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UNIVERSITY OF WYOMING
School of Energy Resources
Center for Energy Regulation & Policy Analysis

THE CARBON STORAGE FUTURE OF PUBLIC LANDS

Tara Righetti,[1] Jesse Richardson,[2] Kris Koski,[3] & Dr. Sam Taylor[4]

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 on public land. 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 pathways to encourage CCUS technology deployment on federal lands. The authors identify opportunities for courts, agencies, and Congress to address uncertainties related to federal pore space and promote cooperation and coordination with state agencies.

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[1] 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, UNITED STATES ENERGY ASSOCIATION, *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* (November 2020).

[2] Professor of Law, West Virginia University College of Law.

[3] Associate Lecturer, University of Wyoming School of Energy Resources.

[4] Assistant Director, West Virginia University Energy Institute.

Geologic Storage as Part of the Climate Change Solution

Removing carbon from our future requires either "effective carbon capture and storage capacity for natural gas plants…or removing natural gas as a fuel source by roughly 2030."[5] 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 (CCUS).[6] 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."[7]

Geologic storage of carbon dioxide (CO_2) is among the core decarbonization technologies considered in proposals to stabilize the atmosphere.[8] 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.[9] The International Standards Organization (ISO) standard for geologic storage defines "geologic storage" as "long-term containment of CO_2 streams in geologic formations."[10] Carbon Capture, Utilization, and Sequestration (CCUS) technologies capture CO_2 and inject it underground for permanent storage.[11] Opportunities to capture CO_2 from anthropogenic sources include fossil fired power plants,[12] closed-loop industrial facilities, [13] and bioenergy facilities.[14] CO_2 can also be captured through direct air capture technologies and sequestered using geologic storage.[15] As such, geologic storage holds the potential to significantly impact climate reduction goals by decarbonizing fossil

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[5] Sam Kalen, *A Bridge to Nowhere: Our Energy Transition and the Natural Gas Pipeline Wars,* 9 MICHIGAN J. ENVTL. & ADMIN. L. 319, 323 (2020).

[6] INT'L ENERGY AGENCY, ENERGY TECHNOLOGY PERSPECTIVES 2020: SPECIAL REPORT ON CARBON CAPTURE UTILISATION AND STORAGE at 3 (Sept. 2020); CLIMATE CHANGE 2014: SYNTHESIS REPORT, SUMMARY FOR POLICYMAKERS (R.K. Pachauri and L.A. Meyer eds.), https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf.

[7] *Id.* at 24.

[8] U.S. DEP'T OF ENERGY, CARBON CAPTURE, UTILIZATION, AND STORAGE: CLIMATE CHANGE, ECONOMIC COMPETITIVENESS, AND ENERGY SECURITY, (August 2016), https://www.energy.gov/sites/prod/files/2017/01/f34/Carbon%20Capture%2C%20Utilization%2C%20and%20Storage--Climate%20Change%2C%20Economic%20Competitiveness%2C%20and%20Energy%20Security_0.pdf.

[9] INTERNATIONAL ENERGY AGENCY, CARBON CAPTURE AND STORAGE: THE SOLUTION OF DEEP EMISSIONS REDUCTIONS, OECD/IEA (2015), https://www.iea.org/publications/freepublications/publication/CarbonCaptureandStorageThesolutionfordeepemissionsreductions.pdf.

[10] Int'l Org. for Standardization, ISO/DIS 27914: Carbon Dioxide Capture, Transportation and Geologic Storage, art. 3.17, http://www.iso.org/iso/catalogue_detail.htm?csnumber=64148 (last visited Sept. 30, 2020) [hereinafter ISO Standard].

[11] Rosa M. Cuéllar-Franca & Adisa Azapagic, *Carbon Capture, Storage, and Utilization Technologies: A Critical Analysis and Comparison of Their Life Cycle Environmental Impacts*, 9 J. OF CO_2 UTILIZATION 82 (2015).

[12] Although a recently promulgated version the rule reverses this finding, the EPA previously 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. *See* 83 FR 65617 - Review of Standards of Performance for Greenhouse Gas Emissions From New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units, 83 Fed. Reg. 65,617 (Dec. 21, 2018).

[13] 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. (2013).

[14] Joris Koornneef, et al., *Global Potential for Biomass and Carbon Dioxide Capture, Transport and Storage up to 2050,* 11 INT'L J. GREENHOUSE GAS CONTROL 117, 119 (2012).

[15] David W. Keith, *Why Capture CO_2 from the Atmosphere*, 325 SCIENCE1654 (2009); Kalen, at 323.

and bioenergy generation[16] 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."[17]

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."[18] Such retrofitting of existing coal- and gas-fired power plants is expected to have "a small to negligible impact" on operational flexibility, potentially even increasing short-term flexibility.[19] By utilizing the infrastructure already in place, such as existing natural gas or oil pipelines, costs will be lowered and projects can begin much sooner.

CCUS development thus far has not kept pace with that 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 storage capacity has been satisfied as of September 2020.[20] This shortfall is 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.[21]

Federal funding has supported technology advancements and may aid in reducing costs of development, ensuring that emerging technologies become commercially feasible.[22] The federal government has provided significant support for carbon storage activities, providing over five billion in funding since 2010.[23] Recent support includes extension of the 45Q tax credit,[24] which provides tax credits for permanent sequestration of CO_2 as part of geologic storage or CO_2-EOR, and a funding opportunity announcement from the Department of Energy (DOE) for over $100 million to jump start "carbon capture, utilization, and storage."[25] Most of these efforts focus 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,

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

[17] *Creating a Climate Resilient America: Hearing Before the House Select Committee on the Climate Crisis,* 116th Cong. 1, 5 (2019) (Statement of Dr. Rachel Cleetus, Policy Director, Climate and Energy Program, Union of Concerned Scientists).

[18] INT'L ENERGY AGENCY, ENERGY TECHNOLOGY PERSPECTIVES 2020: SPECIAL REPORT ON CARBON CAPTURE UTILISATION AND STORAGE at 21-22 (Sept. 2020).

[19] *Id.* at 52.

[20] *Id.* at 28.

[21] *Id.* at 28.

[22] *Id.* at 16.

[23] PETER FOLGER=CONG. RSCH. SERV., CARBON CAPTURE AND SEQUESTRATION (CCS) IN THE UNITED STATES (2017), https://fas.org/sgp/crs/misc/R44902.pdf.

[24] ANGELA C. JONES, CONG. RSCH. SERV., IF11639, CARBON STORAGE REQUIREMENTS IN THE 45Q TAX CREDIT (2020), https://www.everycrsreport.com/files/2020-09-18_IF11639_b12b1c8eae4f32d07c828831aff114cf855fc8de.pdf. 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.

[25] DEPT. OF ENERGY, U.S. DEPARTMENT OF ENERGY ANNOUNCES $110M FOR CARBON CAPTURE, UTILIZATION, AND STORAGE (2019) https://www.energy.gov/articles/us-department-energy-announces-110m-carbon-capture-utilization-and-storage.

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 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 GHG Reporting Program requirements of the Clean Air Act.[29] These examples, however, represent the exception, rather than the rule. The majority of U.S. 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 CO2 storage, and some, especially the Endangered Species Act (ESA), may operate to ban carbon sequestration in certain areas.[31] Similarly, researchers at the Sabin Center for Climate Change Law at Columbia University have noted the lack of laws specifically regulating offshore CO_2 sequestration.[32] These commentators note that existing laws are confusing, sometimes overlapping, and are marred by frequent shortcomings which, in some instances, may prevent rather than encourage CCUS.[33] Although recently enacted and proposed legislation endeavors to streamline the project review and permitting processes across multiple agencies,[34] it does not address land management aspects of carbon storage activities on federal land.

The lack of specific statutes and regulatory programs regarding federal pore space utilization presents a significant hurdle to development of geologic storage projects. A recent report by the Congressional Research Service (CRS) acknowledges that some of the issues that need to be addressed relating to geologic sequestration and EOR include "liability and property rights issues" like long term stewardship and the need for policies regarding ownership of pore

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[26] IAN HAVERCROFT, CCS LEGAL AND REGULATORY INDICATOR (CCS-LRU), GLOBAL CCS INSTITUTE, 5 (2018).

[27] *See* U.S. ENVTL. PROTECTION AGENCY, OFFICE OF WATER, EPA-816-P-13-004, GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE: DRAFT UNDERGROUND INJECTION CONTROL PROGRAM GUIDANCE ON TRANSITIONING CLASS II WELLS TO CLASS VI WELLS, 43 (2013); https://19january2017snapshot.epa.gov/sites/production/files/2015-07/documents/epa816p13004.pdf [hereinafter UIC Program Guidance on Transitioning Class II Wells to Class VI Wells].

[28] ANGELA C. JONES, CONG. RSCH. SERV., R46192, INJECTION AND GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE: FEDERAL ROLE AND ISSUES FOR CONGRESS 18 (2020), https://crsreports.Congress.gov/product/pdf/R/R46192.

[29] 40 C.F.R. §§ 98.440–98.449 (2020).

[30] *See, e.g.* Romany M. Webb & Michael B. Gerrard, *Overcoming Impediments to Offshore CO2 Storage: Legal Issues in the United States and Canada*, 49 ENVTL L. REP 10634 (2019).

[31] Arnold W. Reitze Jr., *Federal Control of Carbon Capture and Storage*, 41 ENVTL. L. REP. News & Analysis 10796, 10817-22 (2011). Professor Reitze's analysis includes the Solid Waste Disposal Act, the Clean Water Act, the Endangered Species Act, and the National Environmental Protection Act (NEPA). *Id.* A recent Congressional Research Service (CRS) report focuses on environmental regulation of geologic sequestration and EOR and provides an overview of these issues, see, ANGELA C. JONES, *supra* note 28.

[32] *See, e.g.* Webb & Gerrard, *supra* note 30; Romany M. Webb & Michael B. Gerrard, *Policy Readiness for Offshore Carbon Dioxide Storage in the Northeast*, Columbia Law School Sabin Center for Climate Change Law, ii, 65-66 (2017).

[33] *Id*.

[34] CCUS Innovation Act, H.R. 5865, 116th Cong. (2020), https://www.Congress.gov/bill/116th-Congress/house-bill/5865/all-actions (last visited Sept. 25, 2020).

space property rights.[35] Although a 2010 report by the Interagency Task Force on Carbon Capture and Storage recognized that use of federal pore space in lands owned in fee simple might streamline leasing and limit conflicts between uses, it also identifies concerns including underground migration of injected CO_2 beyond federal boundaries and additional regulatory requirements such as compliance with the National Environmental Protection Act (NEPA).[36] These concerns, and the absence of clear laws or regulations addressing these issues, provide an opportunity for federal lawmakers and agencies to address the issue.

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.[37] The storage unit must have 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.[38] The ISO standard for geologic storage requires reservoirs with an adequate primary seal and secondary barriers to CO_2 leakage.[39] 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.[40]

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"[41] and "subsurface space which can be used as storage space for carbon dioxide or other substances."[42] 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

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[35] CONG. RSCH. SERV., INJECTION AND GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE: FEDERAL ROLE AND ISSUES FOR CONGRESS, 18-19 (2020), https://fas.org/sgp/crs/misc/R46192.pdf.

[36] INTERAGENCY TASK FORCE ON CARBON CAPTURE AND STORAGE, REPORT OF THE INTERAGENCY TASK FORCE ON CARBON CAPTURE AND STORAGE 6, L-1 (2010), https://www.osti.gov/servlets/purl/985209 [hereinafter Report of the Interagency Task Force].

[37] Michael. J. Nasi & Jacob Arechiga, *Greenhouse Gas Reduction Technologies for Power Generation*, RMMLF SPECIAL INSTITUTE, CLIMATE CHANGE L. AND REG.: PLANNING FOR A CARBON-CONSTRAINED REGULATORY ENVIRONMENT, Ch. 9B (2015).

[38] ISO Standard, *supra* note 10.

[39] *Id*.

[40] Stephanie M. Haggerty, *Legal Requirements for Widespread Implementation of CO_2 Sequestration in Depleted Oil Reserves*, 21 PACE ENVTL. L. REV. 197, 200-01 (2003); 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. OF GREENHOUSE GAS CONTROL 152, (2016); Sally Benson et al., *Underground Geological Storage*, in IPCC SPECIAL REPORT ON CARBON DIOXIDE CAPTURE AND STORAGE 195, 210 (Bert Metz et al. eds. 2005).

[41] N.D. CENT. CODE ANN. § 47-31-02 (West 2020).

[42] WYO. STAT. ANN. § 34-1-152(d) (West 2020).

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,[43] compaction in surface mine reclamation,[44] and screening sites for a nuclear waste repository.[45]

A significant amount of storage capacity exists within the United States. In 2007 the U.S. Department of Energy (DOE) estimated that the US had adequate geologic storage sequestration capacity for more than 3,300 billion metric tons of CO_2.[46] In 2012, pursuant to the Energy Independence and Security Act, the U.S. Geological Survey and the U.S. Department of Interior, together with other state and federal agency partners, conducted a national assessment of geologic storage resources for CO_2.[47] This report estimates as much as 470,000 megatons of technically suitable storage capacity in the United States, enough for 3,000 billion metric tons of CO_2.[48] Of this usable pore space, the USGS estimates that roughly 130 million acres are overlayed by federal lands.[49] The vast majority of this 130 million acres comes under the authority of either the Bureau of Land Management[50] or the Forest Service.[51] Various other agencies, including the U.S. Fish and Wildlife Service and Department of Defense, manage a small portion.[52] 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.[53]

[43] 43 C.F.R. § 3130.0-5(h) (2020).

[44] 30 C.F.R. § 710.5 (2020).

[45] 10 C.F.R. § 960.2 (2020); 10 C.F.R. § 963.2 (2020).

[46] 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.

[47] U.S. GEOLOGICAL SURVEY, GEOLOGIC CARBON DIOXIDE STORAGE RESOURCES ASSESSMENT TEAM, 2013, NATIONAL ASSESSMENT OF GEOLOGIC CARBON DIOXIDE STORAGE RESOURCES—RESULTS (ver. 1.1, September 2013), U.S. GEOLOGICAL SURVEY CIRCULAR 1386, 41 p., https://pubs.usgs.gov/circ/1386/ (supersedes ver. 1.0 released June 26, 2013.)

[48] USGS, NATIONAL ASSESSMENT OF GEOLOGIC CARBON DIOXIDE STORAGE RESOURCES – RESULTS, 3 (2013), https://pubs.usgs.gov/circ/1386/pdf/circular1386_508.pdf

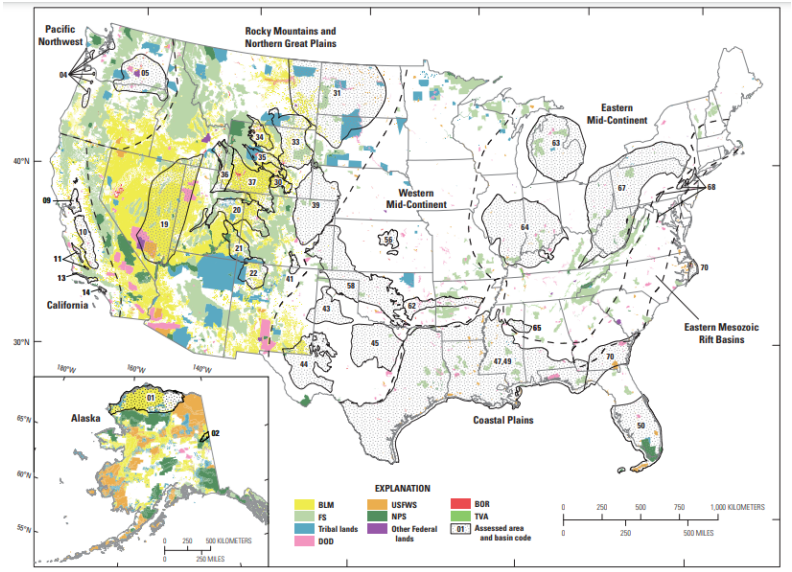
[49] MARC L. BUURSINK ET AL., NATIONAL ASSESSMENT OF GEOLOGIC CARBON DIOXIDE STORAGE RESOURCES – ALLOCATIONS OF ASSESSED AREAS TO FEDERAL LANDS, UNITED STATES GEOLOGICAL SURVEY, 1 (2015).

[50] BLM manages 64% of federal land overlaying technically accessible storage reservoirs. *Id.* at 3.

[51] FS manages 21% of federal land overlaying technically accessible storage reservoirs. *Id.*

[52] *Id.*

[53] *Id.* at 1.



Ian Havercroft, CCS Legal and Regulatory Indicator (CCS-LRU), Global CCS Institute (2018).

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 United States is federally owned.[54] 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,[55] as well as the importance of cooperation between the federal and relevant state governments.[56]

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.[57] Depending on the language of the treaties and agreements originally establishing the tribal trust land, tribal ownership rights may include beneficial interests

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[54] CAROL HARDY VINCENT ET AL., CONG. RSCH. SERV., R42346, FEDERAL LAND OWNERSHIP: OVERVIEW AND DATA (2020), https://fas.org/sgp/crs/misc/R42346.pdf.

[55] *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 Envtl. L. Rep. News & Analysis 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 ENVTL. L. 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 & ENVTL. L. J. (2016); Owen L. Anderson, *Geologic CO2 Sequestration: Who Owns the Pore Space*, 9 Wyo. L.R. 97, 98 (2009).

[56] Anderson, *supra* note 55, at 98; Jonas J. Monast et al., *A Cooperative Federalism Framework for CCS Regulation*, 1 Monast 1 (2012).

[57] *See* Worcester v. Georgia., 31 U.S. 515 (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 (1893) (examining the trust relationship between the federal government and tribal nations and holding the government liable for damages following a breach of fiduciary duty); U.S. DEP'T OF INTERIOR, NATURAL RESOURCES REVENUE DATA, NATIVE AMERICAN OWNERSHIP AND GOVERNANCE OF NATURAL RESOURES, https://revenuedata.doi.gov/how-revenue-works/native-american-ownership-governance/ (last visited Oct. 22, 2020).

in pore space.[58] Accordingly, and dependent upon the structure and government of the particular tribe, the tribe itself may have established procedures and regulatory requirements which are applicable to pore space utilization. In addition, federal statutes such as the NEPA or the ESA likely apply to any federal decisions regarding tribal land administered in trust.[59]

"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.[60] 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,[61] the Agricultural Entry Act,[62] and the Stock-Raising Homestead Act (SRHA), among others.[63] While the majority of split estates involve federal minerals under 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 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. However, state legislative or court declarations of pore space ownership could be preempted by these federal statutes and their federal court interpretations.

An examination of judicial decisions interpreting federal mineral reservations may be instructive regarding ownership of pore space for split-estate lands with federally owned minerals.[64] Mineral reservations in the Stock-Raising Homestead Act of 1916 ("SRHA") included coal, oil and gas, and a general reservation of "other minerals."[65] The issue principally concerns whether pore space could be considered an "other mineral." In *Watt v. Western Nuclear, Inc.* the Supreme Court of the United States examined the 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.[66] *Watt* established that a substance would be considered within the scope of the SRHA reservation if it (1) was mineral in character, (2) was removable from the soil, (3) was amendable to use for commercial purposes, and (4) was not intended to be part of the surface estate as necessary to the stock and forage raising purposes of the act.[67] *Watt* partially relied on *United States v. Union Oil Co. of California*[68] which held that SRHA mineral reservations included geothermal resources.[69] Other cases interpreting mineral reservations in the Coal Lands Act[70] and the Agricultural Entry Act[71] provide even less guidance.

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[58] *See* United States v. Shoshone Tribe, 304 U.S. 111 (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).

[59] *See,* BUREAU OF INDIAN AFFAIRS, INDIAN AFFAIRS NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) GUIDEBOOK: 59 IAM 3-H (2012), https://www.bia.gov/sites/bia.gov/files/assets/public/raca/handbook/pdf/59_IAM_3-H_v1.1_508_OIMT.pdf.

[60] U.S. DEP'T OF INTERIOR, NATURAL RESOURCES REVENUE DATA, HOW REVENUE WORKS, OWNERSHIP, https://revenuedata.doi.gov/how-revenue-works/ownership/ (last visited Aug. 27, 2020).

[61] 30 U.S.C. §§ 81, 83–85 (2018).

[62] Agricultural Entry Act, ch. 142, 38 Stat. 509 (1914) (current version at 30 U.S.C. §§ 121 *et seq.* (2020)).

[63] Stock-Raising Homestead Act, ch. 9, 39 Stat. 862 (1916) (current version at 43 U.S.C. § 299 (2020)).

[64] 43 U.S.C. § 299 (2018).

[65] *Id*.

[66] Watt v. W. Nuclear, Inc., 462 U.S. 36, 59 (1983).

[67] *Id,* at 53.

[68] U.S. v. Union Oil Co. of California, 549 F.2d 1271 (9th Cir. 1977).

[69] *Id.* at 1279-80.

[70] Amoco Production Co. v. Southern Ute Tribe, 526 U.S. 865 (1999).

[71] Aulston v. United Stated, 823 F.2d 510 (Fed. Cir. 1987).

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.[72] The court's analysis 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 commentary focuses on the Stock Raising and Homestead Act (SRHA), under which over 70 million acres of land in the United States are patented.[73] 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.[74] 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.[75] Expressly disagreeing with Professor Anderson, Professor Kevin L. Doran has argued that the mineral reservation of the SRHA should be read expansively.[76] Citing circuit and Supreme Court holdings, including *Watt*, Professor Doran bases his argument on judicial interpretations finding that analyses of the scope of the SRHA 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."[77] Because pore space is not necessary to farming and stock-raising, and totally exists embedded within the mineral estate, Professor Doran concludes that the SRHA did reserve the pore space to the federal government.[78] 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 attached to these properties had often been previously reserved by an owner in the chain of 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').[79] 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.[80] 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.[81] Therefore, determination 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

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[72] *See* Amoco Production, *supra* note **Error! Bookmark not defined.**.

[73] Doran & Cifor, *supra* note 55, at 531.

[74] Anderson, *supra* note 55 at 137 (2009); *see also* 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, NATURAL RESOURCES, AND ENERGY J. 277 (2015); *see also* Stefanie L. Burt, *supra* note 55.

[75] Anderson, *supra* note 55, at 38.

[76] Doran & Cifor, *supra* note 55.

[77] *Id.* at 540.

[78] *Id.* at 545.

[79] Dave Fredley, *Surface and Mineral Rights and the Weeks Act*, FOREST HISTORY TODAY, 32-35 (2011).

[80] *See* Minard Run Oil Co. v. U.S. Forest Service, 670 F.3d 236, 243 (3rd Cir. 2011); *see also* Duncan Energy Co. v. U.S. Forest Service, 109 F.3d 497 (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).

[81] *Id.*

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,[82] 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.[83] The possibility of conflicting claims regarding ownership of pore space within federal split estates may contribute to the cost, risk, and uncertainty of projects on federal land. Quite simply, if the pore space owner cannot be identified with certainty, any storage project is unlikely to go forward.

Present and Future Uses of Federal Pore Space

Use of federal pore space for CO_2-EOR and wastewater injection operations[84] is well established. 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.[85] 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.[86] Injection wells for CO_2 and wastewater disposal are permitted pursuant to Class II of the UIC program.[87]

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 regarding unclear guidance, procedures, and agency authority associated with use of federal pore space forms an obstacle to potential projects on federal land. The following case study illustrates the nature and extent of the regulatory uncertainty.

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[82] *See* Stefanie L. Burt, *supra* note 55; Joseph A. Schremmer, *Pore Space Property*, 2021 UTAH L. REV. 1 (2021).

[83] *See* Berenergy Corporation v. Bureau of Land Management, Case No. 19-8041 (U.S. Court of Appeals, Tenth Circuit).

[84] BUREAU OF LAND MANAGEMENT, INSTRUCTION MEMORANDUM NO. WY-2013-019, at 1 (2013) https://www.blm.gov/policy/im-wy-2013-019; *See also* 43 C.F.R. § 2801.9 (2020).

[85] J. Greg Schnacke et al, *Enhanced Oil Recovery: Legal Framework for Sustainable Management of Mature Oil Fields, Chapter 10 Carbon Dioxide Infrastructure: Pipeline Transport Issues and Regulatory Concerns – Past, Present, and Future,* 52 ROCKY MT. MIN. L. FDN. 283 (2015).

[86] *See* Craig Newman, *Secondary Recovery Units, Pressure Maintenance and Recycling*, 43B ROCKY MTN. MIN'L L. FDN. 10 (1997).

[87] 40 C.F.R. §147.1-147.3400 (2020). Whether these wells are permitted by the individual state or the Environmental Protection Agency ('EPA') depends upon whether said state where the proposed well is to be located has been granted primacy to regulate Class II wells.

Case Study:

Consider a geologic CO_2 storage operator who seeks to establish a new geologic sequestration project in Carbon County, Wyoming. Carbon 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. The area also includes a mix of private, federal, and split estate lands. It 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.

The proposed injection site lies on privately-owned land, but a few parcels within which the CO_2 will be stored are federally owned and managed by the Bureau of Land Management (BLM). Some of these parcels are federally owned in fee and others are federal split estates with private surface and federal minerals. Although Wyoming has legislatively declared that pore space is owned by the surface owner, the operator has been advised that this declaration may not apply to federal split estates. Operator's counsel suggests that a court may need to determine the nature and extent of federal interests in the property as it pertains to geologic storage.

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 under the Federal Land Policy and Management Act (FLPMA) by filling out Form 2920-1.[88] *However, the process has never been pursued and its viability remains theoretical. When the operator approaches the regional field office, the operator learns that the resource management plan for the region fails to include geologic storage. Before the BLM may permit any carbon sequestration projects in federally owned pore space, an amendment to Resource Management Plans may be required and the Environmental Impact Statement (EIS) may need to be updated.*[89] *This analysis is in addition to any project specific analysis that may be required regarding grants of injection rights or approval of the operator's Class VI permit. These findings may be subject to legal challenges and the potential that decisions regarding the proposed project could be vacated. Lack of guidance regarding processes for granting injection rights or a rental schedule relating to federal pore space adds to the uncertainty of the project. Additionally, the operator 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, no equivalent federal statute exists.*

Given that the total amount of federal pore space within the proposed injection area is small, the operator considers unitizing the area under Wyoming's statute for creation of geologic storage units. Doing so could prevent the requirement of acquiring individual pore space rights on every parcel within the unit, provided that the operator has the agreement of the majority of owners of interests. However, the extent, if any, to which this state process applies to federal land remains unclear. No corollary federal law for federal unitization of pore space for geologic storage exists.

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[88] U.S. DEP'T OF THE INTERIOR BUREAU OF LAND MANAGEMET., INSTRUCTION MEMORANDUM NO. 2012-035, INTERIM GUIDANCE ON EXPLORATION AND SITE CHARACTERIZATION FOR POTENTIAL CARBON DIOXIDE GEOLOGIC SEQUESTRATION (2011), https://www.blm.gov/policy/im-2012-035 [hereinafter IM 2012-035].

[89] *See, e.g.* N. Plains Res. Council v. U.S. Army Corps of Engineers, No. CV 19-44-GF-BMM, 2020 WL 3638125 (D. Mont. May 11, 2020).

Governance of Federal Pore Space

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.[90] 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 pore space, the current federal statutes that pertain most specifically to pore space include the Federal Land Policy Management Act (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.[91]

Federal mineral holdings, including oil and gas operations, and the development thereof, are managed by the BLM largely pursuant to the Mineral Leasing Act and the FLPMA.[92] FLPMA mandates that public lands be managed "under the principles of multiple use and sustained yield" and the preservation and protection of public lands.[93] 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.[94] 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. [95] Therefore, the BLM will likely be required to prepare "Reasonable Foreseeable Development Scenarios" before sequestration leases may properly be issued.[96]

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 Resource Management Plans (RMPs) pertaining to its management of public lands and to periodically update these plans.[97] 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 with federal regulations.[98] As a result, carbon sequestration projects likely require an amendment of current BLM RMPs.[99] 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

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[90] U.S. Const. Art. IV § , cl.2.

[91] 43 U.S.C.A. § 1712(c) (West 2020); 43 U.S.C. § 1732(a) (West 2020); Denise A. Dragoo, *Federal Land Use Planning Primer under FLPMA and NFMA*, 19 RMMLF INST. 16 (2003).

[92] 43 U.S.C.A. § 1702(c) (West 2020); 30 U.S.C.A. § 181-263 (West 2020).

[93] 43 U.S.C.A. § 1712(c).

[94] U.S. DEP'T OF THE INTERIOR BUREAU OF LAND MANAGEMENT AND OFFICE OF THE SOLICITOR, THE FEDERAL LAND POLICY AND MANAGEMENT ACT, AS AMENDED 69 (2001), https://www.blm.gov/or/regulations/files/FLPMA.pdf.

[95] Reitze, *supra* note 31, at 10821.

[96] *Id.*

[97] 43 U.S.C.A. § 1712 (West 2020).

[98] 43 C.F.R. § 1610.5-5 (2020).

[99] Reitze, *supra* note 31, at 10821.

require management of National Forest lands for multiple use and sustained yield.[100] 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.[101] 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.[102] 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.[103] 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[.]"[104] As part of the assessment, the Department of Agriculture must keep an inventory of renewable resources, including "new and emerging resources and values."[105] FRRRPA defines "renewable resources" as matters within the Forest Service's "scope of responsibility."[106] While this definition may still be too narrow to encompass pore space, the broader mandate that Renewable Resource Assessments address may provide opportunities for climate mitigation and may open pathways to include pore space and 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 the EPA and DOE.[107] 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 Federal Land Policy Management Act (FLPMA).[108] 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*.'"[109] 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."[110] 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.

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[100] 16 U.S.C.A. § 473-482 (West 2020).
[101] 16 U.S.C.A. §§ 1600-1614 (West 2020).
[102] 36 C.F.R. § 219.5 (2020)
[103] 16 U.S.C.A. § 1601 (West 2020).
[104] *Id.*
[105] 16 U.S.C.A. § 1603 (West 2020).
[106] 16 U.S.C.A. § 1610 (West 2020).
[107] Report of the Interagency Task Force, *supra* note **Error! Bookmark not defined.**, at 6.
[108] *Id.* at 64-65.
[109] *Id.* at 65 (quoting 43 U.S.C. § 1761(a)(2)).
[110] *Id.* at 65 (quoting 43 U.S.C. § 1732).

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 likely 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 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.[111] This 80-acre limitation may be 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.[112] The MUSYA specifically applies to administration of national forest land for "outdoor recreation, range, timber, watershed, and wildlife and fish purposes[,]"[113] 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."[114] 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),[115] the BLM, acting on behalf of the Department of the Interior, bears primary responsibility for managing the mineral estate on U.S Forest Service Lands.[116] As part of this role, the BLM may lease the mineral estate to private parties,[117] including for purposes such as CO_2-EOR, subject to approval from the Forest Service.[118] FOOGLRA does not define what exactly is encompassed by the mineral estate on national forest land.[119] However, the Act provides that only land "known or believed to contain oil or gas deposits" are subject to BLM leasing.[120] FOOGLRA was enacted to amend the Mineral Leasing Act of 1920 (MLA) and thus likely only extends BLM's leasing authority to leasable minerals. Consistent with the Interagency Task Force findings that the mineral leasing act was not broad enough to cover geologic storage,[121] the BLM's authority for managing minerals in U.S. 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

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[111] 16 U.S.C.A. § 497 (West 2020).

[112] Rangeland Renewable Resources Planning Act 16 U.S.C.A. §§ 1600 to 1610 (West 2020); Multiple Use Sustained Yield Act 16 U.S.C.A. §§ 523 to 531 (West 2020).

[113] 16 U.S.C.A. § 528 (West 2020).

[114] 16 U.S.C.A. § 531 (West 2020).

[115] 30 U.S.C.A. §§ 226 to 226e (West 2020).

[116] 30 U.S.C.A. § 226; *see also* MEMORANDUM OF UNDERSTANDING BETWEEN UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT AND UNITED STATES DEPARTMENT OF AGRICULTURE FOREST SERVICE, 2 (eff. Apr. 14, 2006), https://www.fs.fed.us/geology/MOU_BLM_Oil_Gas.pdf.

[117] 30 U.S.C.A. § 226(a).

[118] 30 U.S.C.A. § 226(h); *see also* 43 C.F.R. § 3101.7-1(c) (2020).

[119] 30 U.S.C.A. § 226.

[120] 30 U.S.C.A. § 226(a).

[121] Report of the Interagency Task Force, *supra* 107**Error! Bookmark not defined.**, at 65.

surface-disturbing activities.[122] 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.[123] 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."[124] 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.[125] 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 minerals. Unitization permits 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. Concerns regarding intra-unit migration and subsurface trespass may result from unitization. Part 226(m) of the MLA permits unitization of oil and gas parcels on federal land.[126] Unitization of oil and gas interests also has the effect of allowing field-wide coordination of surface facilities, without regards to individual boundaries.[127] Kentucky,[128] North Dakota,[129] and Wyoming[130] all have statutes permitting regulatory agencies to create units for geologic storage. While in some circumstances federal land can be included in oil and gas pools or units formed under state law,[131] 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 laws 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.[132] In a recent report by the Congressional Research Service, the EPA expressly disclaimed responsibility for the transfer of

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[122] 30 U.S.C.A. § 226(g) (West 2020).
[123] IM 2012-035, *supra* note88.
[124] *Id.*
[125] *Id.*
[126] 30 U.S.C.A. § 226(m) (West 2020); *see also* 43 C.F.R. §§ 3180 *et seq.* (2020).
[127] Entek GRB, LLC v. Stull Ranches, LLC, 763 F.3d 1252 (10th Cir. 2014)
[128] KY. REV. STAT. ANN. § 353.806 (West 2020).
[129] N.D. CENT. CODE ANN. § 38-22-08 to 10 (West 2020).
[130] WYO. STAT. ANN. § 35-11-313 to 316 (2020).
[131] Owen L. Anderson, *State Conservation Regulation – Single Well Spacing and Pooling – Vis-à-vis Federal and Indian Lands,*, No. 4 RMMLF-INST Paper No. 2 (2006).
[132] CONG. RSCH. SER., INJECTION AND GEOLOGIC SEQUESTRATION OF CARBON DIOXIDE: FEDERAL ROLE AND ISSUES FOR CONGRESS (Jan. 2020), https://fas.org/sgp/crs/misc/R46192.pdf

liability from operators/injectors to any other parties, including federal agencies.[133] Indeed, questions regarding responsibility for a 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.[134] Professor Wendy B. Jacobs suggests multiple solutions to the liability problem,[135] including Congressional authorization for the DOE and BLM to designate sequestration sites and assume long-term responsibility for projects at the very beginning,[136] and Congressional creation of a liability trust fund financed by fees on CO_2 emissions and storage projects.[137] Another solution would require the federal government to assume liability after a shortened term of liability for the injector,[138] as has already been done by several states including Louisiana,[139] North Dakota,[140] and Montana.[141]

NEPA

Compliance with the requirements of 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 actions significantly affecting the quality of the human environment[.]"[142] 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.[143] However, even with these changes, the injection of CO_2 on federal lands for geologic storage would almost certainly trigger NEPA, even where no surface operations on federal land result. NEPA could also be triggered where geologic storage operations are conducted, regulated, approved, or funded by a federal agency or where a federal agency significantly

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[133] *Id.* at 16.

[134] *Id.* at 18.

[135] Wendy B. Jacobs & Michael Craig, *Legal Pathways to Widespread Carbon Capture and Sequestration*, 47 Envir. L. Rev. 11022, 11043—46 (2017).

[136] *Id.* at 11043.

[137] *Id.* 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. OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT, U.S. DEPARTMENT OF THE INTERIOR, GRANT RESOURCES, https://www.osmre.gov/resources/grants.shtm

[138] Jacobs & Craig, *supra* note 135, at 11045.

[139] Louisiana statutes permit assumption of liability by the state after at least 10 years. LA. REV. STAT. ANN. § 30:1109(A) (West). Louisiana also maintains a trust fund financed by industry fees to cover future damages. LA. REV. STAT. ANN. § 30:1110(E) (West). *See* Wendy B. Jacobs & Michael Craig, *Legal Pathways to Widespread Carbon Capture and Sequestration*, 47 ENVIR. L. REV. 11022, 11045 (2017).

[140] Similarly to Louisiana, North Dakota will assume liability for injected CO2 after at least 10 years. N.D. CENT. CODE ANN. § 38-22-17 (West 2020). North Dakota also maintains an industry-funded trust fund to cover liability costs. N.D. CENT. CODE ANN. § 38-22-15 (West 2020). *See* Wendy B. Jacobs & Michael Craig, *Legal Pathways to Widespread Carbon Capture and Sequestration*, 47 ENVIR. L. REV. 11022, 11045 (2017).

[141] 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 CO2 50 years after injection is completed. These statutes also provide for the sate to cede liability to the federal government if the federal government acts to assume the liability. MONT. CODE ANN. § 82-11-183 (West 2019) (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 United States environmental protection agency as established in 2009 Mont. Laws ch. 474, § 4).

[142] 42 U.S.C.A. § 4332(2)(C) (West 2020).

[143] Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act, 85 Fed. Reg. at 43,346 (July 16, 2020).

participates in planning.[144] As a result, NEPA has also been applied to federal decisions on both private,[145] state, and tribal trust land.[146] Although test projects in limited circumstances may be able to rely on a categorical exclusion, [147] 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.[148] A recent study reports that the average EIS completion time is 4.5 years.[149]

A project on federal lands may be subject to many layers of environmental review. Since most resource management plans do not already evaluate subsurface use and infrastructure for geologic storage, amendments to existing RMPs would trigger NEPA analysis.[150] 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."[151] However, NEPA review is not limited to the development of federal resources; reviews must also precede a pipeline crossing federal lands[152] or where the federal government is funding a large portion of the project.[153] Although proposed CEQ regulations[154] and a limited judicial exception[155] 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.[156]

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[144] See, e.g., Indian River County. 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 Service, 235 F. Supp. 2d 1109 (D. Or. 2002); Arnold W. Reitze Jr., *Carbon Capture and Storage Program's NEPA Compliance*, 42 ENVTL. L. REP. NEWS & ANALYSIS 10853, 10857 (2012); *See also* U.S. DEP'T OF ENERGY, SITING AND REGULATING CARBON CAPTURE, UTILIZATION AND STORAGE INFRASTRUCTURE – WORKSHOP REPORT, 31 (2017), https://www.energy.gov/sites/prod/files/2017/01/f34/Workshop%20Report--Siting%20and%20Regulating%20Carbon%20Capture%2C%20Utilization%20and%20Storage%20Infrastructure.pdf [hereinafter WORKSHOP REPORT].

[145] *See* Notice of Availability of the Wyoming Pipeline Corridor Initiative Draft Environmental Impact Statement and Resource Management Plan Amendment for 9 BLM-Wyoming Resource Management Plans, 85 Fed. Reg. 21,453 (Apr. 17, 2020).

[146] *See* Jicarilla Apache Tribe v. Andrus, 687 F.2d 1324 (10th Cir. 1982).

[147] 40 C.F.R. § 6.204 (2020).

[148] Sharon Buccino and Linda Bullen, *A Path Forward: Navigating Changes to CEQ's NEPA Regulations*, Forthcoming ___ RMMLF ___ § 7.02 (2021).

[149] COUNCIL ON ENVTL. QUALITY, EXEC. OFFICE OF THE PRESIDENT, FACT SHEET: CEQ REPORT ON ENVIRONMENTAL IMPACT STATEMENT TIMELINES (2020), https://www.whitehouse.gov/wp-content/uploads/2020/01/20200612Final-EIS-Timeline-Fact-Sheet.pdf.

[150] 43 C.F.R. § 1601.0-6 (2020); Reitze, *supra* note 144 at 10856-65.

[151] Ezekiel J. Williams & Steven K. Imig, *EOR on Federal Lands*, 2015 NO. 4 RMMLF-INST PAPER NO. 6, 20 (2015).

[152] WORKSHOP REPORT, *supra* note144, at 31.

[153] *See Id.*; Reitze, *supra* note 144, at 10857.

[154] 85 Fed. Reg. at 1714 (codified at 40 C.F.R. § 1501.1(a)(6)(2020)).

[155] See, e.g. Western Nebraska Resources Council v. EPA, 943 F.2d 867 (8th Cir. 1991)

[156] 40 C.F.R. §§ 1508.9, 1508.11 (2020); For instance, the DOE sponsored Archer Daniels Midland geologic sequestration project was evaluated under the EA process and successfully passed EA review, see, ARCHER DANIELS

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 also present challenges.[157] 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[.]"[158] 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.[159] For example, the relative lack of large scale carbon-dioxide removal alternatives which are "practical and feasible from a technical and economic standpoint"[160] 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.

Legislative and Regulatory Opportunities

Increased use of CCUS forms an integral part of any reasonable plan to reduce or eliminate carbon dioxide 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.[161] Large amounts of storage will be necessary to reach the carbon deduction targets established in the agreement. Moreover, coordinating activities on federal lands to encourage utilization of federal pore space is consistent with President Biden's Executive *Order on Tackling the Climate Crisis at Home and Abroad*. It directs federal agencies to coordinate to promote decarbonization strategies, revitalize energy communities, and "aligning the management of Federal procurement and real property, public lands and waters, and financial programs to support robust climate action."[162]

In the west, federal lands make up a significant portion of total land area and are frequently interspersed with private 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 land. 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

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MIDLAND COMPANY FOR U.S. DEP'T OF ENERGY, CO_2 CAPTURE FROM BIOFUELS PRODUCTION AND SEQUESTRATION INTO THE MT. SIMON SANDSTONE, FINAL ENVIRO. ASSESSMENT: FINDING OF NO SIGNIFICANT IMPACT (DOE/EA-1828) (2011), https://netl.doe.gov/sites/default/files/environmental-assessments/Final-EA--ADM.pdf.

[157] Reitze, *supra* note 144 at 10818-20.

[158] *Id*. at 10819.

[159] 42 U.S.C. § 4332(2)(C); WildEarth Guardians v. Zinke, 368 F. Supp. 3d 41 (D.D.C. 2019).

[160] Forty Most Asked Questions Concerning CEQ's NEPA Regulations, 46 Fed. Reg. 18,026, 18,027 (Mar. 23, 1981).

[161] PARIS CLIMATE AGREEMENT, ACCEPTANCE ON BEHALF OF THE UNITED STATES OF AMERICA, https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/20/paris-climate-agreement/.

[162] EXEC. ORDER ON TACKLING THE CLIMATE CRISIS AT HOME AND ABROAD, https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/ (last visited Jan. 29, 2021).

pore space in lands managed by both the BLM and the National Forest Service; (2) providing 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.

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.[163] 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, a more specific geologic storage bill 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, this bill 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, 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.

In addition, Agencies can 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 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 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. Rulemaking along these lines would likely require preparation of a programmatic EIS under NEPA.

[163] *See* 43 U.S.C.A. § 1457 (West 2020); 43 U.S.C.A. § 2 (West 2020).

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.[164] 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. For instance, the Energy Policy Act of 2005 created a number of new categorical exclusions for certain aspects of energy development.[165] 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.[166] 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.[167] As such, Congress and agencies should judiciously consider the appropriateness of new categorical exclusions.

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.[168] 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.[169] 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 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.

NEPA analyses, CEQ guidance, and agency instructional memoranda, and designation and application of categorical exclusions are all vulnerable to legal challenge. Although environmental

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[164] Alaska Ctr. For Env't v. U.S Forest Serv., 189 F.3d 851, 859 (9th Cir. 1999).

[165] Carolyn L. McIntosh, "NEPA and the Energy Policy Act of 2005," *NEPA and Federal Land Developme*nt 6-1 (Rocky Mt. Min. L. Fdn. 2006); 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. ENVTL. L. 371, 373 (2017).

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

[167] Kevin H. Moriarty, *Circumventing the National Environmental Policy Act: Agency Abuse of the Categorical Exclusion*, 79 N.Y.U. L. REV. 2312, 2317 (2004).

[168] 36 CFR 220; Subpart D, 10 C.F.R. Part 1021; 16 U.S. Code § 6591e.

[169] Guidance for Federal Departments and Agencies on Establishing, Applying, and Revising Categorical Exclusions Under the National Environmental Policy Act, 75 Fed. Reg. 75628 (Dec. 6, 2010).

litigation to reveal errors is expensive,[170] 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.[171] Judicial review pursuant to the Administrative Procedure Act is deferential and applies the "arbitrary and capricious" standard.[172] 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.[173] CEQ regulations require environmental review of actions covered by the categorical exclusion in extraordinary circumstances.[174] Extraordinary circumstances exist when an activity that normally falls within the scope of a categorical exclusion "may have significant environmental effect."[175] Courts have held that extraordinary circumstances exist where an agency has found an indication of impacts based on best available science.[176] Failure to conduct NEPA analysis in extraordinary circumstances may result in reversal of any permits or approvals.[177] 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.[178]

Moreover, the approval and designation of new categorical exclusions by federal agencies are also subject to judicial review.[179] For example, in *Heartwood, Inc. v. U.S. Forest Service*, the 7th 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.[180] Federal courts have found that while categorical exclusion designations must comply with public review and comment requirements,[181] categorical exclusions themselves are not subject to EA or EIS requirements.[182] 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.[183] In *Sierra Club v. Bosworth*, after finding that the Forest Service failed to properly consider the significant impacts of a categorical exclusion, the 9th 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."[184]

The remedies available to environmental litigants challenging NEPA reviews discourage abuse of categorical exclusions. In extreme circumstances courts have granted preliminary injunctions in environmental cases challenging NEPA reviews.[185] More commonly courts remand

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[170] Moriarty, *supra* note 167, at 2333

[171] *Id; see also* Sierra Club v. Bosworth, 510 F.3d 016, 1022 (9th Cir. 2007).

[172] *Id.* (quoting Alaska Ctr. For Env't v. U.S Forest Serv., 189 F.3d 851, 857 (9th Cir. 1999).).

[173] *Sierra Club*, 510 F.3d at 1023 (quoting W. Radio Servs. Co. v. Espy, 79 F.3d 896, 900 (9th Cir. 1996)).

[174] Alaska Ctr. For Env't v. U.S Forest Serv., at 858.

[175] *Id.*

[176] Riverhawks v. Zapeda, 228 F. Supp. 2d 1173 (D. Or. 2002); Utah Envtl. Cong. v. Dale Bosworth, 443 F.3d 732 (10th Cir. 2006).

[177] The Steamboaters v. F.E.R.C., 759 F.2d 1382, 1394 (9th Cir. 1985).

[178] *Alaska Ctr. For Env't*, 189 F.3d at 859.

[179] *See, e.g.* Heartwood, Inc. v. U.S. Forest Serv., 230 F.3d 947 (7th Cir. 2000).

[180] *Heartwood*, 230 F.3d at 952-53.

[181] Sierra Club v. Bosworth, 510 F.3d 016, 1025 (9th Cir. 2007).

[182] *Id*; *see also Heartwood*, 230 F.3d at 953-55.

[183] *Sierra Club*, 510 F.3d at 1034.

[184] *Id.*

[185] Monsanto Co. v. Geertson Seed Farms, 561 U.S. 139 (2010).

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.[186] 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.

Settling Ownership in Split Estates

Uncertainty regarding ownership of pore space in federal split estates forms the most difficult of the land-management issues to address legislatively. 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. As illustrated in the case study above, potential inclusion of federal pore space could subject the project to additional NEPA review, even beyond that required for permitting.

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.[187] 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 many potential storage projects from comprehensive NEPA review and federal permitting and would furthermore assure that the private pore space could be unitized pursuant to state statutes.

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. By directing federal agencies, including the forest service and BLM, to include carbon storage in resource management plan and forest plan revisions within areas of high geologic storage potential, agencies could avoid costly and time-consuming review later. Furthermore, 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.

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.

[186] Sierra Club v. Van Antwerp, 719 F. Supp. 2d 77, 78 (D.D.C. 2010).
[187] Watt v. W. Nuclear, Inc., 462 U.S. 36, 59 (1983).

As the Biden Administration and Congress examine federal programs for coal and oil and gas leasing and 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 coals but will also provide pathways for new industries to develop around uses of federal lands providing needed economic revitalization to fossil-dependent energy communities.