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The Carbon Storage Future of Public Lands

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ARTICLES

The Carbon Storage Future of Public Lands

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To meet the climate and energy goals set forth by the Biden Administration and the Paris Agreement, the United States must dramatically reduce carbon emissions. Use of public lands for carbon dioxide removal activities, including carbon capture, utilization, and storage (CCUS), has the potential to advance carbon reduction goals and concurrently provide economic revitalization opportunities to communities dependent on fossil industries. Current federal law presents numerous challenges and opportunities associated with utilization of federal pore space for CCUS. Although federal grant programs and tax incentives encourage deployment of CCUS technologies, legal and land-management issues related to public lands have received comparatively little legislative or agency attention. This essay seeks to bring attention to land-management aspects of geologic storage and to broaden conversations regarding CCUS technology deployment on federal lands. The authors identify

* Professor of Law, University of Wyoming College of Law. This work builds off the authors' prior research in a project supported by the United States Energy Association. *See* KRIS KOSKI, JESSE RICHARDSON, TARA RIGHETTI, & SAM TAYLOR, STUDY ON STATE'S POLICIES & REGULATIONS PER CO_2-EOR STORAGE CONVENTIONAL, ROZ AND EOR IN SHALE: PERMITTING, INFRASTRUCTURE, INCENTIVES, ROYALTY OWNERS, EMINENT DOMAIN, MINERAL-PORE SPACE, AND STORAGE LEASE ISSUES (2020).

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opportunities for courts, agencies, and Congress to address uncertainties related to federal pore space and promote cooperation and coordination with state agencies.

I. Introduction: Geologic Storage as Part of the Climate Change Solution 182
II. Storage Space in Public Lands 188
A. Federal Ownership of Pore Space 191
B. Present and Future Uses of Federal Pore Space 196
C. Case Study: Integrated Commercial Carbon Capture Project at Dry Fork Station—Campbell County, Wyoming 197
III. Governance of Federal Pore Space 199
A. Land Management Laws and Regulations 199
B. NEPA 206
IV. Legislative and Regulatory Opportunities 209
A. Clarify Processes, Rules, and Regulations Regarding Federal Pore Space Utilization 210
B. NEPA—Categorical Exclusions and CEQ Regulations 212
C. Settling Ownership in Federal Split Estates 217
D. Incorporating Geologic Storage in Resource Planning 218
V. Conclusion 219

I. INTRODUCTION: GEOLOGIC STORAGE AS PART OF THE CLIMATE CHANGE SOLUTION

Achieving CO_2 emission reduction goals will either require extensive investments in carbon removal technologies to decarbonize electric generation, transportation fuels, and industrial sources or near cessation of their use. As professor Kalen writes, a "deeply decarbonized future will require either effective carbon capture and storage capacity for natural gas plants . . . or removing natural gas as a fuel source by roughly 2030."[1] Recognizing the unlikelihood of the latter, organizations such as the Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA) acknowledge that reaching international energy and climate goals will likely require "Carbon Capture Utilization and Storage"

1. Sam Kalen, *A Bridge to Nowhere? Our Energy Transition and the Natural Gas Pipeline Wars*, 9 MICH. J. ENV'T & ADMIN. L. 319, 323 (2020).

(CCUS).[2] Specifically, the IEA has indicated that achieving the Paris Agreement's climate goal of 1.5°C "will almost certainly require some form of carbon removal."[3]

Geologic storage of carbon dioxide (CO_2) is among the core decarbonization technologies considered in proposals to stabilize the atmosphere.[4] Several intensive—or deep—negative emissions technologies, such as direct air capture and net negative generation, rely on geologic storage to permanently remove CO_2 from the atmosphere.[5] The International Standards Organization (ISO) standard for geologic storage defines "geologic storage" as "long-term containment of CO_2 streams in subsurface geological formations."[6] CCUS technologies capture CO_2 and inject it underground for permanent storage.[7] Opportunities to capture CO_2 from anthropogenic sources include fossil-fuel fired power plants,[8] closed-loop industrial facilities,[9] and biofuels facilities.[10] CO_2 can also be captured through direct air capture technologies and sequestered

2. Int'l Energy Agency [IEA], *Energy Technology Perspectives 2020 Special Report on Carbon Capture Utilisation and Storage: CCUS in Clean Energy Transitions*, at 18 (Sept. 2020); Intergovernmental Panel on Climate Change [IPCC], *Climate Change 2014: Synthesis Report*, at 99–103, 109 (Rajendra K. Pachauri et al. eds., 2015).

3. IEA, *supra* note 2, at 24.

4. U.S. DEP'T OF ENERGY, CARBON CAPTURE, UTILIZATION, AND STORAGE: CLIMATE CHANGE, ECONOMIC COMPETITIVENESS, AND ENERGY SECURITY 6 (Aug. 2016).

5. *See* Int'l Energy Agency [IEA], *Carbon Capture and Storage: The Solution for Deep Emissions Reductions*, §§ 4–6 (2015).

6. Int'l Org. for Standardization [ISO], *Carbon Dioxide Capture, Transportation and Geological Storage — Geological Storage*, § 3.17, ISO 27914:2017 (2017), http://www.iso.org/iso/catalogue_detail.htm?csnumber=64148 [https://perma.cc/63J5-HJ95] (internal cross-references omitted).

7. Rosa M. Cuéllar-Franca & Adisa Azapagic, *Carbon Capture, Storage, and Utilisation Technologies: A Critical Analysis and Comparison of their Life Cycle Environmental Impacts*, J. CO_2 UTILIZATION, Mar. 2015, at 82, 85.

8. In Standards of Performance for Greenhouse Gas Emissions From New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64,510, 64,513 (Oct. 23, 2015), the EPA determined that Carbon Capture, Sequestration, and Utilization was the "best system of emissions reduction" for new coal-fired generating units under section 111(b) of the Clean Air Act, but this finding was reversed by a recently promulgated version of the rule in 83 Fed. Reg. 65,617 (Dec. 21, 2018) (to be codified at 40 C.F.R. pt. 60).

9. Marco Mazzotti et al., *Direct Air Capture of CO_2 with Chemicals: Optimization of a Two-loop Hydroxide Carbonate System Using a Countercurrent Air-liquid Contactor*, 118 CLIMATIC CHANGE 119, 122–23 (2013).

10. Joris Koornneef et al., *Global Potential for Biomass and Carbon Dioxide Capture, Transport and Storage up to 2050*, INT'L J. GREENHOUSE GAS CONTROL, Nov. 2012, at 117, 117.

using geologic storage.[11] As such, geologic storage holds the potential to significantly impact climate reduction goals by decarbonizing fossil and bioenergy generation[12] and facilitating negative-emissions technologies. The Union of Concerned Scientists has recognized that "[n]atural gas with [carbon capture and sequestration] . . . could be a contributor to a net-zero world."[13]

Use of CCUS technology, with accompanying federal pore space utilization, could also be a means to aid a just transition for areas which rely heavily on fossil fuels. Facilities which rely on fossil fuels can be retrofitted with CCUS technology, "preserv[ing] employment and economic prosperity in regions that rely on emissions-intensive industry, while avoiding the economic and social disruption of early retirements."[14] Retrofits may permit important baseload energy sources to continue operating without jeopardizing emissions reductions goals. Retrofitting of existing coal- and gas-fired power plants is expected to have "a small to negligible impact on . . . operational flexibility," potentially even "increas[ing] short-term flexibility."[15] In its April 2021 initial report, President Biden's Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization identified retrofitting traditional energy generation and industrial facilities with carbon capture technologies as among key opportunities to create good-paying jobs in energy communities.[16]

CCUS development thus far has not kept pace with what is necessary to achieve climate goals. In 2009, the IEA indicated that 100 large-scale CCUS projects would need to be developed between 2010 and 2020 to reach climate goals, yet only 13% of the target

11. David W. Keith, *Why Capture CO_2 from the Atmosphere?*, SCIENCE, Sept. 25, 2009, at 1654, 1654–55; Kalen, *supra* note 1, at 323.

12. R. Stuart Haszeldine, *Can CCS and NET Enable the Continued Use of Fossil Carbon Fuels after CoP21?*, 32 OXFORD REV. ECON. POL'Y 304, 310 (2016).

13. ClimateCrisis, *Creating a Climate Resilient America*, YouTube, at 01:09:43 (May 23, 2019), https://www.youtube.com/watch?v=oWxwFOUlt0s [https://perma.cc/EXQ2-AYZ9] (oral testimony of Dr. Rachel Cleetus at hearing before the House Subcommittee on the Environment and Climate Change).

14. IEA, *supra* note 2, at 21–22.

15. *Id.* at 52.

16. INTERAGENCY WORKING GROUP ON COAL AND POWER PLANT CMTYS. & ECON. REVITALIZATION, INITIAL REPORT TO THE PRESIDENT ON EMPOWERING WORKERS THROUGH REVITALIZING ENERGY COMMUNITIES 4, 13 (2021), https://netl.doe.gov/sites/default/files/2021-04/Initial%20Report%20on%20Energy%20Communities_Apr2021.pdf [https://perma.cc/54AC-H7AL].

storage capacity has been satisfied as of September 2020.[17] This shortfall results largely from commercialization issues related to the high costs of installing the necessary infrastructure for CCUS and the lack of sufficient incentives to reduce CO_2 emissions.[18]

Federal funding has supported technology advancements and may aid in reducing costs of development, ensuring that emerging technologies become commercially feasible.[19] The federal government has provided significant support—over five billion in funding—for carbon storage activities since 2010.[20] Recent support includes appropriations for carbon capture retrofits as part of the Rural Electrification and Telecommunications Loans Program,[21] extension of the 45Q tax credit,[22] which provides tax credits for permanent sequestration of CO_2 as part of geologic storage or CO_2-Enhanced Oil Recovery (EOR), and a funding opportunity announcement from the Department of Energy (DOE) for over $100 million in cost-shared CCUS research and development.[23] The Energy Act of 2020 included further federal support for CCUS and direct capture projects.[24] Although Division S of the Consolidated Appropriations Act of 2021 directed the Council of Environmental Quality and other agencies to review federal regulations and evaluate the "improvement of permitting process for carbon dioxide capture and infrastructure projects,"[25] until very recently most

17. IEA, *supra* note 2, at 28.

18. *Id.*

19. *Id.* at 35–37, 155–56; Edward Hirsch & Thomas Foust, *Policies and Programs Available in the United States in Support of Carbon Capture and Utilization*, 41 ENERGY L. J. 91, 92 (2020).

20. PETER FOLGER, CONG. RSCH. SERV., R44902, CARBON CAPTURE AND SEQUESTRATION (CCS) IN THE UNITED STATES 1 (2018).

21. Consolidated Appropriations Act of 2021, Pub. L. No. 116-260, div. A, tit. III, 134 Stat. 1182 (2020).

22. Bipartisan Budget Act of 2018, Pub. L. No. 115-123, § 41119, 132 Stat. 64, 162 (2018); Energy Act of 2020, Pub. L. No. 116-260, div. Z., § 5001, 134 Stat. 1182 (2020). *See* ANGELA C. JONES, CONG. RSCH. SERV., IF11639, CARBON STORAGE REQUIREMENTS IN THE 45Q TAX CREDIT 1 (2020) (The 45Q tax credit allows industrial manufacturers that capture carbon from their operations to earn $50 per metric ton of CO_2 stored permanently, or $35 if the $CO_2$is put to use, such as for EOR).

23. *U.S. Department of Energy Announces $110M for Carbon Capture, Utilization, and Storage*, ENERGY.GOV (Sept. 13, 2019), https://www.energy.gov/articles/us-department-energy-announces-110m-carbon-capture-utilization-and-storage [https://perma.cc/TD6Z-9MSB].

24. Energy Act §§ 4001–04, 4004.

25. Consolidated Appropriations Act § 102.

federal efforts have focused on commercial aspects of CO_2 storage and on research and development for carbon storage technologies.

United States laws and regulations currently address numerous aspects of carbon storage. A report from the Global CCS Institute currently lists the United States as a "Band A" country, meaning that it has "CCS-specific laws or [other] laws that are applicable across most parts of the CCS project cycle" and that "[l]egal and regulatory models in [the United States] are sophisticated and address the novel aspects of the CCS process."[26] Most significantly, injection wells for CCUS are permitted according to Class VI of the Underground Injection Control (UIC) Program under the Safe Drinking Water Act.[27] Of the various classes of injection activities authorized under the UIC program, Class VI is the most stringent and includes comprehensive performance requirements, as well as more extensive monitoring, verification, and reporting.[28] CCUS projects are also subject to the Greenhouse Gas (GHG) Reporting Program requirements of the Clean Air Act.[29] These examples, however, represent the exception, rather than the rule. The majority of laws in the United States laws do not directly address carbon sequestration, much less handle the process in a sophisticated manner.[30] For example, Professor Arnold W. Reitze Jr. observed that none of the potentially relevant statutes for onshore geologic CO_2 storage present a clear regulatory framework for geologic CO_2 storage, and some, especially the Endangered Species Act (ESA), may operate to ban carbon sequestration in certain areas.[31]

26. IAN HAVERCROFT, GLOBAL CCS INST., 2018 THOUGHT LEADERSHIP REPORT: CCS LEGAL AND REGULATORY INDICATOR (CCS-LRI) 5 (2018).

27. *See* U.S. EPA, EPA-816-P-13-004, GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE: DRAFT UNDERGROUND INJECTION CONTROL (UIC) PROGRAM GUIDANCE ON TRANSITIONING CLASS II WELLS TO CLASS VI WELLS 43 (2013); *see also* 40 C.F.R. § 146 (2020).

28. *See* ANGELA C. JONES, CONG. RSCH. SERV., R46192, INJECTION AND GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE: FEDERAL ROLE AND ISSUES FOR CONGRESS 11–12 (2020).

29. 40 C.F.R. §§ 98.441 (2020).

30. *See, e.g.*, Romany M. Webb & Michael B. Gerrard, *Overcoming Impediments to Offshore CO_2 Storage: Legal Issues in the United States and Canada*, 49 ENV'T L. REP. 10634, 10635 (2019).

31. *See* Arnold W. Reitze Jr., *Federal Control of Carbon Capture and Storage*, 41 ENV'T L. REP. 10796, 10817–22 (2011) (analyzing the Solid Waste Disposal Act, the Clean Water Act, the Endangered Species Act, and the National Environmental Protection Policy Act (NEPA)); *see also* JONES, *supra* note 28 (focusing on

Similarly, researchers at the Sabin Center for Climate Change Law at Columbia University noted the lack of laws specifically regulating offshore CO_2 sequestration.[32] These commentators describe existing laws as confusing, sometimes overlapping, and marred by frequent shortcomings, which, in some instances, may prevent rather than encourage CCUS.[33] Although recently enacted[34] and proposed legislation endeavors to streamline the project review and permitting processes across multiple agencies, the legislation fails to comprehensively address land management aspects of carbon storage activities on federal land.[35]

The lack of specific statutes and regulatory programs regarding federal pore space utilization presents a significant hurdle to the development of geologic storage projects. A recent report by the Congressional Research Service acknowledged that issues relating to geologic sequestration and EOR include "liability and property rights issues," such as long term stewardship and the need for policies regarding ownership of pore space property rights.[36] Although a 2010 report by the Interagency Task Force on CCS recognized that the use of federal pore space in lands owned in fee simple might streamline leasing and limit conflicts between uses, the report also identified concerns including underground migration of injected CO_2 beyond federal boundaries and additional regulatory requirements such as compliance with the National Environmental Policy Act (NEPA).[37] These concerns, and the absence of clear laws

environmental regulation of geologic sequestration and EOR and providing an overview of these issues).

32. Webb & Gerrard, *supra* note 30, at 10635; ROMANY M. WEBB & MICHAEL B. GERRARD, POLICY READINESS FOR OFFSHORE CARBON DIOXIDE STORAGE IN THE NORTHEAST 12 (2017).

33. Webb & Gerrard, *supra* note 30, at 10641.

34. *See e.g.*, Energy Act of 2020, Pub. L. No. 116-260, div. Z, 134 Stat. 1182 (2020).

35. *See* CCUS Innovation Act, H.R. 5865, 116th Cong. § 6 (2020); Accelerating Carbon Capture and Extending Secure Storage through 45Q Act, H.R. 1062, 117th Cong. (2021); Carbon Capture, Utilization, and Storage Tax Credit Amendments Act, S. 986, 117th Cong. (2021); Storing CO_2 and Lowering Emissions (SCALE) Act, H.R. 1992, 117th Cong. (2021); SCALE Act, S. 799, 117th Cong. (2021).

36. JONES, *supra* note 28, at 18.

37. OFF. OF FOSSIL ENERGY, REPORT OF THE INTERAGENCY TASK FORCE ON CARBON CAPTURE AND STORAGE L-1 to L-2 (2010), https://www.energy.gov/sites/default/files/2013/04/f0/CCSTaskForceReport2010_0.pdf [https://perma.cc/V3YC-4N94].

or regulations addressing these issues, provide an opportunity for federal lawmakers and agencies to address the issue.

II. STORAGE SPACE IN PUBLIC LANDS

Geologic storage requires a significant amount of subsurface land capable of securely containing CO_2. Sequestration requires rock formations with both adequate storage capacity and trapping mechanisms to contain the injected CO_2 and prevent migration out of the storage complex.[38] The storage unit must include both the legal ownership right to inject in the pore space as well as sufficient porosity for injection activities and confining strata that assure containment of CO_2.[39] The ISO standard for geologic storage requires reservoirs with an adequate primary seal and secondary barriers to CO_2 leakage.[40] Potential storage complexes include deep saline aquifers, coal seams, and depleted oil or gas fields, some of which have already demonstrated their ability to contain gaseous substances for millennia.[41]

Pore space can be understood as the voids within rocks, soils, and geologic formations that collectively form a potential storage resource or reservoir. Pore spaces may be occupied by gasses, fluids, or brines, but additional storage capacity may be achieved through increases in pressure or by removal of existing substances. North Dakota and Wyoming state law, respectively, define pore space as "a cavity or void, whether naturally or artificially created, in a subsurface sedimentary stratum"[42] and "subsurface space which can be used as storage space for carbon dioxide or other substances."[43]

38. Michael J. Nasi & Jacob Arechiga, *Greenhouse Gas Reduction Technologies for Power Generation*, *in* CLIMATE CHANGE LAW AND REGULATIONS: PLANNING FOR A CARBON-CONSTRAINED REGULATORY ENVIRONMENT 9B-1, 9B-9 (2015).

39. *See* ISO, *supra* note 6, at § 3.54.

40. *Id.* at §§ 3.32, 3.50.

41. Stephanie M. Haggerty, *Legal Requirements for Widespread Implementation of CO_2 Sequestration in Depleted Oil Reservoirs*, 21 PACE ENV'T L. REV. 197, 200–01 (2004); Stefan Bachu, *Identification of Oil Reservoirs Suitable for CO_2–EOR and CO_2 Storage (CCUS) Using Reserves Databases, with Application to Alberta, Canada*, 44 INT'L J. GREENHOUSE GAS CONTROL 152, 153 (2016); Sally Benson et al., *Underground Geological Storage*, *in* IPCC SPECIAL REPORT ON CARBON DIOXIDE CAPTURE AND STORAGE, 195, 210 (Günther Borm et al. eds. 2005).

42. N.D. CENT. CODE § 47-31-2 (2021).

43. WYO. STAT. ANN. § 34-1-152(d) (2021).

No federal definition of pore space exists within federal land-management statutes or regulations.

Geologic storage requires a property right to utilize the pore space. Within this context of property rights, gaps regarding the extent of federal pore space ownership remain. However, the importance of pore space to various uses of federal land is well recognized. For example, the amount of pore space is one of the properties considered when determining reservoir heterogeneity for the Alaska National Petroleum Reserve,[44] compaction in surface mine reclamation,[45] and screening sites for a nuclear waste repository.[46]

A significant amount of storage capacity exists within the United States. In 2007, the DOE estimated that the United States had adequate geologic storage sequestration capacity for more than 3,300 billion metric tons of CO_2.[47] In 2012, pursuant to the Energy Independence and Security Act, the United States Geological Survey (USGS) and the United States Department of Interior, together with other state and federal agency partners, conducted a national assessment of geologic storage resources for CO_2.[48] This report estimates as much as 470,000 megatons of technically suitable storage capacity exists in the United States, enough for 3,000 metric gigatons of CO_2.[49] The USGS estimates that federal lands overlay roughly 130 million acres of this usable pore space.[50] The vast majority of this 130 million acres comes under the authority of either

44. 43 C.F.R. § 3130.0-5(h) (2020).

45. 30 C.F.R. § 710.5 (2020).

46. *See* 10 C.F.R. § 960.2 (2020) (porosity mentioned in the definition of "effective porosity"); 10 C.F.R. § 963.2 (2020) (porosity mentioned in the definitions of "infiltration" and "seepage").

47. U.S. DEP'T OF ENERGY, CARBON SEQUESTRATION ATLAS OF THE UNITED STATES AND CANADA 15 (2007), http://www.precaution.org/lib/carbon_sequestration_atlas.070601.pdf [https://perma.cc/2B8N-562G].

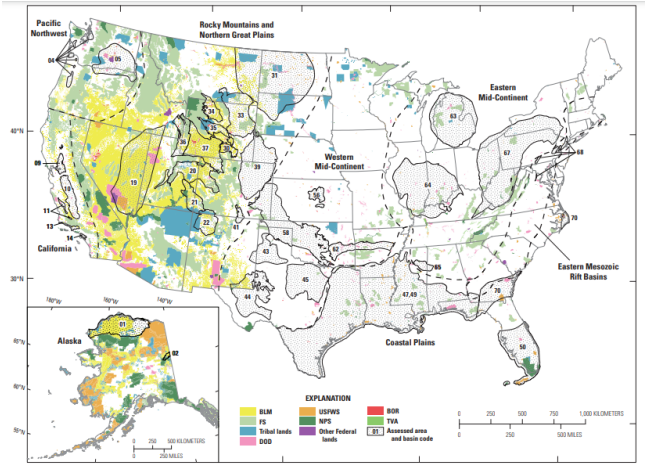
48. U.S. GEOLOGICAL SURV., NATIONAL ASSESSMENT OF GEOLOGIC CARBON DIOXIDE STORAGE RESOURCES—RESULTS (Version 1.1, Sept. 2013).

49. *Id.* at 3, 17 tbl.4.

50. MARC L. BUURSINK ET AL., NATIONAL ASSESSMENT OF GEOLOGIC CARBON DIOXIDE STORAGE RESOURCES—ALLOCATIONS OF ASSESSED AREAS TO FEDERAL LANDS: U.S. GEOLOGICAL SURVEY SCIENTIFIC INVESTIGATIONS REPORT 2015–5021, 12 fig.2 (2015).

the Bureau of Land Management (BLM)[51] or the Forest Service.[52] Various other agencies, including the United States Fish and Wildlife Service and Department of Defense, manage a small portion.[53] Altogether, about 18% of pore space available for geologic CO_2 sequestration is overlaid by federally owned land, not accounting for split estate lands where federally owned minerals underlie privately owned surface estates.[54] Pore space interest in federal land represents a significant opportunity for carbon containment. Although geologic uncertainty results in large ranges, data produced by the National Energy Technology Laboratory indicates that federal lands may include enough capacity to store between twenty-five and seventy-three years of CO_2 storage for the entire United States energy sector based on 2009 levels.[55]

Figure 1.[56]



51. *Id.* at 3 (BLM manages 64% of federal land overlaying technically accessible storage reservoirs).

52. *Id.* (FS manages 21% of federal land overlaying technically accessible storage reservoirs).

53. *Id.*

54. *See id.*

55. Calculations for these values on file with the authors, using data gathered from NAT'L ENERGY TECH. LAB'Y, DEP'T OF ENERGY, DOE/NETL-2009/1358, STORAGE OF CAPTURED CARBON DIOXIDE BENEATH FEDERAL LANDS 12 fig.7 (2009); BUURSINK ET AL., *supra* note 50; U.S. ENERGY. INFO. ADMIN., U.S. ENERGY-RELATED CARBON DIOXIDE EMISSIONS, 2019 at 7 fig.4 (Sept. 2020), https://www.eia.gov/environment/emissions/carbon/pdf/2019_co2analysis.pdf [https://perma.cc/DXD8-KJZL].

56. BUURSINK ET AL., *supra* note 50, at 8 fig.1A.

A. Federal Ownership of Pore Space

Use of federally owned pore space is important to widespread deployment and utilization of geologic storage. Approximately 640 million acres, or 28%, of the land in the U.S. is federally owned.[57] The majority of federal land is owned in fee simple absolute, which encompasses ownership of surface and subsurface interests, including pore space. This land is concentrated in the western United States and, in certain areas, lies in large contiguous blocks, thus potentially reducing the need to contract with numerous, dispersed landowners over fragmented interests in pore space. For these reasons, scholars acknowledge the importance of federal law to geologic CO_2 sequestration[58] as well as the importance of cooperation between the federal and relevant state governments.[59]

In addition to lands owned outright by the federal government, the federal government also plays a role in tribal lands. Title to tribal lands is often held in trust by the federal government for the benefit of tribal populations.[60] Depending on the language of the treaties and agreements originally establishing the tribal trust land, tribal

57. CAROL HARDY VINCENT ET AL., CONG. RSCH. SERV., R42346, FEDERAL LAND OWNERSHIP: OVERVIEW AND DATA 1 (2020).

58. *See, e.g.*, Tara K. Righetti, *Correlative Rights and Limited Common Property in the Pore Space: A Response to the Challenge of Subsurface Trespass in Carbon Capture and Sequestration*, 47 ENV'T L. REP. 10420, 10427 (2017); Kevin L. Doran & Angela M. Cifor, *Does the Federal Government Own the Pore Space Under Private Lands in the West? Implications of the Stock-Raising Homestead Act of 1916 for Geologic Storage of Carbon Dioxide*, 42 LEWIS & CLARK ENV'T L. REV. 527, 531 (2012); Stefanie L. Burt, *Who Owns the Right to Store Gas: A Survey of Pore Space Ownership in U.S. Jurisdictions*, 4 JOULE: DUQ. ENERGY & ENV'T L. J. 1, 10–11 (2016); Owen L. Anderson, *Geologic CO_2 Sequestration: Who Owns the Pore Space*, 9 WYO. L. REV. 97, 98 (2009).

59. *See* Anderson, *supra* note 58, at 98; Jonas J. Monast et al., *A Cooperative Federalism Framework for CCS Regulation*, 7 ENV'T & ENERGY L. & POL'Y J. 18–22 (2012).

60. *See* Worcester v. Georgia, 31 U.S. 515, 529–31 (1832) (finding the federal government was the sole authority to deal with Indian nations, which helped establish the doctrine of tribal sovereignty in the United States); United States v. Mitchell, 463 U.S. 206, 244 (1983) (examining the trust relationship between the federal government and tribal nations and holding the government liable for damages following a breach of fiduciary duty); *Native American Ownership and Governance of Natural Resources*, U.S. DEP'T OF INTERIOR NAT'L RES. REVENUE DATA, https://revenuedata.doi.gov/how-revenue-works/native-american-ownership-governance/ [https://perma.cc/L5PX-UE9S] ("In general, most Native American lands are trust land. Approximately 56 million acres of land are held in trust by the United States for various Native American tribes and individuals.").

ownership rights may include beneficial interests in pore space.[61] Accordingly, and dependent on the structure and government of the particular tribe, tribes may have procedures and regulatory requirements applicable to pore space utilization. In addition, federal statutes such as NEPA or ESA likely apply to any federal decisions regarding tribal land administered in trust.[62]

"Split estates" may include additional federal pore space interests. The federal government owns approximately 57 million acres of federal split estate minerals in the United States.[63] These mineral interests underlie private surface interests and were reserved in land patents granted under various land disposition laws. Severed mineral estates were reserved by the Federal Government in patents issued under the Coal Land Acts,[64] the Agricultural Entry Act,[65] and the Stock-Raising Homestead Act (SRHA),[66] among others. While the majority of split estates involve federal minerals underlying private surface, in some acquired lands, such as those in the Allegheny National Forest, federal surface interests may overlie private minerals. Determining ownership of pore space in these federal split estate-acquired lands proves to be more complex and requires a unique analysis of each statute which disposed of or acquired the surface as well as state law pertaining to pore space ownership. Even where state law is clear regarding pore space ownership, state legislative or judicial determinations could be preempted by federal statutes.

Judicial decisions interpreting federal mineral reservations provide some insight into the issues associated with determining ownership of pore space within split-estate lands with federally owned minerals. Mineral reservations in the SRHA include coal, oil, gas, and a general reservation of "other minerals."[67] Although at

61. *See* United States v. Shoshone Tribe, 304 U.S. 111, 117 (1938) (finding that when lands are reserved or otherwise set aside for tribes, this included the peaceable and unqualified possession of the land thereby vesting the tribes with the beneficial rights to the minerals and timber).

62. *See* BUREAU OF INDIAN AFFAIRS, 59 IAM 3-H, INDIAN AFFAIRS NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) GUIDEBOOK 9, 13 (2012).

63. *How Revenue Works: Ownership*, U.S. DEP'T OF INTERIOR NAT'L RES. REVENUE DATA, https://revenuedata.doi.gov/how-revenue-works/ownership/ [https://perma.cc/FYJ5-TGSB].

64. 30 U.S.C. §§ 81–85.

65. *Id.* §§ 121-125.

66. 43 U.S.C. § 299.

67. *Id.*

least one expired instructional memorandum from 2016 declared that "the subsurface pore space is the property of the surface owner,"[68] scholars have speculated whether, based on federal court interpretations of federal mineral reservations, pore space could be considered an "other mineral" reserved to the United States.[69] In *Watt v. Western Nuclear, Inc.*, the Supreme Court of the United States examined this general reservation as it pertained to gravel. The Court held that land grants should be construed in favor of the government and that rights could be conveyed only by express language and not by implication.[70] *Watt* established that a substance would be considered within the scope of the SRHA reservation if it was (1) mineral in character, (2) removable from the soil, (3) amendable to use for commercial purposes, and (4) not intended to be part of the surface estate as necessary to the stock and forage raising purposes of the act.[71] *Watt* partially relied on *United States v. Union Oil Co. of California*,[72] which held that SRHA mineral reservations included geothermal resources.[73] Other cases interpreting mineral reservations in the Coal Lands Act[74] and the Agricultural Entry Act[75] provide even less guidance. For instance, in *Amoco Production Co. v. Southern Ute Tribe*, the Court found that federal coal reservations did not include the coal bed methane (CBM) within the pore spaces in the coal seam.[76] The Court's analysis

68. Instruction Memorandum No. CO-2016- on Class II injection Facilities and Wells from Deputy State Director of Energy, Lands, and Minerals to All District and Field Offices (March 28, 2016).

69. Doran & Cifor, *supra* note 58.

70. Watt v. W. Nuclear, Inc., 462 U.S. 36, 59 (1983).

71. *Id.* at 53.

72. *Id.* at 52 (citing United States v. Union Oil Co. of Cali., 549 F.2d 1271, 1274 (9th Cir. 1977)).

73. *Union Oil Co.*, 549 F.2d at 1279–80.

74. *See, e.g.*, Amoco Prod. Co. v. S. Ute Tribe, 526 U.S. 865, 873 (1999).

75. *See, e.g.*, Aulston v. United States, 823 F.2d 510 (Fed. Cir. 1987).

76. *Amoco Prod.*, 526 U.S. at 879.

> It may be true, nonetheless, that the right to mine the coal implies the right to release gas incident to coal mining where it is necessary and reasonable to do so. The right to dissipate the CBM gas where reasonable and necessary to mine the coal does not, however, imply the ownership of the gas in the first instance. Rather, it simply reflects the established common-law right of the owner of one mineral estate to use, and even damage, a neighboring estate as necessary and reasonable to the extraction of his own minerals.

Id.

focused on whether CBM had customarily been considered part of coal and did not consider ownership of the vacant pore spaces within the coal.

Scholars are divided on how courts would apply *Watt* to determine ownership of pore space in split estates. Most analysis focuses on the SRHA, under which over 70 million acres of land in the United States are patented.[77] Professor Owen L. Anderson, among others, argues that under the *Watt* holding, even a broad reading of the SRHA should not be interpreted as reserving pore space to the federal government.[78] Rather, because "the Congressional focus of the Act was on reserving minerals," pore space should be interpreted as having been conveyed to private owners with the surface.[79] Expressly disagreeing with Professor Anderson, Professor Kevin L. Doran has argued that the mineral reservation of the SRHA should be read expansively.[80] Citing circuit and Supreme Court holdings, including *Watt*, Professor Doran bases his argument on judicial interpretations finding that a proper analysis of the scope of SRHA patents should focus not on what Congress intended to reserve, but what was intended to be conveyed. Professor Doran argues that "Congress intended to give away only those resources relevant for farming and raising livestock, leaving the rest of the estate to the federal government."[81] Because pore space is not necessary to farming and stock-raising, and totally exists embedded within the subsurface mineral estate, Professor Doran concludes that the SRHA did reserve the pore space to the federal government.[82] Accordingly, this fundamental issue of "who owns the pore space" remains unresolved. This issue is more critical in certain areas such as the Powder River Basin of Wyoming, where numerous SRHA patents were issued and dispersed throughout the basin.

In acquired lands, such as those acquired under the Weeks Act and similar statutes, the federal government often acquired the surface estate but not the minerals. The minerals within acquired lands had often been previously reserved by an owner in the chain of

77. Doran & Cifor, *supra* note 58, at 531.

78. Anderson, *supra* note 58, at 137. *See* Trae Gray, *A 2015 Analysis and Update on U.S. Pore Space Law—The Necessity of Proceeding Cautiously with Respect to the "Stick" Known as Pore Space*, 1 OIL & GAS, NAT'L RES. & ENERGY J. 277, 320 (2015).

79. Anderson, *supra* note 58, at 138.

80. *See* Doran & Cifor, *supra* note 58, at 536–39.

81. *Id.* at 540.

82. *Id.* at 545.

title prior to the conveyance to the United States (outstanding mineral rights) or were reserved by the grantor in the conveyance to the United States (reserved mineral rights).[83] The existence and extent of outstanding mineral rights have generally been determined to be governed by the earlier instrument of conveyance and the state law where the property is located.[84] However, reserved mineral rights are usually subject to the terms of the reservation included in the instrument of conveyance, state law and any federal rules and regulations in effect as of the date of conveyance.[85] Therefore, determining whether the acquired surface lands include pore space ownership rights requires an analysis of pore space ownership under the applicable state law where the property is located, the chain of title of the acquired surface lands, the individual terms of any instrument of conveyance to the United States, the particular acquisition statute(s) for which the land was acquired under and any applicable federal rules and regulations in existence at the time the United States acquired such parcel. However, because state law typically finds the surface owner to be the pore space owner,[86] in these "split estates," the federal government is likely to own the pore space for the vast majority of acquired surface lands.

The issues regarding determination of ownership in federal split estates illustrates both the complexity of determining ownership of pore space within federal reservations and the potential issues that may arise with fragmented ownership in overlapping and enmeshed resources. The potential for differential ownership within a specific geologic structure creates the potential for conflicts in use and priority and may give rise to questions regarding obligations of accommodation. For instance, a series of recent cases has evaluated multiple mineral development issues related to conflicts between federal coal and oil and gas lessees.[87] The possibility of conflicting claims regarding ownership of pore space within federal split estates

83. Dave Fredley, *Surface and Mineral Rights and the Weeks Act*, FOREST HIST. TODAY, Spring/Fall 2011, at 32, 32.

84. *See* Minard Run Oil Co. v. U.S. Forest Serv., 670 F.3d 236, 243 (3d Cir. 2011); *see also* Duncan Energy Co. v. U.S. Forest Serv., 109 F.3d 497, 499 (8th Cir. 1997) (finding that the U.S. Forest Service did have limited authority to determine the reasonable use of the federal surface under federal law).

85. *Minard Run Oil Co.*, 670 F.3d at 253; *Duncan Energy Co.*, 109 F.3d at 499.

86. *See* Burt, *supra* note 58, at 2–4; *see also* Joseph A. Schremmer, *Pore Space Property*, 2021 UTAH L. REV. 1, 66 (2021).

87. *See, e.g.*, Berenergy Corp. v. Bureau of Land Mgmt., No. 19-8041 (10th Cir. June 11, 2019).

may contribute to the cost, risk, and uncertainty of projects which include federal surface and/or mineral interests. Quite simply, if the pore space owner cannot be identified with certainty, any storage project is unlikely to go forward.

B. Present and Future Uses of Federal Pore Space

Use of federal pore space for CO_2-EOR and wastewater injection operations is well established.[88] The grant of a federal oil and gas lease includes the right to use the pore space for exploration, production, and extraction of minerals. This right includes the right to conduct enhanced recovery operations within federal oil and gas leases, including the injection of water or CO_2. Approximately 90% of the total CO_2 injected remains within the depleted hydrocarbon reservoir, a process that is referred to as associated storage or incidental storage.[89] Injection of CO_2 or water for enhanced recovery frequently requires unitization pursuant to federal law and harmonization with state law requirements for compulsory pooling and unitization.[90] Injection wells for CO_2 and wastewater disposal are permitted pursuant to Class II of the UIC program.[91] Injection activities may be conducted pursuant to an oil and lease, or a separate right of way acquired pursuant to Title V of FLPMA.

Due to the size and unified ownership of pore space within federal lands, federal lands pore space has well recognized potential for use in geologic storage as well as for other clean energy applications including biogenic natural gas generation and compressed air energy storage. However, regulatory uncertainty results from vague or missing guidance, lack of procedures, and ambiguities related to agency authority associated with use of

88. *See* Instruction Memorandum No. WY-2013-019 on Rental for Produced Water Injection Facilities and Wells from Deputy State Director, Division of Minerals and Lands, to District Managers (Jan. 22, 2013), https://www.blm.gov/policy/im-wy-2013-019 [https://perma.cc/3N9U-BC3P]; *see also* 43 C.F.R. § 2801.9 (2020).

89. Greg Schnacke, *Carbon Dioxide Infrastructure: Pipeline Transport Issues and Regulatory Concerns—Past, Present, and Future*, *in* ENHANCED OIL RECOVERY: LEGAL FRAMEWORK FOR SUSTAINABLE MANAGEMENT OF MATURE OIL FIELDS 10-1, 10-1, 10-8 (2015).

90. *See* Craig Newman, *Secondary Recovery Units, Pressure Maintenance, and Recycling*, *in* ONSHORE POOLING AND UNITIZATION 10-1, 10-20 to 10-21 (1997).

91. 40 C.F.R. §§ 147.1, 147.3400 (2020) (whether these wells are permitted by the individual State or EPA depends upon whether said state has been granted primacy to regulate Class II wells where the proposed well is to be located).

federal pore space. The following hypothetical case study, based on the Prefeasibility Study prepared as part of the Carbon Safe project evaluating an integrated CCUS project at Dry Fork Station,[92] illustrates the nature and extent of the regulatory uncertainty as an obstacle to potential projects on federal land.

C. Case Study: Integrated Commercial Carbon Capture Project at Dry Fork Station—Campbell County, Wyoming

Consider a geologic CO_2 storage operator who seeks to establish a new geologic sequestration project in Campbell County, Wyoming. Campbell County has historically had extensive coal mining from federal coal leases, oil and gas development on private and federal minerals, and coal-fired electricity generation. Dry Fork Power Station, which began operation in 2011, is the newest coal-fired power plant in the lower 48 states and is adjacent to the Integrated Test Center which provides access to flue gas for CO_2 utilization and capture technologies.[93] The area around Dry Fork Station includes a mix of private, federal, and split estate lands. As an "energy community"[94] the county is particularly vulnerable to the economic impacts of the energy transition and shift away from fossil-dependent industries. Commercial-scale carbon storage operations could provide a new source of employment and revenue. Technical estimates indicate that the area is capable of storing between 2.32 to 4.45 megatons per square mile,[95] or the equivalent of the CO_2 emissions produced from burning between two and a half and five billion pounds of coal.[96]

92. Tara Righetti, *Section 2.2: Legal Assessment*, *in* INTEGRATED COMMERCIAL CARBON CAPTURE AND STORAGE (CCS) PREFEASIBILITY STUDY AT DRY FORK STATION, WYOMING 32 (2019) [hereinafter CCS PREFEASIBILITY STUDY]; Scott Quillinan, J. Fred McLaughlin & Kipp Coddington, Commercial-Scale Carbon Storage Complex Feasibility Study at Dry Fork Station, Wyoming (Dep't of Energy, Technical Report, 2021) (on file with author).

93. Scott Quillinan & Kipp Coddington, *Executive Summary*, *in* CCS PREFEASIBILITY STUDY, *supra* note 92, at 3.

94. Exec. Order No. 14,008, Tackling the Climate Crisis at Home and Abroad, 86 Fed. Reg. 7619, 7623 (Feb. 1, 2021).

95. Nicholas W. Bosshart et al., *Geologic Model Development and Simulation*, *in* CCS PREFEASIBILITY STUDY, *supra* note 92, at 128, 134 tbl.4.5.

96. Calculations prepared by authors by converting emissions data into fossil use equivalency, available at *Greenhouse Gas Equivalencies Calculator*, EPA,

Due to the land ownership patterns in the area, federal pore space rights will almost certainly be necessary for the project. Even if the proposed injection sites lie on privately-owned land, the estimated areal surface area of the plume is approximately 5mi^2. The 10mi^2 area of review includes both federal fee interests and split-estate mineral interests managed by the BLM. Wyoming has legislatively declared that pore space is owned by the surface owner. While there is no question that the federal government would own the pore space within its fee parcels, Wyoming's statutory declaration may not apply to federal split estates.[97] As a result, prior to obtaining rights to the pore space either the operator will need to obtain a disclaimer of interest from the managing federal agency, or a court may need to determine the nature and extent of federal interests in split-estate properties within the project area.

Once federal pore space is identified, the project developer will need to acquire the right to use those lands from the managing federal agency. The project may also falter at this stage due to a lack of clarity from the federal government regarding the application process for use of federal pore space for geologic storage. Outdated guidance from the BLM suggests that operators may apply for a federal land use permit for certain activities under the Federal Land Policy and Management Act (FLPMA) by filling out Form 2920-1.[98] However, the process has never been pursued and its viability remains theoretical. Lack of guidance regarding processes for granting injection rights or a rental schedule setting forth the fees associated with use of federal pore space adds to the uncertainty of the project. Although Wyoming allows project operators to unitize pore space for geologic storage projects, thus allowing projects to move forward with only the consent of the owners of 80% of the "pore space storage capacity,"[99] the extent, if any, to which this state

https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator [https://perma.cc/3T6H-GGDE] (Oct. 15, 2018).

97. Righetti, *supra* note 92, at 32.

98. Instruction Memorandum No. 2012-035 on Interim Guidance on Exploration and Site Characterization for Potential Carbon Dioxide Geologic Sequestration from Assistant Director, Minerals and Realty Management to All WO and Field Officials (Dec. 1, 2011), https://www.blm.gov/policy/im-2012-035 [https://perma.cc/4VLD-6YHR] [hereinafter IM 2012-035].

99. WYO. STAT. ANN. §§ 35-11-313 to 318 (202`); 055-0001-3 WYO. CODE R. § 43 (LexisNexis 2021).

process applies to federal land remains unclear. No corollary federal law for federal unitization of pore space for geologic storage exists.

The project may also face significant delays due to required environmental reviews associated with resource planning and permitting. Currently, the resource management plans (RMP) for the region do not include geologic storage. Before the BLM may permit any carbon sequestration projects in federally owned pore space, a project level amendment to the relevant RMPs may be required and the Environmental Impact Statement (EIS) may need to be updated.[100] This analysis could be in addition to any project specific analysis that may be required regarding grants of injection rights to federal pore space, or approval of the operator's Class VI permit by the state Department of Environmental Quality. Moreover, these findings may be subject to legal challenges and the potential that decisions regarding the proposed project could be vacated.

Additionally, the project developer faces significant uncertainty regarding its potential long-term liability and requirements and timing of its eventual surrender of rights in the lands. Whereas some states, such as North Dakota, have statutory schemes for liability transfer after a determined period of time,[101] no equivalent federal statute exists.

III. GOVERNANCE OF FEDERAL PORE SPACE

A. Land Management Laws and Regulations

The Property Clause of the Constitution provides Congress with broad rights of disposal of federal lands and the authority to make rules and regulations regarding the use or non-use of federal lands.[102] Rights of access and use for federal lands are managed by a variety of agencies according to various statutes. The statutes involved depend on the substance and proposed use, whether regarding leasable minerals, coal mining, timber, or other purposes. Although these statutes fail to specifically address carbon storage or

100. *See, e.g.*, N. Plains Res. Council v. U.S. Army Corps of Eng'rs, 454 F. Supp. 3d 985, 995 (D. Mont. 2020), *amended by* 460 F. Supp. 3d 1030 (D. Mont. 2020); 43 C.F.R. §§ 1610.5-3(c), 1610.5-5.

101. N.D. CENT. CODE § 38-22-17 (2020). North Dakota also maintains an industry-funded trust fund to cover liability costs. *Id.* § 38-22-15(2).

102. *See* U.S. CONST. art. IV, § 3, cl. 2.

pore space, the current federal statutes that pertain most specifically to pore space include the FLPMA and the National Forest Management Act (NFMA). These statutes provide management authority over federal lands to certain agencies and require the agencies to identify and inventory the permissible and contemplated uses on such public lands.[103]

Federal mineral holdings, including oil and gas operations, and the development thereof, are managed by the BLM largely pursuant to the Mineral Leasing Act (MLA) and the FLPMA.[104] FLPMA mandates that public land be managed under "the principles of multiple use and sustained yield" and the preservation and protection of public lands.[105] Thus, the BLM balances resources and uses on the public lands. Such uses include, but are not limited to, renewable and non-renewable energy development, recreation, grazing, timber harvest, and wildlife preservation.[106] While FLPMA authorizes the BLM to lease public land for "use, occupancy, and development," as Professor Reitze notes, long-term sequestration may conflict with the BLM's mandate to manage public lands for multiple uses.[107] Therefore, the BLM will likely be required to prepare "Reasonable Foreseeable Development Scenarios" before sequestration rights may properly be issued.[108]

In order to assure that resources are appropriately allocated for multiple use, the BLM engages in comprehensive planning processes. FLPMA requires the BLM to create RMPs pertaining to its management of public lands and to periodically update these plans.[109] RMPs create opportunities for public participation, allocate resources, and establish monitoring systems and protection strategies for public lands. When new information arises or new uses of public lands are proposed, RMPs may be amended in accordance

103. 43 U.S.C. § 1712(c); 43 U.S.C. § 1732(a); Denise A. Dragoo, *Federal Land Use Planning Primer Under FLPMA and NFMA*, *in* PROCEEDINGS OF 49TH ANNUAL ROCKY MOUNTAIN MINERAL LAW INSTITUTE 16-1, 16-2 (2003).

104. 30 U.S.C. §§ 181–263; 43 U.S.C. § 1702(c).

105. 43 U.S.C. § 1712(c)(1).

106. *Id.* § 1702(c); U.S. DEP'T OF THE INTERIOR BUREAU OF LAND MGMT., BLM/WO/GI-01/002+REV16, THE FEDERAL LAND POLICY AND MANAGEMENT ACT OF 1976, AS AMENDED 2 (2016).

107. Reitze, *supra* note 31, at 10821.

108. *Id.*

109. 43 U.S.C. § 1712.

with federal regulations.[110] As a result, carbon sequestration projects likely require an amendment of current BLM RMPs.[111] Any such amendments are likely to invoke the NEPA process.

National Forests are managed by the Forest Service within the Department of Agriculture pursuant to the requirements of the NFMA and other forest management statutes. These statutes require management of National Forest lands for multiple use and sustained yield.[112] The NFMA and Forest and Rangeland Renewable Resources Planning Act of 1974 (FRRRPA) require development and periodic amendment of land-management plans for lands within the national forest system.[113] While forest plans do not currently assess subsurface resources such as pore space or use of lands in the national forest system for geologic storage, the Forest Service may have authority to do so. In 2012, the planning rule was amended to require the Forest Service to adapt forest plans to changing conditions, including climate change.[114] Additionally, FRRRPA requires the Forest Service to engage in long-term planning for its renewable resource programs, and requires the Department of Agriculture to prepare "Renewable Resource Assessments" every ten years.[115] These assessments must address the "use, ownership, and management of forest, range, and other associated lands" as well as "an analysis of the rural and urban forestry opportunities to mitigate the buildup of atmospheric carbon dioxide and reduce the risk of global climate change."[116] As part of the assessment, the Department of Agriculture must keep an inventory of renewable resources, including "new and emerging resources and values."[117] FRRRPA defines "renewable resources" as matters within the Forest Service's "scope of responsibility."[118] While this definition may still be too narrow to encompass uses of pore space for permanent geologic sequestration, the broader mandate that Renewable Resource Assessments address may provide opportunities for climate

110. 43 C.F.R. § 1610.5-5 (2020).
111. Reitze, *supra* note 31, at 10821.
112. 16 U.S.C. §§ 473–482.
113. 16 U.S.C. §§ 1600–1614.
114. 36 C.F.R. § 219.5 (2020).
115. 16 U.S.C. § 1601.
116. *Id.*
117. 16 U.S.C. § 1603.
118. 16 U.S.C. § 1610.

mitigation and may open pathways to include geologic storage potential within such assessments.

The BLM may derive authority to permit uses of federal pore space for geologic storage and other non-mineral purposes from FLPMA. In 2010, President Obama established an Interagency Task Force on Carbon Capture and Storage that consisted of participants from multiple agencies including EPA and DOE.[119] This task force considered numerous aspects related to geologic storage including the application of federal laws and evaluated the possibility of CCS on federal lands. The task force determined that pipelines and other transportation systems necessary for the projects would likely be permitted under Title V of the FLPMA.[120] While acknowledging that "no provision of FLPMA expressly authorizes the sequestration of CO_2 on public lands" the drafters concluded that Section 501 is broad enough to allow such development because it "authorizes rights-of-way for transportation and distribution of certain gases and liquids 'and *for storage and terminal facilities in connection therewith*.'"[121] Read together with FLPMA's general provisions for management, use, and occupancy of Federal lands, this provision may provide BLM with sufficient authorization to develop regulations regarding pore space use. Section 302(b) of FLPMA authorizes the BLM "to undertake any use and development of public lands not specifically forbidden by law and not authorized by other laws or regulations."[122] Together, these provisions of FLPMA may authorize the Secretary of Interior to grant rights-of-way in pore space and across public lands for purposes related to geologic storage in public lands.

Whereas Section V of FLPMA authorizes grants of rights of way for gas pipelines and associated storage facilities and terminals for both public lands and national forests, forest service authorizations are more limited. Section 302(b) of FLPMA does not encompass national forest lands. While various sections of the forest management statutes may provide some authorization for activities related to geologic carbon storage, most are not expansive enough to provide general authorization for development of a geologic storage land-management program on National Forest lands. For instance, the Term Permit Act of March 4, 1915, authorizes the Secretary of

119. OFF. OF FOSSIL ENERGY, *supra* note 37, at 7.
120. *Id.* at 64–65.
121. *Id.* at 65 (emphasis added) (quoting 43 U.S.C. § 1761(a)(2)).
122. *Id.* at 65 (quoting 43 U.S.C. § 1732).

Agriculture to issue permits for "buildings, structures, and facilities" for up to 30 years and for lands not greater than 80 acres for "industrial or commercial purposes" consistent with or related to other uses on the national forests.[123] This 80-acre limitation is incompatible with the acreage of pore space required in a typical CO_2 storage project. Similarly, the Forest Service is authorized by the Multiple Use Sustained Yield Act (MUSYA) to manage renewable resources within National Forest lands.[124] The MUSYA specifically applies to administration of national forest land for "outdoor recreation, range, timber, watershed, and wildlife and fish purposes,"[125] and requires that all "renewable surface resources" are managed to allow multiple uses and sustained yield, or "high-level annual or regular periodic output . . . without impairment of the productivity of the land."[126] Given the specifically enumerated values of the MUSYA, pore space is not likely to be considered a "renewable surface resource." Thus, authority of the forest service to grant rights to use National Forest lands for geologic storage is less clear than the authority of the BLM under FLPMA.

In addition, ambiguity potentially surrounds management authority for subsurface storage resources within National Forest lands. Under the Federal Onshore Oil and Gas Leasing Reform Act (FOOGLRA),[127] the BLM, acting on behalf of the Department of the Interior, bears primary responsibility for managing the mineral estate on United States Forest Service Lands.[128] As part of this role, the BLM may lease the mineral estate to private parties,[129] including for purposes such as CO_2-EOR, subject to approval from the Forest Service.[130] FOOGLRA does not define what exactly is encompassed by the mineral estate on national forest land.[131] However, the Act provides that only land "known or believed to

123. 16 U.S.C. § 497.

124. Rangeland Renewable Resources Planning Act, 16 U.S.C. §§ 1600–1610; Multiple Use Sustained Yield Act, 16 U.S.C. §§ 528–531.

125. 16 U.S.C. § 528.

126. 16 U.S.C. § 531.

127. 30 U.S.C. §§ 226–226e.

128. *See* 30 U.S.C. § 226; *see also* Memorandum of Understanding between U.S. Dep't of the Interior Bureau of Land Mgmt. and U.S. Dep't of Agric. Forest Serv., 2 (Apr. 14, 2006) https://www.fs.fed.us/geology/MOU_BLM_Oil_Gas.pdf [https://perma.cc/9HTN-MREY].

129. *See* 30 U.S.C. § 226(a).

130. 30 U.S.C. § 226(h); *see* 43 C.F.R. § 3101.7-1(c) (2020).

131. 30 U.S.C. § 226.

contain oil or gas deposits" are subject to BLM leasing.[132] FOOGLRA was enacted to amend the MLA of 1920 and thus likely only extends BLM's leasing authority to leasable minerals. Consistent with the Interagency Task Force findings that the MLA was not broad enough to cover geologic storage,[133] the BLM's authority for managing minerals in United States Forest Service Lands likely does not extend to pore space. Pursuant to these amendments to the MLA, the Forest Service retains responsibility for regulating all surface-disturbing activities.[134] Thus, despite BLM's extensive experience managing subsurface resources in national forest lands for fluid mineral extraction, the agency likely lacks authority to lease or grant rights of way in National Forest lands for geologic storage unrelated to oil and gas development.

No specific regulations address the disposition of federal pore space for geologic storage. The only guidance directly addressing the issue is an expired Instruction Memorandum (IM) issued by the Obama Administration in December of 2011.[135] This IM explains the BLM's "policy to allow environmentally responsible exploration and site characterization studies in acceptable areas on public lands to assess the feasibility of using public lands for potential CO_2 GS [CCUS] development projects in compliance with applicable state and Federal requirements."[136] The IM explains that permits issued by the BLM will be required for CCS "exploration and site characterization studies on public lands" and "must be filed under Section 302(b) of FLPMA" using Form 2920-1.[137] These initial efforts addressed the procedure and requirements for obtaining a permit, including notification and financial assurances, but left other questions, such as the process for determining rental rates or fees for pore space usage, undetermined. The IM expired in September of 2013 and no new guidance has been issued.

No federal authorization exists for unitization of pore space. Unitization is a process by which numerous parcels and interests can be combined for coordinated development as a single unit. Units may include federal, state, and fee interests. Unitization permits

132. *Id.* § 226(a).
133. OFF. OF FOSSIL ENERGY, *supra* note 37, at 65.
134. 30 U.S.C. § 226(g).
135. *See* IM 2012-035, *supra* note 98.
136. *Id.*
137. *Id.*

planning of infrastructure and development on a reservoir-scale rather than based on individual parcels and acknowledges that injected substances are likely to migrate within the storage complex, thus addressing concerns related to subsurface trespass resulting from intra-unit plume migration. Unitization processes may also grant administrative agencies primary jurisdiction over issues of subsurface trespass, which requires landowners to petition an administrative agency for inclusion in a unit[138] and may further address concerns related to subsurface trespass. Moreover, compulsory unitization processes that permit inclusion of non-consenting interests may resolve issues relating from holdouts. Part 226(m) of the MLA permits unitization of oil and gas parcels on federal land.[139] Unitization of oil and gas interests also has the effect of allowing field-wide coordination of surface facilities, without regards to individual boundaries.[140] Kentucky, North Dakota, and Wyoming all have statutes permitting regulatory agencies to create units for geologic storage.[141] While in some circumstances federal land can be included in oil and gas pools or units formed under state law,[142] no current authority allows federal pore space to be unitized in state regulatory proceedings. Lack of federal pore space unitization authorizations and confusion regarding whether federal pore space can be unitized under state law is likely to be problematic for storage projects in areas with fragmented land ownership.

Finally, long term liability issues remain as one of the enduring hurdles to widespread development of geologic storage activities on federal land.[143] In a recent report by the Congressional Research Service, EPA expressly disclaimed responsibility for the transfer of liability from operators or injectors to any other parties, including federal agencies.[144] Indeed, questions regarding responsibility for a

138. WYO. STAT. ANN. § 35-11-316 (2020).

139. 30 U.S.C. § 226(m); *see* 43 C.F.R. § 3180 (2020).

140. Entek GRB, L.L.C. v. Stull Ranches, L.L.C., 763 F.3d 1252, 1256 (10th Cir. 2014).

141. *See* KY. REV. STAT. ANN. § 353.806 (West 2021); N.D. CENT. CODE §§ 38-22-08 to -10 (2021); WYO. STAT. ANN. §§ 35-11-313 to -316 (2020).

142. Owen L. Anderson, *State Conservation Regulation – Single Well Spacing and Pooling – Vis-à-vis Federal and Indian Lands*, *in* FEDERAL ONSHORE OIL AND GAS POOLING AND UNITIZATION (2006).

143. ANGELA C. JONES, CONG. RSCH. SERV., R46192, INJECTION AND GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE: FEDERAL ROLE AND ISSUES FOR CONGRESS 18 (2020).

144. *Id.* at 16.

Class VI UIC well after the required 50-year maintenance period and any role the federal government may play in assuming financial responsibility for long-term liability remain open.[145] Professor Wendy B. Jacobs suggests multiple solutions to the liability problem,[146] including Congressional authorization for the DOE and BLM to designate sequestration sites and assume long-term responsibility for projects at the very beginning[147] as well as Congressional creation of a liability trust fund financed by fees on CO_2 emissions and storage projects.[148] Another solution would require the federal government to assume liability after a shortened term of liability for the injector,[149] as has already been done by several states including Louisiana,[150] North Dakota,[151] and Montana.[152]

B. NEPA

Compliance with NEPA presents an obstacle to expanded deployment of both CCS and CCUS and greater utilization of federal pore space for carbon storage. NEPA applies to any "major Federal

145. *Id.* at 18.

146. Wendy B. Jacobs & Michael Craig, *Legal Pathways to Widespread Carbon Capture and Sequestration*, 47 ENV'T L. REV. 11022, 11043–46 (2017).

147. *Id.* at 11043.

148. *Id.* at 11043–44; *Grant Resources,* OFF. OF SURFACE MINING RECLAMATION & ENF'T, https://www.osmre.gov/resources/grants.shtm [https://perma.cc/C327-DRY4] (Mar. 8, 2021) (finding a similar solution was implemented for abandoned coal mines: active coal mines pay a fee per ton of coal mined and the fund is used to finance reclamation projects).

149. Jacobs & Craig, *supra* note 146, at 11045.

150. Louisiana statutes permit assumption of liability by the state after at least 10 years. LA. STAT. ANN. § 30:1109(A) (2020). Louisiana also maintains a trust fund financed by industry fees to cover future damages. *Id.* § 30:1110(C). *See* Jacobs & Craig, *supra* note 146, at 11045.

151. Similar to Louisiana, North Dakota will assume liability for injected CO2 after at least 10 years. N.D. CENT. CODE § 38-22-17 (2020). North Dakota also maintains an industry-funded trust fund to cover liability costs. *Id.* § 38-22-15(2). *See* Jacobs & Craig, *supra* note 146, at 11045.

152. Montana statutes, the effectiveness of which are contingent on Montana obtaining primacy over EPA UIC Class VI wells, provide for Montana to assume liability for injected CO_2 fifty years after injection is completed. MONT. CODE ANN. § 82-11-183 (2019). These statutes also provide for the state to cede liability to the federal government if the federal government acts to assume the liability, *Id.*, which are effective on the date that the board of oil and gas conservation is granted primacy to administer activities at carbon dioxide sequestration wells by the EPA, as established in 2009 Mont. Laws ch. 474, § 4.

actions significantly affecting the quality of the human environment."[153] Recent updates to the CEQ regulations amend the definition of "major federal actions" and differentiate between major actions and those which are "significantly affecting" the environment.[154] However, even with these changes, the injection of CO_2 on federal lands for geologic storage would almost certainly trigger NEPA environmental review, even where no surface operations on federal land result. NEPA environmental reviews could also be required where geologic storage operations are conducted, regulated, approved, or funded by a federal agency or where a federal agency significantly participates in planning.[155] As a result, NEPA has also been applied to federal decisions on both private, state, and tribal trust land.[156] Although test projects in limited circumstances may be able to rely on a categorical exclusion, [157] compliance with NEPA is expected to be a significant aspect of geologic storage projects. Although few would dispute that some level of environmental analysis of proposed geologic storage projects on federal lands should be undertaken, compliance may be both time consuming and costly.[158] A recent study reports that the average EIS completion time is 4.5 years,[159] a timeline which may be impractical given 45Q's current beginning of construction deadline of January 1, 2026.

153. 42 U.S.C. § 4332(2)(C).

154. Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act, 85 Fed. Reg. 43,304, 43,346 (July 16, 2020) (to be codified at 40 C.F.R. pts. 1500–08, 1515–18).

155. *See, e.g.*, Indian River Cnty. v. Rogoff, 201 F. Supp. 3d 1, 5 (D.D.C. 2016); Scottsdale Mall v. Indiana, 549 F.2d 484 (7th Cir. 1977); Sierra Club v. U.S. Fish & Wildlife Serv., 235 F. Supp. 2d 1109 (D. Or. 2002); Arnold W. Reitze Jr., *Carbon Capture and Storage Program's NEPA Compliance*, 42 ENV'T L. REP. 10853, 10857 (2012). *See also* NAT'L ENERGY & TECH. LAB'Y, SITING AND REGULATING CARBON CAPTURE, UTILIZATION AND STORAGE INFRASTRUCTURE – WORKSHOP REPORT 31 (2017).

156. *See* Notice of Availability of the Wyoming Pipeline Corridor Initiative Draft Environmental Impact Statement and Resource Management Plan Amendment, 85 Fed. Reg. 21,453 (Apr. 17, 2020); Jicarilla Apache Tribe v. Andrus, 687 F.2d 1324, 1340 (10th Cir. 1982).

157. *See* 40 C.F.R. § 6.204 (2020).

158. Sharon Buccino & Linda Bullen, *A Path Forward: Navigating Changes to CEQ's NEPA Regulations*, *in* PROCEEDINGS OF 66TH ANNUAL ROCKY MOUNTAIN MINERAL LAW INSTITUTE 7-1, 7.02 (2020).

159. COUNCIL ON ENV'T QUALITY, EXEC. OFF. OF THE PRESIDENT, ENVIRONMENTAL IMPACT STATEMENT TIMELINES (2010-2018) (2020) https://ceq.doe.gov/docs/nepa-practice/CEQ_EIS_Timeline_Report_2020-6-12.pdf [https://perma.cc/Q3QU-EJ3J].

A project on federal lands may be subject to many layers of environmental review. Since most RMPs do not already evaluate subsurface use and infrastructure for geologic storage, amendments to existing RMPs would trigger NEPA analysis.[160] Additional environmental reviews could occur prior to significant federal decisions regarding land uses either as part of the project or as connected actions, including issuance of a land use permit, easement, or lease. Still others may apply to decisions regarding permitting of infrastructure, drilling operations, river crossings, or construction of surface facilities. For instance, common NEPA triggers encountered in federal lands during EOR development include: "(1) approval of an Application for Permit to Drill (APD); (2) BLM or Forest Service approval of a surface use plan of operations; and (3) BLM or Forest Service approval of a right of way for pipelines or other facilities."[161] However, NEPA review is not limited to the development of federal resources; reviews must also precede a pipeline crossing federal lands[162] or where the federal government is funding a large portion of the project.[163] Although proposed CEQ regulations[164] and a limited judicial exception[165] could except certain aspects of projects from NEPA where other agencies have prepared functionally equivalent environmental analyses, geologic storage projects will most likely still require extensive NEPA review.[166]

The scope and potential challenges associated with environmental review of geologic storage projects is relatively untested. Although clearly important to evaluation of potential geologic storage projects on federal land, the application of NEPA

160. 43 C.F.R. § 1601.0-6 (2020). *See* Reitze, *supra* note 155, at 10857–63 (discussing the EIS requirement under NEPA for various proposed on federally owned land that might significantly affect the quality of the human environment).

161. Zeke J. Williams & Steven K. Imig, *EOR on Federal Lands*, *in* ENHANCED OIL RECOVERY: LEGAL FRAMEWORK FOR SUSTAINABLE MANAGEMENT OF MATURE OIL FIELDS 6-1, 6-20 (2015).

162. NAT'L ENERGY & TECH. LAB'Y, *supra* note 155, at 31.

163. *See id.*; Reitze, *supra* note 155, at 10857.

164. *See* 85 Fed. Reg. 1684, 1714 (proposed Jan. 10, 2020) (to be codified at 40 C.F.R. § 1500–08).

165. *See, e.g.*, W. Neb. Res. Council v. EPA, 943 F.2d 867, 870 (8th Cir. 1991).

166. 40 C.F.R. §§ 1508.9, 1508.11 (2020); s*ee* U.S. DEP'T OF ENERGY, DOE/EA-1828, CO_2 CAPTURE FROM BIOFUELS PRODUCTION AND SEQUESTRATION INTO THE MT. SIMON SANDSTONE 27 (2011) (detailing how the DOE-sponsored Archer Daniels Midland geologic sequestration project was evaluated under the EA process and successfully passed EA review).

also presents challenges.[167] For example, draft guidance from the EPA suggests that federal agencies should consider carbon sequestration as a GHG emissions reduction option, but this guidance "is not applicable to federal land and resource management."[168] In the absence of guidance, agencies and proponents of geologic storage projects will need to determine how to meet NEPA requirements relative to consideration of cumulative impacts and indirect effects, including potential impacts on GHG emissions, and an analysis of alternatives.[169] For example, the relative lack of large scale carbon-dioxide removal alternatives which are "practical or feasible from the technical and economic standpoint"[170] may complicate decisions about which alternatives to discuss. Issues like these may increase coordination challenges associated with NEPA and make agency decisions based on environmental review especially vulnerable to challenge.

IV. LEGISLATIVE AND REGULATORY OPPORTUNITIES

Increased use of CCUS forms an integral part of any reasonable plan to reduce or eliminate CO_2 emissions in order to meet energy and climate goals in the United States and internationally. In January of 2021, the United States submitted the instrument of acceptance to rejoining the Paris Agreement.[171] Large amounts of storage will be necessary to reach the carbon emission reduction targets established in the agreement. Moreover, coordinating carbon dioxide removal activities on federal lands is consistent with President Biden's Executive *Order on Tackling the Climate Crisis at Home and Abroad*. The order directs federal agencies to coordinate to promote decarbonization strategies, revitalize energy communities, and "align[] the management of Federal procurement

167. *See* Reitze, *supra* note 31, at 10818–20.

168. *Id.* at 10819.

169. 42 U.S.C. § 4332(2)(C); WildEarth Guardians v. Zinke, 368 F. Supp. 3d 41, 53, 85 (D.D.C. 2019).

170. Forty Most Asked Questions Concerning CEQ's NEPA Regulations, 46 Fed. Reg. 18,026, 18,027 (Mar. 23, 1981) (to be codified at 40 C.F.R. §§ 1500–08) (emphasis omitted).

171. Statement on Acceptance of the Paris Agreement on Climate Change on Behalf of the United States, DAILY COMP. PRES. DOC. 1 (Jan. 20, 2021), https://www.govinfo.gov/content/pkg/DCPD-202100049/pdf/DCPD-202100049.pdf [https://perma.cc/YR5X-D4AV].

and real property, public lands and waters, and financial programs to support robust climate action."[172]

In the west, federal lands make up a significant portion of total land area and are frequently interspersed with private and state lands. Commercial scale CCUS projects require a large land area, and thus proposed injection projects in the western United States are likely to include at least some federal lands and minerals. Uncertainty regarding the acquisition of injection and storage rights and application of NEPA to these projects may discourage investment in CCUS projects across wide swaths of federal land. Legislative and regulatory opportunities to encourage federal pore space utilization for carbon storage include (1) legislation creating a comprehensive regulatory program for federal pore space utilization and associated rulemaking, including authorization for unitization of federal pore space in lands managed by both the BLM and the National Forest Service; (2) clarity on the application of NEPA and the enactment of new categorical exclusions; (3) legislative and judicial clarification of pore space ownership in split estates; and, (4) guidance directing agencies to incorporate geologic storage and pore space utilization within land planning processes.

A. Clarify Processes, Rules, and Regulations Regarding Federal Pore Space Utilization

Although Section 302(b) of the FLPMA already gives the BLM authority to grant approvals for use of federal pore space, without clear regulatory programs and guidance, uncertainty clouds efforts to promote carbon storage on federal lands.[173] Lawmakers can address this uncertainty by enacting legislation that provides land-management agencies with specific direction regarding the use of federal pore space. Rather than relying on a broad interpretation of Section 501 of FPLMA to grant rights of way for "storage and terminal facilities" in connection with gas pipelines, more specific geologic storage legislation could provide the authorization necessary to BLM and the Forest Service to develop a comprehensive program for geologic storage within federal lands. At the minimum,

172. Exec. Order No. 14,008, Tackling the Climate Crisis at Home and Abroad, 86 Fed. Reg. 7,619, 7,623 (Feb. 1, 2021).

173. *See* Federal Land Policy and Management Act of 1976 § 302(b), 43 U.S.C. § 1732(b); 43 U.S.C. § 2.

this legislation should (1) designate which land management agencies shall have regulatory jurisdiction for geologic storage; (2) authorize such land-management agencies to grant rights to pore space for geologic storage and other uses; (3) authorize such land-management agencies to grant right-of-way access to facilitate pore space development, including necessary roads, pipelines and facilities; (4) address issues related to long term liability and procedures for abandonment, surrender, or reclamation of federal lands at the conclusion of operations; (5) harmonize requirements under various federal environmental laws and encourage coordination between agencies; and (6) authorize unitization of interests for geologic storage and address the extent to which federal subsurface interests are subject to state unitization processes. Potential legislation could also clarify whether pore space is considered a "renewable surface resource" within the meaning of the FRRRPA or a "renewable surface resource" within the meaning of the MUSYA. As part of the specific authorizations discussed above, Congress may wish to consider expanding the BLM's management authority of subsurface minerals within the National Forests to include pore space. Owing to its history of subsurface and fluid mineral management, particularly in the context of CO_2-EOR and unitization related to mineral development on federal lands,[174] the BLM likely has more expertise regarding subsurface property than other potential management agencies. The cooperative process currently employed for oil and gas leasing in National Forest lands could also work well for geologic storage management.

Although certain actions, such as authority to create geologic storage units, almost certainly require legislative action, much of the work can be done through rulemaking. Agencies have an opportunity to clarify processes regarding pore space utilization through rulemaking and guidance. Rulemaking with respect to federal pore space utilization and geologic storage would streamline projects and reduce the uncertainty for developers. For instance, agencies could undertake rulemaking to formalize the previously expired guidance which suggests that geologic storage projects require an application using Form 2920-1. Rulemaking regarding potential liability transfer and surrender of federal pore space rights at the conclusion of operations should be harmonized with MRV requirements for Class VI wells. Although instructional memoranda do not have the

174. *See supra* Part II.B.

same force and durability as laws and regulations, agency guidance can provide clarity to project proponents and encourage consistency across agencies. For instance, agency guidance frequently establishes rental schedules for produced water injection facilities and wells. Similar guidance for geologic storage would be instructive and provide project proponents with certainty regarding certain commercial aspects of the project.

Developing land management programs and regulations for carbon storage would provide carbon containment project proponents with guidance on the process, cost, and time required to obtain land management authorizations. In so doing, it would encourage use of public lands to create jobs around net-negative energy development and CO_2 removal technologies. New technologies and evolving public priorities for use of public lands in order to meet national resilience, energy, and security needs have always required planning and rulemaking. Examples range from passage of the 1920 MLA, which removed oil and gas from location under the general mining law,[175] to more recent efforts to promote renewable energy development through landscape planning efforts and promulgation of the Solar and Wind Energy Rule.[176] As with those efforts, rulemaking related to subsurface carbon containment activities on public land will facilitate responsible development in areas of high priority, assure a fair return from use of public resources, and institute transparent and consistent practices across land management agencies.

B. NEPA—Categorical Exclusions and CEQ Regulations

NEPA may present a significant cost and time delay associated with geologic storage projects on federal land even where projects may only involve federal subsurface pore space and have no surface activities. Categorical exclusions are appropriate where an agency, with CEQ review, has determined that the proposed activity does not have a significant impact on the human environment.[177] An EA or EIS is not required for activities covered by categorical exclusions, thus saving time and resources. Categorical exclusions may be created through an administrative process or be enacted into law.

175. 30 U.S.C. § 226.

176. *See* 43 C.F.R. §§ 2800, 2880 (2020).

177. Alaska Ctr. for the Env't v. U.S. Forest Serv., 189 F.3d 851, 859 (9th Cir. 1999).

For instance, the Energy Policy Act of 2005 created a number of new categorical exclusions for certain aspects of energy development.[178] As a result, an opportunity exists for Congress to enact new categorical exclusions as part of comprehensive legislation for geologic storage as well as CEQ to encourage individual agencies to consider whether there are additional categorical exclusions related to geologic storage which may be appropriate for designation.[179] In the Consolidated Appropriations Act of 2021, Congress directed CEQ, together with other agencies, to evaluate opportunities to streamline the permitting process for CCUS project.[180] Evaluation of new categorial exclusions is a critical aspect of that process.

Agency expansion of categorical exclusions to cover certain aspects of storage projects could streamline federal pore space utilization for geologic storage projects. In other contexts, agencies have created categorical exclusions for restoration and habitat enhancement projects designed to address environmental harms and increase resilience.[181] To properly create a categorical exclusion, an agency must demonstrate that the activity covered by the proposed exclusion will not have a significant impact on the human environment.[182] As a result, a categorical exclusion for all aspects of geologic storage– including pipelines, surface uses, and other connected actions - would most likely be inappropriate. However, smaller exclusions are possible. For instance, the BLM could propose a categorical exclusion covering actions, including grants of land use permits or pore space rights, involving no surface operations on federal land. Another possible exclusion could cover actions related to the conversion of enhanced oil recovery facilities to geologic

178. Carolyn L. McIntosh, *NEPA and the Energy Policy Act of 2005*, NEPA & FED. LAND DEV., Feb. 2006, at 6-1 to 6-3; Mark K. Capone & John C. Ruple, *NEPA and the Energy Policy Act of 2005 Statutory Categorical Exclusions: What Are the Environmental Costs of Expedited Oil and Gas Development?*, 18 VT. J. ENV'T L. 371, 372 (2017).

179. CEQ has previously encouraged agencies to expand categorical exclusions. Guidance Regarding NEPA Regulations, 48 Fed. Reg. 34,263, 34,265 (July 22, 1983) (codified at 40 C.F.R. pt. 1500).

180. Consolidated Appropriations Act of 2021, Pub. L. No. 116-260, div. S, 134 Stat. 1182 (2020).

181. 36 C.F.R. § 220.6 (2020); 10 C.F.R. §§ 1021.400–.410 (2020); 16 U.S.C. § 6591e.

182. Final Guidance for Federal Departments and Agencies on Establishing, Applying, and Revising Categorical Exclusions Under the National Environmental Policy Act, 75 Fed. Reg. 75,628, 75,628 (Dec. 6, 2010).

storage facilities, provided the footprint for the operation was not extended. Other agencies could consider whether certain decisions related to the financing of geologic storage projects or grant of permits could be appropriately excluded from NEPA review. Although approval of new or expanded categorical exclusions for geologic storage projects would streamline review, agencies should assure that creation of new categorical exclusions do not undermine NEPA's important objectives. Some scholars have criticized the creation of new categorical exclusions as sidestepping the substantive and public participation aspects of NEPA.[183] As such, Congress and agencies should judiciously consider the appropriateness of new categorical exclusions while concurrently weighing the opportunity costs of climate inaction.

NEPA analyses, CEQ guidance, agency instructional memoranda, and designation and application of categorical exclusions are all vulnerable to legal challenge. Although environmental litigation to reveal errors is expensive,[184] the additional delays and potentially extreme remedies available should encourage prudence in the application of categorical exclusions by federal agencies. The application of a categorical exclusion to a specific project is subject to judicial review.[185] Judicial review pursuant to the Administrative Procedure Act is deferential and applies the "arbitrary and capricious" standard.[186] A reviewing court may only reverse an agency decision if the agency improperly considered certain factors, did not "consider an important aspect of the problem," or reached either an implausible conclusion or one not supported by the facts.[187] CEQ regulations require environmental review of actions covered by the categorical exclusion in "extraordinary circumstances."[188] Extraordinary circumstances exist when an activity that normally falls within the scope of a

183. Kevin H. Moriarty, *Circumventing the National Environmental Policy Act: Agency Abuse of the Categorical Exclusion*, 79 N.Y.U. L. REV. 2312, 2316–17 (2004).

184. *Id.* at 2316.

185. *See id.* at 2333–34; *see also* Sierra Club v. Bosworth, 510 F.3d 1016, 1022 (9th Cir. 2007).

186. *Sierra Club*, 510 F.3d at 1022 (quoting Alaska Ctr. for the Env't v. U.S. Forest Serv., 189 F.3d 851, 857 (9th Cir. 1999)).

187. *Id.* at 1023 (quoting W. Radio Servs. Co. v. Espy, 79 F.3d 896, 900 (9th Cir. 1996)).

188. *Alaska Ctr. for the Env't*, 189 F.3d at 858 (internal citation omitted).

categorical exclusion "may have significant environmental effect."[189] Courts have held that extraordinary circumstances exist where an agency has found an indication of impacts based on "best available science."[190] Failure to conduct NEPA analysis in extraordinary circumstances may result in reversal of any permits or approvals.[191] Thus, an agency must "adequately explain" by "convincing statement[s]" why the effects of the activity will be insignificant in order to satisfy a judicial inquiry.[192]

Moreover, the approval and designation of new categorical exclusions by federal agencies are also subject to judicial review.[193] For example, in *Heartwood, Inc. v. U.S. Forest Service*, the Seventh Circuit found that a facial challenge to a Forest Service categorical exclusion designation was ripe, even though plaintiffs did not challenge a specific application of the exclusion.[194] Federal courts have found that while categorical exclusion designations must comply with public review and comment requirements,[195] categorical exclusions themselves are not subject to EA or EIS requirements.[196] However, an agency's failure to adequately consider the impacts of a new categorical exclusion designation may result in injunction against the categorical exclusion and reversal of activities previously permitted under the challenged exclusion.[197] In *Sierra Club v. Bosworth*, after finding that the Forest Service failed to properly consider the significant impacts of a categorical exclusion, the Ninth Circuit remanded the case with instructions to the district court to enjoin not only new application of the categorical exclusion, but also all activity previously permitted under the categorical exclusion that was not "at or near completion."[198]

The remedies available to environmental litigants challenging NEPA reviews discourage abuse of categorical exclusions. In extreme circumstances courts have granted preliminary injunctions in

189. *Id.*

190. Utah Env't Cong. v. Bosworth, 443 F.3d 732, 737 (10th Cir. 2006); *see* Riverhawks v. Zepeda, 228 F. Supp. 2d 1173, 1188 (D. Or. 2002).

191. *See* Steamboaters v. FERC, 759 F.2d 1382, 1394 (9th Cir. 1985).

192. *Alaska Ctr. for the Env't*, 189 F.3d at 859.

193. *See* Heartwood, Inc. v. U.S. Forest Serv., 230 F.3d 947, 953 (7th Cir. 2000).

194. *Id.* at 952–53.

195. Sierra Club v. Bosworth, 510 F.3d 1016, 1025 (9th Cir. 2007).

196. *Id.*; *see also Heartwood*, 230 F.3d at 954.

197. *Sierra Club*, 510 F.3d at 1034.

198. *Id.*

environmental cases challenging NEPA reviews.[199] More commonly courts remand environmental reviews for new consideration while vacating the underlying government action grants of permits or easements made based on flawed environmental review or arbitrary guidance.[200] Thus, while categorical exclusions may streamline the process of obtaining use rights in federal pore space and in permitting geologic storage projects, projects might still be delayed as a result of litigation challenging agency action.

NEPA is a critical aspect of environmental protection for projects on federal land. However, the process also adds to project time, risk, and uncertainty which may discourage investments in carbon storage projects that are critical to meeting climate goals and avoiding the catastrophic impacts of climate change. Developing appropriately limited categorical exclusions for aspects of carbon storage projects that are not expected to have significant environmental impacts may help streamline the NEPA process. Categorical exclusions and CEQ regulations can provide guidance and certainty to developers and agencies. Additionally, development of categorical exclusions and CEQ regulations for carbon storage would commence important public participation and engagement processes, providing information on carbon storage projects for critical examination and identifying avenues of potential legal challenges. No doubt, the process will be imperfect, subject to challenge, and likely require revisions. These challenges and revisions form part of the hard work of crafting compromises that strike a balance between preventing negative environmental impacts and permitting the large-scale infrastructure, facility, and land uses necessary for carbon containment. However, faced with the imperative to address climate change, land management agencies would be wise to remember Voltaire's aphorism not to let "best [be] the enemy of the good."[201]

199. *See, e.g.*, Geertson Seed Farms v. Johanns, 570 F.3d 1130, 1141 (9th Cir. 2009), *rev'd and remanded sub nom.* Monsanto Co. v. Geertson Seed Farms, 561 U.S. 139 (2010).

200. *See, e.g.*, Sierra Club v. Van Antwerp, 719 F. Supp. 2d 77, 78 (D.D.C. 2010).

201. Deep Patel, *Why Perfection is the Enemy of Done*, FORBES (Jun. 16, 2017), https://www.forbes.com/sites/deeppatel/2017/06/16/why-perfection-is-the-enemy-of-done/?sh=506c0e064395 [https://perma.cc/4SZK-KVV4].

C. Settling Ownership in Federal Split Estates

Uncertainty regarding ownership of pore space in federal split estates forms the most difficult of the land-management issues to address. Although SRHA and similar split estates represent a relatively small proportion of total federal lands, uncertainty regarding ownership of pore space may be a significant and potentially project determinant issue. This issue is most pronounced where federal split estate lands are interspersed with private fee and state lands, as exists in much of the western United States. In states such as Wyoming, SRHA split estate lands represent a relatively large percentage of lands, making development of a storage project that would not include such split estate lands extremely difficult. Uncertainty regarding ownership of pore space in split estates, and the related potential implications of NEPA review and lack of regulatory clarity, may impact the feasibility of proposed projects.

Courts, as in the *Watt* and *Amoco* cases, would most likely need to interpret the language in federal statutes in order to establish whether pore space is included within federal mineral reservations. In so doing, courts need to determine whether the pore spaces, and their available reservoir storage capacity, are "mineral in character" within the familiar definition of the term and of the type Congress intended to reserve.[202] Perhaps most helpful for pore space storage development would be a ruling that pore space was not reserved to the United States pursuant to the reservations under the various homestead statutes. Because most states find the pore space to be owned by the surface owner, such a ruling would likely shelter potential storage projects that do not include other federal surface lands from comprehensive NEPA review and federal permitting and would furthermore assure that the private pore space could be unitized pursuant to state statutes.

In the absence of an actual project, claims to settle ownership of pore space may not be ripe. Federal law 28 U.S.C. 2409a permits the United States to be named in civil actions to quiet title but only where there is "disputed title in real property to which the United States claims an interest."[203] However, in the absence of the grant of a permit to use pore space in federally reserved mineral estates, or, as in *Watt*, notification or administrative determination that use of

202. Watt v. W. Nuclear, Inc., 462 U.S. 36, 53 (1983).
203. 28 U.S.C. § 2409a.

the property by the surface owner constituted a trespass, civil claims to quiet title may not be ripe. Thus, to press the issue, a project proponent may need to either seek a federal permit or proceed under agreements with the surface owner, in both cases risking liability for trespass.

At least on a parcel-by-parcel basis, however, there may be the possibility of administratively clarifying pore space ownership in federal split estates: Section 2409a(e) notes that jurisdiction to quiet title will cease "if the United States disclaims all interest in the real property or interest therein."[204] FLPMA provides the Secretary with authorization to issue recordable disclaimers of interest in lands "if the disclaimer will help remove a cloud on the title to lands and there is a determination that such lands are not lands of the United States or that the United States does not hold a valid interest in the lands."[205] Accordingly, surface owners or project proponents claiming title to pore space in federal split estates may, after meeting with the BLM, request a "disclaimer of interest."[206] These disclaimers, however, would apply only to the individual parcel for which the disclaimer was requested, and thus may not resolve uncertainty or provide precedent for other projects.

The difficulty of resolving this issue either judicially or through administrative law also suggests the need for congressional action. Congress has an opportunity to limit the extent of federal interests in pore space to those underlying a federal surface estate or with federal fee lands. This would resolve uncertainty regarding federal ownership of pore space in split estates, and also be consistent with pore space ownership rules under state law.

D. Incorporating Geologic Storage in Resource Planning

Although a handful of resource management plans mention pore space as an aspect of non-storage related projects, the plans fail to evaluate geologic storage as a potential use of public lands or national forests. Land use plan decisions may include both "desired outcomes" and "allowable uses and management actions."[207] By

204. *Id.* § 2409a(e).

205. 43 C.F.R. § 1864.0-1 (2020).

206. *Id.* § 1864.1-1.

207. U.S. DEP'T OF THE INTERIOR BUREAU OF LAND MGMT., H-1601-1, LAND USE PLANNING HANDBOOK 12–13 (2005).

directing federal agencies, including the forest service and BLM, to include management goals and decisions that favor carbon storage in resource management plan and forest plan revisions within areas of high geologic storage potential, agencies can begin the process of scoping, gathering relevant data, and engaging in NEPA environmental analysis including identification of mitigation options and alternatives. These actions may streamline or avoid costly and time-consuming reviews later, as well as provide project proponents with guidance regarding potential areas that are economically and environmentally suitable for carbon storage. Amending resource management plans and forest plans to include geologic storage will provide an opportunity to identify conflicts with existing uses, coordinate with other agencies and harmonize requirements regarding habitat or other restrictions, discuss potential mitigation pathways, and address public concerns.

V. CONCLUSION

Achieving the Paris Agreement's climate goal of 1.5°C will require coordination of land agencies, laws, and regulations in order to promote utilization of federal land for carbon storage. As the Biden Administration and Congress examine federal programs for coal and oil and gas leasing, as well as laws and agency practices for management of public lands to align them around climate and decarbonization goals, there is an opportunity to support broader deployment and investment of carbon storage technologies. Doing so is not only critical to advancing the United States' decarbonization goals but will also provide pathways for new industries to develop around uses of federal lands, providing needed economic revitalization and just transitions to fossil-dependent energy communities.