November 14, 2016

VIA FAX

Karen E. Mouritsen
Eastern States State Director
Bureau of Land Management
Eastern States
20 M Street SE, Suite 950
Washington, DC 20003

Re: Protest of BLM Eastern States' Office December 13, 2016 Competitive Oil and Gas Lease Sale—Mississippi Parcel

Dear Director Mouritsen:

Center for Biological Diversity and Sierra Club hereby file this Protest of the Bureau of Land Management's ("BLM") planned December 13, 2016 oil and gas lease sale and Determination of NEPA Adequacy ("DNA"), DNA-020-2016-12, pursuant to 43 C.F.R. § 3120.1-3.

We formally protest the inclusion of parcel ES-002-12/2016 MSES 058184 ACQ, totaling 40.3 acres in Mississippi's Bienville National Forest in Scott County.

PROTEST

1. Protesting Parties: Contact Information and Interests:

This Protest is filed on behalf of:

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The Center is a non-profit environmental organization with 47,955 members, many of whom live and recreate in Mississippi. The Center uses science, policy and law to advocate for the conservation and recovery of species on the brink of extinction and the habitats they need to survive. The Center has and continues to actively advocate for increased protections for species and their habitats in Mississippi. The lands that will be affected by the proposed lease sale include habitat for listed, rare, and imperiled species that the Center has worked to protect including the red-cockaded woodpecker. The Center's board, staff, and members use the public lands in Mississippi, including the lands and waters that would be affected by actions under the lease sale, for quiet recreation (including hiking and camping), scientific research, aesthetic pursuits, and spiritual renewal.

The Sierra Club is a national nonprofit organization with 64 chapters and over 645,000 members dedicated to exploring, enjoying, and protecting the wild places of the earth; to practicing and promoting the responsible use of the earth's ecosystems and resources; to educating and enlisting humanity to protect and restore the quality of the natural and human environment; and to using all lawful means to carry out these objectives. The Mississippi Chapter has approximately 1,400 members in the State of Mississippi, including members who live or recreate in areas that would be affected by this lease sale. The Sierra Club has members that live in and use the affected areas for recreation such as hiking, backpacking, camping, fishing and wildlife viewing, as well as for business, scientific, spiritual, aesthetic and environmental purposes.

2. Statement of Reasons as to Why the Proposed Lease Sale Is Unlawful:

BLM's proposed decision to lease the parcel listed above is substantively and procedurally flawed for the reasons described in (1) the Center's August 22, 2016 comment on the proposed DNA, which also incorporates by reference our protest of BLM Eastern States' September 20, 2016 lease sale; (2) the Center's September 19, 2016 letter to BLM supplementing our protest of the September 20, 2016 Eastern States Lease Sale. These documents are attached hereto as Exhibits H and I and incorporated by reference.[1] In addition, the lease sale is unlawful for all of the reasons discussed below. Part 1 addresses specific deficiencies in the NEPA process and environmental analysis for the Bienville Forest parcel. Part 2 addresses issues that BLM must generally address in a full EIS in considering oil and gas leasing on the proposed parcel.

PART 1

[1] Hard copies of these two exhibits, as well as a CD of all references cited therein and this letter, have been separately delivered to BLM's office via Federal Express.

I. BLM Failed to Respond to the Center's Comments on the DNA and Provide an Adequate Protest Period

BLM opened up a 30-day comment period on the Determination of NEPA Adequacy, but failed to address or respond to any of the comments submitted by the Center. The DNA's finding that the public involvement is adequate because the DNA "will be posted for a 30 day comment period" is unsupported. Without having responded to the comments, there is no evidence that BLM took into account the public comments received on the DNA in its decision to lease, or performed any meaningful review of those comments.

BLM also failed to provide a full and fair opportunity for the public to protest the lease sale. It appears that BLM initially posted the wrong DNA for public review--the DNA from the September 2016 lease sale—which was later replaced by the DNA now posted on BLM's website.[2]

BLM also has provided inconsistent responses to the public's inquiry regarding the due date of protests, and how protests may be received, making the protest process extremely confusing. For example, for the September 2016 lease sale, BLM staff stated that the protest deadline was a postmark deadline, as long as the protest was postmarked by the U.S. postal service on the deadline. *See* Ex. J. When we inquired again with the same staff person whether this was still true for the December 2016 lease sale, we did not receive a response. *See id.* We inquired again with another staff person five days later, who responded that "all protests and supporting documents be submitted to our office no later than COB the day the protest period ends." *Id.* No staff member has explicitly disavowed the previous statement by a BLM official that protests may be received after the protest deadline, as long as they are U.S. mail postmarked on that date.

Moreover, BLM's time receipt requirement of "close of business" is not specified in the sale notice. Even in BLM's emailed response referenced above, BLM failed to specify what "close of business" meant until we inquired again what that meant, placing the burden on the public to seek clarification as to BLM's protest submission requirements. Dismissal of a protest on the basis that it was not timely received before close of business is not a proper basis for dismissal, when the sale notice provides no notice of this requirement. It is unreasonable for BLM to expect protesters to specifically inquire as to a time receipt deadline, just because it is not specified in the sale notice. In addition, it would not be fair to hold the Center and Sierra Club to this requirement as all protesters should be treated equally and have the same amount of time to submit their protests.

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[2] On October 21, 2016, Wendy Park of the Center downloaded the DNA from BLM's website (https://www.blm.gov/es/st/en/info/newsroom2/2016/october/blm_posts_sale_notice.html) and notified BLM that it incorrectly stated that no public comment had been received on the DNA--but without realizing that the wrong DNA (from the September 2016 lease sale) had been posted. *See* Ex. E. The website now shows that the website was last updated on October 24, 2016, and the link to the incorrect DNA appears to have been removed and replaced with the correct link. However, BLM never responded to explain the reason for the discrepancy, nor did it notify the public that the correct DNA had been posted.

II. BLM and the Forest Service Failed to Provide the Public Adequate Notice of the Proposed Auction and Solicit Public Comment

BLM and the Forest Service failed to adequately notify the public of the leasing auction in violation of NEPA. Because the public was denied a fair opportunity to participate in these agencies' decisions to allow new oil and gas leasing, BLM should cancel the auction, or at minimum, postpone the auction and hold public hearings to allow the public to voice their concerns and have their questions addressed.

NEPA regulations require that "[t]here shall be an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action. This process shall be termed scoping." 40 C.F.R. § 1501.7. This requirement to provide "an early and open process" cannot be met when the people and communities most immediately affected by the proposed federal action receive no reasonable notice of the action. Effective analysis of "significant issues" requires that those who will feel the impacts of the action be notified and given the opportunity to identify the issues that will affect them.

We strongly urge BLM to postpone the auction, reinitiate scoping and provide notice to "those persons…who may be interested or affected" and "solicit appropriate information from the public," in compliance with NEPA. *See* 40 C.F.R. § 1506.6.The only means that BLM used to publicize the sale is its website for the Eastern States Office. No public notice was disseminated in any of the communities near the areas for lease, or via the local offices of the Forest Service. BLM's pro forma notice violated NEPA's mandate for agencies to "invite the participation of… interested persons" and "make diligent efforts to involve the public" in considering the environmental consequences of its actions. 40 C.F.R. §§ 1501.7(a)(1), 1506.6(a).

NEPA regulations repeatedly emphasize the need for early and effective public notice and involvement. NEPA procedures must ensure "environmental information is available to public officials and citizens before decisions are made and before actions are taken." 40 C.F.R. § 1500.1(b). "[P]ublic scrutiny [is] essential to implementing NEPA." *Id.* Accordingly, "agencies *shall to the fullest extent possible*…encourage and facilitate public involvement in decisions." *Id.* § 1500.2(d) (emphasis added). Specifically, agencies "shall…make *diligent* efforts to involve the public in preparing and implementing their NEPA procedures[,]…provide public notice of…the availability of environmental documents *so as to inform those persons…who may be interested or affected[,]* [and]…solicit appropriate information from the public." *Id.* § 1506.6(a), (b), (d); *see also id.* § 1501.4(b) ("The agency shall involve environmental agencies, applicants, and the public, to the extent practicable, in preparing [environmental] assessments."). Moreover, as part of the scoping process, the lead agency must "[i]nvite the participation of affected Federal, State, and local agencies, any affected Indian tribe, the proponent of the action, and other interested persons." 40 C.F.R. § 1501.7(a)(1). "In all cases the agency shall mail notice to those who have requested it on an individual action." *Id.* § 1506.6(b)(1).

BLM's efforts here fell far short of "diligent" efforts and public notice "so as to inform those persons… who may be interested or affected" by its leasing decision. It is unclear if the availability of the DNA was publicized beyond posting them on BLM's Eastern States Office

website. [3] That a single announcement on an obscure federal agency website would have reached any Mississippi residents—many of whom are probably unfamiliar with BLM given its very limited presence in the Southeast—is highly doubtful. Inexplicably, BLM failed to send out a news release, as the Eastern States Office recently did to announce the availability of an EA for an oil and gas leasing proposal in Ohio's Wayne National Forest, prompting announcements and stories in local media outlets.[4] BLM routinely issues news releases about upcoming lease sale public comment opportunities in other field offices.[5] (BLM public comment notices for Nevada and Wyoming lease sales). Further, it does not appear that BLM reached out to any local governments regarding the lease auction.[6] Simply posting an announcement on BLM's website does not encourage public involvement "*to the fullest extent possible.*" 40 C.F.R. § 1500.2(d); *see also Dine Citizens Against Ruining Our Env't v. Klein*, 747 F. Supp. 2d 1234, 1262 (D. Col. 2010) (agency notice did not constitute "meaningful effort to provide information to the public affected by an agency's actions" where it failed to provide notice of Environmental Assessment via news outlets that community relied on, as it had done previously).

Likewise, the Forest Service has made no efforts to notify the public, or local governments and officials, even though the agency's consent was required for leasing. Given the failure of and the Forest Service to notify and involve the public, BLM should postpone the lease sale, reinitiate scoping, and provide adequate notice of BLM's proposed leasing decisions.

III. The Forest Service Violated NEPA by Failing to Conduct Any Independent Environmental Review and by Consenting Prior to Any Adequate NEPA Review

A. The Forest Service Cannot Consent to the Lease Sale Before Verifying that the Proposed Parcels Have Been Adequately Reviewed in NEPA Document

Before BLM can issue leases in the Mississippi National Forest, BLM must obtain the Forest Service's authorization (or "consent") from the Forest Service. *See* 30 U.S.C. § 226(h).[7] The Forest Service may consent to leasing only after it verifies that "leasing of the specific lands

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[3] No announcement is posted in the BLM's national NEPA Register, which presumably provides a comprehensive listing of all BLM actions and notices of availability *See* BLM, ePlanning Project Search, https://eplanning.blm.gov/epl-front-office/eplanning/lup/lup_register.do. According to BLM's Eastern States Office, the only other way BLM provides notice of lease sales is via a service that sends notice to *paying* subscribers. *See* Ex B.

[4] *See* Ex. C; Smith, Terry, BLM draft assessment: Leasing to driller won't hurt national forest, The Athens News (May 1, 2016), http://www.athensnews.com/news/local/blm-draft-assessment-leasing-to-drillers-won-t-hurt-national/article_af68f364-0fc0-11e6-9b7d-734bf3299019.html; Staff writer, Wayne National Forest environment assessment ready for comment, Athens Messenger (April 29, 2016) http://www.athensmessenger.com/news_briefs/wayne-national-forest-environment-assessment-ready-for-comment/article_04fe2a57-4731-5336-ac9d-7693398be1d2.html; Staff writer, Possible acres to be leased for oil and gas at Wayne National Forest, The News Center (April 28, 2016) http://www.thenewscenter.tv/content/news/Possible-acres-to-be-leased-for-oil-and-gas-at-Wayne-National-Forest-377513501.html.

[5] Ex. D (Wyoming and Nevada state office notices).

[6] *See* Ex. B (e-mail from BLM listing entities that were contacted).

[7] "The Secretary of the Interior may not issue any lease on National Forest System Lands reserved from the public domain over the objection of the Secretary of Agriculture." 30 U.S.C. § 226(h).

[1] has been adequately addressed in a NEPA document, and [2] is consistent with the Forest land and resource management plan." 36 C.F.R. § 228.102(e)(1).[8] As detailed further below, NEPA has not been adequately addressed; by simply preparing a DNA, BLM has disregarded a multitude of environmental consequences from opening up the Bienville Forest to oil and gas development and hydraulic fracturing. As we addressed in our previous, herein incorporated comments, the 2014 EIS for the Mississippi Forest Plan and the 2010 Leasing EA also fail to adequately address the impacts of new leasing. To the extent that the Forest Service relies on these outdated and inadequate analyses for consent to leasing, that reliance is improper. See Kunaknana v. United States Army Corps of Eng'rs, 23 F. Supp. 3d 1063, 1070 (D. Alaska 2014) ("The agency must be alert to new information that may alter the results of its original environmental analysis, and continue to take a hard look at the environmental effects of its planned action.") (internal quotations omitted). This failure to fulfill the Forest Service's independent duty to ensure "leasing of the specific lands has been adequately addressed in a NEPA document" under NEPA renders its consent to the auction invalid, such that the auction must be cancelled. Before consenting to the lease sale, the Forest Service must undertake a supplemental environmental review of the proposed action. Id.

B. The Forest Service Is a Cooperating Agency for the Proposed Lease Sale, and Must Independently Review the Sufficiency of the EA

That BLM has adopted a DNA for the proposed lease sale does not relieve the Forest Service of its duty to ensure that new information arising since the 2010 Leasing EA and 2014 Forest Plan EIS is adequately considered. The Forest Service has an independent obligation as a cooperating agency to evaluate the effects of the proposed lease auction. Under CEQ regulations, "[a] cooperating agency may adopt without recirculating the [EIS] of a lead agency when, after an independent review of the statement, the cooperating agency concludes that its comments and suggestions have been satisfied." 40 C.F.R. § 1506.3(c). The Forest Service's consent is required before BLM may lease minerals underlying Forest Service lands. *See* 30 U.S.C. § 226(h); 36 C.F.R. § 228.102(e)(1). Because its consent is required by statute and regulation, the Forest Service is an agency that has "jurisdiction by law," and therefore "shall be a cooperating agency" under NEPA. 40 C.F.R. § 1501.6(a).

As the "lead agency" BLM has primary responsibility in preparing the environmental document. *Id.* § 1501.5. Cooperating agencies may "adopt an environmental assessment that another federal agency has prepared, so long as the agency adopting the assessment reviews it and accepts responsibility for its scope and content." *Anacostia Watershed Soc'y v. Babbitt*, 871 F. Supp. 475, 485 (D.D.C. 1994). "If the [cooperating] agency adopts an environmental assessment, however, it must issue its own FONSI [Finding of No Significant Impact]." *Id.*

Here, there is no indication that the Forest Service independently reviewed and adopted the DNA before providing consent to the lease sale. Instead, the Forest Service relied solely on

[8] Explicitly prohibiting authorization of leasing "[i]f NEPA has not been adequately addressed, or if there is significant new information or circumstances as defined by 40 CFR 1502.9 requiring further environmental analysis," or "[i]f there is inconsistency with the Forest land and resource management plan".

BLM's judgment in BLM's adoption of the DNA; this reliance is improper. "To rely entirely on the environmental judgments of other agencies is in fundamental conflict with the basic purpose of NEPA: to require federal agencies to make an informed judgment of the balance between the economic and technical benefits of an action and its environmental costs." *See Anacostia Watershed*, 871 F. Supp. at 484 (internal quotation marks and alterations omitted).

The procedural requirement of independent environmental analysis by the Forest Service is not merely a formality, but is there to allow the agencies and the public to understand the consequences of the proposed lease auction. Without expert assessment from the Forest Service of the potential consequences of leasing for the resources within its jurisdiction, the agencies and the public are deprived of a meaningful opportunity to evaluate the potential consequences of BLM's proposed action.

IV. BLM Cannot Rely on a Determination of NEPA Adequacy

BLM's preparation of Determinations of NEPA Adequacy for the parcel within the Bienville National Forest is wholly improper and violates NEPA. The DNA tiers to the 2010 Leasing Analysis EA and the 2014 Forest Plan EIS (which incorporates the Leasing EA and which BLM adopted in a recent record of decision), but BLM's reliance on these programmatic documents is woefully misplaced. Neither of these documents address site-specific impacts that could foreseeably result from new leasing, including impacts on wildlife, water resources, geological hazards, and air quality. Nor do the EA and EIS provide a complete analysis of the cumulative impacts of new oil and gas development, including greenhouse gas emissions, to properly support a DNA. Further, new information has arisen since these analyses were adopted, revealing significant, reasonably foreseeable effects of hydraulic fracturing that BLM and the Forest Service must take into account in their leasing decision, but which the Forest Plan and BLM's adoption thereof do not take into account.

Case law and NEPA itself make clear that BLM is required to perform and disclose an analysis of environmental impacts *before* the issuance of an oil and gas lease. *N.M. ex rel. Richardson v. BLM*, 565 F.3d 683, 716 (10th Cir. 2009). In the Tenth Circuit, "assessment of all 'reasonably foreseeable' impacts must occur at the earliest practicable point, and must take place before an irretrievable commitment of resources' is made." *Id.* at 718 (citations omitted).

The issuance of a lease is an "irretrievable commitment of resources." *See id.*; *Sierra Club v. Peterson*, 717 F.2d 1409, 1414 (D.C. Cir. 1983); *Pennaco Energy, Inc. v. U.S. Dep't of Interior*, 377 F.3d 1147, 1160 (10th Cir. 2004). Under BLM's interpretation of its regulations, absent a no surface occupancy stipulation, a lessee cannot be prohibited entirely "from surface use of the leased parcel once its lease is final." *See Richardson*, 565 F.3d at 718 (citing 43 C.F.R. § 3101.1-2 ["A lessee shall have the right to use so much of the leased lands as is necessary to explore for, drill for, mine, extract, remove and dispose of all the leased resource in a leasehold subject to: Stipulations attached to the lease . . . [and other] reasonable measures . . . ."]); *see also* BLM Handbook H-1624-1 ("By law, these impacts [from oil and gas development] must be analyzed before the agency makes an irreversible commitment. In the fluid minerals program, this commitment occurs at the point of lease issuance.").

Instead of disclosing reasonably foreseeable impacts, however, BLM improperly tiers to the Leasing EA and Forest Plan EIS, in violation of NEPA. The EA and EIS lack any analysis of the impacts of oil and gas development in the specific local areas at issue, and BLM unlawfully postpones disclosure of site-specific impacts when such analysis is possible now. These documents also fail to analyze the impacts of greenhouse gas emissions and hydraulic fracturing, hiding the full climate change impacts and public health risks of new leasing.

A. Site-Specific Analysis Is Required But Lacking

NEPA establishes action-forcing procedures that require agencies to take a "hard look" at environmental consequences of the proposed action. *Pennaco Energy, Inc.*, 377 F.3d at 1150; *see also N.M. ex rel. Richardson*, 565 F.3d at 714. In the matter at hand, BLM has not taken any look, let alone the requisite "hard look," at the potential impacts of oil and gas development on the parcel. Instead, the agencies' decision to proceed with the September 2016 lease sale is based solely on the analysis contained in the Leasing EA, which is incorporated in the Forest Plan EIS.

The Leasing EA performs only broad and generalized analysis of the RMP's effects on resources throughout the planning area. The EA provides only a highly general overview of the range of possible impacts on a very broad scale – the analysis area covers approximately 1.2 million acres of in the Mississippi National Forests, which is too general to meaningfully address the foreseeable impacts to the parcel at issue.

The Leasing EA therefore does not contain any of the required analysis of environmental impacts likely to occur from oil and gas development *in the areas to be leased*. Any and all significant environmental consequences of site-specific projects such as this one must be reviewed and disclosed. For example, impacts on the following resources must be addressed:

Local Water Resources

The parcel appears to be within wetlands and floodplains (based on the stipulations applied to the parcel), but the EA's discussion of water resources provides no sense of how specific streams and watersheds would be impacted by increased oil and gas development, including whether leasing could impact already impaired streams and watersheds. The EA notes that "[a] buffer of at least 250 feet would be the minimum allowance permitted for surface occupancy within riparian, wetlands, and floodplains. This provision would be based on site-specific analysis rather than a standard operating procedure."[9]

But without site-specific analysis at the leasing stage, it is unknown what setback distance is appropriate to minimize water pollution, and whether a lease stipulation of 250 feet or more would be warranted. The failure to impose a stipulation establishing no surface occupancy at the leasing stage could make it more difficult for BLM to require necessary setbacks at the APD stage. Under BLM regulations, "[a] lessee shall have the right to use so much of the leased lands as is necessary to explore for, drill for, mine, extract, remove and dispose of all the leased resource in a leasehold *subject to: Stipulations attached to the lease* . . . [and other] reasonable

[9] Leasing EA at 13.

measures . . . ." 43 C.F.R. § 3101.1-2 (emphasis added). A No Surface Occupancy (NSO) stipulation following a non-NSO lease would be characterized by BLM and the lessee as not "consistent with the lease rights granted." Given the presence of water resources, including floodplains, wetlands, and streams, within the areas to be leased, and the failure to conduct site-specific analysis when the agencies have expressly noted the need for such analysis to determine appropriate setbacks from water resources, BLM and the Forest Service cannot rationally find that the Leasing EA and Forest Plan EIS adequately address impacts on water resources on and around the parcel and effective mitigation to reduce or avoid such impacts.

Effects on Local Air Quality

Increased development could worsen air quality around the lease parcel, especially when considered in connection with the numerous lease sale parcels that were auctioned in September 2016.[10] Indeed, the Leasing EA makes no attempt to even quantify oil and gas pollution emissions from existing oil and gas wells or foreseeable oil and gas development. A DNA based on such a wholly deficient analysis is improper.

Industrialization and Habitat Fragmentation Impacts

In the Bienville National Forest, the parcel to be leased and surrounding area appears relatively untouched by oil and gas development. New oil and gas leasing could significantly alter and industrialize relatively pristine or rustic landscapes and degrade prime habitat for wildlife, but the potential for such effects is not disclosed. There is no analysis of the specific characteristics of the areas to be leased, their habitat values, and the extent to which wildlife would be impacted by new oil and gas development in these areas.

For example, according to the Forest Plan EIS, core populations of the endangered red-cockaded woodpecker (RCW) exist within the Bienville and Homochitto National Forests, which provide some of the most important habitat for the species in the state—for example, the Bienville district contains the state's largest population of RCWs.[11] As described in the literature review attached as Exhibit A, habitat fragmentation is a significant threat to the RCW. The parcel to be leased, as well as areas leased in BLM's September 2016 lease sale—are suitable habitat for the species (the species does not have designated critical habitat),[12] but BLM and the Forest Service have failed to analyze the extent to which habitat fragmentation could degrade suitable habitat, and if so, the specific measures required to protect the species from new oil and gas development. BLM and the Forest Service must also analyze the extent to which cumulative effects could result from leasing the parcel, in connection with leasing the September 2016 lease sale parcels. Moreover, the "Protective Measures" referenced in the EA's analysis of impacts on RCW are extremely general—they only reiterate BLM and the Forest Service's ability to impose

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[10] *See* CBD Parcel and Shale Play Maps, created by overlaying leasing parcels on top of FracTracker Alliance's Missisippi Shale Viewer, Oil and Gas Wells (2016) (Ex. F). FracTracker maps available at https://maps.fractracker.org/latest/?appid=a72d458485ae4880bc3f26ff98854df8. Light blue areas indicate areas of oil and gas activity, which are not present near the Bienville parcels.

[11] Forest Plan EIS at 31, 33.

[12] Center for Biological Diversity, Map of Mississippi September and December 2016 lease sale parcels in relation to suitable habitat for the RCW (Ex. G).

stipulations on leases to protect listed species, without any detail as to what specific measures would be required (including timing and no surface occupancy stipulations) and whether such measures would be effective in avoiding habitat fragmentation, habitat loss, and disturbance that could result in take of the species. *See* EA Appendix D at 28-30. This totally open-ended approach violates NEPA's requirement to identify and discuss mitigation and does not assure the public that sensitive species including the RCW would be protected.

In addition, the current RCW populations are far below the target numbers set for a "recovered" population as specified in Fish and Wildlife Service's RCW Recovery Plan.[13] As a fully recovered RCW population will require large areas of mature forest habitat,[14] allowing oil and gas leasing in areas that provide suitable habitat for the RCW runs contrary to recovery goals and conservation needs for the RCW. Minerals development will result in the clearing of forest for drill pads, roads and pipelines and increase fragmentation in suitable habitat areas that are largely intact. But the Forest Plan EIS and Leasing EA fail to address how total disturbance from oil and gas activities would impact red cockaded woodpecker habitat, including impacts from hydraulic fracturing and horizontal drilling, which are likely to have a larger footprint than conventional drilling.

In evaluating these impacts, the EA must also consider climate change impacts on the RCW's recovery. The Forest Plan EIS recognizes that extreme weather events will become more frequent in the Southeast as climate change worsens.[15] Extreme weather events such as Hurricane Katrina resulted in damage to RCW trees and the loss of several RCW group clusters entirely.[16] But the Forest Plan EIS fails to analyze the impacts of climate change on the RCW and take into account climate change impacts on the RCW's recovery, let alone in connection with the impacts of new leasing and oil and gas development in RCW habitat.

Finally, all of these issues must also be addressed in a section 7 consultation regarding the lease sale. BLM and the Service cannot tier to the consultation for the 2014 Forest Plan, as it fails to address the above issues, including climate change and hydraulic fracturing.

B. Analysis of Site-Specific Impacts Is Feasible

The analysis of site-specific impacts must occur at the leasing stage, because leasing is highly likely to result in development of the parcel at issue and production of fluid mineral resources. A multitude of effects are readily foreseeable as discussed above.

Rather than conduct any environmental review of the parcel before proceeding with the lease sale, BLM suggests that it may postpone analysis until an Application for Permit to Drill ("APD") is submitted for a specific well. In *Richardson*, the Tenth Circuit rejected the contention that site-specific analysis may be deferred until the APD stage in all cases. Rather, the inquiry of whether site-specific analysis is required is "necessarily contextual" and "fact-specific." *Id.*

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[13] Forest Plan at 30, 61-62. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3814664.pdf.
[14] Forest Plan EIS at 76.
[15] Forest Plan EIS at 9-10; Forest Plan at 30.
[16] *Id.*

In the instant lease sale, BLM cannot seriously dispute that offering the parcel is likely to result in oil and gas development and the production of oil and gas. The parcel is offered for the sole purpose of promoting oil and gas development. As discussed further below in section C(2), BLM has made specific projections as to the number of wells that could be expected to be developed in each national forest and the proportion that would be productive. BLM can also project the type of development that would likely occur in the leased areas based on existing well types already within the area and the plays that are likely to be developed.

That BLM cannot precisely determine the type and amount of development that could occur on the lease parcel is a red herring. NEPA requires "reasonable forecasting," which includes the consideration of "reasonably foreseeable future actions...even if they are not specific proposals." *See N. Plains Res. Council, Inc. v. Surface Transp. Bd.*, 668 F.3d 1067, 1079 (9th Cir. 2011) (citation omitted). "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.* Further, while specific development plans have not yet been proposed, such plans are not necessary to predict that development in these areas would entail significant impacts. The problem of increased surface disturbance, water pollution, degradation of air quality, greenhouse gas emissions, and wildlife impacts from new oil and gas leasing are "readily apparent," and there are "enough specifics to permit productive analysis of [oil and gas development], including proposals for alternative ways of dealing with the problem." *Kern v. BLM*, 284 F.3d 1062, 1073 (9th Cir. 2002).

C. Reliance on the Forest Plan EIS and Leasing EA Is Improper, Because They Fail to Properly Analyze the Effects of Fracking and Horizontal Drilling

BLM cannot rely on the Forest Plan EIS and Leasing EA for the NEPA documentation, because that analysis is incomplete or inadequate in other respects. Aside from failing to analyze site-specific impacts, the Forest Plan EIS and Leasing EA fail to thoroughly address the wildlife, greenhouse gas, seismic risks, and public health impacts of increased horizontal drilling and hydraulic fracturing and fail to discuss adequate mitigation.

1. BLM Must Analyze the Impacts of Hydraulic Fracturing that Could Result from New Leasing

BLM and the Forest Service entirely ignore the potential for hydraulic fracturing and horizontal drilling to occur within the Bienville National Forest, despite that new leasing could foreseeably result in these drilling techniques, which may have far worse environmental consequences than conventional drilling.

According to a 2013 report on the oil and gas industry in Mississippi, fracking has allowed for expanded oil development in the Tuscaloosa Marine Shale, which overlaps with the Homochitto National Forest.[17] Industry Reports on the Tuscaloosa Marine Shale show that horizontal drilling has occurred in this shale play, oil production is happening, and that it is an

[17] *See* Stennis Institute, A Basic Overview of the Mississippi Oil and Gas Industry (2013) (Stennis 2013) at p. 40.

attractive play to industry. [18] Production results show that "it harbors a light, sweet, very high quality crude," with 85-95% of production being crude oil and the remainder natural gas with a high liquid content.[19] Further, "its proximity to transportation and refining facilities will help make it competitive with other plays if drilling costs can be reduced."[20]

Mapping that we have performed shows that the proposed parcel overlies an existing shale basin.[21] Part II below discusses the fracking and horizontal drilling techniques necessary to exploit oil and gas shale plays, as well as numerous environmental risks and effects that would result from deployment of these techniques. These effects include, for example, increased hazardous pollutant emissions from larger rigs; increased risks of spills and contamination from more fracking chemicals transported to and stored at the well pad (including for fracking deeper and longer horizontal boreholes); more concentrated air pollution with more wells concentrated on a single well pad; greater waste generation (including drilling cuttings and produced water); increased risks of endocrine disruption, birth defects, and cardiology hospitalization risk; and the risk of earthquakes caused by increased wastewater injection and fracking.

Because the Forest Plan EIS and Leasing EA do not acknowledge the potential for use of these toxic and dangerous techniques and their environmental effects, reliance on the DNA for the Mississippi leasing proposals is wholly improper.

2. The DNA is based on an EIS which failed to quantify greenhouse gas emissions that will result from BLM's decision to lease the parcel, and are therefore inadequate.

BLM failed to quantify GHG emissions, and subsequent climate change impacts, resulting from the Proposed Action in Mississippi. The DNA is inadequate where it relies on NEPA documents that fail to consider these factors. BLM needs to take these factors into account in an EIS.

As an initial matter, the DNA relied on several NEPA documents that were either completed by BLM, by the Forest Service, or by the Forest Service in cooperation with BLM. In a March 2016 Record of Decision, BLM formally adopted the Forest Service's Revised Land Resource Management Plan for National Forests in Mississippi ("Forest Plan"), as well as the corresponding Final Environmental Impact Statement ("Forest Plan EIS").[22] The Forest Plan EIS, furthermore, incorporated the "management direction and environmental analysis" from the

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[18] Sharp, Dan, Tuscaloosa marine shale – Lots of potential, slow in coming, Bakken Breakout (Feb 4, 2015), http://bismarcktribune.com/bakken/breakout/tuscaloosa-marine-shale---lots-of-potential-slow-in/article_60adaa0c-ad5c-11e4-801c-73646d8c33e6.html
[19] *Id.*
[20] *Id.*
[21] Ex. F.

[22] BLM, Record of Decision for Adoption of the Final Environmental Impact Statement and Revised Land and Resource Management Plan, National Forests in Mississippi, March 2016, at 7. Available at http://www.blm.gov/style/medialib/blm/es/jackson_field_office/nepa.Par.48151.File.dat/BLM.ROD.MS%20Forests.March%2023%202016%20signed.pdf.

Lands Available for Oil and Gas leasing Environmental Assessment, Decision Notice Finding of No Significant Impact, August 2010 (the "Leasing EA").[23] That document evaluated the environmental impacts of, and eventually authorized, oil and gas development in all but a select portion of National Forests in Mississippi.[24]

The documents cited to provide the relevant NEPA analysis relied on by the DNA. The following comments show that the Leasing EA, which provides the only analysis of GHG emissions and climate change impacts resulting from oil and gas development in national forests in Mississippi, both fails to quantify the volume of GHG emissions that will result from the Proposed Action in Mississippi, as well as assess subsequent climate change impacts. Where the Leasing EA, which the FEIS incorporates, fails to adequately discuss or analyze climate change effects resulting from the decision to lease the Mississippi parcel, the DNA is inadequate and BLM must analyze these impacts in an EIS.

a. *BLM has thus far failed to quantify GHG emissions resulting from oil and gas development in national forests in Mississippi. BLM needs to provide such an analysis in an EIS.*

The Leasing EA details the causes of, and challenges presented by climate change.[25] It totally fails, however, to quantify GHG emission that will result from the decision to lease parcel for oil and gas development in Mississippi's national forests.[26] The reasonably foreseeable development scenarios within the Leasing EA, furthermore, provide projections for the number of wells reasonably foreseeable within each national forest in Mississippi, including for the Homochitto and Bienville National Forests.[27] Those estimates are based on three separate development scenarios, which assume either "low," "anticipated," or "high" development activity in each national forest.[28] Under those same three development scenarios, the Leasing EA goes on to project the proportion of those wells drilled that will be productive.[29] Again, given this information, BLM should at least be able to provide a minimum estimate of the amount of oil or gas produced from each well, as well as the resulting GHG emissions. BLM needs to make this quantification in an EIS. When quantifying GHG emissions resulting from the Proposed Action BLM should account for emissions resulting from: fossil fuel combustion used to power construction of the facility, facility operation and related transportation, fugitive GHG emissions associated with the Proposed Action, transport of the extracted product offsite, as well as end user combustion of oil and gas produced by the Proposed Action.

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[23] U.S. Forest Service, Final Environmental Impact Statement for the Land and Resource Management Plan, National Forests in Mississippi (August 2014), at 2. Available at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3814668.pdf.

[24] U.S. Forest Service, Lands Available for Oil and Gas leasing Environmental Assessment, National Forests in Mississippi (August 2010), at 15. Available at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5210291.pdf.

[25] U.S. Forest Service, Lands Available for Oil and Gas leasing Environmental Assessment, August 2010, at 68-71. Available at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5210291.pdf.

[26] *Id.* at 72.

[27] *Id.* at 29 (Table 8).

[28] *Id.*

[29] *Id.*

b. BLM needs to evaluate climate change impacts, including the social cost of carbon, resulting from GHG emissions resulting from the Proposed Action

For the same reasons as those laid forth in the section discussing the Kentucky parcel, above, the BLM must evaluate the impacts on climate change resulting from GHG emissions from the Proposed Action. This includes conducting a SCC analysis based on the reasonably foreseeable development of the Mississippi parcel and subsequent GHG emissions.

In addressing the need to evaluate the climate change impacts of GHG emissions resulting from the decision to lease the parcel, BLM maintains that the discovery and development of "fossil fuel raw products is less significant than demand for fossil fuel consumer products…The likely contribution to climate change is more dependent on how much fossil fuel is burned than where it comes from."[30] The Leasing EA, then, is essentially asserting that oil and gas development does not result in GHG emissions, and rather that it is consumer demand that controls the volume of GHG emitted.

This assertion is not only unsupported by the record, but is legally incorrect. "Indirect effects… are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable." 40 C.F.R. 1508.8(b). The development of an area for lease and subsequent oil and gas production would certainly result in combustion of the extracted product, which the EA implicitly acknowledges. As courts have held in similar contexts, combustion emissions resulting from opening up a new area to development are "reasonably foreseeable," and therefore a "proximate cause" of the leasing. *See Mid States Coal. for Progress v. Surface Transp. Bd.*, 345 F.3d 520, 549 (8th Cir. 2003) (holding that agency violated NEPA when it failed to disclose and analyze the future coal combustion impacts associated with the agency's approval of a railroad line that allowed access to coal deposits); *High Country Conserv'n Advocates v. United States Forest Serv.*, 52 F. Supp. 3d 1174, 1197 (D. Colo. 2014) (same with respect to GHG emissions resulting from approval of coal mining exploration project).

In both *Mid States Coalition* and *High Country*, the courts rejected the government's rationale that increased emissions from combustion of coal was not reasonably foreseeable because the same amount of coal would be burned without opening up the areas at issue to new coal mining. Both courts found this argument "illogical at best" and noted that "increased availability of inexpensive coal will at the very least make coal a more attractive option to future entrants into the utilities market when compared with other potential fuel sources, such as nuclear power, solar power, or natural gas." *See High Country*, 52 F. Supp. 3d at 1197 (quoting *Mid States Coalition*, 345 F.3d at 549). On similar grounds, the development of new wells over the proposed areas for lease will

> increase the supply of [oil and natural gas]. At some point this additional supply will impact the demand for [oil and gas] relative to other fuel sources, and [these minerals] that otherwise would have been left in the ground will be burned. This reasonably foreseeable effect must be analyzed, even if the precise extent of the effect is less certain.

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[30] *Id.* at 72.

Id. See also WildEarth Guardians v. United States Office of Surface Mining, Reclamation & Enf't, 104 F. Supp. 3d 1208, 1229-30 (D. Colo. 2015) (coal combustion was indirect effect of agency's approval of mining plan modifications that "increased the area of federal land on which mining has occurred" and "led to an increase in the amount of federal coal available for combustion"); Council on Environmental Quality (CEQ) Revised Draft Guidance for Greenhouse Gas Emissions and Climate Change Impacts at 12 (2014) ("NEPA analysis for a proposed open pit mine could include the *reasonably foreseeable effects* of various components of the mining process, such as clearing land for the extraction, building access roads, transporting the extracted resource, refining or processing the resource, *and using the resource*." [emphasis added]).[31]

The Leasing EA's failure to quantify reasonably foreseeable GHG emissions that could result from new leasing within the Mississippi areas for lease—including emissions from construction, operating fossil-fuel powered equipment during production, reclamation, transportation, processing and refining, and combustion of the extracted product—is unlawful and unsupported by evidence or reasoned analysis.

Where BLM's reasoning in the Leasing EA is both contrary to law, and unsupported by the record, BLM needs to evaluate climate change impacts, including via an SCC analysis, that would result from the Proposed Action.

c. *Without an analysis of the SCC, BLMs consideration of socioeconomic effects is impermissibly biased in favor of the decision to lease the Mississippi parcel*

Utilizing SCC analysis is especially important to ensure an unbiased analysis on the part of BLM. This is because the Leasing EA touts the economic benefits that it anticipates will result from new leasing, while at the same time failing to consider potentially adverse economic impacts.[32] In addition to highlighting the importance of oil and gas development in national forests in Mississippi to generating lease revenue for the federal government and Mississippi, the Leasing EA points to the employment opportunities and private investment that will result over the life of oil and gas development in national forests in Mississippi. The Leasing EA, furthermore, states that "These private investments in oil and exploration and development on Federal Leases are major engines of economic activity generated by Federal leasing on the [Mississippi National Forests]."[33]

Neither the Forest Service nor BLM, however, account for the SCC, or any other potentially adverse economic consequences resulting from the decision to lease the Mississippi parcel. An SCC analysis would allow BLM to monetize potential damage resulting from the proposed action, and weigh that against potential economic benefits highlighted in the Leasing

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[31] Council on Environmental Quality, Revised draft guidance for greenhouse gas emissions and climate change impacts (2014), available at https://www.whitehouse.gov/sites/default/files/docs/nepa_revised_draft_ghg_guidance_searchable.pdf.

[32] U.S. Forest Service, Lands Available for Oil and Gas leasing Environmental Assessment, August 2010, at 71-75. Available at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5210291.pdf.

[33] *Id.* at 73.

EA. BLM needs to conduct an SCC analysis of GHG emissions resulting from the Proposed Action. Without this analysis, the BLM improperly biases its decision in favor of the Proposed Action as it only focuses on economic benefits.

PART 2

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 Mississippi, 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 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.[34] 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. [35] As the United States signed the treaty on April 22, 2016[36] as a legally binding instrument through executive

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[34] *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).

[35] United Nations Framework Convention on Climate Change, Adoption of the Paris Agreement, Proposal by the President, Draft decision -/CP.21 (2015) ("Paris Agreement"), Art. 2.

[36] 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).

agreement,[37] 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.[38]

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."[39] 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*,"[40] imperatively commanding that developed countries specifically "should continue taking the lead by undertaking economy-wide absolute emission reduction targets"[41] and that such actions reflect the "highest possible ambition."[42]

The Paris Agreement codifies the international consensus that climate change is an "urgent threat" of global concern,[43] 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"[44] (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.[45] 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.[46] Those impacts include increased global food and water insecurity, the inundation of coastal regions and small island nations by sea level rise

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[37] *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.

[38] 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.

[39] *Id.*, Recitals.

[40] *Id.*, Art. 4(1).

[41] *Id.*, Art. 4(4).

[42] Id, Art. 4(3).

[43] *Id.*, Recitals.

[44] *Id.*, Art. 2.

[45] *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.

[46] *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.

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.[47] 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."[48] Consequently, a target of 1.5 °C or less 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 1.5° 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.[49]

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.[50] Given more than 100 $GtCO_2$ have been emitted since 2011,[51] the remaining portion of the budget under this scenario is well below 900 $GtCO_2$. To have an

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[47] *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 2°C 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).

[48] 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).

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

[50] 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").

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

80% probability of staying below the 2°C target, the budget from 2000 is 890 $GtCO_2$, with less than 430 $GtCO_2$ remaining.[52]

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,[53] 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,[54] 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 $GtCO_2$,[55] 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.[56]

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.[57]

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[52] 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)

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

[54] *Id.*

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

[56] 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 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 2°C. *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.

[57] 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

Moreover, a recent study by Oil Change International shows that meeting the Paris climate goals requires a managed decline in *currently operating* fossil fuel production activities.[58] Specifically:

- The potential carbon emissions from the oil, gas, and coal in the world's currently operating fields and mines would take us beyond 2°C of warming.
- The reserves in currently operating oil and gas fields alone, even with no coal, would take the world beyond 1.5°C.[59]

Based on these findings, the report recommends: "No new fossil fuel extraction or transportation infrastructure should be built, and governments should grant no new permits for them."[60]

Fracking and other unconventional well stimulation methods have also opened up vast resources that otherwise would not be available, increasing the potential for future greenhouse gas emissions. In recognition of established climate science, and global carbon budgeting, the Forest Service should consider the climate change effects of oil and gas leasing, as well as bans on fracking and new leasing.

Beginning the phase-out of public fossil fuel production by ceasing new onshore leases would have a significant effect on U.S. contributions to greenhouse gas emissions, allowing us to meet targets under the Paris Agreement. The first systematic quantitative assessment of the emissions consequences of a cessation of federal leasing (both onshore and offshore) found that:

> [U]nder such a policy, U.S. coal production would steadily decline, moving closer to a pathway consistent with a global 2°C temperature limit. Oil and gas extraction would drop as well, but more gradually, as federal lands and waters represent a smaller fraction of national production, and these resources take longer to develop. Phasing out federal leases for fossil fuel extraction could reduce global CO2 emissions by 100 million tonnes per year by 2030, and by greater amounts thereafter.[61]

The looming threat of catastrophic climate disruption, and the need for swift action to reduce its worst effects, including a halt to *all* new fossil fuel production, should compel BLM and the Forest Service to take a hard look at the climate consequences of leasing within the Mississippi National Forests, and cease new leasing and fracking within the forests.

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.

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[58] Oil Change International, The Sky's Limit: Why the Paris Climate Goals Require a Managed Decline of Fossil Fuel Production, 5 (2016), available at http://priceofoil.org/content/uploads/2016/09/OCI_the_skys_limit_2016_FINAL_2.pdf.
[59] *Id.*
[60] *Id.*
[61] Erickson, Peter and Michael Lazarus, How Would Phasing Out U.S. Federal Leases for Fossil Fuel Extraction Affect CO_2 Emissions and 2°C Goals? 1, 31-32, Stockholm Environment Institute Working Paper 2016-02 (May 2016).

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.[62]

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 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."[63] 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."[64]

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....

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[62] *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).
[63] *See* Secretary of Interior, Order No. 3338, § 4 (Jan. 15, 2016)
[64] *Id.* § 4(c).

> 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.[65]

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."[66] BLM should halt all new leasing and fracking until a programmatic review is completed.

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. NEPA regulations and case law require that BLM evaluate all "reasonably foreseeable" direct and indirect effects of its leasing.[67]

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 developin fossil fuel resources in the Southeast and throughout the country. 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 Tuscaloosa marine shale. 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."[68]

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

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[65] *Id.* § 5.
[66] *Id.*
[67] 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).
[68] Arthur, J. Daniel et al., Hydraulic Fracturing Considerations for Natural Gas Wells of the Marcellus Shale at 2 (Sep. 2008) ("Arthur") at 9.

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 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;[69] however, companies now use permutations of "slick-water" fracturing fluid developed in the mid-1990s.[70] 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.[71] 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.[72] 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.[73]

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.[74] 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."[75] 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.[76] 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

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[69] 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).

[70] 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.

[71] *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").

[72] Arthur at 10.

[73] *Id.*

[74] 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").

[75] Waxman 2011b at 8.

[76] Colborn 2011 at 1.

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.[77]

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 became the first country to ban the practice.[78] 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."[79] 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.[80,81] Also, New Jersey's legislature recently passed a bill that would prevent fracking waste, like toxic wastewater and drill cuttings, from entering its borders,[82] and Pennsylvania, ground zero for the fracking debate, has banned "natural-gas exploration across a swath of suburban Philadelphia . . . ."[83] Numerous cities and communities, like Buffalo, Pittsburgh, Raleigh, Woodstock, and Morgantown have banned fracking.[84]

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.[85] 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.[86] Although hydraulic fracturing increases the radius of this cylinder of shale, this effect is often itself insufficient to allow profitable extraction of shale resources.[87] 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

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[77] *Id.*
[78] Castelvecchi, Davide, *France becomes first country to ban extraction of natural gas by fracking*, Scientific American (Jun. 30, 2011).
[79] CNN Staff Writer, *Vermont first state to ban fracking*, CNN U.S. (May 17, 2012).
[80] 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 .
[81] RT Network. June 30, 2015. *It's official: New York bans fracking.* https://www.rt.com/usa/270562-new-york-fracking-ban/ .
[82] 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 .
[83] Philly.com, *Fracking ban is about our water*, The Inquirer (Jul. 11, 2012).
[84] *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.
[85] 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").
[86] *Id.*
[87] *Id.*; Arthur at 8 (Figure 4).

that passes through producing zones.[88] The practice of combining horizontal drilling with hydraulic fracturing was developed in the early 1990s.[89]

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.[90] 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.[91] 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.[92]

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.[93] 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."[94] 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."[95] 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.[96]

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

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[88] Venoco, Inc., Monterey Shale Focused Analyst Day Slide Show at 23 (May 26, 2010) ("Venoco Slide Show"); U.S. Energy Information Administration, Annual Energy Outlook 2012 with Projections to 2035 (2012) at 63.
[89] *Id.*
[90] NYDEC SGEIS at 5-93.
[91] *Id.*
[92] *Id.*
[93] *See* CITI at 9 ; USEIA 2011 at 4; Orszag, Peter, *Fracking Boom Could Finally Cap Myth of Peak Oil* (Jan. 31, 2011) ("Orszag").
[94] Waxman 2011b at 1.
[95] USEIA 2011 at 4.
[96] USEIA 2012a at 2

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 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 shale plays in the Southeast.

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

While much remains to be learned about fracking,[97] 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 unconventional oil and gas activity has occurred in several states, including Colorado,[98] Wyoming,[99] Texas,[100] Pennsylvania,[101] Ohio,[102] and West Virginia.[103]

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?

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[97] 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).

[98] 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).

[99] 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.

[100] 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").

[101] 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").

[102] 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

[103] 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).

- 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.

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.[104] 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.[105] As much as 25 percent of fracking chemicals are carcinogens,[106] and flowback can even be radioactive.[107] 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

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[104] 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").
[105] 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").
[106] Colborn 2011.
[107] 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).

injected.[108] Approximately 16 million gallons of wastewater from in-state were injected into wastewater injection wells in Ohio.[109] 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.[110] 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.[111] The only way to deal with them is to remove them.[112] The accumulation of long-lived isotopes of radium has been observed in the sediments and soils of produced-water spill sites.[113] Due to its relatively long half-life, radium contamination could remain in the soil for thousands of years.[114] 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.[115] 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.[116] 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[117] 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).[118] Accidents during transit may cause leaks and spills that result in the transported chemicals and fluids reaching surface waters.

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[108] EPA 2015 at ES-12

[109] 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.

[110] 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).

[111] *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).

[112] *Id.*

[113] Lauer 2016 at G.

[114] *Id.*

[115] King 2015.

[116] Warco, Kathy, *Fracking truck runs off road; contents spill*, Observer Reporter (Oct 21, 2010).

[117] 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.

[118] 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.

Chemicals and waste transported by pipeline can also leak or spill. There are also multiple reports of truckers dumping waste uncontained into the environment.[119]

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.[120] 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.

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.[121] 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.[122] Fracking and other unconventional techniques likewise pose inherent risks to groundwater due to releases below the surface, and these risks must be properly evaluated.[123] 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.

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[119] 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.
[120] EPA 2015 at ES-10.
[121] EPA 2015 at ES-11.
[122] *See, e.g.*, Fontenot 2013, Jackson 2013.
[123] Vengosh 2014.

Groundwater contamination can occur in a number of ways, and the contamination may persist for many years.[124] 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,[125] Wyoming,[126] Pennsylvania,[127] Ohio,[128] West Virginia,[129] and Texas.[130] 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.[131] 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.[132]

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.[133] 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."[134] 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.

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[124] Myers, Tom, Potential Contamination Pathways from Hydraulically Fractured Shale to Aquifers, National Groundwater Association (2012).

[125] 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).

[126] U.S. Environmental Protection Agency, Draft Investigation of Ground Water Contamination Near Pavillion, Wyoming (2011) ("EPA Draft Pavillion Investigation").

[127] 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").

[128] 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").

[129] Begos, Seattle Times, Jan 6. 2014.

[130] Darrah 2014.

[131] Ingraffea, Anthony R., Some Scientific Failings within High Volume Hydraulic Fracturing Proposed Regulations 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).

[132] EPA 2015 at 6-11.

[133] 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).

[134] EPA 2015 at 6-55.

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.[135] 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.[136] 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.[137] Wells as far away as 1.8 miles away have provided pathways for surface contamination.[138] 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."[139] 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.[140]

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.[141] These results have been confirmed with follow-up analyses.[142] Groundwater contamination in the Barnett Shale region is likely a result of unconventional well development activities.[143] 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."[144] 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

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[135] *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.

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

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

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

[139] EPA 2015 at 6-56 – 6-57.

[140] Myers, Tom, Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers, Ground Water 50, no. 6, p. 1 (2012).

[141] EPA Draft Pavillion Investigation.

[142] 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).

[143] 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.

[144] *Id.*

from private water wells located within 3 km of active natural gas wells.[145] Many of the detected compounds were associated with unconventional oil and gas extraction.[146]

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.[147] At the surface, pits or tanks can leak fracking fluid or waste.[148] 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 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.[149] 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.[150] In 2008, the back wall of a pit in Ohio gave way, causing pit contents to spill and flow towards a creek.[151]

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.[152] In some areas hydraulic fracturing may occur at shallower depths or within the same formation as drinking water resources, resulting in direct aquifer contamination.[153] 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.[154] The study found that 15 organic compounds found in hydraulic fracturing

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[145] 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").

[146] *Id.*

[147] Natural Resources Defense Council, Water Facts: Hydraulic Fracturing Can Potentially Contaminate Drinking Water Sources (2012) at 2; Food and Water Watch, The Case for a Ban on gas Fracking (June 2011).at 7.

[148] *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.

[149] 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).

[150] ODNR, Notice of Violation No. 1278508985 (June 21, 2010).

[151] ODNR, Notice of Violation No. 2016754140 (May 16, 2008).

[152] Howarth, Robert, 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, Physicians, Scientist & Engineers for Healthy Energy, (Sept 15, 2011), *available at* http://www.psehealthyenergy.org/data/Cuomo_ScientistsLetter_15Sep20112.pdf (accessed July 29, 2015).

[153] EPA 2015 at ES-15.

[154] 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).

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.

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;
- 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.[155]

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.[156] BLM must study in an EIS the cumulative impact of underground wastewater disposal from increased fracking in these areas.

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.

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[155] 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.
[156] 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).

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,[157] it is particularly important that the impact of runoff is considered as part of the NEPA process.

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.[158] These volumes far exceed the amounts used in conventional natural gas development.[159] In Ohio, for example, 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.[160] 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."[161]

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.[162]

Withdrawal of large quantities of freshwater from streams and other surface waters will undoubtedly have an impact on the environment.[163] 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.[164] 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

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[157] 33 U.S.C. § 1342(l)(2).

[158] U.S. Government Accountability Office 2012 at 17.

[159] *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.

[160] 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#.

[161] 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/.

[162] International Energy Agency, Golden Rules for the Golden Age of Gas at 31-32 (2012).

[163] *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.

[164] Healy, Jack. For Farms 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.

companies paid $1200 to $2,900 per acre-feet.[165] 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 restored.[166] 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 due to climate change, seasonal drought, and increasing population.

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. 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.[167]

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.

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[165] *Id.*

[166] 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.

[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.

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.[168] 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.[169] 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.

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. 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,[170] also referred to as Hazardous Air Pollutants, which are

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[168] 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).

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

[170] 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.

known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.[171] 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.[172] 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.[173] EPA has also identified six "criteria" air pollutants that must be regulated under the National Ambient Air 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.[174] The VOCs emitted include the BTEX compounds – benzene, toluene, ethyl benzene, and xylene – which are listed as Hazardous Air Pollutants.[175] There is substantial evidence showing the grave harm from these pollutants.[176] Recent studies and reports confirm the pervasive and extensive amount of VOCs emitted by unconventional oil and gas extraction.[177] 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.[178] Another study determined that vehicle traffic and engine exhaust were likely the sources of intermittently high dust and benzene concentrations observed near well pads.[179] Recent studies have found that oil and gas operations are likely responsible for elevated levels of hydrocarbons such as benzene downwind of the

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[171] U.S. EPA, Hazardous Air Pollutants, *available at* http://www.epa.gov/haps (accessed Jan. 10, 2016).
[172] Center for Biological Diversity, Air Toxics One Year Report, p. 1 (June 2014).
[173] 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).
[174] 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.
[175] 42 U.S.C. § 7412(b).
[176] Colborn 2011; McKenzie 2012; Food & Water Watch 2012.
[177] 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).
[178] 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.
[179] McCawley 2013.

Denver-Julesburg Fossil Fuel Basin, north of Denver.[180] Another study found that oil and gas operations in this area emit approximately 55% of the VOCs in northeastern Colorado.[181]

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,[182] 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 gas development, as it interacts with nitrogen oxides and sunlight.[183] 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.[184] 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 . . . ."[185]

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.[186] Ozone can result in serious health conditions, including heart and lung disease and mortality.[187] 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.[188]

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[180] 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").

[181] 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).

[182] *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.

[183] Fiore, Arlene et al., Linking Ozone Pollution and Climate Change: The Case for Controlling Methane, 29 Geophys. Res Letters 19 (2002).

[184] 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).

[185] 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.

[186] 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.

[187] U.S. Environmental Protection Agency, Integrated Science Assessment (ISA) for Ozone (O3) and Related Photochemical Oxidants (2013).

[188] 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

Oil and gas operations can also emit hydrogen sulfide. The hydrogen sulfide is contained in the natural gas and makes that gas "sour."[189] 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.[190]

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[191] that is especially harmful.[192] Vehicles traveling on unpaved roads also kick up fugitive dust, which is particulate matter.[193] Further, both NO_X and VOCs, which as discussed above are heavily emitted by the oil and gas industry, are also particulate matter precursors.[194] Some of the health effects associated with particulate matter exposure are "premature mortality, increased hospital admissions and development of chronic respiratory disease."[195]

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.[196] 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.[197] 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.[198] Further, these proppants often include silica sand, which increases the risk of lung disease and silicosis when inhaled.[199] Finally, as flowback returns to the surface and is deposited in pits or tanks that are open to the atmosphere, there is the potential

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compounds from oil and natural gas operations in northeastern Colorado, Environ Sci and Technology (Jan 14, 2013), DOI: 10.1021/es304119a.

[189] Sierra Club Comments.

[190] 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").

[191] Earthworks, Sources of Oil and Gas Pollution (2011).

[192] Bay Area Air Quality Management District, Particulate Matter Overview, Particulate Matter and Human Health (2012).

[193] 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").

[194] EPA RIA at 2-2.

[195] 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).

[196] Colborn 2011 at 8.

[197] 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").

[198] *Id.*

[199] 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.

for organic compounds and toxic air pollutants to be emitted, which are harmful to human health as described above.[200]

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.

B. 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 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.[201] 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.[202]

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.

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[200] SCAQMD Revised Draft Staff Report PR1148-2 at 15.
[201] Miller 2013.
[202] Allen, David et al., Measurements of methane emissions at natural gas production sites in the United States, PNAS Early Edition, doi:10.1073/pnas.1304880110 (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.

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.

C. 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 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.[203]
>
> *Sulfur Dioxide* (SO_2) has been shown to cause an array of adverse respiratory effects including bronchoconstriction and increased asthma symptoms.[204] 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.[205]
>
> *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.[206] 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

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[203] 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).

[204] U.S. Environmental Protection Agency, Sulfur Dioxide http://www.epa.gov/airquality/sulfurdioxide/health.html, *available at* (accessed July 29, 2015).

[205] *Id.*

[206] U.S. Environmental Protection Agency, Carbon Monoxide, *available at* http://www.epa.gov/airquality/carbonmonoxide/health.html (accessed July 29, 2015).

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.[207] 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.[208]

Ozone (O_3) can trigger or worsen asthma and other respiratory ailments.[209] 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 result are summarized in a study by Dr. Theo Colburn, which charts which chemicals have been shown to be linked to certain illnesses.[210]

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.[211] 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.[212]

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.[213] While none of the detected chemicals exceeded governmental safety thresholds of exposure, the study

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[207] *Id.*
[208] *Id.*
[209] U.S. Environmental Protection Agency, Ground Level Ozone, *available at* http://www.epa.gov/airquality/ozonepollution/health.html (accessed July 29, 2015).
[210] 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) ("Colborn 2012"); *see* note 120 & accompanying text below.
[211] Colborn 2012.
[212] Colborn 2012, p. 11.
[213] *Id.*, p. 10.

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."[214] 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.[215] 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.[216] 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.[217]

Another study reviewed exposures to emissions from unconventional natural gas development and noted that trimethylbenzenes are among the largest contributors to non-cancer 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.[218]

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.

D. 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

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[214] *Id.*, pp. 11-12.
[215] *Id.* p. 12.
[216] *Id.*, p. 10-11.
[217] *Id.*, p. 12.

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.[219]

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.[220] New research shows methane leakage from some gas wells may be as high at 17.3 percent.[221] Moreover, new research has shown that unconventional gas wells are up

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

[220] 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").

[221] 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).*

to 2.7 times more likely than a conventional well to have a cement or casing impairment, which can lead to methane leaks.[222] The intersection of new fractures with nearby abandoned wells can also result in methane migration to the surface.[223] Leakage can also occur during storage, processing, and distribution to customers.[224]

Natural gas emissions are generally about 84 percent methane.[225] 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.[226] Oil and gas operations release 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."[227] 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.[228]

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.[229] 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.[230]

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:

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[222] 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).
[223] King, Pamela. *'Frack hits' provide pathways for methane migration study* , E&E News (Oct. 21, 2015).
[224] 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").
[225] 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").
[226] 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 Climate Forcing to Emissions*, 326 Science 716 (2009).
[227] 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).
[228] 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).
[229] 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)
[230] Tollefson, Jeff, *Methane leaks erode green credentials of natural gas*, Nature News (Jan 2, 2013).

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.[231] Release of greenhouse gases (from extraction, leakage, and 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.[232]

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."[233] 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).[234]

Numerous authoritative scientific assessments have established that climate change is

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

[232] *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).

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

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

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."[235]

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"[236] and "[i]impacts related to climate change are already evident in many regions and are expected to become increasingly disruptive across the nation throughout this century and beyond."[237] 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."[238]

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.[239]
> ***
>
> 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*).[240]

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

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[235] IPCC AR5 Synthesis Report at 2.
[236] 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.).
[237] Third National Climate Assessment at 10.
[238] National Research Council, Advancing the Science of Climate Change (2010), available at www.nap.edu. ("Advancing the Science of Climate Change") at 2.
[239] Third National Climate Assessment at 2.
[240] IPCC AR5 Synthesis Report at 46.

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."[241] 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."[242]

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, also provides support for a public health endangerment finding."[243]

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."[244]

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."[245]

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

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[241] Final Endangerment Finding, 74 Fed. Reg. at 66,497.
[242] *Id.*
[243] *Id.*
[244] *Id.* at 66,497-98.
[245] *Id.* at 66,498.

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."[246]

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."[247]

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."[248]

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.[249]

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.[250] 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

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[246] *Id.*
[247] *Id.*
[248] *Id.*; *see also* Third National Climate Assessment at 195-219.
[249] *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.
[250] 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).

ecosystems.[251] 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.[252] In Florida, the Everglades face severe ecosystem disruption from already-occurring saltwater incursion.[253] 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.[254] 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.[255] Because 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.[256]

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.

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[251] U.S. Environmental Protection Agency, Climate Change and Public Lands (1999).

[252] *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.

[253] *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.

[254] National Climate Assessment at 13.

[255] *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 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).

[256] 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, *see* 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)..

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.[257] 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."[258] 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 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.[259]

The Social Cost of Carbon is explicitly designed to present "a defensible set of input assumptions grounded in the existing scientific and economic literatures."[260] 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."[261] The authors recommend presenting estimates of cost using this range of rates.[262] In addition to estimating the social cost of greenhouse gas emissions, BLM should have examined the significance of these emissions by

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[257] *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).

[258] BLM, Roberson Internal Memo.

[259] *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).

[260] *Id.* at 1.

[261] *Id.* at 23.

[262] *Id.*

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.[263] 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."[264]

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. An EIS for the proposed lease sales must provide an accounting of these potential costs.

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.[265] 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,"[266] 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

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[263] *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.

[264] *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.

[265] *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.

[266] 43 U.S. Code § 1701(a)(8).

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.[267]

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.[268]

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.[269] 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.[270]

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

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[267] 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).
[268] Johnson, N., Pennsylvania energy impacts assessment: Report 1: Marcellus shale natural gas and wind, Nature Conservancy – Pennsylvania Chapter (2010) at 10.
[269] Thompson, 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.
[270] *Id.*

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 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.[271] Among the species harmed was the blackside dace, a threatened minnow species.[272] 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.[273] 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.[274] 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.[275]

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.[276] 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.[277] Recently, new information has come to light that operators in California have been dumping wastewater into hundreds of unpermitted open pits.[278] 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

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[271] 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).
[272] *Id.*
[273] 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).
[274] 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
[275] Adams, Mary Beth, Land Application of Hydrofracturing Fluids Damages a Deciduous Forest Stand in West Virginia, 40 Journal of Environmental Quality 1340 (2011).
[276] *See, e.g.,* Ramirez, P. Jr., Bird Mortality in Oil Field Wastewater Disposal Facilities, 46 Environ Mgmt 5: 820 (2010).
[277] 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").
[278] 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.

at significantly higher levels in feathers of birds in sites with fracking activity than at sites without fracking."[279] While the study did not resolve the pathway for these metals entering the 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."[280]

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.[281] 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.[282] 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

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[279] 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.

[280] *Id.*

[281] Warren, R. et al., Quantifying the benefit of early climate change mitigation in avoiding biodiversity loss, 3 Nature Climate Change 678 (2013) ("Warren 2013").

[282] 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").

extinction.[283] 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[284]; the extinction of 10 to 14 percent of species by 2100 if climate change continues unabated.[285] 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.[286] 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.[287] In Wyoming, an increasing density of wells was associated with decreased numbers of Brewer's sparrows, sage sparrows, and vesper sparrows.[288] In the Fayetteville Shale of central Arkansas, the proportional abundance of sensitive aquatic taxa, including darters, was negatively correlated with gas well density.[289] 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 and the Forest Service 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 parcel. The EIS must discuss any impacts to such species, including the red-cockaded woodpecker. In addition, BLM and the Forest Service 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.

As explained in detail in our September 19, 2016 letter supplementing our protest of BLM Eastern States' September 20, 2016 lease sale (Exhibit I), BLM, the Forest Service, and Fish and Wildlife Service must reinitiate consultation regarding the Forest Service's 2014 Forest Plan and its 2010 Leasing Analysis, in light of new information concerning habitat fragmentation

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[283] Intergovernmental Panel on Climate Change, *Climate Change 2014: Synthesis Report, Summary for Policy Makers IPCC Fifth Assessment Synthesis Report*, 18 (2014).
[284] Thomas, C.D. et al., Extinction Risk from Climate Change, 427 Nature 8:145 (2004).
[285] Maclean and Wilson 2011.
[286] Warren 2013.
[287] Holloran, M.J. et al., Yearling Greater Sage-Grouse Response to Energy Development in Wyoming, 74 Journal of Wildlife Management 1:65 (2010).
[288] Gilbert, Michelle M. & Anna D. Chalfoun, Energy Development Affects Populations of Sagebrush Songbirds in Wyoming, 75 The Journal of Wildlife Management 4:816 (2011).
[289] 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).

and climate change effects on the RCW, which have not previously been taken into account. Fish and Wildlife Service's December 10, 2013 Letter of Concurrence regarding the Forest Plan and its July 6, 2010 Concurrence in the Biological Evaluation for the Leasing Analysis lack meaningful analysis of these effects, and the underlying NEPA documentation in support of the Forest Service's determination is similarly deficient.

Accordingly, BLM and the Service may not rely on these concurrences to authorize new oil and gas leasing within the Mississippi National Forests. In addition, reliance on these concurrences for the September 20, 2016 lease sale is improper, as the impacts of leasing the specific parcel at issue on RCW survival and recovery has never been examined at the localized scale. BLM must therefore postpone the lease auction and the Forest Service must withdraw consent to new leasing until these effects have been properly addressed in an updated Section 7 consultation.

H. 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.

I. 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.[290] 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.[291]

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[290]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").
[291]Ellsworth 2013.

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.[292] Mid-continent states experiencing elevated levels of seismic activity include Arkansas, Colorado, New Mexico, Ohio, Oklahoma, Texas, and Virginia.[293]

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.[294] 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.[295] 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.[296] 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.[297] 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.[298] Other large earthquakes attributed to wastewater injection include an M5.3 in Colorado,[299] M4.9 in Texas,[300] M4.7 in Arkansas,[301] and M3.9 in Ohio.[302]

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[292]Keranen 2013.
[293]Ellsworth 2013.
[294] *Id.*

[295] 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 .

[296] 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.
[297] Chow, Lorraine. November 19, 2015. Strong Earthquake Rattles Oklahoma, Felt in 7 Other States. https://ecowatch.com/2015/11/19/oklahoma-earthquake-fracking/
[298]Ellsworth 2013, Keranen 2013.
[299] 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).
[300] 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).
[301] 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).
[302] 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 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).

The proliferation of unconventional oil and gas development, including increases in extraction and injection, will increase earthquake risk in the areas to be leased. 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,[303] and the Department of Energy[304]:

(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);

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

[304]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.

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. BLM must study these public health risks, to allow 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.[305] Just as troubling, is how much is *unknown* about the chemicals used in well stimulation activities.[306] 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 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:

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[305] 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).
[306] *See, e.g.* EPA 2015 at 5-73, 10-7.

- 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.[307]

- 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.[308] 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.[309, 310]

- 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.[311] The chances of a low Apgar score, a summary measure of the health of newborn children, roughly doubled, to more than 5 percent.[312] 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.[313]

- 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.[314] 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 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.

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[307] 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").
[308] 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").
[309] Hill, Elaine L., Unconventional Natural Gas Development and Infant Health: Evidence from Pennsylvania, Cornell University (2012).
[310] 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.
[311] *Id.*, citing Janet Currie of Princeton University, Katherine Meckel of Columbia University, and John Deutch and Michael Greenstone of the Massachusetts Institute of Technology.
[312] *Id.*
[313] 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.
[314] 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.

- 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.[315]

- 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. [316] 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.[317]

- In Texas, a jury awarded nearly $3 million to a family who lived near a well that was hydraulically fractured.[318] 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.[319] 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.[320]

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.[321] 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 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

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[315] 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).

[316] 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).

[317] *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).

[318] *Parr v. Aruba Petroleum, Inc.*, Case No. 11-01650-E (Dallas Cty., filed Sept.13, 2013).

[319] 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.

[320] *Id.*

[321] 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.

> 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.[322]

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.[323] 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.[324]

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 concentrations of benzene, a known carcinogen, were detected at levels over 1,500 times the federal limits for drinking water.[325] Of the 329 available tests that measured for benzene, the

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[322] *Id.*, p. 905.
[323] Wiseman, 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.
[324] *Id.*
[325] California Department of Conservation Division of Oil, Gas, & Geothermal Resources, California Well Stimulation Public Disclosure Report, *available at*

chemical was detected at levels in excess of federal limits in 320 tests (97 percent).[326] On average, benzene levels were around 700 times the federal limit for drinking water.[327] Among other carcinogenic or otherwise dangerous chemicals found in flowback fluid from fracked wells are toluene and chromium-6.[328] 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."[329] Compounds in mixtures can have synergistic or antagonistic effects, but again, it is impossible to know these effects without full disclosure.[330] 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."[331]

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."[332] Without this data, EPA could not adequately assess potential impacts on drinking water resources and human health.[333] Further, of 1,076 hydraulic fracturing fluid chemicals identified by the EPA, 623 did not have estimated

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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.

[326] *Id.*

[327] *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.

[328] *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.

[329] EPA 2015 at 10-18.

[330] Souther, Sara et al. Biotic Impacts of Energy Development from Shale: Research Priorities and Knowledge Gaps, Front Ecol Environ 2014; 12(6): p. 334.

[331] EPA 2015 at 10-18.

[332] *Id.* at 10-7, 9-7.

[333] *Id.* at 9-37-38.

physiochemical properties reported in EPA's toxics database, although this information is "essential to predicting how and where it will travel in the environment."[334] 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.[335]

An EIS must 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, BLM cannot accurately project the true impact of unconventional oil and gas extraction.

An EIS must 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.[336] Rates of traffic fatalities and major injuries may be higher in areas with heavy drilling activity than areas without.[337]

VIII. The Proposed Leasing Will Result in Industrialization of Public Lands

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.[338] 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).[339] 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."[340] The total surface

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[334] *Id.* at 5-73.
[335] *Id.* at 9-38.
[336] Graham, J., Irving et al., Increased Traffic Accident Rates Associated with Shale Gas Drilling in Pennsylvania. 74 Accident Analysis and Prevention 203 (2015).
[337] *Id.*
[338] 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.
[339] *Id.*
[340] *Id.*

disturbance by oil and gas development within this time period is 3 million hectares, the equivalent of three Yellowstone National Parks.[341] 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.[342]

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:

> The degree to which the effects on the quality of the human environment are likely to be highly controversial.

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[341] *Id* at 402.
[342] *Id.*

> 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, raising a substantial dispute about the "size, nature, or effect of the action."

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 parcel, 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.[343] 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.

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

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[343] 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")

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 listed species threatened by the proposed lease have been highlighted above in Part I, section IV(A).

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. [344]

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).

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[344] *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).

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 of federal minerals. 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 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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