May 31, 2016

Via Electronic Delivery

Attn: Kurt Wadzinski
BLM Northeastern States District
Planning & Environmental Coordinator
626 E. Wisconsin Ave., Suite 200
Milwaukee, WI 53202-4617
blm_es_comments@blm.gov

Re: ***Draft Environmental Assessment for Oil and Gas Leasing on Wayne National Forest* (DOI-BLM-Eastern States-0030-2016-0002-EA)**

Dear Mr. Wadzinski:

The Center for Biological Diversity (the "Center"), Friends of the Earth, Ohio Environmental Council (the "OEC") and Sierra Club submit the following comments on the Draft Environmental Assessment ("EA") and Finding of No Significant Impact ("FONSI") for the proposed oil and gas leasing on the Wayne National Forest. The Bureau of Land Management ("BLM") Northeastern States District is considering the leasing of up to 40,000 acres of the Athens Ranger District, Marietta Unit of the Wayne National Forest ("planning area" or "WNF") in southeastern Ohio.

We are deeply concerned that new fossil fuel leasing within the planning area will contribute to worsening the climate crisis. To preserve any chance of averting catastrophic climate disruption, the vast majority of all *proven* fossil fuels must be kept in the ground. Opening up new areas to oil and gas exploration and unlocking new sources of greenhouse gas pollution would only fuel greater warming and contravenes BLM's mandate to manage the public lands "without permanent impairment of the productivity of the land and the quality of the environment."[1] BLM should end all new leasing in the planning area and all other areas that it manages in order to limit the climate change effects of its actions; at a minimum, it should defer any such leasing until such time as it can conduct a comprehensive review of the climate consequences of its leasing activities, at the national and regional scale.

BLM should also ban new hydraulic fracturing ("fracking") and other unconventional well stimulation activities in the planning area. BLM must analyze the consequences of

[1] *See* 43 U.S.C. §§ 1701(a)(7), 1702(c), 1712(c)(1), 1732(a) (emphasis added); *see also id*. § 1732(b) (directing Secretary to take any action to "prevent unnecessary or undue degradation" of the public lands).

alternatives other than simply leasing and no action, including a no-fracking alternative. The existing National Environmental Policy Act ("NEPA") documentation for the Wayne (including the Draft EA) does not adequately analyze the relatively new and dangerous extraction methods of fracking and horizontal drilling, or the increased seismic risks from such extraction methods. Given the likelihood that fracking and other similarly harmful techniques would be employed in the exploration and development of the parcels, BLM must analyze and disclose the potential impacts resulting from such frequently used practices. BLM must fully analyze the public health, environmental justice, and industrialization impacts of unconventional fossil fuel extraction and especially hydraulic fracturing across the planning area.

For the reasons set forth in this letter, we insist that BLM: (1) cease all new leasing of fossil fuels in the planning area, including oil and natural gas; or, at a minimum (2) defer the proposed leasing pending a programmatic review of all federal fossil fuel leasing which must consider "no leasing" and "no fracking" plan amendments. Before BLM may proceed with any proposed leasing, it must: (1) initiate formal consultation with the Fish and Wildlife Service, as required by the Endangered Species Act ("ESA"); and (2) prepare a full EIS for the proposed leasing in consideration of significant unexamined impacts from the consequences of leasing. Any such EIS must consider a full range of alternatives, including an alternative that bans new leasing[2] and an alternative that bans hydraulic fracturing and other unconventional well stimulation activities, and require strict controls on natural gas emissions and leakage.

Finally, BLM and the Forest Service have provided the public too little time to comment on the leasing proposal. A mere 30 days is not enough time for the public to review the EA, the 2006 Forest Plan and Final EIS, the 2012 Supplemental Information Report ("SIR" or "2012 SIR"), and the numerous appendices to these documents. While we have done our best to provide comments in the short time period allowed, the EA raises many more questions than it answers. A 30-day extension is necessary for full and meaningful public participation. The Forest Service and BLM should also hold public meetings that would allow the public's questions and concerns to be heard and addressed in a public forum, in light of the intense public interest in the proposal to allow high-volume hydraulic fracturing in Ohio's only national forest.

I. BLM Must End All New Fossil Fuel Leasing and Hydraulic Fracturing.

Climate change is a problem of global proportions resulting from the cumulative greenhouse gas emissions of countless individual sources. A comprehensive look at the impacts of fossil fuel extraction, including fracking, is absolutely necessary. BLM has *never* thoroughly considered the cumulative climate change impacts of *all* potential fossil fuel extraction and fracking (1) within the planning area, (2) across the state, or (3) across all public lands. Proceeding with new leasing proposals *ad hoc* in the absence of a comprehensive plan that addresses climate change and fracking is premature and risks irreversible damage before the

[2] BLM's multiple-use mandate authorizes a no leasing alternative. The agency's obligation to manage for multiple use does not mean that development is mandatory or that BLM must eliminate protective alternatives from analysis. BLM must weigh benefits and potential impacts of development against other possible uses and their benefits – including protection of environmental values. This assessment is best undertaken through the NEPA process, in a thorough EIS, with full public participation. It follows that an alternative closing the planning area to development does not violate the multiple use provision of the Federal Land Policy and Management Act (FLPMA.

agency and public have had the opportunity to weigh the full costs of oil and gas and other fossil fuel extraction and consider necessary limits on such activities. Therefore BLM must cease all new leasing at least until the issue is adequately analyzed in a programmatic review of all U.S. fossil fuel leasing, or at least within amended RMPs.

A. BLM Must Limit Greenhouse Gas Emissions By Keeping Federal Fossil Fuels In the Ground.

Expansion of fossil fuel production will substantially increase the volume of greenhouse gases emitted into the atmosphere and jeopardize the environment and the health and wellbeing of future generations. BLM's mandate to ensure "harmonious and coordinated management of the various resources *without permanent impairment of the productivity of the land and the quality of the environment*" requires BLM to limit the climate change effects of its actions.[3] Keeping all unleased fossil fuels in the ground and banning fracking and other unconventional well stimulation methods would lock away millions of tons of greenhouse gas pollution and limit the destructive effects of these practices.

A ban on new fossil fuel leasing and fracking is necessary to meet the U.S.'s greenhouse gas reduction commitments. On December 12, 2015, 197 nation-state and supra-national organization parties meeting in Paris at the 2015 United Nations Framework Convention on Climate Change Conference of the Parties consented to an agreement ("Paris Agreement") committing its parties to take action so as to avoid dangerous climate change. [4] As the United States signed the treaty on April 22, 2016[5] as a legally binding instrument through executive agreement,[6] the Paris Agreement commits the United States to critical goals—both binding and aspirational—that mandate bold action on the United States' domestic policy to rapidly reduce greenhouse gas emissions.[7]

The United States and other parties to the Paris Agreement recognized "the need for an effective and progressive response to the urgent threat of climate change on the basis of the best available scientific knowledge."[8] The Paris Agreement articulates the practical steps necessary to obtain its goals: parties including the United States have to "reach global peaking of greenhouse gas emissions *as soon as possible . . .* and to *undertake rapid reductions* thereafter in accordance *with best available science*,"[9] imperatively commanding that developed countries specifically

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[3] *See* 43 U.S.C. §§ 1701(a)(7), 1702(c), 1712(c)(1), 1732(a) (emphasis added); *see also id*. § 1732(b) (directing Secretary to take any action to "prevent unnecessary or undue degradation" of the public lands).
[4] Paris Agreement, Art. 2.
[5] For purposes of this Petition, the term "treaty" refers to its international law definition, whereby a treaty is "an international law agreement concluded between states in written form and governed by international law" pursuant to article 2(a) of the Vienna Convention on the Law of Treaties, 1155 U.N.T.S. 331, 8 I.L.M. 679 (Jan. 27, 1980).
[6] *See* United Nations Treaty Collection, Chapter XXVII, 7.d Paris Agreement, List of Signatories; U.S. Department of State, Background Briefing on the Paris Climate Agreement, (Dec. 12, 2015), http://www. state.gov/ r/pa/prs/ps/2015/12/250592.htm.
[7] Although not every provision in the Paris Agreement is legally binding or enforceable, the U.S. and all parties are committed to perform the treaty commitments in good faith under the international legal principle of *pacta sunt servanda* ("agreements must be kept"). Vienna Convention on the Law of Treaties, Art. 26.
[8] *Id.*, Recitals.
[9] *Id.*, Art. 4(1).

"should continue taking the lead by undertaking economy-wide absolute emission reduction targets"[10] and that such actions reflect the "highest possible ambition."[11]

The Paris Agreement codifies the international consensus that climate change is an "urgent threat" of global concern,[12] and commits all signatories to achieving a set of global goals. Importantly, the Paris Agreement commits all signatories to an articulated target to hold the long-term global average temperature "to *well below 2°C* above pre-industrial levels and to *pursue efforts to limit the temperature increase to 1.5°C* above pre-industrial levels"[13] (emphasis added).

In light of the severe threats posed by even limited global warming, the Paris Agreement established the international goal of limiting global warming to 1.5°C above pre-industrial levels in order to "prevent dangerous anthropogenic interference with the climate system," as set forth in the UNFCCC, a treaty which the United States has ratified and to which it is bound.[14] The Paris consensus on a 1.5°C warming goal reflects the findings of the IPCC and numerous scientific studies that indicate that 2°C warming would exceed thresholds for severe, extremely dangerous, and potentially irreversible impacts.[15] Those impacts include increased global food and water insecurity, the inundation of coastal regions and small island nations by sea level rise and increasing storm surge, complete loss of Arctic summer sea ice, irreversible melting of the Greenland ice sheet, increased extinction risk for at least 20-30% of species on Earth, dieback of the Amazon rainforest, and "rapid and terminal" declines of coral reefs worldwide.[16] As scientists noted, the impacts associated with 2°C temperature rise have been "revised upwards, sufficiently so that 2°C now more appropriately represents the threshold between 'dangerous' and 'extremely dangerous' climate change."[17] Consequently, a target of 1.5 ºC or less

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[10] *Id.*, Art. 4(4).
[11] Id, Art. 4(3).
[12] *Id.*, Recitals.
[13] *Id.*, Art. 2.
[14] *See* U.N. Framework Convention on Climate Change, Cancun Agreement. Available at http://cancun.unfccc.int/ (last visited Jan 7, 2015); United Nations Framework Convention on Climate Change, Copenhagen Accord. Available at http://unfccc.int/meetings/copenhagen_dec_2009/items/5262.php (last accessed Jan 7, 2015). The United States Senate ratified the UNFCC on October 7, 1992. *See* https://www.congress.gov/treaty-document/102nd-congress/38.
[15] *See* Paris Agreement, Art. 2(1)(a); U); U.N. Framework Convention on Climate Change, Subsidiary Body for Scientific and Technical Advice, Report on the structured expert dialogue on the 2013-15 review, No. FCCC/SB/2015/INF.1 at 15-16 (June 2015);IPCC AR5 Synthesis Report at 65 & Box 2.4.
[16] *See* Jones, C. et al, Committed Terrestrial Ecosystem Changes due to Climate Change, 2 Nature Geoscience 484, 484–487 (2009);Smith, J. B. *et al.*, Assessing Dangerous Climate Change Through an Update of the Intergovernmental Panel on Climate Change (IPCC) 'Reasons for Concern', 106 Proceedings of the National Academy of Sciences of the United States of America 4133, 4133–37 (2009); ; Veron, J. E. N. *et al.*, The Coral Reef Crisis: The Critical Importance of <350 ppm CO2, 58 Marine Pollution Bulletin 1428, 1428–36, (2009); ; Warren, R. J. *et al.*, Increasing Impacts of Climate Change Upon Ecosystems with Increasing Global Mean Temperature Rise, 106 Climatic Change 141–77 (2011); Hare, W. W. *et al.*, Climate Hotspots: Key Vulnerable Regions, Climate Change and Limits to Warming, 11 Regional Environmental Change 1, 1–13 (2011); ; Frieler, K. M. *et al.*, Limiting Global Warming to 2ºC is Unlikely to Save Most Coral Reefs, Nature Climate Change, Published Online (2013) doi: 10.1038/NCLIMATE1674; ; M. Schaeffer *et al.*, Adequacy and Feasibility of the 1.5°C Long-Term Global Limit, Climate Analytics (2013).
[17] Anderson, K. and A. Bows, Beyond 'Dangerous' Climate Change: Emission Scenarios for a New World, 369 Philosophical Transactions, Series A, Mathematical, Physical, and Engineering Sciences 20, 20–44 (2011).

temperature rise is now seen as essential to avoid dangerous climate change and has largely supplanted the 2°C target that had been the focus of most climate literature until recently.

Immediate and aggressive greenhouse gas emissions reductions are necessary to keep warming below a 1.5º or 2°C rise above pre-industrial levels. Put simply, there is only a finite amount of CO_2 that can be released into the atmosphere without rendering the goal of meeting the 1.5°C target virtually impossible. Only a slightly larger amount could be burned before meeting a goal of 2°C became an impossibility. Globally, fossil fuel reserves, if all were extracted and burned, would release enough CO_2 to exceed this limit several times over.[18]

The question of what amount of fossil fuels can be extracted and burned without negating a realistic chance of meeting a 1.5 or 2°C target is relatively easy to answer, even if the answer is framed in probabilities and ranges. The IPCC Fifth Assessment Report and other expert assessments have established global carbon budgets, or the total amount of remaining carbon that can be burned while maintaining some probability of staying below a given temperature target. According to the IPCC, total cumulative anthropogenic emissions of CO_2 must remain below about 1,000 gigatonnes ($GtCO_2$) from 2011 onward for a 66% probability of limiting warming to 2°C above pre-industrial levels.[19] Given more than 100 $GtCO_2$ have been emitted since 2011,[20] the remaining portion of the budget under this scenario is well below 900 $GtCO_2$. To have an 80% probability of staying below the 2°C target, the budget from 2000 is 890 $GtCO_2$, with less than 430 $GtCO_2$ remaining.[21]

To have even a 50% probability of achieving the Paris Agreement goal of limiting warming to 1.5°C above pre-industrial levels equates to a carbon budget of 550-600 $GtCO_2$ from 2011 onward, [22] of which more than 100 $GtCO_2$ has already been emitted. To achieve a 66% probability of limiting warming to 1.5°C requires adherence to a more stringent carbon budget of only 400 $GtCO_2$ from 2011 onward, [23] of which less than 300 $GtCO_2$ remained at the start of 2015. An 80% probability budget for 1.5°C would have far less than 300 $GtCO_2$ remaining. Given that global CO_2 emissions in 2014 alone totaled 36 $GtCO_2$,[24] humanity is rapidly consuming the remaining burnable carbon budget needed to have even a 50/50 chance of meeting the 1.5°C temperature goal.[25]

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[18] Marlene Cimons, Keep It In the Ground 6 (Sierra Club *et al.*, Jan. 25, 2016).

[19] IPCC, 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change; Summary for Policymakers at 27; IPCC, 2014: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change at 64 & Table 2.2 [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)] at 63-64 & Table 2.2 ("IPCC AR5 Synthesis Report").

[20] From 2012-2014, 107 GtCO2 was emitted (*see* Annual Global Carbon Emissions at http://co2now.org/Current-CO2/CO2-Now/global-carbon-emissions.html).

[21] Carbon Tracker Initiative, Unburnable Carbon – Are the world's financial markets carrying a carbon bubble? available at http://www.carbontracker.org/wp-content/uploads/2014/09/Unburnable-Carbon-Full-rev2-1.pdf; Meinshausen, M. *et al.*, Greenhouse gas emission targets for limiting global warming to 2 degrees Celsius, 458 Nature 1158, 1159 (2009)

[22] IPCC AR5 Synthesis Report at 64 & Table 2.2.

[23] *Id*.

[24] *See* Global Carbon Emissions, http://co2now.org/Current-CO2/CO2-Now/global-carbon-emissions.html

[25] In addition to limits on the *amount* of fossil fuels that can be utilized, emissions pathways compatible with a 1.5 or 2°C target also have a significant temporal element. Leading studies make clear that to reach a reasonable likelihood

According to a recent report by EcoShift Consulting commissioned by the Center and Friends of the Earth, unleased (and thus currently unburnable) federal fossil fuels represent a significant source of potential greenhouse gas emissions:

- Potential GHG emissions of federal fossil fuels (leased and unleased) if developed would release up to 492 gigatons (Gt) (one gigaton equals 1 billion tons) of carbon dioxide equivalent pollution (CO2e); representing 46 percent to 50 percent of potential emissions from all remaining U.S. fossil fuels.
- Of that amount, up to 450 Gt CO2e have not yet been leased to private industry for extraction;
- Releasing those 450 Gt CO2e (the equivalent annual pollution of more than 118,000 coal-fired power plants) would be greater than any proposed U.S. share of global carbon limits that would keep emissions below scientifically advised levels.[26]

Fracking has also opened up vast reserves that otherwise would not be available, increasing the potential greenhouse gas emissions that can be released into the atmosphere. BLM must consider a ban on this dangerous practice and a ban on new leasing to prevent the worst effects of climate change.

B. BLM Must Consider A Ban on New Oil and Gas Leasing and Fracking in a Programmatic Review and Halt All New Leasing and Fracking in the Meantime.

Development of unleased oil and gas resources will fuel climate disruption and undercut the needed transition to a clean energy economy. As BLM has not yet had a chance to consider no-leasing and no-fracking alternatives as part of any of its RMP planning processes or a comprehensive review of its federal oil and gas leasing program, BLM should suspend new leasing until it properly considers this alternative in updated RMPs or a programmatic EIS for the entire leasing program. BLM demonstrably has tools available to consider the climate consequences of its leasing programs, and alternatives available to mitigate those consequences, at either a regional or national scale.[27]

BLM would be remiss to continue leasing when it has never stepped back and taken a hard look at this problem at the programmatic scale. Before allowing more oil and gas extraction

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of stopping warming at 1.5° or even 2°C, global CO2 emissions must be phased out by mid-century and likely as early as 2040-2045. *See, e.g.*, Joeri Rogelj *et al.*, Energy system transformations for limiting end-of-century warming to below 1.5°C, 5 Nature Climate Change 519, 522 (2015). United States focused studies indicate that we must phase out fossil fuel CO2 emissions even earlier—between 2025 and 2040—for a reasonable chance of staying below 2ºC. *See, e.g.*, Climate Action Tracker, http://climateactiontracker.org/countries/usa. Issuing new legal entitlements to explore for and extract federal fossil fuels for decades to come is wholly incompatible with such a transition.

[26] EcoShift Consulting et al., The Potential Greenhouse Gas Emissions of U.S. Federal Fossil Fuels (Aug. 2015), available at http://www.ecoshiftconsulting.com/wp-content/uploads/Potential-Greenhouse-Gas-Emissions-U-S-Federal-Fossil-Fuels.pdf

[27] *See, e.g.*, BLM Montana, North Dakota and South Dakota, Climate Change Supplementary Information Report (updated Oct. 2010) (conducting GHG inventory for BLM leasing in Montana, North Dakota and South Dakota); BLM, Proposed Rule: Waste Prevention, Production Subject to Royalties, and Resource Conservation, 81 Fed. Reg. 6615 (Feb. 8, 2016) (proposing BLM-wide rule for prevention of methane waste).

in the planning area, BLM must: (1) comprehensively analyze the total greenhouse gas emissions which result from past, present, and potential future fossil fuel leasing and all other activities across all federal lands and within the planning area at issue here, (2) consider their cumulative significance in the context of global climate change, carbon budgets, and other greenhouse gas pollution sources outside federal lands and the planning area, and (3) formulate measures that avoid or limit their climate change effects. By continuing leasing and allowing new fracking in the absence of any overall plan addressing climate change, BLM is effectively burying its head in the sand.

A programmatic review and moratorium on new leasing would be consistent with the Secretary of Interior's recent order to conduct a comprehensive, programmatic EIS (PEIS) on the federal coal leasing program, in light of the need to take into account the program's impacts on climate change, among other issues, and "the lack of any recent analysis of the Federal coal program as a whole."[28] Specifically, the Secretary directed that the PEIS "should examine how best to assess the climate impacts of continued Federal coal production and combustion and how to address those impacts in the management of the program to meet both the Nation's energy needs and its climate goals, as well as how best to protect the public lands from climate change impacts."[29]

The Secretary also ordered a moratorium on new coal leasing while such a review is being conducted. The Secretary reasoned:

> Lease sales and lease modifications result in lease terms of 20 years and for so long thereafter as coal is produced in commercial quantities. Continuing to conduct lease sales or approve lease modifications during this programmatic review risks locking in for decades the future development of large quantities of coal under current rates and terms that the PEIS may ultimately determine to be less than optimal. This risk is why, during the previous two programmatic reviews, the Department halted most lease sales with limited exceptions…. Considering these factors and given the extensive recoverable reserves of Federal coal currently under lease, I have decided that a similar policy is warranted here. A pause on leasing, with limited exceptions, will allow future leasing decisions to benefit from the recommendations that result from the PEIS while minimizing any economic hardship during that review.[30]

The Secretary's reasoning is also apt here. A programmatic review assessing the climate change effects of public fossil fuels is long overdue. And there is no shortage of available oil and gas that would preclude a moratorium while such a review is conducted, as evidenced by very low oil and natural gas prices. More importantly, BLM should not "risk[] locking in for decades the future development of large quantities of [fossil fuels] under current…terms that a [programmatic review] may ultimately determine to be less than optimal."[31] BLM should halt all new leasing and fracking until a programmatic review is completed.

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[28] *See* Secretary of Interior, Order No. 3338, § 4 (Jan. 15, 2016)
[29] *Id*. § 4(c).
[30] *Id*. § 5.
[31] *Id*.

II. The Dangers of Hydraulic Fracking and Horizontal Drilling

The use of hydraulic fracturing within the area is both readily foreseeable and already occurring with significant environmental consequences.[32] NEPA regulations and case law require that BLM evaluate all "reasonably foreseeable" direct and indirect effects of its leasing.[33]

The proposed leasing action is part of a dramatic recent increase in oil and gas leasing in the region, and reflects increased industry interest in developing Ohio's fossil fuel resources. The entire basis for this surge of interest is the possibility that hydraulic fracturing and other advanced recovery techniques will allow the profitable exploitation of geologic formations previously perceived as insufficiently valuable for development, such as the Utica and Marcellus shales. Elements of these technologies have been used individually for decades. However, the combination of practices employed by industry recently is new: "Modern formation stimulation practices have become more complex and the process has developed into a sophisticated, engineered process in which production companies strive to design a hydraulic fracturing treatment to emplace fracture networks in specific areas."[34]

Hydraulic fracturing brings with it all of the harms to water quality, air quality, the climate, species, and communities associated with traditional oil and gas development, but also brings increased risks in many areas. Analysis of the consequences of this practice, prior to irrevocable consequences, is therefore required at this stage. Oil and gas leasing is an irrevocable commitment to convey rights to use of federal land – a commitment with readily predictable environmental consequences that BLM is required to address. These include the specific geological formations, surface and ground water resources, seismic potential, or human, animal, and plant health and safety concerns present in the area to be leased.

Hydraulic fracturing, a dangerous practice in which operators inject toxic fluid underground under extreme pressure to release oil and gas, has greatly increased industry interest

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[32] *See, e.g.*, Ohio Department of Natural Resources ("ODNR"), Ohio Oil & Gas Well Locator, *available at*: http://oilandgas.ohiodnr.gov/well-information/oil-gas-well-locator; FracTracker Alliance, Ohio Shale Gas Viewer, *available at* http://maps.fractracker.org/3.13/?appid=2b7611b38d434714ba2033d76cc0ccc3. The Statoil Eisenbarth well pad fire and fish kill event of June-July of 2014 is an example of both development and impacts in the area. The Eisenbarth pad is located in Monroe County, close to the proclamation boundary of the Marietta Unit. In 2014, the Eisenbarth well pad fire took nearly a week to completely extinguish, risked firefighter safety, forced the evacuation of 25 households, posed a potential risk to drinking water supplies, and killed approximately 70,000 fish in a 5-mile long fish kill. *See, e.g.*, U.S. Environmental Protection Agency Pollution/Situation Report, Statoil Eisenbarth Well Response, POLREP #1, *available at* http://www.theoec.org/sites/default/files/Eisenbarth%20well%20pad%20fire.pdf; Junkins, Casey, *EPA: 70K Fish, Aquatic Life Killed*, Wheeling Intelligencer, July 22, 2014, *available at* http://www.theintelligencer.net/page/content.detail/id/607167.html. Opossum Creek, the location of the Eisenbarth fish kill, is partially located within the proclamation boundary of the Marietta Unit.

[33] 40 C.F.R. § 1508.8; *Davis v. Coleman*, 521 F.2d 661, 676 (9th Cir. 1975)*; Center for Biological Diversity v. Bureau of Land Management* ("*CBD*"), 937 F. Supp. 2d 1140 (N.D. Cal. 2013) (holding that oil and gas leases were issued in violation of NEPA where BLM failed to prepare an EIS and unreasonably concluded that the leases would have no significant environmental impact because the agency failed to take into account all reasonably foreseeable development under the leases).

[34] Arthur, J. Daniel et al., Hydraulic Fracturing Considerations for Natural Gas Wells of the Marcellus Shale at 2 (Sep. 2008) ("Arthur") at 9.

in developing tightly held oil and gas deposits such as those in the proposed lease area. The first aspect of this technique is the hydraulic fracturing of the rock. When the rock is fractured, the resulting cracks in the rock serve as passages through which gas and liquids can flow, increasing the permeability of the fractured area. To fracture the rock, the well operator injects hydraulic fracturing fluid at tremendous pressure. The composition of fracturing fluid has changed over time. Halliburton developed the practice of injecting fluids into wells under high pressure in the late 1940s;[35] however, companies now use permutations of "slick-water" fracturing fluid developed in the mid-1990s.[36] The main ingredient in modern fracturing fluid (or "frack fluid") is generally water, although liquefied petroleum has also been used as a base fluid for modern fracking.[37] The second ingredient is a "proppant," typically sand, that becomes wedged in the fractures and holds them open so that passages remain after pressure is relieved.[38] In addition to the base fluid and proppant, a mixture of chemicals are used, for purposes such as increasing the viscosity of the fluid, keeping proppants suspended, and impeding bacterial growth or mineral deposition.[39]

Frack fluid is hazardous to human health, although industry's resistance to disclosing the full list of ingredients formulation of frack fluid makes it difficult for the public to know exactly how dangerous.[40] A congressional report sampling incomplete industry self-reports found that "[t]he oil and gas service companies used hydraulic fracturing products containing 29 chemicals that are (1) known or possible human carcinogens, (2) regulated under the Safe Drinking Water Act for their risks to human health, or (3) listed as hazardous air pollutants under the Clean Air Act."[41] Recently published scientific papers also describe the harmfulness of the chemicals often in fracking fluid. One study reviewed a list of 944 fracking fluid products containing 632 chemicals, 353 of which could be identified with Chemical Abstract Service numbers.[42] The study concluded that more than 75 percent of the chemicals could affect the skin, eyes, and other sensory organs, and the respiratory and gastrointestinal systems; approximately 40 to 50 percent could affect the brain/nervous system, immune and cardiovascular systems, and the kidneys; 37 percent could affect the endocrine system; and 25 percent could cause cancer and mutations.[43]

The impacts associated with the fracking-induced oil and gas development boom has caused some jurisdictions to place a moratorium or ban on fracking. For instance, in 2011 France

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[35] Tompkins, How will High-Volume (Slick-water) Hydraulic Fracturing of the Marcellus (or Utica) Shale Differ from Traditional Hydraulic Fracturing? Marcellus Accountability Project at 1 (Feb. 2011).
[36] New York State Department of Environmental Conservation, *Final Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program, Well Permit Issuance for Horizontal Drilling and High-Volume Hydraulic Fracturing to Develop the Marcellus Shale and Other Low-Permeability Gas Reservoirs* (2015) ("NYDEC SGEIS") at 5-5.
[37] *Id.*; Arthur at 10; United States House of Representatives, Committee on Energy and Commerce, Minority Staff, Chemicals Used in Hydraulic Fracturing (Apr. 2011) ("Waxman 2011b").
[38] Arthur at 10.
[39] *Id*.
[40] Waxman 2011b; *see also* Colborn, Theo et al., *Natural Gas Operations for a Public Health Perspective*, 17 Human and Ecological Risk Assessment 1039 (2011) ("Colborn 2011"); McKenzie, Lisa et al., *Human Health Risk Assessment of Air Emissions form Development of Unconventional Natural Gas Resources*, Sci Total Environ (2012), doi:10.1016/j.scitotenv.2012.02.018 ("McKenzie 2012").
[41] Waxman 2011b at 8.
[42] Colborn 2011 at 1.
[43] *Id*.

became the first country to ban the practice.[44] In May, Vermont became the first state to ban fracking. Vermont's governor called the ban "a big deal" and stated that the bill "will ensure that we do not inject chemicals into groundwater in a desperate pursuit for energy."[45] New York State halted fracking within its borders in 2008, continued the moratorium in 2014 and banned the practice in 2015.The state's seven-year review concluded that fracking posed risks to land, water, natural resources and public health.[46,47] Also, New Jersey's legislature recently passed a bill that would prevent fracking waste, like toxic wastewater and drill cuttings, from entering its borders,[48] and Pennsylvania, ground zero for the fracking debate, has banned "natural-gas exploration across a swath of suburban Philadelphia . . . ."[49] Numerous cities and communities, like Buffalo, Pittsburgh, Raleigh, Woodstock, and Morgantown have banned fracking.[50]

Separate from hydraulic fracturing, the second technological development underlying the recent shale boom is the use of horizontal drilling. Shale oil and shale gas formations are typically located far below the surface, and as such, the cost of drilling a vertical well to access the layer is high.[51] The shale formation itself is typically a thin layer, such that a vertical well only provides access to a small volume of shale—the cylinder of permeability surrounding the well bore.[52] Although hydraulic fracturing increases the radius of this cylinder of shale, this effect is often itself insufficient to allow profitable extraction of shale resources.[53] Horizontal drilling solves this economic problem: by drilling sideways along the shale formation once it is reached, a company can extract resources from a much higher volume of shale for the same amount of drilling through the overburden, drastically increasing the fraction of total well length that passes through producing zones.[54] The practice of combining horizontal drilling with hydraulic fracturing was developed in the early 1990s.[55]

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[44] Castelvecchi, Davide, *France becomes first country to ban extraction of natural gas by fracking*, Scientific American (Jun. 30, 2011).
[45] CNN Staff Writer, *Vermont first state to ban fracking*, CNN U.S. (May 17, 2012).
[46] Public News Service - NY, *Cuomo Declares: No Fracking for Now in NY.* See: http://www.publicnewsservice.org/2014-12-18/health-issues/cuomo-declares-no-fracking-for-now-in-ny/a43579-1 .
[47] RT Network. June 30, 2015. *It's official: New York bans fracking.* https://www.rt.com/usa/270562-new-york-fracking-ban/ .
[48] Tittel, Jeff, *Opinion: Stop fracking waste from entering New Jersey's borders* (Jul 14, 2012) *available at* http://www.nj.com/times-opinion/index.ssf/2012/07/opinion_stop_fracking_waste_fr.html .
[49] Philly.com, *Fracking ban is about our water*, The Inquirer (Jul. 11, 2012).
[50] *CBS, Pittsburgh Bans Natural Gas Drilling*, CBS/AP (Dec 8, 2010)*;* Wooten, Michael *City of Buffalo Bans Fracking* (Feb. 9, 2011); The Raleigh Telegram, *Raleigh City Council Bans Fracking Within City Limits* (Jul. 11, 2012); Kemble, William, *Woodstock bans activities tied to fracking*, Daily Freeman (Jul. 19, 2012); MetroNews.com, *Morgantown Bans Fracking* (June 22, 2011), *available at* http://www.wvmetronews.com/news.cfm?func=displayfullstory&storyid=46214.
[51] CITI, Resurging North American Oil Production and the Death of the Peak Oil Hypothesis at 9 (Feb.15, 2012) ("CITI"); United States Energy Information Administration, Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays at 4 (Jul. 2011) ("USEIA 2011"); Orszag, Peter, Fracking Boom Could Finally Cap Myth of Peak Oil (Jan. 31, 2011) ("Orszag").
[52] *Id.*
[53] *Id.*; Arthur at 8 (Figure 4).
[54] Venoco, Inc., Monterey Shale Focused Analyst Day Slide Show at 23 (May 26, 2010) ("Venoco Slide Show"), USEIA 2012a at 63.
[55] *Id.*

A third technological development is the use of "multi-stage" fracking. In the 1990s, industry began drilling longer and longer horizontal well segments. The difficulty of hydraulic fracturing increases with the length of the well bore to be fractured, however, both because longer well segments are more likely to pass through varied conditions in the rock and because it becomes difficult to create the high pressures required in a larger volume.[56] In 2002, industry began to address these problems by employing multi-stage fracking. In multi-stage fracking, the operator treats only part of the wellbore at a time, typically 300 to 500 feet.[57] Each stage "may require 300,000 to 600,000 gallons of water," and consequently, a frack job that is two or more stages can contaminate and pump into the ground over a million gallons of water.[58]

Notwithstanding the grave impacts that these practices have on the environment, this new combination of multi-stage slickwater hydraulic fracturing and horizontal drilling has made it possible to profitably extract oil and gas from formations that only a few years ago were generally viewed as uneconomical to develop.[59] The effect of hydraulic fracturing on the oil and gas markets has been tremendous, with many reports documenting the boom in domestic energy production. A recent congressional report notes that "[a]s a result of hydraulic fracturing and advances in horizontal drilling technology, natural gas production in 2010 reached the highest level in decades."[60] A 2011 U.S. EIA report notes how recently these changes have occurred, stating that "only in the past 5 years has shale gas been recognized as a 'game changer' for the U.S. natural gas market."[61] With respect to oil, the EIA notes that oil production has been increasing, with the production of shale oil resources pushing levels even higher over the next decade:

> Domestic crude oil production has increased over the past few years, reversing a decline that began in 1986. U.S. crude oil production increased from 5.0 million barrels per day in 2008 to 5.5 million barrels per day in 2010. Over the next 10 years, continued development of tight oil, in combination with the ongoing development of offshore resources in the Gulf of Mexico, pushes domestic crude oil production higher.[62]

Thus, it is evident that fracking, including fracking with the most recent techniques that have been associated with serious adverse impacts in other areas of the country, is poised to expand; it is further evident that the oil and gas industry is still exploring new locations to develop, and the nation has not yet seen the full extent of fracking's impact on oil and gas development and production.

In large part through the use of fracking, the oil and gas sector is now producing huge amounts of oil and gas throughout the United States, rapidly transforming the domestic energy outlook. Fracking is occurring in the absence of adequate federal or state oversight. The current informational and regulatory void makes it even more critical that the BLM perform its legal

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[56] NYDEC SGEIS at 5-93.
[57] *Id.*
[58] *Id.*
[59] *See* CITI at 9 ; USEIA 2011 at 4; Orszag, Peter, *Fracking Boom Could Finally Cap Myth of Peak Oil* (Jan. 31, 2011) ("Orszag").
[60] Waxman 2011b at 1.
[61] USEIA 2011 at 4.
[62] USEIA 2012a at 2

obligations to review, analyze, disclose, and avoid and mitigate the impacts of its oil and gas leasing decisions, and analyze cumulative impacts in the context of increasing exploitation of the Utica and Marcellus shale plays in the Appalachian Basin. Further, given the failure of the 2006 Wayne National Forest FEIS and Forest Plan and the Forest Service's 2012 Supplemental Information Report to adequately address the impacts of fracking and horizontal drilling, it would be inappropriate for BLM to simply refer to the environmental analysis in these documents.

A. The Draft EA Underestimates Surface Disturbance and Well Development Resulting from New Leasing.

The leasing of approximately 40,000 acres of WNF subsurface will likely result in significant surface impacts from new drilling and hydraulic fracturing – the amount and nature of which have not been adequately examined in the Forest Plan, the Forest Plan EIS, the 2004 Reasonably Foreseeable Development Scenario (RFDS), the 2012 Supplemental Information Report (SIR) regarding horizontal drilling, or the Draft EA.

Specifically, the existing NEPA documentation for the WNF seriously underestimates the potential for surface disturbance resulting from both horizontal and vertical development, because: (1) it ignores the potential for federal mineral leasing to provide operators access to private minerals via horizontal drilling, and to open up private surface for new well development; (2) the BLM's surface impact footprint estimates for well pad sites, compressor station sites, and gathering lines are significantly lower than empirical field data suggests, and fails to meaningfully discuss vertical well development;[63] and (3) no site-specific analysis is performed with respect to the location of horizontal well pad development, even though BLM has identified areas in which such development could occur.

1. <u>The Draft EA Ignores the Potential for New Federal Leasing to Open Up Private Minerals and Private Surface to Horizontal Drilling.</u>

It is highly likely that horizontal drilling for federal minerals would open up substantial private minerals for development, given that large portions of the Marietta Unit are private surface or private mineral and surround tracts of federal minerals which are too small to develop on their own, but which operators wish to access to develop adjacent private minerals. Further, any horizontal drilling would likely occur from private surface, as operators would likely prefer to develop on private surface out of the reach of federal regulation. The Draft EA and the 2012 SIR that it relies on, however, ignore the potential for federal leasing to open up private minerals and private surface for development, rendering the Draft EA fundamentally flawed.

In scoping, commenters noted that federal leasing is necessary to enable the development of private mineral resources on adjacent lands. EA at 17. Surface and mineral ownership is "highly fragmented and complicated" throughout the Wayne National Forest. EA at 18. Over three-quarters of the Marietta Unit is private surface, almost all of which overlays private

[63] Nor have the agencies evaluated potential impacts from transmission lines for the foreseeable pipeline infrastructure needed to transport the oil and gas to market. Foreseeable transmission line impacts should be considered in an EIS.

minerals. EA at 50. Federal surface within the Marietta Unit is scattered throughout this area and is non-contiguous.[64] Of this federal surface, nearly three-quarters is underlain by private oil and gas. EA at 50.

The 2012 SIR projects that 10 horizontal well pads (or 80 horizontal wells) could be developed on federal surface in the Marietta Unit and that horizontal wells would likely target the Utica and Marcellus shales. Horizontal drilling, however, is only economically feasible if sufficiently large expanses of minerals are available. To drill up to 8 wells from a single horizontal well pad, the scenario considered in the 2012 SIR, each lateral wellbore would extend one to two miles,[65] with a minimum spacing of 1,000 foot between each lateral.[66] The total production area per well pad amounts to approximately one to two square miles or 640 to 1,280 acres.

Many of the nominated parcels for lease, however, are substantially smaller than 640 or 1,280 acres and thus would not be exploitable via horizontal drilling unless they were "pooled" with adjacent private minerals. By the same token, private oil and gas extraction within the Marietta Unit may not be feasible unless the minerals are pooled with adjacent federal minerals.[67] Thus, a reasonably foreseeable consequence of federal leasing is opening up private minerals for oil and gas development, including those minerals beneath private surface.

Neither the 2004 Reasonably Foreseeable Development Scenario (RFDS), the 2006 Forest Plan EIS, nor the 2012 SIR, however, took into account the potential for federal oil and gas leasing to open up private minerals, and they specifically excluded the consideration of private mineral development beneath private surface. The 2004 Reasonably Foreseeable Development Scenario prepared for the Wayne National Forest only analyzed the total number of vertical well pads that could be developed on *federal* surface (both private and federal minerals). *See* 2012 SIR, Appendix B, 1.[68] The 2004 RFDS formed the basis for the 2006 Forest

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[64] U.S. Forest Service, Athens Ranger District- Marietta Unit Map, *available at* http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5108534.pdf.

[65] "Horizontal drilling into a formation requires that the formation in question be thick enough that the drill bit can penetrate the formation, be turned horizontally and remain in the formation during drilling and production. The driller must also have the right to access a continuous and large enough portion of the formation to make the wells economically viable." 2012 SIR, Appendix C at 2. "Optimally, operators would like to have lease blocks of about 2 square miles contiguous to allow drilling in two directions from one central drill pad." Wickstrom, Larry et al. The Utica-Point Pleasant Shale Play of Ohio, Ohio Dept. of Natural Resources, Division of Geological Survey, p. 5, available at https://geosurvey.ohiodnr.gov/portals/geosurvey/energy/Utica-PointPleasant_presentation.pdf; *see also* Geology.com, Utica Shale – Horizontal Wells Drilled in Ohio, available at http://geology.com/utica.shtml (noting horizontal wells can extend underground up to two miles beyond the drilling location); FracTracker, Ohio Shale Gas Viewer (showing horizontal wellbores of one to two miles), available at http://maps.fractracker.org/3.13/?appid=2b7611b38d434714ba2033d76cc0ccc3).

[66] For wells over 4,000 feet deep, the minimum spacing is 1,000 feet (vertically and horizontally). 2012 SIR at 3. Utica shale is around 6,000 to 7,000 feet deep. *See* Wickstrom at 30; *see also id*. at 6 (noting 1,000 foot spacing).

[67] *See* Landowners for Energy Access and Safe Exploration (LEASE), Press Release, Landowners Encourage Public Comment In Support of Leasing Wayne (May 11, 2016) available at http://www.ohio.com/blogs/drilling/ohio-utica-shale-1.291290/ohio-landowners-urge-blm-to-proceed-with-wayne-nf-drilling-1.682216 (spokesperson of private mineral owners complaining that delay in leasing has "block[ed] landowners from developing their private mineral rights" and that "should the agency take no further action, landowners' private property rights would continue to be squandered").

[68] 2012 SIR, Appendix B at 1 (forecasting "total number of new wells and associated surface disturbance that will

Plan EIS's effects evaluation. The 2012 SIR's updated analysis projected that 10 horizontal well pads would be developed in the Marietta Unit, causing 55 acres of short-term disturbance. But this projection only includes "well sites that may take place on federal minerals or private minerals *underlying WNF surface lands*," and excludes private surface lands located within the administrative boundary of the Marietta Unit. [69] The EA's failure to address private mineral development and overlying private surface disturbance resulting from federal leasing, and its tiering to these outdated studies, violates NEPA's requirement to study reasonably foreseeable consequences of the proposed action, and infects the entire effects analysis in the EA. By opening up federal and *private* minerals to drilling, the proposed leasing could dramatically increase the total number of new well pads and wells, total surface disturbance, watershed impacts, cumulative air pollution emissions, public health risks, habitat loss, and disturbance to wildlife.[70]

Further, if wells can be drilled from different locations to access pooled federal and non-federal minerals, operators will undoubtedly choose to drill from areas where they are subject to the least stringent regulations, and less federal oversight.[71] While an operator that drills on private surface to extract federal minerals horizontally as part of a pool or unit would be subject to BLM's requirement for an Application for Permit to Drill ("APD"), it would not be subject to any of the Forest Plan's requirements on surface use, and therefore would only be constrained by the APD, state regulations, and whatever agreement, if any, it has in place with the surface owner.v Whether BLM would incorporate in an APD Forest Plan surface protections on private surface is not addressed in the EA.[72] In addition, it is unclear to what extent notifications and stipulations attached to a lease would apply to private surface activities overlying private minerals that have been pooled with federal minerals. Such lease conditions are presumably only intended to apply to the areas overlying the federal minerals—the only area the agencies would have analyzed at the time of lease issuance. *See* 2012 SIR, Appendix A ("Not all of these notifications and stipulations are applied to every lease, rather, *only those that are relevant based on site conditions*. These notifications and stipulations are necessary to protect specific resource values *on the lease area*." [emphasis added].).

The EA's assumption, then, that all impacts of oil and gas leasing within the Marietta Unit would be mitigated by Forest Plan regulations, or by surface use agreements with the Forest Service, is baseless. Surely, much of the leased acreage can and likely would be accessed from

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likely occur on federal surface over the next 10 years, regardless of mineral classification").

[69] 2012 SIR at 3.

[70] *See Northwoods Wilderness Recovery, Inc. v. U.S. Forest Service*, 323 F.3d 405 (6th Cir. 2003) (holding Forest Service acted arbitrarily and capriciously in approving logging project that exceeded acreage projected in applicable forest plan and EIS; environmental impacts to wildlife and other resources had been tailored to the EIS/plan logging projections, thus additional NEPA analysis was required prior to any logging project approval).

[71] "With only 7 wells on federal surface over the last 8 years, the extensive drilling in Washington and Monroe Counties has not significantly impacted the WNF. This lack of drilling activity in the Marietta Unit is most likely attributed to operator's disdain for the additional paperwork and operating requirements associated with being on Forest Service surface and their unwillingness to wait for the necessary authorization to begin their projects (The average time to receive a drilling permit from the Ohio Division of Oil and Gas was 12.6 days in 2002 compared to Forest Service processing times requiring from 60 days to one year.)." 2012 SIR, Appendix B at 12.

[72] *See* 2012 SIR, Appendix E at 9 ("The BLM has sole decision authority for split estate lands (Federal minerals/private or State surface) within boundaries of Forest Service administrative units.").

wells on private surface, which comprises three-quarters of the Marietta Unit, but the EA completely ignores this potential and its consequences.

For example, the 2012 SIR assumes that surveys for listed species and "closed systems" for storing wastewater will be required, and netting would not be allowed, to protect the ESA-listed Indiana bat. 2012 SIR at 47. But these Forest Plan requirements are only applicable to federally-owned surface within the national forest. Because wastewater ponds are allowed under Ohio law, *see* OAC § 1501:9-3-08, ORC 1509.22(C)(4), federal leasing could lead to these hazards for the Indiana bat on private surface lands.[73] These are not only "reasonably foreseeable" impacts that must be studied under NEPA, but are "effects of other activities that are…interdependent with [the proposed] action," over which consultation is required under section 7 of the ESA. *See* section VI(H)(1)(a) below.

The Draft EA and the 2012 SIR's total failure to project well pad development on private surface within the planning area and its watersheds (regardless of whether enabled by federal leasing) also results in an incomplete cumulative effects analysis. BLM routinely projects future well development on non-federal surface within the administrative boundaries of its field offices to inform its study of cumulative effects.[74] There is no reason why BLM could not do so here. BLM must prepare a new reasonably foreseeable development scenario that projects well development on both private and federal land. The cumulative impacts of these activities on watershed health, air quality, greenhouse gases, wildlife, and land use must be studied in an EIS.

Finally, the Draft EA's reliance on the 2012 SIR is improper, because it incorrectly concludes that Standards and Guidelines in the Forest Plan would reduce the effects of horizontal drilling. *See, e.g.*, 2012 SIR at 70. But these purported requirements (such as closed systems for wastewater storage) would not necessarily apply to federal surface activities overlying private minerals. The 2005 Biological Opinion explicitly acknowledges that even Standards and Guidelines intended to protect listed species would be voluntary and would not always be enforceable in split-estate situations, despite the Forest Service's ownership of the surface.[75] The

[73] Ramirez, Pedro, U.S. Fish and Wildlife Service, Reserve Pit Management: Risks to Migratory Birds (Sept. 2009), available at https://www.fws.gov/migratorybirds/pdf/management/reservepitmanagementriskstomigbirds.pdf (noting bats can be attracted to wastewater pits); *see also* Ohio Department of Natural Resources, Wastewater (Flowback) from Hydraulic Fracturing, available at https://oilandgas.ohiodnr.gov/portals/oilgas/pdf/Wastewater-flowback.pdf.

[74] *See, e.g.*, BLM, Reasonable Foreseeable Development Scenario for Oil and Gas Activities in the BLM White River Field Office: Rio Blanco, Moffat and Garfield Counties, Colorado, p. 36 (Sept. 10, 2007), available at http://www.blm.gov/style/medialib/blm/co/programs/land_use_planning/rmp/white_river/documents.Par.71793.File.dat/WRFO_RFD_2007.pdf; BLM, Reasonably Foreseeable Development Scenario for Oil and Gas Grand Junction Field Office, Colorado, p. 44 (noting "BLM managed" wells is a subset of "total" projected wells) (June 18, 2012), available at http://www.blm.gov/style/medialib/blm/co/field_offices/grand_junction_field/Draft_RMP/DRMP_Documents.Par.18960.File.dat/GJFO%20RFD%206-18-2012%20Final.pdf.

[75] Biological Opinion at 18 ("In the process of reviewing the plan of operation for reserved [private] rights, or when negotiating the terms and conditions of a plan of operation for outstanding [private] minerals, the WNF will request a voluntary adherence to Forest Plan S&G that protect endangered species and their habitat."); *see also id.* at 55. ("Although the WNF provides Indiana bat protection recommendations to private individuals needing access across or on the forest, S&G are not always enforceable.").

2012 SIR incorrectly assumes that the Service could "require" these measures.[76] BLM's proposed finding of no significance on this basis is arbitrary and capricious.

2. BLM's Estimates of Surface Disturbance for Well Pads, Compressor Stations, and Gathering Lines Are Inaccurate and Fail to Account for Vertical Well Development.

In addition to underestimating the total number of well pads that could result from the leasing proposal, the NEPA documentation for the proposed leasing fails to accurately estimate the total surface disturbance associated with each well pad, new compressor stations, gathering lines, and vertical well development, thereby precluding a complete disclosure of soil, water quality, vegetation, and wildlife impacts.

As former Wayne National Forest Supervisor Anne Carey noted in the 2012 SIR, an accurate surface disturbance analysis is critical because the validity of the Forest Plan and Forest Plan EIS hang on that analysis and the upper limits of disturbance considered therein. Per the 2012 SIR,

> It is unlikely that, for the foreseeable future, drilling disturbance will exceed the acreage envisioned in the existing analysis. This is important, since the biological documents for the Forest Plan (EIS Appendices F1-F3) considered the effects of oil and gas activities on wildlife and plant resources up to the projected acres.[77] (emphasis added)

The BLM and Forest Service must prepare a full Environmental Impact Statement in order to take the requisite "hard look" at the true potential for surface impacts resulting from leasing approximately 40,000 acres of federal subsurface. Moreover, given the importance of the NEPA surface analysis to the overall structure and content of the 2006 Forest Plan and EIS, the shortcomings of those documents, and the quickly approaching end of the period analyzed (2006-2016), the agencies may well need to supplement, amend, and/or revise the Forest Plan and EIS. This prospect was expressly advanced in the 2012 SIR:

> If the combination of horizontal and vertical well activity approaches the analyzed acreage totals (272 acres and 121 acres), or the potential effects of specific well proposals are outside of those predicted in the existing EIS, I will then determine whether to suspend leasing activity, revise the Forest Plan EIS or amend the Forest Plan.[78]

As noted in the 2012 SIR, the 2006 Forest Plan and EIS considered 272 acres of initial disturbance and 121 acres of disturbance after site reclamation to be the "upper limits for the first decade of the Forest Plan [2006-2016]."[79] At the time of the 2012 SIR, and due to development

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[76] 2012 SIR at 47.

[77] Supplemental Information Report (SIR), August 27, 2012 Letter of Anne Carey, Wayne National Forest Supervisor, RE: Review of New Information.

[78] *Id.*

[79] SIR, Executive Summary, pp. 9-10:

> For acres of disturbed surface, the RFDS for oil and gas projected the total acres of surface disturbed by oil and gas drilling before reclamation as 272 acres (sum of the 3 units: Athens,

since the effective date of the 2006 Forest Plan, the available analyzed acreage of disturbance remaining had been revised downward to 180.5 acres of pre-reclamation disturbance and 93.1 acres of post-reclamation disturbance.[80] The RFDSs in the agencies' existing NEPA documentation do not appear to consider potential surface impacts beyond 2016.

The 2006 Forest Plan EIS separately contemplated an upper limit of 45 miles (87 acres) of road disturbance resulting from oil and gas development (43 miles remaining as of 2012 SIR) and an upper limit of 50 acres total for any and all utility development (not just oil and gas pipeline) proposed to cross the Wayne (36.73 acres remaining as of 2012 SIR).[81] Notably, neither the 2006 Forest Plan and EIS nor the 2012 SIR considers the potential impacts associated with gathering pipelines. Rather, the 2004 RFDS and 2012 SIR dismiss this class of impact out of hand, stating:

> Given the long history of gas production in the WNF, there is already a well developed pipeline infrastructure in place which should minimize the need for lengthy gathering lines to service new wells.[82]

Moreover, the Draft EA offers a mere two passing statements on the subject of pipeline construction, stating only that: "If the well produces natural gas, and the flowline is in the road, another 0.5 acres may be affected by flowline construction. … If the well is productive, additional land may be affected by pipeline construction." Draft EA at pp. 21 and 22. The Draft EA fails to elaborate on these statements.

This oversight is particularly problematic because gathering lines have been recognized as the single largest source of surface impacts associated with oil and gas development. According to one source, over two-thirds of the surface disturbance caused by horizontal well development is created by the construction of gathering pipelines (19 acres per well pad site, direct and edge effects).[83] Moreover, it is unlikely that existing gathering line infrastructure on the Wayne could accommodate future horizontal operations. Field studies conducted by The Nature Conservancy show that "the supporting [horizontal] infrastructure is much larger in scale

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> Ironton, and Marietta) and the total acres of surface needed to support drilled wells that are completed for production (excess disturbance reclaimed) as 121 acres (sum of 3 units)(EIS Appendix G, p G-1, also see EIS, p 3-18, Table 3-8 and p 3-262, Table 3-69). These are the acres which were the focus for analysis within the EIS and associated planning documents. Whether a vertical or horizontal well site is created, the acres described above (272 acres development and 121 production phase) were analyzed as upper limits for the first decade of the Forest Plan. (emphasis added).

[80] SIR, August 27, 2012 Letter of Anne Carey, Wayne National Forest Supervisor, RE: Review of New Information, at Table 1.

[81] SIR, pp. 43 and 75, Table 13.

[82] SIR, Appendix B: Oil and Gas Management, including the Reasonably Foreseeable Development Scenario (Appendix G of the EIS), p. 7.

[83] The Nature Conservancy, *Land Use and Ecological Impacts from Shale Development in the Appalachians*, Summary Statement for DOE Quadrennial Energy Review Public Stakeholder Meeting Pittsburgh, PA July 21, 2014, available at: http://energy.gov/sites/prod/files/2014/07/f17/pittsburg_qermeeting_minney_statement.pdf; *see also* E.T. Slonecker, et al., U.S. Geological Survey, Landscape Consequences of Natural Gas Extraction in Bradford and Washington Counties, Pennsylvania, 2004-2010 (2012) at p. 26 ("Pipeline construction was the source of most of the increase in forest patch number."), available at: https://pubs.usgs.gov/of/2012/1154/of2012-1154.pdf.

(24" diameter pipelines to gather gas from wells versus 2" or 4" pipelines in shallow fields)."[84] Additional findings from The Nature Conservancy include the following:

- In the Marcellus region, gathering lines may range from 6 to 24 inches in diameter and may clear rights-of-way (ROW) of 30 to 150 feet wide. These are much larger than gathering lines used in shallow gas fields, which generally range from 2 to 6 inches in diameter.[85]

- The result is an average of 1.65 miles of gathering pipeline for each Marcellus well pad. Although the entire network of wells and gathering pipelines will take years to complete, the density of development in Bradford County is one of the highest in Pennsylvania. The ratio of pipelines to pads may be higher in other counties where gas development is more dispersed.[86]

- Each mile of a 100-foot right-of-way directly disturbs 528,000 square feet or approximately 12 acres and creates an additional 72 acres of new forest edges.[87]

- Rights-of-way for Marcellus gathering lines are generally cleared up to a width of 100 feet, but may be up to 150 or 200 feet if transport lines share the same corridor. After construction is completed, some portion of the right-of-way may be allowed to re-vegetate to trees and shrubs. At least 50 feet of the right-of-way, centered on the pipeline, is generally kept open, though vegetated with grass to minimize erosion and to facilitate monitoring, maintenance and repairs of the pipeline. This area represents a long-term loss of the cleared habitat. Even where forest remains, pipeline corridors can fragment large patches of forest into smaller ones …. The new open corridor inhibits the movement of some species, such as forest interior nesting birds, which are reluctant to cross openings where they are more exposed to predators (Bennett, 2003).[88]

In addition, recent research in Eastern Ohio examined 122 horizontal well pads and found an average of 17 acres of direct pipeline disturbance per well pad.[89] Separate, ongoing research in Eastern Ohio has found approximately 8.5 acres of gathering line clearing for every acre of

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[84] Johnson, Nels, 2010, *Pennsylvania energy impacts assessment, Report 1*: Marcellus Shale Natural Gas and Wind, The Nature Conservancy, Pennsylvania Chapter, and Pennsylvania Audubon, page 9 available at: http://www.nature.org/media/pa/tnc_energy_analysis.pdf.

[85] *See also* Johnson, N.. Gagnolet, T., Ralls, Stevens, J. 2011. *Pennsylvania Energy Impacts Assessment. Report 2: Natural Gas Pipelines*. The Nature Conservancy, Harrisburg, page 1, *available at*: http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/pennsylvania/ng-pipelines.pdf.

[86] *Id*. at 3.

[87] *Id*. at 5.

[88] *Id*. at 6.

[89] *See* McClaugherty, Charles (Biology, University of Mount Union); Auch, Walter (Cleveland State University; The Great Lakes Program of The FracTracker Alliance); Genshock, Eric (Environmental Science, University of Mount Union); Buzulencia, Haley (Environmental Science, University of Mount Union), *Landscape Impacts of Infrastructure Associated with Utica Shale Oil and Gas Extraction in Eastern Ohio*. (847 ha of pipeline divided by 122 well pad sites), *available at*: http://www.fractracker.org/a5ej20sjfwe/wp-content/uploads/2012/12/Genshock_MtUnion_Pipeline_LandUseChange.jpg.

well pad, though ratios have been found to average as high as 14:1 in areas with relatively low well pad density.[90]

The SIR and the BLM Eastern States, May 3, 2012 Letter to WNF Supervisor Anne Carey contained therein project the potential for up to 13 horizontal well pad sites on the WNF (10 on the Marietta Unit and 3 on the Athens Unit). It is difficult, if not impossible, to evaluate the validity of this estimate because the SIR does not adequately reveal the methodology or process used to arrive at it in any detail.

In addition, the agencies should consider potential surface impacts resulting from co-location of horizontal and vertical development. The 2004 RFDS suggests this possibility, but the agencies have not yet given it any consideration.[91] Further, it is unclear from the 2012 SIR whether surface disturbance from vertical well development is still expected to occur within the WNF. The SIR's analysis indicates only that because new horizontal well development falls within the scope of projected effects of vertical well development, increased effects are not expected from horizontal drilling. This reasoning implies that vertical well pad development would no longer occur within the WNF, but it is unclear whether that is actually the case.

Moreover, the horizontal well site disturbance estimates provided by BLM in the SIR appear to seriously underestimate the potential for negative impacts. The BLM Letter (adopted in the SIR) estimates that horizontal well pad sites average 3-5.5 acres of disturbance during construction and prior to reclamation, and 0.68-1.38 acres during the production phase, after reclamation. However, it is not clear that the BLM's analysis includes the Limits of Disturbance (LOD) for each well pad – i.e., the clearing and earth-moving impacts that occur immediately adjacent to the pad itself. For example, a review of 122 horizontal wells in East-Central Ohio revealed a mean LOD of 6.94 acres:

> Well pads were remarkably consistent in their area with a mean of 1.35 (sd = 0.14) ha [3.33 acres] per pad regardless of the number of bore holes on the pad. Limits of disturbance (LOD) on the other hand were variable depending on the surrounding terrain. The mean LOD, including the well pad itself, was 2.81 (sd=0.71) ha [6.94 acres].[92]

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[90] Information obtained from January 28, 2016 conversation with Ted Auch, PhD, The FracTracker Alliance, relating to his ongoing landscape impact research in East-Central Ohio in collaboration with Chuck McClaugherty's lab at the University of Mt. Union (examining 285 well pads and associated infrastructure); *see also* Auch, Ted, FracTracker Alliance, Testimonial re Land-Use Footprint of High Volume Hydraulic Fracturing in Eastern Ohio (May 2016).

[91] SIR, Appendix B: Oil and Gas Management, including the Reasonably Foreseeable Development Scenario (Appendix G of the EIS), at 4.

> In areas of the WNF where there are multiple potentially productive zones at varying depths, the potential exists for a higher density of wells due to overlapping spacing units. Two wells could be located side by side and still satisfy spacing requirements because they are completed at different depths.

[92] McClaugherty, Charles (Biology, University of Mount Union); Auch, Walter (Cleveland State University; The Great Lakes Program of The FracTracker Alliance); Genshock, Eric (Environmental Science, University of Mount Union); Buzulencia, Haley (Environmental Science, University of Mount Union), *Landscape Impacts of Infrastructure Associated with Utica Shale Oil and Gas Extraction in Eastern Ohio*.

Ongoing research of 285 well pads in Eastern Ohio has found LODs of 10-14 acres per pad (not including access roads, gathering lines, or transmission lines).[93] In a recent review of 242 Marcellus well pads, researchers found "[w]ell pads occupy 3.1 acres on average while the associated infrastructure (roads, water impoundments, pipelines) takes up an additional 5.7 acres, or a total of nearly 9 acres per well pad."[94] This study found an average of 21 additional acres of edge effect disturbance, for an average of 30 acres total of both direct and indirect interior forest habitat loss per well pad.[95]

It is also not clear whether the 2012 SIR and 2006 EIS consider the surface footprints of freshwater or wastewater retention ponds. The footprint of retention ponds should be considered if they may be allowed.

The BLM Letter and SIR also estimate acreage for compressor stations at 1-5 acres.[96] However, ongoing research in East-Central Ohio suggests that compressor station sites tend to range between 15 to 30 acres in size.[97] Note, too, that the SIR – which includes a section on "Noise and Light Pollution," fails to mention, let alone consider, the significant noise and air pollution generated by compressor stations and their associated equipment.[98] The Draft EA likewise fails to consider the substantial and continuous noise impacts generated by compressor stations. *See* Draft EA, pp. 78 and 88-89 (describing noise impacts as temporary and associated with construction equipment).

The 2006 Forest Plan and EIS, 2012 SIR, and the Draft EA severely underestimate the potential surface impacts of well pad site development and associated infrastructure – both the immediate effects of land clearing and earthmoving, and the resulting surface runoff, industrialization, habitat fragmentation, and edge effects.[99] Consequently, the agencies must

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[93] Information obtained from January 28, 2016 conversation with Ted Auch, PhD, The FracTracker Alliance, relating to his ongoing landscape impact research in East-Central Ohio in collaboration with Chuck McClaugherty's lab at the University of Mt. Union (examining 285 well pads and associated infrastructure); *see also* Auch, Ted, FracTracker Alliance, Testimonial re Land-Use Footprint of High Volume Hydraulic Fracturing in Eastern Ohio (May 2016).

[94] Johnson, Nels, 2010, *Pennsylvania energy impacts assessment, Report 1*: Marcellus Shale Natural Gas and Wind, The Nature Conservancy, Pennsylvania Chapter, and Pennsylvania Audubon, accessed January 12, 2011, page 9-11 at: http://www.nature.org/media/pa/tnc_energy_analysis.pdf.

[95] *Id.*

[96] SIR, Executive Summary, p. 2 at Table 1.

[97] Information obtained from January 28, 2016 conversation with Ted Auch, PhD, The FracTracker Alliance, relating to his ongoing landscape impact research in East-Central Ohio in collaboration with Chuck McClaugherty's lab at the University of Mt. Union; *see also* Auch, Ted, FracTracker Alliance, Testimonial re Land-Use Footprint of High Volume Hydraulic Fracturing in Eastern Ohio (May 2016).

[98] *See* SIR, Executive Summary, page 13.

[99] The negative edge effects resulting from oil and gas development have been well documented. *See, e.g.*, Thomas, E., Brittingham, M., & Stoleson, S. (2014). *Conventional oil and gas development alters forest songbird communities.* The Journal of Wildlife Management, *78* (2), 293-306 DOI: 10.1002/jwmg.662 (fragmentation effects from conventional oil and gas development on Allegheny National Forest greatly reduced core forest habitat type and negatively impacted neotropical migrant songbird species, while benefitting less desirable species, e.g., cowbird); Slonecker, E.T., Milheim, L.E., Roig-Silva, C.M., Malizia, A.R., Marr, D.A., and Fisher, G.B., 2012, *Landscape consequences of natural gas extraction in Bradford and Washington Counties, Pennsylvania*, 2004–2010: U.S. Geological Survey Open-File Report 2012–1154, 36 p.

supplement, amend, and/or revise the Forest Plan and EIS. The potential for 40,000 acres of new leasing in the WNF clearly necessitates the preparation of a full Environmental Impact Statement.

3. BLM Must Analyze the Site-Specific Impacts of Horizontal Well Pad Development.

BLM's May 2012 letter to the Forest Service updating its projection of horizontal well pad development indicates that BLM could disclose the likely locations of new horizontal wells and resulting site-specific impacts within those areas. BLM explained its horizontal well pad development projections as follows:

> The two key factors in the development of the minerals below the WNF are the surface topography and the extent and continuity of the geologic formations. The well pad sites for horizontal drilling require relatively flat surfaces that are at least 3.5 acres in size. The WNF does not contain many locations that are this size or greater, and are relatively flat. Horizontal drilling into a formation requires that the formation in question be thick enough that the drill bit can penetrate the formation, be turned horizontally and remain in the formation during drilling and production. The driller must also have the right to access a continuous and large enough portion of the formation to make the wells economically viable. Given these factors, even with the change in horizontal drilling technology, 13 horizontal well pad sites with an average of 6 wells per site is a reasonable forecast of horizontal drilling on the WNF.

2012 SIR, Appendix C, p. 2.

This statement strongly suggests that BLM knows generally where horizontal well pads are likely to be developed, because the number of new well pads are constrained by location-specific factors. Because BLM has existing information allowing it to meaningfully perform site-specific analysis of the potential effects of future well pad and other infrastructure development, it is wholly improper for BLM to defer such analysis until a later stage. For example, BLM defers analysis of road and well pad development's sub-watershed effects on "water quality and quantity." *See* 2012 SIR at 33. But because the general locations of where new horizontal well pads could be developed are already known, it is entirely possible for BLM to disclose those locations and assess potential water quality effects at the local sub-watershed scale.

III. Unconventional Oil and Gas Operations Pose Risks to Water Resources

While much remains to be learned about fracking,[100] it is clear that the practice poses serious threats to water resources. Across the U.S., in states where fracking or other types of unconventional oil and gas recovery has occurred, surface water and groundwater have been contaminated. Recent studies have concluded that water contamination attributed to

[100] United States Government Accountability Office, Unconventional Oil and Gas Development – Key Environmental and Public Health Requirements (2012); United States Government Accountability Office, Oil and Gas – Information on Shale Resources, Development, and Environmental and Public Health Risks (2012).

unconventional oil and gas activity has occurred in several states, including Colorado,[101] Wyoming,[102] Texas,[103] Pennsylvania,[104] Ohio,[105] and West Virginia.[106]

The likelihood that the proposed oil and gas leasing will result in fracking raises several issues that BLM must address:

- Where will the water come from and what are the impacts of extracting it?
- What chemicals will be used in the drilling and fracking process?
- How will BLM ensure the collection and disclosure of that information?
- What limitations will BLM place on the chemicals used in order to protect public health and the environment?
- What measures will BLM require to ensure adequate monitoring of water impacts, both during and after drilling?
- What baseline data is available to ensure that monitoring of impacts can be carried out effectively? How will BLM collect baseline data that is not currently available?
- Much of the fracking fluid returns to the surface as toxic waste. Where will the discharge go?
- Is there the potential for subsurface migration of fracking fluids, or the potential for those fluids to escape into the groundwater by way of a faulty casing?
- What kinds of treatment will be required?
- What is the potential footprint and impact of the necessary treatment facilities?

BLM's analysis of potential impacts to water must take account of all significant and "foreseeable" impacts to water that may arise from the proposed oil and gas leasing, including the following issues.

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[101] Trowbridge, A., *Colorado Floods Spur Fracking Concerns*, CBS News, Sept. 17, 2013, *available at* http://www.cbsnews.com/8301-201_162-57603336/colorado-floods-spur-fracking-concerns/ ("Trowbridge 2013") (accessed July 30, 2015).

[102] U.S. Environmental Protection Agency, Draft Investigation of Ground Water Contamination near Pavillion, Wyoming (2011) ("USEPA Draft Pavillion Investigation"); DiGiulio, Dominic C. et al. Impact to Underground Sources of Drinking Water and Domestic Wells from Production Well Stimulation and Completion Practices in the Pavillion, Wyoming, Field, Environ. Sci. Technol., 2016, 50 (8), pp. 4524–4536, abstract available at http://pubs.acs.org/doi/abs/10.1021/acs.est.5b04970.

[103] Fontenot, Brian et al., *An Evaluation of Water Quality in Private Drinking Water Wells Near Natural Gas Extraction Sites in the Barnett Shale Formation*, Environ. Sci. Technol., 47 (17), 10032–10040 DOI: 10.1021/es4011724, *available at* http://pubs.acs.org/doi/abs/10.1021/es4011724 ("Fontenot 2013").

[104] Jackson, Robert et al., *Increased Stray Gas Abundance in a Subset of Drinking Water Wells near Marcellus Shale Gas Extraction*, Proc. Natl. Acad. of Sciences Early Edition, doi: 10.1073/pnas.1221635110/-/DCSupplemental (2013) ("Jackson 2013").

[105] Shulman, Seth, *Ohio Wake-Up Call On Fracking Disclosure Laws*, Union of Concerned Scientists, August 2014, *available at* http://www.ucsusa.org/publications/got-science/2014/got-science-august-2014.html#.V0NKhvkrK2w

[106] Begos, K., *Four States Confirm Water Pollution*, Associated Press, January 5, 2014, *available at* http://www.usatoday.com/story/money/business/2014/01/05/some-states-confirm-water-pollution-from-drilling/4328859/ (accessed July 29, 2015); *see also* U.S. EPA, Assessment of the Potential Impacts of Hydraulic Fracturing for Oil and Gas on Drinking Water Resources, External Review Draft (June 2015) ("EPA 2015"), *available at* http://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=523539 (accessed July 30, 2015).

1. Surface Water Contamination

Surface waters can be contaminated in many ways from unconventional well stimulation. In addition to storm water runoff, surface water contamination may also occur from chemical and waste transport, chemical storage leaks, and breaches in pit liners.[107] The spilling or leaking of fracking fluids, flowback, or produced water is a serious problem. Harmful chemicals present in these fluids can include volatile organic compounds ("VOCs"), such as benzene, toluene, xylenes, and acetone.[108] As much as 25 percent of fracking chemicals are carcinogens,[109] and flowback can even be radioactive.[110] As described below, contaminated surface water can result in many adverse effects to wildlife, agriculture, and human health and safety. It may make waters unsafe for drinking, fishing, swimming and other activities, and may be infeasible to restore the original water quality once surface water is contaminated. BLM should consider this analysis in the EIS.

i. Chemical and Waste Transport

Massive volumes of chemicals and wastewater used or produced in oil and gas operations have the potential to contaminate local watersheds. Between 2,600 to 18,000 gallons of chemicals are injected per hydraulically fracked well depending on the number of chemicals injected.[111] Approximately 16 million gallons of wastewater from in-state were injected into wastewater injection wells in Ohio.[112] This waste can reach fresh water aquifers and drinking water.

Produced waters that fracking operations force to the surface from deep underground can contain high levels of total dissolved solids, salts, metals, and naturally occurring radioactive materials.[113] If spilled, the effects of produced water or brine can be more severe and longer-lasting than oil spills, because salts do not biodegrade or break down over time.[114] The only way

[107] Vengosh, Avner et al., *A Critical Review of the Risks to Water Resources from Unconventional Shale Gas Development and Hydraulic Fracturing in the United States*, Environ. Sci. Technol., DOI: 10.1021/es405118y (2014) ("Vengosh 2014").
[108] U.S. Environmental Protection Agency, Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources (Nov. 2011) ("EPA Plan to Study Fracking Impacts").
[109] Colborn 2011.
[110] EPA Plan to Study Fracking Impacts; White, Ivan E., Consideration of radiation in hazardous waste produced from horizontal hydrofracking, National Council on Radiation Protection (2012).
[111] EPA 2015 at ES-12
[112] Arenschield, Laura. Injections of wastewater rise in Ohio despite lull in fracking, The Columbus Dispatch (March 7, 2016), available at http://www.dispatch.com/content/stories/local/2016/03/07/injections-of-wastewater-rise-in-ohio-despite-lull-in-fracking.html.
[113] Brittingham, Margaret C. et al., *Ecological Risks of Shale Oil and Gas Development to Wildlife, Aquatic Resources and their Habitats*, Environ. Sci. Technol. 2014, 48, 11034-11047, p. 11039; Lauer, Nancy E. Brine Spills Associated with Unconventional Oil Development in North Dakota. Environmental Science & Technology Article ASAP, DOI: 10.1021/acs.est.5b06349 (April 27, 2016), available at http://pubs.acs.org/doi/abs/10.1021/acs.est.5b06349 (finding contaminants such as ammonium, selenium, and lead at produced-water spill sites in North Dakota, and contamination in violation of national water quality regulations).
[114] *Id*. at G (observing contamination from produced water "is remarkably persistent in the environment" and "elevated levels of salts and trace elements…can be preserved in spill sites for at least months to years"); King, Pamela, *Limited study supports findings on bigger brine spill risks*, E&E News (Nov. 4, 2015).

to deal with them is to remove them.[115] The accumulation of long-lived isotopes of radium has been observed in the sediments and soils of produced-water spill sites.[116] Due to its relatively long half-life, radium contamination could remain in the soil for thousands of years.[117] Flowback waters (i.e., fracturing fluids that return to the surface) may also contain similar constituents along with fracturing fluid additives such as surfactants and hydrocarbons.[118] Given the massive volumes of chemicals and wastewater produced, their potentially harmful constituents, and their persistence in the environment, the potential for environmental disaster is real.

Fluids must be transported to and/or from the well, which presents opportunities for spills.[119] Unconventional well stimulation relies on numerous trucks to transport chemicals to the site as well as collect and carry disposal fluid from the site to processing facilities. A U.S. Government Accountability Office (GAO) study found that up to 1,365 truck loads can be required just for the drilling and fracturing of a single well pad[120] while the New York Department of Conservation estimated the number of "heavy truck" trips to be about 3,950 per horizontal well (including unloaded and loaded trucks).[121] Accidents during transit may cause leaks and spills that result in the transported chemicals and fluids reaching surface waters. Chemicals and waste transported by pipeline can also leak or spill. There are also multiple reports of truckers dumping waste uncontained into the environment.[122]

The EIS should evaluate how often accidents can be expected to occur, and the effect of chemical and fluid spills. Such analysis should also include identification of the particular harms faced by communities near oil and gas fields. The EIS must include specific mitigation measures and alternatives based on a cumulative impacts assessment, and the particular vulnerabilities of environmental justice communities in both urban and rural settings.

ii. On-site Chemical Storage and Processing

Thousands of gallons of chemicals can be potentially stored on-site and used during hydraulic fracturing and other unconventional well stimulation activities.[123] These chemicals can be susceptible to accidental spills and leaks. Natural occurrences such as storms and earthquakes may cause accidents, as can negligent operator practices.

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[115] *Id*.
[116] Lauer 2016 at G.
[117] *Id*.
[118] King 2015.
[119] Warco, Kathy, *Fracking truck runs off road; contents spill*, Observer Reporter (Oct 21, 2010).
[120] U.S. Government Accountability Office, Oil and Gas: Information on Shale Resources, Development, and Environmental and Public Health Risks, GAO 12-732 (2012) at 33.
[121] New York Department of Environmental Conservation, *Final Supplemental Generic Environmental Impact Statement on the Oil, Gas and Solution Mining Regulatory Program*, Ch. 6 Potential Environmental Impacts (2015) at 6-306 –*available at* http://www.dec.ny.gov/docs/materials_minerals_pdf/fsgeis2015.pdf.
[122] Kusnetz, Nicholas, *North Dakota's Oil Boom Brings Damage Along with Prosperity* at 4, ProPublica (June 7, 2012) ("Kusnetz North Dakota"); Ohio Department of Natural Resources ("ODNR"), *Ohio Pursues Action Against Companies for Illegal Brine Dumping*, June 4, 2013, *available at* http://ohiodnr.gov/news/post/ohio-pursues-action-against-companies-for-illegal-brine-dumping.
[123] EPA 2015 at ES-10.

Some sites may also use on-site wastewater treatment facilities. Improper use or maintenance of the processing equipment used for these facilities may result in discharges of contaminants. Other spill causes include equipment failure (most commonly, blowout preventer failure, corrosion and failed valves) and failure of container integrity.[124] Spills can result from accidents, negligence, or intentional dumping.

The EIS should examine and quantify the risks to human health and the environment associated with on-site chemical and wastewater storage, including risks from natural events and negligent operator practices. Again, such analysis must also include an analysis of potential impacts faced by environmental justice communities in both rural and urban settings.

2. Groundwater Contamination

Studies have reported many instances around the country of groundwater contamination due to surface spills of oil and gas wastewater, including fracking flowback.[125] Fracking and other unconventional techniques likewise pose inherent risks to groundwater due to releases below the surface, and these risks must be properly evaluated.[126] Once groundwater is contaminated, it is very difficult, if not impossible, to restore the original quality of the water. As a result, in communities that rely on groundwater drinking water supplies, groundwater contamination can deprive communities of usable drinking water. Such long-term contamination necessitates the costly importation of drinking water supplies.

Groundwater contamination can occur in a number of ways, and the contamination may persist for many years.[127] Improper well construction and surface spills are cited as a confirmed or potential cause of groundwater contamination in numerous incidents at locations across the U.S. including but not limited to Colorado,[128] Wyoming,[129] Pennsylvania,[130] Ohio,[131] West Virginia,[132] and Texas.[133] These sorts of problems at the well are not uncommon. Dr. Ingraffea of Cornell University has noted an 8.9 percent failure rate for wells in the Marcellus Shale.[134]

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[124] EPA 2015 at ES-11.
[125] *See, e.g.*, Fontenot 2013, Jackson 2013.
[126] Vengosh 2014.
[127] Myers, Tom, Potential Contamination Pathways from Hydraulically Fractured Shale to Aquifers, National Groundwater Association (2012).
[128] Gross, Sherilyn A. et al., *Abstract: Analysis of BTEX groundwater concentrations from surface spills associated with hydraulic fracturing operations*, 63 J. Air and Waste Mgmt. Assoc. 4, 424 doi: 10.1080/10962247.2012.759166 (2013).
[129] U.S. Environmental Protection Agency, Draft Investigation of Ground Water Contamination Near Pavillion, Wyoming (2011) ("EPA Draft Pavillion Investigation").
[130] Darrah, Thomas H. et al., *Noble Gases Identify the Mechanisms of Fugitive Gas Contamination in Drinking-Water Wells Overlying the Marcellus and Barnett Shales*, Proc. Natl. Acad. Of Sciences Early Edition, doi: 10.1073/pnas.1322107111 (2014) ("Darrah 2014").
[131] Begos, Kevin, *Some States Confirm Water Pollution from Oil, Gas Drilling*, Seattle Times, Jan. 6, 2014, http://www.seattletimes.com/business/some-states-confirm-water-pollution-from-oil-gas-drilling/ (accessed July 29, 2015) ("Begos, Seattle Times, Jan 6, 2014"); *see also* Ohio Department of Natural Resources, *Report on the Investigation of the Natural Gas Invasion of Aquifers in Bainbridge Township of Geauga County, Ohio* (Sep. 2008) ("ODNR 2008").
[132] Begos, Seattle Times, Jan 6. 2014.
[133] Darrah 2014.
[134] Ingraffea, Anthony R., Some Scientific Failings within High Volume Hydraulic Fracturing Proposed Regulations

Older wells that may not have been designed to withstand the stresses of hydraulic fracturing but which are reused for this purpose are especially vulnerable.[135]

Current federal rules do not ensure well integrity. The EIS should study the rates of well casing failures over time and evaluate the likelihood that well casing failures can lead to groundwater contamination.

Also, fluids and hydrocarbons may contaminate groundwater by migrating through newly created or natural fractures.[136] Many unconventional techniques intentionally fracture the formation to increase the flow of gas or oil. New cracks and fissures can allow the additives or naturally occurring elements such as natural gas to migrate to groundwater. "[T]he increased deployment of hydraulic fracturing associated with oil and gas production activities, including techniques such as horizontal drilling and multi-well pads, may increase the likelihood that these pathways could develop," which, "in turn, could lead to increased opportunities for impacts on drinking water sources."[137] Fluids can also migrate through pre-existing and natural faults and fractures that may become pathways once the fracking or other method has been used.

A well in which stimulation operations are being conducted may also "communicate" with nearby wells, which may lead to groundwater and surface contamination, particularly if the nearby wells are improperly constructed or abandoned.[138] In the last 150 years, as many as 12 million "holes" have been drilled across the United States in search of oil and gas, many of which are old and decaying, or are in unknown locations.[139] According to the Forest Plan, "literally hundreds of old, (early 1900s) abandoned oil and gas wells…have not been plugged or have been improperly plugged" in the WNF, and between 1992 and 2004 only 11 wells were plugged on the Marietta Unit.[140] Fracking can contaminate water resources by intersecting one of those wells. For instance, one study found at least nineteen instances of fluid communication in British Columbia and Western Alberta.[141] Wells as far away as 1.8 miles away have provided

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6 NYCRR Parts 550-556, 560, Comments and Recommendations Submitted to the NYS Dept. of Environmental Conservation (Jan 8, 2013); *see also* Davies, Richard J. et al. Oil and gas wells and their integrity: Implications for shale and unconventional resource exploitation, Marine and Petroleum Geology 56 (2014) 239e254, available at http://ac.els-cdn.com/S0264817214000609/1-s2.0-S0264817214000609-main.pdf?_tid=7344676e-d5f1-11e5-9200-00000aab0f02&acdnat=1455767050_bdf90f64ecdb607187778614024039c4 (documenting 6.3% of wells in the Marcellus shale experienced well barrier or integrity failure between 2005 and 2013).

[135] EPA 2015 at 6-11.

[136] EPA Draft Pavillion Investigation; Warner, Nathaniel R., et al., Geochemical Evidence for Possible Natural Migration of Marcellus Formation Brine to Shallow Aquifers in Pennsylvania, PNAS Early Edition (2012).

[137] EPA 2015 at 6-55.

[138] *See* Detrow, Scott. (2012) *Perilous Pathways: How Drilling Near An Abandoned Well Produced a Methane Geyser*, StateImpact Pennsylvania, National Public Radio (October 9, 2012), *available at* https://stateimpact.npr.org/pennsylvania/2012/10/09/perilous-pathways-how-drilling-near-an-abandoned-well-produced-a-methane-geyser/ (accessed July 29, 2015); Alberta Energy Board, Directive 083: Hydraulic Fracturing – Subsurface Integrity, Alberta Energy Regulator (2013), *available at* http://www.aer.ca/documents/directives/Directive083.pdf.

[139] Kusnetz, Nicholas, *Deteriorating Oil and Gas Wells Threaten Drinking Water, Homes Across the Country*, ProPublica (April 4, 2011).

[140] Forest Plan EIS at 3-260-261.

[141] BC Oil & Gas Commission, Safety Advisory 2010-03, Communication During Fracture Stimulation (2010).

pathways for surface contamination.[142] The EIS must consider long-term studies on the potential for fluid migration through newly created subsurface pathways.

According to the EPA, "evidence of any fracturing-related fluid migration affecting a drinking water resources…could take years to discover."[143] Another study based on modeling found that advective transport of fracking fluid from a fracked well to an aquifer could occur in less than 10 years.[144]

Contamination of groundwater of drinking water sources is a real risk. The EPA's Draft Investigation of Groundwater Contamination near Pavillion, Wyoming, found that chemicals found in samples of groundwater were from fracked wells.[145] These results have been confirmed with follow-up analyses.[146] Groundwater contamination in the Barnett Shale region is likely a result of unconventional well development activities.[147] One study detected "multiple volatile organic carbon compounds throughout the region, including various alcohols, the BTEX family of compounds, and several chlorinated compounds" in private and public drinking water well samples drawn from aquifers overlying the Barnett shale formation."[148] Another study found that arsenic, selenium, strontium and total dissolved solids (TDS) exceeded the Environmental Protection Agency's Drinking Water Maximum Contaminant Limit (MCL) in some samples from private water wells located within 3 km of active natural gas wells.[149] Many of the detected compounds were associated with unconventional oil and gas extraction.[150]

Fracking fluid can also spill at the surface during the fracking process. For instance, mechanical failure or operator error during the process has caused leaks from tanks, valves, and pipes.[151] At the surface, pits or tanks can leak fracking fluid or waste.[152] Surface pits, in which wastewater is often dumped, are a major source of pollution. In California, a farmer was awarded $8.5 million in damages after his almond trees died when he irrigated them with well water that had been contaminated by nearby oil and gas operations. The contamination was traced to

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[142] King, Pamela, *'Frack hits' provide pathways for methane migration study*, E&E News (Oct. 21, 2015).
[143] EPA 2015 at 6-56 – 6-57.
[144] Myers, Tom, Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers, Ground Water 50, no. 6, p. 1 (2012).
[145] EPA Draft Pavillion Investigation.
[146] Drajem, Mark, *Wyoming Water Tests in Line with EPA Finding on Fracking*, Bloomberg (Oct. 11, 2012); U.S. Environmental Protection Agency, Investigation of Ground Water Contamination near Pavillion, Wyoming Phase V Sampling Event - Summary of Methods and Results (September 2012); Myers, Tom, Review of DRAFT: Investigation of Ground Water Contamination near Pavillion Wyoming Prepared by the Environmental Protection Agency, Ada OK (Apr. 30, 2012).
[147] Hildenbrand, Zacariah, A Comprehensive Analysis of Groundwater Quality in The Barnett Shale Region, Environ. Sci. Technol. (June 16, 2015), available at http://pubs.acs.org/doi/abs/10.1021/acs.est.5b01526.
[148] *Id*.
[149] Fontenot, Brian et al., An Evaluation of Water Quality in Private Drinking Water Wells Near Natural Gas Extraction Sites in the Barnett Shale Formation, Environ. Sci. Technol., 47 (17), 10032–10040 DOI: 10.1021/es4011724, available at http://pubs.acs.org/doi/abs/10.1021/es4011724 ("Fontenot 2013").
[150] *Id*.
[151] NRDC, Water Facts at 2; Food & Water Watch 2012 at 7.
[152] *See, e.g.*, E&E Staff Writer, *Fracking Fluid leaks from wellhead in Colo.*, E&E News (Feb 14, 2013). ("At least 84,000 gallons of water contaminated from hydraulic fracturing seeped from a broken wellhead and into a field . . . ."); Michaels, Craig, et al., Fractured Communities: Case Studies of the Environmental Impacts of Industrial Gas Drilling, Riverkeeper (2010) at 12.

unlined pits where one of California's largest oil and gas producers for decades dumped billions of gallons of wastewater that slowly leached pollutants into nearby groundwater.[153] In Ohio, a fracturing flowback pit was cut by a track hoe in 2010, causing more than 1.5 million gallons of fluid to spill into the environment.[154] In 2008, the back wall of a pit in Ohio gave way, causing pit contents to spill and flow towards a creek.[155]

Unfiltered drinking water supplies, such as drinking water wells, are especially at risk because they have no readily available means of removing contaminants from the water. Even water wells with filtration systems are not designed to handle the kind of contaminants that result from unconventional oil and gas extraction.[156] In some areas hydraulic fracturing may occur at shallower depths or within the same formation as drinking water resources, resulting in direct aquifer contamination. [157] The EIS must disclose where the potential for such drilling exists.

Setbacks from surface or groundwater wells may not be adequate to protect groundwater from potential fracking fluid contamination. A recent study by the University of Colorado at Boulder suggests that setbacks of even up to 300-feet may not prevent contamination of drinking water resources.[158] The study found that 15 organic compounds found in hydraulic fracturing fluids may be of concern as groundwater contaminants based on their toxicity, mobility, persistence in the environment, and frequency of use. These chemicals could have 10 percent or more of their initial concentrations remaining at a transport distance of 300 feet, the average "setback" distance in the U.S. The effectiveness and feasibility of any proposed setbacks must be evaluated. The issue of setbacks is especially salient for Ohio, because state law allows wells and tank batteries to be located within 100 feet of occupied dwellings and public buildings in non-urbanized areas, as well as within 50 feet of surface waters.[159] Ohio law does not contain setbacks for sources of groundwater.[160]

3. Disposal of Drilling and Fracking Wastes

Finally, disposal of wastes from oil and gas operations can also lead to contamination of water resources. Potential sources of contamination include:

- leaching from landfills that receive drilling and fracking solid wastes;
- spreading of drilling and fracking wastes over large areas of land;

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[153] Renee Sharp & Bill Allayuad, California Regulator: See No Fracking, Speak No Fracking at 6 (2012); *see also* Miller, Jeremy, *Oil and Water Don't Mix with California Agriculture*, High Country News (2012).
[154] ODNR, Notice of Violation No. 1278508985 (June 21, 2010).
[155] ODNR, Notice of Violation No. 2016754140 (May 16, 2008).
[156] Physicians, Scientist & Engineers for Healthy Energy, Letter from Robert Howarth Ph.D. and 58 other scientists to Andrew M. Cuomo, Governor of New York State re: municipal drinking water filtration systems and hydraulic fracturing fluid (Sept 15, 2011), *available at* http://www.psehealthyenergy.org/data/Cuomo_ScientistsLetter_15Sep20112.pdf (accessed July 29, 2015).
[157] EPA 2015 at ES-15.
[158] University of Colorado--Boulder, New study identifies organic compounds of potential concern in fracking Fluids (July 1, 2015), *available at* http://www.colorado.edu/news/releases/2015/06/30/newstudyidentifiesorganiccompoundspotentialconcernfrackingfluids (accessed July 29, 2015).
[159] ORC 1509.021(H) & (L).
[160] *See* ORC 1509.021.

- wastewaters discharged from treatment facilities without advanced "total dissolved solids" removal processes, or inadequate capacity to remove radioactive material removal; and
- breaches in underground injection disposal wells.[161]

The EIS must evaluate the potential for contamination from each of these disposal methods.

U.S. EPA has found California's Class II underground injection well program to be insufficiently protective of groundwater resources.[162] This is the most common disposal method in Ohio. Several injection wells are located near the Ohio River in Washington County, in the southern end of the Marietta Unit, and have accepted millions of gallons of wastewater between 2010 and 2015.[163] With increased fracking in the Wayne National Forest as a result of federal leasing, new injections in these wells would be highly likely to increase. BLM and the Forest Service must study in an EIS the cumulative impact of underground wastewater disposal from increased fracking within the Marietta Unit, in connection with enormous levels of wastewater that are already being produced in and out of state, including Pennsylvania and West Virginia. Wastewater transport and injection are likely to increase as operators expand fracking in the Utica and Marcellus shale plays. In 2015, Ohio injection well sites took in over 29 million barrels of fracking wastewater, a 15 percent increase from 2014, despite declining shale gas drilling nationwide.[164] Sixteen million barrels, or 55%, of this wastewater came from in-state, while about 13 million barrels came from Pennsylvania and West Virginia.[165] In addition, the risk of truck traffic accidents resulting in spills and risk of leaks and contamination at the disposal site must be addressed in an EIS.

The 2012 SIR wrongly suggests that wastewater injections resulting from horizontal drilling would not have any significant impacts, because Forest Plan guideline SFW-SAFE-19 prohibits disposal of non-federal wastewater on federal land. But this restriction only applies to federal lands, and wastewater injection is already occurring within the Marietta Unit.[166] It is entirely possible that wastewater disposal underneath private surface could impact adjacent federal lands. A recent West Virginia study shows wastewater injection can impact areas

[161] EPA 2015, 8-20, 8-36, 8-48, 8-65, 8-70; USGS, Indication of Unconventional Oil and Gas Wastewaters Found in Local Surface Waters, available at http://toxics.usgs.gov/highlights/2016-05-09-uog_wastes_in_streams.html.
[162] Walker, James, California Class II UIC Program Review, Report submitted to Ground Water Office USEPA Region 9 at 119 (Jun. 2011); U.S. Environmental Protection Agency Region IX, Letter from David Albright, Manager Ground Water, to Elena Miller, State Oil and Gas Supervisor Dept of Conservation re California Class II Underground Injection Control (UIC) Program Review final report (July 18, 2011).
[163] FracTracker.org, OH Fracking Waste Transport & Disposal Network, Ohio Class II Injection Wells and Volumes Between 2010 and 2015 ("FracTracker Injection Well Map"), available at http://maps.fractracker.org/3.13/?appid=2a68b20a338f464da12d6e8f1cb66c08&webmap=0f6bdbb82b1246f6a2d2d7a6c4c3bb74.
[164] Arenschield, Laura. Injections of wastewater rise in Ohio despite lull in fracking, The Columbus Dispatch (March 7, 2016), available at http://www.dispatch.com/content/stories/local/2016/03/07/injections-of-wastewater-rise-in-ohio-despite-lull-in-fracking.html
[165] *Id*.
[166] FracTracker Injection Well Map, available at http://maps.fractracker.org/3.13/?appid=2a68b20a338f464da12d6e8f1cb66c08&webmap=0f6bdbb82b1246f6a2d2d7a6c4c3bb74.

downstream of an injection well site,[167] but the EA fails to acknowledge this fact. More fundamentally, a risk of contamination—whether occurring on federal or non-federal lands—is an impact that must be evaluated. The 2012 SIR and EA, again, wrongfully limit their analysis to potential impacts on federal lands.

According to a report by Earthworks, there are numerous gaps in Ohio's regulation of wastewater disposal.[168] For example:

- Ohio does not have specific standards for pits, requiring only that they "prevent the escape" of waste substances. *See* ORC § 1509.22(C)(2).[169]

- "A new law passed in 2013 (HB59) directs ODNR to adopt rules, procedures, and requirements related to the storage and disposal of oil and gas waste fluids—but current state regulations do not address the burial of pits that are used for solid waste (e.g., drill cuttings or muds) or contain specific requirements such as pit liner thickness or distance of a buried pit from seasonal high groundwater."[170]

- "Since the passage of HB59, Ohio has required oil and gas operators to have a permit to store, recycle, treat, process, or dispose of oil and gas waste. Currently, however, Ohio has not enacted regulations for impoundments or production pits used for the purposes spelled out in the new law. In 2013, ODNR drafted such rules but has not moved them forward for public review and adoption. The draft rules do not include any specific standards or methods for the construction and use of waste management facilities; instead, ODNR simply requests that, 'sound engineering design and construction, and commonly accepted industry practices, shall be used.' The absence of specific standards would in effect leave inspectors with nothing to enforce, and would make it difficult for regulators to define and subsequently issue violations."[171]

- Ohio does not require solid waste or injection well facilities to test for radiation in drill cuttings or brine, nor does it limit radioactive loads of such waste. Further, "Ohio's regulatory agencies have done little testing of oil and gas field wastes to determine their radioactivity content, particularly with regard to the Utica Shale. However, in 2012, the Ohio Department of Health sampled muds from horizontal wells and found they contained concentrations of Ra-228 at almost 20 times and Ra-226 at more than 40 times the federal limit for combined radium in subsurface soil."[172]

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[167] Akob, D.M., et al., 2016, Wastewater disposal from unconventional oil and gas development degrades stream quality at a West Virginia injection facility: Environmental Science and Technology, doi:10.1021/acs.est.6b00428 (Advanced Web release); Kassotis, C.D., et al., 2016, Endocrine disrupting activities of surface water associated with a West Virginia oil and gas Industry wastewater disposal site: Science of the Total Environment, v. 557–558, p. 901910, doi:10.1016/j.scitotenv.2016.03.113. The two studies are summarized at: http://toxics.usgs.gov/highlights/2016-05-09-uog_wastes_in_streams.html.

[168] Steinzor, Nadia & Bruce Baizel, Earthworks. Wasting away: Four states' failure to manage gas and oil field waste from the Marcellus and Utica Shale (April 2015), available at https://www.earthworksaction.org/files/publications/WastingAway-FINAL-lowres.pdf.

[169] *Id*. at 17.

[170] *Id*.

[171] *Id*. at 19.

[172] *Id*. at 21.

- Ohio does not require monitoring of groundwater quality near injection wells. "GAO has also criticized Ohio for not requiring operators to test or disclose the chemicals in its waste before injecting it underground, an omission that poses a risk to groundwater—the only one of the eight oil and gas producing states that the GAO examined for its recent report that doesn't have such rules."[173]

- "ODNR has not taken enforcement action in numerous cases when inspectors found regulatory violations at injection wells. A key example is the Ginsburg injection well, which has been cited for failing mechanical integrity tests, spilling oil and brine, and causing significant erosion in the surrounding area since 1986, when ODNR stated that it "presents an imminent danger to public health or safety or is likely to result in immediate substantial damage to natural resources." Despite citation for numerous violations, an ODNR order to cease operations, and indication that the the health of animals and people nearby might be at risk, the injection well has continued to operate."[174]

These gaps in regulation could lead to significant water quality impacts from the disposal of fracking waste.[175]

A. More Intensive Oil and Gas Development Will Increase Storm Water Runoff

Oil and gas operations require land clearance for access roads, pipelines, well pads, drilling equipment, chemical storage, and waste disposal pits. As a result, new oil and gas development will cause short-term disturbance as well as long-term disturbance within the areas for lease. While undisturbed land can retain greater amounts of water through plants and pervious soil, land that has been disturbed or developed may be unable to retain as much water, thereby increasing the volume of runoff. The area of land that is able to retain water will be significantly decreased if unconventional oil and gas extraction methods are permitted to expand.

Water from precipitation and snowmelt can serve as an avenue through which contaminants travel from an operation site to sensitive areas, including population centers. Contaminated water runoff may seep into residential areas, polluting streets, sidewalks, soil, and vegetation in urban areas, adversely affecting human health. Thus, not only do these oil and gas activities create pollution, they create greater conduits for storm water runoff to carry those pollutants from the operation site, into areas in which significant harm can be caused.

Rapid runoff, even without contaminants, can harm the environment by changing water flow patterns and causing erosion, habitat loss, and flooding. Greater runoff volumes may also increase the amount of sediment that is carried to lakes and streams, affecting the turbidity and chemical content of surface waters. Because a National Pollutant Discharge Elimination System permit is not required for oil and gas operations,[176] it is particularly important that the impact of runoff is considered as part of the NEPA process.

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[173] *Id*. at 35-36.
[174] *Id*. at 35.
[175] *See id*. at 46-51 (providing overview of Ohio waste disposal problems).
[176] 33 U.S.C. § 1342(l)(2).

B. Fossil Fuel Development Depletes Enormous Amounts of Water

Some unconventional extraction techniques, most notably fracking, require the use of tremendous amounts of freshwater. Typically between 2 and 5.6 million gallons of water are required to frack each well.[177] These volumes far exceed the amounts used in conventional natural gas development.[178] In Ohio, the average amount of water used in fracking has increased from 5.6 million gallons per well in 2011 to 7.6 million gallons in 2014.[179] FracTracker has found that "[f]or each lateral that is fractured in Ohio, ~6.6 million gallons of fresh water are needed, and this figure, too, is increasing by 1.6 million gallons per year. This trend equates to an increase of 7,777 gallons of water used for every extra foot the lateral is extended out into the ground."[180]

Water used in large quantities may lead to several kinds of harmful environmental impacts. The extraction of water for fracking can, for example, lower the water table, affect biodiversity, harm local ecosystems, and reduce water available to communities.[181]

Withdrawal of large quantities of freshwater from streams and other surface waters will undoubtedly have an impact on the environment.[182] Withdrawing water from streams will decrease the supply for downstream users, such as farmers or municipalities. Rising demand from oil and gas operators has already led to increased competition for water between farmers and oil and gas operators. In some regions of Colorado, farmers have had to fallow fields due to astronomical water prices.[183] For example, in prior years, farmers in Colorado have paid at most $100 per acre-feet of water in auctions held by cities with excess supplies, but in 2013 energy companies paid $1200 to $2,900 per acre-feet.[184] Reductions in stream flows may also lead to downstream water quality problems by diminishing the water bodies' capacity for dilution and degradation.

Furthermore, withdrawing large quantities of water from subsurface waters to supply oil and gas production will likely deplete and harm aquifers. Removing water from surface water or directly from underground sources of water faster than the rate that aquifers can be replenished lowers the volume of water available for other uses. Depletion can also lead to compaction of the rock formation serving as an aquifer, after which the original level of water volume can never be

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[177] U.S. Government Accountability Office 2012 at 17.
[178] *See* Clark, Corrie E. et al., *Life Cycle Water Consumption for Shale Gas and Conventional Natural Gas*, Environ. Sci. Technol., 2013, 47 (20), pp 11829–11836, abstract *available at* http://pubs.acs.org/doi/abs/10.1021/es4013855.
[179] Arenschield, Laura. Drillers Using more water to frack Ohio shale, Columbus Dispatch (Feb. 8, 2016), available at http://www.dispatch.com/content/stories/local/2016/02/07/drillers-using-more-water-to-frack-ohio-shale.html#.
[180] Auch, Ted et al. Fractracker Alliance, The Ultimate Price of PA State Forest Drilling (Nov. 4, 2015), available at https://www.fractracker.org/2015/11/pa-state-forest-drilling/.
[181] International Energy Agency, Golden Rules for the Golden Age of Gas at 31-32 (2012).
[182] *See* Entrekin, Sally et al., *Rapid Expansion of Natural Gas Development Poses a Threat to Surface Waters*, 9 Front Ecol. Environ. 9, 503 (2011); EPA 2015 at 4-16.
[183] Healy, Jack. For Farmers in the West, Oil Wells are Thirsty Rivals, The New York Times (Sept. 5,2012), available at http://www.nytimes.com/2012/09/06/us/struggle-for-water-in-colorado-with-rise-in-fracking.html?_r=0 (accessed July 29, 2015); Burke, Garance. Fracking fuels water fights in nation's dry spots, Associated Press (June 17, 2013), available at http://news.yahoo.com/fracking-fuels-water-fights-nations-dry-spots-133742770.html.
[184] *Id*.

restored.[185] Depleted aquifer water resources may also adversely affect agriculture, species habitat and ecosystems, and human health.

The freshwater in the planning area therefore would be greatly affected by the increased demand for water if fracking and other unconventional oil and gas extraction are permitted. A no-leasing or no-fracking alternative would preserve scarce water resources and keep critical sources of drinking water in the planning area safe and clean. The EIS must analyze where water will be sourced, how much, and the effects on water sources under different alternatives. All of these effects must be analyzed in the context of increasing water scarcity in Ohio due to climate change, seasonal drought, and increasing population.

In addition, an EIS must study the cumulative impacts of increased water use by hydraulic fracturing within the Ohio River Basin. The Utica and Marcellus shales are among the highest water-consuming shale plays in the U.S.[186] West Virginia, Pennsylvania, and Ohio have the third, fourth, and fifth highest water use for hydraulic fracturing, respectively.[187] And depletions from fracking in these states are increasing.[188] Because the primary water source for fracking within this region is surface water and very little recycling occurs, cumulative withdrawals have the potential to significantly impact the Ohio River Basin, its sub-watersheds, and aquatic habitat.[189]

C. Oil and Gas Developments Harm Aquatic Life and Habitat

When streams and other surface waters are depleted, the habitat for countless plants and animals will be harmed, and the depletion places tremendous pressure on species that depend on having a constant and ample stream of water. Oil and gas activities in the Marietta Unit, for example, may harm the fanshell and pink mucket pearly mussel in the Ohio River and lower Muskegee River, due to an increased risk of toxic spills and massive water depletions required for hydraulic fracturing and horizontal drilling. A pair of studies that compared water quality downstream from a wastewater injection site in West Virginia to that of upstream areas found (1) downstream sites had elevated levels of endocrine-disrupting chemicals at levels known to adversely affect aquatic organisms; and (2) microbial communities in downstream sediments had lower diversity and shifts in community composition, altering microbial activity and potentially impacting nutrient cycling.[190]

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[185] Freyman, Monika and Ryan Salmon, Hydraulic Fracturing and Water Stress: Growing Competitive Pressures for Water, CERES, 9 (2013) ("Freyman 2013"), *available at* http://www.ceres.org/resources/reports/hydraulic-fracturing-water-stress-water-demand-by-the-numbers.

[186] Gallegos, Tanya J. et al. "Hydraulic fracturing water use variability in the United States and potential environmental implications," Water Resources Research, vol. 51, issue 7, pp. 5839-5845, Figs. 1, 3 (July 2015), *available at* http://onlinelibrary.wiley.com/doi/10.1002/2015WR017278/full.

[187] EPA 2015 at 4-33.

[188] Auch, Ted et al. FracTracker Alliance, The Ultimate Price of PA State Forest Drilling (Nov. 4, 2015), *available at* https://www.fractracker.org/2015/11/pa-state-forest-drilling/.

[189] EPA 2015 at 4-33-36.

[190] Akob, D.M., et al., 2016, Wastewater disposal from unconventional oil and gas development degrades stream quality at a West Virginia injection facility: Environmental Science and Technology, doi:10.1021/acs.est.6b00428 (Advanced Web release); Kassotis, C.D., et al., 2016, Endocrine disrupting activities of surface water associated with a West Virginia oil and gas Industry wastewater disposal site: Science of the Total Environment, v. 557–558, p. 901910, doi:10.1016/j.scitotenv.2016.03.113. The two studies are summarized at:

Physical habitats such as banks, pools, runs, and glides (low gradient river sections) are important yet susceptible to disturbance with changing stream flows. Altering the volume of water can also change the water's temperature and oxygen content, harming some species that require a certain level of oxygenated water. Decreasing the volume of streamflow and stream channels by diverting water to fracking would have a negative impact on the environment.

The physical equipment itself that is designed to intake and divert water may also pose a threat to certain wildlife. If not properly designed, such equipment and intake points may be a risk to wildlife.

D. Harm to Wetlands

Oil and gas development, and particularly the practice of fracking, pose an immense threat to water resources. High volume removal of surface or groundwater can result in damage to wetlands, which rely on ample water supplies to maintain the fragile dynamics of a wetland habitat. Damage can also occur from spills of chemicals or wastewater, filling operations, and sediment runoff.[191] BLM in its environmental document must fully vet the impacts from every potential aspect of the proposed oil and gas leasing.

Many plant and animal species depend on wetland habitats, and even small changes can lead to significant impacts. Wetlands provide a variety of "eco-service" functions, including water purification, protection from floods, and functioning as carbon sinks.[192] The ecological importance of wetlands is unquestionable, and their full protection is paramount. The EIS must analyze these potential impacts to wetlands, and the related, potential indirect impacts that may stem from such impacts.

E. Water Depletion Impacts

The 2012 SIR's analysis of water depletion impacts from horizontal drilling is severely deficient, such that the EA cannot properly rely on this analysis. With respect to both groundwater and surface water depletion impacts, the SIR arbitrarily limits its analysis to water depletion activities that could occur on federal surface. For example, in the discussion of surface water impacts it states:

> Because of the reasonable use water law in Ohio, the WNF would need to agree to any surface water withdrawals associated with oil and gas activities, *if the*

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http://toxics.usgs.gov/highlights/2016-05-09-uog_wastes_in_streams.html.

[191] U.S. Department of Justice, *Trans Energy Inc. to Restore Streams and Wetland Damaged by Natural Gas Extraction Activities in West Virginia* (Sep. 2, 2014), http://www.justice.gov/opa/pr/trans-energy-inc-restore-streams-and-wetland-damaged-natural-gas-extraction-activities-west (accessed July 29, 2015); *See also*, Pennsylvania Department of Environmental Protection, Commonwealth of Pennsylvania, DEP Fines Seneca Resources Corp. $40,000 for Violations at Marcellus Operation in Tioga County (Jul. 10, 2010), http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=14655&typeid=1 (accessed July 29, 2015).

[192] U.S. Environmental Protection Agency, Wetlands and People, http://water.epa.gov/type/wetlands/people.cfm (accessed July 29, 2015).

> *withdrawals were proposed on National Forest lands*. It is unlikely that surface water from the WNF would supply HVHF operations, since supply is limited on much of the National Forest. No additional analysis or protections are needed at the Forest Plan level. While the 3.5 – 4 million gallons required for horizontal operations represent a change from the conventional well operations, the level of effect is not anticipated to increase. By using the existing measures in the Forest Plan, supported by Ohio reasonable use doctrine, there is no increased effect to surface water due to depletion, since at the site specific level the WNF will be able to control withdrawals and limit them to periods when water is plentiful.

2012 SIR at 41; *see also id*. at 29 (similar reasoning with respect to groundwater).

On the one hand, the SIR suggests that any and all water depletions associated with fracking activities will be subject to the Forest Service's agreement and Forest Plan limits allowing depletions only "when water is plentiful." But there is no reason to believe that depletions will always be proposed "on National Forest lands." Further, depletions on private surface within the administrative boundary of the national forest would not be subject to these restrictions. Thus, more than likely, operators would seek to withdraw water from groundwater or surface water underlying or crossing private lands. And because "[t]here is no agency (federal or state) that regulates water withdrawals from streams and rivers in the State of Ohio," 2012 SIR at 29, the only limits on an operator's ability to withdraw water would be the private landowner's consent. *See id*.

The 2012 SIR also suggests that because it is unlikely that water will be drawn from federal surface due to limited water resources on federal surface, there will be no significant impacts to any water resources. *See* 2012 SIR at 29, 41. But the water will have to come from somewhere—most likely from surface water diversions from the Ohio River or its tributaries flowing through private surface (the 2012 SIR suggests that headwater stream flows and groundwater production rates within the national forest are too low to supply water needed for fracking). Over seven million gallons of water could be required for the fracking and drilling of a single horizontal well. And as many as eight horizontal wells could be drilled from one location, resulting in the potential depletion of tens of millions of gallons of water in a short time period for a single well pad. Whether this water comes from private or federal surface within the Wayne National Forest administrative boundary or some other source offsite, the effects would be felt by wildlife, streams, and water users downstream from the point of diversion, but these impacts are entirely ignored.

IV. Oil and Gas Operations Harm Air Quality

Oil and gas operations emit numerous air pollutants, including volatile organic compounds (VOCs), NO_X, particulate matter, hydrogen sulfide, and methane. Fracking operations are particularly harmful, emitting especially large amounts of pollution, including toxic air pollutants. Permitting fracking and other well stimulation techniques will greatly increase the release of harmful air emissions in this and other regions. BLM should adopt a no-leasing alternative, or else adopt a no-fracking alternative, which would prevent further degradation of local air quality, respiratory illnesses, premature deaths, hospital visits, as well as missed school and work days.

A. BLM Failed to Take a Hard Look at Impacts to Air Resources

The draft EA does not fully and accurately evaluate the air quality impacts from foreseeable development, and does not include adequate enforceable mitigation measures to assure no significant impacts to air quality and protection of air resources. According to the draft EA, the Proposed Action will have the following anticipated environmental effects on air resources:

> No direct impacts from leasing. Potential for minor, short and long-term emissions from potential future construction activities and well completion, including National Ambient Air Quality Standards (NAAQS) criteria contaminants and hazardous air pollutants. Effects from emissions may include health hazards, reduced visibility, and contribution to global climate change. Effects minimized by Standard Operating Procedures (SOPs), best management practices (BMPs) and conditions of approval (COAs) at time of drilling.[193]

The 2012 SIR states that "[h]orizontal drilling activities could release greater amounts of pollutants into the air, thus contributing to air pollution."[194] It downplays the air quality impacts of oil and gas drilling, stating that the "EIS notes that most impacts to air quality from WNF activities would be due to prescribed fire and wildfires and other management activities would have only negligible effects on air quality."[195] The 2012 SIR concludes: "Because of the low level of horizontal well activity projected to take place for the remainder of the first ten years of Forest Plan implementation (13 well sites) the EIS remains valid in that effects to air quality would be negligible"[196] (that ten year period ends in 2016).

BLM has an obligation to analyze and disclose the potential impacts resulting from this action, including from hydraulic fracturing and horizontal drilling. The NEPA documents fail to analyze the foreseeable impacts that this proposal would have on air resources. The Draft EA acknowledges that "potential future development of the lease could lead to increases in area and regional emissions," but maintains that because "it is unknown if the parcels would be developed, or the extent of the development, it is not possible to reasonably quantify potential air quality effects through dispersion modeling or another applicable method at this time."[197] Further, the Draft EA maintains that "the timing, construction and production equipment specifications and configurations, and specific locations of activities are also unforeseeable at this time."[198] Consequently, the Draft EA states that "[a]dditional air effects will be addressed in a subsequent analysis when lessees file an APD."[199]

BLM bases its failure to provide an evaluation of the air quality impacts on this uncertainty, but NEPA requires that BLM make reasonable effort to anticipate and analyze

[193] Draft EA, pp. 4-5.
[194] 2012 SIR, p. 74.
[195] *Id*.
[196] 2012 SIR, p. 75.
[197] Draft EA, p. 64.
[198] *Id*.
[199] *Id.*

reasonably foreseeable impacts at this time. BLM cannot excuse itself of this obligation; the purpose of an environmental review is for BLM to look at the impacts in total, and to take a hard look at all reasonably foreseeable impacts now, prior to opening the land to leasing. NEPA regulations and case law clearly establish that uncertainty about the precise extent and nature of environmental impacts does not relieve an agency of the obligation to disclose and analyze those impacts utilizing the best information available. *See* 40 C.F.R. 1502.22(a),(b). An agency must prepare all environmental analyses required by NEPA at "the earliest possible time." 40 C.F.R. 1501.2. *See New Mexico ex rel. Richardson v. BLM*, 565 F.3d 583, 716-18 (10th Cir. 2009) (NEPA analysis of "all reasonably foreseeable impacts must occur at the earliest practicable point"); *see also* 40 C.F.R. 1500.1(b) ("NEPA procedures must ensure that environmental information is available to public officials and citizens before decisions are made and before actions are taken."). Indeed, as discussed above, BLM is capable of projecting the general areas in which horizontal drilling could occur, and it has ample information to draw on regarding the typical well site configuration in eastern Ohio, such that meaningful analysis is possible now. BLM cannot defer the required analysis of air impacts until the APD stage. Furthermore, piecemeal analyses fail to provide the appropriate perspective for examining the cumulative impacts on air quality.

BLM thus fails to take a "hard look" at foreseeable impacts to air quality. The Draft EA also does not include a comprehensive and enforceable set of air quality mitigation measures to ensure no significant impacts to air quality. BLM "encourages industry to incorporate and implement Best Management Practices"[200] ("BMPs") to reduce air quality impacts, but such measures would be encouraged, not required. These non-mandatory measures do not go far enough in either analysis or commitments. The discretionary and non-specific nature of the BMPs is very concerning since they are relied upon in the Draft EA as a primary means for protecting air resources and are part of BLM's justification for not proposing additional mitigation to address air quality impacts. Without further analysis of the mitigation measures necessary to sufficiently address air quality impacts, the BLM has failed to satisfy its most fundamental obligations under NEPA. BLM should commit to implementation of specific and enforceable measures that ensure no significant impacts to air quality and air quality related values in the Draft EA.

Furthermore, it is not enough to state that "[o]perations that would violate a state and/or federal air quality standard would not be approved."[201] Air impacts can nonetheless be significant. Furthermore, as noted in the Draft EA, Washington County is currently in non-attainment for sulfur dioxide.[202] The draft EA notes that "[a] number of pollutants associated with combustion of fossil fuels are anticipated to be released during future drilling activities," including SO_2.[203] Washington County also was recently in non-attainment for eight-hour ozone (2004-2006) and particulate matter (2005-2012).[204] Merely stating that operations that would violate an applicable air quality standard would not be approved is insufficient; NEPA requires more than an analysis of whether a project will violate other environmental statutory

[200] Draft EA, p. 66.
[201] Draft EA, p. 66.
[202] Draft EA, pp. 31-32.
[203] Draft EA, p. 64.
[204] Draft EA, pp. 31-32.

requirements. Air toxics can have potentially significant health impacts even at concentrations below regulatory thresholds. For ozone, in particular, a large body of scientific evidence indicates that ozone levels adversely impact human health even at levels that do not violate the present 70 ppb 8-hour standard. The Clean Air Scientific Advisory Committee ("CASAC") has explained that even "[a]t 70 ppb, there is substantial scientific evidence of adverse effects . . . , including decrease in lung function, increase in respiratory symptoms, and increase in airway inflammation."[205] CASAC explained that the 70 ppb, provides "little margin of safety for the protection of public health, particularly for sensitive subpopulations," and that the scientific evidence supports a standard as low as 60 ppb.[206] Even the 60 ppb level recommended in CASAC's June 2014 letter is not low enough to prevent impacts to human health. For example, robust chamber studies show significant adverse health impacts to healthy adults exposed to 60 ppb for only 6.6 hours—indicating that sensitive populations such as children could be impacted at even lower levels of ozone, especially for the longer 8-hour timeframes used in setting the standard.[207] NEPA requires BLM to take a hard look at the proposal's impacts on air quality.

B. Types of Air Emissions

BLM failed to provide adequate analysis of the type, extent, or source of emissions from unconventional oil and gas extraction methods. Unconventional oil and gas operations emit large amounts of toxic air pollutants,[208] also referred to as Hazardous Air Pollutants, which are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.[209] The reporting requirements recently implemented by the California South Coast Air Quality Management District ("SCAQMD") have shown that at least 44 chemicals known to be air toxics have been used in fracking and other types of unconventional oil and gas recovery in California.[210] Through the implementation of these new reporting requirements, it is now known that operators have been using several types of air toxics in California, including crystalline silica, methanol, hydrochloric acid, hydrofluoric acid, 2-butoxyethanol, ethyl glycol monobutyl ether, xylene, amorphous silica fume, aluminum oxide, acrylic polymer, acetophenone, and ethylbenzene. Many of these chemicals also appear on the U.S. EPA's list of hazardous air pollutants.[211] EPA has also identified six "criteria" air pollutants that must be regulated under the National Ambient Air

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[205] Frey, Christopher H., Dr. "CASAC Review of the EPA's Second Draft Policy Assessment for the Review of the Ozone National Ambient Air Quality Standards." Letter to Gina McCarthy. 26 June 2014. Available at http://yosemite.epa.gov/sab/sabproduct.nsf/5EFA320CCAD326E885257D030071531C/$File/EPA-CASAC- 14-004+unsigned.pdf

[206] Id.

[207] Kim et al (2011). Lung function and inflammatory responses in healthy young adults exposed to 0.06 ppm ozone for 6.6 hours. Am J Respir Crit Care Med 183: 1215-1221; Schelegle et al. (2009) concentrations from 60 to 87 parts per billion in healthy humans. Am J Respir Crit Care Med 180: 265-272; Brown et al. (2008). Effects of exposure to 0.06 ppm ozone on FEV1 in humans: A secondary analysis of existing data. Environ Health Perspect 116: 1023-1026.

[208] Sierra Club et al. comments on New Source Performance Standards: Oil and Natural Gas Sector; Review and Proposed Rule for Subpart OOOO (Nov. 30, 2011) ("Sierra Club Comments") at 13.

[209] U.S. EPA, Hazardous Air Pollutants, *available at* http://www.epa.gov/haps (accessed Jan. 10, 2016).

[210] Center for Biological Diversity, Air Toxics One Year Report, p. 1 (June 2014).

[211] U.S. Environmental Protection Agency, The Clean Air Act Amendments of 1990 List of Hazardous Air Pollutants, Technology Transfer Network Air Toxics Web Site, http://www.epa.gov/ttnatw01/orig189.html (accessed July 29, 2015).

Quality Standards (NAAQS) due to their potential to cause primary and secondary health effects. Concentrations of these pollutants—ozone, particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide and lead—will likely increase in regions where unconventional oil and gas recovery techniques are permitted.

VOCs, from car and truck engines as well as the drilling and completion stages of oil and gas production, make up about 3.5 percent of the gases emitted by oil or gas operations.[212] The VOCs emitted include the BTEX compounds – benzene, toluene, ethyl benzene, and xylene – which are listed as Hazardous Air Pollutants.[213] There is substantial evidence showing the grave harm from these pollutants.[214] Recent studies and reports confirm the pervasive and extensive amount of VOCs emitted by unconventional oil and gas extraction.[215] In particular, a study covering sites near oil and gas wells in five different states found that concentrations of eight volatile chemicals, including benzene, formaldehyde and hydrogen sulfide, exceeded risk-based comparison values under several operational circumstances.[216] Another study determined that vehicle traffic and engine exhaust were likely the sources of intermittently high dust and benzene concentrations observed near well pads.[217] Recent studies have found that oil and gas operations are likely responsible for elevated levels of hydrocarbons such as benzene downwind of the Denver-Julesburg Fossil Fuel Basin, north of Denver.[218] Another study found that oil and gas operations in this area emit approximately 55% of the VOCs in northeastern Colorado.[219]

Research indicates a strong correlation between oil and gas development and increased ozone concentrations – especially in the summer when warm, stagnant conditions yield an increase in O3 from oil and gas emissions. Increases in ground-level ozone not only impact regional haze and visibility, they can also result in dramatic impacts to human health. VOCs can form ground-level (tropospheric) ozone when combined with nitrogen oxides ("NO_X"), from compressor engines, turbines, other engines used in drilling, and flaring,[220] and sunlight. This reaction can diminish visibility and air quality and harm vegetation. Tropospheric ozone can also be caused by methane, which is leaked and vented at various stages of unconventional oil and

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[212] Brown, Heather, Memorandum to Bruce Moore, U.S.EPA/OAQPS/SPPD re Composition of Natural Gas for use in the Oil and Natural Gas Sector Rulemaking, July 28, 2011 ("Brown Memo") at 3.
[213] 42 U.S.C. § 7412(b).
[214] Colborn 2011; McKenzie 2012; Food & Water Watch 2012.
[215] McCawley, M., Air, Noise, and Light Monitoring Plan for Assessing Environmental Impacts of Horizontal Gas Well Drilling Operations (ETD-10 Project), West Virginia University School of Public Health, Morgantown, WV (2013) ("McCawley 2013"), *available at* http://www.dep.wv.gov/oil-and-gas/Horizontal-Permits/legislativestudies/Documents/WVU%20Final%20Air%20Noise%20Light%20Protocol.pdf; Center for Biological Diversity, Dirty Dozen: The 12 Most Commonly Used Air Toxics in Unconventional Oil Development in the Los Angeles Basin (Sept. 2013).
[216] Macey, G.P. et al., Air Concentrations of Volatile Compounds Near Oil and Gas Production: A Community-Based Exploratory Study, 13 Environmental Health 82 (2014) at 1.
[217] McCawley 2013.
[218] Pétron, G. et al., Hydrocarbon Emissions Characterization in the Colorado Front Range – A Pilot Study, 117 J. Geophysical research D04304 (2012), at 8, 13 ("Pétron 2012").
[219] Gilman, J.B. et al., *Source Signature of Volatile Organic Compounds from Oil and Natural Gas Operations in Northeastern Colorado*, 47 Envtl. Sci & Tech. 1297, 1303 (2013).
[220] *See, e.g.*, U.S. Environmental Protection Agency, Oil and Gas Sector: Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution: Background Technical Support Document for Proposed Standards at 3-6 (July 2011); Armendariz, Al, Emissions for Natural Gas Production in the Barnett Shale Area and Opportunities for Cost-Effective Improvements (2009) ("Armendariz") at 24.

gas development, as it interacts with nitrogen oxides and sunlight.[221] In addition to its role as a greenhouse gas, methane contributes to increased concentrations of ground-level ozone, the primary component of smog, because it is an ozone precursor.[222] Methane's effect on ozone concentrations can be substantial. One paper modeled reductions in various anthropogenic ozone precursor emissions and found that "[r]educing anthropogenic CH_4 emissions by 50% nearly halves the incidence of U.S. high-O_3 events . . . ."[223]

Like methane, VOCs and NO_X are also ozone precursors; therefore, many regions around the country with substantial oil and gas operations are now suffering from extreme ozone levels due to heavy emissions of these pollutants.[224] Ozone can result in serious health conditions, including heart and lung disease and mortality.[225] A recent study of ozone pollution in the Uintah Basin of northeastern Utah, a rural area that experiences hazardous tropospheric ozone concentrations, found that oil and gas operations were responsible for 98 to 99 percent of VOCs and 57 to 61 percent of NO_X emitted from sources within the Basin considered in the study's inventory.[226]

Oil and gas operations can also emit hydrogen sulfide. The hydrogen sulfide is contained in the natural gas and makes that gas "sour."[227] Hydrogen sulfide may be emitted during all stages of operation, including exploration, extraction, treatment and storage, transportation, and refining. Long−term exposure to hydrogen sulfide is linked to respiratory infections, eye, nose, and throat irritation, breathlessness, nausea, dizziness, confusion, and headaches.[228]

The oil and gas industry is also a major source of particulate matter. The heavy equipment regularly used in the industry burns diesel fuel, generating fine particulate matter[229] that is especially harmful.[230] Vehicles traveling on unpaved roads also kick up fugitive dust,

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[221] Fiore, Arlene et al., Linking Ozone Pollution and Climate Change: The Case for Controlling Methane, 29 Geophys. Res Letters 19 (2002).
[222] U.S. Environmental Protection Agency, Oil and Gas Sector: New Source Performance Standards and National Emission Standards for Hazardous Air Pollutants Reviews Proposed Rule, 76 Fed. Reg 52,738 (Aug 23, 2011).
[223] Fiore, Arlene et al., Linking ozone pollution and climate change: The case for controlling methane, 29 Geophys. Res Letters 19 (2002); *see also* Martin, Randal et al., Final Report: Uinta Basin Winter Ozone and Air Quality Study Dec 2010 - March 2011 (2011) at 7.
[224] Armendariz at 1, 3, 25-26; Wendy Koch, *Wyoming's Smog Exceeds Los Angeles' Due to Gas Drilling,* USA Today (May 9, 2011); Craft, Elena, Environmental Defense Fund, Do Shale Gas Activities Play a Role in Rising Ozone Levels? (2012); Colorado Dept. of Public Health and Environment, Conservation Commission, Colorado Weekly and Monthly Oil and Gas Statistics (July 6, 2012) at 12.
[225] U.S. Environmental Protection Agency, Integrated Science Assessment (ISA) for Ozone (O3) and Related Photochemical Oxidants (2013).
[226] Lyman, Seth and Howard Shorthill, Final Report: 2012 Uintah Basin Winter Ozone & Air Quality Study, Utah Department of Environmental Quality (2013); *see also* Gilman, Jessica et al., Source signature of colatile organic compounds from oil and natural gas operations in northeastern Colorado, Environ Sci and Technology (Jan 14, 2013), DOI: 10.1021/es304119a.
[227] Sierra Club Comments.
[228] USEPA, Office of Air Quality Planning and Standards, Report to Congress on Hydrogen Sulfide Air Emissions Associated with the Extraction of Oil and Natural Gas (EPA-453/R-93-045) at i (Oct. 1993) ("USEPA 1993").
[229] Earthworks, Sources of Oil and Gas Pollution (2011).
[230] Bay Area Air Quality Management District, Particulate Matter Overview, Particulate Matter and Human Health (2012).

which is particulate matter.[231] Further, both NO_X and VOCs, which as discussed above are heavily emitted by the oil and gas industry, are also particulate matter precursors.[232] Some of the health effects associated with particulate matter exposure are "premature mortality, increased hospital admissions and development of chronic respiratory disease."[233]

Fracking results in additional air pollution that can create a severe threat to human health. One analysis found that 37 percent of the chemicals found at fracked gas wells were volatile, and that of those volatile chemicals, 81 percent can harm the brain and nervous system, 71 percent can harm the cardiovascular system and blood, and 66 percent can harm the kidneys.[234] Also, the SCAQMD has identified three areas of dangerous and unregulated air emissions from fracking: (1) the mixing of the fracking chemicals; (2) the use of the silica, or sand, as a proppant, which causes the deadly disease silicosis; and (3) the storage of fracking fluid once it comes back to the surface.[235] Preparation of the fluids used for well completion often involves onsite mixing of gravel or proppants with fluid, a process which potentially results in major amounts of particulate matter emissions.[236] Further, these proppants often include silica sand, which increases the risk of lung disease and silicosis when inhaled.[237] Finally, as flowback returns to the surface and is deposited in pits or tanks that are open to the atmosphere, there is the potential for organic compounds and toxic air pollutants to be emitted, which are harmful to human health as described above.[238]

The BLM should study the potential for oil and gas operations in the planning area to emit such air toxics and any other pollutants that may pose a risk to human health, paying particular attention to the impacts of air pollution on environmental justice communities that already bear the burden of disproportionately high levels of air pollution. The BLM should rely on the most up-to-date information regarding the contribution of oil and gas operations to VOC and air toxics levels.

C. Sources of Air Emissions

Harmful air pollutants are emitted during every stage of unconventional oil and gas recovery, including drilling, completion, well stimulation, production, and disposal. Drilling and casing the wellbore require substantial power from large equipment. The engines used typically run on diesel fuel, which emits particularly harmful types of air pollutants when burned. Similarly, high-powered pump engines are used in the fracturing and completion phase. This too

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[231] U.S. Environmental Protection Agency, Regulatory Impact Analysis for the Proposed Revisions to the National Ambient Air Quality Standards for Particulate Matter (June 2012), http://www.epa.gov/ttnecas1/regdata/RIAs/PMRIACombinedFile_Bookmarked.pdfat 2-2, ("EPA RIA").
[232] EPA RIA at 2-2.
[233] U.S. Environmental Protection Agency, National Ambient Air Quality Standards for Particulate Matter Proposed Rule, 77 Fed. Reg. 38,890, 38,893 (June 29, 2012).
[234] Colborn 2011 at 8.
[235] South Coast Air Quality Management District, Draft Staff Report on Proposed Rule 1148.2 - Notification and Reporting Requirements for Oil and Gas Wells and Chemical Suppliers (January 2013).at 15 ("SCAQMD Revised Draft Staff Report PR1148-2").
[236] *Id.*
[237] South Coast Air Quality Management District, Response to Questions re Air Quality Risks of Hydraulic Fracturing in California, Submission to Joint Senate Hearing (2013) at 3.
[238] SCAQMD Revised Draft Staff Report PR1148-2 at 15.

can result in large volumes of air pollution. Flaring, venting, and fugitive emissions of gas are also a potential source of air emissions. Gas flaring and venting can occur in both oil and gas recovery processes when underground gas rises to the surface and is not captured as part of production. Fugitive emissions can occur at every stage of extraction and production, often leading to high volumes of gas being released into the air. Methane emissions from oil and gas production are as much as 270 percent greater than previously estimated by calculation.[239] Recent studies show that emissions from pneumatic valves (which control routine operations at the well pad by venting methane during normal operation) and fugitive emissions are higher than EPA estimates.[240]

Evaporation from pits can also contribute to air pollution. Pits that store drilling waste, produced water, and other waste fluid may be exposed to the open air. Chemicals mixed with the wastewater—including the additives used to make fracking fluids, as well as volatile hydrocarbons, such as benzene and toluene, brought to the surface with the waste—can escape into the air through evaporation. Some pits are equipped with pumps that spray effluents into the air to hasten the evaporation process. Even where waste fluid is stored in so-called "closed loop" storage tanks, fugitive emissions can escape from tanks.

As mentioned above, increased truck traffic will lead to more air emissions. Trucks capable of transporting large volumes of chemicals and waste fluid typically use large engines that run on diesel fuel. Air pollutants from truck engines will be emitted not only at the well site, but also along truck routes to and from the site.

BLM must provide an adequate analysis and disclosure of the effects that leasing approximately 40,000 acres could have on air quality, including the impacts that would result from fracking. BLM should also analyze the climate and air quality effects of the combustion of any hydrocarbons extracted as a result of the proposed leasing. The EA cannot postpone the discussion of air pollution impacts until site-specific plans are proposed. Because BLM must analyze impacts at the "earliest practicable time," and no benefit would be gained from postponing the analysis, BLM must discuss these impacts at this time.

D. Impact of Increased Air Pollution

The potential harms resulting from increased exposure to the dangerous air pollutants described above are serious and wide ranging. The negative effects of criteria pollutants are well documented and are summarized by the U.S. EPA's website:

> *Nitrogen oxides* (NOx) react with ammonia, moisture, and other compounds to form small particles. These small particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature

[239] Miller 2013.
[240] Allen 2013; Harriss, Robert et al., Using Multi-Scale Measurements to Improve Methane Emission Estimates from Oil and Gas Operations in the Barnett Shale Region, Texas, Environ. Sci. Technol., 2015, 49 (13), pp 7524–7526.

death. NO_x and volatile organic compounds react in the presence of heat and sunlight to form ozone.

Particulate matter (PM) – especially fine particles – contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including: premature death in people with heart or lung disease, increased mortality, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms, such as irritation of the airways, coughing or difficulty breathing.[241]

Sulfur Dioxide (SO_2) has been shown to cause an array of adverse respiratory effects including bronchoconstriction and increased asthma symptoms.[242] Studies also show a connection between short-term exposure and increased visits to emergency departments and hospital admissions for respiratory illnesses, particularly in at-risk populations including children, the elderly, and asthmatics.[243]

Carbon Monoxide (CO) can cause harmful health effects by reducing oxygen delivery to the body's organs (like the heart and brain) and tissues. At extremely high levels, CO can cause death.[244] Exposure to CO can reduce the oxygen-carrying capacity of the blood. People with several types of heart disease already have a reduced capacity for pumping oxygenated blood to the heart, which can cause them to experience myocardial ischemia (reduced oxygen to the heart), often accompanied by chest pain (angina), when exercising or under increased stress.[245] For these people, short-term CO exposure further affects their body's already compromised ability to respond to the increased oxygen demands of exercise or exertion.[246]

Ozone (O_3) can trigger or worsen asthma and other respiratory ailments.[247] Ground level ozone can have harmful effects on sensitive vegetation and ecosystems. Ozone may also lead to loss of species diversity and changes to habitat quality, water cycles, and nutrient cycles.

Air toxics and hazardous air pollutants, by definition, can result in harm to human health and safety. The full extent of the health effects of exposure is still far from being complete, but already there are numerous studies that have found these chemicals to have serious health consequences for humans exposed to even minimal amounts. The range of illnesses that can

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[241] U.S. Environmental Protection Agency, Particulate Matter, (PM) http://www.epa.gov/airquality/particlepollution/health.html (accessed July 30, 2015); Ostro, Bart et al., Long-term Exposure to Constituents of Fine Particulate Air Pollution and Mortality: Results from the California Teachers Study, 118 Environmental Health Perspectives 3 (2010).
[242] U.S. Environmental Protection Agency, Sulfur Dioxide http://www.epa.gov/airquality/sulfurdioxide/health.html, *available at* (accessed July 29, 2015).
[243] *Id.*
[244] U.S. Environmental Protection Agency, Carbon Monoxide, *available at* http://www.epa.gov/airquality/carbonmonoxide/health.html (accessed July 29, 2015).
[245] *Id.*
[246] *Id.*
[247] U.S. Environmental Protection Agency, Ground Level Ozone, *available at* http://www.epa.gov/airquality/ozonepollution/health.html (accessed July 29, 2015).

result are summarized in a study by Dr. Theo Colburn, which charts which chemicals have been shown to be linked to certain illnesses.[248]

Natural gas drilling operations result in the emissions of numerous non-methane hydrocarbons (NMHCs) that have been linked to numerous adverse health effects. A recent study that analyzed air samples taken during drilling operations near natural gas wells and residential areas in Garfield County, detected 57 chemicals between July 2010 and October 2011, including 44 with reported health effects.[249] For example:

> Thirty-five chemicals were found to affect the brain/nervous system, 33 the liver/metabolism, and 30 the endocrine system, which includes reproductive and developmental effects. The categories with the next highest numbers of effects were the immune system (28), cardiovascular/blood (27), and the sensory and respiratory systems (25 each). Eight chemicals had health effects in all 12 categories. There were also several chemicals for which no health effect data could be found.[250]

The study found extremely high levels of methylene chloride, which may be used as cleaning solvents to remove waxy paraffin that is commonly deposited by raw natural gas in the region. These deposits solidify at ambient temperatures and build up on equipment.[251] While none of the detected chemicals exceeded governmental safety thresholds of exposure, the study noted that such thresholds are typically based on "exposure of a grown man encountering relatively high concentrations of a chemical over a brief time period, for example, during occupational exposure."[252] Consequently, such thresholds may not apply to individuals experiencing "chronic, sporadic, low-level exposure," including sensitive populations such as children, the elderly, and pregnant women.[253] For example, the study detected polycyclic aromatic hydrocarbon (PAH) levels that could be of "clinical significance," as recent studies have linked low levels of exposure to lower mental development in children who were prenatally exposed.[254] In addition, government safety standards do not take into account "the kinds of effects found from low-level exposure to endocrine disrupting chemicals…, which can be particularly harmful during prenatal development and childhood.[255]

Another study reviewed exposures to emissions from unconventional natural gas development and noted that trimethylbenzenes are among the largest contributors to non-cancer

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[248] Colborn, Theo et al., Natural Gas Operations from a Public Health Perspective, 17 Human and Ecological Risk Assessment 1039 (2011) ("Colborn 2011"); Colborn, Theo, et al., An Exploratory Study of Air Quality near Natural Gas Operations, Human and Ecological Risk Assessment: An International Journal doi:10.1080/10807039.2012.749447 (2012); *see* note 120 & accompanying text below.
[249] Colborn et al., An Exploratory Study of Air Quality Near Natural Gas Operations, Human and Ecological Risk Assessment: An International Journal, Vol. 20, Iss. 1, 2014, pp. 21-22 (pages refer to page numbers in attached manuscript and not journal pages) ("Colborn 2014), *available at* http://www.tandfonline.com/doi/full/10.1080/10807039.2012.749447.
[250] Colborn 2014, p. 11.
[251] *Id*., p. 10.
[252] *Id*., pp. 11-12.
[253] *Id*. p. 12.
[254] *Id*., p. 10-11.
[255] *Id*., p. 12.

threats for people living within a half mile of a well, while benzene is the largest contributor to cumulative cancer risk for people, regardless of the distance from the wells.[256]

The relationship between air quality and human health must be analyzed by BLM. The failure to do so here represents a fundamental shortcoming of the agency's analysis, and must be corrected.

E. Air Modeling

BLM should use air modeling to understand what areas and communities will most likely be affected by air pollution. It is crucial to gather independent data rather than relying on industry estimates, which may be inaccurate or biased. Wind and weather patterns, and atmospheric chemistry, determine the fate and transport of air pollution over a region, over time. The EIS should be informed by air modeling to show where the air pollution will flow.

V. Fossil Fuel Development Will Exacerbate Climate Change

A. BLM Must Fully Analyze Greenhouse Gas Emissions of Oil and Gas Operations.

BLM cannot ignore the mounting evidence proving that oil and gas operations are a major cause of climate change. This is due to emissions from the operations themselves, and emissions from the combustion of the oil and gas produced. Every step of the lifecycle process for development of these resources results in significant carbon emissions, including but not limited to:

End-user oil and gas combustion emissions. The combustion of extracted oil and gas will add vast amounts of carbon dioxide to the atmosphere, further heating the climate and moving the Earth closer to catastrophic and irreversible climate change. Though much of the oil is used as gasoline to fuel the transportation sector, the produced oil may also be used in other types of products. The EIS should study all end-uses as contributors to climate change.

Combustion in the distribution of product. To the extent that distribution of raw and end-use products will rely on rail or trucks, the combustion of gasoline or diesel to transport these products will emit significant greenhouse gas emissions.

Emissions from Refineries and Production. Oil and gas must undergo intensive refinery and production processes before the product is ready for consumption. Refineries and their auxiliary activities constitute a significant source of emissions.

Vented emissions. Oil and gas wells may vent gas that flows to the surface at times where the gas cannot otherwise be captured and sold. Vented gas is a significant source of greenhouse gas emissions and can also pose a safety hazard.

Combustion during construction and extraction operations. Operators rely on both mobile and stationary sources of power to construct and run their sites. The engines of

drilling or excavation equipment, pumps, trucks, conveyors, and other types of equipment burn large amounts of fuel to operate. Carbon dioxide, methane, and nitrous oxide (another potent greenhouse gas) are emitted from oxidized fuel during the combustion process. Engines emit greenhouse gases during all stages of oil and gas recovery, including drilling rig mobilization, site preparation and demobilization, completion rig mobilization and demobilization, well drilling, well completion (including fracking and other unconventional extraction techniques), and well production. Transportation of equipment and chemicals to and from the site is an integral part of the production process and contributes to greenhouse gas emissions. Gas flaring is another important source of carbon dioxide emissions. Significant sources of emissions in oil production include pneumatic devices, dehydrators and pumps, and compressors, and system upsets.[257]

Fugitive emissions. Potent greenhouse gases can leak as fugitive emissions at many different points in the production process, especially in the production of gas wells. Recent studies suggest that previous estimates significantly underestimate leakage rates.[258] New research shows methane leakage from some gas wells may be as high at 17.3 percent.[259] Moreover, new research has shown that unconventional gas wells are up to 2.7 times more likely than a conventional well to have a cement or casing impairment, which can lead to methane leaks.[260] The intersection of new fractures with nearby abandoned wells can also result in methane migration to the surface.[261] Leakage can also occur during storage, processing, and distribution to customers.[262]

Natural gas emissions are generally about 84 percent methane.[263] Methane is a potent greenhouse gas that contributes substantially to global climate change. Its global warming potential is approximately 34 times that of carbon dioxide over a 100 year time frame and at least 86 times that of carbon dioxide over a 20 year time frame.[264] Oil and gas operations release

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[257] U.S. Environmental Protection Agency, National Gas STAR Program, Basic Information, Major Methane Emission Sources and Opportunities to Reduce Methane Emissions ("USEPA, Basic Information").

[258] Brandt, A. R. *et al., Methane leaks from North American natural gas systems, 343* Science 733 *(2014);* Miller, S. M. et al. Anthropogenic Emissions of Methane in the United States, Proc. Natl. Acad. Sci. Early Edition, DOI: 10.1073/pnas.1314392110 (2013) ("Miller 2013").

[259] Caulton, Dana R. et al., *Toward a Better Understanding and Quantification of Methane Emissions from Shale Gas Development*, 111 Proc. Natl. Acad. Sciences 17 (2014); Schneising, Oliver, et al., Remote Sensing of Fugitive Methane Emissions from Oil and Gas Production in North American Tight Geologic Formations, Earth's Future 2, doi:10.1002/2014EF000265 (2014); Allen, D. T. *et al., (2013), Measurements of Methane Emissions at Natural Gas Production Sites in the United States, 110* Proc. Natl. Acad. Sci. 44 *(2013) ("Allen 2013"); Zavala-Araizaa, Daniel et al., Reconciling divergent estimates of oil and gas methane emissions, 112 Proc. Natl. Acad. Sciences 51 (2015), available at* www.pnas.org/cgi/doi/10.1073/pnas.1522126112 *(*leakage rate 1.5% of production in Barnett shale or twice EPA's estimate)*;* Vaidyanathan, G, Bad news for the climate as methane leaks far surpass previous estimates,E&E News (Dec. 8, 2015) (leakage rate in Barnett shale equal to annual emissions of 8,000 cars).

[260] Ingraffea, Anthony R, et al., *Assessment and Risk Analysis of Casing and Cement Impairment in Oil and Gas Wells in Pennsylvania, 2000 – 2012*, 111 Proc. Natl. Acad. Sciences 30 (2014).

[261] King, Pamela. *'Frack hits' provide pathways for methane migration study* , E&E News (Oct. 21, 2015).

[262] Howarth, R. W. A bridge to nowhere: methane emissions and the greenhouse gas footprint of natural gas, Energy Science and Engineering 2014; 2(2): 47–60, 49 ("Howarth 2014").

[263] Brown Memo to EPA at 3; Power, Thomas, The Local Impacts of Natural Gas Development in Valle Vidal, New Mexico, University of Montana (2005) ("Power").

[264] Intergovernmental Panel on Climate Change, Chapter 8: Anthropogenic and Natural Radiative Forcing in Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Table 8.7 (2013); Howarth, Robert, et al., Methane and the greenhouse-gas footprint of natural gas from shale formations, Climactic Change (Mar. 31, 2011) ("Howarth 2011"); Shindell, Drew, *Improved Attribution of*

large amounts of methane. While the exact amount is not clear, EPA has estimated that "oil and gas systems are the largest human-made source of methane emissions and account for 37 percent of methane emissions in the United States and is expected to be one of the most rapidly growing sources of anthropogenic methane emissions in the coming decades."[265] That proportion is based on an estimated calculation of methane emissions, rather than measured actual emissions, which indicate that methane emissions may be much greater in volume than calculated.[266]

Fracked wells leak an especially large amount of methane, with some evidence indicating that the leakage rate is so high that shale gas is worse for the climate than coal.[267] In fact, a research team associated with the National Oceanic and Atmospheric Administration recently reported that preliminary results from a field study in the Uinta Basin of Utah suggest that the field leaked methane at an eye-popping rate of nine percent of total production.[268]

The BLM must prepare an EIS weighing the no-leasing and no-fracking alternatives' climate-change benefits against the impacts of allowing new leasing and fracking, and address the following:

1. Sources of Greenhouse Gases

In performing a full analysis of climate impacts, BLM must consider all potential sources of greenhouse gas emissions (e.g. greenhouse gas emissions generated by transporting large amounts of water for fracking). BLM should also perform a full analysis of all gas emissions that contribute to climate change, including methane and carbon dioxide. The EIS should calculate the amount of greenhouse gas that will result on an annual basis from (1) each of the fossil fuels that can be developed within the planning area, (2) each of the well stimulation or other extraction methods that can be used, including, but not limited to, fracking, acidization, acid fracking, and gravel packing, and (3) cumulative greenhouse gas emissions expected over the long term (expressed in global warming potential of each greenhouse pollutant as well as CO_2 equivalent), including emissions throughout the entire fossil fuel lifecycle discussed above.

2. Effects of Climate Change

In addition to quantifying the total emissions that would result from the proposal, an EIS should consider the environmental effects of these emissions, resulting from climate disruption's ecological and social effects.[269] Release of greenhouse gases (from extraction, leakage, and

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Climate Forcing to Emissions, 326 Science 716 (2009).

[265] USEPA, Basic Information; *see also* Petron, Gabrielle, et al., *Hydrocarbon emissions characterization in the Colorado Front Range: A pilot study*, 117 Journal of Geophysical Research (2012).

[266] Miller, S. M. et al., *Anthropogenic Emissions of Methane in the United States*, Proc. Natl. Acad. Sci. Early Edition, DOI: 10.1073/pnas.1314392110 (2013).

[267] Howarth 2011; Brune, Michael, Statement of Sierra Club Executive Director Michael Brune Before the Committee on Oversight & Government Reform (May 31, 2012); Wang, Jinsheng, et al., Reducing the Greenhouse Gas Footprint of Shale (2011); Alvarez, Ramon et al., *Greater focus needed on methane leakage from natural gas infrastructure*, Proc. Nat'l. Acad. Sci. Early Edition (Feb 13, 2012) at 3; *see also* Howarth, Robert, et al., Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et al., (2012); Hou, Deyi, et al., Shale gas can be a double-edged sword for climate change, Nature Climate Change at 386 (2012)

[268] Tollefson, Jeff, *Methane leaks erode green credentials of natural gas*, Nature News (Jan 2, 2013).

[269] *See* Council on Environmental Quality, Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts 11 (Dec. 18, 2014), *available at*

downstream combustion) is not merely a reasonably foreseeable consequence of fracking extraction. CEQ and the courts have repeatedly cautioned federal agencies that they cannot ignore either climate change generally, or the combustion impacts of fossil fuel extraction in particular.[270]

On December 12, 2015, nearly 200 governments, including the United States, agreed to the commitments enumerated in the Paris Agreement to "strengthen the global response to the threat of climate change."[271] The Paris Agreement codified the international consensus that the climate crisis is an urgent threat to human societies and the planet, with the parties recognizing that:

> Climate change represents an *urgent and potentially irreversible threat to human societies and the planet* and thus requires the widest possible cooperation by all countries, and their participation in an effective and appropriate international response, with a view to accelerating the reduction of global greenhouse gas emissions (emphasis added).[272]

Numerous authoritative scientific assessments have established that climate change is causing grave harms to human society and natural systems, and these threats are becoming increasingly dangerous. The Intergovernmental Panel on Climate Change (IPCC), in its 2014 Fifth Assessment Report, stated that: "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased" and that "[r]ecent climate changes have had widespread impacts on human and natural systems."[273]

The 2014 Third National Climate Assessment, prepared by a panel of non-governmental experts and reviewed by the National Academy of Sciences and multiple federal agencies similarly stated:"That the planet has warmed is 'unequivocal,' and is corroborated though multiple lines of evidence, as is the conclusion that the causes are very likely human in origin"[274] and "[i]impacts related to climate change are already evident in many regions and are expected

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https://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance (instructing agencies to consider indirect and connected actions, including "downstream" emissions). Although the CEQ guidance is still in draft form and not binding, it is arbitrary for agencies to ignore its reasoning without explanation.

[270] *See* 40 C.F.R. §§ 1508.7, 1508.8; *Center for Biological Diversity v. Nat'l Highway Transp. Safety Admin.*, 538 F.3d 1172, 1217 (9th Cir. 2008); *Utahns for Better Transp. v. U.S. Dep't of Transp.*, 305 F.3d 1152, 1176 (10th Cir. 2002); *Dine Citizens Against Ruining Our Env't v. U.S. Office of Surface Mining*, 82 F.Supp.3d 1201, 1212-14 (D. Colo. 2015).

[271] Paris Agreement, Art. 2(1).

[272] Paris Agreement, Decision, Recitals (emphasis added).

[273] IPCC AR5 Synthesis Report at 2.

[274] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment(U.S. Global Change Research Program). doi:10.7930/J0Z31WJ2 ("Third National Climate Assessment") at 61 (quoting IPCC, 2007:. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller, Eds., Cambridge University Press, 1-18.).

to become increasingly disruptive across the nation throughout this century and beyond."[275] The United States National Research Council similarly concluded that: "[c]limate change is occurring, is caused largely by human activities, and poses significant risks for—and in many cases is already affecting—a broad range of human and natural systems."[276]

The IPCC and National Climate Assessment further decisively recognize the dominant role of fossil fuels in driving climate change:

> While scientists continue to refine projections of the future, observations unequivocally show that climate is changing and that the warming of the past 50 years is primarily due to human-induced emissions of heat-trapping gases. These emissions come mainly from burning coal, oil, and gas, with additional contributions from forest clearing and some agricultural practices.[277]
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> CO_2 emissions from fossil fuel combustion and industrial processes contributed about 78% to the total GHG emission increase between 1970 and 2010, with a contribution of similar percentage over the 2000–2010 period (*high confidence*).[278]

These impacts ultimately emanating from the extraction and combustion of fossil fuels are harming the United States in myriad ways, with the impacts certain to worsen over the coming decades absent deep reductions in domestic and global GHG emissions. EPA recognized these threats in its 2009 Final Endangerment Finding under Clean Air Act Section 202(a), concluding that greenhouse gases from fossil fuel combustion endanger public health and welfare: "the body of scientific evidence compellingly supports [the] finding" that "greenhouse gases in the atmosphere may reasonably be anticipated both to endanger public health and to endanger public welfare."[279] In finding that climate change endangers public health and welfare, EPA has acknowledged the overwhelming evidence of the documented and projected effects of climate change upon the nation:

Effects on air quality: "The evidence concerning adverse air quality impacts provides strong and clear support for an endangerment finding. Increases in ambient ozone are expected to occur over broad areas of the country, and they are expected to increase serious adverse health effects in large population areas that are and may continue to be in nonattainment. The evaluation of the potential risks associated with increases in ozone in attainment areas also supports such a finding."[280]

Effects on health from increased temperatures: "The impact on mortality and morbidity associated with increases in average temperatures, which increase the likelihood of heat waves,

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[275] Third National Climate Assessment at 10.
[276] National Research Council, Advancing the Science of Climate Change (2010), available at www.nap.edu. ("Advancing the Science of Climate Change") at 2.
[277] Third National Climate Assessment at 2.
[278] IPCC AR5 Synthesis Report at 46.
[279] Final Endangerment Finding, 74 Fed. Reg. at 66,497.
[280] *Id.*

also provides support for a public health endangerment finding."[281]

Increased chance of extreme weather events: "The evidence concerning how human induced climate change may alter extreme weather events also clearly supports a finding of endangerment, given the serious adverse impacts that can result from such events and the increase in risk, even if small, of the occurrence and intensity of events such as hurricanes and floods. Additionally, public health is expected to be adversely affected by an increase in the severity of coastal storm events due to rising sea levels."[282]

Impacts to water resources: "Water resources across large areas of the country are at serious risk from climate change, with effects on water supplies, water quality, and adverse effects from extreme events such as floods and droughts. Even areas of the country where an increase in water flow is projected could face water resource problems from the supply and water quality problems associated with temperature increases and precipitation variability, as well as the increased risk of serious adverse effects from extreme events, such as floods and drought. The severity of risks and impacts is likely to increase over time with accumulating greenhouse gas concentrations and associated temperature increases."[283]

Impacts from sea level rise: "The most serious potential adverse effects are the increased risk of storm surge and flooding in coastal areas from sea level rise and more intense storms. Observed sea level rise is already increasing the risk of storm surge and flooding in some coastal areas. The conclusion in the assessment literature that there is the potential for hurricanes to become more intense (and even some evidence that Atlantic hurricanes have already become more intense) reinforces the judgment that coastal communities are now endangered by human-induced climate change, and may face substantially greater risk in the future. Even if there is a low probability of raising the destructive power of hurricanes, this threat is enough to support a finding that coastal communities are endangered by greenhouse gas air pollution. In addition, coastal areas face other adverse impacts from sea level rise such as land loss due to inundation, erosion, wetland submergence, and habitat loss. The increased risk associated with these adverse impacts also endangers public welfare, with an increasing risk of greater adverse impacts in the future."[284]

Impacts to energy, infrastructure, and settlements: "Changes in extreme weather events threaten energy, transportation, and water resource infrastructure. Vulnerabilities of industry, infrastructure, and settlements to climate change are generally greater in high-risk locations, particularly coastal and riverine areas, and areas whose economies are closely linked with climate-sensitive resources. Climate change will likely interact with and possibly exacerbate ongoing environmental change and environmental pressures in settlements, particularly in Alaska where indigenous communities are facing major environmental and cultural impacts on their historic lifestyles."[285]

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[281] *Id.*
[282] *Id.* at 66,497-98.
[283] *Id.* at 66,498.
[284] *Id.*
[285] *Id.*

Impacts to wildlife: "Over the 21st century, changes in climate will cause some species to shift north and to higher elevations and fundamentally rearrange U.S. ecosystems. Differential capacities for range shifts and constraints from development, habitat fragmentation, invasive species, and broken ecological connections will likely alter ecosystem structure, function, and services, leading to predominantly negative consequences for biodiversity and the provision of ecosystem goods and services."[286]

In addition to these acknowledged impacts on public health and welfare more generally, climate change is causing and will continue to cause serious impacts on natural resources that the Department of Interior is specifically charged with safeguarding.[287]

Impacts to Public Lands: Climate change is causing and will continue to cause specific impacts to public lands ecosystem services. Although public lands provide a variety of difficult-to-quantify public benefits, one recent Forest Service attempt at quantification estimates the public land ecosystem services at risk from climate change at between $14.5 and $36.1 billion annually.[288] In addition to the general loss of ecosystem services, irreplaceable species and aesthetic and recreational treasures are at risk of permanent destruction. High temperatures are causing loss of glaciers in Glacier National Park; the Park's glaciers are expected to disappear entirely by 2030, with ensuing warming of stream temperatures and adverse effects to aquatic ecosystems.[289] With effects of warming more pronounced at higher latitudes, tundra ecosystems on Alaska public lands face serious declines, with potentially serious additional climate feedbacks from melting permafrost.[290] In Florida, the Everglades face severe ecosystem disruption from already-occurring saltwater incursion.[291] Sea level rise will further damage freshwater ecosystems and the endangered species that rely on them.

Impacts to Biodiversity and Ecosystems: Across the United States ecosystems and biodiversity, including those on public lands, are directly under siege from climate change—leading to the loss of iconic species and landscapes, negative effects on food chains, disrupted migrations, and the degradation of whole ecosystems.[292] Specifically, scientific evidence shows that climate change is already causing changes in distribution, phenology, physiology, genetics, species interactions, ecosystem services, demographic rates, and population viability: many animals and plants are moving poleward and upward in elevation, shifting their timing of breeding and migration, and experiencing population declines and extirpations.[293] Because

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[286] *Id.*; *see also* Third National Climate Assessment at 195-219.
[287] *See* Federal Land Policy and Management Act of 1976, 43 U.S.C. §§ 1701(a)(8), 1712(c)(1); Multiple-Use Sustained Yield Act of 1960, 16 U.S.C. § 528; National Environmental Policy Act of 1969, 42 U.S.C. §§ 4331-4332.
[288] Esposito, Valerie et al., Climate Change and Ecosystem Services: The Contribution and Impacts on Federal Public Lands in the United States, USDA Forest Service Proceedings RMRS-P-64 at 155-164 (2011).
[289] U.S. Environmental Protection Agency, Climate Change and Public Lands (1999).
[290] *See* National Climate Assessment at 48; MacDougall, A. H., et al., Significant contribution to climate warming from the permafrost carbon feedback, 5 Nature Geoscience 719-721 (2012), doi:10.1038/ngeo1573.
[291] *See* National Climate Assessment at 592; Foti, R., Met al., Signs of critical transition in the Everglades wetlands in response to climate and anthropogenic changes, 110 Proceedings of the National Academy of Sciences6296-6300, (2013), doi:10.1073/pnas.1302558110.
[292] National Climate Assessment at 13.
[293] *See* Parmesan, C. and G. Yohe, A globally coherent fingerprint of climate change impacts across natural systems, 421 Nature 37–42 (2003); Root, T. et al., Fingerprints of global warming on wild animals and plants, 421

climate change is occurring at an unprecedented pace with multiple synergistic impacts, climate change is predicted to result in catastrophic species losses during this century. For example, the IPCC concluded that 20% to 30% of plant and animal species will face an increased risk of extinction if global average temperature rise exceeds 1.5°C to 2.5°C relative to 1980-1999, with an increased risk of extinction for up to 70% of species worldwide if global average temperature exceeds 3.5°C relative to 1980-1999.[294]

In sum, climate change, driven primarily by the combustion of fossil fuels, poses a severe and immediate threat to the health, welfare, ecosystems and economy of the United States. These impacts are felt across the nation, including upon the public lands the Secretary of the Interior is charged with safeguarding. A rapid and deep reduction of emissions generated from fossil fuels is essential if such threats are to be minimized and their impacts mitigated.

Although cost-benefit analysis is not necessarily the ideal or exclusive method for assessing contributions to an adverse effect as enormous, uncertain, and potentially catastrophic as climate change, BLM does have tools available to provide one approximation of external costs and has previously performed a "social cost of carbon" analysis in prior environmental reviews.[295] Its own internal memo identifies one available analytical tool: "For federal agencies the authoritative estimates of [social cost of carbon] are provided by the 2013 technical report of the Interagency Working Group on Social Cost of Carbon, which was convened by the Council of Economic Advisers and the Office of Management and Budget."[296] As explained in that report:

> The purpose of the "social cost of carbon" (SCC) estimates presented here is to allow agencies to incorporate the social benefits of reducing carbon dioxide (CO_2) emissions into cost-benefit analyses of regulatory actions that impact cumulative global emissions. The SCC is an estimate of the monetized damages associated

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Nature 57–60 (2003); Chen, I. et al., Rapid range shifts of species associated with high levels of climate warming, 333 Science 1024–1026 (2011).

[294] IPCC, 2007:. Synthesis Report: An Assessment of the Intergovernmental Panel on Climate Change. Other studies have predicted similarly severe losses: 15%-37% of the world's plants and animals committed to extinction by 2050 under a mid-level emissions scenario, s*ee* Thomas et al., Extinction risk from climate change, 427 Nature 145–8 (2004)); the potential extinction of 10% to 14% of species by 2100 if climate change continues unabated, *see* Maclean, I. M. D. and R. J. Wilson, Recent ecological responses to climate change support predictions of high extinction risk, 108 Proceedings of the National Academy of Sciences of the United States of America 12337-12342 (2011); and the loss of more than half of the present climatic range for 58% of plants and 35% of animals by the 2080s under the current emissions pathway, in a sample of 48,786 species, *see* Warren, R. J. et al., Increasing Impacts of Climate Change Upon Ecosystems with Increasing Global Mean Temperature Rise, 106 Climatic Change 141–77 (2011)..

[295] *See High Country Conserv'n Advocates v. United States Forest Serv.*, 2014 U.S. Dist. Lexis 87820 (D. Colo. 2014) (invalidating environmental assessment ["EA"] for improperly omitting social cost of carbon analysis, where BLM had included it in preliminary analysis); Taylor, P. "BLM crafting guidance on social cost of carbon -- internal memo," Greenwire, April 15, 2015, available at http://www.eenews.net/greenwire/stories/1060016810/; BLM Internal Memo from Assistant Director of Resources and Planning Ed Roberson ("Roberson Internal Memo"), April 2015, available at http://www.eenews.net/assets/2015/04/15/document_gw_01.pdf (noting "some BLM field offices have included estimates of the [social cost of carbon] in project-level NEPA documents") (accessed July 29, 2015); *see also* Council on Environmental Quality, Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts, p. 18, available at www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance (accessed Jul 29, 2015) (quantitative analysis required if GHGs > 25k tons/yr).

[296] BLM, Roberson Internal Memo.

> with an incremental increase in carbon emissions in a given year. It is intended to include (but is not limited to) changes in net agricultural productivity, human health, property damages from increased flood risk, and the value of ecosystem services due to climate change.[297]

The Social Cost of Carbon is explicitly designed to present "a defensible set of input assumptions grounded in the existing scientific and economic literatures."[298] The method is "generally accepted" despite the lack of consensus on a single, most appropriate rate for discounting future costs. There is a consensus that the range of values presented in the tool "reflect reasonable judgments" and "span a plausible range."[299] The authors recommend presenting estimates of cost using this range of rates.[300] In addition to estimating the social cost of greenhouse gas emissions, BLM should have examined the significance of these emissions by determining how they would impact federal efforts to address climate change by meeting specific emission reduction targets.

Further, other analytical tools exist to evaluate the cost of methane emissions.[301] EPA has peer reviewed and employed such a tool in its "Regulatory Impact Analysis of the Proposed Emission Standards for New and Modified Sources in the Oil and Natural Gas Sector."[302]

Leasing and development of unconventional wells could exact extraordinary financial costs to communities and future generations, setting aside the immeasurable loss of irreplaceable, natural values that can never be recovered. The Draft EA fails to provide an accounting of these potential costs.

B. The Draft EA Fails to Analyze the Proposal's Greenhouse Gas Impacts

The Draft EA fails to fully analyze the impacts of increased oil and gas development on greenhouse gas emissions and climate change. It makes no attempt to even identify the various sources of greenhouse gas pollution that could result from new leasing, much less quantify

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[297] *See* Interagency Working Group on Social Cost of Carbon, United States Government, Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis - Under Executive Order 12866, May 2013, available at https://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf (accessed July 29, 2015); *see also* Interagency Working Group on Social Cost of Carbon, United States Government, Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866, Feb. 2010, available at http://www.epa.gov/otaq/climate/regulations/scc-tsd.pdf (accessed July 29, 2015).

[298] *Id*. at 1.

[299] *Id*. at 23.

[300] *Id.*

[301] *See* Marten A.L., Kopits K.A., Griffiths C.W., Newbold S.C., Wolverton A. 2014, online publication (2015, print publication). "Incremental CH4 and N2O mitigation benefits consistent with the US Government's SC-CO2 estimates," Climate Policy 15(2):272-298, abstract available at http://www.tandfonline.com/doi/abs/10.1080/14693062.2014.912981.

[302] *See* USEPA, Social Cost of Carbon, *available at* http://www3.epa.gov/climatechange/EPAactivities/economics/scc.html (noting application of social cost of methane supported by peer review); USEPA, Regulatory Impact Analysis of the Proposed Emission Standards for New and Modified Sources in the Oil and Natural Gas Sector, Ch. 4, available at http://www3.epa.gov/airquality/oilandgas/pdfs/og_prop_ria_081815.pdf.

potential emissions. It also incorrectly suggests that because a precise assessment of greenhouse gas emissions is not possible, it need not make any effort to quantify these emissions. Specifically, the Draft EA states that "[u]ncertainties regarding the number of wells and other factors make it impractical to project amounts of GHG that the Proposed Action would emit."[303] Furthermore, with regard to climate change, the draft EA states that "[t]he lack of scientific tools designed to predict climate change at regional or local scales limits the ability to quantify potential future impacts," but that "potential impacts to air quality due to climate change are likely to be varied."[304] The Draft EA maintains that "while BLM actions may contribute to the climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science."[305] The Draft EA concludes that "an assessment of impacts on climate change from the release of GHGs is outside the scope of this document because it is a global phenomenon."[306]

NEPA requires "reasonable forecasting," which includes the consideration of "reasonably foreseeable future actions…even if they are not specific proposals" *N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1079 (9th Cir. 2011) (citation omitted). It is reasonably foreseeable that opening this acreage to oil and gas leasing will result in the commercial production of oil and gas. As discussed above, BLM has ample information to inform a greenhouse gas emissions analysis, including figures for total wells and well pads, average length of gathering lines, and compressor stations. The agency also knows the general location of horizontal well pads, which would inform an analysis of transportation emissions. Further, Ohio keeps track of natural gas and oil production numbers in the Utica and Marcellus shales, which could inform a study of pipeline and combustion emissions.[307] That BLM cannot precisely calculate the total emissions anticipated is not a rational basis for cutting off its analysis. "Because speculation is . . . implicit in NEPA," agencies may not "shirk their responsibilities under NEPA by labeling any and all discussion of future environmental effects as crystal ball inquiry." *Id*. Indeed, the EA for a recent lease sale in Utah undercuts BLM's assertion here that GHGs cannot be quantified at the leasing stage;[308] *see also High Country Conservation Advocates v. United States Forest Serv.*, 52 F. Supp. 3d 1174, 1196 (D. Colo. 2014) (decision to forgo calculating mine's reasonably foreseeable GHG emissions was arbitrary "in light of the agencies' apparent ability to perform such calculations"). While the Utah sale EA does not provide a complete analysis, it estimates that sale of the Fillmore parcels will result in GHG emissions of 7,074.54 metric tons of CO2e per year, which includes emissions from the development of oil and gas. *Id*.

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[303] Draft EA, p. 87.
[304] Draft EA, p. 35.
[305] Draft EA, p. 86.
[306] *Id*.
[307] ODNR, Division of Oil and Gas Resources, Oil & Gas Production, *available at* http://oilandgas.ohiodnr.gov/production.
[308] BLM, Environmental Assessment for West Desert District, Fillmore Field Office, August 2015 Oil and Gas Lease Sale, pp. 57-58 (Dec. 2015), available at https://eplanning.blm.gov/epl-front-office/projects/nepa/55342/72905/80038/Fillmore_FO_Final_EA_4-19.pdf; BLM, Greenhouse Gases Emissions Estimate (West Desert District Nov. 2015 lease Sale), available at http://www.blm.gov/style/medialib/blm/ut/natural_resources/airQuality.Par.38065.File.dat/GreenhouseGasEmissionsNov2015.xlsx.

Even if it were true that potential emissions cannot reasonably be estimated, it is possible for BLM to identify significant sources of greenhouse gas emissions, which would enable the identification of specific measures to reduce emissions and an understanding of the extent to which certain emissions are avoidable. As alluded to above, the extreme urgency of the climate crisis requires BLM to pursue all means available to limit the climate change effects of its actions. Any emissions source, no matter how small, is potentially significant, such that BLM should fully explore mitigation and avoidance options for all sources.

Instead of performing this minimum level of analysis, the Draft EA provides no practical understanding of the sources of emissions from oil and gas development and whether they can be controlled. Without a breakdown of all potential sources, there can be no understanding of whether each source can be mitigated. For example, fugitive methane leaks from equipment and pipelines are an enormous source of emissions, but this source is ignored. The Draft EA also fails to quantify emissions from end-use combustion of fossil fuels extracted within the planning area at issue.

VI. Oil and Gas Development Harms Sensitive Species and Wildlife

The expansion of oil and gas development activities will harm wildlife through habitat destruction and fragmentation, stress and displacement caused by development-related activities (e.g., construction and operation activities, truck traffic, noise and light pollution), surface water depletion leading to low stream flows, water and air contamination, introduction of invasive species, and climate change. These harms can result in negative health effects and population declines. Studies and reports of observed impacts to wildlife from unconventional oil and gas extraction activities are summarized in the Center's "Review of Impacts of Oil and Gas Exploration and Development on Wildlife," submitted herewith.[309] Because the allowance of destructive oil and gas extraction runs contrary to BLM's policy of managing resources in a manner that will "protect the quality of…ecological…values" and "provide…habitat for wildlife,"[310] a no-fracking alternative minimizing industrial development and its harmful effects on wildlife must be considered.

A. Habitat Loss

Oil and gas development creates a network of well pads, roads, pipelines, and other infrastructure that lead to direct habitat loss and fragmentation, as well as displacement of wildlife from these areas due to increased human disturbance. Habitat loss occurs as a result of a reduction in the total area of the habitat, the decrease of the interior-to-edge ratio, isolation of one habitat fragment from another, breaking up of one habitat into several smaller patches of habitat, and decreasing the average size of a habitat patch. New research has revealed the extent of this habitat loss. For example, in the western United States, the amount of high-quality habitat for the pronghorn has shrunk drastically due to oil and gas development.[311]

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[309] *See* Center for Biological Diversity, Review of Impacts of Oil and Gas Exploration and Development on Wildlife (June 20, 2015). This review presents the findings of numerous studies and reports on the impacts of hydraulic fracturing on wildlife.

[310] 43 U.S. Code § 1701(a)(8).

[311] Beckmann, J.P. et al. Human-mediated shifts in animal habitat use: Sequential changes in pronghorn use of a natural gas field in Greater Yellowstone, 147 Biological Conservation 1:222 (2012).

The indirect effects from unconventional oil and gas development can often be far greater than the direct disturbances to habitat. The impacts from the well site—including noise, light, and pollution—extend beyond the borders of the operation site and will consequently render even greater areas uninhabitable for some wildlife. Species dependent on having an "interior" habitat will lose their habitat as operation sites or other infrastructure fragment previously buffered and secluded areas. These and other indirect effects can be far greater than the direct disturbances to land. In the Marcellus shale of Pennsylvania, for instance, research shows that 8.8 acres of forest on average are cleared for each drilling pad along with associated infrastructure, but after accounting for ecological edge effects, each drilling station actually affected 30 acres of forest.[312]

While individual well sites may cause some disturbance and destruction, the cumulative impacts of oil and gas production using unconventional methods must receive attention as well. While the actual well pads may only occupy a small proportion of a particular habitat, their impact can be much greater when their aggregate impact is considered. As discussed above, interior habitats will be destroyed by removing the buffer between the interior habitat and the operation site. For example, one study found that grassland bird species' habitat have been degraded by oil development in the Bakken shale region, as evidenced by their avoidance of these areas. Grassland birds avoided areas within 150 meters of roads, 267 meters of single-bore well pads, and 150 meters of multi-bore well pads.[313] In areas of dense development, these habitat effects are greatly multiplied for sensitive species, such as the Sprague's pipit (*Anthus spragueii*), which avoided areas within 350 meters of single-bore well pads. The EIS must quantify the potential cumulative loss of habitat for sensitive species.[314]

B. Water Depletion

Water depletion also affects species whose habitats are far removed from the actual well site. Because of the high volume of water required for even a single well that uses unconventional extraction methods, the cumulative water depletion has a significant impact on species that rely on water sources that serve to supply oil and gas operations. In addition, water depletion adversely impacts water temperature and chemistry, as well as amplifies the effects of harmful pollutants on wildlife that would otherwise be diluted without the depletion.

C. Water Contamination

Accidental spills or intentional dumping of wastewater contaminate surface water and cause large-scale harm to wildlife. Numerous incidents of wastewater contamination from pipelines, equipment blowouts, and truck accidents have been reported, and have resulted in kills of fish, aquatic invertebrates, and trees and shrubs, as well as negative health effects for wildlife

[312] Johnson, N., Pennsylvania energy impacts assessment: Report 1: Marcellus shale natural gas and wind, Nature Conservancy – Pennsylvania Chapter (2010) at 10.
[313]Thomas, Sarah J. et al. Avoidance of unconventional oil wells and roads exacerbates habitat loss for grassland birds in the North American great plains, Biological Conservation 192 (2015) 82–90, *available at* https://www.researchgate.net/publication/282292567_Avoidance_of_unconventional_oil_wells_and_roads_exacerbates_habitat_loss_for_grassland_birds_in_the_North_American_great_plains.
[314] *Id.*

and domestic animals. In 2013, a company admitted to dumping wastewater from fracking operations into the Acorn Fork Creek in Kentucky, causing a massive fish kill.[315] Among the species harmed was the blackside dace, a threatened minnow species.[316] An analysis of water quality of Acorn Creek and fish tissues taken shortly after the incident was exposed showed the fish displayed general signs of stress and had a higher rate of gill lesions, than fish in areas not affected by the dumping.[317] The discharge of fracking wastewater into the Susquehanna River in Pennsylvania is suspected to be the cause of fish abnormalities, including high rates of spots, lesions, and intersex.[318] In West Virginia, the permitted application of hydrofracturing fluid to an area of mixed hardwood forest caused extensive tree mortality and a 50-fold increase in surface soil concentrations of sodium and chloride.[319]

In addition, open air pits that store waste fluid pose risks for wildlife that may come into contact with the chemicals stored in the pits. Already, there have been several documented cases of animal mortality resulting from contact with pits. A field inspection of open pits in Wyoming found 269 bird carcasses, the likely cause of death being exposure to toxic chemicals stored in the open pits.[320] Open pits can also serve as breeding grounds for mosquitoes, which serve as a vector for West Nile virus, a threat to humans and animals alike. In Wyoming, an increase of ponds led to an increase of West Nile virus among greater sage-grouse populations.[321] Recently, new information has come to light that operators in California have been dumping wastewater into hundreds of unpermitted open pits.[322] The EIS must take into account the impact of both unpermitted, illegal waste pits as well as those that are regulated.

Contaminants from spills not only directly harm species exposed to these contaminants but can enter the food chain and harm predators. A recent study found that in watersheds where hydraulic fracturing occurs, a top predator , riparian songbird in headwater systems, the Louisiana Waterthrush (*Parkesia motacilla*), accumulated metals associated with the fracking process. "In both the Marcellus and Fayetteville shale regions, barium and strontium were found at significantly higher levels in feathers of birds in sites with fracking activity than at sites without fracking."[323] While the study did not resolve the pathway for these metals entering the

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[315] Vaidyanathan, Gayathri, *Fracking Spills Cause Massive Ky. Fish Kill*, E&E News, Aug. 29. 2013, http://www.eenews.net/greenwire/2013/08/29/stories/1059986559 (accessed July 30, 2015).
[316] *Id.*
[317] Papoulias, D.M. and A.L. Velasco. Histopathological analysis of fish from Acorn Fork Creek, Kentucky, exposed to hydraulic fracturing fluid releases, 12 Southwestern Naturalist (Special Issue 4):92 (2013).
[318] Piette, Betsy, BP Oil Spill, Fracking Cause Wildlife Abnormalities, Workers World (April 27, 2012) available at http://www.workers.org/2012/us/bp_oil_spill_fracking_0503/; Pennsylvania Fish & Boat Commission, Ongoing Problems with the Susquehanna River smallmouth bass, a Case for Impairment (May 23, 2012), www.fish.state.pa.us/newsreleases/2012press/senate_susq/SMB_ConservationIssuesForum_Lycoming.pdf
[319] Adams, Mary Beth, Land Application of Hydrofracturing Fluids Damages a Deciduous Forest Stand in West Virginia, 40 Journal of Environmental Quality 1340 (2011).
[320] *See, e.g.*, Ramirez, P. Jr., Bird Mortality in Oil Field Wastewater Disposal Facilities, 46 Environ Mgmt 5: 820 (2010).
[321] Zou, Li et al., Mosquito Larval Habitat Mapping Using Remote Sensing and GIS: Implications of Coalbed Methane Development and West Nile Virus, 43 J. Med. Entomol. 5:1034 (2006) ("Zou 2006").
[322] Cart, Julie. *Hundreds of Illicit Oil Wastewater Pits Found in Kern County*, (Feb. 26, 2015), *available at* http://www.latimes.com/local/lanow/la-me-ln-pits-oil-wastewater-20150226-story.html.
[323] Latta, Steven C., et al., Evidence from two shale regions that a riparian songbird accumulates metals associated with hydraulic fracturing," *Ecosphere* vol. 6(9), Article 144 (September 2015), *available at* http://www.esajournals.org/doi/pdf/10.1890/ES14-00406.1.

food chain, their findings suggested that "hydraulic fracturing may be contaminating surface waters and underscores the need for additional monitoring and study to further assess ecological and human health risks posed by the increasingly widespread development of unconventional sources of natural gas around the world."[324]

D. Invasive Species

Invasive species may be introduced through a variety of pathways that would be increasingly common if oil and gas activity is allowed to expand. Machinery, equipment, and trucks moved from site to site can carry invasive plant species to new areas. In addition, materials such as crushed stone or gravel transported to the site from other locations may serve as a conduit for invasive species to migrate to the well site or other areas en route.

Aquatic invasive species may also spread more easily given the large amounts of freshwater that must be transported to accommodate new drilling and extraction techniques. These species may be inadvertently introduced to new habitats when water is discharged at the surface. Alternatively, hoses, trucks, tanks, and other water use equipment may function as conduits for aquatic invasive species to access new habitats.

E. Climate Change

Anthropogenic climate change poses a significant threat to biodiversity.[325] Climate disruption is already causing changes in distribution, phenology, physiology, genetics, species interactions, ecosystem services, demographic rates, and population viability: many animals and plants are moving poleward and upward in elevation, shifting their timing of breeding and migration, and experiencing population declines and extinctions.[326] Because climate change is occurring at an unprecedented pace with multiple synergistic impacts, climate change is predicted to significantly increase extinction risk for many species. The IPCC concludes that it is extremely likely that climate change at or above 4°C will result in substantial special extinction.[327] Other studies have predicted similarly severe losses: 15-37 percent of the world's plants and animals committed to extinction by 2050 under a mid-level emissions scenario[328]; the extinction of 10 to 14 percent of species by 2100 if climate change continues unabated.[329]

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[324] *Id*.
[325] Warren, R. et al., Quantifying the benefit of early climate change mitigation in avoiding biodiversity loss, 3 Nature Climate Change 678 (2013) ("Warren 2013").
[326] Cahill, A.E. et al., How Does Climate Change Cause Extinction? Proceedings of the Royal Society B, doi:10.1098/rspb.2012.1890 (2012); Chen, I. et al., Rapid range shifts of species associated with high levels of climate warming, 333 Science 1024 (2011); Maclean, I.M.D., and R.J. Wilson, Recent ecological responses to climate change support predictions of high extinction risk, 108 Proc. Natl. Acad. Sci. Early Edition 12337 (2011) ("Maclean and Wilson 2011"); Parmesan, C., Ecological and Evolutionary Responses to Recent Climate Change, 37 Annual Review of Ecology Evolution & Systematics 637 (2006); Parmesan, C., and G. Yohe, A globally coherent fingerprint of climate change impacts across natural systems, 421 Nature 37 (2003); Root, T.L. et al., Fingerprints of Global Warming on Wild Animals and Plants, 421 Nature 57 (2003); Warren, Rachel et al., Increasing Impacts of Climate Change Upon Ecosystems with Increasing Global Mean Temperature Rise, 106 Climatic Change 141 (2011). ("Warren 2011").
[327] Intergovernmental Panel on Climate Change, *Climate Change 2014: Synthesis Report, Summary for Policy Makers IPCC Fifth Assessment Synthesis Report*, 18 (2014).
[328] Thomas, C.D. et al., Extinction Risk from Climate Change, 427 Nature 8:145 (2004).
[329] Maclean and Wilson 2011.

Another recent study predicts the loss of more than half of the present climatic range for 58 percent of plants and 35 percent of animals by the 2080s under the current emissions pathway, in a sample of 48,786 species.[330] Because expansion of oil and gas production in the planning area will substantially increase the emissions of greenhouse gases, this activity will further contribute to the harms from climate change to wildlife and ecosystems.

F. Population-level Impacts

Oil and gas development has been linked to population-level impacts on wildlife, including lower reproductive success of sage grouse and declines in the abundance of songbirds and aquatic species. For example, young greater-sage grouse avoided mating near infrastructure of natural-gas fields, and those that were reared near infrastructure had lower annual survival rates and were less successful at establishing breeding territories compared to those reared away from infrastructure.[331] In Wyoming, an increasing density of wells was associated with decreased numbers of Brewer's sparrows, sage sparrows, and vesper sparrows.[332] In the Fayetteville Shale of central Arkansas, the proportional abundance of sensitive aquatic taxa, including darters, was negatively correlated with gas well density.[333] The EIS must consider the population-level impacts that oil and gas development may have on wildlife in the planning areas.

G. Endangered, Threatened, and Sensitive Species

BLM must use the existing readily available data to identify which sensitive species that are of critical concern with regards to the lands included in, or in immediate proximity to, the proposed sale parcels. BLM's EIS must discuss any impacts to such species, including the Indiana bat, Northern long-eared bat, fanshell, and pink mucket pearly mussel, all of which are listed as "endangered" species under the ESA.

In addition, BLM must consult with the Service regarding the impacts of the lease sale on affected listed species, in compliance with its section 7 obligations under the ESA. To the extent that BLM relies on its section 7 programmatic consultation for the 2006 Forest Plan, that reliance is not proper for any of the listed species affected by BLM's action. The potential for fracking and horizontal drilling and its associated impacts within the planning area constitutes "new information reveal[ing] effects of the [RMPs] that may affect listed species or critical habitat in a manner or to an extent not previously considered [in the prior section 7 programmatic consultations]." 50 CFR § 402.16(b). BLM must therefore reinitiate consultation on the 2006 Forest Plan. In any case, it must formally consult over the proposed leasing's potential adverse effects on listed species and consider the full scope of fracking and other drilling activities that could affect these species.

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[330] Warren 2013.
[331] Holloran, M.J. et al., Yearling Greater Sage-Grouse Response to Energy Development in Wyoming, 74 Journal of Wildlife Management 1:65 (2010).
[332] Gilbert, Michelle M. & Anna D. Chalfoun, Energy Development Affects Populations of Sagebrush Songbirds in Wyoming, 75 The Journal of Wildlife Management 4:816 (2011).
[333] Green, Jessie J. et al., Abstract: Examining Community Level Variables of Fishes in Relation to Natural Gas Development, Southeastern Fishes Council, Annual Meeting Program, November 8 - 9, 2012, New Orleans, Louisiana (2012).

H. The EA Fails to Properly Evaluate the Impacts of New Development on Wildlife

The EA completely fails to analyze site-specific impacts of oil and gas development on important wildlife areas, including the Indiana bat, Northern long-eared bat, fanshell, and pink mucket pearly mussel.

1. The Forest Service and the Service Must Re-consult Regarding Effects of Horizontal Drilling, White Nose Syndrome, and Climate Change on the Indiana Bat

Under the ESA, 16 U.S.C. §1536(a)(2), action agencies must consult with the Fish and Wildlife Service to evaluate the effects and cumulative effects of a proposed project on listed species and critical habitat in the formal consultation process.[334] Where a formal consultation has already been completed, the agencies are required to reinitiate consultation, if "new information reveals effects of the action that may affect the [listed species]… in a manner or to an extent not previously considered." 50 C.F.R. § 402.16(b). The Forest Service and BLM must reinitiate consultation with Fish and Wildlife Service, in light of new information concerning the potential for horizontal well development and its effects on the Indiana bat. In addition, new information concerning white-nose syndrome and climate change trigger reinitiation of consultation.

a. Horizontal Well Development

The 2005 Biological Opinion for the Forest Plan is woefully outdated, failing to address grave impacts of hydraulic fracturing and horizontal drilling on the Indiana bat. As discussed above, the Forest Service only analyzed the effects of vertical well development on federal surface in the EIS for the 2006 Forest Plan. The rise in fracking and horizontal drilling and recent data regarding horizontal well pad surface disturbance detailed above constitutes "new information reveal[ing] effects of the action that may affect [the Indiana bat]…in a manner or to an extent not previously considered," and triggers BLM and the Forest Service's duty to reinitiate consultation on the 2005 Biological Opinion. *See* 50 C.F.R. § 402.16(b).

The likelihood that new federal leasing will open up private minerals for development and entail the development of horizontal well pads on private surface also triggers reinitiation. The effects of the proposed leasing must be evaluated "together" with these "interdependent" private surface activities in a reinitiated consultation, regardless of whether BLM or the Forest Service authorizes the private surface activities. 50 C.F.R. §§ 402.02, 402.16; *Sierra Club v. U.S. DOE*, 255 F. Supp. 2d 1177, 1188 (D. Col. 2002) (agency that granted easement to mine required to analyze mine's impacts on listed species, even though another agency authorized mine). While the number of new horizontal well pads on private surface that federal leasing could lead to has never been analyzed, significant habitat loss (e.g., fragmentation of maternal summer roost areas) not accounted for in the Biological Opinion and hazardous conditions endangering the Indiana bat could result from these activities. This is especially because weaker Ohio regulations, such as those permitting wastewater ponds would govern these private activities.

The same holds true for effects of horizontal drilling on federal surface activities overlying private minerals (which could also be opened up with new federal leasing)—in these

[334] 50 C.F.R. § 402.14(g)(3).

split estate situations, the Forest Service can only request operators to voluntarily comply with Standards and Guidelines set forth in the Forest Plan. Indeed, if well development on private and federal surface were proportionate to the Marietta Unit's private and federal surface acreages, a significant portion of wells within the Forest (75%) would escape mandatory federal controls. The resulting take could be cumulatively significant and lead to forest-wide, population-level effects on the Indiana bat. BLM, the Forest Service, and Fish and Wildlife Service must ensure that oil and gas leasing does not jeopardize the Indiana bat and must reinitiate consultation on the 2005 Biological Opinion.

b. White-nose syndrome

White-nose syndrome is a fatal disease affecting hibernating bats that is named for a white fungus that appears on the muzzle and other parts of bats. The disease has spread rapidly across the eastern and midwestern U.S., and is estimated to have killed more than 6 million bats in the Northeast and Canada. [335] Bats with white-nose syndrome "act strangely during cold winter months, including flying outside during the day and clustering near the entrances of caves and other hibernation areas."[336] These abnormal behaviors "may contribute to the untimely consumption of stored fat reserves causing emaciation, a characteristic documented in a portion of the bats that die from WNS."[337]

White-nose syndrome has spread to 16 counties in Ohio, [338] including in the Wayne National Forest in Lawrence County.[339] In 2011, the Forest Service performed a review of new information regarding the Wayne National Forest Plan and white-nose syndrome and concluded that supplementation of the environmental review for the Forest Plan was not necessary at that time. However, since then, a 2013 study has determined that white nose syndrome threatens the Indiana bat with a high risk of extirpation throughout large parts of its range.[340] The study concluded:

> Our sensitivity analyses indicated that management actions devoted to increasing, in order, winter, summer, and fall survival of breeding adult females would have the greatest potential for mitigating impacts of WNS on Indiana bat populations.

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[335] USFWS, White-nose syndrome: The devastating disease of hibernating bats in North America (May 2016), *available at* https://www.whitenosesyndrome.org/sites/default/files/resource/white-nose_fact_sheet_5-2016_2.pdf.
[336] *Id.*
[337] USGS, National Wildlife Health Center, White-Nose Syndrome, *available at* http://www.nwhc.usgs.gov/disease_information/white-nose_syndrome/.
[338] Ohio Dept. of Natural Resources, White-nosesSyndrome.org, *available at* https://www.whitenosesyndrome.org/partner/ohio-department-natural-resources; White-nose Syndrome.org, Updated white-nose syndrome map (May 10, 2016) https://www.whitenosesyndrome.org/resource/updated-white-nose-syndrome-map-may-10-2016.
[339] USFS, White-nose Syndrome Detected in Ohio (Mar. 30, 2011), *available at* http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c4/04_SB8K8xLLM9MSSzPy8xBz9CP0os3gjAwhwtDDw9_AI8zPyhQoY6BdkOyoCAGixyPg!/?ss=110914&navtype=BROWSEBYSUBJECT&cid=STELPRDB5288711&navid=180000000000000&pnavid=null&position=News&ttype=detail&pname=Wayne%20National%20Forest-%20News%20&%20Events.
[340] Thogmartin, Wayne E. et al. White-nose syndrome is likely to extirpate the endangered Indiana bat over large parts of its range, Biological Conservation, Vol. 160, pp. 162-172 (April 2013), *available at* http://www.sciencedirect.com/science/article/pii/S0006320713000207.

> Management actions for improving survival, however, may be difficult to achieve because these parameters are quite high (95% seasonal survival) in the absence of WNS. Alternatively, increasing reproduction, while less efficient at addressing a declining population trajectory, has more room for improvement; further, if management actions on the breeding grounds to improve reproduction also improve adult female summer survival, our global sensitivity analyses suggest improved performance in the other parameters may occur as well. *Because of the heightened risk faced by small, range-restricted populations* (Terborgh and Winter, 1980; Gilpin and Soulé, 1986; Schoener and Spiller, 1987), *it is also prudent in the face of this potential extinction agent to limit additive sources of mortality.* Our model suggests a timeframe for action, for the species is expected to reach its lowest level of abundance by the early 2020s, no more than a decade hence.[341]

The potential for white-nose syndrome to wipe out the species in large parts of its range makes the bat's population much more sensitive to other threats, including oil and gas development. It is therefore crucial to reduce these threats. New information concerning this devastating disease reveals effects of the leasing proposal that "may affect [the Indiana bat]…in a manner or to an extent not previously considered," and compels reinitiation.

c. Climate Change

Climate change is also projected to shift the Indiana bat's range, because the species' reproductive cycles, hibernation patterns, and migration are closely linked to temperature. One landmark study projects that warming summer temperatures will cause "maternity colonies in the western portion of the range [including Ohio]…to begin to decline and possibly disappear in the next 10–20 years," causing the range to shift northeast-ward.[342] The researchers note that "the effects of climate change should be considered in future threats analyses and conservation strategies for the Indiana bat," and that "management actions which foster high reproductive success and survival… will be critical for the conservation and recovery of the species."[343] The 2005 Biological Opinion does not account for climate change effects. BLM and the Forest Service must consult with the Fish and Wildlife Service regarding these effects on the Indiana bat.

2. Water Depletion, Surface Disturbance, and Toxic Spills From Horizontal Drilling Will Harm Aquatic Species and Should Compel Section 7 Consultation.

As discussed above, the 2012 SIR's water depletion effects analysis is flawed, rendering its effects analysis on the endangered fanshell and pink mucket pearly mussel and other aquatic species inadequate. The fanshell is found immediately downstream of the Marietta Unit in the Belleville and Racine pools of the Ohio River in Wood County, West Virginia and in the lower

[341] *Id*.
[342] Loeb, Susan C. & Eric A. Winters, Indiana bat summer maternity distribution: effects of current and future climates, Ecology and Evolution 2013; 3(1): 103–114, *available at* http://onlinelibrary.wiley.com/doi/10.1002/ece3.440/abstract.
[343] *Id*.

Muskingum River.[344] The pink mucket pearly mussel has been found in the Belleville, Racine, Gallipolis, and Greenup pools of the Ohio River and potentially still exists in the lower Muskingum River; its distribution is presumed to be in Gallia, Meigs, Morgan, Washington, and Lawrence counties.[345] As the 2012 SIR acknowledges, these species are threatened by reduced water flows. High volume water depletions for fracking and horizontal drilling would certainly impact these species, whether or not those depletions occur on private or federal surface. But the 2012 SIR, again, is wrong to conclude that "[a]t the site specific level the WNF will be able to control withdrawals and limit them to periods when water is plentiful" when many depletions could occur in connection with private surface activities.

These potential effects meet the ESA's bar for formal consultation: it is clear that massive water depletions, increased surface disturbance (which the 2012 SIR underestimated), and toxic spills from hydraulic fracturing and horizontal drilling throughout the Marietta Unit "may affect" the fanshell and pink mucket pearly mussels found downstream from the proposed areas for lease. Because the 2005 Biological Opinion does not address any effects of oil and gas development on these listed species, and most horizontal drilling activities on private surface would likely be out of the Forest Service's regulatory reach, BLM and the Forest Service must consult Fish and Wildlife Service regarding these issues, in compliance with section 7 of the ESA.

3. The EA Does Not Analyze Impacts to the Northern Long-Eared Bat.

The EA fails to address whether roost trees and other suitable habitat for the Northern Long-Eared bat (NLEB) are within the action area. The fact that there are not known hibernacula within the areas for lease does not mean that NLEB foraging or summer roost sites are absent from these areas. Like many other bat species, NLEBs migrate between their winter hibernacula and summer habitat. While "NLEB is not considered to be a long distance migrant (typically 40-50 miles)…known migratory distances vary greatly between 5 and 168 miles."[346] The EA must address the extent to which NLEB could use the proposed areas for lease and any potential impacts to the NLEB from new drilling activities. New leasing and drilling could fragment habitat for spring staging/fall swarming and foraging, disrupt breeding and foraging patterns, pollute and degrade the bat's drinking water sources, and result in death traps for bats in the form of wastewater pits. The EA must also address how such impacts would be mitigated.

It is also unclear whether the agencies have consulted over the leasing proposal's effects on the Northern Long-Eared bat under ESA section 7. On the one hand, the EA mentions that the agencies have performed this consultation for the proposed leasing, EA at 41; on the other, the EA suggests that the only consultation that has been performed with respect to future oil and gas activities is the programmatic consultation for the Forest Plan in 2005, when the bat was not yet a listed species. *See* EA at 39. The EA should clarify what steps BLM and the Forest Service have taken or plan to take to ensure that the NELB is adequately protected in compliance with ESA section 7.

[344] Forest Plan EIS, Appendix F1, Biological Assessment at F1-112.
[345] Forest Plan EIS, Appendix F1, Biological Assessment at F1-126 – F1-127.
[346] USFWS, Northern Long-Eared Bat Interim Conference and Planning Guidance (Jan. 6, 2014), available at https://www.fws.gov/northeast/virginiafield/pdf/NLEBinterimGuidance6Jan2014.pdf.

4. The EA Does Not Properly Document Baseline Conditions for Species Within the Areas for Lease.

It is unclear whether surveys for the Indiana bat, Northern long-eared bat, and other sensitive species and their habitat have already been performed on the Marietta Unit or will be performed at a later time. The agencies do not appear to have conducted site visits in all areas to be leased under the leasing proposal. The EA indicates that BLM "conducted site visits within the Marietta Unit on October 26 and 27, 2015 of portions of the Marietta Unit that have already been requested for leasing to document the physical characteristics of the area and collect information on baseline conditions." EA at 15. Purportedly, "BLM did not identify any issues of concern from internal scoping or the site visits." *Id*. However, these limited visits on "portions" of the areas that have "already been requested for leasing," do not provide a sufficient basis to document baseline conditions and identify issues of concern for all areas of the Marietta Unit in which leasing is proposed. Without performing such surveys in advance, appropriate stipulations for the protection of sensitive wildlife (or other resources) may be lacking, and it may be too late to include them when site-specific drilling is proposed.

I. Metrics

BLM should conduct a full assessment of the direct and indirect impacts of unconventional oil and gas development activities on wildlife and ecosystems through a suite of comprehensive studies on all species and ecosystems that could be affected. The studies should be particularly detailed for federally and state listed species, federal and state candidates for listing, and state species of special concern. The studies should address the following impacts: (1) habitat loss, degradation, and fragmentation, including edge effects; (2) water depletion; (3) air and water contamination; (4) introduction of invasive species; (5) climate change impacts; (6) health and behavioral effects such as increased stress and changes in life history behaviors; (7) changes in demographic rates such as reproductive success and survival; and (8) potential for population-level impacts such as declines and extirpations. These studies should consider these harms individually and cumulatively.

J. Unconventional Extraction Techniques and Underground Wastewater Disposal Pose Seismic Risks and Other Geological Hazards

If oil and gas development is allowed to proliferate in the areas for lease, increased unconventional oil and gas extraction and underground waste injection will increase the risk of induced seismicity. Induced seismic events could damage or destroy property and cause injuries or even death, especially in a state where earthquakes are rare and communities are typically not prepared for them. A no-fracking alternative would minimize these risks, while continued leasing and unconventional well development would increase them.

Research has shown that in regions of the central and eastern United States where unconventional oil and gas development has proliferated in recent years, earthquake activity has

increased dramatically.[347] More than 300 earthquakes with magnitude (M) ≥ 3 occurred between 2010 through 2012, compared with an average of 21 per year between 1967 and 2000.[348] Moreover, although earthquakes with magnitude (M) ≥ 5.0 are very uncommon east of the Rocky Mountains, the number per year recorded in the midcontinent increased 11-fold between 2008 and 2011, compared to 1976 to 2007.[349] Mid-continent states experiencing elevated levels of seismic activity include Arkansas, Colorado, New Mexico, Ohio, Oklahoma, Texas, and Virginia.[350]

Research has linked much of the increased earthquake activity and several of the largest earthquakes in the U.S. midcontinent in recent years to the disposal of wastewater into deep injection wells, which is well-established to pose a significant seismic risk.[351] Much of the fracking wastewater is a byproduct of oil and gas production and is routinely disposed of by injection into wells specifically designed and approved for this purpose. The injected fluids push stable faults past their tipping points, and thereby induce earthquakes.[352] In 2015, a study published in *Science* found that the unprecedented increase in earthquakes in the U.S. mid-continent that began in 2009 has been caused solely by the instability caused by fluid injection wells associated with fracking waste disposal.[353] To put an exclamation point on this finding, a 4.7 magnitude earthquake struck northern Oklahoma that was felt in 7 additional states, leading the Oklahoma Geological Survey to reiterate the connection between disposal wells and earthquakes and to shut down the most high risk wells.[354] Earthquakes at magnitudes (M) that are felt (M3 and M4) or destructive (M4 and M5) have been attributed to wastewater injection wells in at least five states - Arkansas, Colorado, Ohio, Oklahoma, and Texas. The largest of these was a M5.7 earthquake in Prague, Oklahoma, which was the biggest in the state's history, destroying 14 homes and injuring two people.[355] Other large earthquakes attributed to wastewater injection include an M5.3 in Colorado,[356] M4.9 in Texas,[357] M4.7 in Arkansas,[358] and M3.9 in Ohio.[359]

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[347]Ellsworth, W.L. Injection-Induced Earthquakes, 341 Science 1225942 (2013) ("Ellsworth 2013"); Keranen, Katie et al., Potentially Induced Earthquakes in Oklahoma, USA: Links Between Wastewater Injection and the 2011 Mw5.7 Earthquake Sequence, Geology doi:10.1130/G34045.1 (March 26, 2013) ("Keranen 2013").
[348]Ellsworth 2013.
[349]Keranen 2013.
[350]Ellsworth 2013.
[351] *Id*.
[352] Lamont-Doherty Earth Observatory, Columbia University. Distant Quakes Trigger Tremors at U.S. Waste-Injection Sites, Says Study. July 11, 2013. *Available at*: https://www.ldeo.columbia.edu/news-events/distant-quakes-trigger-tremors-us-waste-injection-sites-says-study .
[353] M. Weingarten, S. Ge, J. W. Godt, B. A. Bekins, and J. L. Rubinstein. June 19, 2015. High-rate injection is associated with the increase in U.S. mid-continent seismicity. Science, VOL 348 ISSUE 6241, pages 1336-1340.
[354] Chow, Lorraine. November 19, 2015. Strong Earthquake Rattles Oklahoma, Felt in 7 Other States. https://ecowatch.com/2015/11/19/oklahoma-earthquake-fracking/
[355]Ellsworth 2013, Keranen 2013.
[356] Rubinstein, J.L. et al., The 2001–present triggered seismicity sequence in the Raton Basin of southern Colorado/northern New Mexico, 104 Bull. Seismol. Soc'y of America 5 (2014).
[357] Brown, W.A. et al. Abstract: Investigating the cause of the 17 May 2012 M4.8 earthquake near Timpson, East Texas, Abstract 84 Seismol. Res. Lett 374 (2013).
[358] Horton, S., Disposal of Hydrofracking Waste Fluid by Injection into Subsurface Aquifers Triggers Earthquake Swarm in Central Arkansas with Potential for Damaging Earthquake, 83 Seismol. Res. Lett. 2 (2012).
[359] Kim, Won-Young, Induced Seismicity Associated with Fluid Injection into a Deep Well in Youngstown, Ohio, 118 J. of Geophys. Res.: Solid Earth 3506 (February 1, 2013); *see also* USGS, 2016 One-Year Seismic Hazard

The proliferation of unconventional oil and gas development, including increases in extraction and injection, will increase earthquake risk in Ohio. Accordingly, an EIS must fully assess the risk of induced seismicity caused by all unconventional oil and gas extraction and injection activities, including wastewater injection wells.

The analysis should assess the following issues based on guidance from the scientific literature, the National Research Council,[360] and the Department of Energy[361]:

(1) whether existing oil and gas wells and wastewater injection wells in the areas for lease have induced seismic activity, using earthquake catalogs (which provide an inventory of earthquakes of differing magnitudes) and fluid extraction and injection data collected by industry;

(2) the region's fault environment by identifying and characterizing all faults in these areas based on sources including but not limited to the USGS Quaternary Fault and Fold database. In its analysis, BLM should assess its ability to identify all faults in these areas, including strike-slip faults and deep faults that can be difficult to detect;

(3) the background seismicity of oil- and gas-bearing lands including the history of earthquake size and frequency, fault structure (including orientation of faults), seismicity rates, failure mechanisms, and state of stress of faults;

(4) the geology of oil- and gas-bearing lands including pore pressure, formation permeability, and hydrological connectivity to deeper faults;

(5) the hazards to human communities and infrastructure from induced seismic activity; and

(6) the current state of knowledge on important questions related to the risk and hazards of induced seismicity from oil and gas development activities, including:

  (a) how the distance from a well to a fault affects seismic risk (i.e., locating wells in close proximity to faults can increase the risk of inducing earthquakes);

  (b) how fluid injection and extraction volumes, rates, and pressures affect seismic risk;

  (c) how the density of wells affects seismic risk (i.e., a greater density of wells affects a greater volume of the subsurface and potentially contacts more areas of a single fault or a greater number of faults);

Forecast for the Central and Eastern United States from Induced and Natural Earthquakes, p. 11 (March 2016), *available at* http://dx.doi.org/10.3133/ofr20161035 (identifying Ohio counties, including Washington county, as regions of induced seismicity to consider in future analysis).

[360]National Research Council, *Induced Seismicity Potential in Energy Technologies*. National Academies Press (2012).

[361]U.S. Department of Energy, *Protocol for Addressing Induced Seismicity Associated with Enhanced Geothermal Systems*, DOE/EE-0662 (2012); U.S. Department of Energy, *Best Practices for Addressing Induced Seismicity Associated with Enhanced Geothermal Systems - Draft* (2013).

(d) the time period following the initiation of injection or extraction activities over which earthquakes can be induced (i.e., studies indicate that induced seismicity often occurs within months of initiation of extraction or injection although there are cases demonstrating multi-year delays);

(e) how stopping extraction or injection activities affects induced seismicity (i.e., can induced seismicity be turned off by stopping extraction and injection and over what period, since studies indicate that there are often delays—sometimes more than a year—between the termination of extraction and injection activities and the cessation of induced earthquake activity);

(f) the largest earthquake that could be induced by unconventional oil and gas development activities in areas for lease, including earthquakes caused by wastewater injection; and

(g) whether active and abandoned wells are safe from damage from earthquake activity over the short and long-term.

Rather than taking a hard look at these issues, the Draft EA cursorily dismisses the potential for earthquake impacts, noting that "[i]nduced seismicity from the Proposed Action is of low probability, particularly because any wastewater injection sites would be located outside of any proposed lease parcels."[362] But the fact that these injections could occur offsite does not make induced seismicity any less significant a threat or excuse the agencies from analyzing these reasonably foreseeable effects of federal leasing. This bare analysis does not support a finding of no significance.

VII. Oil and Gas Development Poses Significant Human Health and Safety Risks.

In addition to climate change effects, oil and gas leasing and fracking entail significant public health risks that should compel BLM to consider a ban on these practices in a programmatic review and in the current leasing proposal. The Draft EA fails to adequately study these public health risks, precluding meaningful review of the proposed action.

Ample scientific evidence indicates that well development and well stimulation activities have been linked to an array of adverse human health effects, including carcinogenic, developmental, reproductive, and endocrine disruption effects. This is all the more alarming when considering how close wells may be developed to schools, residences, and businesses under BLM's proposed leasing decision.[363] Just as troubling, is how much is *unknown* about the chemicals used in well stimulation activities.[364] The potential human health dangers and the precautionary principle should further compel BLM to consider not allowing further development of oil and gas minerals in the area for lease. In comparing the no-leasing and no-fracking alternatives to leasing and continued unconventional well development scenarios, BLM should include a health impact assessment, or equivalent, of the aggregate impact that

[362] Draft EA at 72.
[363] ORC 1509.021(H) & (L) (allowing wells within 100 feet of occupied dwellings and public buildings in non-urbanized areas; allowing wells within 50 feet of surface waters).
[364] *See, e.g.* EPA 2015 at 5-73, 10-7.

unconventional extraction techniques, including fracking, will have on human health and nearby communities.

Due to the heavy and frequent use of chemicals, proximity to fracked wells is associated with higher rates of cancer, birth defects, poor infant health, and acute health effects for nearby residents who must endure long-term exposure:

- In one study, residents living within one-half mile of a fracked well were significantly more likely to develop cancer than those who live more than one-half mile away, with exposure to benzene being the most significant risk.[365]

- Another study found that pregnant women living within 10 miles of a fracked well were more likely to bear children with congenital heart defects and possibly neural tube defects.[366] A separate study independently found the same pattern; infants born near fracked gas wells had more health problems than infants born near sites that had not yet conducted fracking.[367, 368]

- A study analyzed Pennsylvania birth records from 2004 to 2011 to assess the health of infants born within a 2.5-kilometer radius of natural-gas fracking sites. They found that proximity to fracking increased the likelihood of low birth weight by more than half, from about 5.6 percent to more than 9 percent.[369] The chances of a low Apgar score, a summary measure of the health of newborn children, roughly doubled, to more than 5 percent.[370] Another recent Pennsylvania study found a correlation between proximity to unconventional gas drilling and higher incidence of lower birth weight and small-for-gestational-age babies.[371]

- A recent study found increased rates of cardiology-patient hospitalizations in zip codes with greater number of unconventional oil and gas wells and higher well density in Pennsylvania.[372] The results suggested that if a zip code went from having zero wells to well density greater than 0.79 wells/km^2, the number of cardiology-patient hospitalizations per 100 people (or "cardiology inpatient prevalence rate") in that zip

[365] McKenzie, L. et al., Human Health Risk Assessment of Air Emissions from Development of Unconventional Natural Gas Resources, 424 Science of the Total Environment 79 (2012) ("McKenzie 2012").
[366] McKenzie, L. et al., Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado, Advance Publication Environmental Health Perspectives (Jan. 28, 2014), http://dx.doi.org/10.1289/ehp.1306722 ("McKenzie 2014").
[367] Hill, Elaine L., Unconventional Natural Gas Development and Infant Health: Evidence from Pennsylvania, Cornell University (2012).
[368] Whitehouse, Mark, *Study Shows Fracking is Bad for Babies*, Bloomberg View, Jan. 4, 2014, *available at* http://www.bloombergview.com/articles/2014-01-04/study-shows-fracking-is-bad-for-babies.
[369] *Id*., citing Janet Currie of Princeton University, Katherine Meckel of Columbia University, and John Deutch and Michael Greenstone of the Massachusetts Institute of Technology.
[370] *Id.*
[371] Stacy, Shaina L. et al. (2015) Perinatal Outcomes and Unconventional Natural Gas Operations in Southwest Pennsylvania. PLoS ONE 10(6): e0126425. doi:10.1371/journal.pone.0126425, *available at* http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0126425.
[372] Jemielital, T. et al. Unconventional Gas and Oil Drilling Is Associated with Increased Hospital Utilization Rates. PLoS ONE 10(7): e0131093, *available at* http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0131093.

code would increase by 27%. If a zip code went from having zero wells to a well density of 0.17 to 0.79 wells/km^2, a 14% increase in cardiology inpatient prevalence rates would be expected. Further, higher rates of neurology-patient hospitalizations were correlated with zip codes with higher well density.

- Recently published reports indicate that people living in proximity to fracked gas wells commonly report skin rashes and irritation, nausea or vomiting, headache, dizziness, eye irritation and throat irritation.[373]

- A survey found agreement among experts that a minimum setback of a quarter mile from oil and gas development is necessary to protect public health. [374] Half of the experts recommended a 1 to 1 ¼ mile setback. The panel also agreed that additional protections are necessary for vulnerable populations such as children and the elderly.[375]

- In Texas, a jury awarded nearly $3 million to a family who lived near a well that was hydraulically fractured.[376] The family complained that they experienced migraines, rashes, dizziness, nausea and chronic nosebleeds. Medical tests showed one of the plaintiffs had more than 20 toxic chemicals in her bloodstream.[377] Air samples around their home also showed the presence of BTEX — benzene, toluene, ethylbenzene and xylene —colorless but toxic chemicals typically found in petroleum products.[378]

Chemicals used for fracking also put nearby residents at risk of endocrine disruption effects. A study that sampled water near active wells and known spill sites in Garfield County Colorado found alarming levels of estrogenic, antiestrogenic, androgenic, and antiandrogenic activities, indicating that endocrine system disrupting chemicals (EDC) threaten to contaminate surface and groundwater sources for nearby residents.[379] The study concluded:

> [M]ost water samples from sites with known drilling-related incidents in a drilling-dense region of Colorado exhibited more estrogenic, antiestrogenic, and/or antiandrogenic activities than the water samples collected from reference

[373] Rabinowitz, P.M. et al., Proximity to Natural Gas Wells and Reported Health Status: Results of a Household Survey in Washington County, Pennsylvania. Environmental Health Perspectives Advance Publication (2014); Bamberger, Michelle and R.E. Oswald, Impacts of Gas Drilling on Human and Animal Health, 22 New Solutions 51 (2012); Steinzor, N. et al., Gas Patch Roulette: How Shale Development Risks Public Health in Pennsylvania, Earthworks Gas & Oil Accountability Project (2012).
[374] Brown, David et al. The Problem of Setback Distance for Unconventional Oil & Gas Development: An analysis of expert opinions. Southwest Pennsylvania Environmental Health Project Technical Reports, Issue 2 (May 9, 2016).
[375] *Id*.; *see also* Webb, Ellen et al. Potential hazards of air pollutant emissions from unconventional oil and natural gas operations on the respiratory health of children and infants, Review Envtl. Health 2016, available at http://ecowatch.com/wp-content/uploads/2016/05/fracking_study.pdf (suggesting greater protection from unconventional oil and gas development necessary for children and infants).
[376] *Parr v. Aruba Petroleum, Inc*., Case No. 11-01650-E (Dallas Cty., filed Sept.13, 2013).
[377] Deam, Jenny, *Jury Awards Texas family Nearly $3 million in Fracking Case*, Los Angeles Times (Apr. 3, 2014) http://www.latimes.com/nation/la-na-fracking-lawsuit-20140424-story.html.
[378] *Id*.
[379] Kassotis, Christopher D. et al., Estrogen and Androgen Receptor Activities of Hydraulic Fracturing Chemicals and Surface and Ground Water in a Drilling-Dense Region. Endocrinology, March 2014, 155(3):897–907, pp. 905-906, *available at* http://press.endocrine.org/doi/full/10.1210/en.2013-1697.

> sites[,] and 12 chemicals used in drilling operations exhibited similar activities. Taken together, the following support an association between natural gas drilling operations and EDC activity in surface and ground water: [1] hormonal activities in Garfield County spill sites and the Colorado River are higher than those in reference sites in Garfield County and in Missouri, [2] selected drilling chemicals displayed activities similar to those measured in water samples collected from a drilling-dense region, [3] several of these chemicals and similar compounds were detected by other researchers at our sample collection sites, and [4] known spills of natural gas fluids occurred at these spill sites.

The study also noted a linkage between EDCs and "negative health outcomes in laboratory animals, wildlife, and humans":

> Despite an understanding of adverse health outcomes associated with exposure to EDCs, research on the potential health implications of exposure to chemicals used in hydraulic fracturing is lacking. Bamberger and Oswald (26) analyzed the health consequences associated with exposure to chemicals used in natural gas operations and found respiratory, gastrointestinal, dermatologic, neurologic, immunologic, endocrine, reproductive, and other negative health outcomes in humans, pets, livestock, and wildlife species.
>
> Of note, site 4 in the current study was used as a small-scale ranch before the produced water spill in 2004. This use had to be discontinued because the animals no longer produced live offspring, perhaps because of the high antiestrogenic activity observed at this site. There is evidence that hydraulic fracturing fluids are associated with negative health outcomes, and there is a critical need to quickly and thoroughly evaluate the overall human and environmental health impact of this process. It should be noted that although this study focused on only estrogen and androgen receptors, there is a need for evaluation of other hormone receptor activities to provide a more complete endocrine-disrupting profile associated with natural gas drilling.[380]

Operational accidents also pose a significant threat to public health. For example in August 2008, Newsweek reported that an employee of an energy-services company got caught in a fracking fluid spill and was taken to the emergency room, complaining of nausea and headaches.[381] The fracking fluid was so toxic that it ended up harming not only the worker, but also the emergency room nurse who treated him. Several days later, after she began vomiting and retaining fluid, her skin turned yellow and she was diagnosed with chemical poisoning.[382]

Harmful chemicals are also found in the flowback fluid after well stimulation events. Flowback fluid is a key component of oil-industry wastewater from stimulated wells. A survey of chemical analyses of flowback fluid dating back to April 2014 in California revealed that

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[380] *Id*., p. 905.
[381] Wiserman, Hannah, Untested Waters: the Rise of Hydraulic Fracturing in Oil and Gas Production and the Need to Revisit Regulation, Fordham Envtl. Law Rev. 115 (2009),138-39.
[382] *Id.*

concentrations of benzene, a known carcinogen, were detected at levels over 1,500 times the federal limits for drinking water.[383] Of the 329 available tests that measured for benzene, the chemical was detected at levels in excess of federal limits in 320 tests (97 percent).[384] On average, benzene levels were around 700 times the federal limit for drinking water.[385]Among other carcinogenic or otherwise dangerous chemicals found in flowback fluid from fracked wells are toluene and chromium-6.[386] These hazardous substances were detected in excess of federal limits for drinking water in over one hundred tests. This dangerous fluid is commonly disposed of in injection wells, which often feed into aquifers, including some that could be used for drinking water and irrigation.

Acidizing presents similarly alarming risks to public health and safety. In acidizing operations, large volumes of hydrochloric and hydrofluoric acid are transported to the site and injected underground. These chemicals are highly dangerous due to their corrosive properties and ability to trigger tissue corrosion and damage to sensory organs through contact.

While many risks are known, much more is unknown about the hundreds of chemicals used in fracking. The identity and effects of many of these additives is unknown, due to operators' claims of confidential business information. But, as the EPA recognizes, chemical identities are "necessary to understand their chemical, physical, and toxicological properties, which determine how they might move through the environment to drinking water resources and any resulting effects."[387] Compounds in mixtures can have synergistic or antagonistic effects, but again, it is impossible to know these effects without full disclosure.[388] The lack of this information also precludes effective remediation: "Knowing their identities would also help inform what chemicals to test for in the event of suspected drinking water impacts and, in the case of wastewater, may help predict whether current treatment systems are effective at removing them."[389]

Even where chemical identities are known, chemical safety data may be limited. In EPA's study of the hazards of fracking chemicals to drinking water, EPA found that "[o]ral reference values and oral slope factors meeting the criteria used in this assessment were not available for the majority of chemicals used in hydraulic fracturing fluids [87%], representing a significant data gap for hazard identification."[390] Without this data, EPA could not adequately

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[383] California Department of Conservation Division of Oil, Gas, & Geothermal Resources, California Well Stimulation Public Disclosure Report, *available at* http://www.conservation.ca.gov/dog/Pages/WellStimulationTreatmentDisclosure.aspx. The highest concentration was 7,700 parts per billion (ppb) for a well with API number 03052587. The US EPA's maximum contaminant level for benzene is 5 ppb.
[384] *Id*.
[385] *Id*., *see also* Cart, J., High Levels of Benzene Found in Fracking Wastewater, Los Angeles Times, Feb. 11, 2015, http://www.latimes.com/local/california/la-me-fracking-20150211-story.html#page=1.
[386] *Id*.; *see also* Center for Biological Diversity, Cancer-causing Chemicals Found in Fracking Flowback from California Oil Wells (2015) Feb. 11, 2015, *available at* http://www.biologicaldiversity.org/news/press_releases/2015/fracking-02-11-2015.html.
[387] EPA 2015 at 10-18.
[388] Souther, Sara et al. Biotic Impacts of Energy Development from Shale: Research Priorities and Knowledge Gaps, Front Ecol Environ 2014; 12(6): p. 334.
[389] EPA 2015 at 10-18.
[390] *Id*. at 10-7, 9-7.

assess potential impacts on drinking water resources and human health.[391] Further, of 1,076 hydraulic fracturing fluid chemicals identified by the EPA, 623 did not have estimated physiochemical properties reported in EPA's toxics database, although this information is "essential to predicting how and where it will travel in the environment."[392] The data gaps are actually much larger, because EPA excluded 35% of fracking chemicals reported to FracFocus from its analysis because it could not assign them standardized chemical names.[393]

The Draft EA fails to incorporate a literature review of the harmful effects of each of the chemicals known to be used in fracking and other unconventional oil and gas extraction methods. Without knowing the effects of each chemical, the Draft EA cannot accurately project the true impact of unconventional oil and gas extraction.

The Draft EA also fails to adequately study the human health and safety impacts of noise pollution, light pollution, and traffic accidents resulting from oil and gas development. A recent study found that automobile and truck accident rates in counties in Pennsylvania with heavy unconventional oil and gas extraction activity were between 15 and 65 percent higher than accident rates in counties without unconventional oil and gas extraction activities.[394] Rates of traffic fatalities and major injuries may be higher in areas with heavy drilling activity than areas without.[395]

VIII. The Proposed Leasing Will Result in Industrialization of the Wayne National Forest.

Increased oil and gas extraction and production have the potential to dramatically and permanently change the landscape of the areas available for lease and their surroundings. Countless acres of land will likely be leveled to allow for the construction and operation of well pads and related facilities such as wastewater pits. Roads may have to be constructed or expanded to accommodate trucks transporting chemicals and the large quantities of water needed for some recovery methods. Transmission lines and other utilities may also be required. The need for new distribution, refining, or waste treatment facilities will expand industrial land use. With new roads and other industrial infrastructure, certain areas could open up to new industrial or extractive activities, permanently changing the character and use of the land.

Such changes would result in a significant cumulative losses of forest and conservation lands. Vegetation removal by oil and gas development across central North America between 2000 and 2012 is estimated to be 4.5 tetragrams of carbon or 10 tetragrams of dry biomass.[396] This is equivalent to more than half of annual available grazing on public lands managed by BLM or 6% of the wheat produced in 2013 within the region (120.2 million bushels of wheat).[397]

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[391] *Id*. at 9-37-38.
[392] *Id*. at 5-73.
[393] *Id*. at 9-38.
[394] Graham, J., Irving et al., Increased Traffic Accident Rates Associated with Shale Gas Drilling in Pennsylvania. 74 Accident Analysis and Prevention 203 (2015).
[395] *Id.*
[396] Allred, Brady et al. Ecosystem services lost to oil and gas in North America: Net primary production reduced in crop and rangelands. Science, vol. 384, issue 6233 (April 24, 2015) at 401.
[397] *Id*.

This loss of "net primary production" (amount of carbon fixed by plants and accumulated as biomass) is "likely long-lasting and potentially permanent, as recovery or reclamation of previously drilled land has not kept pace with accelerated drilling."[398] The total surface disturbance by oil and gas development within this time period is 3 million hectares, the equivalent of three Yellowstone National Parks.[399] As noted above, the fragmented nature of this surface disturbance negatively impacts wildlife by severing migratory pathways, altering wildlife behavior and mortality, and increasing susceptibility to ecologically disruptive species.[400]

The conversion of substantial acreages from rural or natural landscapes to industrial sites will also mar scenic views throughout the planning area. Given BLM's failure to ensure full reclamation of idle wells and the difficulty of restoring sites to their original condition, scenic resources may be permanently impaired.

IX. BLM Must Prepare an Environmental Impact Statement

NEPA demands that a federal agency prepare an EIS before taking a "'major [f]ederal action[] significantly affecting the quality' of the environment." *Kern v. U.S. Bureau of Land Mgmt.*, 284 F.3d 1062, 1067 (9th Cir. 2002). In order to determine whether a project's impacts may be "significant," an agency may first prepare an Environmental Assessment ("EA"). 40 C.F.R. §§ 1501.4, 1508.9. If the EA reveals that "the agency's action may have a significant effect upon the . . . environment, an EIS must be prepared." *Nat'l Parks & Conservation Ass'n v. Babbitt*, 241 F.3d 722, 730 (9th Cir. 2001) (internal quotations omitted). If the agency determines that no significant impacts are possible, it must still adequately explain its decision by supplying a "convincing statement of reasons" why the action's effects are insignificant. *Blue Mountains Biodiversity Project v. Blackwood*, 161 F.3d 1208, 1212 (9th Cir. 1998). Further, an agency must prepare all environmental analyses required by NEPA at "the earliest possible time." 40 C.F.R. § 1501.2. "NEPA is not designed to postpone analysis of an environmental consequence to the last possible moment," but is "designed to require such analysis as soon as it can reasonably be done." *Kern*, 284 F.3d at 1072.

BLM is therefore required under NEPA to prepare an EIS to support this proposed project. This is especially true in light of the likelihood that fracking would occur on the leases. *CBD*, 937 F. Supp. 2d at 1155-59 (holding that oil and gas leases were issued in violation of NEPA where BLM failed to prepare an EIS and failed to properly address the significance factors for context and intensity in 40 C.F.R. § 1508.27).

In considering whether the proposed oil and gas leasing would have significant effects on the environment, NEPA's regulations require BLM to evaluate ten factors regarding the "intensity" of the impacts. 40 C.F.R. § 1508.27(b). The Ninth Circuit has held that the existence of any "one of these factors may be sufficient to require preparation of an EIS." *Ocean Advocates*, 402 F.3d at 865; *Nat'l Parks & Conservation Ass'n*, 241 F.3d at 731. Several of these "significance factors" are implicated in this proposed action and clearly warrant the preparation of an EIS:

[398] *Id*.
[399] *Id* at 402.
[400] *Id*.

> The degree to which the effects on the quality of the human environment are likely to be highly controversial.
>
> The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
>
> The degree to which the proposed action affects public health or safety.
>
> The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

40 C.F.R. § 1508.27(b)(4), (5), (2) & (9). *See CBD*, 937 F. Supp. 2d at 1158-59 (holding that BLM failed to properly address the significance factors regarding controversy and uncertainty that may have been resolved by further data collection (citing *Native Ecosystems Council v. U.S. Forest Serv.*, 428 F.3d 1233, 1240 (9th Cir. 2005)). Here, individually and considered as a whole, there is no doubt that significant effects may result from this proposal; thus, NEPA requires that BLM must prepared an EIS for the action.

i. The effects on the human environment will be highly controversial

A proposal is highly controversial when "substantial questions are raised as to whether a project . . . may cause significant degradation" of a resource, *Nw. Envtl. Def. Ctr. v. Bonneville Power Admin.*, 117 F.3d 1520, 1536 (9th Cir. 1997), or when there is a "substantial dispute [about] the size, nature, or effect of the" action. *Blue Mtns. Biodiversity*, 161 F.3d at 1212. A "substantial dispute exists when evidence, raised prior to the preparation of [a] . . . FONSI, casts serious doubt upon the reasonableness of an agency's conclusions." *Nat'l Parks & Conserv. Ass'n*, 241 F.3d at 736. When such a doubt is raised, "NEPA then places the burden on the agency to come forward with a 'well-reasoned explanation' demonstrating why those responses disputing the EA's conclusions 'do not . . . create a public controversy.'" *Id. See also CBD*, 937 F. Supp. 2d at 1158.

Here, the controversy regarding the proposal is fully evident. This comment letter provides abundant evidence that oil and gas operations can cause significant impacts to human health, water resources, air quality, imperiled species, and seismicity. The potential for these significant impacts to occur is particularly clear in light of the potential for fracking to result from the lease sale.

Fracking is among the top, if not the most controversial energy issue facing America today. The controversy spans the public arena, scientific discourse, local governments, and the halls of Congress. At the request of Congress, EPA is conducting a study into the effects of fracking on drinking and ground water.[401] Similarly, the New York DEC concluded that the health and environmental risks from fracking supports its ban in New York State. However, in

[401] U.S. Environmental Protection Agency, Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources (November 2011).

addition to the presence of controversy, it is already evident, as discussed above, that fracking is harmful. Clearly, the level of controversy associated with fracking and its expansion in Ohio in association with the proposed action is sufficient to trigger the need for an EIS. 40 C.F.R. § 1508.27(b)(4).

ii. The proposal presents highly uncertain or unknown risks

An EIS must also be prepared when an action's effects are "highly uncertain or involve unique or unknown risks." 40 C.F.R. § 1508.27(b)(5). As the Ninth Circuit has held, "[p]reparation of an EIS is mandated where uncertainty may be resolved by further collection of data, or where the collection of such data may prevent speculation on potential . . . effects." *Native Ecosystems Council v. U.S. Forest Serv.*, 428 F.3d 1233, 1240 (9th Cir. 2005) (internal citations omitted); *Blue Mtns. Biodiversity*, 161 F.3d at 1213-1214 (finding "EA's cursory and inconsistent treatment of sedimentation issues . . . raises substantial questions about . . . the unknown risks to" fish populations). As one court recently explained regarding oil and gas leasing that may facilitate fracking, "BLM erroneously discounted the uncertainty from fracking that may be resolved by further data collection. 'Preparation [of an EIS] is mandated where uncertainty may be resolved by further collection of data, or where collection of such data may prevent speculation on potential effects.'" *CBD*, 937 F. Supp. 2d at 1159 (quoting *Native Ecosystems Council v. U.S. Forest Serv*., 428 F.3d 1233, 1240 (9th Cir. 2005)).

While it is clear that oil and gas activities can cause great harm, there remains much to be learned about the specific pathways through which harm may occur and the potential degree of harm that may result. Additional information is needed, for example, about the surface footprints of well pads and pipelines, possible rates of natural gas leakage, the potential for fluids to migrate through the ground in and around the parcels, the safety of various fracking chemicals, and the potential for drilling and wastewater injection to affect local faults. NEPA clearly dictates that the way to address such uncertainties is through the preparation of an EIS.

iii. The proposal poses threats to public health and safety

As discussed in great detail above, the oil and gas activities that may occur as a result of the proposed leasing could cause significant impacts to public health and safety. 40 C.F.R. § 1508.27(b)(2). Fracking would pose a grave threat to the region's water resources, harm air quality, pose seismic risks, negatively affect wildlife, and fuel climate change.

As a congressional report noted, oil and gas companies have used fracking products containing at least 29 products that are known as possible carcinogens, regulated for their human health risk, or listed as hazardous air pollutants.[402] The public's exposure to these harmful pollutants alone would plainly constitute a significant impact. So do the many other public health risks associated with unconventional drilling as described above in section VII. Furthermore, and as previously discussed, information continues to emerge on the risk of earthquakes induced by wastewater injected into areas near faults. It is undeniable that these earthquakes pose risks to the residents of the area and points beyond.

[402] Waxman, Henry et al., United States House of Representatives, Committee on Energy and Commerce, Minority Staff, Chemicals Used in Hydraulic Fracturing (Apr. 2011) ("Waxman 2011")

The use of fracking fluid, which is likely to occur as a result of the proposed action, and other risks associated with unconventional drilling, pose a major threat to public health and safety and therefore constitute a significant impact. BLM therefore must evaluate such impacts in an EIS.

iv. The Proposed Action Will Adversely Affect Candidate and Agency Sensitive Species and Their Habitat

An EIS may also be required when an action "may adversely affect an endangered or threatened species or its habitat." 40 C.F.R. § 1508.27(b)(9). Although a finding that a project has "some negative effects does not mandate a finding of significant impact," an agency must nonetheless fully and closely evaluate the effects on listed species and issue an EIS if those impacts are significant. *Klamath-Siskiyou Wildlands Ctr. v. U.S. Forest Serv.*, 373 F. Supp. 2d 1069, 1081 (E.D. Cal. 2004) (finding agency's conclusion that action "may affect, is likely to adversely affect" species due to "disturbance and disruption of breeding" and "degradation" of habitat is "[a]t a minimum, . . . an important factor supporting the need for an EIS").

Impacts to BLM sensitive and other rare species threatened by the proposed lease have been highlighted in section "V" subsection "H" of these comments.

X. BLM Must Ensure That the Federal Land Policy and Management Act and the Mineral Leasing Act Are Not Violated

The Mineral Leasing Act ("MLA") requires BLM to demand lessees take all reasonable measures to prevent the waste of natural gas. The MLA states:

> All leases of lands containing oil or gas, made or issued under the provisions of this chapter, shall be subject to the condition that the lessee will, in conducting his explorations and mining operations, use all reasonable precautions to prevent waste of oil or gas developed in the land, or the entrance of water through wells drilled by him to the oil sands or oil-bearing strata, to the destruction or injury of the oil deposits.

30 U.S.C. § 225; *see also id.* § 187 (stating that for the assignment or subletting of leases that "[e]ach lease shall contain . . . a provision . . . for the prevention of undue waste"). This statutory mandate is unambiguous and must be enforced. *Tenn. Valley Auth. v. Hill*, 437 U.S. 153, 184 n.29 (1978) (stating that "[w]hen confronted with a statute which is plain and unambiguous on its face," "it is not necessary to look beyond the words of the statute."). As already discussed in previous sections, oil and gas operations emit significant amounts of natural gases, including methane and carbon dioxide, which can be easily prevented. [403]

[403] *See* U.S. Government Accountability Office, Federal Oil and Gas Leases, Opportunities Exist to Capture Vented and Flared Natural Gas, Which Would Increase Royalty Payments and Reduce Greenhouse Gases 20 (2010).

Pursuant to the Federal Land Policy and Management Act ("FLPMA"), BLM must "take any action necessary to prevent unnecessary or undue degradation of the [public] lands." 43 U.S.C. § 1732(b). Written in the disjunctive, BLM must prevent degradation that is "unnecessary" and degradation that is "undue." *Mineral Policy Ctr. v. Norton*, 292 F.Supp.2d 30, 41-43 (D. D.C. 2003). The protective mandate applies to BLM's leasing decisions. *See Utah Shared Access Alliance v. Carpenter*, 463 F.3d 1125, 1136 (10th Cir. 2006) (finding that BLM's authority to prevent degradation is not limited to the RMP planning process). Greenhouse gas pollution for example causes "undue" degradation. Even if the activity causing the degradation may be "necessary," where greenhouse gas pollution is avoidable, it is still "unnecessary" degradation. 43 U.S.C. § 1732(b).

In addition to being harmful to human health and the environment, the emissions from oil and gas operations are also an undue and unnecessary waste and degradation of public lands. Consequently, BLM's proposed oil and gas leasing violates FLPMA. *See* 43 U.S.C. § 1732(b).

Conclusion

Oil and gas leasing is an irrevocable commitment to convey rights to use of federal land – a commitment with readily predictable environmental consequences that BLM is required to address. These include the specific geological formations; surface and ground water resources; seismic potential; and animal, plant, and human health and safety concerns present in the area to be leased. Unconventional oil and gas development not only fuels the climate crisis but entails significant public health risks and harms to the environment. Accordingly, BLM should end all new leasing on BLM lands. Should BLM proceed with the proposed oil and gas leasing, it must thoroughly analyze the alternatives of no new leasing (or no action), and no fracking or other unconventional well stimulation methods in an EIS.

Thank you for your consideration of these comments. The Center, Friends of the Earth, Ohio Environmental Council, and Sierra Club look forward to reviewing a legally adequate EIS for this proposed oil and gas leasing action. The proposed leasing's significant environmental impacts should compel the Forest Service to withdraw consent to new leasing and BLM to withdraw the leasing proposal.

Sincerely,

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