NEPA, CLIMATE CHANGE, AND PUBLIC LANDS DECISION MAKING

BY

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One of the most difficult challenges facing public land managers today is how to address climate change in a meaningful way when making decisions affecting public lands. This problem is largely the product of the high levels of uncertainty surrounding climate change and the potential consequences of climate change for the large and complex landscapes and ecosystems that public land agencies manage.

In February 2010, the Council on Environmental Quality (CEQ) issued draft guidance to federal agencies describing how these agencies should address climate change in their decision documents. Recognizing the difficulty of the task, however, the CEQ's draft guidance expressly disclaimed any intention of affording assistance to public land management agencies making complex land-use decisions. This Article seeks to fill that gap. It begins by describing the National Environmental Policy Act (NEPA) and the unique difficulties in applying NEPA to climate change and public land management. It then considers three case studies that illustrate the complex challenges that face public land managers, including 1) the United States Forest Service's treatment of the Mountain Pine Beetle in Colorado and Southern Wyoming, 2) the Regional Water Supply Pipeline proposal to bring 250,000 acre-feet of water from the Colorado River Basin to the Front Range of Colorado and Southern Wyoming, and 3) fossil fuel leasing on public lands in general, with specific discussions of shale gas fracking, coal mine methane, and oil shale extraction.

These case studies form the basis for a series of recommendations for the CEQ and land-use planning agencies. Most importantly, the Article recommends that land-use planning agencies quantify the greenhouse gas (GHG) emissions that result from their proposed actions and attach a price to those emissions that reflects the marginal social cost of climate change that might result from those emissions. Although the social cost of GHG emissions may be uncertain, assigning a price to those emissions that reflects their social cost will promote

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more accurate cost assessments, and ensures that such costs become a meaningful part of the decision-making process. The Article also recommends that the CEQ propose rules to ensure that agencies are held accountable when they commit to adaptive management in their decision documents. Finally, the Article offers several general recommendations for coping effectively with the uncertainty and scale of climate change.

I. INTRODUCTION

The chief federal agencies that manage our public lands, and many other federal agencies that make decisions affecting our natural resources, must generally comply with the National Environmental Policy Act (NEPA).[1] NEPA requires federal agencies to prepare an environmental impact statement (EIS) where a proposed federal action "significantly affect[s] the quality of the human environment."[2] Even where federal actions do not *significantly* affect the environment, agencies must usually prepare an environmental assessment (EA).[3] Both EISs and EAs must consider alternatives to the proposed action and must analyze the environmental impacts of these alternatives,[4] including the direct, indirect, and cumulative impacts.[5] Among the most difficult contemporary problems facing agencies charged with NEPA compliance is determining how best to address climate

1 National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321–4347 (2006)

2 *Id.* § 4332(2)(C).

3 *See* 40 C.F.R. § 1501.3 (2011).

4 The Council on Environmental Quality (CEQ) regulations describe the alternatives analysis as the "heart of the [EIS]." *Id.* § 1502.14. "[I]t should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public." *Id.* NEPA requires an alternatives analysis even where an EIS is not required for any proposal that "involves unresolved conflicts concerning alternative uses of available resources." 42 U.S.C. § 4332(2)(E)(2006); *see also* Mountaineers v. U.S. Forest Serv., 445 F. Supp. 2d 1235, 1250 (W.D. Wash. 2006); 40 C.F.R. § 1508.9(b) (2011).

5 *See* 40 C.F.R. §§ 1502.16, 1508.7, 1508.8 (2011).

change. The difficulty stems predominantly from the global scale and the perceived uncertainty of climate change.

Though scientists generally agree that anthropogenic climate change is real, substantial uncertainty exists about the primary driver of climate change—future greenhouse gas (GHG) emissions—and the environmental consequences for any particular global emissions level.[6] Notwithstanding this uncertainty, NEPA forces federal agencies that increasingly face resource constraints to undertake the onerous and daunting task of analyzing their proposals in the context of global climate change.

While it is relatively simple to describe the kinds of climate-related issues that federal agencies should address in any NEPA document, it is much harder for agencies to conduct an analysis that will be helpful to decision makers and the public. This is largely because of the high degree of uncertainty and unpredictability about 1) the extent to which the climate will actually change at the particular location where the agency proposes to act, 2) the ways in which that change will affect the local environment, and 3) the direct, indirect, and cumulative impacts of the proposed action on the climate. Moreover, climate change seems likely to disrupt—if it has not done so already—our most reliable tool for predicting future conditions in the natural world: the historic record of past conditions. As one article famously suggested in the context of climate change and water resources management—"stationarity is dead."[7]

The problem of dealing with climate-related uncertainty is especially challenging for federal land managers and federal agencies that make decisions that affect the natural environment because these types of activities often play out over large geographic areas or ecosystems. How, for example, can a land manager possibly manage an ecosystem to protect keystone or endangered species, if the ecosystem itself is likely to face unprecedented disruptions due to climate change?

In an effort to provide assistance to agencies facing the difficult challenge of addressing climate change in their environmental analyses, the Council on Environmental Quality (CEQ)—the executive agency tasked with implementing NEPA—published draft climate change guidance.[8] This guidance attempts to reconcile NEPA's mandate with the unique problem that climate change presents to agency planners by

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6 *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: SYNTHESIS REPORT 72–73 (Lenny Bernstein et al. eds., 2008), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf (noting that climate change is a certainty, but exactly how climate will change is uncertain).

7 P. C. D. Milly et al., *Stationarity Is Dead: Whither Water Management?*, 319 SCIENCE 573, 573 (2008). Stationarity means using past data to make future predications, or "the idea that natural systems fluctuate within an unchanging envelope of variability." *Id.*

8 Memorandum from Nancy H. Sutley, Chair, Council on Envtl. Quality, to the Heads of Fed. Dep'ts & Agencies, Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions 1 (Feb. 18, 2010), *available at* http://ceq.hss.doe.gov/nepa/regs/Consideration_of_Effects_of_GHG_Draft_NEPA_Guidance_FINAL_02182010.pdf [hereinafter *CEQ Draft Climate Change Guidance*].

offering recommendations on both how agencies should analyze their actions' impacts on climate change and the impacts of climate change on their actions.[9]

By its own admission, however, the draft guidance fails to address the climate-related issues facing land-use planners. The CEQ is explicit about both its exclusion of land-use actions and its reasons for the exclusion:

> Land management techniques, including changes in land use or land management strategies, lack any established Federal protocol for assessing their effect on atmospheric carbon release and sequestration at a landscape scale. Therefore, at this time, CEQ seeks public comment on this issue but has not identified any protocol that is useful and appropriate for NEPA analysis of [] proposed land and resource management actions.[10]

By excluding land-use management decisions from its recommendations, the CEQ leaves land-use planners with no meaningful guidance on how to assess climate change in their NEPA analyses. Not surprisingly, the lack of appropriate guidance and the inherent difficulty of this task have led to NEPA documents that address climate change superficially and inconsistently, if at all.[11] Such efforts are not likely to further NEPA's purpose of "foster[ing] excellent action."[12]

This Article offers the guidance that federal land management agencies and other agencies making decisions impacting natural resource systems currently lack. It begins by describing NEPA and focusing especially on those legal requirements most relevant for federal land managers and other agencies making decisions with significant impacts on natural resources. Specifically, Part II discusses the CEQ regulations pertaining to programmatic assessments and tiering, uncertainty, and mitigation.[13]

Part III then explains the unique difficulties of applying NEPA to climate change.[14] In particular, this Part notes that NEPA's cumulative impacts requirement applied literally to climate change is a seemingly impossible burden for land-use decision makers. Part III also addresses the inherent uncertainty related to climate change, how to understand that uncertainty in the context of predictive climate models, the use of adaptive management to respond to that uncertainty, and the different meanings of the terms "adaptation" and "mitigation" in the NEPA and climate change contexts. Part IIII concludes with useful insights that land managers might glean from the otherwise inapplicable draft CEQ climate change guidance.

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9 *Id.* at 7.

10 *Id.* at 4.

11 *See* Amy L. Stein, *Climate Change Under NEPA: Avoiding Cursory Consideration of Greenhouse Gases*, 81 U. COLO. L. REV. 473, 477 (2010) (analyzing the Bureau of Land Management's consideration of climate change in NEPA documents and describing it as "sporadic and superficial").

12 40 C.F.R. § 1500.1(c) (2011).

13 *See infra* Part II.

14 *See infra* Part III.

Part IV of the Article discusses the role of NEPA in land-use planning and the challenges of land-use planning in a future of climate change.[15] There is a brief primer on the current approach to land-use planning on public lands, how NEPA is incorporated into the planning process, and how the uncertainty of climate change is affecting the planning process.

Three case studies follow that help illustrate the problems facing federal land-use managers as they try to reconcile their NEPA mandate with climate change. The first case study considers the struggles of the United States Forest Service to cope with the Mountain Pine Beetle epidemic in Colorado and Southern Wyoming.[16] The second addresses the Regional Water Supply Pipeline (RWSP or "Million Pipeline")—a Colorado water project that proposes drawing 250,000 additional acre-feet of water out of the Colorado River Basin for use on the Front Range of Colorado and Southern Wyoming.[17] The third examines some of the difficulties of incorporating climate change into NEPA analyses in the context of fossil fuel leasing on public lands.[18]

The Article concludes with a series of recommendations that could, if implemented, help ensure that climate change is meaningfully incorporated into land-use NEPA analyses and, thus, land-use decisions.[19] First, it recommends that agencies attach a price to GHG emissions that reflects the true cost of climate change so that agencies are able to meaningfully weigh those costs against the benefits of their actions.[20] Second, it proposes that the CEQ adopt rules requiring agencies to commit to mitigate the effects of climate change with discrete actions and adaptive management.[21] This will ensure that agencies can be held to these commitments, in court if necessary. Finally, the Article offers several general proposals for rethinking some of the current requirements in the CEQ rules in ways that will help ensure that climate change impacts are addressed in a meaningful way during the NEPA process.[22]

II. UNDERSTANDING NEPA

A. NEPA Generally

NEPA announces an environmental policy for the United States and implements that policy through the action-forcing EIS requirement.[23] At its core, the purpose of NEPA and its EIS requirement is to help "foster

15 *See infra* Part IV.
16 *See infra* Part V.A.
17 *See infra* Part V.B.
18 *See infra* Part V.C.
19 *See infra* Part VI.
20 *See infra* Part VI.A.
21 *See infra* Part VI.B.
22 *See infra* Part VII.
23 42 U.S.C. §§ 4331(a), 4332(2)(C) (2006).

excellent action" by federal agencies.[24] In particular, the EIS process is meant to help agencies better understand the environmental consequences of actions they propose and how to "protect, restore, and enhance the environment" in the actions they take.[25] But the U.S. Supreme Court has made clear that NEPA's EIS requirement is procedural and not substantive,[26] thereby making it easier for federal agencies to view NEPA as a mere hurdle to overcome before taking a predetermined action.[27] Nonetheless, when agencies employ NEPA robustly, as a means to improve their decisions, national environmental policy goals are more likely to be achieved.

NEPA lays out an ambitious policy "to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans."[28] The policy defines the responsibilities of the federal government and recognizes that each person "should enjoy a healthful environment."[29] The only legal mandate in NEPA, however, is its requirement that federal agencies prepare an EIS for all proposed agency actions "significantly affecting the quality of the human environment." [30] An EIS is "a detailed statement by the responsible official on"—

> (i) the environmental impact of the proposed action,
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> (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented,
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> (iii) alternatives to the proposed action,
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> (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and
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> (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.[31]

Though the statute articulates these five EIS requirements, the CEQ—the agency charged with implementing NEPA[32]—has effectively reduced these requirements to two: 1) an analysis of the environmental impacts of a proposed action, and 2) consideration of all reasonable alternatives to the

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24 40 C.F.R. §1500.1(c) (2011).

25 *Id.*

26 Vt. Yankee Nuclear Power Corp. v. Natural Res. Def. Council, 435 U.S. 519, 558 (1978).

27 *See* Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 350 (1989); *Vt. Yankee Nuclear Power*, 435 U.S. at 558.

28 42 U.S.C § 4331(a) (2006).

29 *Id.* § 4331(b)–(c).

30 *Id.* § 4332(2)(C). "[A]ll agencies of the Federal Government *shall* . . . include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement [(i.e., an EIS)] by the responsible official." *Id.* (emphasis added).

31 *Id.* § 4332(2)(C)(i)–(v).

32 *Id.* §§ 4342–4347.

proposed action.[33] An environmental impacts analysis considers direct, indirect, and cumulative impacts.[34] A direct impact is "caused by the action and occur[s] at the same time and place";[35] an indirect impact is "caused by the action and [is] later in time or farther removed in distance, but [is] still reasonably foreseeable";[36] and a cumulative impact is "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions."[37] An alternatives analysis must "[r]igorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated."[38]

The first step in meeting NEPA's mandate is for an agency to decide whether to prepare an EIS.[39] The CEQ regulations guide agencies in answering this question. First, the rules require that all agencies establish procedures for identifying three classes of actions: 1) actions that always require EISs,[40] 2) actions that never require EISs (known as categorical

33 40 C.F.R. §§ 1502.14, 1502.16 (2011). The analysis of environmental consequences "shall consolidate the discussions of those elements required by [42 U.S.C. § 4332] (2)(C)(i), (ii), (iv), and (v)." *Id.* § 1502.16.

34 *Id.* § 1508.25(c) ("To determine the scope of environmental impact statements, agencies shall consider . . . 3 types of impacts. They include . . . [i]mpacts, which may be: (1) [d]irect; (2) indirect; (3) cumulative."). An environmental impacts analysis "shall include discussions of: (a) [d]irect effects and their significance [and] (b) [i]ndirect effects and their significance." *Id.* § 1502.16. The terms "impact" and "effect" are used synonymously by the CEQ. *Id.* § 1508.8. "Cumulative impacts" are defined separately from "direct effects" and "indirect effects." *See id.* §§ 1508.7–1508.8.

35 *Id.* § 1508.8(a).

36 *Id.* § 1508.8(b).

37 *Id.* § 1508.7.

38 *Id.* § 1502.14(a). An alternatives analysis must also "[d]evote substantial treatment to each alternative considered," *id.* § 1502.14(b), "[i]nclude reasonable alternatives not within the jurisdiction of the lead agency," *id.* § 1502.14(c), "[i]nclude the alternative of no action," *id.* § 1502,14(d), "[i]dentify the agency's preferred alternative or alternatives," *id.* § 1502.14(e), and "[i]nclude appropriate mitigation measures not already included in the proposed action or alternatives." *Id.* § 1502.14(f).

39 As stated above, all "major Federal actions significantly affecting the quality of the human environment" are subject to NEPA and require an EIS. 42 U.S.C. § 4332(2)(C) (2006); *see also* 40 C.F.R. § 1506.1(a), (c) (2011). "*Major Federal action* includes actions with effects that may be major and which are potentially subject to Federal control and responsibility." 40 C.F.R. § 1508.18 (2011). Agencies proposing major federal actions must determine whether the action is likely to "significantly affect[] the quality of the human environment." 42 U.S.C. § 4332(2)(C). A federal agency, when determining whether an EIS is appropriate, must determine whether its proposal is of a type that "[n]ormally requires an [EIS]" or instead falls into a categorical exclusion. 40 C.F.R. § 1501.4(a) (2011). If the proposed action does not fall into either of those categories, the agency must prepare an "environmental assessment." *Id.* § 1501.4(b). An environmental assessment is a "concise public document" that serves to "[b]riefly provide sufficient evidence and analysis for determining whether to prepare an [EIS] or a finding of no significant impact." *Id.* § 1508.9(a). The environmental assessment may then be used to determine whether an EIS must be prepared. *Id.* § 1501.4(c).

40 *See* 40 C.F.R. § 1501.4(a)(1) (2011).

exclusions),[41] and 3) actions that sometimes require an EIS. [42] For this third class of actions agencies must prepare an EA,[43] which is defined as "a concise public document" that provides "sufficient evidence and analysis for determining whether to prepare an [EIS]" and includes a brief discussion of the "need for the proposal, . . . alternatives . . . , [and] . . . environmental impacts of the proposed action."[44] This is designed to allow the agency to ascertain whether the proposed action will significantly affect the human environment. If the EA leads to an affirmative answer, an EIS must be prepared; if not, the agency must make a finding of no significant impact (FONSI),[45] "a document . . . briefly presenting the reasons why an action . . . will not have a significant effect on the human environment."[46]

As currently interpreted by the CEQ and the Supreme Court, NEPA's EIS requirement is "essentially procedural," mandating *how* an agency makes decisions rather than *what* decisions an agency makes.[47] Thus, while NEPA requires that agencies take a "hard look" at proposed actions that significantly affect the human environment, it does not preclude decisions that might cause significant harm to the environment.[48]

Because NEPA itself lacks an enforcement mechanism,[49] private enforcement is generally available only under the judicial review provisions

41 *Id.* § 1508.4 (describing categorical exclusions as "categor[ies] of actions which do not individually or cumulatively have a significant effect on the human environment and which have been found to have no such effect in procedures adopted by a Federal agency in implementation of these regulations (§ 1507.3) and for which, therefore, neither an [EA] nor an [EIS] is required.").

42 *Id.* § 1507.3(b) ("Agency procedures . . . shall include . . . [s]pecific criteria for and identification of those typical classes of action: (i) Which normally do require [EISs]. (ii) Which normally do not require either an [EIS] or an [EA] (categorical exclusions (§ 1508.4)). (iii) Which normally require [EAs] but not necessarily [EISs].").

43 *Id.* § 1501.4(a)–(b) (advising agencies to prepare an EA where a proposed action neither normally requires an EIS, nor falls under a categorical exclusion that would exempt the action from an EA).

44 *Id.* § 1508.9.

45 *Id.* § 1501.4(b)–(e).

46 *Id.* § 1508.13.

47 *Vt. Yankee Nuclear Power*, 435 U.S. 519, 558 (1978) ("NEPA does set forth significant substantive goals for the Nation, but its mandate to the agencies is essentially procedural."); *see also* 40 C.F.R. § 1500.1(a). Though the CEQ recognizes that NEPA's purpose is to "foster excellent action," the purpose of its regulations is purely procedural: "to tell federal agencies what they must do to comply with [NEPA's] procedures." *Id.* § 1500.1(a), (c). Thus, the CEQ seeks to create procedures for making excellent decisions but relies on the agencies to use and benefit from the procedures to make the decisions actually excellent. *See id.* § 1500.1(c).

48 *See* Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 350 (1989) ("If the adverse environmental effects of the proposed action are adequately identified and evaluated, the agency is not constrained by NEPA from deciding that other values outweigh the environmental costs.").

49 Congress assumed that the Executive Branch would enforce the statute. *See* ZYGMUNT J.B. PLATER ET AL., ENVIRONMENTAL LAW AND POLICY: NATURE, LAW, AND SOCIETY 477–78 (3d ed. 2004).

of the Administrative Procedure Act (APA),[50] which allow federal courts to set aside agency action found to be "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law."[51] Because NEPA has been construed as "essentially procedural," an agency decision can generally be overturned only if the agency failed to follow the NEPA process or if the decision was "arbitrary and capricious, an abuse of discretion, or otherwise not in accordance with law."[52]

B. Programmatic Assessments and Tiering

The CEQ rules encourage the preparation of programmatic environmental impact statements (PEISs) for "broad Federal actions."[53] Broad federal actions include both single large proposals with far-reaching impacts—e.g., the creation of new agency programs or regulations[54]—and multiple proposals "that will have cumulative or synergistic environmental impact[s]."[55] The benefits of PEISs are best realized by agencies when accompanied by "tiering."

"Tiering" refers to the incorporation of information from broad EISs, like programmatic statements, into narrower analyses that focus on specific issues that are unique to a narrower proposal.[56] So, for example, an agency might prepare a programmatic EIS for developing an oil and gas field and then prepare more specific EISs or even EAs for individual applications to drill on a particular tract of land. PEISs accompanied by subsequent tiered statements allow an agency "to relate broad and narrow actions and to avoid duplication and delay,"[57] thereby focusing on "the actual issues ripe for decision at each level of environmental review."[58]

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50 5 U.S.C. §§ 551–559, 701–706, 1305, 3105, 3344, 4301, 5335, 5362, 7521 (2006). The judicial review procedures can be found at 5 U.S.C. §§ 701–706 (2006).

51 *Id.* § 706(2)(A); *e.g.*, Dep't of Transp. v. Pub. Citizen, 541 U.S. 752, 763 (2004) ("An agency's decision not to prepare an EIS can be set aside only upon a showing that it was 'arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law.'"(quoting 5 U.S.C. § 706(2)(A))); Marsh v. Or. Natural Res. Council, 490 U.S. 360, 375–76 (1989) ("We conclude that review of the narrow question before us whether the Corps' determination that the FEISS need not be supplemented should be set aside is controlled by the 'arbitrary and capricious' standard of [the APA].").

52 5 U.S.C. § 706(2)(A); *see also* Kleppe v. Sierra Club, 427 U.S. 390, 410 n.21 (1976) ("[An agency] cannot 'interject itself within the area of discretion of the executive as to the choice of the action to be taken.'" (quoting Natural Res. Def. Council, Inc. v. Morton, 458 F.2d 827, 838 (D.C. Cir. 1972))).

53 40 C.F.R. § 1502.4(b) (2011).

54 *Id.*

55 *Kleppe*, 427 U.S. at 410.

56 40 C.F.R. § 1508.28 (2011).

57 *Id.* § 1502.4(d).

58 *Id.* § 1502.20.

C. NEPA and Uncertainty

Uncertainty regarding an action's potential environmental effects does not release agencies from NEPA's requirements. On the contrary, uncertainty can actually lead to a significance finding that requires an EIS, since one factor in determining significance is "[t]he degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks."[59]

More importantly, the CEQ regulations create a framework for analyzing uncertainty. In particular, where "incomplete information relevant to reasonably foreseeable significant adverse impacts is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement."[60] An effect is "reasonably foreseeable" even if the probability of its occurrence is low and its consequences catastrophic, as long as its occurrence is supported by "credible scientific evidence, is not based on pure conjecture, and is within the rule of reason."[61]

If it is not possible to obtain the information or the cost of obtaining it is exorbitant, the agency must include the following in its EIS:

> (1) A statement that such information is incomplete or unavailable;
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> (2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;
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> (3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and
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> (4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community.[62]

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59 *Id.* § 1508.27(b)(5); Nat'l Parks & Conservation Ass'n v. Babbitt, 241 F.3d 722, 731 (9th Cir. 2001) ("An agency must generally prepare an EIS if the environmental effects of a proposed agency action are highly uncertain.").

60 40 C.F.R. § 1502.22(a) (2011).

61 *Id.* § 1502.22(b)(1). Section 1502.22 replaced the "worst-case scenario" requirement, which provided "that if certain information relevant to the agency's evaluation of the proposed action is either unavailable or too costly to obtain, the agency must include in the EIS a 'worst case analysis and an indication of the probability or improbability of its occurrence.'" Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 354 (1989) (quoting 40 C.F.R. § 1502.22(b) (1985)). The current section 1502.22 "'retains the duty to describe the consequences of a remote, but potentially severe impact, but grounds the duty in evaluation of scientific opinion rather than in the framework of a conjectural "worst case analysis."'" *Id.* at 354–55 (quoting 50 Fed. Reg. 32,234, 32,237 (Aug. 9, 1985)).

62 40 C.F.R. § 1502.22(b)(1)–(4) (2011).

D. NEPA and Mitigation

Courts have found that NEPA's requirement that an EIS analyze "any adverse environmental effects which cannot be avoided" implicitly requires a discussion of how environmental effects can be mitigated.[63] This is because the severity of environmental impacts cannot be properly evaluated without understanding whether and how those impacts can be mitigated.[64] The CEQ rules require that an EIS discuss mitigation measures in both its alternatives analysis and its environmental consequences analysis.[65] Types of mitigation are defined by the CEQ as including:

> (a) Avoiding the impact altogether by not taking a certain action or parts of an action.
>
> (b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
>
> (c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
>
> (d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
>
> (e) Compensating for the impact by replacing or providing substitute resources or environments.[66]

Though an EIS must *describe* possible mitigation measures, the Supreme Court found that neither NEPA nor the CEQ's rules require that mitigation measures actually be implemented.[67] As the Court explained, "[t]here is a fundamental distinction [] between a requirement that mitigation be discussed in sufficient detail to ensure that environmental consequences have been fairly evaluated, on the one hand, and a substantive requirement that a complete mitigation plan be actually formulated and

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63 42 U.S.C. § 4332(2)(C)(ii) (2006); *Methow Valley Citizens Council*, 490 U.S. at 351–52 (1989) ("Implicit in NEPA's demand that an agency prepare a detailed statement on 'any adverse environmental effects which cannot be avoided should the proposal be implemented' is an understanding that the EIS will discuss the extent to which adverse effects can be avoided." (citation omitted)); DANIEL R. MANDELKER, NEPA LAW AND LITIGATION § 10:43 (2d ed. 2011).

64 *Methow Valley Citizens Council*, 490 U.S. at 352 (stating that without adequate discussion of mitigation measures, "neither the agency nor other interested groups and individuals can properly evaluate the severity of the adverse effects"). The Court in *Methow Valley Citizens Council* recognized the obvious connection between easily available mitigation and the severity of an impact: "An adverse effect that can be fully remedied by, for example, an inconsequential public expenditure is certainly not as serious as a similar effect that can only be modestly ameliorated through the commitment of vast public and private resources." *Id.*

65 40 C.F.R. §§ 1502.14(f), 1502.16(h) (2011). A discussion of alternatives in an EIS must "[i]nclude appropriate mitigation measures not already included in the proposed action or alternatives." *Id.* § 1502.14(f). A discussion of environmental consequences in an EIS must include a discussion of "[m]eans to mitigate adverse environmental impacts." *Id.* § 1502.16(h).

66 *Id.* § 1508.20.

67 *Methow Valley Citizens Council*, 490 U.S. at 353.

adopted, on the other."[68] Nonetheless, it is at least possible that the failure to adopt reasonable mitigation measures could render a decision arbitrary. For example, if reasonable and inexpensive mitigation measures are available to address severe environmental impacts from a proposed action, a court might easily find that the failure to adopt those measures was arbitrary and capricious or an abuse of discretion.

III. NEPA AND CLIMATE CHANGE

A. The Difficulties in Incorporating Climate Change into NEPA Analyses

1. Cumulative Impacts and the Scale of Climate Change

The global scale of climate change is difficult to reconcile with NEPA's requirement that NEPA analyses consider the cumulative impacts of proposed actions. A cumulative impact is the "incremental impact of the action when added to other past, present, and reasonably foreseeable future actions."[69] These past, present, and future actions include actions by the state or federal government, or by a private actor.[70] As applied to an analysis of cumulative GHG impacts on the action itself, the requirement seems feasible. The impacts of climate change on the action—warming temperatures, changing rainfall patterns, increased evaporation, or decreased river flows—can be estimated and applied to the decision, and the scope and scale of the analysis can be controlled by NEPA's "rule of reason."[71] This is the approach the CEQ's draft climate change guidance recommends.[72] However, the required analysis of cumulative GHG impacts on the environment in general makes much less sense. The smallest GHG emission—along with the emissions of other reasonably foreseeable actions—incrementally leads to global climate change.[73] This arguably

68 *Id.* at 352.

69 40 C.F.R. § 1508.7 (2011).

70 *Id.* ("Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions *regardless of what agency (Federal or non-Federal) or person undertakes such other actions*." (emphasis added)).

71 The rule of reason is implied in the CEQ regulations, which require "[e]mphasizing the portions of the [EIS] that are useful to decisionmakers and the public and reducing emphasis on background material" and "[u]sing the scoping process, not only to identify significant environmental issues deserving of study, but also to deemphasize insignificant issues, narrowing the scope of the [EIS] process accordingly." *Id.* § 1500.4(f)–(g). The U.S. Supreme Court describes NEPA's rule of reason as "ensur[ing] that agencies determine whether and to what extent to prepare an EIS based on the usefulness of any new potential information to the decisionmaking process." Dep't of Transp. v. Pub. Citizen, 541 U.S. 752, 767 (2004).

72 *CEQ Draft Climate Change Guidance*, *supra* note 8, at 10 (citing Kleppe v. Sierra Club, 427 U.S. 390, 414 (1976); 40 C.F.R. § 1502.22 (2011)).

73 *See* Mass. v. Envt'l Prot. Agency, 549 U.S. 497, 524 (2007).

requires a full-scale analysis of global climate change generally for every action that triggers NEPA compliance.[74]

A literal application of the cumulative impacts requirement to climate change seems not only impractical, but also unhelpful to the decision-making process, which, after all, is the hallmark of NEPA. Nonetheless, in *Center for Biological Diversity v. National Highway Traffic Safety Administration*, the United States Court of Appeals for the Ninth Circuit seemed to require a broad cumulative impacts analysis of climate change. There, the National Highway Traffic Safety Administration (NHTSA) set fuel economy standards for light trucks for model years 2008 to 2011.[75] The NHTSA prepared an EA and a FONSI.[76] Though the EA quantified the direct increase in GHG emissions resulting from the action, it failed to analyze the cumulative impacts of the GHG emissions.[77] The court found this to be a fatal flaw and remanded the decision because the EA failed to "evaluate the 'incremental impact' that [emissions resulting from the new fuel economy standards would] have on climate change or on the environment more generally in light of other past, present, and reasonably foreseeable actions."[78] Importantly, the court noted that "[t]he impact of greenhouse gas emissions on climate change is precisely the kind of cumulative impacts analysis that NEPA requires agencies to conduct."[79]

After *Center for Biological Diversity*, it was unclear whether any GHG emission resulting from an action, no matter how small, required an analysis of global climate change as a cumulative impact in NEPA documents. But in *Hapner v. Tidwell*,[80] the Ninth Circuit clarified the issue by making it clear that the required climate change discussion in NEPA documents was governed by NEPA's rule of reason.[81] Specifically, the court held that relatively small direct emissions of GHGs do not warrant an analysis of global climate change as a cumulative impact if the analysis would not be helpful to the decision maker.[82]

74 Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin., 538 F.3d 1172, 1217 (9th Cir. 2008) ("The cumulative impacts regulation specifically provides that the agency must assess the 'impact of the action when added to other past, present, and reasonably foreseeable future actions *regardless of what agency (Federal or non-Federal) or person undertakes such other actions*.'" (emphasis added in opinion) (quoting 40 C.F.R. § 1508.7 (2008))).

75 *Id.* at 1191.

76 *Id.* at 1220.

77 *Id.* at 1216.

78 *Id.*

79 *Id.* at 1217.

80 621 F.3d 1239 (9th Cir. 2010).

81 *Id.* at 1245 (stating that the Forest Service considered the project's impact on global warming "adequately," or in other words, "in proportion to its significance"). For a discussion of the rule of reason and NEPA, see Dep't of Transp. v. Pub. Citizen, 541 U.S. 752, 767 (2004).

82 *See Hapner*, 621 F.3d at 1245.

2. Using Adaptive Management to Reconcile NEPA and Climate Change

Soon after NEPA's passage, land-use planners and scientists realized that the predictive environmental management model underlying NEPA and other environmental statutes of the 1970s was lacking.[83] NEPA's "predict-mitigate-implement" approach to planning failed to "account for unanticipated changes in environmental conditions, inaccurate predictions, or subsequent information that might affect the original environmental protections."[84] In reaction to this realization, scientists began promoting a more flexible approach to management known as adaptive management.[85]

Adaptive management changes the "predict-mitigate-implement" model of environmental management underlying NEPA to "predict-mitigate-implement-*monitor-adapt*" and repeat.[86] Importantly, it allows an agency the flexibility to continually adapt in response to new information.[87] More specifically—

> Adaptive management [is a decision process that] promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management also recognizes the importance of natural variability in contributing to ecological resilience and productivity. It is not a "trial and error" process, but rather emphasizes learning while doing. Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it

83 *See, e.g.*, J.B. Ruhl & Robert L. Fischman, *Adaptive Management in the Courts*, 95 MINN. L. REV. 424, 428 & n.10 (2010). The scientific field underlying adaptive management—ecosystems management—moved "decisionmaking from a process of setting rigid standards based on comprehensive rational planning to one of experimentation using continuous monitoring, assessment, and recalibration." *Id.* at 428.

84 NEPA TASK FORCE, REPORT TO THE COUNCIL ON ENVIRONMENTAL QUALITY: MODERNIZING NEPA IMPLEMENTATION 44 (2003), *available at* http://ceq.hss.doe.gov/ntf/report/finalreport.pdf.

85 *See, e.g.*, 3 C.S. HOLLING ET AL., INTERNATIONAL SERIES ON APPLIED SYSTEMS ANALYSIS: ADAPTIVE ENVIRONMENTAL ASSESSMENT AND MANAGEMENT 1 (C.S. Holling ed., 1978) (describing the foundation for the modern science of adaptive management).

86 NEPA TASK FORCE, *supra* note 84, at 45 (emphasis added). The Department of the Interior describes the evolving and repeating process of environmental management this way: (1) Assess Problem; (2) Design; (3) Implement; (4) Monitor; (5) Evaluate; and (6) Adjust. BYRON K. WILLIAMS ET AL., ADAPTIVE MANAGEMENT: THE U.S. DEPARTMENT OF INTERIOR TECHNICAL GUIDE 5 fig.1.1 (2009), *available at* http://www.doi.gov/initiatives/AdaptiveManagement/TechGuide.pdf.

87 *See* C.S. HOLLING ET AL., *supra* note 85, at 7–9 (noting that adaptive management techniques can benefit from uncertainty).

> helps meet environmental, social, and economic goals, increases scientific knowledge, and reduces tensions among stakeholders.[88]

Applying adaptive management, land-use planners can embrace uncertainty, monitor their actions, and adapt to mitigate environmental impacts as they arise. Recognizing its utility, the Bureau of Land Management (BLM) and the Forest Service have incorporated adaptive management into their land-use planning regulations.[89]

In October 2010, the White House's Climate Change Adaptation Task Force, a multiagency group co-chaired by the CEQ, recommended that adaptive management be part of a national climate change strategy.[90] The task force recognized that "[a]gencies should consider how climate change affects them using a flexible, forward-thinking approach that moves away from using past conditions as indicators of the future."[91] Furthermore, "[t]his approach should include a commitment to ongoing evaluation and revision of management activities and decisions through adaptive management."[92] Earlier in 2010, the Secretary of the Interior similarly recognized that "the Department must . . . [c]ontinue to provide state-of-the art science to better understand the impacts of climate change *and to develop science-based adaptive management strategies for natural and cultural resource managers*."[93]

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88 NAT'L RESEARCH COUNCIL, ADAPTIVE MANAGEMENT FOR WATER RESOURCES PROJECT PLANNING 1–2 (2004), *available at* http://www.nap.edu/catalog.php?record_id=10972 (free registration required).

89 BLM requires that—

> Bureaus should use adaptive management, as appropriate, particularly in circumstances where long-term impacts may be uncertain and future monitoring will be needed to make adjustments in subsequent implementation decisions. The NEPA analysis conducted in the context of an adaptive management approach should identify the range of management options that may be taken in response to the results of monitoring and should analyze the effects of such options. The environmental effects of any adaptive management strategy must be evaluated in this or subsequent NEPA analysis.

43 C.F.R. § 46.145 (2010). The new Forest Service planning regulations describe the Forest Service's planning framework as "an adaptive planning cycle" which is "an iterative process that includes assessment; developing, amending, or revising a plan; and monitoring." 76 Fed. Reg. 8480, 8515–16 (Feb. 14, 2011) (codified at 36 C.F.R. pt. 219) (citations omitted). "The intent of this framework is to create a responsive and agile planning process that informs integrated resource management and allows the Forest Service to adapt to changing conditions, including climate change, and improve management based on new information and monitoring." *Id.* at 8516.

90 WHITE HOUSE COUNCIL ON ENVT'L QUALITY, PROGRESS REPORT OF THE INTERAGENCY CLIMATE CHANGE ADAPTATION TASK FORCE: RECOMMENDED ACTIONS IN SUPPORT OF A NATIONAL CLIMATE CHANGE ADAPTATION STRATEGY 7–8 (2010), *available at* http://www.whitehouse.gov/sites/default/files/microsites/ceq/Interagency-Climate-Change-Adaptation-Progress-Report.pdf.

91 *Id.* at 25.

92 *Id.* at 25–26.

93 SEC'Y OF THE INTERIOR, ORDER NO. 3289, AMENDMENT NO. 1: ADDRESSING THE IMPACTS OF CLIMATE CHANGE ON AMERICA'S WATER, LAND, AND OTHER NATURAL AND CULTURAL RESOURCES 2 (Feb. 22, 2010) (emphasis added).

3. Understanding the Meaning of "Mitigation" and "Adaptation" in the Context of NEPA and Climate Change

Modern NEPA analyses and climate change scientists both frequently discuss "adaptation" and "mitigation," but both use the words differently often leading to confusion. In the context of NEPA, adaptation is merely one form of mitigation. NEPA mitigation includes limiting the action and "repairing, rehabilitating, or restoring" the environment, but also adaptive measures "*[r]educing or eliminating the impact over time by preservation and maintenance operations during the life of the action.*"[94] Thus, NEPA mitigation can include both mitigation measures and adaptive measures to cope with the unknown future environmental impacts, like those impacts associated with climate change.

By contrast, in the climate change context, "mitigation" and "adaptation" are distinct concepts. According to the Intergovernmental Panel on Climate Change, climate change mitigation involves measures to reduce GHG emissions through "[t]echnological change and substitution that reduce resource inputs and emissions per unit of output."[95] Alternatively, climate change adaptation involves "measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects."[96] The differing meanings of these key terms counsel care in their use and clarity in indicating their context.

B. The Draft CEQ Climate Change Guidance

On February 18, 2010, the CEQ issued draft guidance meant to end any debate over whether NEPA requires an analysis of climate change and to help agencies reconcile their NEPA mandate with climate change.[97] The Guidance, however, explicitly excludes land-use planning from its recommendations: "CEQ does not propose to make this guidance applicable to Federal land and resource management."[98] Though not directly applicable

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94 40 C.F.R. § 1508.20 (b)–(d) (2011) (emphasis added).

95 INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: MITIGATION OF CLIMATE CHANGE 818 (Bert Metz et al. eds., 2007), *available at* http://www.ipcc-wg3.de/publications/assessment-reports/ar4/working-group-iii-fourth-assessment-report (click on "Annex I: Glossary" section to access PDF version). Climate change mitigation is "[t]echnological change and substitution that reduce resource inputs and emissions per unit of output. Although several social, economic and technological policies would produce an emission reduction, with respect to climate change, mitigation means implementing policies to reduce GHG emissions and enhance sinks." *Id.*

96 *Id.* at 809. Climate change adaptation is "[i]nitiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Various types of adaptation exist, e.g. anticipatory and reactive, private and public, and autonomous and planned. Examples are raising river or coastal dikes, the substitution of more temperature-shock resistant plants for sensitive ones, etc." *Id.*

97 *See CEQ Draft Climate Change Guidance*, *supra* note 8, at 1.

98 *See id.* at 2.

to land-use planning, the Guidance nevertheless offers insights for land-use planners for incorporating climate change into their NEPA analyses.

The Guidance does not attempt to help agencies determine when or if climate change can trigger an EIS through a significance determination. Instead, it focuses on how climate change should be analyzed in NEPA documents.[99] These recommendations are separated into two categories: 1) analysis of the effects of a proposed agency action on climate change, and 2) analysis of the effects of climate change on proposed agency actions.[100]

1. Analyzing the Effects of a Proposed Agency Action on Climate Change

In addressing the effects of a proposed action on climate change, the Guidance recognizes that quantifying GHG emissions or reductions from a proposed action is critical and suggests methods for quantification.[101] These GHG quantifications stand as a proxy for the actual impacts of emissions because, according to the CEQ, effective connections between GHG emissions and actual environmental impacts are currently impractical.[102] Thus, GHG emissions quantities are the useful metric to "provide decision makers and the public with useful information for a reasoned choice among alternatives."[103]

Once emissions are quantified, the Guidance suggests the reporting of GHG emissions in EISs and EAs when the levels of emissions are "meaningful"—i.e., helpful to decision makers.[104] For NEPA direct impacts analyses, the guidance suggests a 25,000 metric tons of CO_2e emissions threshold for determining if emissions are meaningful and thus, if they require quantification.[105] The direct impacts analysis would include the following: "(1) quantify cumulative emissions over the life of the project; (2) discuss measures to reduce GHG emissions, including consideration of

99 *Id.* at 1–2.

100 *Id.* at 1.

101 *See id.* at 3–4. For quantifying GHG emissions from a proposed action, the guidance creates three categories of emitters: large direct emitters, federal facilities, and other emitters including carbon sequestration. *Id.* at 4. For large direct emitters, the guidance suggests using the EPA's mandatory GHGs reporting rules. *See* Final Rule for Mandatory Reporting of Greenhouse Gases, 74 Fed. Reg. 56,260 (Oct. 30, 2009) (codified at 40 C.F.R. pts 86, 87, 89, 90, 94, 98, 1033, 1039, 1042, 1045, 1048, 1051, 1054, 1065). For federal facilities, the guidance suggests GHG emissions reporting guidelines being issued by executive order. Exec. Order No. 13514, 74 Fed. Reg. 52,117, 52,121, 52,123 (Oct. 8, 2009). For carbon sequestration and other emitters, the guidance suggests using the U.S. Energy Information Administration's Voluntary Reporting of Greenhouse Gases Program, which is currently suspended. U.S. Energy Info. Admin., *Voluntary Reporting of Greenhouse Gases Program*, http://www.eia.doe.gov/oiaf/1605/ (last visited Apr. 7, 2012).

102 *See CEQ Draft Climate Change Guidance*, *supra* note 8, at 3.

103 *Id.*

104 *See id.* at 2. Here, the CEQ's reasoning seems irrational. Since the Guidance requires quantification of GHGs to determine whether the threshold has been met for reporting GHG emissions, those quantities should be available in every case and thus should be reported in every case.

105 *Id.* at 1.

reasonable alternatives; and (3) qualitatively discuss the link between such GHG emissions and climate change."[106]

For indirect impacts analyses—reasonably foreseeable consequences of the action that occur "downstream" from the action—the Guidance does not propose any emissions quantity that would trigger an analysis. This is because of the supposed impracticality of determining downstream GHG emissions.[107] In fact, an assessment of the impacts from downstream GHG emissions may be no more difficult than assessing the direct impacts from a proposed action. If, for example, an agency is assessing the climate-related impacts of approving a new lease for a coal mine on federal lands, a projection of the likely GHG emissions that will result from transporting and burning the coal should be relatively easy to quantify.[108]

For cumulative impacts analyses, the Guidance leaves the question of when to prepare an analysis in the discretion of the agencies, but suggests that such an analysis would "appropriately focus on an assessment of annual and cumulative emissions of the proposed action and the difference in emissions associated with alternative actions."[109] At best, this seems incomplete since it seems to focus entirely on the emissions from the proposed action without reference to the requirement that agencies consider the emissions from all "past, present, and reasonably foreseeable future actions" as required by the CEQ rules.[110] Moreover, the existing CEQ rules appear to offer more robust assistance on this question than does the new draft guidance. In particular, the definition of "scope" makes clear that an EIS must consider all actions that are connected, cumulative, and similar to the proposed action.[111] In the context of an EIS for a proposed coal lease on federal lands, for example, the mine, the transportation of the coal to its point of use, and the combustion of the coal to generate power are all connected actions to be assessed under the coal lease EIS.[112] Likewise, the cumulative impacts from multiple leasing, mining, transportation, and coal

106 *Id.* at 3.

107 *See id.* at 3.

108 *See, e.g.*, U.S. BUREAU OF LAND MGMT., FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE BUCKSKIN MINE HAY CREEK II COAL LEASE APPLICATION 4-120 to 4-143 (2011), *available at* http://www.blm.gov/pgdata/etc/medialib/blm/wy/information/NEPA/cfodocs/haycreekii/feis.Par.89003.File.dat/07chap4.pdf.

109 *CEQ Draft Climate Change Guidance*, *supra* note 8, at 5.

110 *See* 40 C.F.R. § 1508.7 (2011) (defining "cumulative impact").

111 *See id.* § 1508.25(a)(1)–(3) (defining "scope").

112 Section 1502.4(a) requires that "[p]roposals or parts of proposals which are related to each other closely enough to be, in effect, a single course of action shall be evaluated in a single impact statement," and further requires that agencies use the criteria for the "scope" found "to determine which proposal(s) shall be the subject of a particular statement." *Id.* § 1502.4(a). Related proposed actions that may need to be considered in a single EIS include "connected," "cumulative," and "similar" actions as defined by section 1508.25. *Id.* In *Thomas v. Peterson*, the Ninth Circuit applied these regulations to find that two proposed actions—a timber sale and a logging road to access the timber—were both connected and cumulative actions and thus had to be considered in the same EIS. 753 F.2d 754, 757–58 (9th Cir. 1985).

combustion activities, at least where they occur in the same geographic region, should arguably be assessed in the same leasing EIS.[113]

The Guidance also suggests using the "rule of reason" to determine the extent and depth of climate change analysis. The rule of reason "ensures that agencies determine whether and to what extent to prepare an EIS based on the usefulness of any new potential information to the decisionmaking process."[114] Applying the rule of reason, the amount of analysis should be directly proportional to how helpful the analysis is to the decision maker.[115] The Guidance further suggests that when the 25,000 metric tons emissions threshold is met for a direct impacts analysis, alternative emissions scenarios and mitigation should also be discussed.[116] Discussions of mitigation should analyze the quality of mitigation, including the mitigation's "permanence, verifiability, enforceability, and additionality."[117] Finally, the Guidance suggests the use of programmatic assessments and tiering in appropriate situations.[118]

2. Analyzing the Effects of Climate Change on a Proposed Agency Action

The CEQ Guidance also describes how an agency should analyze the effects of climate change on a proposed agency action. In this context, if relevant, climate change must be analyzed in the discussion of a proposed action's affected environment.[119] Such an analysis should discuss how a proposed action "will add to, modify, or mitigate" the effects of climate change on the environment affected by the action: for example, "effects on the environment, on public health and safety, and on vulnerable populations who are more likely to be adversely affected by climate change."[120]

The Guidance suggests that the analysis of affected environment should be undertaken by first identifying a reasonably foreseeable future environment with no action, and identifying reasonably foreseeable future environments given different alternative actions.[121] The Guidance further suggests resources for evaluating the effects of climate change on the environment[122] as well as the uncertainty inherent in such evaluations.[123] The

113 *See* 40 C.F.R. §§ 1502.4, 1508.7, 1508.25 (2011); *supra* text accompanying note 112.

114 *See CEQ Draft Climate Change Guidance*, *supra* note 8, at 4 (quoting Dep't of Transp. v. Pub. Citizen, 541 U.S. 752, 767 (2004)). The "rule of reason" is a guiding principle under the CEQ regulations. *See* 40 C.F.R. §1500.1(b) (2011) ("NEPA documents must concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail.").

115 *Dep't of Transp.*, 541 U.S. at 767.

116 *See CEQ Draft Climate Change Guidance*, *supra* note 8, at 5.

117 *Id.* at 6.

118 *Id.* at 5.

119 *Id.* at 6 (citing 40 C.F.R. § 1502.15 (2011)).

120 *Id.*

121 *Id.* at 7.

122 *Id.* at 8 (citing U.S. Global Change Research Program, *Synthesis and Assessment Products*, http://www.globalchange.gov/publications/reports/scientific-assessments/saps (last visited Apr. 7, 2012); U.S. Global Change Research Program, *Global Climate Change Impacts*

no-action environment is the baseline for determining the impacts of climate change, while the environments given the various alternative actions provide a means of measuring how the proposed action will, given climate change, affect the environment.[124] To combat the uncertainty inherent in these predictions of reasonably foreseeable environments, the Guidance suggests monitoring and adaptation.[125] Finally, the Guidance suggests that the scope of an analysis of climate change impacts on an action—as with an analysis of an action's impacts on climate change—should be governed by NEPA's "rule of reason."[126]

IV. NEPA, LAND-USE PLANNING, AND CLIMATE CHANGE

A. The Current Approach to Land-Use Planning on the Public Lands

Public land-use planning is required for all major federal land holdings, including national forest lands,[127] BLM-managed public lands,[128] national parks,[129] national wildlife refuges,[130] and even lands under the jurisdiction of the Department of Defense.[131] While parks, wildlife refuges, and defense installations are necessarily focused primarily on protecting the resources for which the lands were set aside, national forests and BLM public lands

in the U.S. (2009), http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts (last visited Apr. 7, 2012)).

123 *See id.* at 8 (citing U.S. GLOBAL CHANGE SCI. PROGRAM, CLIMATE MODELS: AN ASSESSMENT OF STRENGTHS AND LIMITATIONS (2008), *available at* http://www.climatescience.gov/Library/sap/sap3-1/final-report/sap3-1-final-all.pdf.)

124 *Id.* at 7.

125 *Id.*

126 *See id.* ("The focus of this analysis should be on the aspects of the environment that are affected by the proposed action and the significance of climate change for those aspects of the affected environment.").

127 National Forest Management Act of 1976, 16 U.S.C. § 1604 (2006).

128 Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1712 (2006).

129 *See* 16 U.S.C. § 1a-7(b) (2006) (requiring "[g]eneral management plans for the preservation and use of each unit of the National Park System"). The National Parks Omnibus Management Act of 1998, 16 U.S.C. §§ 5931–5937 (2006), builds on this requirement by establishing inventory and monitoring requirements on the agency, and by promoting scientific study of park resources, and the integration of study results into management decisions.

130 Under the National Wildlife Refuge System Administration Act of 1966, 16 U.S.C. §§ 668dd–668ee (2006), the U.S. Fish and Wildlife Service is required to prepare comprehensive plans for each wildlife refuge or complex of refuges by October 9, 2012. *Id.* § 668dd(e)(1)(B). *See, e.g.*, Zachary H. Gerson, *The Unrealized Authority of the Fish and Wildlife Service to Protect National Wildlife Refuges from Surface Disturbance Due to Private Mineral Rights*, 29 STAN. ENVTL. L.J. 181, 224–29 (2010) (arguing that conservation plans can guide the management of each refuge).

131 Under the Sikes Act, as amended in 1997, 16 U.S.C. §§ 670–670f, the Department of Defense, in cooperation with the U.S. Fish and Wildlife Service, is required to prepare integrated natural resource management plans "to implement landscape-level management of their natural resources while coordinating with various stakeholders." DEP'T OF DEF. NATURAL RES. CONSERVATION PROGRAM, INTEGRATED NATURAL RESOURCE MANAGEMENT PLANS 1 (2009), *available at* http://www.denix.osd.mil/nr/upload/inrmps-2.pdf.

have a broader "multiple use" mandate.[132] Because the Forest Service and BLM share this broad management responsibility, and because these two agencies are the largest public land managers, the issue of NEPA compliance in the land-use planning process has special relevance to them.[133] Still, all land management agencies confront climate change issues in managing their resources and so this analysis is by no means limited to the multiple use agencies.

Public land-use planning generally follows three steps. First, the agency prepares an inventory of the land's resources.[134] Second, the agency uses a public process to develop a land-use plan that identifies uses that will be allowed or prohibited, and that may further prescribe conditions or restrictions on such uses where they are allowed.[135] The third step, which occurs after the plan has been approved, involves monitoring and adjusting both the inventory and the plan to reflect new knowledge that is gained from experience.[136]

As suggested above, public land-use planning is not unlike land-use planning carried out by local governments. It essentially involves deciding what uses will be allowed or prohibited on particular tracts of land, and for

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132 National Forests are subject to the requirements of the Multiple-Use Sustained-Yield Act of 1960, 16 U.S.C. §§ 528–531 (2006). That statute defines "multiple use" broadly:

> The management of all the various renewable surface resources of the national forests so that they are utilized in the combination that will best meet the needs of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some land will be used for less than all of the resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration being given to the relative values of the various resources, and not necessarily the combination of uses that will give the greatest dollar return or the greatest unit output.

Id. § 531(a). The statue goes on to define "sustained yield" to mean "the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land." *Id.* § 531(b). BLM is subject to identical requirements under the Federal Land Policy and Management Act of 1976, 43 U.S.C. §§ 1701–1785 (2006). *See* §§ 1702(e), 1712(c)(1).

133 BLM manages over 245 million acres, while the Forest Service manages 193 million acres. U.S. Bureau of Land Mgmt., Dep't of the Interior, *About the BLM*, http://www.blm.gov/wo/st/en/info/About_BLM.html (last visited Apr. 7, 2012); U.S. Forest Serv., *About Us – Meet the Forest Service*, http://www.fs.fed.us/aboutus/meetfs.shtml (last visited Apr. 7, 2012).

134 *See* 43 C.F.R. § 1610.4-3 (2010); 36 C.F.R. § 219.5 (2011).

135 *See* 43 C.F.R. § 1610.4-8 (2010). The Forest Service requires collaborative planning that "actively engage[s] the American public, interested organizations, private landowners, state, local, and Tribal governments, federal agencies, and others in the stewardship of National Forest System lands." 36 C.F.R. §§ 219.3, 219.12(a) (2011).

136 Both BLM and the Forest Service have regulations in place to ensure monitoring and adaptation. BLM requires that "[t]he proposed plan shall establish intervals and standards, as appropriate, for monitoring and evaluation of the plan." 43 C.F.R. § 1610.4-9 (2010). The Forest Service requires that "[e]ach plan must contain a practicable, effective, and efficient monitoring strategy to evaluate sustainability in the plan area." 36 C.F.R. § 219.11(a) (2011).

those uses that are allowed, what restrictions can or must be imposed.[137] Some lands may be managed primarily for wilderness, primitive recreational use, or wildlife protection; others may be targeted for various types of development such as logging, oil and gas production, hard rock mining, or developed for recreational uses such as ski areas.[138] Compatible uses are generally allowed within each management area.[139]

Historically, both BLM and the Forest Service have prepared EISs in conjunction with their land-use plans.[140] The primary value of the EIS is to force the agency to consider alternative visions for the land management area.[141] The CEQ regulations describe the alternatives analysis as "the heart of the environmental impact statement"[142] It is supposed to "present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public."[143] The CEQ rules further require agencies to "[r]igorously explore and objectively evaluate all reasonable alternatives."[144]

In the context of public land-use planning, the requirement to explore and evaluate all reasonable alternatives is crucial. When properly followed, it assures that the public will have the opportunity to imagine what a land management area might look like under different management scenarios. Consider for example, a typical national forest that might have high potential for logging, oil and gas development, mining, developed recreation, and wilderness or primitive recreation.[145] Some areas of the forest might also be degraded due to past uses, while other areas remain largely in their natural condition. The area will most likely support a diverse population of flora and fauna, with a few species perhaps listed as endangered or threatened, or at risk for such a listing. For any such forest, different management scenarios might be developed to emphasize different uses to varying degrees. One scenario might maximize resource production; another might seek to maximize the protection of the natural environment and restore degraded lands. Any number of options might be offered in between these two

137 *See supra* notes 134–35 and accompanying text.

138 *See* U.S. Bureau of Land Mgmt., *supra* note 133.

139 *See, e.g.*, National Wildlife Refuge System Improvement Act of 1998, 16 U.S.C. § 668dd(a)(3)(B)–(D) (2006).

140 In 2006, the Forest Service promulgated a directive that categorically excluded national forest land-use plans from NEPA. 71 Fed. Reg. 75,481 (Dec. 15, 2006). Although the National Forest Management Act specifically requires land management plans to be prepared in accordance with NEPA, see 16 U.S.C. § 1604(g)(1) (2006), the agency claimed that the "[u]se of a categorical exclusion is itself a form of NEPA compliance." 71 Fed. Reg. at 75,493. This was a remarkable assertion since the CEQ rules that established the concept of a categorical exclusion were not promulgated until 1978—two years after NFMA and its NEPA compliance requirement were enacted.

141 40 C.F.R. § 1502.1 (2011).

142 *Id.* § 1502.14.

143 *Id.*

144 *Id.* § 1502.14(a).

145 *See* U.S. Bureau of Land Mgmt., *supra* note 133.

extremes, with certain areas set aside primarily for resource production and other areas slated for varying levels of protection. While the Forest Service will enjoy a great deal of flexibility in deciding which plan to adopt, some substantive legal constraints may limit the agency's choices, such as the obligation to protect threatened and endangered species.[146]

Once a land-use plan is approved, it necessarily restricts project-level choices made by the agency. So, for example, where a land-use plan designates a certain area to be managed primarily for primitive recreation, and specifically prohibits uses that are not compatible with primitive recreation, such as oil and gas development, the agency may not approve such development unless and until it lawfully amends the plan and changes the management emphasis for the area so that it can encompass the proposed use.[147]

B. Using NEPA to Address Climate Change in the Context of Land-Use Planning

As previously noted, the CEQ's Draft Climate Change Guidance omits recommendations for public land-use planning decisions, opting instead to solicit public comments on this subject.[148] The CEQ's reluctance to confront this issue reflects its difficulty.

The problem arises on two levels. First, climate change threatens to change public land resources irrespective of any land-use choices that are made by the agency during the planning process.[149] So, for example, a land-use plan that seeks to preserve the historic natural conditions of a landscape may be stymied by climatic changes that are outside the control of the planning agency. A NEPA process can anticipate some of these changes, but will not likely be meaningful or effective unless it is built around a plan for monitoring and adapting to the changes as they occur. As noted above, monitoring and adapting are generally built into the planning process itself, but planning agencies have often lacked the resources and the will to monitor effectively and to adapt when conditions call for it, and the public does not have an effective legal handle to push better performance by

146 *See* Endangered Species Act of 1973, 16 U.S.C. § 1538(a)(1)(B)–(C) (2006) (prohibiting generally the taking of listed species). The word "take" is broadly defined in the statute. *See id.* § 1532(19). In addition, the Endangered Species Act imposes on all federal agencies the affirmative obligation to "conserve" listed species. *Id.* §1531(c)(1).

147 *See* Ohio Forestry Ass'n v. Sierra Club, 523 U.S. 726, 733–34 (1998) (holding that the Sierra Club could not sue to challenge parts of a forest plan that had not yet been implemented). *But see* Norton v. S. Utah Wilderness Alliance, 542 U.S. 55, 71–72 (2004) (holding that land-use plans are essentially advisory and that an agency that commits to a plan does not necessarily have to implement the plan).

148 *See CEQ Draft Climate Change Guidance*, *supra* note 8, at 4.

149 *See* JOEL B. SMITH & WILLIAM R. TRAVIS, ADAPTATION TO CLIMATE CHANGE IN PUBLIC LANDS MANAGEMENT 4–5 (2010), *available at* http://sciencepolicy.colorado.edu/admin/publication_files/resource-2814-2010.12.pdf.

agencies.[150] A more robust application of NEPA in the planning context could go a long way toward addressing this problem.

Climate change also raises unique problems for public land managers at the project level. Almost any significant decision involving the development or use of resources impacts climate change directly or indirectly.[151] For example, a decision to open an area to oil and gas development will have a direct impact on climate change because of the fossil fuels that are burned to develop the site and the methane gases that are often released during development and production. The refining and end use of the oil and gas will have further, albeit less direct impacts on the climate.[152] Likewise, a decision to cut timber will require burning of fossil fuels and will remove carbon sinks from the forest.[153] What is different about such decisions in the public land-use planning context is that the land management agency often makes multiple decisions of the same kind over a landscape or multiple landscapes,[154] thereby exercising direct responsibility for cumulative climate impacts. The CEQ rules specifically require that these impacts be addressed during the NEPA process.[155] The difficult question for the agency is how to address these impacts in a meaningful way.

The difficult problem of addressing the cumulative impacts of all "past, present, and reasonably foreseeable future actions" has long challenged land management agencies.[156] The uncertainties surrounding climate change, and the global nature of climate change and all of the activities that cumulatively affect it, are part of what make the problem so intractable. In the NEPA context, the challenge is to assess these issues in a way that is meaningful in the context of the project that is being considered.

150 *See id.* at 10, 12 (noting that there is a lack of funding and staffing for federal agencies).

151 *See, e.g.*, Mohan Jiang et al., *Life Cycle Greenhouse Gas Emissions of Marcellus Shale Gas*, ENVTL. RESEARCH LETTERS, July–Sept. 2011, at 4–5, *available at* http://iopscience.iop.org/1748-9326/6/3/034014/pdf/1748-9326_6_3_034014.pdf (discussing the life cycle of GHGs associated with natural gas wells in the Marcellus shale).

152 U.S. ENVTL. PROT. AGENCY, DRAFT INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990–2010, at 3-1, 3-46 to 3-57 (2012), http://epa.gov/climatechange/emissions/usinventoryreport.html (last visited Apr, 7 2012).

153 *Id.* at 7-1.

154 *See, e.g.*, U.S. BUREAU OF LAND MGMT., NOTICE OF COMPETITIVE LEASE SALE: OIL AND GAS 1 (2012), *available at* http://www.blm.gov/pgdata/etc/medialib/blm/co/programs/oil_and_gas/Lease_Sale/2012.Par.60641.File.dat/May_2012_Final_Sale_Notice2.pdf (showing the BLM's decision to accept bids for oil and gas leases on over 30,000 acres of public land in Colorado).

155 See the definitions of "cumulative impact" and "scope" in the CEQ rules. 40 C.F.R. §§ 1508.7, 1508.25 (2011).

156 *See, e.g.*, Thomas v. Peterson, 753 F.2d 754, 759–60 (9th Cir. 1985).

V. CASE STUDIES

A. The Mountain Pine Beetle in Colorado and Southern Wyoming

Forests throughout the Rocky Mountain region are currently experiencing an epidemic caused by the Mountain Pine Beetle (*Dendroctonus ponderosae*) attacking and killing pine trees: predominantly lodgepole pines (*Pinus contorta*), but also ponderosas (*Pinus ponderosa*), scotch (*Pinus sylvestris*), and limber (*Pinus flexilis*).[157] The current outbreak is unprecedented in the recorded history of the region's forests and is largely attributed to symptoms of climate change, for example, warming temperatures and drought.[158] In Colorado and Southern Wyoming, the United States Forest Service currently employs a site-specific piecemeal approach to the epidemic which focuses entirely on protecting people and property from falling trees, does not address the post-beetle future forests, and largely escapes NEPA review using categorical exclusions.[159]

1. Climate Change and the Mountain Pine Beetle

The scientific consensus is that the unprecedented nature of the beetle outbreak is largely due to a warming climate.[160] Generally, the warming climate is leading to a longer beetle life cycle and less mortality, which, in turn, is driving the unprecedented tree mortality.[161] The warming climate has increased the beetle "flying season"—the days during which adult pine beetles are actively moving from tree to tree to lay their larvae—from roughly 50 days to roughly 120 to 130 days a year.[162] Beetles are now emerging in mid May, rather than late July, and the length of the flying

157 D.A. LEATHERMAN ET AL., TREES & SHRUBS: MOUNTAIN PINE BEETLE 1 (2007), *available at* http://csfs.colostate.edu/pdfs/MPB.pdf.

158 Though not stating that the underlying cause of the beetle epidemic is climate change, the U.S. Forest Service blames the beetle epidemic on many of the symptoms of climate change: "Triggered by drought and a shorter frost season, mountain pine beetle populations grew across a landscape of mature, dense, homogenous lodgepole pine trees. The long-term drought weakened tree resistance. Numerous warm winters also helped beetles survive and multiply." Forest Serv., U.S. Dep't of Agric., *Rocky Mtn. Bark Beetle: About the Epidemic*, http://www.fs.usda.gov/main/barkbeetle/aboutepidemic (last visited, Apr. 7, 2012).

159 *See* U.S. FOREST SERV., MOUNTAIN PINE BEETLE ON THE SOUTHEASTERN WYOMING: WHAT TO KNOW 2, *available at* http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5340089.pdf (describing the response of land management agencies to beetle infestations in Wyoming in 2011); U.S. FOREST SERV., MOUNTAIN PINE BEETLE ON THE COLORADO FRONT RANGE: WHAT TO KNOW 2 (2012), *available at* http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5340091.pdf (describing the response in Colorado in 2011).

160 *See supra* note 158 and accompanying text.

161 *See* José F. Negrón et al., *US Forest Service Bark Beetle Research in the Western United States: Looking Toward the Future*, 106 J. FORESTRY 325, 329 (2008), *available at* http://www.fs.fed.us/rm/pubs_other/rmrs_2008_negron_j002.pdf.

162 Jeffrey B. Mitton & Scott M. Ferrenberg, *Mountain Pine Beetle Develops an Unprecedented Summer Generation in Response to Climate Warming*, THE AMERICAN NATURALIST, May 2012, at 1, 4 tbl. 2.

season is allowing multiple generations to emerge in the same year; second-generation have been observed emerging in August and September.[163]

A warmer climate is also resulting in less larvae mortality during the winter and an increasing beetle habitat. The days at or below forty degrees Fahrenheit—the approximate temperature below which larvae cannot develop—have steadily decreased, while warmer temperatures have allowed the beetle to move from its previous 9000 ft. altitude limit to 11,000 ft.[164] The beetles' impacts on tree populations are further exaggerated by the effect of climate change on trees' defenses to the beetle; healthy trees can "pitch-out" the beetle—kill the beetles by drowning them in pitch—while trees stressed by drought are less able to defend themselves.[165]

Because of their sensitivity to climate change, the beetles' environmental impacts are an early indicator of climate change. The impacts of climate change are "magnified through biological and ecological feedback," and therefore relatively small changes in climate have immediate and disastrous effects.[166] As such, the beetles' devastation foreshadows future climate change impacts: "We will probably experience ecological catastrophes such as the loss of high-elevation five-needle pines long before we are paddling sea kayaks in Central Park."[167]

The mountain pine beetle is also having an immediate and significant impact on climate change as the devastated forests decompose and release their vast stores of carbon into the atmosphere.[168] A 2010 Forest Service aerial survey revealed that more than 4 million acres of forest in Colorado and Southern Wyoming have been impacted by the beetle since 1996.[169] While these numbers are staggering enough, in 2006, roughly 34 million acres of forest had been impacted in Canada's British Columbia.[170] There, a study found that the cumulative impact of the beetle epidemic from 2000 to 2020

163 *Id.* at 4.

164 Jesse A. Logan et al., *Assessing the Impacts of Global Warming on Forest Pest Dynamics*, 1 FRONTIERS ECOLOGY & ENV'T 130, 130 (2003); Mitton & Ferrenberg, *supra* note 162 (noting that "the upper elevational limit of [Mountain Pine Beetle] attacks has increased from roughly 2,740 m to more than 3,350 m," which equates to roughly 8,990 feet to 10,991 feet).

165 Negrón et al., *supra* note 161, at 329; Interview with James Krugman, Forester, U.S. Forest Service, Region 2, in Lakewood, Colo. (Apr. 21, 2011). "The recent large-scale dieback of [trees] and associated bark beetle outbreaks in the Southwestern United States has been linked to the 'climate change type drought' (e.g., dry and warm) that occurred in this region in the early 2000s. . . . [T]he western pine beetle . . . responded to the vast landscapes of drought-stressed trees, contributing significantly to the widespread tree mortality." Barbara Bentz, *Western U.S. Bark Beetles and Climate Change*, http://www.fs.fed.us/ccrc/topics/bark-beetles.shtml (last visited Apr. 7, 2012).

166 Logan et al., *supra* note 164, at 136.

167 *Id.*

168 *Id.*; *Dead Trees Spewing Greenhouse Gases*, REDORBIT, Nov. 16, 2007, http://www.redorbit.com/news/science/1147048/dead_trees_spewing_greenhouse_gases/ (last visited Apr. 7, 2012).

169 U.S. Forest Serv., *Rocky Mtn. Bark Beetle: More Than 4 Million Acres Impacted*, http://www.fs.usda.gov/main/barkbeetle/home (last visited Apr. 7, 2012).

170 W. A. Kurz et al., *Mountain Pine Beetle and Forest Carbon Feedback to Climate Change*, 452 NATURE 987, 987 (2008), *available at* http://www.sysecol2.ethz.ch/Refs/EntClim/K/Ku076.pdf.

would turn the British Columbia forests from a net carbon sink to a large net carbon source, emitting a total of 471 megatons of CO_2e during the worst years of 2003 through 2007.[171] This is significant when put in the context of Canada's total CO_2e output of 3678 megatons over the same period.[172]

2. The Forest Service Response to the Mountain Pine Beetle

The Forest Service's immediate response to pine beetle devastation in Colorado and Southern Wyoming has been tactical—mitigating immediate harms to public health and welfare posed by dead trees—rather than strategic—planning for the post-beetle future forest.[173] The Forest Service's only current concern is the risk posed by the over 100,000 beetle-killed trees falling every day.[174] Due to the rapid spread of the beetle epidemic, forest plans were not amended, and the Forest Service's site-specific tactical actions to improve human safety are occurring in a piecemeal fashion.[175] In 2007, the Forest Service did publish a Bark Beetle Incident Implementation Plan which was meant to "provide[] a strategy with a detailed multi-year [from 2007 to 2011] implementation schedule of integrated projects to enable the Forest Service to efficiently and effectively address the impacts associated with the mountain pine beetle epidemic in lodgepole pine on National Forest System lands."[176] However, this plan received no NEPA review and the Forest Service subsequently abandoned the plan.[177]

Many of the site-specific tactical actions that the Forest Service undertakes escape NEPA review because of two categorical exclusions appearing in the Forest Service regulations implementing NEPA and authorized by the Healthy Forests Restoration Act of 2003 (HFRA).[178] Pursuant to HFRA, the Forest Service "may conduct applied silvicultural assessments on Federal land" infected, or at risk of infection, by beetles,[179] and these "assessments" can be categorically excluded from NEPA if they occur on 1000 acres or less.[180] HFRA also allows a categorical exclusion for "hazardous fuel reduction" in "wildland-urban interface" areas,[181] where the

171 *Id.* at 987–88.

172 Env't Can., *Environmental Indicators: Greenhouse Gas Emissions Data*, http://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=en&n=BFB1B398-1 (last visited Apr. 7, 2012).

173 Interview with James Krugman, *supra* note 165.

174 U.S. Forest Serv., National Strategy: Bark Beetle Infestation in the Interior West 5 (drft. Nov. 22, 2010) (on file with author). "Keeping visitors, residents and employees safe in the forests is the most urgent priority." *Id.* at 6.

175 Interview with James Krugman, *supra* note 165.

176 *See* U.S. FOREST SERV., BARK BEETLE INCIDENT IMPLEMENTATION PLAN (2007 TO 2011): NARRATIVE 3 (2007), *available at* http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5195926.pdf.

177 Interview with James Krugman, *supra* note 165.

178 16 U.S.C. §§ 6501–6591 (2006).

179 *Id.* § 6554(a).

180 *Id.* § 6554(d)(1).

181 *Id.* § 6512.

forest is adjacent to developed land. The Forest Service used this statutory authority to create two categorical exclusions in its rules implementing NEPA: 1) for timber harvests on 250 acres or less of land in order to "to control insects or disease,"[182] and 2) for hazardous fuel reduction in wildland urban-interface areas.[183] Under current Forest Service regulations, a broad strategic plan to prepare for the post-beetle forest would escape NEPA review by falling under a categorical exclusion for land management plans.[184] However, the Forest Service's proposed planning regulations will require EISs for new plans and plan revisions, and thus any strategic beetle plan would then trigger an EIS.[185]

B. The Regional Water Supply Pipeline

The Million Conservation Resource Group has proposed drawing approximately 250,000 acre-feet of water out of the Green River's Flaming Gorge Reservoir, part of the already stressed Colorado River Basin, and transporting it by pipeline to the Front Range of Colorado and southeastern Wyoming.[186] The Regional Watershed Supply Project—commonly known as the "Million Pipeline"—is a private project, but the proponents are required to obtain a permit from the United States Army Corps of Engineers (Corps or Army Corps) under section 404 of the Clean Water Act,[187] and the Corps must prepare an EIS before it can approve any such permit.[188] The EIS process, when only in its infancy, was terminated when the permit application was withdrawn.[189] Given the consensus that climate change will significantly reduce future flows in the Colorado River Basin, if and how climate change had been addressed in the Army Corps's EIS would have significantly influence the Corps's decision.

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182 The categorical exclusion is for "[c]ommercial and non-commercial sanitation harvest of trees to control insects or disease not to exceed 250 acres, requiring no more than ½ mile of temporary road construction, including removal of infested/infected trees and adjacent live uninfested/uninfected trees as determined necessary to control the spread of insects or disease. The proposed action may include incidental removal of live or dead trees for landings, skid trails, and road clearing." 36 C.F.R. § 220.6(e)(14) (2011).

183 *Id.* § 220.6(e)(10).

184 The Forest Service regulations provide a categorical exclusion for "[l]and management plans, plan amendments, and plan revisions . . . that provide broad guidance and information for project and activity decisionmaking in a NFS unit." *Id.* § 220.6(e)(16).

185 *See* National Forest System Land Management Planning, 76 Fed. Reg. 8480, 8504 (Feb. 14, 2011) (to be codified at 36 C.F.R. § 219.5).

186 Denver Regulatory Office, U.S. Army Corps of Eng'rs, *Regional Watershed Supply Project Environmental Impact Statement (RWSP EIS)*, http://www.nwo.usace.army.mil/html/od-tl/eis/RWSP-EIS.html (last visited Apr. 7, 2012).

187 Section 404 requires the Army Corps to issue a permit before dredged or fill material can be discharged into the navigable waters of the United States. *See* 33 U.S.C. § 1344 (2006).

188 Denver Regulatory Office, *supra* note 186.

189 *Id.*

1. The Million Pipeline in the Context of the Colorado River Basin's Existing Allocations

As proposed, the Million Pipeline would annually remove as much as 250,000 acre-feet of water from the Colorado River Basin's Green River and Flaming Gorge Reservoir in Wyoming and bring that water east across the Continental Divide to southeastern Wyoming and the Front Range of Colorado.[190] The pipeline would be 578 miles long and require sixteen natural gas powered pump stations to move the water along the route.[191] An existing reservoir in Wyoming and new reservoirs in Colorado would be used to store the water.[192]

The amount of water involved in the Million Pipeline proposal is best understood in the broader context of the Colorado River Basin's current water allocation. Allocations on the Colorado River assume an average annual supply of at least 16.5 million acre-feet (MAF).[193] The Colorado River Compact contemplates that both the Upper Basin (Colorado, Utah, Wyoming, New Mexico, and part of Arizona) and the Lower Basin (California, Nevada, and Arizona) will receive on average 7.5 MAF annually.[194] The Mexican Water Treaty of 1944 allocates the remaining 1.5 MAF per year to Mexico.[195] The Upper Basin's annual allocation is further divided among the Upper Basin states as follows: Colorado, 51.75%; Utah, 23%; Wyoming, 14%; New Mexico, 11.25%; and Arizona 0.05 MAF.[196] If there is not enough surplus from the Colorado River Compact's allocation to supply Mexico's 1.5 MAF, the Colorado River Compact requires both the Upper Basin and the Lower Basin to sacrifice equally to ensure Mexico's supply.[197]

Although the 1922 Compact was designed to ensure the Upper Basin 7.5 MAF annually, the Upper Basin arguably bears most of the risk if supplies prove inadequate. This is because the Compact requires the Upper Basin to supply to the Lower Basin a ten-year rolling average of 75 MAF.[198] If the Upper Basin fails to maintain this ten-year flow, the Lower Basin can place a

190 *Id.*

191 *Id.*

192 *Id.*

193 Lorri Gray-Lee, Reg'l Dir., U.S. Bureau of Reclamation, Presentation at the Water Resources Research Center Annual Conference: Salinity and Desalination in the Southwest (Apr. 26–27, 2011), *available at* http://cals.arizona.edu/azwater/programs/conf2011/pdf/Gray-Lee.pdf.

194 Colorado River Compact, COLO. REV. STAT. § 37-61-101, art. II–III (2011) (citing the Colorado River Compact as incorporated into Colorado Law). The dividing line for the two basins is at Lee's Ferry, Arizona. *Id.*

195 *See* Treaty Respecting Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande, U.S.-Mex., Feb. 3, 1944, 59 Stat. 1219.

196 Upper Colorado River Compact, COLO. REV. STAT. § 37-62-10, art. III(2) (2011) (citing the Upper Colorado River Basin Compact as incorporated into Colorado Law).

197 COLO. REV. STAT. § 37-61-101, art. III(c) (2011).

198 *Id.* § 37-61-101, art. III(d).

"call" on the river and "require the delivery of water" from the Upper Basin to the Lower Basin to fulfill the deficiency.[199]

The Million Pipeline proposal thus assumes that the Colorado River Basin has sufficient flow to satisfy what Colorado views as its allocation of the River—51.75% of the 7.5 MAF that is supposed to be the Upper Basin's share.[200] But over the past century, the average annual flow of the Colorado River has been substantially less than the 16.5 MAF that was assumed when the Compact was signed in 1922.[201] For the period between 1906 and 2008 the average flow was approximately 15 MAF per year.[202] More recently, during the period from 1998 to 2008, average flows have fallen to approximately 12 MAF per year.[203] If this more recent figure signifies something closer to the long-term average due to climate change, then the Upper Basin's share of the River is likely less than 4 MAF. This is because the Upper Basin must deliver a minimum of 8.25 MAF annually to satisfy the Lower Basin, with an equal sharing of the burden of meeting Mexico's 1.5 MAF share.[204] This leaves only 3.75 MAF for all of the Upper Basin states, and Colorado's 51.5% share at only about 1.93 MAF. As of 2008, Colorado was already using 2.4 MAF per year.[205] Thus, it appears that even current Upper Basin uses are not sustainable unless long-term flows increase substantially to something closer to their historic average. But climate forecasts suggest that flows will continue to decrease.

The Bureau of Reclamation seems to recognize that even if historic flows remain constant, there is not enough water to support the Million Pipeline.[206] In response to a request by the Million Pipeline's developers, the Bureau prepared a water availability study for the Flaming Gorge Reservoir.[207] It found that the reservoir could only support a diversion of 165,000 acre-feet per year over the forty-year life of the pipeline.[208] But even

199 *See id.* § 37-61-101, art. III(d)–(e).

200 *Id.* at § 37-61-101, art. III(a); § 37-62-101, art. III(2).

201 *See* U.S. BUREAU OF RECLAMATION, LOWER COLORADO REGION, CURRENT NATURAL FLOW DATA 1906–2008 (2011), *available at* http://www.usbr.gov/lc/region/g4000/NaturalFlow/current.html. The allocations in the Colorado River Compact are based on flows from 1905 to 1920, one of the wettest periods on record for the Colorado River during which an average of 16.4 MAF per year flowed. ERNEST T. SMERDON ET AL., NAT'L RESEARCH COUNCIL COMM. ON THE SCIENTIFIC BASES OF COLO. RIVER BASIN WATER MGMT., COLORADO RIVER BASIN WATER MANAGEMENT: EVALUATING AND ADJUSTING TO HYDROCLIMATIC VARIABILITY 110–11 (2007).

202 U.S. BUREAU OF RECLAMATION, *supra* note 201.

203 *Id.*

204 SMERDON ET AL., *supra* note 201, at 39–40 (indicating that the Upper Basin must supply the Lower Basin with an average of 7.5 MAF per year, which, combined with half of Mexico's 1.5 MAF, amounts to 8.25 MAF).

205 U.S. BUREAU OF RECLAMATION, PROVISIONAL UPPER COLORADO RIVER BASIN CONSUMPTIVE USES AND LOSSES REPORT 2006–2010, at v (2011), *available at* http://www.usbr.gov/uc/library/envdocs/reports/crs/pdfs/cul2006-2010prov.pdf.

206 *See* Letter from Rick L. Gold, Reg'l Dir., U.S Bureau of Reclamation, to Don Ostler, Exec. Dir., Upper Colo. River Comm'n, add. at 1–2 (Mar. 30, 2007), *available at* http://www.westernresourceadvocates.org/water/pipeline/USBRReporttoUCRC.pdf.

207 *Id.* at 1.

208 *Id.* add. at 2.

this figure ignores the likely decreases in the long-term water supply due to climate change, relying instead solely on a historic flow regime, which seems unlikely to serve as a useful marker for predicting future flows.[209]

2. Climate Change Will Lead to Less Water Supply and More Water Demand in the Colorado River Basin

The scientific consensus is that temperatures in the Colorado River Basin are increasing and that these increased temperatures will result in decreased annual river flows.[210] In 2011, the Bureau of Reclamation found that Colorado River inflows at Lee's Ferry could decrease 8.5% by 2050 and cited studies finding decreased flows ranging from 6% to 45%.[211] Though it is unclear whether the warming will cause an increase or decrease in future precipitation, several other effects of climate change will likely depress Colorado River flows, including decreased snowpack, increased water demands for crops and other vegetation, and greater water loss from evapotranspiration and evaporation.[212]

The effects of a decreasing flow will be compounded by an ever increasing demand for water. In particular, the number of people dependent on the Colorado River will continue to grow and demand more water.[213] But regardless of population growth, climate change itself will increase demands, especially in agricultural uses: "[i]t is widely accepted that water demand changes will occur due to increased air temperatures, increased greenhouse gas concentrations, and changes in precipitation, winds, humidity, and atmospheric aerosol and ozone levels."[214] In short, climate change will most likely lead to a future with less supply and more demand in the Colorado River Basin.

3. Past NEPA Analyses of Water Projects Impacting Colorado River Flows Suggest a Reluctance to Incorporate Climate Change Predictions into Decisions

While the Million Pipeline EIS process was cancelled early, the Corps's analyses of other water projects drawing from the Colorado River Basin inspire little confidence that the Corps will incorporate some scientific assessment of the effect of climate change on future Colorado River flows. Two recent NEPA analyses of water projects in Colorado's Front Range

209 *Id.* add. at 1–2.

210 SMERDON ET AL., *supra* note 201, at 108–09.

211 *See* DEP'T OF THE INTERIOR, U.S. BUREAU OF RECLAMATION, SECURE WATER ACT SECTION 9503(C)—RECLAMATION CLIMATE CHANGE AND WATER 2011, at 32–36 (2011), *available at* http://www.usbr.gov/climate/SECURE/docs/SECUREWaterReport.pdf (fulfilling the Bureau of Reclamation's duty under 42 U.S.C. § 10363(c) (Supp. II 2008) to submit a report to Congress addressing each of the impacts of climate change on each of the river basins under Bureau's jurisdiction).

212 SMERDON ET AL., *supra* note 201, at 88.

213 *Id.* at 69–72.

214 DEP'T OF THE INTERIOR, *supra* note 211, at 39.

illustrate the Corps' approach to climate change impacts. The Windy Gap Firming Project proposes drawing an additional 30,000 acre-feet of water per year from the Colorado River Basin.[215] The Denver Water Board's Moffat Collection System Project proposes drawing an additional 18,000 acre-feet.[216] Climate change is addressed the same way in the draft EISs for both projects. The EISs acknowledge that climate change could lead to less water in the Colorado River Basin in the future, but stop short of quantifying the impact of climate change on flows and leave planners without a useful metric for decision making.[217]

C. Fossil Fuel Leasing and Development on Public Lands

Among the most challenging issues facing public land managers is how to address climate change in the context of proposals to lease federal deposits of fossil fuels—primarily oil, gas, coal, and perhaps oil shale in the future. This case study broadly considers NEPA analysis issues in the context of leasing or related activities.

1. Oil and Gas Generally

Federal oil and gas leasing inevitably raises questions about GHG emissions and climate change, but whether those questions can be addressed in a meaningful way in the context of a NEPA analysis is far from obvious. Even quantifying GHG emissions that may result from the leasing of federal oil and gas resources is complicated by the fact that GHGs are emitted at every stage in the process, beginning with exploration, and continuing through the production, refining, storage, transportation, and end use of the resource.[218] Moreover, depending on the type of development, oil and gas production often results in significant amounts of fugitive methane emissions, a GHG with significantly more climate change effects than CO_2.[219]

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215 U.S. BUREAU OF RECLAMATION, GREAT PLAINS REGION, DRAFT ENVIRONMENTAL IMPACT STATEMENT: WINDY GAP FIRMING PROJECT, at ES-1 to ES-2 (2008) [hereinafter WINDY GAP DEIS], *available at* http://www.northernwater.org/WaterProjects/WGFDocuments.aspx.

216 U.S. ARMY CORPS OF ENG'RS, DRAFT ENVIRONMENTAL IMPACT STATEMENT: MOFFAT COLLECTION SYSTEM PROJECT 1-2 to 1-3 (2009), *available at* http://www.nwo.usace.army.mil/html/od-tl/eis/moffat-deis-docs.html [hereinafter MOFFAT DEIS]; WINDY GAP DEIS, *supra* note 215, at 1-1.

217 MOFFAT DEIS, *supra* note 216, at 5-34 to 5-36 ("Climate change and global warming may be considered reasonably foreseeable; but currently, there is no accepted scientific method of transforming the general concept of increasing temperatures into incremental changes in stream flow or reservoir levels. . . . Thus, hydrologic changes in response to global climate change have not been quantitatively described in this EIS."); WINDY GAP DEIS, *supra* note 215, at 2-44 ("Hydrologic changes attributable to global climate change are a possibility; however, potential impacts have not been quantitatively estimated in the EIS because of the uncertainties associated with predicting change and the effects.").

218 Interview with Ellen Athas, Senior Counsel, Council on Envtl. Quality (May 11, 2011).

219 *See* Piers Forster et al., *Changes in Atmospheric Constituents and in Radiative Forcing*, *in* CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE

The BLM's recent series of decisions to lift the suspensions on fifty-three oil and gas leases in Montana illustrates the difficulty of analyzing climate change in a way that is meaningful to decision making.[220] In 2008, BLM issued sixty-one oil and gas leases on 38,000 acres of public land in Montana.[221] That decision was challenged in federal court on the grounds that BLM had failed to properly consider climate change in its NEPA analysis.[222] In March 2010, BLM settled the lawsuit and agreed to suspend the leases pending analysis of their climate change impacts.[223]

For most of the leases, the only effect of the settlement was a modest delay. In December 2010, BLM lifted the suspensions on fifty-three of the sixty-one leases after BLM made findings of no significant impact.[224] The EAs prepared for the decisions to lift the suspensions relied heavily on a 176-page Climate Change Supplementary Information Report (SIR) that thoroughly analyzed climate change implications both qualitatively and quantitatively.[225] After exhaustively explaining its quantitative methodology, the SIR went on to offer GHG emissions projections for each project area during the year predicted to have highest expected emissions from oil and gas production.[226] For example, oil and gas production in the Billings Planning Area is expected to have the most GHG emissions in 2030, when the SIR estimates 9040.61 metric tons of CO_2e will be emitted.[227]

NEPA analysis of federal oil and gas leasing is further complicated by the politics surrounding domestic energy production. The delay that resulted

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE: CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 212 tbl.2.14 (Susan Solomon et al. eds., 2007), *available at* http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg1_report_the_physical_science_basis.htm.

220 Press Release, Mont. State Office, U.S. Bureau of Land Mgmt., BLM Lifts Oil and Gas Lease Suspensions (Dec. 28, 2010), http://www.blm.gov/mt/st/en/info/newsroom/2010/december/suspendedleases.html (last visited Apr. 7, 2012).

221 Noelle Straub, *BLM Suspends Some Oil and Gas Lease Sales to Review Warming Impacts*, N.Y. TIMES, Apr. 9, 2010, http://www.nytimes.com/gwire/2010/04/09/09greenwire-blm-suspends-some-oil-and-gas-lease-sales-to-r-83918.html (last visited Apr. 7, 2012).

222 Settlement Agreement at 2, Mont. Envtl. Info. Ctr. v. U.S. Bureau of Land Mgmt., No. 08-178-M-DWM (D. Mont. Mar. 12, 2010) (on file with *Environmental Law*).

223 *Id.* at 4; Straub, *supra* note 221.

224 U.S. Bureau of Land Mgmt., *supra* note 220. The EAs are available at U.S. Bureau of Land Mgmt., Montana/Dakotas, *2010 Oil and Gas Leasing EAs*, http://www.blm.gov/mt/st/en/prog/energy/oil_and_gas/leasing/leasingEAs.html (last visited Apr. 7, 2012).

225 The SIR "describes the data and methodologies used to estimate greenhouse gas (GHG) emissions and consider potential climate change impacts resulting from future oil and gas development of Montana, North Dakota, and South Dakota federal mineral estate. GHG emissions are estimated based on use of current oil and gas exploration and production techniques. The report provides a summary of planning area oil and gas Reasonably Foreseeable Development (RFD) scenarios in the following BLM Field Offices (FOs)." URS CORP., CLIMATE CHANGE SUPPLEMENTARY INFORMATION REPORT: MONTANA, NORTH DAKOTA AND SOUTH DAKOTA 1-1 (2010), *available at* http://www.blm.gov/pgdata/etc/medialib/blm/mt/blm_programs/energy/oil_and_gas/leasing/eas.Par.26526.File.dat/SIRupdate.pdf. GHG emission inventories are also included for these planning areas. *Id.* at 5-4 to 5-16

226 *Id.* at 5-2 to 5-16.

227 *Id.* at 5-5 tbl.5-1.

from the Montana settlement persuaded some proponents of domestic energy production to introduce "The NEPA Certainty Act"[228] in the U.S. Senate, which if passed would bar agencies from considering climate change in any NEPA analyses.[229]

Finally, a November 2010 EPA GHG reporting rule will create some uniformity in how GHGs resulting from oil and gas production are measured, but it is still unclear how even uniform quantitative analyses will help decision makers.[230] The new rule requires oil and gas producers to report their GHG emissions if they are greater than 25,000 metric tons of CO_2e.[231] It provides uniform methodologies for calculating GHG emissions, but appears to limit the responsibility to calculate and report emissions resulting from actual production activities.[232] The rule does not require the reporting of emissions over the life of the produced oil or gas, which would, for example, encompass emissions from any possible combustion.[233] Still, the required EPA reporting gives oil and gas producers a uniform framework for quantitative GHG emissions analysis. And while this is a step in the right direction, it is not clear how this information will be helpful to agency decision makers.

2. Special Considerations for Leasing Unconventional Gas

In conventional gas recovery, fugitive methane emissions tend to be quite modest. The gas is trapped in permeable rock beneath an impermeable rock layer and when the impermeable rock is pierced, the gas rises to the surface where it is recovered.[234] Relatively little gas escapes during this process.[235] By 2009, however, most natural gas and some oil were being recovered unconventionally from shale rock through a method called

228 S. 3230, 111th Cong., 2d Sess. (2010), *available at* http://www.gpo.gov/fdsys/pkg/BILLS-111s3230is/pdf/BILLS-111s3230is.pdf.

229 *Id.* § 2(a)(4), (b) ("[I]solating the specific causes of various climatic changes is exceedingly difficult, if not impossible, to achieve" and therefore NEPA "should not be used to document, predict, or mitigate the climate effects of specific Federal actions.").

230 Mandatory Reporting of Greenhouse Gases: Petroleum and Natural Gas System, 75 Fed. Reg. 74,458 (Nov. 30, 2010) (codified at 40 C.F.R. pt. 98).

231 *Id.* at 74,461–62 (stating that the 25,000 metric ton threshold would apply to oil and gas producers (citing 40 C.F.R. § 98.2(a)(2)).

232 *Id.* at 74,462 (citing 40 C.F.R. pt. 98(W) for methodologies for calculating GHG emissions).

233 *See id.* at 74,462–63.

234 Energy Info. Admin., *What Is Shale Gas and Why Is It Important?*, http://www.eia.gov/energy_in_brief/about_shale_gas.cfm (last visited Apr. 7, 2012).

235 *See id.* ("Conventional gas reservoirs are created when natural gas migrates from an organic-rich source formation into permeable reservoir rock, where it is trapped by an overlying layer of impermeable rock. In contrast, shale gas resources form within the organic-rich shale source rock. The low permeability of the shale greatly inhibits the gas from migrating to more permeable reservoir rocks."). Without horizontal drilling and hydraulic fracturing, shale gas production would not be economically feasible because the natural gas would not flow from the formation at high enough rates to justify the cost of drilling. *Id.*

"fracking."[236] With fracking, "[l]arge volumes of water are forced under pressure into the shale to fracture and re-fracture the rock to boost gas flow."[237] By 2035, 75% of natural gas recovered domestically could come from fracking shale rock.[238]

Proponents of domestic energy production often cite natural gas as climate friendly because it is the fossil fuel with the least impact on climate change. The argument appears to have merit when considering the relative emissions of *burning* different fossil fuels.[239] Unfortunately, oil and gas produced with fracking techniques can release significant quantities of "fugitive" methane directly into the atmosphere.[240] Shale fracking can release significantly more fugitive methane than conventional recovery, both during drilling and from water returning to the surface after fracking.[241] Furthermore, scientists estimate that methane traps about twenty-five times as much heat as CO_2 over a hundred-year period.[242] One recent study suggests that fracking typically results in fugitive methane emissions of as much as 1.9% of the total amount of gas recovered.[243] According to that study, burning natural gas may be more climate friendly than burning other fossil fuels, but the overall GHG footprint for natural gas produced from fracking could be at least 20% more than the GHG footprint from coal.[244]

The findings in this study have been challenged recently for, among other things, vastly overestimating the fugitive emissions associated with

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236 *See* Robert W. Howarth et al., *Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations*, 106 CLIMATIC CHANGE 679, 680–81 (2011), *available at* http://www.springerlink.com/content/e384226wr4160653/fulltext.pdf.

237 *Id.* at 681.

238 *Id.* at 680 (stating that 75% of domestic gas will come from "unconventional gas," e.g., fracking).

239 *See* Energy Info. Admin., *Voluntary Reporting of Greenhouse Gases Program: Fuel Emission Coefficients*, http://www.eia.gov/oiaf/1605/coefficients.html (last visited Apr. 7, 2012). The U.S. Energy Information Administration has described CO_2 emissions from the various fossil fuels to produce the same amount of energy. Coal emits roughly 95 kg CO_2 per MMBtu; oil roughly 75 kg CO_2 per MMBtu; and natural gas, a relatively climate friendly 55 kg per kg CO_2 per MMBtu. *Id.* Put simply, natural gas appears to produce the same amount of energy for less CO_2.

240 Howarth et al., *supra* note 236, at 680, 685.

241 *Id.* at 681–83.

242 Piers Forster et al., *supra* note 219, at 212 tbl.2.14

243 Howarth et al., *supra* note 236, at 681–83.

244 The study explained:

> Considering the 20-year horizon, the GHG footprint for shale gas is at least 20% greater than and perhaps more than twice as great as that for coal when expressed per quantity of energy available during combustion. Over the 100-year frame, the GHG footprint is comparable to that for coal: the low-end shale-gas emissions are 18% lower than deep-mined coal, and the high-end shale-gas emissions are 15% greater than surface-mined coal emissions. For the 20 year horizon, the GHG footprint of shale gas is at least 50% greater than for oil, and perhaps 2.5-times greater. At the 100-year time scale, the footprint for shale gas is similar to or 35% greater than for oil.

Id. at 687 (citations omitted).

shale gas extraction.[245] Moreover, fugitive emissions may vary significantly from site to site, and in some cases the operator may be able to control, capture, or limit fugitive emissions.[246] However, these facts simply demonstrate the importance of a NEPA-like process to ensure that decision makers understand the potential for emissions and options available for controlling those emissions.

Fracking could unlock over 50 trillion cubic feet of natural gas previously thought unrecoverable in the Marcellus Shale Formation, located beneath Pennsylvania, West Virginia, New York, Ohio, Virginia, and Maryland.[247] Though most Marcellus Shale rights are held privately, and thus do not implicate NEPA through federal leasing, the Delaware River Basin Commission (DRBC)—an interstate commission formed by the federal government and the Delaware River Basin states[248]—is promulgating rules on fracking based on its authority to regulate water quality in the Delaware River Basin.[249] The DRBC ignored NEPA entirely in promulgating the regulations, but New York sued the Army Corps, a member of the DRBC, for failing to undertake a NEPA analysis of fracking's environmental impacts.[250] A successful lawsuit would likely force the DRBC to consider the unique

245 Lawrence M. Cathles, III et al., *A Commentary on "The Greenhouse-Gas Footprint of Natural Gas in Shale Formations" by R.W. Howarth, R. Santoro, and Anthony Ingraffea*, CLIMATIC CHANGE, Jan. 3, 2012, at 3–4, *available at* http://www.springerlink.com/content/x001g12t2332462p/fulltext.pdf (arguing Howarth et al. overstated the impacts of fugitive emissions). *But see* Robert W. Howarth et al., *Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et al.*, CLIMATIC CHANGE, Feb. 1, 2012, at 4–6, *available at* http://www.eeb.cornell.edu/howarth/Howarthetal2012_Final.pdf (defending his original premise that fugitive emissions drastically increase the impacts of shale gas on climate change over the lifecycle of the gas).

246 *See* U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-11-34, FEDERAL OIL AND GAS LEASES: OPPORTUNITIES EXIST TO CAPTURE VENTED AND FLARED NATURAL GAS, WHICH WOULD INCREASE ROYALTY PAYMENTS AND REDUCE GREENHOUSE GASES 7, 10 (2010), *available at* http://www.gao.gov/new.items/d1134.pdf.

247 ANTHONY ANDREWS ET AL., CONG. RESEARCH SERV., R 40894, UNCONVENTIONAL GAS SHALES: DEVELOPMENT, TECHNOLOGY, AND POLICY ISSUES 10, 12 (2009), *available at* http://assets.opencrs.com/rpts/R40894_20091030.pdf. The Marcellus Shale Formation could supply the Northeast with natural gas for approximately 13 years. *Id.* at 13–14.

248 The commission was created by the Delaware River Compact signed by Delaware, New York, New Jersey, Pennsylvania, and the federal government. DEL. CODE ANN. tit. 7, §§ 6501–6511 (2011) (the Del. River Basin Compact as incorporated into Delaware statutes).

249 Del. River Basin Comm'n, *Natural Gas Drilling Index Page*, http://www.nj.gov/drbc/programs/natural/ (last visited Apr. 7, 2012) (noting that the DRBC has legal authority over water quality and quantity throughout the basin). DRBC's proposed regulations are available here: Del. River Basin Comm'n, *Draft Natural Gas Development Regulations*, http://www.nj.gov/drbc/library/documents/naturalgas-REVISEDdraftregs110811.pdf (last visited Apr. 7, 2012).

250 *See* Lawrence Hurley, *N.Y. Fracking Lawsuit Raises NEPA Questions*, GREENWIRE, June 1, 2011, http://www.eenews.net/public/Greenwire/2011/06/01/4?page_type=print (last visited Apr. 7, 2012); Press Release, N.Y. Att'y Gen., A.G. Schneiderman to Sue Federal Government Today for Failure to Study "Fracking" (May 31, 2011), http://www.oag.state.ny.us/press-release/ag-schneiderman-sue-federal-government-today-failure-study-%E2%80%9Cfracking%E2%80%9D (last visited Apr. 7, 2012).

climate change implications of fracking activities in the Delaware River Basin.[251]

3. Special Considerations for Coal Mining

Coal mining is also a significant source of fugitive methane emissions. Coal production releases large quantities of methane, which is trapped in the coal, especially in the deeper deposits that are subject to development through underground mining methods.[252] Because it can explode, this "coal mine methane" (CMM) poses a significant danger to underground mine workers and, as a result, the Mine Safety and Health Administration (MSHA) requires coal operators to vent CMM into the atmosphere.[253] Alternatives to venting are flaring—burning the vented CMM to transform it into the more climate change friendly CO_2 before it enters the atmosphere—and CMM capture for onsite or offsite use as natural gas.[254] Currently, mine operators are reluctant to flare or capture.[255] The reluctance to flare is largely associated with the lack of clear guidance from MSHA on if and how CMM flaring is allowed under MSHA regulations.[256] The limitations on capture are due to legal uncertainty regarding who has a legal right to capture and use CMM, especially with respect to federal coal deposits.[257]

In *Amoco Production Co. v. Southern Ute Indian Tribe* (*Southern Ute*),[258] the U.S. Supreme Court held that the definition of "coal" under the Coal Lands Acts of 1909[259] and 1910[260] did not include CMM.[261] The Coal Lands Acts reserved federal coal rights in conjunction with the conveyance of the

251 *See* Complaint at 30, New York v. U.S. Army Corps of Eng'rs (E.D.N.Y. 2011), *available at* http://www.oag.state.ny.us/sites/default/files/press-releases/2011/DRBC%20Complaint%20%28Final%29.pdf (describing fracking's potential effect on the climate of New York).

252 *See* U.S. Envtl. Prot. Agency, *Coalbed Methane Outreach Program (CMOP)*, http://www.epa.gov/cmop/basic.html (last visited Apr. 7, 2012) (explaining sources of CMM).

253 *See id.* (describing hazard); *see also* 30 U.S.C. § 863(a) (2006) (stating that "[a]ll coal mines shall be ventilated").

254 *See* Teresa B. Clemmer, *Staving Off the Climate Crisis: The Sectoral Approach Under the Clean Air Act*, 40 ENVTL. L. 1125, 1153 (2010) (discussing the viability of capture and flaring).

255 *See* WildEarth Guardians v. U.S. Forest Serv., No. 08-CV-02167-MSK, 2011 WL 5172277, at *11–12 (D. Colo. Oct. 31, 2011) (discussing guidance from MSHA to U.S. Forest Service that there are "too many questions remaining unanswered" about flaring in finding that it was not arbitrary or capricious for Forest Service not to consider flaring as an option when preparing an EIS for a proposed mine).

256 CMM ventilation is required under 30 U.S.C. § 863, see *supra* note 253, but there is no clear guidance from MSHA on if and how ventilated CMM can be flared. *See WildEarth Guardians*, 2011 WL 5172277 at *2–3 (discussing the debate between multiple agencies about whether flaring would be allowed at a proposed mine).

257 *Wild Earth Guardians*, 2011 WL 5172277 at *3.

258 526 U.S. 865 (1999).

259 Act of March 3, 1909, Pub. L. No. 60-323, ch. 270, 35 Stat. 844 (codified at 30 U.S.C. § 81 (2006)).

260 Act of June 22, 1910, Pub. L. No. 61-226, ch. 318, 36 Stat. 583 (codified at 30 U.S.C. §§ 83–85 (2006)).

261 The Coal Lands Acts involved the reservation of federal mineral rights when conveying real property to private parties. *Southern Ute*, 526 U.S. at 870, 879.

remaining estate to a third party, and the *Southern Ute* decision held that these coal rights did not include the methane that was embedded in that coal.[262] *Southern Ute* does not apply directly to federal mineral properties that encompass, for example, the entire mineral estate. But because the Mineral Leasing Act (MLA)[263] establishes separate standards for coal and gas leasing, the *Southern Ute* interpretation of "coal" strongly suggests that a federal coal lessee has no right to the CMM unless that lessee can obtain a separate gas lease under the separate gas leasing provisions of the MLA.[264]

A 2008 Board of Land Appeals decision adds to the uncertainty created by *Southern Ute* by concluding that a gas lease cannot be issued under the MLA—even to the coal lessee—to recover fugitive emissions from coal mining because these fugitive emissions are not a "deposit" as defined by the MLA.[265] While legislation has been introduced to address this problem, it is tied up in an energy bill that is unlikely to be enacted in the near term.[266] The legal uncertainty regarding CMM ownership has exacerbated the prospects for promoting capture or flaring of CMM.[267]

An example that illustrates the problem involves a decision by BLM and the Forest Service to allow Colorado's West Elk Mine to vent CMM without flaring or capture.[268] In its initial NEPA analysis, the Forest Service failed to consider any alternatives to venting,[269] but in response to a legal challenge, and despite lacking clear authority to do so under the MLA, BLM amended the leases to require that West Elk capture the CMM if capture is "economically feasible" independent of their coal mining operations.[270] In its subsequent analysis of economic feasibility, West Elk determined that all of

262 *Id.* at 879.

263 30 U.S.C. § 181 (2006).

264 *See id.* §§ 201, 226; *Southern Ute*, 526 U.S. at 873–75.

265 Vessels Coal Gas, Inc., 175 IBLA 8, 25 (2008).

266 *See* Consolidated Land, Energy, and Aquatic Resources Act of 2010, H.R. 3534, 111th Cong., 2d Sess. (2010).

267 L. James Lyman, *Coalbed Methane: Crafting a Right to Sell from an Obligation to Vent*, 78 U. COLO. L. REV. 613, 616 (2007).

268 *WildEarth Guardians*, No. 08-cv-02167-MSK, 2011 WL 5172277, at *2, *5–6 (D. Colo. Oct. 31, 2011).

269 *See* U.S. FOREST SERV., FINAL–AUGUST 2007 ENVIRONMENTAL IMPACT STATEMENT: DEER CREEK SHAFT AND E SEAM METHANE DRAINAGE WELLS PROJECT 46, 59–60 (2007) (discussing the alternatives reviewed).

270 Letter from Lynn E. Rust, Deputy State Dir., U.S. Bureau of Land Mgmt., to Gene E. DiClaudio, President, Mountain Coal Co. (Apr. 25, 2009), *in* WEST ELK MINE E-SEAM GAS ECONOMIC EVALUATION REPORT, at Exhibit A (2009), *available at* http://www.wildearthguardians.org/support_docs/west_elk_mine_report_12.8.09.pdf; U.S. Bureau of Land Mgmt., *Coal Lease Addendum*, *in* WEST ELK MINE E-SEAM GAS ECONOMIC EVALUATION REPORT, at Exhibit C (2009), *available at* http://www.wildearthguardians.org/support_docs/west_elk_mine_report_12.8.09.pdf. "Lessee shall not be obligated or required to capture for use or sale coal mine methane that would otherwise be vented or discharged if the capture of the coal mine methane . . . is not economically feasible or if the coal mine methane must be vented in order to abate the potential hazard to the health or safety of the coal miners or coal mining activities." *Id.* (amending Coal Lease C-1362).

the alternatives to venting were economically infeasible.[271] The alternatives to venting that West Elk considered included flaring, using the gas for electric generation, selling the gas to a pipeline, capturing the CMM for carbon credits, and oxidizing the CMM.[272]

4. Oil Shale

Like other fossil fuels, oil shale development poses unique climate change impacts. Producing oil from shale will likely emit significantly more GHGs than conventional oil production, largely due to the heat needed to turn solid shale into liquid oil.[273] The current technology for producing oil from shale requires heating the shale rock to as much as 1000 degrees Fahrenheit.[274] The energy to heat the rock will likely come from burning GHG emitting fossil fuels,[275] thus producing significantly more GHG emissions than results from conventional oil production.[276]

BLM barely confronted these issues in making its 2008 decision to open 1.9 million acres of public land in the Green River Basin—located in Colorado, Utah, and Wyoming—for potential oil shale leasing.[277] The decision relied on an over 1000-page PEIS that discussed global climate change qualitatively for fewer than four pages.[278] Most importantly for potential decision makers, the PEIS draws no nexus between oil shale production and GHGs, instead relying on its broad discussion of global climate change and the uncertainty surrounding it.[279] The record of decision opening the land to

271 MOUNTAIN COAL CO. L.L.C., WEST ELK MINE E-SEAM GAS ECONOMIC EVALUATION REPORT 14 (2009), *available at* http://www.wildearthguardians.org/support_docs/west_elk_mine_report_12.8.09.pdf.

272 *Id.* at 13–17.

273 JAMES T. BARTIS ET AL., OIL SHALE DEVELOPMENT IN THE UNITED STATES: PROSPECTS AND POLICY ISSUES 40 (2005) ("[T]he production of petroleum products derived from oil shale will entail significantly higher emissions of carbon dioxide, compared with conventional crude oil production . . . .").

274 *Id.* at 13.

275 *Id.* at 17, 40.

276 *Id.* at 40.

277 Press Release, U.S. Bureau of Land Mgmt., BLM Identifies Lands for Potential Development of Significant Oil Shale Resources (Sept. 4, 2008), *available at* http://ostseis.anl.gov/documents/docs/ostsFinalPEIS_press_rls.pdf (describing BLM's opening of 1.9 million acres of lands for oil shale development); *see* U.S. BUREAU OF LAND MGMT., APPROVED RESOURCE MANAGEMENT PLAN AMENDMENTS/RECORD OF DECISION (ROD) FOR OIL SHALE AND TAR SANDS RESOURCES TO ADDRESS LAND USE ALLOCATIONS IN COLORADO, UTAH, AND WYOMING AND FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT 50–51 (2008), *available at* http://ostseis.anl.gov/documents/docs/OSTS_ROD.pdf [hereinafter OIL SHALE ROD] (explaining that BLM considered the effects of GHG emissions on critical habitat and endangered species, but concluded that its proposed action would have no effect).

278 *See* U.S. BUREAU OF LAND MGMT., PROPOSED OIL SHALE AND TAR SANDS RESOURCE MANAGEMENT PLAN AMENDMENTS TO ADDRESS LAND USE ALLOCATIONS IN COLORADO, UTAH, AND WYOMING AND FINAL PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT 3-100 to 3-101, 4-51 to 4-52 (2008) [hereinafter OIL SHALE PEIS], *available at* http://ostseis.anl.gov/documents/fpeis/vol1/OSTS_FPEIS_Vol1_Front.pdf.

279 *See id.*

leasing makes no mention of climate change and discusses GHGs only in discussing its compliance under section 7 of the Endangered Species Act.[280] There, BLM reasoned that opening lands for future leasing is not actual leasing, and therefore the decision to open lands cannot actually lead to GHG emissions.[281] In this way of thinking, the only decision that would require consideration of actual GHG emissions would be a project-specific leasing decision. If BLM is waiting for subsequent actions to connect climate change implications to actual leasing, it is following the letter of NEPA law; an environmental impact need not be considered in a NEPA analysis until there has been an "irretrievable commitment of resources."[282] However, waiting for site-specific decisions for such an analysis avoids a broad project-level analysis of climate change that would seemingly be more helpful to decision makers.

In January 2012, BLM issued a draft PEIS to consider amending the 2008 oil shale leasing decision.[283] Under the preferred alternative, less than half of the roughly 2 million acres of public land opened for oil shale leasing in 2008 would remain open for leasing, and any leasing would be limited to research and development.[284] Despite the environmental concerns cited for preparing an amended PEIS, the new discussion of climate change—similar to the 2008 PEIS's discussion—is purely qualitative, broad, and seemingly unhelpful to decision makers: "Activities associated with oil shale and tar sands development, if any, would contribute to overall atmospheric GHG emissions; however, it is not possible at this time to predict either the specifics of those GHG emissions, or how they might result in specific climate change related impacts."[285]

5. Addressing Climate Change in Fossil Fuel Development

While the development scenarios for different types of fossil fuels vary considerably, several common analytical issues relating to climate change emerge from this review. First, it is possible to identify quantitatively the extent of GHG emissions associated with the various types of fossil fuel development, and to describe generally the impact of GHG emissions on the

280 OIL SHALE ROD, *supra* note 277, at 50–51.

281 *Id.* at 50.

282 Conner v. Burford, 848 F.2d 1441, 1448 (9th Cir. 1988). "For projects directly undertaken by Federal agencies the [EIS] shall be prepared at the feasibility analysis *(go-no go) stage* and may be supplemented at a later stage if necessary." 40 C.F.R. § 1502.5(a) (2011) (emphasis added).

283 U.S. BUREAU OF LAND MGMT., DRAFT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT AND POSSIBLE LAND USE PLAN AMENDMENTS FOR ALLOCATION OF OIL SHALE AND TAR SANDS RESOURCES ON LANDS ADMINISTERED BY THE BUREAU OF LAND MANAGEMENT IN COLORADO, UTAH, AND WYOMING, at ES-1 (2012), *available at* http://ostseis.anl.gov/documents/peis2012/vol/OSTS_VOLUME_1.pdf.

284 *Id.* at ES-5 to ES-6, ES-9.

285 *Id.* at 3-102.

global climate.[286] To the extent that such development must be preceded by a NEPA process, courts may require such a quantitative analysis by agencies for decisions that are likely to result in more than a de minimis level of GHG emissions. Second, agencies seem uncertain about how to use this information to better inform their decisions, and as a result, information about GHG emissions does not seem to be particularly meaningful in the decision-making process. Finally, implicit in the decision to quantify GHG emissions is the assumption that such emissions impose external costs. While agencies have thus far not made much progress in quantifying those costs, doing so would offer a relatively simple way to address climate change in a meaningful way during the NEPA process. The prospect for estimating the external costs associated with GHG emissions is explored in greater detail in the final Part of this Article.

VI. RECOMMENDATIONS

The goal of all NEPA analyses "is not to generate paperwork—even excellent paperwork—but to foster excellent action."[287] As the case studies demonstrate, even when land-use planning agencies undertake thorough, exhaustive, and often quite lengthy NEPA analyses of climate change, those analyses often do little to inform the actual decision.

What follows are a series of recommendations to assist land management agencies in undertaking climate change analyses in a manner that helps promote better decisions. First, we recommend that agencies attach a price to GHG emissions that reflects the cost of climate change emissions.[288] This will allow agencies to consider those GHG emissions that result from their actions in a meaningful way. Second, we recommend that the CEQ promulgate regulations requiring agencies to take discrete actions associated with any commitment to mitigate the effects of climate change with adaptive management.[289] This will ensure that agencies are held accountable for that adaptive management through the prospect of third-party enforcement. Each of these recommendations is described in more detail below.

A. Land Management Agencies Must Quantify Both the Amount and Value of GHG Emissions to Fairly Consider the Climate-Related Impacts of Their Decisions

As the case studies show, land management agencies are reasonably adept at quantifying GHG emissions but flummoxed by how those quantified GHG emissions should impact their decisions. Solving this problem begins

286 *See, e.g.*, 40 C.F.R. §§ 98.1–98.2 (2011) (providing appropriate methodology and instruction for calculating GHG emissions from various source categories).

287 *Id.* § 1500.1(c).

288 *See* discussion *infra* Part IV.A.

289 *See* discussion *infra* Part IV.B.

by recognizing that GHG emissions impose external costs that must be reflected, to the extent possible, in agency decisions. Once a price is placed on each ton of CO_2e, determining the impact from GHG emissions is a simple matter of multiplying total emissions by that cost.

Of course, estimating the cost per ton of CO_2e emissions will be difficult, in part because the basis for establishing a price is not even clear. Should it be set by the cost of purchasing carbon credits in a cap-and-trade market? Should it be based upon the offset market price for GHG emissions? Or should the figure derive from an economic estimate of the social cost of carbon? Each of these approaches is likely to yield significantly different prices and each are described in more detail below, but the key is for decision makers to determine a price and ensure that the resulting costs of carbon emissions are taken into account in the decision.

Quantifying and considering the external costs associated with GHG emissions are critical given the staggering costs associated with climate change. While the costs are difficult to calculate, some economists estimate the discounted cost of all future climate change to be as high as 14% of global gross domestic product.[290] Among these costs are the human health and environmental impacts associated with coastal erosion, flooding, drought, wildfire, increased risk of plant and animal extinction, and increased stress on already taxed water resources.[291] Scientists have also linked a warming climate to an increase in the number, duration, and intensity of destructive tropical cyclones and inland storms.[292] The recent increase in the frequency and intensity of extreme weather in the United States bears[293] out these predictions. As the climate continues to warm, the United States can likely expect more frequent severe hurricanes like 2005's

290 Gary W. Yohe et al., *Perspectives on Climate Change and Sustainability*, *in* CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE: CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 811, 821 (Martin Parry et al. eds., 2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-chapter20.pdf. *See generally* NICHOLAS HERBERT STERN, THE ECONOMICS OF CLIMATE CHANGE: THE STERN REVIEW 143–67 (2007), *available at* http://www.hm-treasury.gov.uk/d/Chapter_6_Economic_modelling_of_climate-change_impacts.pdf (discussing the general impacts of climate change on the world economy and estimating that climate change, if left unmitigated, will result in global decreases in consumption of 5% to 20%).

291 INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 6, at 48–49.

292 *See* Lauren Morello & Evan Lehmann, *Deadly Joplin, Mo., Twister Raises 'Tough,' Costly Questions, Weather Experts Say*, CLIMATEWIRE, May 24, 2011, http://www.eenews.net/public/climatewire/2011/05/24/1?page_type=print (last visited Apr. 7, 2012) (interviewing the Director of the National Oceanic and Atmospheric Administration National Weather Service, who said that though we have experienced an increase in destructive tornadoes, he is uncertain whether the evidence definitively supports climate change as the cause); *see also* P. J. Webster et al., *Changes in Tropical Cyclone Number, Duration, and Intensity in a Warming Environment*, 309 SCIENCE 1844, 1844, 1846 (2005), *available at* http://www.sciencemag.org/content/309/5742/1844.full.

293 One-third of all inland thunderstorm insurance claims since 1990 are from the past three years. Morello & Lehmann, *supra* note 292.

Katrina, the most costly hurricane in United States history, for which recovery is still underway.[294]

The best-established cap-and-trade system is the European Union Emissions Trading System (EU ETS), which began in 2005 and currently involves all of the EU countries and three non-EU countries.[295] The Regional Greenhouse Gas Initiative (RGGI) was the first active cap-and-trade market in the United States.[296] It sets a mandatory cap on GHG emissions from electric power generators in nine northeastern and mid-Atlantic states.[297] From 2003 through 2010 the Chicago Climate Exchange maintained a voluntary cap-and-trade market that included "major corporations, utilities and financial institutions with activities in all 50 United States, 8 Canadian provinces and 16 countries."[298] The price for an allowance to emit one ton of CO_2e was on average $3.26 during the existence of the Chicago Exchange market,[299] fluctuated roughly between $1.50 and $2.50 during 2010 in the RGGI market,[300] and is currently $8.55 on the EU ETS. [301] California began implementing a mandatory cap-and-trade system for all large emitters in 2012.[302] In 2009, the United States House of Representatives passed the

294 AXEL GRAUMANN ET AL., NAT'L OCEANIC & ATMOSPHERIC ADMIN., HURRICANE KATRINA: A CLIMATOLOGICAL PERSPECTIVE 1, 3, 12 (2005), *available at* http://www.ncdc.noaa.gov/oa/reports/tech-report-200501z.pdf. *See generally* Massachusetts v. U.S. Envtl. Prot. Agency, 549 U.S. 497, 521–22 (2007) (explaining that one climate scientist has observed that "rising ocean temperatures may contribute to the ferocity of hurricanes").

295 European Comm'n, *Emissions Trading System (EU ETS)*, http://ec.europa.eu/clima/policies/ets/index_en.htm (last visited Apr. 8, 2012).

296 Reg'l Greenhouse Gas Initiative, *CO2 Budget Trading Program*, http://www.rggi.org/ (last visited Apr. 7, 2012).

297 *Id.* The states participating in RGGI are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. *Id.*

298 CHI. CLIMATE EXCH., CCX FACT SHEET 3 (2011), *available at* https://www.theice.com/publicdocs/ccx/CCX_Fact_Sheet.pdf; *see also* Nathaniel Gronewold, *Chicago Climate Exchange Closes Nation's First Cap-and-Trade System but Keeps Eye to the Future*, N.Y. TIMES, Jan. 3, 2011, http://www.nytimes.com/cwire/2011/01/03/03climatewire-chicago-climate-exchange-closes-but-keeps-ey-78598.html (last visited Apr. 7, 2012) (describing the end of the Chicago Exchange's voluntary cap-and-trade system, and the continuation of its offset scheme).

299 Gronewold, *supra* note 298.

300 POTOMAC ECON., ANNUAL REPORT ON THE MARKET FOR RGGI CO_2 ALLOWANCES: 2010, at 15 fig.1 (2011), *available at* http://www.rggi.org/docs/MM_2010_Annual_Report.pdf.

301 *European Climate Exchange OTC 1st Year CO2 Emission EU ETS Px*, BLOOMBERG, http://www.bloomberg.com/apps/quote?ticker=EECXSYR1:IND (last visited Apr. 7, 2012).

302 Press Release, Cal. Envtl. Prot. Agency, California Air Resources Board Gives Green Light to California's Emissions Trading Program (Dec. 16, 2010), *available at* http://www.arb.ca.gov/newsrel/2010/cap_and_trade_release.pdf. Registration for the cap-and-trade program ended in January 2012 and the first auction will occur in June 2012. AIR RES. BD., CAL. ENVTL. PROT. AGENCY, MAJOR ACTIVITIES FOR THE CAP-AND-TRADE AND MANDATORY REPORTING PROGRAM IN 2012 (2012), *available at* http://www.arb.ca.gov/cc/capandtrade/2012activities.pdf. The statute creating the authority for the Air Resources Board to implement the cap-and-trade program is the California Global Warming Solutions Act of 2006, CAL. HEALTH & SAFETY CODE §§ 38500–38570 (West 2012).

American Clean Energy and Security Act of 2009.[303] This billwhich would have created a nationwide cap-and-trade market in the United States similar to that of the EU ETS, but it never passed the Senate and the prospects for a national mandatory cap-and-trade system in the United States seem dim, at least in the short term.[304]

All of the cap-and-trade systems create a market, and thus a market price, for carbon by creating artificial scarcity. An emissions cap is set for all market participants (the Chicago Exchange's cap was 700 million megatons of CO_2e per year while the 2013 EU ETS cap will be 2.04 billion megatons of CO_2e per year);[305] that cap is allocated among participants as rights to emit a set amount of CO_2e (Chicago allocations were 100 tons of CO_2e and EU ETS allocations are one ton of CO_2e);[306] and market participants are then free to trade their allocations, while the trading market establishes a price. While these markets can serve an important purpose in reducing GHG emissions, the artificial nature of these markets makes them less desirable as a tool for estimating external costs.

Perhaps more relevant to land management applications is the similar concept of carbon offsets. A carbon offset is "a unit of [CO_2e] that is reduced, avoided, or sequestered to compensate for emissions occurring elsewhere."[307] Rather than decreasing its own emissions, a net carbon emitter can offset its emissions by paying for a project elsewhere that reduces or sequesters GHGs. In the United States, both RGGI and the Chicago Climate Exchange currently provide a market for carbon offsets. With RGGI, the electric generators governed by the cap can buy carbon offsets, rather than allowances, to cover up to 3.3% of their CO_2e emissions, and the categories of projects permitted for offsets include land-use applications like landfill methane capture and planting trees, or preventing deforestation for carbon sequestration.[308] The Chicago Climate Exchange provides a voluntary market for carbon emitters to offset their carbon footprint.[309] There, the project categories accepted for offsets are much broader, including coalmine methane capture, forestry carbon sequestration, landfill methane, and

303 H.R. 2454, 111th Cong. (2009); *see also* Library of Congress, *Bill Summary & Status, 111th Congress (2009-2010), H.R. 2454, Major Congressional Actions*, http://thomas.loc.gov/cgi-bin/bdquery/z?d111:HR02454:@@@R (last visited Apr. 7, 2012).

304 H.R. 2454 §§ 721–728; *see also* Library of Congress, *supra* note 303.

305 CHI. CLIMATE EXCH., *supra* note 298, at 3; European Comm'n, *Climate Action: Cap*, http://ec.europa.eu/clima/policies/ets/cap/index_en.htm (last visited Apr. 7, 2012).

306 Climate Lab, *Chicago Climate Exchange*, http://climatelab.org/Chicago_Climate_Exchange (last visited Apr. 7, 2012); *European Climate Exchange OTC 1st Year CO2 Emission EU ETS Px*, *supra* note 301.

307 WORLD RES. INST., THE BOTTOM LINE ON OFFSETS 1 (2010), *available at* http://pdf.wri.org/bottom_line_offsets.pdf (last visited Apr. 7, 2012).

308 Reg'l Greenhouse Gas Initiative, *CO_2 Offsets*, http://www.rggi.org/market/offsets (last visited Apr. 7, 2012); Reg'l Greenhouse Gas Initiative, *Offset Categories*, http://rggi.org/market/offsets/categories (last visited Apr. 7, 2012).

309 CHI. CLIMATE EXCH., *supra* note 298, at 3.

renewable energy systems.[310] Chicago offset prices in 2011 ranged from $.05 to $2.75 per ton of CO_2e.[311] The current largest offset program in the world is incorporated into the Kyoto Protocol.[312] Industrialized countries can meet their carbon emissions requirements under Kyoto by reducing their own emissions or paying for emissions reduction or sequestration programs in developing countries.[313] As of March 2012, 3,886 offset projects, known as Clean Development Mechanisms (CDMs), have been approved and purport to generate annual offsets of 571,446,694 tons of CO_2e in the industrialized world.[314] Using an offset price has more appeal than the cap-and-trade market price since the offset price is designed to reflect a commitment to making an action carbon neutral.[315] Still, concerns about whether CDMs actually achieve the offsets claimed for them[316] suggest that this approach must be used with care.

Unlike cap-and-trade and offset prices for GHGs, the social cost of carbon (SCC) seeks to tie a price to the actual costs of climate change.[317] Mandatory caps and offsets establish a price by creating artificial scarcity through restricting supply, while the price for voluntary caps and offsets relies solely on the altruism of those choosing to participate in the market. By contrast, the SCC is designed to reflect the true price of carbon emissions since it represents the marginal cost "of the *climate change impacts* from 1 tonne of [CO_2e emitted today], aggregated over time and discounted back to

310 The complete list of carbon offset project types can be found at the Chicago Climate Exchange website. *See* Chi. Climate Exch., *CCX Offset Project Public Registry Homepage*, https://registry.chicagoclimatex.com/public/projectsReport.jsp (last visited Apr. 7, 2012).

311 Chi. Climate Exch., *CCX Daily Transactions*, https://www.theice.com/publicdocs/ccx/CCX_Daily_Transactions.xls (last visited Apr. 7, 2012).

312 ELEC. POWER RESEARCH INST., A COMPARISON OF GREENHOUSE GAS EMISSIONS OFFSETS PROJECT DEVELOPMENT AND APPROVAL PROCESS 2 (2010), *available at* http://globalclimate.epri.com/doc/EPRI_Offsets_Wrkshp8_Background%20Paper_Offset%20Dvlpmnt%20%26%20Approval%20Processes_Final2_063010_Locked.pdf.

313 U.N. Framework Convention on Climate Change, *About CDM*, http://cdm.unfccc.int/about/index.html (last visited Apr. 7, 2012).

314 U.N. Framework Convention on Climate Change, *CDM in Numbers*, http://cdm.unfccc.int/Statistics/index.html (last visited Apr. 7, 2012). Current CDMs include, for example, renewable energy projects, capture of fugitive emissions from fossil fuel production and consumption, and planting forests and preventing deforestation. U.N. Framework Convention on Climate Change, *Project Search*, http://cdm.unfccc.int/Projects/projsearch.html (last visited Apr. 7, 2012) (providing a searchable database of CDMs).

315 *See, e.g.*, U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-08-1048, CARBON OFFSETS: THE U.S. VOLUNTARY MARKET IS GROWING, BUT QUALITY ASSURANCE POSES CHALLENGES FOR MARKET PARTICIPANTS 33–35 (2008), *available at* http://www.gao.gov/assets/280/279878.pdf (discussing the inherent benefit of carbon offsets in securing effective carbon reductions).

316 *See* OFFSET QUALITY INITIATIVE, ASSESSING OFFSET QUALITY IN THE CLEAN DEVELOPMENT MECHANISM 6–16 (2009), *available at* http://www.climatetrust.org/documents/OQICDMpaper_webversion.pdf (offering recommendations to ensure CDMs truly result in a net carbon reduction).

317 *See* Yohe et al., *supra* note 290, at 821; *see also Glossary*, *in* CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE: CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 290, at 869, 881.

the present day."[318] The SCC is difficult to calculate, however, and estimates by economists vary widely. One 2005 study cited by the IPCC aggregated existing SCC estimates from other published studies.[319] It found that the median SCC from all studies was roughly $3.80 per ton of CO_2e, the mean from all studies was roughly $25.30 per ton of CO_2e, the mean from peer reviewed studies was roughly $11.70 per ton of CO_2e, and the standard deviation from peer review studies—revealing the extreme variability in the estimates—was roughly $22.60 per ton of CO_2e.[320]

The United States Government has attempted to estimate SCCs for incorporation into agency decision making, but these estimates have come under attack for being too conservative. In 2010, the United States Government's Interagency Working Group (IWG) on Social Cost of Carbon published a report estimating SCCs.[321] The IWG was attempting to help agencies fulfill their obligation under Executive Order 12866[322] to "assess both the costs and the benefits of [any] intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs."[323] The IWG's SCC estimates are in 2007 dollars per ton of CO_2e emitted and offer a range of possible SCCs based on most likely climate change impacts and worst-case scenario SCCs based on worse-than-expected future climate change impacts, from 2010 to 2050.[324] For 2010, the IWG estimates a $4.70 to $35.10 range of most likely SCCs, and a worst-case SCC of $64.90.[325] The IWG also offers a most likely SCC estimate for 2010 of $21.40.[326] The IWG's SCC estimates were challenged in a July 2011 report by the Economics for Equity and the Environment Network (E3).[327] The authors of the E3 study argue that the government's study "omits

318 *Id.* at 881 (emphasis in original).

319 *See* Richard S.J. Tol, *The Marginal Damage Costs of Carbon Dioxide Emissions: An Assessment of the Uncertainties*, 33 ENERGY POL'Y 2064, 2072 (2005), *available at* http://puc.sd.gov/commission/dockets/civil/2006/civ06-399/7930-7940.pdf.

320 *See* Yohe et al., *supra* note 290, at 822 (citing Tol, *supra* note 319, at 2068–69). The SCC is measured in both dollars per metric ton of carbon and dollars per metric ton of carbon dioxide. One metric ton of carbon is equivalent to 3.67 tons of CO_2e. U.S. ENVTL. PROT. AGENCY, METRICS FOR EXPRESSING GREENHOUSE GAS EMISSIONS: CARBON EQUIVALENTS AND CARBON DIOXIDE EQUIVALENTS 3 (2005), *available at* http://www.tribesandclimatechange.org/docs/tribes_66.pdf. The IPCC presents SCCs in dollars per metric ton of carbon, which have been converted in this Report to dollars per metric ton of CO_2e.

321 INTERAGENCY WORKING GRP. ON SOCIAL COST OF CARBON, TECHNICAL SUPPORT DOCUMENT: SOCIAL COST OF CARBON FOR REGULATORY IMPACT ANALYSIS UNDER EXECUTIVE ORDER 12866, at 1 (2010), *available at* http://www.epa.gov/oms/climate/regulations/scc-tsd.pdf.

322 *Id.*

323 Exec. Order No. 12866, 58 Fed. Reg. 51,735, 51,736 (Oct. 4, 1993).

324 INTERAGENCY WORKING GRP. ON SOCIAL COST OF CARBON, *supra* note 321, at 1, 3.

325 *Id.* at 1.

326 *Id.* at 1, 3.

327 *See* FRANK ACKERMAN & ELIZABETH A. STANTON, CLIMATE RISKS AND CARBON PRICES: REVISING THE SOCIAL COST OF CARBON 3 (2011), *available at* http://www.e3network.org/papers/Climate_Risks_and_Carbon_Prices_full_report.pdf (noting that uncertainties within the government's IWG Report regarding climate sensitivity to GHGs, the damage expected at low

many of the biggest risks associated with climate change, and downplays the impact of our current emissions on future generations."[328] Because the E3 study includes these risks and impacts, it estimates significantly higher SCCs for 2010, ranging from $28 to $481 and with worst-case scenario SCCs as high as $893.[329]

Both the IWG and the E3 encourage agencies to account for the uncertainty of climate change and its impacts by creating ranges of SCCs, rather than single SCC estimates, for use in decision making. As the IWG explained, its goal "was to develop a range of SCC values using a defensible set of input assumptions grounded in the existing scientific and economic literatures. In this way, key uncertainties and model differences transparently and consistently inform the range of SCC estimates used in the rulemaking process."[330] As such, agencies using these ranges of SCC estimates for decision making would not simply evaluate their actions based on the most likely SCC estimate—the IWG's $21.40 estimate—but would also consider the SCCs representing the range of likely climate change impacts—$4.70–$35.10 for the IWG, or $28–$481 for the E3—and less likely, but more devastating, worst-case climate change impacts—$64.90 for the IWG and up to $893 for the E3.[331]

None of the mechanisms for pricing carbon are perfect. The artificial prices associated with cap-and-trade and offsets are easily determined but do not reflect the external costs associated with CO_2e emissions. The SCC attempts to represent the true cost of carbon, but the SCC estimates vary widely and the true price is intensely debated among economists. Still, because it focuses on the actual external costs of carbon, the SCC seems to offer the best basis for estimating the climate-related costs associated with agency actions. To address uncertainty, agencies might simply offer a range of total SCC that reflects the range of estimates put forward by different studies. But by using the SCC, agencies will help ensure that cost estimates improve over time. Whatever price for CO_2e emissions is used, agencies must recognize that the costs associated with such emissions that result from their actions are often substantial. If these costs are considered as they should be they might very well lead agencies to make different choices among the alternatives considered than they are likely to make without considering these costs.

temperature, the damage anticipated at higher temperatures, and the discount rate require re-evaluation and a recalculation of the SCC based on their findings). The differences between the IWG estimates and the E3 estimates were also due to differences in other variables, for example, the models relied on to calculate the SCC and discount rates. *Id.* at 7–12. However, the principal driver of the differences in the two reports SCC estimates is the E3 study's reliance on models showing that climate change impacts—the actual future damage caused by climate change—will be worse than assumed by the IWG. *Id.* at 2, 7–12.

328 *Id.* at 2.

329 *Id.* at 13.

330 INTERAGENCY WORKING GRP. ON SOCIAL COST OF CARBON, *supra* note 321, at 1.

331 ACKERMAN & STANTON, *supra* note 327, at 13; INTERAGENCY WORKING GRP. ON SOCIAL COST OF CARBON, *supra* note 321, at 1, 3.

Putting aside the idea of using ranges of SCCs for agency decision making, consider, for example, the impact of applying the IWG's conservative 2010 most likely SCC estimate of $21.40 per ton of CO_2e to decisions in the case studies.[332] If the Forest Service attached this price to the amount of CO_2e it would be offsetting through a strategic beetle mitigation plan, then suddenly they would see a concrete monetary benefit associated with pine forests as carbon sinks, and that benefit could be weighed against the cost of beetle mitigation.[333] Similarly, the BLM decision to lift its suspensions of the Montana oil and gas leases might have turned out differently if the agency had attached a $193,661.70 price ($21.40 x 9040.61 tons of CO_2e) to the GHG emissions that would result from just one year of peak oil and gas production.[334] Finally, though not an agency decision, West Elk Mine's economic feasibility analysis for alternatives to CMM release would have looked much different if the estimated 3 million cubic feet per day of CMM released by the mine were associated with a $21.40 per ton of CO_2e price.[335] This is the equivalent of more than $34 million in *annual* social costs attributable to carbon.[336] Over the approximate twenty-one-year life of the coalmine these costs could easily exceed $700 million![337]

In each example, assigning a price to carbon emissions—even a conservative price—makes the cost of those emissions concrete for agency decision makers, and thus meaningful in the context of their decisions. To be sure, there is room for debate regarding the proper price for carbon. The United States' conservative SCC estimate of $21.40 could alone have a significant impact on agency decision making. However, as recent studies indicate, $21.40 could be far too low.[338] Further, agencies' use of ranges of SCCs and worst-case SCCs would allow agencies to account for the uncertainty of climate change and would force agencies to confront less likely, but possibly catastrophic, climate change impacts. But these are issues over which the agencies can and should engage the public during the public comment process. If they do so, it seems likely that agencies will

332 *See* INTERAGENCY WORKING GRP. ON SOCIAL COST OF CARBON, *supra* note 321, at 1, 3.

333 *See supra* Part V.A.

334 *See supra* note 227 and accompanying text.

335 *See* MOUNTAIN COAL CO. L.L.C., *supra* note 271, at 13; *see also supra* Part V.C.3.

336 See U.S. Envtl. Prot. Agency, *Interactive Units Converter*, http://www.epa.gov/cmop/resources/converter.html (last visited Apr. 7, 2012), for EPA's conversion chart to convert cubic feet of methane (CH_4) to pounds (3,000,000 cubic feet = 382,104 lbs. of CH_4 = 191.07 tons CH_4). Since CH_4 is 23 times as potent a GHG as carbon, the CO_2e of 191.07 tons of carbon is 4,394.61 CO_2e. At an SCC of $21.40 per ton of CO_2e, this works out to $94,044.65 per day. Over the course of a single year, that would amount to $34,326,298.71.).

337 The West Elk Mine, opened in January 1982, currently contains over 150 million tons of recoverable reserves within the B and E seams of the mine. In 2001, the mine shipped 5.05 million tons, and design capacity stands at 7.0 million tons annually. Union Pac. R.R., *West Elk Mine*, http://www.uprr.com/customers/energy/coal/colorado/west_elk.shtml (last visited Apr. 7, 2012). Based on the volume of the mine and the yearly rate of production, the mine can expect to be active for 21 years. *See id.* (dividing the current recoverable reserves by the current annual production capacity yields the approximate active life of 21 years).

338 *See* ACKERMAN & STANTON, *supra* note 327, at 2, 13.

recognize that SCC costs offer the most honest assessment of the marginal cost of CO_2e emissions to society, even if they are fraught with uncertainty.

B. The CEQ Should Require that Agencies Honor Adaptive Management Commitments

Despite seemingly mandatory regulations and strict guidance, it remains unclear whether an agency that commits to adaptive management to mitigate the environmental impacts of climate change can be held accountable for failing to actually implement adaptive management. To help ensure accountability, the CEQ should promulgate regulations that would allow third parties to compel agencies to implement adaptive management strategies that they have committed to implementing in order to justify their decision.

A consensus seems to have emerged that adaptive management is often the most effective means of mitigating the uncertain environmental impacts of climate change.[339] But adaptive management is still a form of NEPA mitigation,[340] and the Supreme Court has made it clear that NEPA's mitigation requirement is only procedural, requiring "that mitigation be discussed in sufficient detail to ensure that environmental consequences have been fairly evaluated."[341] It does not require that "a complete mitigation plan be actually formulated and adopted."[342] Perhaps in a perfect world, all mitigation measures, including adaptive management strategies, that are discussed in an EIS and designed to respond to the possible consequences of an agency action would have to be implemented, but the Supreme Court has found that such measures are not required by NEPA.

Still, the CEQ's rules are not silent on these issues. In particular, those rules require that "[a] monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation" in an agency's record of decision.[343] Even more importantly, the CEQ's rules require that "[m]itigation . . . established in the [EIS] or during its review *and committed as part of the decision* shall be implemented by the lead agency or other appropriate consenting agency."[344] The Court of Appeals for the Ninth Circuit has made clear that notwithstanding the Supreme Court's decision in *Robertson*, where an agency commits to the mitigation rather than simply

339 *See supra* Part III.A.2.

340 *See* 40 C.F.R. § 1508.20 (2011). NEPA mitigation encompasses adaptive management by including in mitigation "[r]educing or eliminating the impact over time by preservation and maintenance operations during the life of the action." *Id.* § 1508.20(d). Adaptation in the climate change vernacular includes "[i]nitiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects." INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 95, at 809.

341 Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 352 (1989).

342 *Id.*

343 40 C.F.R. § 1505.2(c) (2011).

344 *Id.* § 1505.3 (emphasis added).

discussing it in a NEPA analysis, that commitment may be binding on the agency.[345]

Despite the seemingly mandatory language, it may be difficult for a third party to enforce this commitment. This is because the Supreme Court has held that in order to sustain a cause of action to compel agency action unlawfully withheld or unreasonably delayed[346] a plaintiff must demonstrate that an agency has "failed to take a *discrete* agency action that it is *required to take*."[347] Since an agency that commits to adaptive management cannot possibly know in advance what discrete actions may be necessary to adapt, this commitment may not be sufficiently discrete to permit a successful challenge to an agency's failure to engage in adaptive management.[348]

In a guidance document on mitigation and monitoring issued in January 2011, the CEQ urged agencies to follow up their mitigation commitments by taking further action that could afford a basis for APA enforcement.[349] Specifically, the guidance suggests that when agencies commit to mitigation in a decision they should establish monitoring systems to ensure that mitigation actually takes place, and if the monitoring reveals that the mitigation is ineffective or simply not occurring, a supplemental EIS should be prepared.[350] The duty to monitor and, if needed, prepare a supplemental EIS could lead to a further decision that would be subject to judicial review. Unfortunately, the CEQ's guidance is not binding on agencies, and even if it were, it does not contain an enforceable mandate. Moreover, agencies concerned that third parties may challenge their decisions are not likely to make binding commitments either to mitigation or monitoring.

A much better approach for promoting accountability for NEPA mitigation would be to promulgate binding regulations requiring agencies to

345 *See* Tyler v. Cisneros, 136 F.3d 603, 608 (9th Cir. 1998) ("Under NEPA, the Supreme Court has made clear that an [EIS] is adequate even where it does not require the agency to actually mitigate adverse environmental impacts or obtain assurances that third parties will do so. However, the NEPA regulations state that, *if an agency does decide to enter into a mitigation measure, that measure shall be implemented*." (emphasis added) (citation and quotation omitted)).

346 *See* 5 U.S.C. § 706(1) (2006).

347 Norton v. S. Utah Wilderness Alliance, 542 U.S. 55, 64 (2004).

348 The authors can find no cases in which an agency has committed to adaptive management in its decision, failed to implement adaptive management, and then been held accountable for that failure through the APA. Arguably, a plaintiff can circumvent the *Norton* decision by alleging that the agency's refusal to adapt was arbitrary and capricious. *See* 5 U.S.C. § 706(2)(A) (2006). No such claim was made in *Norton* and thus it would appear not to apply to such a claim. *See Norton*, 542 U.S. at 60–61.

349 *See, e.g.*, Memorandum from Nancy H. Sutley, Chair, Council on Envtl. Quality, to the Heads of Fed. Dep'ts & Agencies, Regarding Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact 5 (Jan. 14, 2011), *available at* http://ceq.hss.doe.gov/current_developments/docs/Mitigation_and_Monitoring_Guidance_14Jan2011.pdf ("The agency's own underlying authority may provide the basis for its commitment to implement and monitor the mitigation. Alternatively, the authority for the mitigation may derive from legal requirements that are enforced by other Federal, state, or local government entities . . . .").

350 *Id.* at 15.

commit themselves to 1) implementing all reasonable mitigation measures in their decision, 2) monitoring and reporting on the effectiveness of those mitigation measures on a regular basis, and 3) preparing supplemental EISs and making additional binding commitments to mitigate if the initial mitigation efforts prove ineffective. Consider, for example, an agency decision to authorize salvage logging in a beetle-killed portion of a national forest. In the original EIS, the agency acknowledged that the logging activities could harm certain sensitive species and for this reason the agency required the operator to conduct population surveys for those species and preserve habitat considered critical to the species. The agency also committed to a program of monitoring and adaptive management so that it can identify and mitigate any unanticipated impacts to those sensitive species. Suppose now that several years have elapsed since the logging has occurred and the critical habitat that was preserved during logging is rapidly deteriorating, possibly due to climate change. If the agency fails to take action quickly to adapt to the changed circumstances, perhaps by restoring other areas that could provide suitable habitat for the species, the species may not survive in that part of the forest. Under the current rules, the agency's failure to take any action to respond to the changed circumstances might not be subject to judicial review under the APA. If, however, the CEQ's rules required the agency to monitor and report on the success of mitigation, and required the agency to prepare a supplemental EIS where the mitigation proved ineffective, an interested party could challenge the agency's failure to monitor, failure to report, failure to prepare a supplemental EIS, or failure to make a decision to adequately mitigate the impacts of the original decision.[351]

The proposed CEQ rules do not create a substantive NEPA requirement, but they do allow interested parties to use the APA to challenge agency decisions that are unlawfully withheld or unreasonably delayed,[352] or that are arbitrary and capricious, an abuse of discretion or otherwise inconsistent with the law.[353] Moreover, the proposed regulations are not a blanket mandate forcing agencies to implement mitigation discussed in NEPA documents. Instead, they would only hold agencies accountable for mitigation they commit to in their decisions. If an agency commits to adaptive management to mitigate climate change in a decision, and the reasonableness of the decision depends on implanting adaptive management strategies, then the agency's failure to engage in adaptive management makes the original decision arbitrary and capricious. The CEQ has already implemented regulations addressing post-NEPA analysis agency procedure that seem to be rooted in the APA's rational decision-making requirement.[354] These proposed regulations need look no further for their authority.

351 *See* 5 U.S.C. § 706(1), (2)(A) (2006).

352 *Id.* § 706(1).

353 *Id.* § 706(2)(A).

354 *See, e.g.*, 40 C.F.R. §§ 1505.2, 1505.3 (2011) (addressing records of decision and implementation of actions).

C. General Recommendations for Land Managers Addressing Climate Change Under NEPA

1. Programmatic Assessments and Tiering

The extant CEQ regulations for programmatic analyses and tiering allow agencies to analyze climate change more efficiently, in ways that produce tiered-project or site-specific analyses that are more useful to decision makers, and at a scale that makes sense for a global problem like climate change.[355] The draft CEQ climate change guidance rightly suggests this approach for non-land management decisions, and this suggestion applies equally in the public lands management context.[356]

Almost every land management decision will be affected by climate change, and many will in fact contribute to climate change through GHG emissions. However, these climate-related impacts are usually not unique to single or site-specific land management actions. Rather than one-off analyses for each action, agencies should take a broader view, analyzing climate change impacts for both single large proposals and multiple proposals "that will have cumulative or synergistic environmental impact[s]" in PEISs.[357] These broad statements can then be "tiered"—incorporated by reference—into NEPA analyses for actions that are smaller in scale, but encompassed by the analysis in the programmatic document.[358] The use of PEISs and tiering increases efficiency by decreasing duplication of work, and ensures project- or site-specific analyses are meaningful to decision makers by allowing them to focus on the impacts truly unique to those actions. Further, a programmatic analysis can consider climate-change impacts at a larger scale (for example, ecosystem scale) that is more appropriate for understanding sweeping environmental impacts like global climate change.

The benefits of programmatic analyses and tiering are evident when applied to actions discussed in the case studies. The Forest Service should prepare a PEIS to assess the strategic plan it is developing on the impacts of the mountain pine beetle in the Rocky Mountain Region. The PEIS would allow the Forest Service to consider the impacts of the beetle on climate change at the regional scale. These impacts might include the GHGs released from rotting beetle-killed pines and the potential ecological consequences from climate change on post-beetle-killed forests.[359] Instead of the current

355 *See supra* Part II.B.

356 *See CEQ Draft Climate Change Guidance*, *supra* note 8, at 5 ("An agency may decide that it would be useful to describe GHG emissions in aggregate, as part of a programmatic analysis of agency activities that can be incorporated by reference into subsequent NEPA analyses for individual agency actions. In addition, Federal programs that affect emissions or sinks and proposals regarding long range energy, transportation, and resource management programs lend themselves to a programmatic approach.").

357 Kleppe v. Sierra Club, 427 U.S. 390, 410 (1976).

358 40 C.F.R. § 1502.4(b) (2011).

359 *See supra* Part V.A.1.

piecemeal approach to beetle-related actions that relies on categorical exclusions and project-specific analyses, a programmatic analysis could efficiently yet meaningfully address the ecosystem-wide impacts of climate change associated with the beetle. Project-specific analysis could then focus on the issues truly unique to each project and climate change impacts would actually be analyzed despite the widespread use of categorical exclusions.[360]

Similarly, rather than considering the impacts of climate change from the Million Pipeline alone, a programmatic document could address climate-change impacts on the entire Upper Colorado River Basin watershed. In addition to the Million Pipeline, at least two other proposals are looking to take significant water resources out of the Upper Colorado River Basin.[361] A single programmatic analysis encompassing all of these proposals would create a unified document that could be tiered into each of the project-specific analyses, and which could objectively consider the cumulative feasibility of all three projects given a future of decreased flows in the watershed.

Of course, programmatic analyses, especially analyses that deal with an issue as volatile and uncertain as climate change, cannot be viewed as static documents. Rather, they must constantly be updated and revised, perhaps at the time that EAs and EISs are being developed for new proposed site-specific actions that will use the PEIS. But if used as they were intended, the current CEQ rules on supplemental EISs should be adequate to ensure that programmatic EISs are not allowed to become stale.[362]

2. Meaningful Cumulative Impacts Analyses of Climate Change

NEPA's cumulative impacts analysis requirement seems especially daunting in the face of global climate change caused by the cumulative impacts of countless "numerous and varied" GHG emitters worldwide.[363] Despite this, an analysis of the cumulative impacts of climate change on the affected environment of an action is relatively straightforward. Although there are uncertainties, the impacts of climate change on the affected environment—for example, warming temperatures, changing rainfall patterns, increased evaporation, or decreased river flows—can be estimated and applied to the decision, and the scope and scale of the analysis can be controlled by NEPA's rule of reason.[364] The draft CEQ climate change guidance recommends this approach.[365]

Analyzing the cumulative effects of GHG emissions on the environment in general poses a more difficult problem. Any land-use action emitting GHGs seemingly requires an exhaustive cumulative impacts analysis of

360 *See supra* Part V.A.2.

361 *See* MOFFAT DEIS, *supra* note 216, at 1-3; WINDY GAP DEIS, *supra* note 215, at 1-1.

362 40 C.F.R. § 1502.9 (2011).

363 *See CEQ Draft Climate Change Guidance*, *supra* note 8, at 2.

364 *See supra* Part III.B.2.

365 *See CEQ Draft Climate Change Guidance*, *supra* note 8, at 10.

climate change in its entirety. This will rarely help decision makers and thus defeats NEPA's core purpose of "foster[ing] excellent action."[366] Still, as the draft CEQ climate change guidance makes clear, every GHG emission, no matter how small, cumulatively leads to global climate change by "either adding to or reducing the cumulative total of GHG emissions"[367] Further, the Ninth Circuit found that "the fact that 'climate change is largely a global phenomenon that includes actions that are outside of [the agency's] control . . . does not release the agency from the duty of assessing the effects of *its* actions on global warming within the context of other actions that also affect global warming.'"[368] The question for land-use decision makers is thus how to meet their legal obligation through a NEPA analysis that is both feasible *and* helpful to them.

The most practical approach would be to rely on applying the SCC discussed in the Recommendations, Part VI.A, above to the GHG emissions resulting from the action. The SCC represents the marginal cost of emitting CO_2e, or the cost of one additional unit of emissions given all past, present, and future emissions of GHGs.[369] If the SCC could be accurately estimated, multiplying the quantified emissions resulting from an action by the SCC would perfectly capture cumulative impacts. The cumulative impacts requirement mandates an analysis of the "incremental impact of the action when added to other past, present, and reasonably foreseeable future actions," while the amount of GHGs resulting from the action multiplied by the SCC would represent the cost of those emissions given all past, present, and future emissions.[370] Of course, the true social cost of GHG emissions is the topic of much debate and estimates vary widely.[371] However, as discussed in Part VI.A above, attaching a price to GHG emissions equal to the SCC is the only practical way for land-use decision makers to assess the cumulative impacts of GHG emissions in a meaningful way.[372]

3. The NEPA Uncertainty Regulation and Adaptive Management

The climate is changing but the extent of future GHG emissions—the principal driver of climate change—is difficult to predict with certainty.[373] Even if we knew with certainty the atmospheric GHG levels of the future, we cannot know precisely how those levels will translate into environmental and climate-related impacts.[374] But uncertainty is not an excuse for agencies to ignore the impacts of climate change in their NEPA analyses. Rather,

366 40 C.F.R. § 1500.1(c) (2011).

367 *CEQ Draft Climate Change Guidance*, *supra* note 8, at 10.

368 Ctr. for Biological Diversity v. Nat'l Highway Traffic Safety Admin., 538 F.3d 1172, 1217 (9th Cir. 2008) (citation omitted).

369 *See supra* Part VI.A.

370 *See* 40 C.F.R. § 1508.7 (2011).

371 *See supra* Part VI.A.

372 *See supra* Part VI.A.

373 *See supra* notes 6–7 and accompanying text.

374 *See supra* Part II.B.1.

agencies should apply the CEQ's uncertainty regulation to describe the current state of knowledge about climate change, to analyze the foreseeable consequences under different plausible scenarios, and then commit to adaptive management to cope with the inevitable uncertainties that remain.[375]

In the context of climate change, the application of the CEQ uncertainty rule might look like this:

- future GHG emissions are unknowable but can be estimated within a certain range;
- even if future GHG emissions were known, the consequences of any particular level of GHG emissions remain highly uncertain;
- knowledge about climate change and its impacts is more certain over shorter time scales, and less certain over the long term;
- climate models afford a rough estimate of possible climate impacts under different GHG emission scenarios;
- the agency can offer some sense about the possible consequences of its actions under climate change, with greater uncertainty over time, and make its decision on the basis of this information;
- the agency can commit itself to adapting to the actual consequences as they unfold.[376]

By approaching the uncertainty inherent in climate change in a systematic and thoughtful way, the agency can prepare itself for whatever outcome ultimately unfolds.

Adaptive management, which is really a form of mitigation,[377] can then be used to respond to that outcome and meet NEPA's mitigation requirement. The CEQ regulations require the discussion of mitigation in an EIS,[378] and it may be possible to consider some concrete mitigation measures for climate change impacts. But agencies must recognize that any mitigation measures considered before an action is taken will have to be revised to reflect the actual impacts that emerge.

Though adaptive management may represent a land manager's "best practice" for mitigating the uncertain impacts of climate change, agencies should not lose sight of the fact that NEPA and adaptive management are inherently at odds. NEPA requires analysis before an action can be taken, while adaptive management requires ongoing monitoring, analysis and

375 *See* 40 C.F.R. § 1502.22(b) (2011). The uncertainty regulation requires the following: "(1) A statement that such information is incomplete or unavailable; (2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and (4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community." *Id.*

376 *See id.*; *supra* Part II.C.

377 *See supra* note 94 and accompanying text.

378 *See* 40 C.F.R. §§ 1502.14, 1502.16 (2011).

adaptation after an action is taken.[379] Thus, to critics, adaptive management amounts to a "'build-first, study later' approach to resource management" and "[t]his backward looking decision making is not what NEPA contemplates."[380] The best response to this concern, as argued in Part VI.B, is to simply change the CEQ rules to hold agencies accountable for actually implementing their adaptive management commitment by raising the prospect of third-party enforcement under the APA.[381]

VII. CONCLUSION

Climate change affects virtually every decision that public land managers make, but the global scale of the problem and the high levels of uncertainty about its likely impacts have thus far proved daunting for land managers trying to meaningfully address climate change in their NEPA analyses. Still, the challenge of addressing climate change during the NEPA process is not insoluble. At the outset, land management agencies must recognize that the climate impacts from their proposed actions will arise in two very different circumstances. First, agency actions can themselves contribute to climate change, either by emitting GHGs or by destroying carbon sinks. In an entirely different way, agency actions may be affected by climate change when, for example, the landscapes that may be altered by a proposed agency action are also evolving due to climate change.

The first problem can be effectively addressed in the NEPA process simply by assigning a fair price to carbon equivalent emissions and factoring in those costs to making a rational choice from among the reasonable alternatives. Although the SCC may be highly uncertain, assigning carbon its social cost at least acknowledges the important policy point that GHG emissions impose external costs on society. And the very fact that agencies choose to assign such costs will help ensure that additional research is carried out to improve cost estimates.

In the circumstance where climate change affects the agency action, or affects the landscape that is host to the agency action, the challenge is more difficult, and the appropriate response necessarily more complex. Most often, the lack of certainty about the consequences of the action, when considered alongside climate change, will force the agency to simply agree to adapt as the changing climate unfolds. And while adaptation may very well be the most sensible solution, the public is rightly concerned that when an agency promises to manage the impacts of an action by adapting, it is essentially avoiding any particular commitments regarding its future action.

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379 *See* NEPA TASK FORCE, *supra* note 84, at 44. The EIS "'requirement obligates the agency to make available to the public high quality information, including accurate scientific analysis, expert agency comments and public scrutiny, *before decisions are made and actions are taken*.'" Ctr. for Biological Diversity v. U.S. Forest Serv., 349 F.3d 1157, 1167 (9th Cir. 2003) (quoting 40 C.F.R. § 1500.1(b) (2011)) (emphasis added)).

380 Mountaineers v. U.S. Forest Serv., 445 F. Supp. 2d 1235, 1250 (W.D. Wash. 2006).

381 *See supra* Part VI.B.

In order to ensure that agencies actually honor their commitments to adapt when the evidence suggests that they should, those commitments must be made enforceable in some fashion.

Some of the existing tools provided under the current CEQ regulations should also be refined to address more specifically the problem of climate change in landscape-level management. Programmatic assessments and tiering should be used more effectively. The requirement for a cumulative impacts analysis should be applied sensibly so that agencies understand the relevant climate-related ramifications of their decisions when viewed alongside other decisions. But agencies should not be burdened with having to analyze or consider global climate emissions, and the incremental effect of such emissions caused by the proposed action, except to the extent that its emissions are imposing external costs. Finally, the CEQ's uncertainty regulation should be used to address the uncertainties surrounding climate change in a thoughtful way that ensures that the reasonable range of possible outcomes are addressed in NEPA documents, and that the agency is prepared to adapt to the outcome that ultimately unfolds.