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# Ownership Models for Geological Sequestration: A Comparison of the Emergent Regulatory Models in Australia and the United States

by Samantha J. Hepburn

Samantha J. Hepburn is a Professor in the Faculty of Business and Law, Deakin University, Australia.

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## Summary

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Modern property frameworks are increasingly deployed to support climate change mitigation strategies. The propertization of geological storage formations, utilized for the purpose of carbon capture and storage (CCS), provides a compelling example of this. Pursuant to regulatory changes to the propertization of CCS in the Australian states of Victoria and Queensland, ownership lies with the State, while in the United States, in Montana, North Dakota, and Wyoming, ownership remains with the private owner. State ownership is preferable as it provides clarity, structure, and certainty for CCS markets. It also removes the difficulties associated with potential CCS projects having to obtain multiple authorizations from private owners, reduces disparity and conflict between subsurface owners, and minimizes future liability. The transformative shift from a disaggregated private resource to a state-owned independent resource must be dealt with carefully so that its impact upon preexisting surface entitlements is clear.

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Climate change legislation is unusually vulnerable to a large number of regulatory failure risks.<sup>1</sup>

Environmental issues test modernist property rights' capacity to make these adaptations—and no test will be more critical than that of dealing with climate change.<sup>2</sup>

Anthropogenic greenhouse gas (GHG) emissions need to be drastically reduced and stabilized to avoid the consequences of catastrophic climate change.<sup>3</sup> Carbon capture and storage (CCS) projects represent an instrumental constituent in carbon dioxide (CO<sub>2</sub>) reduction strategies because of their significant potential to mitigate GHG emissions from large point-source emitters including coal, natural gas-fired power plants, and oil refineries.<sup>4</sup> The concept of carbon capture through geosequestration refers to the capture and storage of carbon dioxide within subsurface geological reservoirs.<sup>5</sup> CO<sub>2</sub> may be captured from a point source (such as a coal- or gas-fired plant) and compressed into a liquid form for transportation, via pipelines, to a safe place for eventual injection or storage into subsurface geologic formations.<sup>6</sup> The progression of CCS is reflective of a broader policy shift toward climate change mitigation and the imposition of restricted carbon emission allocations.<sup>7</sup>

1. William W. Buzbee, *State Greenhouse Gas Regulation, Federal Climate Change Legislation and the Preemption Sword*, 1 SAN DIEGO J. CLIMATE & ENERGY L. 23, 28 (2009).
2. Carol M. Rose, *Big Roads, Big Rights: Varieties of Public Infrastructure and Their Impact on Environmental Resources*, 50 ARIZ. L. REV. 409, 443 (2008).
3. See the conclusions of the INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SYNTHESIS REPORT 43-54 (IPCC, 2007), available at [http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4\\_syr.pdf](http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf). The report indicates at 36 that anthropogenic emissions have increased by 70% since preindustrial times. The Australian government has agreed to reduce GHG emissions by at least 5% below 2000 levels by 2020, and the longer term target is to reduce carbon pollution by 80% below 2000 levels by 2050. See COMMONWEALTH GOVERNMENT OF AUSTRALIA, SECURING A CLEAN ENERGY FUTURE 15 (2011), available at <http://www.environment.gov.au/cleanenergyfuture/index.html>.
4. See BERT METZ ET AL., IPCC SPECIAL REPORT ON CARBON DIOXIDE CAPTURE AND STORAGE 195, 210 (2005), available at [http://www.ipcc.ch/pdf/special-reports/srrcs\\_wholereport.pdf](http://www.ipcc.ch/pdf/special-reports/srrcs_wholereport.pdf).
5. The concept of geosequestration is used in contradistinction to biosequestration, which is another form of carbon sequestration whereby plants take up CO<sub>2</sub> through photosynthesis.
6. For an excellent discussion on the scientific process of capturing and transporting CO<sub>2</sub>, see Larry Nettles & Mary Conner, *Carbon Dioxide Sequestration—Transportation, Storage, and Other Infrastructure Issues*, 4 TEX. J. OIL, GAS & ENERGY L. 27, 28 (2008-2009). The authors note that a geologic storage site that is properly selected and managed could store CO<sub>2</sub> for millions of years. See also IPCC SPECIAL REPORT ON CARBON DIOXIDE CAPTURE AND STORAGE, *supra* note 4, at 51, 53. For an Australian perspective, see HOUSE OF REPRESENTATIVES STANDING COMMITTEE ON SCIENCE AND INNOVATION, PARLIAMENT OF AUSTRALIA, BETWEEN A ROCK AND A HARD PLACE: THE SCIENCE OF GEOSEQUESTRATION 25 (2007), available at <http://www.aph.gov.au/house/committee/scin/geosequestration/report/fullreport.pdf>.
7. See the outline by DENNIS HIRSCH ET AL., EMISSIONS TRADING—PRACTICAL ASPECTS IN GLOBAL CLIMATE CHANGE AND UNITED STATES LAW 629-30 (M.B. Gerrard ed. 2007).

In Australia, CCS has significant value within the context of the carbon pricing mechanism. Whilst no carbon units have been issued for CCS projects under the Australian emission-trading framework, where CCS is carried out, and CO<sub>2</sub> is successfully captured, entities will be less likely to exceed their emission allocations.<sup>8</sup> In this context, CCS is intrinsically important as an emission-reduction strategy. In the United States, however, if CCS activities are recognized within a cap-and-trade framework, and CO<sub>2</sub> is successfully captured, CCS operators may be allocated units.<sup>9</sup> Where CCS activities are recognized, emitters may eventually be required to surrender those units in the event of future carbon leakage.<sup>10</sup>

Globally, planned and operational CCS projects are increasing.<sup>11</sup> In the United States, it has been suggested that CCS has become so critical to the carbon economy that many emitters would be incapable of meeting their emission allocations without it.<sup>12</sup> In China, CCS projects

are increasingly apparent in the clean technology revolution.<sup>13</sup> In Australia, the relevance of carbon capture as a strategy for emission reduction is apparent in new strategic and regulatory developments such as the creation of the global Carbon Net Project in the Latrobe Valley in Victoria, a region boasting some of the most developed CCS programs in the country.<sup>14</sup>

Where a CCS project is established, carbon may be stored in geological storage formations (pore spaces) located under the surface of the land or the seabed. It is increasingly clear that a vital component in the progression of CCS lies in the implementation of a clear and properly structured legislative framework outlining the ownership principles relevant to subsurface geological storage formations. The proprietization of subsurface storage space provides a persuasive illustration of the increasing alignment occurring between climate change mitigation policies and modern property frameworks.<sup>15</sup>

In Australia, the new regulatory framework for offshore geological storage was implemented at the federal level through detailed amendments to the Offshore Petroleum and Greenhouse Gas Storage Act (OPGGSA) 2006 (Cth) that came into effect in 2008. The Victorian government has implemented mirror legislation in the OPGGSA 2010 (Vic). Onshore regulation remains the subject of state jurisdiction. To date, Victoria and Queensland are the only states to have introduced specific carbon capture legislation. The relevant Victorian legislation is the Greenhouse Gas Geological Sequestration Act (GGGSA) 2008 (Vic). In Queensland it is the Greenhouse Gas Storage Act (GGSa) 2009 (Qld).<sup>16</sup>

8. See the framework of the Clean Energy Act 2011 (Cth). The benefit connected with CCS is consistent with the volume of CO<sub>2</sub> captured, where that CO<sub>2</sub> is intended for permanent storage in subsurface geological storage formations and is captured by or transferred to a "relevant person." See also National Greenhouse and Energy Reporting (Measurement) Determination—F2012COO472, S1.19B (Office of Legislative, Drafting & Publishing, Attorney-General's Dept., Canberra, 2008).
9. California has recently introduced a cap-and-trade framework pursuant to the Global Warming Solution Act of 2006, AB32. The first auction under this new framework took place on Nov. 14, 2012. Compliance commenced on Jan. 1, 2013. The framework does not currently incorporate carbon capture into its California Air Resources Board (CARB)-approved offset protocols. The European Emission Trading Scheme (ETS), launched in 2005 as a part of the European Climate Change Programme (ECCP), is now in its third phase. From the start of Phase II of the EU ETS in 2008, Member states have had the option of including CCS projects under the EU ETS, subject to European Commission approval. However, CCS is given fuller recognition within the system under the revised EU ETS Directive, adopted in 2009, which will take effect from Phase III in 2013. The amendments to the regime introduced by the 2009 Directive will play a significant role in the financing of CCS activities. Emission allowances need not be surrendered where CO<sub>2</sub> is successfully captured and stored; captured emissions will be counted as "not emitted." See Global CCS Institute, European Emission Trading Legislation, <http://www.globalccsinstitute.com/networks/ccdp/legalresources/emission-trading/eu-emission-trading> (last visited Feb. 27, 2014).
10. See *id.*
11. One of the most significant projects to date, associated with natural gas production, is the Sleipner Offshore Natural Gas field located in the North Sea, between Norway and Sweden, where approximately one million metric tons of CO<sub>2</sub> have been injected in subsurface storage areas since 1996. In 2011, Statoil released its plans to develop a full-scale carbon capture plant at Mongstad. See <http://www.globalccsinstitute.com/projects/12386>.
12. In North America, it has been estimated that up to 3,000 gigatons of storage space exists. This would be enough to sequester the combined CO<sub>2</sub> emissions of 1,000 coal-fired power plants over 1,000 years. See Federal Requirements Under the Underground Injection Control Program for Carbon Dioxide Geologic Sequestration Wells, 73 Fed. Reg. 43496 (July 25, 2008). See also CONGRESSIONAL BUDGET OFFICE, THE POTENTIAL FOR CARBON SEQUESTRATION IN THE UNITED STATES (2007), available at <http://www.cbo.gov/sites/default/files/cbofiles/ftpdocs/86xx/doc8624/09-12-carbonsequestration.pdf>. For a broader discussion of the position in the United States, see Donna M. Attanasio, *Surveying the Risks of Carbon Dioxide: Geological Sequestration and Storage Projects in the United States*, 39 ELR 10376, 10377 (May 2009); A. Bryan Endres, *Geologic Carbon Sequestration: Balancing Ef-*

*iciency Concerns and Public Interest in Property Rights Allocations*, 2011:2 U. ILL. L. REV. 623, 633 (2011).

13. The General Electric Company and Shenhua Group in China, in seeking to improve the performance of commercial-scale gasification and integrated gasification combined-cycle (IGCC) solutions, have jointly agreed to pursue the deployment of commercial-scale IGCC plants with carbon capture. This is discussed at <http://www.captureready.com/EN/Channels/News/showDetail.asp?objID=1361> (last visited Mar. 6, 2014).
14. The CarbonNet Project (CarbonNet) has been set up on the LaTrobe Valley in Victoria. The project is investigating the potential for establishing a world-class, large-scale CCS network. The network would bring together multiple CO<sub>2</sub> capture projects in Victoria's Latrobe Valley. The offshore Gippsland Basin has some of the largest and best-quality CO<sub>2</sub> reservoirs from 25 major basins across Australia. Energy and Earth Resources, The CarbonNet Project, <http://www.dpi.vic.gov.au/energy/sustainable-energy/carbon-capture-and-storage/the-carbonnet-project> (last visited Feb. 27, 2014).
15. See, for example, the discussion by Alexandra B. Klass & Elizabeth J. Wilson, *Climate Change, Carbon Sequestration, and Property Rights*, 2010 U. ILL. L. REV. 363 (2010), where the authors argue that the U.S. federal government should be able to exercise the power of eminent domain to implement CCS as a "public use" under the Fifth Amendment to the U.S. Constitution.
16. Other Australian states are yet to follow. In 2012, however, Western Australia (WA) introduced amendments to the Petroleum and Geothermal Energy Resources Act, WA (1967) providing for onshore geological storage of GHG. Prior to the introduction of these amendments, the injection and



In the United States, many states have introduced some form of regulatory control over CCS projects. This Article focuses exclusively on the regulatory developments that have occurred in Montana, North Dakota, and Wyoming. Each of these states has introduced specific legislation vesting ownership of pore space in the surface estate owner and regulating the capacity to develop CCS projects.<sup>17</sup>

The regulatory frameworks introduced in Australia for on- and offshore geological storage formations have been ostensibly designed to encourage private industry investment and to protect underlying public interest.<sup>18</sup> The onshore verification of geological storage formations as independent resources, severed from the inclusive realm of surface ownership, represents not only a fundamental shift in normative perspectives regarding resource allocation, but also a strategic shift in ownership assumptions.<sup>19</sup>

It is axiomatic that modern property frameworks have become amorphous creatures, generating rights and interests that range from institutionalized common-law forms to novel statutory creations.<sup>20</sup> The promulgation of new rights and the dissection of established ones inevitably disturb the conventional property mainframe.<sup>21</sup> In particular, the statutory reorientation of private or common property norms affects established patterns of control and can disturb the conceptual nucleus of our property schema.<sup>22</sup> This is because many new resource interests have been disembodied from their corporeal origins and any correlative common-law foundation.

storage of GHGs in WA was not regulated, apart from the Gorgon Project, which is the largest commercial CCS project in the world and which is regulated according to the Barrow Island Act (2003) State Agreement.

17. See *infra* Part III. There has also been development in other states, but an evaluation of that is beyond the scope of this Article.
18. See Allison M. Warburton & J.A. Grove, *Geosequestration Law in Australia*, in CLIMATE CHANGE LAW IN AUSTRALIA, 148-49 (T. Bonyhady & P. Christoff eds., 2007). See also James Fahey & Rosemary Lyster, *Geosequestration in Australia: Existing and Proposed Regulatory Mechanisms* 4(5) J. EUR. ENVTL. & PLAN. L. 378 (2007).
19. See, for example, the discussion on this by J.B. Ruhl, *Climate Change Adaptation and the Structural Change of Environmental Law*, 40 ENVTL. L. 363, 366-71 (2010) (the author argues that adaptation policy has produced a significant shift in natural resource perspectives).
20. See Michael Heller, *The Boundaries of Private Property*, 108 YALE L.J. 1163, 1166 (2008) (evaluating the interests that inhabit the "commons" and the "anticommons"). See also Michael Heller, *Tragedy of the Anticommons: Property in the Transition From Marx to Markets*, 111 HARV. L. REV. 621, 651 (1998) (describing "anticommons" as "disaggregated rights" conferred by the state upon multiple owners who each hold rights of exclusion. The author argues that the proliferation of these rights can result in the underuse of a resource. For an Australian perspective, see the discussion by Matthew Storey, *Not of This Earth: The Extraterrestrial Nature of Statutory Property in the 21st Century*, 25 AUSTRALIAN RESOURCES & ENERGY L.J. 51 (2006).
21. See Edella Schlager & Elinor Ostrom, *Property-Rights Regimes and Natural Resources: A Conceptual Analysis* 68(3) LAND ECON. 249, 260 (1992) (outlining the difficulty of introducing new property rights within established private and common property frameworks, noting that an evaluation of the conditions that enhance or detract from "systemic stability in the face of exogenous or endogenous changes" should be taken into account in this process).
22. See Michael A. Heller, *The Dynamic Analytics of Property Law*, 2 THEORETICAL INQUIRIES L. 79, 87 (2001) (examining the "property governance" rules relevant to new ownership forms). See also Andrzej Rapaczynski, *The Roles of the State and the Market in Establishing Property Rights*, 10 J. ECON. PERSP. 87 (1996) (considering the importance that a workable system of legal entitlements has for the progression of economic growth).

The absence of an institutional basis can generate difficulties because new statutory rights often lack formative guidance.<sup>23</sup> According to the Demestzian view, property rights have the capacity to adjust naturally and in a cost-minimizing direction to accommodate new externalities produced by emergent property.<sup>24</sup> This theory has, however, been challenged and it has been argued that new property demands specific elaboration in order to better ascertain systemic risks and the ongoing viability of the right as a stabilizing factor.<sup>25</sup>

The proprietization of new natural resource interests is increasingly achieved through the implementation of statutory provisions.<sup>26</sup> The launch of a new natural resource interest must, however, be supported by adequate definitional orientation.<sup>27</sup> Detailing the nature and scope of the interest and its connection to the institutional framework is imperative if the right is to be appropriately identified, observed by relevant stakeholders and supported by appropriate dispute resolution mechanisms.<sup>28</sup> The verification process itself must strive to produce simple, clear, fungible rights, as these are the rights that best serve the interests of the commercial world.

In vesting subsurface storage rights in the state, the Victorian and Queensland onshore GGSA legislation has displayed a clear preference for state control in the development of subsurface geological storage projects. These statutory initiatives provide strong incentives for the progression of the CCS market, particularly in comparison with the "private ownership" frameworks that have been introduced in some parts of the United States.

This Article argues that the Australian approach, verifying subsurface storage space as a separate resource from the subsurface land in which it resides and vesting that separate resource in the state, provides structural clarity and stability for the CCS industry. The contrasting approach, adopted by the new regulatory frameworks in Montana, North Dakota, and Wyoming, whereby ownership of subsurface storage space continues to reside with the surface estate owner, burdens the long-term progression of CCS initiatives. The private ownership model mandates the

23. See Storey, *supra* note 20, at 56-57. See also Samantha J. Hepburn, *Carbon Rights as New Property: The Benefits of Statutory Verification*, 31:2 SYDNEY L. REV. 239, 246 (2009).
24. Harold Demestz, *Towards a Theory of Property Rights*, 57 AM. ECON. REV. 347, 350 (1967).
25. See Rashmi Dyal-Chand, *Useless Property*, 32 CARDOZO L. REV. 1373, 1410 (2011) (arguing that the bare fact of ownership does not inevitably produce efficient results because it does not always incentivize use). See also Robert C. Ellickson, *Property in Land*, 102 YALE L.J. 1315, 1321 (1993) (examining broader noneconomic issues relevant to land regimes, including liberty, privacy, equality, and community).
26. See, for example, the verification of biological carbon sequestration interests. Marianna Parry, *A Property Law Perspective on the Current Carbon Sequestration Laws and the Green Paper Model*, 36:1 MONASH U. L. REV. 321 (2010); Hepburn, *supra* note 23.
27. The fact that the modern regulatory state has adopted the role of owner of environmental goods, determining their total allowable use through detailed regulation, was outlined by Carol Rose, *supra* note 2, at 410.
28. Rose, *supra* note 2, at 410. "Property rights regimes at a minimum require some system to define rights, to signal their presence, to monitor transgressions, to resolve disputes about who has what rights, and to enforce the rights held valid."



need for surface owner consent, a process fraught with difficulty, particularly where the subsurface storage space extends across vast tracts of land and approval from multiple surface owners is required.

The idea that the surface estate owner is entitled to control subsurface storage spaces located deep within the strata is derived from common-law orthodoxy.<sup>29</sup> This assumption has, however, been significantly qualified over time as mineral and extractive rights in the subsurface strata have evolved. Arguably, the tenacity of surface owner control in the United States stems from a deeper and more entrenched concern, sourced in an underlying preoccupation with private land value, underpinned by the Fifth and Tenth Amendments in the U.S. Constitution.

The Takings Clause in the Fifth Amendment provides that “private property shall not be taken for public use, without just compensation.”<sup>30</sup> The nature and scope of the reference to “public use” has created some debate, although courts have equated public use with public interest giving governments the power of eminent domain to advance any conceivable public purpose.<sup>31</sup> The Tenth Amendment, known as the police power, gives the government the power to regulate private property.<sup>32</sup> Where a government goes too far in regulating private land, an unconstitutional taking may result. The key question is whether the regulation of property amounts to a taking requiring the payment of just compensation.<sup>33</sup> The categories of regulatory takings have been found to include permanent physical occupations, regulations depriving landowners of all economic use of their property and regulations depriving landowners of some use or value of their land.<sup>34</sup> The scope and range of the regulatory takings jurisprudence means governments tend to avoid the introduction of any legislation with the potential to generate large-scale compensation claims.<sup>35</sup>

The landscape of eminent domain and regulatory takings has significantly influenced the development of regulatory initiatives for CCS. Upholding the private rights of the surface estate owner to subsurface pore estate is the preferred model for CCS in the United States because any attempt to vest subsurface storage space in the state is likely

to amount to a physical taking.<sup>36</sup> Further, if the regulation of CCS deprives a surface or mineral estate owner of economic value, it is likely to constitute a regulatory taking.<sup>37</sup> The trajectory of physical and regulatory takings jurisprudence in the United States appears disconnected with the macroimperatives of a carbon economy.

On the other hand, should a government seek to introduce legislation vesting ownership of subsurface storage areas in the state, it is likely to constitute a valid exercise of the power of eminent domain as a public use given the public benefit connected with climate change mitigation.<sup>38</sup> Where this occurs, the significant issue is likely to be how much compensation will be “just” in all the circumstances.<sup>39</sup> The compensation may be significant in circumstances where other commercial usages are already operational for the subsurface strata of private property, such as oil and gas development. Where, however, no such usage exists, the compensation may be minimal.<sup>40</sup>

The state-based ownership regime that has been introduced in Australia, while broadly preferable to the private ownership model, nevertheless requires significant development. The failure of both the Victorian and the Queensland frameworks to properly articulate the nature and scope of the subsurface storage interest increases the potential for ownership and liability disputes. Further, the absence of a uniform federal framework paves the way for a bewilderment of different jurisdictional claims within an expansive regulatory commons. Subsurface storage formations will rarely conform to state boundaries, and the absence of jurisdictional consistency will inevitably produce complex regulatory discrepancies.<sup>41</sup> This Article contends that the regulatory framework that has emerged in Australia to date is inadequate because of the absence of clear and structured verification provisions. These regulatory failures must be improved for a state ownership framework to properly support the nascent CCS industry.

Part I of the Article outlines the fundamental common-law position. It examines the structural importance of the *cuius est solum, eius est usque ad coelum et ad inferos* (“whoever owns [the] soil, [it] is theirs all the way [up] to Heaven and [down] to Hell”) maxim and considers its ongoing

29. See *infra* Part I.

30. U.S. CONST. amend. V. See also RICHARD A. EPSTEIN, TAKINGS: PRIVATE PROPERTY AND THE POWER OF EMINENT DOMAIN, 162-85 (1985).

31. See *Haw. Hous. Auth. v. Midkiff*, 467 U.S. 229, 244 (1984) (observing that “[j]udicial deference is required because, in our system of government, legislatures are better able to assess what public purposes should be advanced by an exercise of the taking power”).

32. U.S. CONST. amend. X.

33. See *Pennsylvania Coal Co. v. Majohn*, 260 U.S. 393 (1922). Justice Oliver Wendell Holmes wrote, “[t]he general rule . . . is that while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking.” *Id.* at 415.

34. *Loretto v. Teleprompter Manhattan CATV Corp.*, 458 U.S. 419 (1982); *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 22 ELR 21104 (1992); *Penn. Cent. Transp. Co. v. New York City*, 438 U.S. 104, 8 ELR 20528 (1978) (evaluating the circumstances where an economic deprivation would occur and set out three steps: (1) the character of the government action; (2) the severity of the economic impact; and (3) the extent to which the regulation interferes with the property owner’s distinct, “investment-backed” expectations).

35. See Frank Michelman, *Takings*, 1987, 88 COLUM. L. REV. 1600, 1607 (1988).

36. See Will Reisinger et al., *Reconciling King Coal and Climate Change: A Regulatory Framework for Carbon Capture and Storage*, 11 VT. J. ENVTL. L. 1, 33 (2009). The authors argue that deep saline aquifer space should be declared a public space and that to avoid any such regulation amounting to a Fifth Amendment taking, it should only apply to spaces that exist beyond a professionally determined “economic viability zone.”

37. See Klass & Wilson, *supra* note 15, at 415-16.

38. See *id.* at 417, where the authors note the critical importance of addressing climate change as well as the important public health and safety concerns associated with preventing the re-release of CO<sub>2</sub> into the atmosphere after injection.

39. See *Boston Chamber of Commerce v. City of Boston*, 217 U.S. 189, 195 (1910). “The question is, what has the owner lost, not what has the taker gained.” See also *Brown v. Legal Found. of Wash.*, 538 U.S. 216, 235 (2003).

40. Klass & Wilson, *supra* note 15, at 421.

41. See Shalini Vajjhala et al., *An International Regulatory Framework for Risk Governance of Carbon Capture and Storage*, International Risk Governance Council, Washington 5-6 (2007). The authors suggest that large-scale CCS operations will require multilateral regulation and uniform standards to ensure effective regulatory progression.

relevance and durability in the context of overlapping subsurface land and mineral claims. It is argued that the institutionalized assumptions reflected in the common-law principles, while instructive in their formative assertions, fail to provide clear directional guidance for the emergent ownership imperatives of CCS.<sup>42</sup>

Part II overviews the regulatory frameworks in Australia, focusing upon the Victorian and Queensland legislation and, in the offshore region, on the federal legislation. This section evaluates the scope of the relevant ownership provisions, and considers their functionality and how they have impacted upon interconnected surface and subsurface land interests. It examines the statutory provisions vesting the ownership of subsurface pore space in the state and argues that this process has been handled ineffectively because the interest is not properly articulated.

Part III evaluates the regulatory framework in Montana, North Dakota, and Wyoming, where the ownership of subsurface storage space is expressly vested in the surface estate owner. Within these states there is no need to verify subsurface space as a new resource because it continues to reside with the surface owner. The statutory provisions rely, therefore, upon the capacity of the preexisting surface estate owners to accommodate a delimitation of subsurface storage space for market purposes. This section explores the difficulties of a private ownership model for the CCS industry and contrasts it with the perceived advantages of a properly configured state ownership model.

The difficulties inherent in the emergent statutory frameworks regulating subsurface geological sequestration in both Australia and the United States illustrate the shifting imperatives of resource ownership models within the climate change polemic. It appears, as Elinor Ostrom has predicted, that “simple models of property panaceas” are ineffective unless properly adjusted. The implementation of a structured legislative framework sourced in state ownership principles will be ultimately more analytically useful for the progression of the CCS market, provided the verification and jurisdiction concerns are properly addressed.<sup>43</sup> The propertization of subsurface storage space demands meticulous statutory construction given that the terrain in which it resides is mired in the nexus of soil, minerals, and geological stratum.<sup>44</sup>

42. For a discussion on the difficulties with the common-law framework for subsurface ownership, see John G. Sprankling, *Owning the Center of the Earth*, 55 UCLA L. REV. 979, 982-88 (2008) (proposing a defined outer limit for subsurface ownership).

43. Daniel H. Cole & Elinor Ostrom, *The Variety of Property Systems and Rights in Natural Resources 2* (Sch. of Pub. & Envtl. Aff., Ind. Univ., Research Paper No. 2010-08-01), available at <http://ssrn.com/abstract=1656418>. The authors make it clear that “specific property regimes that prove viable and sustainable in one set of social-ecological circumstances may prove nonviable or unsustainable in another.”

44. Most jurisdictions in the United States have not introduced definitive regulation. The Interstate Oil and Gas Compact Commission (IOGCC) Task Force on Carbon Capture and Geologic Storage indicated in its report, *STORAGE OF CARBON DIOXIDE IN GEOLOGIC STRUCTURES: A LEGAL AND REGULATORY GUIDE FOR STATES AND PROVINCES* 1-47, 10 (2007), that resolving the question of pore space ownership through the development of “model laws and regulations for geologic storage” will facilitate the implementation of a critical legal and regulatory infrastructure for CO<sub>2</sub> storage.

## I. The Common-Law Framework

The common-law position in Australia and the United States regarding the ownership of subsurface land is embodied in the maxim, *cujus est solum, ejus est usque ad coelum et ad inferos*, which means that the person who owns land owns it from the heavens above to the center of the earth below.<sup>45</sup> The maxim is suggestive of an infinite stretch of ownership in the airspace above the land and in the subsurface land toward the earth’s core. Taken literally, the maxim has been described as unfeasible and, in the words of one commentator, “an unfortunate scrap of Latin.”<sup>46</sup> Numerous curtailments to the application of the maxim have evolved, making its ongoing relevance increasingly debatable. The maxim will only apply where the grant is not subject to specific limitations and will not, for example, have an application to surface estate grants that are subject to express height or depth limitations.<sup>47</sup>

The maxim only has a limited application to airspace because of the trespass actions that air travel and satellite navigation would generate.<sup>48</sup> As outlined by the U.S. Supreme Court in *United States v. Causby*,<sup>49</sup> the maxim “has no relevance to the world of modern air-travel” and, in this context, the surface estate owner controls only as much airspace “as can be used in connection with the land.”

The maxim has been most commonly applied to support the subsurface rights of the surface estate owner; however, even in this context, its scope is subject to a range of limitations.<sup>50</sup> In the first instance, the maxim cannot be taken literally because it is absurd to suggest that the surface holder may claim ownership rights that extend to the center of the earth. Productive activity is only feasible within a shallow portion of earth’s crust, and the maxim

45. For an Australian perspective on the maxim, see PETER BUTT, *LAND LAW* [2.05]-[2.07] (6th ed. 2010). The author notes that the maxim dates back to at least 1285 in English law, but may in fact have its origins 1,000 years earlier in Jewish law. See also Sprankling, *supra* note 42, at 1003, where the author suggests that “[t]he doctrine functions merely as a convenient shorthand for the idea that a landowner owns the subsurface to the extent necessary to support normal and reasonable uses of the surface.” See also Stuart Ball, *The Vertical Extent of Ownership in Land*, 76 U. PA. L. REV. 631 (1928).

46. EDWIN PEEL, WINFIELD & JOLOWICZ ON TORT 339 (1937). In *Commissioner for Railways v. Valuer General*, 1 AC 382 (1974), the court concluded that the maxim was imprecise. In *Bocardo SA v. Star Energy UK Onshore Ltd.*, 3 WLR 354 (2010), Justice Lord Hope suggested that the Latin maxim, while flawed, nevertheless retained some utility as a general guide to subsurface ownership under common law. See also Peter Butt, *How Far Down do You Own? The Final Word*, 84 AUSTRALIAN L.J. 746 (2010).

47. Some Acts specifically incorporate this right. The Western Lands Act (NSW), Sch. 4, cl. 5 (1901) specifically sets out that the Minister may “limit a grant to the surface of the land or to the surface and a stated depth below the surface.” Clause 5(2) then sets out that land “excluded by such a limitation is surrendered to the Crown.”

48. In *Bernstein v. Skyviews & General Ltd.* [1978] Q.B. 479 (Eng.), Griffiths, J., concluded that the rights of a surface owner to airspace should be restricted to “such height as is necessary for the ordinary use and enjoyment of his land and the structures upon it.”

49. *United States v. Causby*, 328 U.S. 256, 264 (1946). See also *Willoughby Hills v. Corrigan*, 278 N.E.2d 658 (1972).

50. In *Chance v. BP Chemicals Inc.*, 77 Ohio St. 3d (1996), the Supreme Court of Ohio concluded that while there are many limitations on the ownership rights in airspace, there are also limitations on property owners’ subsurface rights.

should only support ownership rights that extend down to a reasonable level.<sup>51</sup> The maxim is also significantly qualified by the creation of ownership rights in subsurface minerals as well as other natural resources, including subsurface storage space.

The English Court of Appeal in *Star Energy Weald Basin Ltd. v. Bocardo SA* recently reviewed the scope of a surface estate owner's rights in the subsurface.<sup>52</sup> The court held that a surface owner's subsurface rights extended downwards to include a petroleum reservoir at a depth of 2,800 feet. This meant that a licensee who had bored pipelines to a depth beneath the landowner's land to recover petroleum from within the adjacent licensed area was found to have committed a trespass.

Lord David Hope concluded that whilst the concept of an infinite ownership in subsurface terrain was impractical, the ongoing utility of the maxim lay in its operation as an "imperfect guide" to the reasonable rights held by a surface estate owner. His Lordship noted that any subsurface ownership rights claimed by a surface estate owner will always be subject to "a conveyance, at common law or by statute to someone else."<sup>53</sup>

The rights of third parties to extract minerals and take advantage of the natural resources in the subsurface represents a significant qualification to the scope of the common-law maxim. The fragmentation of the subsurface strata in this way is consistent with its functional and economic utility, although disaggregation of the subsurface can often produce complexity and overlap.<sup>54</sup>

The articulation of land as a three-dimensional concept means that the subsurface strata are, theoretically, amenable to both vertical and horizontal divisions.<sup>55</sup> A horizontal division of the substratum would generate separate subsurface layers thereby restricting the scope of surface

owners' entitlements.<sup>56</sup> Horizontal divisions, while common in airspace, have rarely been attempted in the subsurface because the physicality of the terrain makes such a division unworkable. The absence of this type of fragmentation helps to facilitate a functional relationship between subsurface resource owners.<sup>57</sup>

Subsurface interests that exist independently of surface estate have been generated in a range of different ways. In Australia, the Crown has an established prerogative right to gold and silver, which are known as royal minerals. This right precludes these minerals from passing with any grant of the land. Royal minerals remain the property of the Crown, even where they are located in the subsurface of private land.<sup>58</sup>

It is also possible for minerals to be precluded from passing with a land grant where a reservation is included. Mineral reservations in Crown grants ensure that specified minerals are not transferred with the grant.<sup>59</sup> Most Crown reservations are defined broadly and cover a diverse range of subsurface minerals including those that were incapable of extraction at the time the grant was issued.<sup>60</sup>

Many Australian states have also introduced legislation vesting ownership of minerals and petroleum in the Crown. The statutory definition of minerals and petroleum is broad, and generally includes oil, shale, coal, hydrocarbons, petroleum, and mineral oils.<sup>61</sup> The vesting provisions make it clear that ownership of the unextracted mineral or petroleum resides with the state and not the surface owner. However, once the mineral or petroleum is extracted, ownership may be transferred to the license holder.<sup>62</sup>

Minerals are not the only subsurface resource to be statutorily vested in the state. The usufructuary rights of surface owners to percolating groundwater have also

51. See Sprankling, *supra* note 42, at 1039 (concluding, "productive human activity is only possible within the shallowest portion of the earth's crust" and that, consequently, subsurface ownership should only extend down to a specified depth of 1,000 feet. Cf. Jean Howell, *Subterranean Land Law: Rights Below the Surface of the Land*, 53 N. IR. LEGAL Q. 268, 270 (2002) (the author rejects the concept of ownership to a specific depth, arguing that "any intrusion in land which is not sanctioned by some counter-veiling property right will constitute a trespass and that, although the surface owner will not usually wish to or be able to utilise the ground below the surface, he has rights in the land which could be valuable").

52. [2011] AC 380.

53. [2011] AC 380 at [26]-[27].

54. The difficulties that fragmentation can generate were outlined by Francesco Parisi in his paper, *Entropy in Property*, 50 AM. J. COMP. L. 595, 596 (2002), where the author notes the difficulty of "reaggregating property once fragmentation is allowed" and suggests that legal systems adopt legal mechanisms to combat the "entropy arising from fragmentation." See also Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement to Facilitate Coasean Trade*, 104 YALE L.J. 1027 (1985) (arguing that fractional ownership structures curb or eliminate strategic inefficiencies attributed to bargaining under private information).

55. See the conclusions of Windeyer, J., in *Bursill Enterprises Pty. Ltd. v. Berger Bros. Trading Co. Pty. Ltd.* [1971] 124 CLR 73, 91 (Austl.):

... at common law he [the freeholder] could dispose of a part of his holding by horizontal subdivision, just as by vertical subdivision. There were objections to this in medieval times. But by Coke's time these had disappeared. He said: "A man may have an inheritance in an upper chamber though the lower buildings and soil be in another, and seeing it is an inheritance corporeal it shall pass by livery."

56. See Parisi, *supra* note 54, at 608 (concluding that the "risks of horizontal forms of property fragmentation are limited").

57. See the discussion by Michael Heller (2008), *supra* note 20, at 1166, where the author notes that in well-functioning property regimes, legislatures and courts draw boundaries that constrain owners' choices regarding fragmentation.

58. *The Case of Mines* [1568] 1 Plowd 310, 336, 75 ER 472, 510 (Austl.); *Cadia Holdings Pty. Ltd. v. New South Wales* [2010] 269 ALR 204 at [40]-[41] (Austl.).

59. *Doe d. Douglas v. Lock* [1835] 2 Ad & E 705, 743-745, 111 ER 271, 287 (Austl.). The words "reservation" and "reserving" are generally used to mean a keeping back of a physical part of a thing otherwise granted. See also *Attorney-General v. Brown* [1847] 1 Legge 312, 322, per Stephen, J. (Austl.); *McGrath v. Williams* [1912] 12 SR (NSW) 477 (Austl.); *Neill v. Davidson* (1890) 11 LR (NSW) Eq 209 (Austl.).

60. See *Minister for Mineral Resources v. Brantag Pty. Ltd.* (1997) 8 BPR 15815, 15822, per Mason, P. (Austl.). A good example of a relatively new form of "mineral" or "hydro-carbon," depending upon which state you are in, is coal seam gas (coal-bed methane).

61. Mineral Resources (Sustainable Development) Act 1990 (Vic), §9; Petroleum Act 1998 (Vic), §13; Petroleum (Onshore) Act 1991 (NSW), §6; Mineral Resources Act 1989 (Qld), §8; Petroleum Act 1923 (Qld), §9; Petroleum and Geothermal Act 2000 (SA), §5(1); Petroleum Act 1936 (WA), §9; Mineral Resources Development Act 1995 (Tas), s6; Minerals (Acquisition) Act (NT), §3; Petroleum Act (NT), §6.

62. Mineral Resources (Sustainable Development) Act 1990 (Vic), §11; Petroleum Act 1998 (Vic), §17; Petroleum (Offshore) Act 182 (NSW), §128; Mineral Resources Act 1989 (Qld), §43, 114 and 310; Petroleum Act 1923 (Qld), s9; Mining Act 1971 (SA), §18; Petroleum and Geothermal Act 2000 (SA), §5(2); Petroleum and Geothermal Energy Resources Act 1967, §11A(1).



been transferred by statute. Lord Chelmsley outlined the common-law position in *Chasemore v. Richards*, who concluded that there is “no limit on the use to which a proprietor of land can make to the water that percolates underneath.”<sup>63</sup> His Lordship held that the right of a private owner to extract groundwater and divert it from neighboring land was a right of diversion that formed a part of the natural rights incidental to surface land ownership.<sup>64</sup> The statutory vesting of these “natural rights” in the state further illustrates the extent to which the common-law maxim has been diminished in Australia.<sup>65</sup> This approach can be contrasted with the position in United States, where the usufructuary right remains in many states.<sup>66</sup>

Unlike Australia, in the United States, ownership of the subsurface has not generally been vested in the state and therefore continues to reside with the surface estate owner. The surface owner retains full control of most subsurface minerals and is therefore in a position to sever what is known as the mineral estate and confer ownership of that estate upon a third party.<sup>67</sup> Once created, a mineral estate is akin to a profit à prendre, conferring a right to enter the land and remove minerals from, upon, or beneath that land and make whatever reasonable use of the surface is necessary to achieve this end.<sup>68</sup> Once the minerals have been extracted, the mineral estate holder will retain corporeal ownership of the mineral.<sup>69</sup> The position in the United States gives greater effect to the *ad inferos* doctrine because the regulatory framework upholds surface owner control. This means that any exercise of eminent domain by the government will constitute a physical taking and just compensation must be paid.<sup>70</sup>

In both Australia and the United States, the common-law maxim continues to represent the basic architecture for subsurface ownership principles. In the absence of regulatory amendment, the maxim dictates that subsurface storage space will belong to the surface estate owner.<sup>71</sup> In

Australia, the maxim treats subsurface storage space as a component of the strata, thereby precluding the capacity for surface owners to create independent mining estates.<sup>72</sup> This is qualified by statutory vesting provisions, and state ownership of natural resources has become commonplace.

In the United States, the maxim treats subsurface storage space as a component of the strata, however it is not regarded as inextricable. Surface owners have the capacity to sever subsurface minerals as well as subsurface pore space and generate separate estates.<sup>73</sup> The difficulty with this position is that the creation of multiple subsurface estates generates significant potential for overlap and conflict, with different estates being subjected to disparate ownership principles.<sup>74</sup> One way of reducing the potential for conflict is to allow the mineral estate holder to retain ownership of subsurface storage space in circumstances where access to the space is incidental to the mining activity.<sup>75</sup> The mineral estate holder could only claim ownership over the pore space where utilization or penetration of the pore space is necessary for effective and expedient mineral extraction.<sup>76</sup> The consensus of academic commentary in the United States now appears to favor this view.<sup>77</sup>

## II. The Statutory Framework

The growing importance of geological storage space in the climate change mitigation framework has accelerated the need to further recalibrate orthodox property assumptions. In both Australia and the United States, the common-law maxim regarding subsurface ownership has been affected by the introduction of new regulatory frameworks for CCS projects. The implementation of this legislation is a product of the perceived need for greater statutory directives, par-

63. [1859] 7 HL Cas 349, 374-74 (Austl.).

64. See also *ICM Agriculture Pty. Ltd. v. Commonwealth* [2009] 240 CLR 140, at [111] (Austl.). In *Ballard v Tomlinson* (1885) 29 Ch. D 115, 120-21 (Austl.), Pearson, J., described the right of a surface owner to percolating groundwater as a right of usage rather than an ownership right. See also JOSHUA GETZLER, A HISTORY OF WATER RIGHTS AT COMMON LAW (2004).

65. In *ICM Agriculture Pty. Ltd. v. Commonwealth* [2009] 240 CLR 140 (Austl.), the High Court concluded that the Water Rights Act 1912 (NSW) had effected a complete vesting of groundwater resources over to the Crown and all subsurface water basins in New South Wales were therefore declared to be restricted water pursuant to §117A of the Water Act 1912 (NSW).

66. See, e.g., Water Use Act 525 ILCS 45/6 (2006) (from ch. 5, § 1606) (establishing a usufructuary right to groundwater based upon a “reasonable use” rule for groundwater withdrawals).

67. See Eugene O. Kuntz, *The Law Relating to Oil and Gas in Wyoming*, 3 Wyo. L.J. 107, 112 (1948) (noting that when a general grant or reservation is made of all minerals without qualifying language, it should be reasonably assumed that the parties intended to sever the entire mineral estate from the surface estate, “leaving the owner of each with definite incidents of ownership enjoyable in distinctly different manners”).

68. *MacDonnell v. Capital Co.*, 130 F.2d 311(9th Cir., cert. denied, 317 U.S. 692 (1942)).

69. Kuntz, *supra* note 67, at 109.

70. See the discussion on the scope of eminent domain, *supra*.

71. See Elizabeth J. Wilson & Mark A. de Figueirido, *Geologic Carbon Dioxide Sequestration: An Analysis of Subsurface Property Law*, 36 ELR 10114,

10116 (Feb. 2006) (outlining the comprehensive rights of the surface estate owners).

72. This is discussed by Ross Ashcroft, *Carbon Capture and Storage: A Need for Reconceiving Property Interests and Resource Management in the Australian Legal System*, LAWASIA J. 70, 82 (2008). See also Tracy J. Logan, *Carbon Down Under—Lessons From Australia: Two Recommendations for Clarifying Subsurface Property Rights to Facilitate Onshore Geologic Carbon Sequestration in the United States*, 11 SAN DIEGO INT’L L.J. 561, 579 (2010) (outlining the common-law position and describing the important shift achieved by the implementation of a new statutory framework where GHG storage formations are articulated as a new form of resource).

73. See Owen L. Anderson, *Geologic CO<sub>2</sub> Sequestration: Who Owns the Pore Space?*, 9 WYO. L. REV. 97, 99 (2009). See also the decision in *Humphreys-Mexia Co. v. Gammon*, 254 S.W. 296, 299 (Tex. 1923) (establishing the principle that where a surface owner transfers the mineral estate, two separate or “severed” estates in land are created. In North Dakota, legislation precludes the creation of pore space estates, although pore space leases may be created. See *infra* Part III.C).

74. This point was raised by Endres, *supra* note 12, at 636, where the author argues that, in line with the analogy of freshwater storage, state ownership of all subsurface storage areas would “simplify otherwise disparate property law rules regarding ownership and compensation for CCS operations.”

75. Anderson encapsulates this debate, *supra* note 73, at 101 (stating that “assuming that the surface owner ‘owns’ the pore space, the mineral-estate owner nevertheless has the right to use the pore space to facilitate mineral exploration and exploitation”).

76. See in particular the discussion by Anderson, *supra* note 73, at 104.

77. Wilson et al., *supra* note 57; Anderson, *supra* note 73, at fn. 55; Endres, *supra* note 12, at 631.

ticularly with respect to uncertainties regarding long-term liability for sequestered CO<sub>2</sub>.<sup>78</sup>

The legislative framework introduced in Australia by both Victoria and Queensland purports to vest ownership of subsurface storage space in the state.<sup>79</sup> State ownership of subsurface storage space formations confers control and, potentially, liability for the process and ongoing management of CCS upon the government. This vesting constitutes a deprivation of interest for the surface owner, but because it is implemented at the state level, avoids the application of §51(xxxi) of the Commonwealth Constitution which would require just compensation to be paid for any acquisition of property.<sup>80</sup>

By contrast, Montana, North Dakota, and Wyoming in the United States have all introduced legislation that confirms the common-law position and vests ownership of subsurface storage space in the surface owner, allowing for the possibility of a transfer to the state at the completion of the injection phase.

The fundamentally different regulatory approaches to ownership of subsurface storage facilities adopted by Australia and the United States is reflective of the distinctive legal and political environments. In Australia, the vesting of subsurface resources in the state is grounded in a tenure system where, fundamentally, all land grants are derived from the Crown, which retains ultimate ownership. It is also a consequence of the fact that the state legislatures are not subject to any constitutional obligation to pay just compensation for an acquisition of property as this obligation is only enshrined in the Commonwealth Constitution.<sup>81</sup> In the United States, the surface estate owner retains full, allodial title, and state sovereignty and property ownership are perceived as doctrinally distinct.<sup>82</sup> Further, any attempt to remove established rights from the surface estate owner and vest them in the state is likely to attract a takings claim.<sup>83</sup>

78. This was explicitly outlined in the debates leading to the introduction of the GGGSA 2008 (Vic). See Victoria Parliament Debates (Hansard) Legis. Assemb. 56th Parl., 1st Session, 2008, 4474 (“the bill addresses a number of unique legal issues, such as the potential migration of the injected greenhouse gas substances and the management of long-term liabilities and monitoring and verification requirements associated with the permanent underground geological storage of greenhouse gas substances”).

79. See *infra* Part II.A.1.-2.

80. CTH CONST. (AUST) §51(xxxi). See, however, the conclusions of the Federal Court of Australia in *Spencer v. Commonwealth of Australia* FCA 1256 [2008] at [153] (Austl.), where the Court suggested that it was “at least arguable” that an acquisition of property might occur where restrictions are imposed by state regulation that is authorized or effected by Commonwealth States or Inter-Governmental Agreements.

81. See the discussion on the scope and foundation of §51(xxxi) by Tom Allen, *The Acquisition of Property on Just Terms*, 22 SYDNEY L. REV. 351 (2000).

82. Brendan Edgeworth, *Tenure, Allodialism, and Indigenous Rights at Common Law: English United States and Australian Land Law Compared After Mabo v. Queensland*, 23 ANGLO AM. L. REV. 397, 402 (1994) (concluding that the allodial framework was “egalitarian rather than hierarchical” so that sovereignty and property rights were doctrinally distinct even if they were “components of a coherent world-view”).

83. See Klass et al., *supra* note 15, at 406 (arguing that vesting subsurface pore space in the state would “invite takings challenges, creating uncertainty surrounding the total costs of CCS implementation and leaving the issue for the courts”).

## A The Australian Onshore Statutory Regime

In Victoria and Queensland, legislation has been introduced regulating onshore geological sequestration of GHGs.<sup>84</sup> Western Australia (WA) has also enacted amendments to the Petroleum and Geothermal Energy Resources Act 1967 vesting geothermal energy and geothermal energy resources, the definition of which includes subsurface rock that contains geothermal energy, in the Crown.<sup>85</sup> Other states are yet to follow and, until they do, will continue to be regulated by the common law.<sup>86</sup>

### 1 Victoria: The GGGSA

Victoria was the first state to enact legislation dealing with onshore geological sequestration and in this respect the regime has a pioneer aspect to it.<sup>87</sup> The GGGSA 2008 was created as a separate act to the Petroleum Act 1998 (Vic) because geological storage formations capable of storing GHGs were intended to be treated as separate resources. The main objective of the GGGSA is to facilitate and regulate the injection of GHG substances into underground geological formations for the purpose of permanent storage.<sup>88</sup> In constructing a legal regime for CCS, the GGGSA seeks to provide certainty for investors and other affected interest holders with respect to their legal rights and obligations. It also seeks to promote community confidence that CCS projects will be undertaken in a manner that minimizes risks to public health and the environment.<sup>89</sup>

Geological storage formations are defined in the GGGSA to include “any seal or reservoir of an underground geological formation” and also “any associated geological attributes or features of an underground geological formation.”<sup>90</sup> This definition mandates the inclusion of a storage area as well as geological formations that are connected to that storage area. A storage area that has additional nongeological attributes will not be excluded from the definition provided the base requirements can be established. The Act makes no distinction between natural and artificial storage areas. As such, any subsurface storage areas with geological attributes that exist within the boundaries of Victoria will come within the scope of the statutory definition.

The pivotal ownership section of the GGGSA is Clause 14, which provides that the Crown retains ownership over

84. This Article will focus exclusively upon the onshore Victorian and Queensland frameworks.

85. Petroleum and Geothermal Energy Resources Act 1967 (WA), §9.

86. New South Wales introduced the Greenhouse Gas Storage Bill 2010 to the New South Wales Parliament; however, this Bill is yet to be passed.

87. See Press Release: Minister for State and Energy Resources, State of Victoria, Victoria Leads Australia With Carbon Capture and Storage Bill (Sept. 9, 2008), available at <http://www.premier.vic.gov.au/component/content/article/4704/html>.

88. Victoria Parliament Debates (Hansard) Legis. Assemb. 56th Parl., 1st Session, 2008, 3674 (Batchelor, Minister for Energy and Resources, 2nd Reading Speech).

89. These objectives were explicitly outlined in the explanatory memorandum of the Bill.

90. Greenhouse Gas Geological Sequestration Act 2008 (Vic), §3.

all underground geological storage formations located on private land.<sup>91</sup> Prior to the introduction of the GGGSA, as outlined in Part I, the Crown held no ownership rights in geological storage formations located underneath private land. It did, however, own geological storage formations in Crown land pursuant to the provisions of the *Land Act* 1958 (Vic).<sup>92</sup> The vesting provisions in the GGGSA have significantly extended the scope of Crown ownership in subsurface storage spaces located within 15x24 meters of the surface of privately owned land.<sup>93</sup> The effect of the vesting provision is that these storage spaces are no longer treated as a component of the land and are recognized as an independent resource, owned by the Crown, in right of the state.<sup>94</sup>

The vesting provision deprives the surface estate owner of their common-law entitlements to these areas. This deprivation constitutes a significant loss for surface estate owners, particularly given the increasing value of subsurface storage areas within a carbon economy. This loss is not addressed by the GGGSA, which explicitly sets out that the Crown is not responsible for the payment of compensation for any loss caused by the operation of these provisions.<sup>95</sup> Further, it is unlikely that the effect of these provisions will offend the Victorian Charter of Human Rights and Responsibilities because the deprivation has occurred "in accordance with the law" as set out in the GGGSA.<sup>96</sup>

The GGGSA does attempt to alleviate this to some extent by setting out that a CCS operation may not commence on private land until the surface estate owner has consented or the parties have entered into a compensation agreement.<sup>97</sup>

The amount of compensation payable under any such agreement to either surface estate owner, or native titleholders must be referable to a direct loss that is a natural and reasonable consequence of the development of a CCS project.<sup>98</sup> This includes damage to the surface, damage to improvements, deprivation of possession, loss of amenity, or any decrease in market value. It does not, however,

include any deprivation in the commercial value of the subsurface storage area.<sup>99</sup>

The regulatory framework of the GGGSA is founded upon the licensing framework established in the *Petroleum Act* 1998 (Vic). The rationale for adopting a similar model is that CCS uses many of the same technologies as the petroleum industry and the industry is familiar with the framework.<sup>100</sup> As such, applicants seeking to develop a CCS project are required, in the same way as if they were developing a subsurface mining project, to apply for an exploration permit authorizing the holder to carry out GHG sequestration exploration.<sup>101</sup> Where the holder of an exploration permit discovers an underground geological storage formation, they are entitled to apply for either an injection and monitoring license, or a GHG sequestration retention lease to facilitate progression of the project to the injection phase.<sup>102</sup>

An injection license authorizes the applicant to carry out GHG substance injection and monitoring within the license area.<sup>103</sup> A GHG sequestration retention lease authorizes the holder to carry out exploration and formation activities for GHG sequestration within the lease area.<sup>104</sup>

The GGGSA mandates the creation of a GHG sequestration register to formalize the creation, dealing, modification, and exemption of licenses and to record the volume of GHG substances permitted to be injected into a subsurface geological storage formation.<sup>105</sup> The creation of the register is important because it ensures a permanent record of CCS activities for future reference.

The regulatory changes implemented by the GGGSA are significant. The vesting provision severs subsurface geological formations in private land, below a certain depth, from the web of corporeal resources coming within the common-law concept of land ownership. The surface estate owner loses control over this separate resource and ownership is transferred to the state. This confers on the state the power to license out rights to utilize the storage space for CCS projects. This allows the state to retain ultimate ownership of the storage space and assumes ownership of the injected GHG upon the expiration or surrender of the injection licenses.<sup>106</sup>

The functionality of the GGGSA framework is dependent upon geological storage spaces being separately verified as a new resource interest. The idea that "space" may constitute a separate property resource is not new. As outlined in Part I, horizontal divisions of airspace are commonly created, despite the absence of a physical division

91. *Id.* §14(1).

92. This is the effect of the *Land Act* 1958 (Vic), §339(1), which applies to Crown land as well as "depth-limited" freehold grants, issued after Dec. 29, 1891, which are not for the purpose of mining.

93. Greenhouse Gas Geological Sequestration Act 2008, §14(2) (Vic). Presumably, this depth restriction seeks to preclude overlap with deeper storage spaces that may be connected to subsurface mining activities.

94. See Tracy J. Logan, *Carbon Down Under: Lessons From Australia: Two Recommendations for Clarifying Sub-Surface Property Rights to Facilitate Onshore Geologic Carbon Sequestration in the United States*, 11 SAN DIEGO INT'L L.J. 561, 579 (2010).

95. Greenhouse Gas Geological Sequestration Act 2008 (Vic), §14(4). See also A Regulatory Framework for the Long-Term Underground Geological Storage of Carbon Dioxide in Victoria (State Government of Victoria, Department of Environment and Primary Industry, Discussion Paper, January 2008), available at <http://www.dpi.vic.gov.au/energy/about/legislation-and-regulation/ccs-regulations/a-regulatory-framework-for-the-long-term-underground-geological-storage-of-carbon-dioxide>.

96. See Charter of Human Rights and Responsibilities 2006, §20 (Vic) ("A person must not be deprived of his or her property other than in accordance with law."). See VIC, Parliamentary Debates, Legislative Council, Oct. 16, 2008, at 4475.

97. Greenhouse Gas Geological Storage Act 2008, §200 (Vic).

98. *Id.* §201 (Vic).

99. *Id.* §201(1)(a)-(g) (Vic). The GGGSA explicitly sets out that compensation is not payable for the value of subsurface storage areas, §203.

100. See VIC, Parliamentary Debates, Legislative Council, Oct. 16, 2008, at 4475.

101. Greenhouse Gas Geological Sequestration Act 2008, §19(1) (Vic).

102. *Id.* §19(2) (Vic).

103. *Id.* §71 (Vic).

104. *Id.* §59 (Vic).

105. *Id.* §281 (Vic).

106. *Id.* §16 (Vic). Upon cancellation or surrender of an injection license, the Crown becomes the owner of any GHG that has been injected into the storage formation.



by solid matter.<sup>107</sup> Horizontal divisions are, however, infrequent in the subsurface zone because of its dense physical status.<sup>108</sup> The verification of subsurface storage space is best regarded as an excision of an independent subsurface resource in the form of space rather than a horizontal division. This space is amenable to verification because of its definitional capacity. Unlike airspace, subsurface space is capable of being measured by the mass that surrounds it, and definitional clarity is a key attribute for verification.<sup>109</sup> The state will retain ownership of the space as a resource and, post-injection, as a corporeal zone amenable to ongoing environmental management responsibilities.

The statutory verification of new natural resource interests is only effective where the interest is supported by clear and articulate legislative configuration.<sup>110</sup> The interest must have sufficient definitional clarity to support its status as a nonaligned, disaggregated interest verified beyond the parameters of the *numerus clausus* principle.<sup>111</sup>

The internal characteristics of many statutory resource interests are ambiguous, and their existence is often perceived as dependent upon legislative approval.<sup>112</sup> This is a particular difficulty for subsurface storage space because its lack of institutional status and its inadequate statutory expression fail to effectively signify its presence.<sup>113</sup>

Subsurface geological storage formations under the GGGSA are not properly verified.<sup>114</sup> The proprietization of this new resource has been conflated with the vesting process. The vesting provisions confer title to subsurface storage formations upon the state and presume that these

“resources” already have an independent status. In the absence of a separate clause in the GGGSA, articulating the nature, scope, or proprietary identity of subsurface storage spaces, this creates confusion. It is unclear whether the interest acquired by the Crown is corporeal or incorporeal, whether it is a land interest or a separate resource interest or whether the ownership relates to the space itself or merely the right to utilize the space.<sup>115</sup>

There are also difficulties with superimposing a new but unarticulated resource interest upon a preexisting subsurface landscape. The excision of subsurface usage rights from a surface owner's entitlements may generate unfairness where owners have previously relied upon the existence of such rights. It may also create a scenario where different holders must compete for usage, which in turn can generate an “anti-commons” problem.<sup>116</sup> The “tragedy” of the anti-commons arises where too many owners with rights of exclusion in the subsurface preclude a resource from being effectively utilized.<sup>117</sup> The potential for underutilization of subsurface storage areas increases as ownership interests expand and the nature or scope of the ownership rights becomes unclear.

There are also significant concerns regarding the status of access rights. State-vested ownership under the GGGSA does not expressly incorporate access rights. This means that if a surface estate owner refuses access, the holder of a geological storage license may be unable to utilize the subsurface resource. In such a scenario, a CCS license holder may raise the “incidental rights” provisions, although the scope of these provisions remains unclear, as they mandate the carrying out of any act within the license area that is “incidental to or necessary for” the purpose of the license.<sup>118</sup>

A further concern with the state-based focus of the GGGSA framework is that it only applies to subsurface storage spaces located within Victoria. The absence of legislative uniformity between the states creates the potential for a patchwork of competing jurisdictional claims.<sup>119</sup> Most

107. This type of title is referred to as “strata title.” See Stuart Ball, *Division Into Horizontal Strata of the Landscape Above the Surface*, 39 YALE L.J. 616 (1930).

108. *Id.* at 632.

109. See National Provincial Bank v. Ainsworth [1965] AC 1175, 1247-1248 (Austl.). Lord Richard Wilberforce stated that before a right or an interest “can be admitted into the category of property, or a right affecting property, it must be definable, identifiable by third parties, capable in its nature of assumption by third parties and have some degree of permanence and stability.” See also the discussion by Heller, *supra* note 22 (discussing the “property governance” rules relevant to the creation of new property and constructing the concept of a “liberal commons” as an analytical tool supporting this process).

110. See Kevin Gray, *Regulatory Property and the Jurisprudence of Quasi-Public Trust*, 32 SYDNEY L. REV. 221, 224 (2010) (noting that “statutory property only has the ambit conferred by the statute itself” and therefore means “just what the legislature chooses it to mean—neither more nor less”).

111. See generally Anthony Scott, *Property Rights and Property Wrongs*, 16 CAN. J. ECON. 555 (1983) (discussing the merits of statute and common law in the evolution of property interests). See also Hepburn, *supra* note 23 (examining the unique issues relevant to statutory verification of carbon property interests). For a discussion of the limitations of the *numerus clausus* principle, see Henry Hansmann & Reinier Kraakman, *Property, Contract, and Verification: The Numerus Clausus Problem and the Divisibility of Rights*, 31 J. LEGAL STUD. S373 (2002).

112. See Craig Arnold, *The Reconstitution of Property: Property as a Web of Interests*, 26 HARV. ENVTL. L. REV. 281, 283 (2002).

113. See Rose, *supra* note 2, at 410 (arguing that regulation is often resorted to because environmental resources are resistant to proprietization. However, environmental property requires, at a minimum, “some system to define rights, to signal their presence, to monitor transgressions, to resolve disputes about who has what rights and to enforce the rights held valid”).

114. See Nicola Swayne & Andrea Phillips, *Legal Liability for Carbon Capture and Storage in Australia: Where Should the Losses Fall?*, 29 ENVTL. PLAN. L.J. 189, 194 (2012) (considering ownership issues in the context of longer term liability).

115. The interest generated may be described as a piece of pure legal puffery with an incomplete status and an unknown scope. See Rose, *supra* note 2, at 440. Professor Rose describes fuzzy property rights as creatures of “legal regimes that bring many interests to the table, that recognize some kind of incomplete consultative rights in all the stakeholders and that require a considerable amount of consultation and double-checking.” See also Carol M. Rose, *Property in All the Wrong Places?*, 114 YALE L.J. 991, 1003-07 (2005).

116. The concept of anticommons property was discussed by Heller, *supra* note 20, at 660-69. Private property usually breaks up the world vertically, with each owner controlling a core bundle of rights in a single object, subject to allowable forms and measurements. Anticommons breaks up the world horizontally, creating relations among competing owners with overlapping rights in a single object. Anticommon property is prone to the “tragedy of underuse.” The author warns that governments must take care to avoid creating anticommons property accidentally when they define new property rights.

117. See Heller, *supra* note 20, at 681-84. “Clarifying property rights,” while only part of the story, is nevertheless an important pathway out of an anticommons tragedy. The author makes it clear, however, that once anticommons property has been created, “it is difficult to find a way out.”

118. The “incidental rights” regime for permits, licenses, and leases is set out in the Greenhouse Gas Geological Sequestration Act (Vic) (2008), §19(1)(b), §59(1)(b), and §71(1)(c).

119. See William W. Buzbee, *Recognizing the Regulatory Commons: A Theory of Regulatory Gaps*, 89 IOWA L. REV. 1 (2003) (examining the difficulties of

subsurface storage areas will not conform to state boundaries, making it likely that competing and possibly conflicting legislative and common-law measures will apply to a single subsurface storage space.<sup>120</sup>

The GGSAs framework contributes to the creation of a regulatory commons, with its focused, state-based application. The implementation of nonuniform, surface-specific legislation is ultimately detrimental to longer term climate change objectives because the overlap and complexity increases capital and operational costs and generates investment resistance.<sup>121</sup> These concerns must be addressed if a more efficient, transparent, and credible regime for the assessment, approval, and commercial deployment of onshore CCS projects in Australia is to emerge. The expedient resolution of jurisdictional and verification concerns is imperative as a regulatory failure for CCS will, ineluctably, lead to a market failure.<sup>122</sup>

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The GGSAs 2009 (Qld) was introduced shortly after the Victorian Act with similar objectives. It aims to facilitate GHG geological storage and to reduce the impact of GHGs on the environment by providing a regulatory system for GHG activities.<sup>123</sup>

The GGSAs vests ownership of all GHG storage reservoirs in the state, expressly setting out that all “GHG storage reservoirs in land are and are taken always to have been the property of the State.”<sup>124</sup> A GHG storage reservoir is defined in the GGSAs as “the spatial extent of an underground geological formation.” This definition focuses upon the subsurface space rather than any right of usage or definitive physical attributes of the storage reservoir. Additional explanatory provisions set out that “a person does not acquire any property in a GHG storage reservoir or petroleum only because the person creates or discovers the reservoir.”<sup>125</sup> Further, the state will acquire ownership of GHG storage reservoirs “whether or not the land is freehold or other land.”<sup>126</sup>

Like the Victorian GGSAs, the Queensland GGSAs segregates subsurface geological storage reservoirs from the land and vests title to this newly independent resource in the state. The GGSAs contains no depth limitations, so that all storage reservoirs within Queensland boundaries

become the property of the state and are deemed to have always been so.

The deeming provision suggests that GHG storage reservoirs are not a newly verified resource as they are in Victoria, but rather a resource that the state has always owned. This is a questionable assumption because until the implementation of the GGSAs, GHG storage reservoirs constituted a part of the surface owners estate in accordance with common law.<sup>127</sup> A vesting provision cannot function retrospectively when the resource to which it relates has no preexisting identity.

The GGSAs establishes a framework for GHG permits and for GHG injection and storage leases in a similar manner to the GGSAs. Once a storage lease has been utilized, safety checks have been carried out, and the appropriate monitoring done, ownership and responsibility of the stored GHG automatically passes over to the state.<sup>128</sup> The titles issued under the licensing framework may be subject to a range of mandatory conditions. For example, GHG storage leases may only carry out GHG injection in compliance with a test plan that has been approved by the Minister.<sup>129</sup> Further, a GHG storage leaseholder may only use a GHG stream for GHG storage injection or for GHG stream storage where the stream consists of CO<sub>2</sub> or any substance incidentally derived from the process of carbon capture.<sup>130</sup>

The GGSAs also sets out that all land grants issued in Queensland, whether before or after the commencement of the Act, are now taken to include a reservation to the state of all GHG storage reservoirs, including the exclusive right to enter and carry out any GHG storage activity, to authorize others to carry out GHG activities, or to regulate others to carry out GHG activities.<sup>131</sup> This provision significantly qualifies the common-law rights of surface estate owners not just by divesting them of their common-law entitlements to subsurface storage facilities, but by deeming implementation of incorporeal rights of access and entry, which are now taken to encumber the surface estate.<sup>132</sup>

As with the retrospective deeming provision, the validity of a deemed reservation clause is questionable. Where a land grant is issued, the underlying radical title of the Crown is elevated to full beneficial ownership and the grantee derives a tenured estate from the Crown.<sup>133</sup> While

overlapping state-based regulation and examining the concept of a regulatory commons.). See also Jonathan B. Wiener, *Global Environmental Regulation: Instrument Choice in Legal Regulation*, 108 YALE L.J. 677 (1999).

120. See Buzbee, *supra* note 1 (arguing that overlapping regulatory requirements can create significant hurdles for market development).

121. See Swayne & Phillips, *supra* note 114, at 191 (noting that in order to encourage private investment in CCS technology, the capital and operational costs need to be carefully monitored).

122. See Buzbee, *supra* note 1, at 33. See also Jonathan B. Wiener, *Think Globally, Act Locally: The Limits of Local Climate Change*, 155 U. PA. L. REV. 1961 (2007).

123. Greenhouse Gas Storage Act (Qld) (2009), §3.

124. *Id.* §27(1). This does not include any of the adjacent area under the Petroleum (Submerged) Lands Act (Qld) (1982).

125. Greenhouse Gas Storage Act (Qld) (2009), §27(2)(a).

126. *Id.* §27(2)(b).

127. The distinction between “geological storage formations” and subsurface minerals is discussed by Anderson, *supra* note 73, at 101. The mineral owner owns the minerals as well as rights to use the land for the purpose of extracting the minerals, but does not own the geological storage space.

128. Greenhouse Gas Storage Act (Qld) (2009), §181(2).

129. *Id.* §161.

130. *Id.* §164.

131. *Id.* §28.

132. By contrast, the GGSAs (Vic) 2008 sets out that rights incidental to exploration permits, injection licenses, or GHG formation-retention leases will be included and presumably this will include access rights. See §§19(1)(b), 59(b), and 71(c). For a general discussion on retrospective vesting, see Jean Paul Salembier, *Understanding Retroactivity: When the Past Just Ain't What It Used to Be*, 33 HONG KONG L.J. 99, 106-07 (2003). “Laws that rewrite legal history by deeming the law to be other than it was properly understood to be at the time it was applied undermine the stability and predictability of the law and lead to a less effective (and ultimately less fair) legal system.”

133. See *Mabo v. Queensland* [No 2] [1992] 175 CLR 1, at [50]-[51] (Austl.).

the Crown may regulate its underlying title, it may not derogate from a grant already issued, and only authorized reservations, consistent with the legislation upon which the grant is based, are valid in this context. The only exception to this is where it is possible to establish that the derogation is for the public benefit of the nation as a whole.<sup>134</sup>

### B. The Australian Offshore Statutory Regime

The Australian statutory framework for offshore geological storage formations was implemented in accordance with international law. The 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter and the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic both include CO<sub>2</sub> as a category of waste or other matter that may be considered for dumping in the sub-seabed where particular conditions are met.<sup>135</sup>

In accordance with these Conventions, the subsurface capture of CO<sub>2</sub> in the seabed has now been exempted from the dumping prohibitions. Both the Commonwealth government and the state government of Victoria have introduced offshore legislation to regulate this process. Unlike the onshore position, where ownership principles for subsurface storage facilities are critical, the absence of any underlying Crown ownership in the seabed means that offshore regulation is concerned with the nature, scope, and jurisdictional authority applicable to CCS projects arising in these regions rather than the resolution of ownership issues.<sup>136</sup>

Both the Commonwealth and the Victorian legislation are consistent with the constitutional arrangement whereby the states regulate the territorial sea out to three miles and the Commonwealth regulates for a further nine miles to the boundary of the territorial sea and in certain

designated jurisdictional zones of the high seas, including the exclusive economic zone.<sup>137</sup>

### Commonwealth: The Offshore Petroleum and Greenhouse Gas Act (Cth)

The Offshore Petroleum and Greenhouse Gas Act (OPGGA) 2006 (Cth) was significantly amended in 2008 to accommodate offshore geological storage provisions.<sup>138</sup> This Act and the mirror legislation introduced by the Victorian government is the product of an ongoing agreement between the Commonwealth and state governments to develop complementary legislative frameworks to regulate offshore GHG storage.<sup>139</sup>

The OPGGA does not incorporate any vesting provision because the Crown has no underlying title in the seabed. The high seas are reserved for the “common heritage of mankind” and are therefore incapable of being owned or apportioned otherwise than in accordance with rules that promote the common interest of all nations.<sup>140</sup> The Crown has no radical title in the territorial seas because they are not the “dominion of the common law” and exclusive ownership is inconsistent with established international rights of free passage, navigation, and fishing.<sup>141</sup>

The absence of core, derivative ownership does not preclude the exercise of state and Commonwealth power. The OPGGA was introduced pursuant to the sovereign power of the Commonwealth to regulate territorial waters extending beyond the three-mile limit.<sup>142</sup> The GHG interests issued pursuant to the OPGGA are likely to be character-

134. See *O’Keefe v. Williams* [1910] 11 CLR 171, 190 (Austl.), where Griffith, C.J., stated, “the obligation of the Crown may also, I think, be put in another way, as an obligation not to do anything in derogation of the rights conferred by the statutory contract.” See also *Wik Peoples v. Queensland* [1996] 187 CLR 1 (Austl.), per Brennan, C.J., at [47]. “The conditions which entitle a person to the grant of a freehold estate under a conditional purchase are prescribed by statute.” An implied covenant not to derogate against the grant will be read down to exclude those measures affecting the nation as a whole that the Crown took for public good. *Commissioners of Crown Lands v. Page* [1960] 2 QB 274.

135. The Protocol to the Convention was ratified on Mar. 24, 2006. There are currently 42 parties to the Protocol, including Australia. Parties to the Protocol also determined guidelines setting out how to store CO<sub>2</sub> in sub-seabed geological formations in 2007. See [http://www.imo.org/blast/blastData-Helper.asp?data\\_id=30645&filename=9-CO2SequestrationEnglish.pdf](http://www.imo.org/blast/blastData-Helper.asp?data_id=30645&filename=9-CO2SequestrationEnglish.pdf). This jurisdictional arrangement is encapsulated in the Seas and Submerged Lands Act (Cth) (1973), an Act that also gives effect to the articles implemented in the 1982 United Nations Convention on the Law of the Sea [hereinafter UNCLOS], Dec. 10, 1982 (entered into force Nov. 16, 1994).

136. For a discussion of the ownership principles relevant to Australian territorial waters, see *Yarmirr v. Northern Territory* [2001] 208 CLR 1, at [70] (Austl.), where Gleeson, C.J., Gaudron, Gummow, and Hayne, JJ., concluded that any provisions purporting to vest property in the seabed beneath the territorial sea could not be characterized as conferring full ownership because any such interpretation would be inconsistent with the recognition and enforcement of established public and international fishing, navigation, and free passage rights.

137. This jurisdictional arrangement is encapsulated in the Seas and Submerged Lands Act 1973 (Cth), an Act that also gives effect to the articles implemented in UNCLOS. Under both the Protocol and the 1992 OSPAR Convention, the CO<sub>2</sub> must form part of a CO<sub>2</sub> stream from CO<sub>2</sub> capture processes for sequestration and may only be considered for dumping if (a) disposal is into a sub-seabed geological formation; (b) the stream consists overwhelmingly of CO<sub>2</sub> (although they may contain incidental associated substances derived from the source material and the capture and sequestration processes used); and (c) no wastes or other matter are added for the purpose of disposing of those wastes or other matter. In addition Annex II and III of the OSPAR Convention also provide that CO<sub>2</sub> streams may only be disposed of into sub-seabed geological formations where they are intended to be retained in these formations permanently and will not lead to significant adverse consequences for the marine environment, human health, and other legitimate uses of the maritime area.

138. The Act was previously known as the Offshore Petroleum Act (Cth) (2006).

139. This was discussed by the Council of Australian governments meeting, Communique, 9 (2009), where the importance of progressing the collaborative work between the Commonwealth and the states with respect to Carbon Capture and Storage Flagship programs was highlighted. Available at <http://www.coag.gov.au/node/475>.

140. See generally Bradley Larschan & Connie B. Brennan, *The Common Heritage of Mankind Principle in International Law*, 21 COLUM. J. TRANSNAT’L L. 305 (1985).

141. *R. v. Keyn* [1876] 2 Ex D 63, 239, per Lush, J. (Austl.). For a further discussion on this by the Australian High Court, see *Commonwealth v. Yarmirr* [2001] 208 CLR 1, at [50] (Austl.). Gleeson, C.J., Gaudron, Gummow, and Hayne, JJ., outline what they describe as the “altogether different rights and interests which arose from the assertion of sovereignty over the territorial sea.” They go on to conclude at [59] that the absence of radical title was consistent with the fact that “at no time before federation did the Imperial authorities assert any claim of ownership to the territorial seas or sea-bed.”

142. For a discussion on the distinction between sovereignty of title and sovereignty of power, see *Mabo v. Queensland* [No. 2] [1992] 175 CLR 1, [50]-[51]. Brennan, J., noted:



ized as defeasible, statutory interests because they are not grounded in any core, derivative title. As purely regulatory interests, these licenses will be subject to the vicissitudes of subsequent modification and amendment and are unlikely to attract the just terms protection of §51(xxxi) of the Commonwealth Constitution.<sup>143</sup>

In accordance with the conclusions of Brennan, C.J., in the High Court decision of *Commonwealth v. WMC Resources Ltd.*, there is a clear distinction between ownership of the territorial sea and seabed and the power to regulate. His Honor held that the Commonwealth “has the power to legislate in respect of the exploration of and the exploitation of the resources of the continental shelf, but it has no property in the continental shelf at common law” and as such, “the statutory modification or extinguishment of a permit or an interest in a permit is not an acquisition of property by the Commonwealth.”<sup>144</sup> Interests that are purely derived from statute are “inherently susceptible to variation in accordance with amendments which might be made to the statute from time to time.”<sup>145</sup>

The regulatory framework of the OPGGA deals with “eligible” GHG storage formations. An eligible storage formation is one that is suitable, without engineering enhancements, for the permanent storage of at least 100 metric tons of GHG, injected over a period of time.<sup>146</sup> An applicant may store injected GHG in an eligible GHG formation where they have obtained the requisite license.<sup>147</sup> GHG storage formations that do not comply with this storage volume or that have been artificially enhanced, including those created either directly or indirectly for the purpose of petroleum drilling, will not be subject to the OPGGA.

A GHG holding lease entitles the holder to explore in the leased area for a potential GHG storage formation and to inject and store GHG, on an appraisal basis, in a geological formation located within the leased area.<sup>148</sup> A GHG injection license authorizes the licensee to inject and per-

manently store a greenhouse substance into an identified GHG storage formation located in the license area.<sup>149</sup> The GHG injection license also allows the holder to explore the area for geological storage formations and to inject and store GHGs on an appraisal basis.<sup>150</sup>

The licensing framework of the OPGGSA is intended to operate consistently with the petroleum-licensing framework. The Act sets out that the issuing of a GHG storage interest is not precluded from areas where a petroleum exploration license, production license, retention lease, special prospecting authority, or access authority has already been issued and vice versa.<sup>151</sup>

The interface between petroleum and storage rights is, however, unclear. For example, where a petroleum exploration license covers a location that includes a GHG storage right, and the injection of GHG into the area may have a “significant adverse impact” upon either the recovery of petroleum or its commercial viability, the Minister has the power to “eliminate the risk” by either suspending or imposing specific directions on the storage license.<sup>152</sup> The OPGGA does not articulate the circumstances that would raise a significant adverse impact, so that it remains unclear whether the future potential for CO<sub>2</sub> to migrate from the storage area would come within the scope of this provision.<sup>153</sup> The absence of an ownership regime in this context generates the potential for overlapping statute-based rights that are unclear in nature and scope. This makes detailed regulatory provisions even more imperative.

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Like its Commonwealth counterpart, the Victorian OPGGSA does not incorporate any vesting provisions for offshore subsurface storage spaces. Rather, it provides for the issuing of assessment permits, GHG holding leases, GHG injection licenses and GHG special authorities.<sup>154</sup>

A gas injection license is expressly mandated to continue “indefinitely” and this aligns the statutory grant with a freehold equivalent. The license may, however, be terminated by the Minister if no operations have been carried on for a continuous period of five years.<sup>155</sup>

If a GHG interest overlaps with a petroleum interest, and there is a risk that operations will have a significant adverse impact upon either the recovery or commercial viability of petroleum, the Victorian OPGGSA will allow the Minister to “eliminate the risk” by either suspending or imposing

By attributing to the Crown a radical title to all land within a territory over which the Crown has assumed sovereignty, the common law enabled the Crown, in exercise of its sovereign power, to grant an interest in land to be held of the Crown or to acquire land for the Crown's demesne. The notion of radical title enabled the Crown to become Paramount Lord of all who hold a tenure granted by the Crown and to become absolute beneficial owner of unalienated land required for the Crown's purposes.

143. For further discussion on the regulatory nature of offshore property, see Storey, *supra* note 20; Kevin Gray, *Regulatory Property and the Jurisprudence of Quasi-Public Trust*, 32 SYDNEY L. REV. 221 (2010); Samantha Hepburn, *Native Title Rights in the Territorial Sea and Beyond: Exclusivity and Commerce in the Akiba Decision*, 34(1) U.N.S.W.L.J. 159 (2011).

144. [1998] 194 CLR 1, [19]-[25]. This decision should be contrasted with the earlier conclusions of the High Court in *Newcrest Mining (WA) Ltd. v. The Commonwealth* [1997] 190 CLR 513 (Austl.), where the Court concluded that onshore mining tenements did constitute property and were protected by §51(xxxi) of the Commonwealth Constitution. See also *Minister for Primary Industry and Energy v. Davey* [1993] 47 FCR 151, 163-65; *Bienke v. Minister for Primary Industry and Energy* [1996] 63 FCR 567, 585-87; *Attorney-General for the Northern Territory v. Chaffey* [2007] 231 CLR 651, [24]-[25].

145. *Commonwealth v. WMC Resources Ltd.* [1998] 194 CLR 1, [197], per Gummow, J.

146. *Offshore Petroleum and Greenhouse Gas Storage Act (Cth)* (2006), §21(1).

147. *Id.* Parts 3.3 and 3.4.

148. *Id.* §319.

149. *Id.* §357.

150. *Id.* §357(c)-(h).

151. *Id.* §458.

152. *Id.* §383.

153. This is discussed by Stuart Haszeldine, *Geological Factors in Framing Legislation to Enable and Regulate Storage of Carbon Dioxide Deep in the Ground*, in *CARBON CAPTURE AND STORAGE: EMERGING LEGAL AND REGULATORY ISSUES* 14-17 (I. Havercroft et al. eds. 2011). It should be noted that the Victorian legislation does address this issue. The *Offshore Petroleum and Greenhouse Gas Regulations (Vic)* (2011), §§157-161 specifically focus upon different types of significant adverse impacts.

154. *Offshore Petroleum and Greenhouse Gas Storage Act (Vic)*, Part 3 (2010).

155. *Id.* §378. The equivalent provision in the *Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth)* is §§359-360.

specific directions on the storage license.<sup>156</sup> Unlike the Commonwealth Act, the Victorian OPGSA provides further guidance on how a “significant adverse impact” should be assessed.<sup>157</sup> The expense of a potential impact must be evaluated in terms of the effect it has upon the operating costs of a petroleum plant and any ongoing costs associated with a reduction in the rate of recovery or quantity of petroleum.<sup>158</sup>

### III. The U.S. Statutory Framework

In Montana, North Dakota, and Wyoming, the regulatory frameworks confirm the ownership of the surface estate owner to subsurface storage space. This regulatory approach is consistent with common-law orthodoxy and therefore does not depend upon any independent verification of subsurface storage spaces as a resource with an independent identity to the land in which it resides. This approach stems from the assumption that subsurface storage spaces may be severed from the land by the surface owner and that this will generate a new estate that may then be conferred upon a third party.<sup>159</sup> The ownership rights of the surface estate owner include the right to fragment both mineral and natural resource interests and to confer estates in these resources upon third parties.<sup>160</sup>

The rationale for upholding private ownership of subsurface pore space is grounded in a well-established liberalism that favors individual property autonomy against what is generally perceived to be an “illiberal” state or commons property regime.<sup>161</sup> It is also the product of an expansive interpretation of the Takings Clause in the Fifth Amendment of the Constitution.<sup>162</sup> It has been found that a regulatory clause will take property where it interferes with a property owner’s right to exclude others.<sup>163</sup> Hence, a statutory framework that deprives a surface estate owner of rights in subsurface storage areas is likely to constitute a Fifth Amendment taking, generating a right to just compensation.<sup>164</sup> This prospect acts as

a strong deterrent for a state ownership model and, arguably, undermines a more efficient regulatory framework for the progression of the CCS market.

#### A. Wyoming

A series of connected acts have been introduced in Wyoming to establish a new regulatory framework for geological carbon sequestration. In the initial Act, ownership of subsurface pore space is expressly vested in the surface estate owner.<sup>165</sup> The Act sets out that the ownership of “all pore space in all strata below the surface lands and waters of this state” is vested in the “several owners” of the surface above the strata.<sup>166</sup> Where surface ownership of real property is conveyed, the Act sets out that the conveyance shall include the pore space in the subsurface unless the ownership interest in the pore space has already been severed from the surface estate.<sup>167</sup>

In this context, pore space is defined as “subsurface space that is capable of being used as storage space for carbon dioxide or other substances.”<sup>168</sup> The provisions in H.B. 89 make it clear that the ownership rights of a surface owner in pore space are not inalienable. The identity of subsurface space as a constituent of the subsurface strata does not prevent a surface owner from severing the pore space and conferring an estate upon a third party. Prior to any such severance, however, the pore space remains a component of the subsurface strata.<sup>169</sup>

To further define the relationship between pore space estates and mineral estates, H.B. 57 introduced a specific amendment that gives a mineral estate holder dominance in the event of an overlap or conflict between these interests.<sup>170</sup> These provisions are important given the fact that the extractive rights of a mineral estate have a high likelihood of overlapping with the storage rights connected to a pore space estate.

The future liability issues that arise from surface estate ownership are reduced by the implementation of H.B. 58. This amendment confirms the fact that once a permit is issued, the CCS operator will continue to own injected CO<sub>2</sub> and ownership of the injected gas cannot be transferred back to the surface estate owner.<sup>171</sup>

#### B. Montana

In 2009, the Montana Legislature passed S.B. 498, which presumes that the surface estate owner will continue to own

156. Offshore Petroleum and Greenhouse Gas Storage Act (Vic), §383 (2010).

157. Offshore Petroleum and Greenhouse Gas Storage Act Regulations (Vic), §§157-161 (2011).

158. *Id.* §158(2) (2011).

159. Anderson, *supra* note 73.

160. BLACK’S LAW DICTIONARY (8th ed. 2004). Most states treat a mineral interest to include both “stationary” and “fugacious” minerals. The capacity of a mineral interest to be severed from the surface interest so that different owners hold the interests was considered by Roger R. Scott, *Underground Storage of Natural Gas: A Study of Legal Problems*, 19 OKLA. L. REV. 47, 57 (1966).

161. See Michael A. Heller & Hanoch Dagan, *The Liberal Commons*, 110 YALE L.J. 549, 553 (2001) (arguing that the most appealing framework is a participatory commons, described as a “liberal commons,” which enables a limited group of owners to capture the economic and social benefits from cooperative use of a scarce resource, while also retaining autonomy to individual members who retain a secure right to exit). See also ERIC T. FREYFOGLE, *THE LAND WE SHARE: PRIVATE PROPERTY AND THE COMMON GOOD*, 157 (2003) (discussing how modern American culture has embraced the trinity of individual liberty, private property, and free markets as “the solution to most environmental and resource management issues”).

162. See Epstein, *supra* note 30.

163. See, e.g., *Nollan v. California Coastal Commission*, 483 U.S. 825, 17 ELR 20918 (1987).

164. See Jan G. Laitos, *Public Use Paradox and the Takings Clause*, 13 J. ENERGY & NAT. RESOURCES L. 9, 13 (1993) (arguing that the language of the clause requires just compensation when the law takes private property for a public

use). For a discussion of the potential application of the Takings Clause in the context of subsurface storage areas, see Klass & Wilson, *supra* note 15, at 417 (arguing that a regulatory taking is unlikely to arise because of the critical importance of addressing climate change as well as the public health and safety concerns associated with preventing the re-release of CO<sub>2</sub> into the atmosphere after injection).

165. Wyo. H.R. 89 (codified at WYO. STAT. ANN. §34-1-152(a)).

166. *Id.* §34-1-152(a).

167. *Id.* §34-1-152(b).

168. *Id.* §34-1-152(d).

169. *Id.* §34-1-152(f).

170. *Id.* §34-1-152(e).

171. *Id.* §34-1-153(e).

subsurface pore space in accordance with the common-law position where there are no deeds or other severance documents that provide evidence to the contrary.<sup>172</sup> Subsurface geologic storage space is defined broadly in S.B. 498 to include any natural or artificially created space capable of being used for storage purposes for CO<sub>2</sub> or other compressed substances, including aquifers and saline formations.<sup>173</sup>

The provisions in S.B. 498 have an immediate effect, although §§2-26 will only become operative once the regulatory body, the Board of Oil and Gas Conservation, has been granted primacy to administer activities at CO<sub>2</sub> sequestration wells by the U.S. Environmental Protection Agency.<sup>174</sup> This primacy will not be granted until 2015.

The Act makes it clear that once carbon is injected into the storage reservoir, the geologic storage operator will be liable for the operation and management of the stored carbon until title is transferred to the state.<sup>175</sup> Further, any transfer to the state of the storage facility and the stored carbon will not attract any compensation or payment and will include all rights, interests, and responsibilities associated with the geological storage reservoir and the stored CO<sub>2</sub>.<sup>176</sup>

## C. North Dakota

Legislation was passed in North Dakota in 2009, expressly preserving the common-law rights of surface owners to exercise rights over subsurface storage areas that have not already been committed, including the rights of any mineral estate owner to explore and develop minerals.<sup>177</sup> Unlike Montana and Wyoming, the North Dakota legislation expressly prohibits the creation of pore space estates by surface estate owners.<sup>178</sup> Leasing subsurface pore spaces is permissible, but full alienation of the estate is prohibited.<sup>179</sup> The North Dakota legislation also expressly sets out that geologic sequestration of CO<sub>2</sub> for the purposes of addressing climate change is a public use in accordance with the Constitution, thereby authorizing eminent domain legislation.<sup>180</sup>

The Act provides for the creation of a CCS permit regime, which is overseen by the regulatory body, the Industry Commission. The Commission retains jurisdiction to regulate activities relating to storage activity, construction,

operation, and closure, and no CCS activity may be conducted in the absence of a permit.<sup>181</sup> A public hearing must be held by the Commission to determine whether a permit should be issued to an applicant with consideration given to a range of factors, including whether the storage facility contains valuable minerals, whether storage will interfere with or adversely affect water supplies, and whether the applicant has made a good-faith attempt to obtain the consent of the owner of the geologic storage space.<sup>182</sup>

Once a permit is issued and the carbon capture project is completed, a certificate of project completion must be issued and title to both the storage facility and the stored carbon may be transferred, without any compensation, to the state.<sup>183</sup> The title acquired by the state will include all rights and interests in and responsibilities associated with the stored CO<sub>2</sub>.<sup>184</sup>

## IV. Conclusion

One of the core differences between the emergent regulatory frameworks for CCS in Australia and the United States concerns the proprietization of subsurface pore space. Under the Australian framework, pore space is verified as an independent resource to the land in which it resides. This verification fundamentally alters the common-law position because ownership of the new resource is vested in the state. A functional and effective state ownership model depends, however, upon a clear and articulate statutory expression of the subsurface resource.

The statutory provisions that have been introduced in Queensland and Victoria physically delimit the dimensions and boundaries of the resource to eligible areas within particularized subsurface zones and to non-engineered constructions in offshore areas, but fail to explain the conceptual basis of the interest. This regulatory error has ramifications for other interconnected interests because the property correlation is blurred. Investors are unsure whether the interest acquired by the state is land or personal property, whether it is corporeal or incorporeal in nature, and whether it expires once the injection process has been completed. These uncertainties have the potential to significantly undermine the strategic progression of CCS in Australia.

By contrast, in the United States, subsurface storage space has not been verified as a new resource, so there is no need to outline the definitional boundaries. Rather, subsurface storage space continues to be regarded as a constituent of the subsurface strata. In this respect, the common-law position remains unaltered; private surface owners retain control over all subsurface pore space, a position reinforced by the regulatory frameworks introduced in Montana, North Dakota, and Wyoming.

A surface owner may, however, create a pore-space estate and transfer that estate to a third party. Where this occurs,

172. S.B. 498, 61st Leg., Reg. Sess. (Mont. 2009) (enacted in pertinent part at W. VA. CODE ANN. §82-11-180).

173. *Id.* §82-11-101(12)(A)).

174. See the outline in the Global Carbon Capture report outlining the legislative framework for the USA, available at <http://www.globalccsinstitute.com/networks/ccip/legal-resources/dedicated-ccs-legislation/us/states-in-force#montana>.

175. Section 82-11-101(4)(9)(A). The storage operator is given the right, upon receiving title, to transfer title in the geologic stored reservoir and the stored CO<sub>2</sub> to the state. A transfer to the state may not proceed until the Board of Oil and Gas Conservation and the Board of Land Commissioners make a final recommendation.

176. See §2-11-101(8)(A) and (B).

177. N.D. S.B. 2319 (codified at N.D. CENT. CODE §38-20-13).

178. *Id.* §47-31-05-06.

179. *Id.* §47-31-06. See also Endres, *supra* note 12, at 642 (arguing that this prohibition on alienation may simplify the process of identifying pore space ownership for proposed CCS operations).

180. See N.D. CENT. CODE §38-20-08(11).

181. Section 38-20-03.

182. Section 38-20-06.

183. Section 38-20-17(6)(a).

184. Section 38-20-17(6)(b).



the space is severed from the land in which it resides and is treated as a new and separate estate. This private verification process also suffers from definitional concerns because the nature and scope of the estate is unclear. There is also significant potential for conflict, particularly if a mineral estate exists within the same subsurface region.<sup>185</sup>

The private ownership model adopted in Montana, North Dakota, and Wyoming relies upon the introduction, in each jurisdiction, of a separate regulatory entity to oversee the issuance of CCS permits and to uphold surface owner interests. The absence of state ownership prevents any direct government involvement in the process of conferring licensing rights upon CCS operators. Hence, while CCS operators may acquire exploration and injection permits from newly established expert bodies, those rights have devolved from a private-law interface that is fraught with difficulty.<sup>186</sup> The essential problem lies in the fact that utilization of subsurface pore space is dependent upon surface owner compliance. As such, any refusal or delay will impede the progression of planned CCS projects.<sup>187</sup>

A further difficulty with the private ownership model lies in the problem of ensuring continuity in the transfer of access rights. Whilst the legislative provisions in Montana, North Dakota, and Wyoming specifically provide for the eventual transfer of injected storage sites to the state, any such transfer is not compulsory, the terms of the transfer are not articulated, and any access rights that have complemented the permit may not accompany the transfer.<sup>188</sup> It is therefore feasible that any access rights held by a CCS operator will cease once the injection phase is completed. This would make ongoing access to that stratum, for the purpose of environmental management by the state, dependent upon the consent of the surface owner.<sup>189</sup>

185. The possibility of conflict and an increase in transaction costs in a situation where numerous fee owners exist was raised by MARK A. DE FIGUEIREDO, *PROPERTY INTERESTS AND LIABILITY OF GEOLOGIC CARBON DIOXIDE: A SPECIAL REPORT TO THE MIT CARBON SEQUESTRATION INITIATIVE 6* (2005), available at [http://sequestration.mit.edu/pdf/deFigueiredo\\_Property\\_Interests.pdf](http://sequestration.mit.edu/pdf/deFigueiredo_Property_Interests.pdf).

186. The legal status of carbon storage permits was outlined by EPA's Environmental Appeals Board (EAB) in *In re Core Energy, LLC, UIC*, Appeal No. 07-02, 2007 WL 4472274, at 4 (EAB Dec. 20, 2007). (Cited and discussed by Anderson, *supra* note 73, at 121.)

The UIC program does not have authority to determine surface, mineral, or storage rights when issuing permit decisions. Issues relating to property ownership or lessee rights are legal issues between the permittee and property owners. Issuance of a permit neither confers the right to trespass nor conveys property rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, any invasion of other private rights, or any infringement of state or local law or regulations. This is the case with respect to all classes of wells, including those that inject CO<sub>2</sub> for permanent sequestration in an underground formation.

187. See in particular the discussion by Endres, *supra* note 12, at 637 (noting, in discussing surface estate ownership of subsurface pore space, that the number of individual properties that may be affected by a basalt storage formation may number in the thousands).

188. For example, S.B. 498 in Montana sets out in §82-11-101(7)(A) that the CCS operator "may transfer" title to the geologic storage reservoir and the stored carbon to the state once all of the verification and monitoring obligations have been satisfied. The Act gives the Board final determination in this process, but transfer is not obligatory and is not a component of the permit issued to the CCS operator.

189. See DE FIGUEIREDO, *supra* note 185.

Under the state ownership model, long-term liability issues are easier to manage.<sup>190</sup> If the state retains ownership of the subsurface storage space during the capture and transport stage, it may pass liability to the operator during the injection phase and subsequently reassume liability for the long-term stewardship of the storage site. This transfer and retransfer process is only achievable where the storage site continues to be controlled by the state. The shift from an empty space to a "filled" subsurface zone is best managed via an ownership framework that has the flexibility to adjust to this transformative process.

The state ownership model introduced in Queensland and Victoria suffers from significant verification and jurisdictional concerns. Despite this, the core framework displays a stronger capacity to support and promote the implementation and management of an emergent CCS market than the fragmented and inefficient "neoclassical" private ownership model.<sup>191</sup> The core principles of a state ownership model allow it to manage operational security and investor certainty and to promote economic efficiency.<sup>192</sup> This model avoids the extemporized effect of surface owner negotiation and the vicissitudes of subsurface fragmentation where mineral and subsurface storage estates are forced to vie for priority.<sup>193</sup>

The shift from a private to a state-based ownership model for subsurface storage space nevertheless appears unlikely in the United States given the Fifth Amendment concerns. A vesting of subsurface storage space in the states is likely to constitute a valid exercise of the eminent domain power, coming within the ambit of the public purpose restriction. This would generate condemnation proceedings. As such, a decision to implement a state ownership model will necessarily depend upon the more fundamental question: can the nature and scope of any compensation that is payable be rationalized as a necessary and appropriate expense for the development of an efficient and effective regulatory framework for CCS? Given the inexorable importance of the CCS market for climate change mitigation strategies, this Article argues that the response should be yes.

190. See Swayne & Phillips, *supra* note 114, at 188-89 (noting that the broad commercial deployment of CCS is further encouraged by the fact that ownership of CCS storage formations, or pore space, extends from the commencement of injection and storage activities through to site closure and beyond).

191. See Endres, *supra* note 12, at 648 (the "neoclassical allocation of property rights to the surface estate, in light of the imperfect market conditions, may not result in an economically efficient allocation of resources").

192. *Id.* Endres argues that the distributional preference of transferring wealth from the state to the individual via the price that the surface owner can extract from the CCS operator may not be enough to justify the loss in economic efficiency.

193. See Klass & Wilson, *supra* note 15, at 386 (suggesting that vesting regulated ownership of subsurface property rights in the government may be in the public interest). See also the discussion of how the public trust doctrine may be extended to incorporate subsurface storage areas in Kenneth R. Richards et al., *Pouring Out Our Soils: Facing the Challenge of Poorly Defined Property Rights in Subsurface Storage Space for Carbon Capture and Storage*, 3 GEO. WASH. J. ENERGY & ENVTL L. 33, 49 (2012). See also Joseph L. Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471, 474 (1970).