 233 (2006).

eastern wood rat.[52] Though Pennsylvania has an increasing black bear population, the wood rat's range has continued to decrease.[53] These species may also limit their movements to save energy. Because moving between different types of habitats may not provide enough benefit to justify the energy expended,[54] the lack of connection between different habitats can prevent mammals and smaller species from moving throughout the Commonwealth's forests, creating smaller isolated populations.

B. Marcellus Shale Development Causes Fragmentation

A number of different activities or types of development can cause forest fragmentation. A recent USGS study described the effect Marcellus shale drilling can have on forests:

> Although many human and natural activities result in habitat fragmentation, gas exploration and development activity can be extreme in their effect on the landscape. Numerous secondary roads and pipeline networks crisscross and subdivide habitat structure. Landscape disturbance associated with shale-gas development infrastructure directly alters habitat through loss, fragmentation, and edge effects . . . .[55]

However, since Marcellus development only took off in 2008, a detailed understanding of its environmental effects in Pennsylvania remains unknown. Fragmentation affects different species in different ways.[56] But Pennsylvania has seen negative impacts from fragmentation in other areas already.[57] Additionally, fragmentation effects are difficult to quantify because "ecological science . . . is often emerging, changing, or simply nonexistent."[58] For these reasons, few studies exist on the fragmentation effects of gas drilling in Pennsylvania. However, there is little doubt that the more general effects of fragmentation, as discussed above, will apply to the required roads, well pads, and pipelines for shale development.

Marcellus development uses a number of different infrastructures. The companies extract the gas, transport it through pipelines, store water

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52. GOODRICH ET AL., *supra* note 27, at 94.
53. *Id.*
54. Kurt H. Ritters et al., *Fragmentation of Continental United States Forests*, 5 ECOSYSTEMS 815, 816 (2002).
55. SLONECKER ET AL., *supra* note 24, at 9–10.
56. *Id.* at 10.
57. GOODRICH ET AL., *supra* note 27, at 7.
58. SMALL & LEWIS, *supra* note 49, at 25.

necessary for production nearby, and transport employees and supplies. Each natural gas well requires a well pad, water impoundments, access roads, and pipelines.[59] All of these create new forest borders and edge forest.

This presents a significant threat to Pennsylvania's wildlife. Along with habitat loss, forest fragmentation poses "the number one threat to wildlife in the state."[60] Since only certain species can thrive in edge forests, the dynamic of species has changed. Even though the state remains largely forested, less than half of this area is "'core' or interior forest" cover.[61] The Marcellus shale development is occurring as habitat continues to disappear. The Commonwealth loses approximately 300 acres of wildlife habitat daily.[62] This has placed twenty percent of the Commonwealth's species on the "special concerns lists,"[63] including "forest-interior nesting birds," such as the wood thrush and barred owl,[64] and also certain mammals, such as bobcats and fishers.[65]

Even with restoration efforts at the end of a well's production, there will likely be long-term consequences. Marcellus wells will produce for an estimated forty-five to sixty years.[66] For this reason, companies use pipelines designed to last over fifty years.[67] Even after the abandonment of a well, the Federal Energy Regulation Commission ("FERC") regulations allow the pipeline to remain in the ground, with certain maintenance requirements.[68] Pipelines may continue to contribute to forest fragmentation for years to come. Pipeline corridors will continue to divide forests, despite the fact the natural gas companies no longer use them. Restoration also faces particular challenges in Pennsylvania because of the white-tail deer population. These animals feed on shrubs and young trees, limiting the forests' ability to regrow.[69] They classify as a "keystone species" because

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59. SLONECKER ET AL., *supra* note 24, at 19.
60. GOODRICH ET AL., *supra* note 27, at 7.
61. *Id.* at 102.
62. *Id.* at 12.
63. *Id.* at 8.
64. *Id.* at 92.
65. *Id.*
66. STEPHANIE LEACH, ENVIRONMENT, ENERGY AND ECONOMY: IMPACTS OF NATURAL GAS PIPELINES IN 9 WATERSHEDS OF NORTH-CENTRAL PENNSYLVANIA 15 (2012), http://repository.upenn.edu/mes_capstones/55/ [https://perma.cc/B5CF-QD8L].
67. *Id.*
68. *See* S. M. FOLGA, NATURAL GAS PIPELINE TECHNOLOGY OVERVIEW 49 (2007), http://corridoreis.anl.gov/documents/docs/technical/APT_61034_EVS_TM_08_5.pdf [https://perma.cc/H6JJ-6KSW] ("FERC typically allows a buried pipeline that has reached the end of its service life to be internally cleaned, purged of natural gas, isolated from interconnections with other pipelines, and sealed without removing the pipe from underground.").
69. GOODRICH ET AL., *supra* note 27, at 8.

they have "a dominating influence on the composition of a community."[70] Deer in particular can "cripple a forest ecosystem," by feeding on young growth.[71] For this reason, Marcellus development could cause extended damage to the forests of Pennsylvania.

III. PIPELINE SITING

A. Regulatory Framework

Regulations for pipeline permitting and siting in Pennsylvania involve both federal and state regulations. For interstate pipelines, which run through Pennsylvania, FERC and the Department of Transportation Pipeline and Hazardous Materials Safety Administration ("PHMSA") have authority.[72] At the state level, the Pennsylvania Public Utility Commission ("PUC") has jurisdiction over intrastate pipelines.[73] Both federal and state agencies are also subject to environmental statutes.[74] However, neither the federal nor state system truly addresses the issue of forest fragmentation.

1. Federal Regulations

Pennsylvania does have a number of interstate pipelines running through the state.[75] These pipelines fall under federal regulations, which pertain mostly to safety and provide little environmental protection. Safety regulations fall under both FERC and PHMSA authority. PHMSA has authority over the transportation of hazardous materials.[76] This includes "flammable, toxic, or corrosive natural gas," including "liquefied natural gas."[77] PHMSA regulations focus on the safety of pipelines.[78] FERC also

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70. PA. GAME COMM'N, A KEYSTONE SPECIES OF THE KEYSTONE STATE (2008).

71. *Id.*

72. *Regulations*, U.S. DEP'T OF TRANSP. PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN.,http://phmsa.dot.gov/regulations [https://perma.cc/VZW5-2ZL2] (last visited Feb. 5, 2016).

73. PATRICK HENDERSON, ENERGY EXECUTIVE, OFFICE OF GOVERNOR TOM CORBETT, REPORT TO THE GENERAL ASSEMBLY ON PIPELINE PLACEMENT OF NATURAL GAS GATHERING LINES 4 (2012), http://files.dep.state.pa.us/OilGas/BOGM/BOGMPortalFiles/Act13/PipelinePlacementReport/FINAL_REPORT.pdf [https://perma.cc/BLC4-CASY].

74. *See* National Environmental Policy Act, 42 U.S.C. §§ 4331, 4332, 4334, 4335 (2014) (noting that NEPA does not affect other statutory obligations an agency may have under another environmental statute).

75. *Natural Gas Pipelines in the Northeast Region*, U.S. ENERGY INFO. ADMIN, http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/northeast.html [https://perma.cc/8ABN-XVWP] (last visited Feb. 4, 2016).

76. Applicability of Hazardous Materials Regulations, 49 C.F.R. § 171.1 (2014).

77. *Natural Gas Pipelines*, U.S. DEP'T OF TRANSP. PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN., http://www.phmsa.dot.gov/pipeline/naturalgas [https://perma.cc/J85C-YCYJ] (last

places the emphasis on safe transportation and handles the siting process for interstate pipelines. Regulations require all pipelines to apply to FERC, giving detailed project information before any construction.[79] While FERC must consider some environmental effects during this process,[80] its review does not really address forest fragmentation. Federal regulations focus on safety and therefore ignore fragmentation.

A pipeline permit given by either PHMSA or FERC does have environmental limitations under other statutes. First, the National Environmental Policy Act ("NEPA") requires an environmental review for certain federal projects. Most interstate pipelines will fall under NEPA, requiring an environmental impact statement for a "major Federal action significantly affecting the quality of the human environment."[81] This requires FERC to at least consider the environmental consequences against the costs and consider alternatives, but only provides a procedural protection.[82] This would require the agency to find that the benefit of preventing forest fragmentation outweighs the costs, and courts will give deference on these issues.[83] NEPA will require FERC to prevent forest fragmentation only when the agency finds that the solution is cost-efficient.

An interstate pipeline can also face environmental protection from other federal statutes. NEPA still requires projects to comply with other environmental statutes, most notably the Clean Water Act ("CWA") and the Endangered Species Act ("ESA").[84] The CWA provides little, if any protection for forests.[85] While the ESA could protect important forest habitat for certain species, the government has listed relatively few species. Department of Interior ("DOI") regulations promulgated under the ESA require all "Federal agencies to confer with the Secretary on any action that is likely to jeopardize the continued existence of proposed species or result

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visited Feb. 21, 2016) [hereinafter *Natural Gas Pipelines*]; *see* 49 C.F.R. § 172.101 app. A (2014) (providing a list of hazardous material regulated, including methane).

78. *Natural Gas Pipelines*, *supra* note 78.

79. 18 C.F.R. § 157.6.

80. *Id.* § 157.9.

81. 42 U.S.C. § 4432.

82. *Id.*

83. *See* Citizens to Preserve Overton Park, Inc. v. Volpe, 401 U.S. 402, 414 (1971) (explaining that courts should give deference to agency decisions that are not "arbitrary" and "capricious" under NEPA).

84. *See* National Environmental Policy Act, 42 U.S.C. § 4434; Clean Water Act, 33 U.S.C. §§ 1251–1388 (2012); Endangered Species Act, 16 U.S.C §§ 1534–1544 (2012); *see* HENDERSON, *supra* note 74, at 15 (discussing the importance of the Clean Water Act in pipeline construction).

85. *See* 33 U.S.C. § 1251 (defining the purpose of the act as protecting "the chemical, physical and biological integrity" of U.S. waters); s*ee* HENDERSON, *supra* note 74, at 15 (explaining that Pennsylvania focuses on erosion and sediment pollution when implementing the CWA).

in the destruction or adverse modification of proposed critical habitat."[86] Though this requires DOI to consider the effect of a natural gas pipeline on certain habitat, it only protects species with an already declining population. DOI must first list a species as endangered or threatened before any of the protections apply.[87] The statute works retroactively, meaning many species may receive protection after a large portion of core forest disappears. The federal government only recognized fourteen endangered or threatened species in Pennsylvania despite a number of species with declining populations.[88] Though the ESA could protect important forest habitats, DOI has only offered protection to a limited group of species within Pennsylvania.

The environmental protections offered under federal statutes provide little prevention against the negative impacts of forest fragmentation. For this reason, the State of Pennsylvania must look to its own regulations. Unfortunately, these also fail to provide adequate protection for forest habitats.

2. Pennsylvania Regulations

Before 2012, Pennsylvania and Alaska were the only two natural gas-producing states without an agency designated to monitor intrastate pipelines.[89] With Act 13 of 2012, Pennsylvania made the first substantial changes to its Oil and Gas Act since 1984.[90] Along with Act 127 of 2011, Act 13 finally gave Pennsylvania a governing body for certain pipelines used with "unconventional wells."[91] The act gave certain powers to PUC, however this only applied to a limited number of pipelines and only for safety purposes.[92]

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86. 50 C.F.R. § 402.01 (2014).

87. 16 U.S.C. § 1533.

88. *See PNHP Species List*, PA. NATURAL HERITAGE PROGRAM, http://www.naturalheritage.state.pa.us/species.aspx [https://perma.cc/NZC4-ZE98] (last visited Feb. 5, 2016) (considering those species which cause "conservation concern"); *Environmental Conservation Online System: Listed Species Believed to or Known to Occur in Pennsylvania*, U.S. FISH & WILDLIFE SERV., http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=PA&s8fid=112761032792&s8fid=112762573902 [https://perma.cc/8ZQF-WUW6] (last visited Feb. 21, 2016); *see* GOODRICH ET AL, *supra* note 27, at 8 (stating that nearly twenty percent of Pennsylvania's species are on "special concerns lists").

89. LEACH, *supra* note 67, at 7.

90. HENDERSON, *supra* note 74, at 5.

91. 2012 Pa. Laws 87.

92. 58 PA. CONS. STAT. § 3218.5 (2012).

Governor Tom Corbett signed Act 127 in December of 2011.[93] This act allowed PUC to implement federal safety requirements on intrastate pipelines.[94] Just two months later in February of 2012 he signed Act 13 into law, which attempted to provide better protection for the natural environment, particularly in relation to Marcellus development.[95] The act added "unconventional development" to PUC's authority.[96] The statute defines unconventional wells as "a bore hole drilled or being drilled for the purpose of or to be used for the production of natural gas from an unconventional formation."[97] Therefore, the key to the statute's coverage is "unconventional formations," defined as:

> A geological shale formation existing below the base of the Elk Sandstone or its geologic equivalent stratigraphic interval where natural gas generally cannot be produced at economic flow rates or in economic volumes except by vertical or horizontal well bores stimulated by hydraulic fracture treatments or by using multilateral well bores or other techniques to expose more of the formation to the well bore.[98]

While some have questioned the use of the Elk Sandstone in the definition, it covers most of the Marcellus shale region.[99] In relation to these unconventional wells, the act provided some regulation of pipelines.

Act 13 gave PUC certain powers over gathering lines for unconventional drilling. The statute defines gathering lines as "a pipeline used to transport natural gas from a production facility to a transmission line."[100] This definition only gives PUC authority over one type of pipeline, and does not include longer transmission lines.[101] Even if it included all of

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93. *Act 127 (Pipeline Act)*, PA. PUB. UTIL. COMM'N, http://www.puc.state.pa.us/filing_resources/issues_laws_regulations/act_127_pipeline_act.aspx [https://perma.cc/5LR8-4R5Z] (last visited Feb. 21, 2016).

94. *Id.*

95. HENDERSON, *supra* note 74, at 5.

96. 58 PA. CONS. STAT. § 3203 (2012).

97. *Id.*

98. *Id.*

99. *See* Anya Litvak, *Pennsylvania Draws a Line in the Sandstone*, POWER SOURCE (June 7, 2014, 10:16 PM), http://powersource.post-gazette.com/powersource/policy-powersource/2014/06/08/Pennsylvania-draws-a-line-in-the-sandstone/stories/201406080054 [https://perma.cc/B3FD-V43D] (discussing the possible implications of defining unconventional wells by a particular geological formation).

100. 58 PA. CONS. STAT. § 3203 (2012).

101. *Fact Sheet: Transmission Pipelines*, U.S. DEP'T OF TRANSP. PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMIN. http://primis.phmsa.dot.gov/comm/FactSheets/FSTransmissionPipelines.htm?nocache=6954 [https://perma.cc/9YPY-ESU5] (last visited Feb. 21, 2016).

the pipelines required in Marcellus development, Act 127 still only gave PUC the right to regulate safety. The only state agency who has express authority over pipeline siting fails to consider environmental issues such as fragmentation.

The Commonwealth's environmental statutes that apply to all projects, including pipelines,[102] offer limited protections, which do not address forest fragmentation. For example, a pipeline will likely fall under the Clean Streams Law during construction phase. Regulations under the law cover "Earth disturbance associated with oil and gas exploration, production, processing, or treatment operations or transmission facilities."[103] Another statute, the Dam Safety and Encroachment Acts, provides certain regulations for "water obstructions and encroachments other than dams located in, along or across, or projecting into a watercourse, floodway or body of water, whether temporary or permanent."[104] These statutes deal with preventing "erosion and sediment pollution" and protecting "waterflow."[105] This does not provide any protection for Pennsylvania forests during the siting process.

The only way the state can really affect the location of a pipeline is through the Pennsylvania Natural Heritage Program ("PNHP"), which protects threatened and endangered species.[106] During the permitting process for a pipeline, the PNHP uses the Pennsylvania Natural Diversity Inventory ("PNDI") Environmental Review Tool.[107] If the pipeline passes through important habitat, then the project may have to avoid the area or at least mitigate the impacts.[108] Though this provides some protection for important habitat, it really serves to inform the permit process.[109] Though it does include "species with unique or specific habitat needs or declining populations," the tool waits until others are "rare, threatened or endangered" on either federal or Pennsylvania lists.[110] Like the federal program, this protection applies largely after a problem already exists. These major environmental laws that apply to natural gas pipelines do not address the siting process. Without a sufficient siting process, the Commonwealth has little control over the environmental impacts of the

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102. HENDERSON, *supra* note 74, at 14–15.
103. 25 PA. CODE § 102.1 (2010).
104. 25 PA. CODE § 105.3 (1991).
105. HENDERSON, *supra* note 74, at 14.
106. *Id.* at 14–15; 25 PA. CODE § 102.1 (1972).
107. HENDERSON, *supra* note 74, at 14–15.
108. *Id.*
109. *Our Purpose*, PA. NAT. HERITAGE PROGRAM, http://www.naturalheritage.state.pa.us/ [https://perma.cc/W6V3-UBJ9] (last visited Feb. 5, 2016).
110. *PNHP Species Lists*, *supra* note 89.

pipeline route, including forest fragmentation. The Commonwealth must consider both its ability and obligation to prevent further forest fragmentation through better pipeline siting requirements.

3. Pennsylvania's Ability and Obligation to Prevent Fragmentation

Pennsylvania needs an efficient system of pipeline siting that limits forest fragmentation effects caused by Marcellus shale development. Before the Marcellus boom, Pennsylvania already had 8,600 miles of pipelines.[111] This number will only continue to expand.[112] Depending on how quickly the industry grows, Pennsylvania could see an additional 10,000 to 25,000 miles.[113] The Commonwealth must carefully consider where it allows for pipeline expansion. This raises a question of whether the Commonwealth has any obligation to protect the environment. Although the Commonwealth currently has no adequate pipeline regulations, a recent case interpreted the Pennsylvania Constitution to require the state government to offer better environmental protection for the benefit of all citizens.[114]

In *Robinson Township v. Commonwealth*, a group of citizens challenged the constitutionality of the recent changes to the Oil and Gas Act under Act 13 of 2012.[115] The case implicates Article 1, Section 27 of the Pennsylvania Constitution or the Environmental Rights Amendment.[116] The amendment provides:

> The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people.[117]

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111. NELS JOHNSON ET AL., NATURAL GAS PIPELINES: EXCERPT FROM REPORT 2 OF THE PENNSYLVANIA ENERGY IMPACTS ASSESSMENT 1 (2011), http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/pennsylvania/ng-pipelines.pdf [hereinafter EXCERPT FROM REPORT 2].

112. *See* NELS JOHNSON, PENNSYLVANIA ENERGY IMPACT ASSESSMENT: EXECUTIVE SUMMARY (2011), http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/pennsylvania/pa-energy-executive-summary.pdf [https://perma.cc/M9F4-KFU6] (finding that Marcellus development will likely require between 38,000 and 90,000 acres of "forest clearing" by 2030).

113. EXCERPT FROM REPORT 2, *supra* note 112, at 4.

114. Robinson Twp. v. Commonwealth, 83 A.3d 901, 913 (Pa. 2013).

115. *Id.* at 915.

116. *Id.* at 913.

117. PA. CONST. art. I, § 27.

Among a number of issues, citizens used this amendment to challenge a provision that required "uniformity among local zoning ordinances."[118] This provision did not allow individual municipalities to decide land use appropriate to their region, because it would need to match a statewide plan.[119] If a township wished to keep Marcellus development away from historical or important ecological areas, it no longer could.[120] The court considered this issue to decide whether the Commonwealth had the authority to limit local land use rights.

The case revolved around the Equal Rights Amendment and the duty it imposes on DEP. The Commonwealth argued that the question involved policy, which only the General Assembly could decide "as trustee of Pennsylvania's public natural resources."[121] The citizens countered that the Environmental Rights Amendment protects individual rights and imposes duties throughout the different levels of government.[122] The court ultimately sided with the citizens for a number of reasons, but most importantly, the court discussed the amendment's importance in relation to other public concerns.[123]

Looking back at Pennsylvania's history, the court noted the reasoning behind the Environmental Rights Amendment. The legislators created it to stop Pennsylvania's "notable history of . . . shortsighted exploitation of its bounteous environment."[124] The court noted that Act 13 served to "provide a maximally favorable environment for industry," as a way to promote the general welfare.[125] However, the opinion shows that the Commonwealth's interest in the general welfare does not outweigh the interest in protecting the environment.[126] Instead, the constitution created these as "corresponding duties."[127] The legislators and regulators may not ignore the environment to promote industry. Though the General Assembly may have wanted to bring jobs and lower energy prices to the Commonwealth,[128] they had to acknowledge the negatives as well.

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118. *Robinson Twp.*, 83 A.3d at 915.
119. *Id.* at 979.
120. *Id.*
121. *Id.* at 974.
122. *Id.*
123. *Id.*
124. *Id.* at 976.
125. *Id.* at 975.
126. *Id.*
127. *Id.*
128. Tom Shepstone, *Marcellus Drilling Benefits Whole State*, PENNLIVE (Aug. 3, 2012 12:45 AM), http://www.pennlive.com/editorials/index.ssf/2012/08/marcellus_drilling_benefits_wh.html [https://perma.cc/QAB5-URDW].

The court also recognized the citizens' right to bring a lawsuit under the amendment.[129] Pennsylvania's Environmental Rights Amendment provides similar protections of the long-standing public trust doctrine, which represents an inherent right.[130] The constitution "preserved rather than created" the rights found in Article I, also called the Declaration of Rights.[131] This creates "a right in the people to seek to enforce the obligations."[132] Going forward, the case allows citizens to bring such suits on two theories. First, citizens argue that the government has interfered with individual rights.[133] Second, they may simply assert that the government has acted improperly as trustee.[134] Pennsylvania's government must act to protect the environment for future generations.[135] All of this should encourage the General Assembly, DEP, and DCNR to implement a pipeline siting program.

The Robinson Township case included a "constitutional challenge . . . unprecedented in Pennsylvania history."[136] It recognizes that Pennsylvania's Environmental Rights Amendment does more than just inform the General Assembly's policy decisions. It requires that they consider the environment and allows citizens to bring suit if they fail to preserve the environment for future generations. The Pennsylvania Supreme Court's opinion strongly suggests that the government provide better environmental protection, which potentially includes protecting forests from fragmentation. For this reason, they should look to other states and create a pipeline siting process that recognizes the rights given to individual citizens through Article I, Section 27.

B. Guidance from Other States

Though Pennsylvania has a unique position because of its large natural gas reserve, other states can provide examples of more efficient regulations. In some states, the Department of Environmental Protection, or its equivalent, have a much larger role in the siting process.[137] In some cases,

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129. *Robinson Twp.*, 83 A.3d at 974.

130. Gerald Torres & Nathan Bellinger, *The Public Trust: The Law's DNA*, 4 WAKE FOREST J.L. & POL'Y 281, 288–89 (2014).

131. *Robinson Twp.*, 83 A.3d at 948.

132. *Id.* at 974.

133. *Id.*

134. *Id.* at 951.

135. *Id.* at 976–77.

136. *Id.* at 976.

137. *See, e.g.*, FLA. STAT. § 403.9404 (2015) (naming the Department of Environmental Protection authority to coordinate the pipeline siting process); *see also* MONT. CODE ANN. §§ 75-20-

the agency has direct control over the process and makes the final decision.[138] Other states provide incentives to limit the number of pipeline corridors necessary. This means providing incentives to use existing rights-of-way.[139] Pennsylvania should consider these programs as suggestions for its own pipeline siting process.

1. Involvement of Department of Environmental Protection

Pennsylvania currently gives PUC pipeline siting powers, but only over gathering lines. DEP only has jurisdiction in a limited number of situations. In some states, the Department of Environmental Protection, or its equivalent, has a much larger role in the pipeline siting process. Montana and Florida provide two examples of this. In Montana, the Department of Environmental Quality ("DEQ") has control over the siting process and makes the final decision.[140] In Florida, the Department of Environmental Protection ("FLDEP") coordinates the process and makes the recommendation to a siting board who makes the final decision.[141] These processes provide a much more thorough review than Pennsylvania, showing greater consideration of the environmental impacts.

Both Montana and Florida require a similar process when companies apply for certification. Unlike Pennsylvania, where PUC only has siting authority in relation to safety, both require environmental review. In Montana, a developer must first submit an application which includes the impact of the project and alternative routes.[142] DEQ then must make a "completeness" determination to make sure the process may move forward.[143] The next stage includes public notice and hearings, as well as input from other state agencies.[144] During this time, DEQ performs an environmental impact study and issues any necessary permits for the project.[145] The entire process can take over nine months,[146] and must consider the "nature of the probable environmental impact."[147] Before

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101–72-20-1205 (giving the Department of Environmental Quality authority to grant certifications for pipelines).

138. MONT. CODE ANN. § 75-20-201.

139. *See* N.Y. PUB. SERV. Law § 122(5)(a) (Consol. 2015) (requiring a lesser application fee for certain pipelines in an existing right-of-way).

140. MONT. CODE ANN. § 75-20-301.

141. FLA. STAT. § 403.9404.

142. MONT. CODE ANN. § 75-20-211.

143. *Id.* § 75-20-216(1).

144. *Id.* § 75-20-216(2)–(3).

145. *Id.* § 75-20-216(4).

146. *Id.*

147. *Id.* § 75-20-301(b).

approval, the department must "find . . . that the facility minimizes adverse environmental impact, considering the state of available technology and the nature and economics of the various alternatives."[148] The process provides an in depth review, which must include minimizing environmental effects.

Florida has a very similar process to Montana, but differs in who makes the decision and how they evaluate the environmental impacts. Again, there is an application and completeness ruling.[149] The review process also includes a series of hearings and public notices.[150] Despite these similarities, FLDEP does not have decision-making authority like DEQ. Instead, the agency uses an administrative law judge, who gives a ruling that the siting board uses for final approval.[151] This administrative law judge only has to balance the environmental impacts against the public need.[152] For this reason, Montana's model provides better environmental protection because it requires minimal effects in light of the need and allows DEQ to make the final decision. Regardless, both states have a thorough review process for pipeline siting.

In addition to more in depth environmental review, both state's agencies also have some oversight once the siting process has ended. First, both can provide certification with certain conditions to better protect the environment.[153] In Montana, this "may require the applicant to post performance bonds to guarantee successful reclamation and revegetation of the project area."[154] After granting certification, DEQ has the responsibility of monitoring the project and "preventing noncompliance."[155] In Florida, the statute gives FLDEP express authority to enforce the permit and conditions.[156] After a thorough review process considering the environmental impacts, both agencies may ensure that the developers actually protect Montana and Florida's environment.

Pennsylvania should consider the benefits of having an environmental agency lead the pipeline siting process. With no real siting process in place, the legislature should provide some direction. This could include both DEP and DCNR, especially since Marcellus development still has a number of unknown environmental effects. DEP who aims to "prevent pollution and

148. *Id.*
149. FLA. STAT. § 403.9408 (2014).
150. *Id.* § 403.9411.
151. *Id.* § 403.9406.
152. *Id.* § 403.9415.
153. MONT. CODE ANN. § 75-20-302; FLA. STAT. § 403.9418.
154. MONT. CODE ANN. § 75-20-302.
155. *Id.* § 75-20-402.
156. FLA. STAT. § 403.9419.

restore . . . natural resources,"[157] and DCNR with the "mission . . . to conserve and sustain Pennsylvania's natural resources for present and future generations' enjoyment," [158] are well suited to address forest fragmentation during the pipeline siting process. Addressing the issue through a more thorough review would allow DEP, and possibly DCNR, to carry out its mission statement while better protecting citizens' constitutional rights under the Environmental Rights Amendment.

2. Utilizing Current Rights-of-way

Pennsylvania may also address forest fragmentation by encouraging siting where other structures have already transformed forestland. Some states offer incentives to natural gas companies who use existing rights-of-way. This could help Pennsylvania coordinate the large number of pipelines required as Marcellus development continues. In New York, companies who use these rights-of-way have a monetary incentive and sometimes an exemption from the siting process altogether.

Certain pipelines require a "certificate of environmental compatibility and public need." [159] Potential pipeline developers must submit an application if the project meets the statute's definition of a "major utility transmission facility." This includes "fuel gas" pipelines over a thousand feet which meet a certain pressure requirement. [160] More importantly though, it creates an exception for pipelines using certain rights-of-way including a "state, county or town highway or village street."[161] Though only a limited exception, it still provides some incentive. The application process requires a time investment from the agency and delays the developer's plans. Both can save time on the review process if developers use certain rights-of-way.

The statute and regulations also requires a fee as part the of application materials. For pipelines over ten miles, the developers have incentive to use existing rights-of-way in certain circumstances. The regulations require a fee to fund the application review process and developers can lower expenses by using existing rights-of-way.[162] Unfortunately, the incentive

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157. *About DEP: Mission Statement*, PA. DEP'T OF ENVTL. PROT., http://www.depweb.state.pa.us/portal/server.pt/community/about_dep/13464 [https://perma.cc/3GBY-ZN3W] (last visited Feb. 4, 2016).

158. *Discover DCNR*, PA. DEP'T OF CONSERVATION & NAT. RES., http://dcnr.state.pa.us/discoverdcnr/index.htm (last visited Feb. 21, 2016).

159. N.Y. PUB. SERV. § 121.

160. *Id.* § 120.

161. *Id.*

162. N.Y. COMP. CODES R. & REGS. tit. 16, § 85-2.4 (1970).

only applies to the shortest pipelines, running from ten to fifty miles. Creating a new transmission right-of-way doubles the fee. A ten- to fifty-mile long pipeline that uses new rights-of-way requires 100,000 dollars.[163] If the pipeline can use existing rights-of-way for ninety percent of the project, regulations require 50,000 dollars.[164] Companies can save a significant amount of money in the application phase. Since the applicants must provide the fee with the initial application,[165] it presents up-front costs to developers. The lower fee increases the incentive to save money before the company has even started to construct or to benefit from the project.

New York's system presents both practical and environmental advantages. It benefits both the state agency and the developer. It allows the state to save time on the review process by adding pipelines to already approved rights-of-way. It also allows developers to save on initial costs. While this solution will not work in all areas, specifically those lacking a large number of existing rights-of-way, it can help address the issue of forest fragmentation. Pennsylvania, through a similar system, can limit the effects by preventing "pipeline networks [that] crisscross and subdivide habitat structure."[166]

Since any deforestation creates edge forest and changes the habitat for 300 feet along the pipeline route, use of existing rights-of-way could protect important core forests. Pennsylvania needs to encourage pipeline developers through both financial and time incentives to better coordinate their projects. Where possible, companies would have little reason to create new rights-of-way and would therefore need to clear less forest. If the state gives DEP, and possibly DCNR, control over the siting process, they could promulgate regulations similar to New York's. Pennsylvania could pass on the costs to developers through application fees and save time on siting review. Pennsylvania would benefit from this system by protecting its forests, with limited additional expenses for the agencies.

CONCLUSION

Pennsylvania needs an adequate pipeline siting process to address the issue of forest fragmentation in light of the recent Marcellus shale development. Forest fragmentation affects both the amount and quality of forest habitat in the state. It divides the forests into smaller and smaller core forest segments, which isolates and endangers certain species.

163. *Id.*
164. *Id.*
165. *Id.*
166. SLONECKER ET AL., *supra* note 24, at 9.

Fragmentation negatively affects the already declining forestland in Pennsylvania. With its roads, well pads, water impoundments, and pipelines, Marcellus shale development will further reduce forest habitat. As the industry continues to expand, Pennsylvania must address forest fragmentation.

The Commonwealth's current law and regulations provide almost no environmental protection related to pipeline siting. The only real review, by PUC, considers safety. Without any meaningful environmental review, Pennsylvania should look to other states for guidance. Some states (those that involve state environmental agencies in the siting process) also consider environmental issues during a thorough review process. Other states provide incentives for companies to use existing rights-of-way, saving both time and money. A combination of these two approaches could address the issue of forest fragmentation in Pennsylvania. DEP should consider forest fragmentation as just one element of environmental impact. They should also encourage companies to use existing rights-of-way, which would limit the amount of forestland cleared. Pennsylvania needs to address forest fragmentation during pipeline siting review and therefore, the state legislature should give DEP authority by following the example of other states.