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SKY CARBON CLEANUP AND BIODIVERSITY RESTORATION: DEVISING REGIONAL FRAMEWORKS

Mary Christina Wood[1]

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1. Philip H. Knight Professor of Law and Faculty Director, University of Oregon School of Law Environmental & Natural Resources (ENR) Center. This project is an undertaking of the ENR Center's Global Environmental Democracy Project. Tremendous thanks to Tom Housel, Research Associate with the ENR Center, who serves as lead project coordinator for the Pacific Northwest Framework for Atmospheric Recovery (PNW-FAR), described in Part IV. Tom contributed valuable research and editing to this Article and has galvanized individuals and organizations across the Pacific Northwest behind the Framework endeavor. Additional thanks goes to Heather Brinton, Director of the ENR Center, and Madison Prue, Program Assistant for the ENR Center, for coordinating logistics supporting the interdisciplinary teams that contribute to the PNW-FAR; and to the team of student Research Fellows contributing to this research as well as to the PNW-FAR: Georgia Christopoulos ('24); Molly Hooks ('24); Alexander Mackay ('24); Madelyn Reese ('24); Abigail Shearer ('24); Hallie Brennan ('24); Chloe Tesch ('24); Clark Barlowe ('25); and Cole Barron ('24). Enormous thanks goes to the VJEL staff for excellent editorial assistance. Finally, I extend tremendous gratitude to Roger Worthington and the Jubitz Family Foundation for their generous gifts that made this research possible.

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INTRODUCTION

"In this planetary climate emergency, the level of our ambition must match the scale of the threat."[2]

Our planet faces a climate emergency, and the next few years encompass a critical, final window of opportunity to stave off tipping points. In addition to full and rapid decarbonization of the energy system, global society must draw down and sequester the excess legacy atmospheric carbon that is heating the planet to dangerous levels.[3] In essence, society must accomplish a massive sky cleanup. This project must start with land-based, natural climate solutions (NCS), which are protocols of land management that boost Nature's own capacity for storing carbon. Such measures are necessary both to regain climate stability and to recover Earth's biodiversity and ecological systems that remain vital to Humanity's survival.[4] As this crisis intensifies, nothing short of a meta-strategy is needed to jumpstart a planetary project of ecological restoration and regeneration, which requires reconstructing the human relationship with the natural world.

This Article proposes Regional Frameworks for organizing the global drawdown project. Such Frameworks are non-governmental, opportunity-announcing informational platforms that can guide carbon sequestration across a region with the aim of maximizing co-benefits of ecosystem recovery, climate resilience, and rural economic revival. Frameworks can create an implementation bridge between NCS opportunity and practice across broad landscapes. Part I of this Article explains the need for atmospheric carbon drawdown as well as the necessity for biodiversity protection. It broadly describes categories of natural climate solutions arranged by four ecotypes: (1) forests; (2) farmlands; (3) grasslands and rangelands; and (4) blue carbon and teal carbon areas. Part II introduces a meta-strategy for catalyzing drawdown in regions worldwide. This strategy is comprised of a "three-gear" approach: (1) developing Regional Atmospheric Recovery Frameworks; (2) financing such Frameworks; and (3) instituting Regional Sky Trusts to carry out the drawdown projects. The discussion differentiates this approach from the more well-known efforts

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2. MARY CHRISTINA WOOD, PROSPECTUS FOR PACIFIC NORTHWEST FRAMEWORK FOR ATMOSPHERIC RECOVERY 1 (2022) [hereinafter PROSPECTUS].

3. *See* UN Intergovernmental Panel on Climate Change, Climate Change 2023 Synthesis Report: Summary for Policymakers 19 (2023), https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf ("Carbon dioxide removal [(drawdown)] will be necessary to achieve net negative CO_2 emissions.").

4. *See id.* at 21 ("[B]iological [carbon drawdown] methods like reforestation, improved forest management, soil carbon sequestration, peatland restoration and coastal blue carbon management can enhance biodiversity and ecosystem functions, employment and local livelihoods."); *see also infra* notes 18–26.

focused on carbon offsets, which this Article argues are fundamentally misguided and undermine climate recovery. Part III then focuses on the Framework as the first, most basic "gear" in this strategy, explaining it as an organizing nucleus around which regional efforts can coalesce. It discusses the purpose of a Framework, underscores the need to incorporate Native perspectives and leaders at every stage in the process, and inventories the components of the Framework. Part IV describes a Regional Framework process already underway in the Pacific Northwest (PNW). The PNW is uniquely positioned to lead the NCS challenge due to its high sequestration potential (with a geographic base containing all four ecotypes) and the plethora of people and entities in the region already researching, developing, and implementing NCS techniques across the land. In particular, the leadership of Native nations in restoring ecology across the PNW contributes distinctive vision and Indigenous knowledge to the regional enterprise. Part V proposes Regional Atmospheric Recovery Institutes to sustain the effort of deploying NCS through the end of the century in a globally interactive and organized way.

I. THE IMPERATIVE AND POTENTIAL FOR HARNESSING NATURAL CLIMATE SOLUTIONS

No corner of Earth remains untouched from climate disruption. It now pummels the planet with floods, fires, droughts, mega-storms, heat waves, and sea-level rise. Scientists warn that continuing to emit greenhouse gases (GHGs) while failing to draw down excess carbon dioxide (CO_2) that has already accumulated in the atmosphere will cause large parts of our planet to become uninhabitable.[5] This widely recognized "direct existential threat,"[6]

5. *See generally* DAVID WALLACE-WELLS, THE UNINHABITABLE EARTH: LIFE AFTER WARMING (2019); David Wallace-Wells, *Jared Diamond: There's a 49% Chance the World as We Know it Will End by 2050*, N.Y. MAG. (May 10, 2019), https://nymag.com/intelligencer/2019/05/jared-diamond-on-his-new-book-upheaval.html (discussing Jared Diamond's new book, *Upheaval*); Jonathan Watts, *Human Society Under Urgent Threat from Loss of Earth's Natural Life*, GUARDIAN (Oct. 29, 2021), https://www.theguardian.com/environment/2019/may/06/human-society-under-urgent-threat-loss-earth-natural-life-un-report (summarizing the Intergovernmental Panel on Climate Change's (IPCC) 2019 Assessment Report); *World Is "On Notice" as Major UN Report Shows One Million Species Face Extinction*, UN NEWS (May 6, 2019), https://new.un.org/en/story/2019/05/1037941.

6. *See, e.g.*, Brian Pascus, *Human Civilization Faces "Existential Risk" by 2050 According to New Australian Climate Change Report*, CBS NEWS (June 4, 2019), https://www.cbsnews.com/news/new-climate-change-report-human-civilization-at-risk-extinction-by-2050-new-australian-climate ("'[C]limate change now represents a near- to mid-term existential threat' to human civilization."); *see also* April Siese, *We Need to Ditch Coal Before It's Too Late, Climate Activist Bill McKibben Warns*, CBS NEWS (May 13, 2019), https://www.cbsnews.com/news/environmentalist-bill-mckibben-says-skipping-coal-and-natural-gas-key-to-combating-climate-change-cbsn-originals/?intcid=CNM-00-10abd1h (offering an explanation by Bill McKibben, author of *Falter*, on the risk of human extinction from climate change); Edith M. Lederer,

worsening for decades, now approaches proximate climate tipping points poised to trigger runaway climate change beyond our control.[7] Some of these dangerous feedbacks are already in motion, like rising temperatures causing melting permafrost, which in turn releases CO_2 and methane that further drive up global temperatures.[8] In a recent study, scientists' models predict that "highly populated regions of the world will be rendered uninhabitable sooner than previously thought for parts of each year."[9]

This climate emergency requires an urgent global response, and time is running out.[10] The coming few years are critical.[11] Stabilizing the planet's climate system requires returning the atmospheric CO_2 to below 350 parts per million (ppm), deemed the highest safe level.[12] Present levels are climbing past 420 ppm (annual global average), whereas pre-Industrial levels were about 280 ppm.[13] This excess "legacy carbon" in the atmosphere came from emissions associated with 150 years of fossil-fueled industrial activity

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UN Chief: World Must Prevent Runaway Climate Change by 2020, AP (Sept. 10, 2018), https://apnews.com/article/floods-united-nations-antonio-guterres-us-news-climate-71ab1abf44c14605bf2dda29d6b5ebcc (quoting UN Chief stating that world faces a "direct existential threat" and must begin the shift away from fossil fuels by 2020 to prevent "runaway climate change").

7. *See* Stockholm Resilience Center, *Earth at Risk of Heading Towards "Hothouse Earth" State*, SCI. DAILY (Aug. 6, 2018), https://www.sciencedaily.com/releases/2018/08/180806152040 (quoting the co-author of a study published in the Proceedings of the National Academy of Sciences: "These tipping elements can potentially act like a row of dominoes. Once one is pushed over, it pushes Earth towards another. It may be very difficult or impossible to stop the whole row of dominoes from tumbling over. Places on Earth will become uninhabitable if 'Hothouse Earth' becomes the reality."); *Secretary-General's Remarks on Climate Change [as Delivered]*, UN (Sept. 10, 2018), https://www.un.org/sg/en/content/sg/statement/2018-09-10/secretary-generals-remarks-climate-change-delivered ("We are careening towards the edge of the abyss.").

8. *See* Yale Forum for Climate Change and the Media, *Permafrost: The Climate's Tipping Time Bomb* (Greenman Studio), *https://worldbusiness.org/permafrost-the-climates-tipping-time-bomb/* (last visited Mar. 18, 2024).

9. Andrew Freedman & Jason Samenow, *Humidity and Heat Extremes Are on the Verge of Exceeding Limits of Human Survivability, Study Finds*, WASH. POST (May 8, 2020), https://www.washingtonpost.com/weather/2020/05/08/hot-humid-extremes-unsurvivable-global-warming/.

10. Andrew Freedman, *More than 11,000 Scientists from Around the World Declare a 'Climate Emergency'*, WASH. POST (Nov. 5, 2019), https://www.washingtonpost.com/science/2019/11/05/more-than-scientists-around-world-declare-climate-emergency/.

11. *Id.*; *see also* Beverly Law et al., *Creating Strategic Reserves to Protect Forest Carbon and Reduce Biodiversity Losses in the United States*, 11 LAND 721 (2022) [hereinafter Law et al., *Creating Strategic Reserves*].

12. *See* Nicola Jones, *How the World Passed a Carbon Threshold and Why It Matters*, YALE ENV'T 360 (Jan. 26, 2017), https://e360.yale.edu/features/how-the-world-passed-a-carbon-threshold-400ppm-and-why-it-matters (quoting climate scientist Dr. James Hansen: "If humanity wishes to preserve a planet similar to that on which civilization developed and to which life on Earth is adapted . . . CO2 will need to be reduced . . . to at most 350 ppm[.]").

13. *A New 66 Million-year History of Carbon Dioxide Offers Little Comfort for Today*, COLUM. CLIMATE SCH. (Dec. 7, 2023), https://phys.org/news/2023-12-million-year-history-carbon-dioxide-comfort.html.

and deforestation, most of it from the last half-century.[14] This has caused a global mean temperature rise of 1.1°C, which has in turn triggered climate disruption and natural disasters worldwide.[15]

Scientists emphasize that restoring climate balance requires a two-prong approach. The first prong requires rapid decarbonization—at least 50% emissions reduction by 2030 and a complete transition away from carbon-intensive fossil fuels by at least mid-century.[16] But as ambitious as that is, decarbonization alone is not sufficient. The second prong necessitates the drawdown and sequestration of 150 or greater gigatons of carbon (GtC) by 2100—in essence, a massive sky carbon cleanup.[17]

While the climate crisis moves rapidly towards points of no return, it collides with another planetary emergency: the collapse of biodiversity. Species are dying out at 1,000 to 10,000 times the rate they would have without human intervention.[18] According to one estimate, as much as half of all currently living species could go extinct by the end of 2050.[19] This new

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14. *Global Temperatures*, NASA EARTH OBSERVATORY, https://earthobservatory.nasa.gov/world-of-change/global-temperatureschange/global-temperatures (last visited Sept. 23, 2022); Katherine Hignett, *Here's How Much Carbon Dioxide Emissions Have Increased Since the Industrial Age*, NEWSWEEK (May 1, 2018), https://www.newsweek.com/carbon-dioxide-climate-change-fossil-fuels-906953.

15. *See WMO Update: 50:50 Chance of Global Temperature Temporarily Reaching 1.5°C Threshold in Next Five Years*, WORLD METEOROLOGICAL ORG. (May 9, 2022), https://wmo.int/news/media-centre/wmo-update-5050-chance-of-global-temperature-temporarily-reaching-15degc-threshold-next-five-years (explaining that recently, the World Meteorological Organization determined there is a 50% chance the annual average global temperature will reach 1.5°C above pre-industrial levels in at least one of the years between 2022 and 2026).

16. *IPCC Report: The Evidence Is Clear: The Time for Action Is Now. We Can Halve Emissions by 2030.*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (Apr. 4, 2022), https://www.ipcc.ch/2022/04/04/ipcc-ar6-wgiii-pressrelease/.

17. *See* James Hansen et al., *Young People's Burden: Requirement of Negative CO_2 Emissions*, 8 EARTH SYS. DYNAMICS 577, 595 (2017), https://esd.copernicus.org/articles/8/577/2017/esd-8-577-2017.pdf ("There is no time to delay.") (estimating required drawdown of 150 GtC equivalent, according to updated scenarios, and noting that the amount of necessary drawdown increased—from 100 GtC equivalent estimated in 2013 to 150 GtC equivalent estimated in 2017—due to delay in starting emissions reduction; also explaining that the amount of carbon in the atmosphere now exceeds the capability of natural drawdown, but noting that "at least a large fraction of required CO2 extraction can be achieved via relatively natural agricultural and forestry practices with other benefits"). Some estimate the necessary cleanup to be up to 1000 GtC by 2100, depending on society's emissions reduction accomplishments or failures. *See* G. Philip Robertson et al., *Land-Based Climate Solutions for the United States*, 28 GLOB. CHANGE BIOLOGY 4912, 4913 (May 31, 2022), https://onlinelibrary.wiley.com/doi/epdf/10.1111/gcb.16267 (tied to goal of limiting temperature rise to 1.5°C); UN Intergovernmental Panel on Climate Change, Special Report: Global Warming of 1.5°C, Summary for Policymakers 17 (Oct. 8, 2018), https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/.

18. Renee Cho, *Why Endangered Species Matter*, COLUM. CLIMATE SCH. (Mar. 26, 2019), https://news.climate.columbia.edu/2019/03/26/endangered-species-matter/.

19. *See* Chris D. Thomas et al., *Extinction Risk from Climate Change*, NATURE (Jan. 8, 2004), https://www.nature.com/articles/nature02121; *see also* Gerardo Ceballos et al., *Biological Annihilation via the Ongoing Sixth Mass Extinction Signaled by Vertebrate Population Losses and Declines*, 114

mass extinction event, driven by human actions, has been labeled the "Sixth Extinction."[20] This existential threat to biodiversity threatens Humanity's health, food supply, and security.[21] These threats also exacerbate long-standing social and environmental injustices.[22]

Leading scientists emphasize that the climate and biodiversity crises must be addressed in an integrated fashion, not separately, or solutions to one may exacerbate the other.[23] A sky-cleanup strategy deploys a set of measures known as "natural climate solutions" (NCS), which hold impressive potential to absorb CO_2 and sequester it in plants and soils.[24] One team of researchers estimates the sequestration potential of land-based NCS across the U.S. alone to be the equivalent of 21% of the nation's current net annual emissions.[25] The goal is to enlarge and protect the natural carbon "sinks" of the world in a way that supports biodiversity and human needs. Leading research points to practices that promote soil- or plant-based carbon sequestration across four ecotypes: (1) forests; (2) farmlands; (3) rangelands and grasslands; and (4) blue and teal carbon (wetlands) areas.[26] These projects would engage

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PNAS 90 (2017), https://www.pnas.org/doi/10.1073/pnas.1704949114. Already, "[r]oughly a third (8,851/27,600) of all land vertebrate species examined are experiencing declines and local population losses of a considerable magnitude," and of the mammal species sampled in one study, almost half had lost more than 80% of their ranges since 1900. *Id.* Additionally, "[a]s much as "50% of the number of animal individuals that once shared Earth with us are already gone[.]" *Id.*

20. *See* ELIZABETH KOLBERT, THE SIXTH EXTINCTION: AN UNNATURAL HISTORY (2015).

21. Catrin Einhorn, *A 'Crossroads' for Humanity: Earth's Biodiversity Is Still Collapsing*, N.Y. TIMES, https://www.nytimes.com/2020/09/15/climate/biodiversity-united-nations-report.html, (Oct. 14, 2021).

22. *See generally* Robert Watson, *Biodiversity Touches Every Aspect of Our Lives – So Why Has Its Loss Been Ignored?*, GUARDIAN (Sept. 19, 2019), https://www.theguardian.com/environment/2019/sep/19/biodiversity-touches-every-aspect-of-our-lives-so-why-has-its-loss-been-ignored ("[L]oss of biodiversity hurts the poorest people, further exacerbating an already inequitable world."); S. Nazrul Islam & John Winkel, *Climate Change and Social Inequality* 4 (UN Dep't of Econ. & Soc. Affs., Working Paper No. 152, 2017), https://www.un.org/esa/desa/papers/2017/wp152_2017.pdf.

23. *See* Catrin Einhorn, *Our Response to Climate Change Is Missing Something Big, Scientists Say*, N.Y. TIMES, https://www.nytimes.com/2021/06/10/climate/biodiversity-collapse-climate-change.html (Oct. 7, 2021) (citing to scientific authority to support the assertion of an integrated approach to climate change and biodiversity loss); *see also* Law et al., *Creating Strategic Reserves*, *supra* note 11 (emphasizing the need for integrated approaches to climate change mitigation and biodiversity restoration); Thomas Crowther, *We Can't Address the Climate Crisis Without Nature*, TIME (Nov. 29, 2023), https://time.com/6340530/climate-change-nature/ ("[Mo]noculture 'carbon farms' are not the restoration of nature. In fact, they are often the destruction of it.").

24. Bronson W. Griscom et al., *Natural Climate Solutions*, 114 PNAS 11645, 11647 (2017).

25. Joseph E. Fargione et al., *Natural Climate Solutions for the United States*, SCI. ADVANCES, Nov. 4, 2018, at 1, 1 (2018); *see also* Robertson et al., *supra* note 17, at 4914 (noting that another, more recent analysis estimates a potential mitigation amount in the U.S. at 110 GtC equivalent if natural climate solutions are combined with bioenergy solutions that would replace some fossil-fuel streams for transportation and other needs; such an estimate combines sequestration with decarbonization gains).

26. *See generally id.*; *see also* Calvin Norman, *How Forests Store Carbon*, PENN STATE EXTENSION (Aug. 22, 2023), https://extension.psu.edu/how-forests-store-carbon (indicating general discussion of the practices that promote soil- or plant-based carbon sequestration); Todd A. Ontl & Lisa

foresters, farmers, ranchers, and land managers to harness Nature's own engines of carbon sequestration, as described in more detail below. But invoked without concern for biodiversity, they may work at cross-purposes for species recovery.[27] The discussion below first describes the global potential of NCS and then briefly inventories the four ecotypes that are amenable to NCS. It omits the potential of ocean-based blue-carbon initiatives as beyond the scope of this Article.[28]

A. The Global Capacity for Natural Climate Solutions

Earth maintained a relatively stable climate throughout Humanity's existence until the start of the Industrial Revolution, when burgeoning industry drew forth carbon fuels stored in below-ground deposits and combusted them, emitting vast quantities of CO_2 into the atmosphere and disrupting the carbon cycle.[29] The excess legacy carbon in the atmosphere—the amount of carbon that needs to be cleaned up in order to return to safe concentrations and thereby regain climate stability—totals at least 150 GtC, perhaps even much more.[30] That amount of legacy carbon grows with every day of continuing fossil-fuel emissions across the planet.

In 2017, a seminal scientific paper announced the potential to remove vast amounts of CO_2 through NCS.[31] NCS harnesses Nature's own processes to draw down atmospheric carbon and sequester it through improved land management and conservation techniques. In 2013, Dr. James Hansen, then head of NASA's Goddard Institute for Space Studies, led a team of scientists to produce a paper that estimated that NCS could, if deployed and scaled to

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A. Schulte, *Soil Carbon Storage*, NATURE EDUC. KNOWLEDGE (2012), https://www.nature.com/scitable/knowledge/library/soil-carbon-storage-84223790/; Kat Kerlin, *Grasslands More Reliable Carbon Sink than Trees*, U.C. DAVIS (July 9, 2018), https://climatechange.ucdavis.edu/climate/news/grasslands-more-reliable-carbon-sink-than-trees; *see also* A.M. Nahlik & M.S. Fennessy, *Carbon Storage in U.S. Wetlands*, NATURE COMM'CNS, Dec. 13, 2016, at 1, https://www.nature.com/articles/ncomms13835.

27. For example, natural climate solutions such as planting trees in grasslands may absorb carbon but may also threaten localized species reliant on that habitat.

28. *See, e.g.*, *How Whales Help Cool the Earth*, BBC (Jan. 20, 2021), https://www.bbc.com/future/article/20210119-why-saving-whales-can-help-fight-climate-change (discussing the potential of ocean carbon-sequestration processes involving marine species).

29. *Carbon Dioxide Now More than 50% Higher than Pre-Industrial Levels*, NAT'L OCEANIC & ATMOSPHERIC ADMIN. (June 3, 2022), https://www.noaa.gov/news-release/carbon-dioxide-now-more-than-50-higher-than-pre-industrial-levels ("Prior to the Industrial Revolution, CO_2 levels were consistently around 280 ppm for almost 6,000 years of human civilization. Since then, humans have generated an estimated 1.5 trillion tons of CO_2, much of which will continue to warm the atmosphere for thousands of years.").

30. *See* discussion *supra* note 17.

31. Griscom et al., *supra* note 24, at 11645–50; *see also* Fargione et al., *supra* note 25 (referencing the Griscom Paper).

maximize opportunity worldwide, draw down 100 GtC by 2100.[32] More recent leading analysis reaffirms that potential.[33] In all likelihood, technological approaches are required to remove the remaining 50 GtC when Nature's processes have been exhausted.

The focus on technological solutions coalesces around direct air capture (DAC) of carbon, which uses equipment to pull carbon from the atmosphere and store it underground.[34] While DAC may hold promise for the future, it faces immediate financial and technological impediments.[35] Other extreme and risky interventions exist, such as fertilizing the ocean with massive amounts of iron in an aim to spur growth of plankton and other plants that will absorb carbon.[36] Among the array of options, NCS techniques are the most well-studied, cost-effective, mature, and presently scalable drawdown solutions.[37] Properly designed, NCS techniques hold significant advantages over technical solutions or chemical interventions. NCS may respond to the other crisis of biodiversity and can provide crucial co-benefits of food production, water protection, and climate adaptation.[38] Because NCS involves land management on a localized level, these solutions may engage and empower local communities rather than consolidate power and decision-making in a small number of corporations—concerns that have been raised with respect to geo-engineering and technology-based interventions.

The drawdown potential of NCS is a function of how much the carbon-sequestering capacity of land- and water-based systems is actualized through human management of those systems. NCS consists of ecosystems and

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32. James Hansen et al., *Assessing "Dangerous Climate Change": Required Reduction of Carbon Emissions to Protect Young People, Future Generations and Nature*, PLOS ONE, Dec. 3, 2013, at 1, 10, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3849278/; *see also* Griscom, *supra* note 24, at 11645 (applying constraints allowing for biodiversity protection and human needs for food and fiber and estimating that NCSs could draw down a maximum of 23.8 Gt CO_2e by 2030).

33. *See* Robertson et al., *supra* note 17, at 4913 (assessing U.S. potential); *see also* Fargione et al., *supra* note 25 (investigating the combination of bioenergy fuels and carbon sequestration).

34. *DOE Explains Direct Air Capture*, OFF. OF SCI., DEP'T OF ENERGY, https://www.energy.gov/science/doe-explainsdirect-air-capture (last visited Feb. 12, 2024).

35. EUR. ACAD. SCI. ADVISORY COUNCIL, NEGATIVE EMISSION TECHNOLOGIES: WHAT ROLE IN MEETING PARIS AGREEMENT TARGETS? 8, 30 (2018), http://unfccc.int/sites/default/files/resource/28_EASAC%20Report%20on%20Negative%20Emission%20Technologies.pdf (discussing barriers to carbon storage associated with DAC and other strategies) ("Installing the capacity required to capture and store the quantities of CO2 envisaged comprises a huge engineering challenge, so inevitably will have the long planning times associated with other major societal infrastructure projects."); *see also* Griscom et al., *supra* note 24, at 11647 (comparing costs and drawbacks of NCS versus technology-based carbon capture and storage).

36. EUR. ACADS. SCI. ADVISORY COUNCIL, *supra* note 35, at 9–10 (describing ocean fertilization and carbon capture and storage).

37. *See* Renee Cho, *Natural Climate Solutions: Why We Need Them*, COLUM. CLIMATE SCH.: STATE OF THE PLANET (Sept. 23, 2021), https://news.climate.columbia.edu/2021/09/23/natural-climate-solutions-why-we-need-them/.

38. Griscom et al., *supra* note 24, at 11646 (including food, fiber, and biodiversity safeguards in estimates of NCS).

agricultural systems essentially mining CO_2 from the atmosphere as a result of plant photosynthesis. Flora, fauna, microbiota, and soils assimilate carbon.[39] Because the rate and scale of drawdown from NCS is determined through photosynthesis and other ecological processes, NCS techniques sequester carbon slowly compared to the rate of emissions from fossil-fuel combustion.[40] The climate-stabilization benefits of NCS will take many decades to accrue. Moreover, the land base required for NCS techniques to measurably help steer the Earth system back towards 350 ppm of atmospheric CO_2 is vast; consequently, the project must incorporate land across the globe.[41] Implementation of NCS techniques at the necessary scale requires rapid development of sophisticated and responsive institutions.

The enormous land base needed for NCS to successfully play a role in atmospheric cleanup runs up against the sheer extent of human impact on land-based systems. Much of Earth's land is degraded and acts as a net source of atmospheric carbon, necessitating an urgent shift toward "regenerating the planet" through preservation, restoration, and improved land use.[42] At the same time, NCS measures must support human communities, as discussed in Part III. To set the context, the following Section explores the four ecotypes that serve as Nature's natural engines of carbon sequestration and biodiversity support.

B. The NCS Ecotypes

Land-based NCS focuses on these primary ecotypes: (1) forests; (2) farmlands; (3) grasslands and rangelands; and (4) blue carbon and teal carbon (wetlands) areas.[43] Of these, regions will vary as to which ecotypes offer the most potential, depending on the biological and geological characteristics of the land base and the land uses on that base.[44] In the PNW region, for example, forests likely offer the greatest drawdown potential due to the immense carbon-absorbing capacity of Douglas fir trees, but that could change over time as forests perish from fire.[45] Across regions, soil carbon is

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39. *DOE Explains Carbon Sequestration*, OFF. OF SCI., DEPT. OF ENERGY, https://www.energy.gov/science/doe-explainscarbon-sequestration (last visited Mar. 20, 2024) (explaining biological sequestration in plants and soils).

40. Dennis Baldocchi & Josep Penuelas, *The Physics and Ecology of Mining Carbon Dioxide from the Atmosphere by Ecosystems*, 25 GLOB. CHANGE BIOLOGY 1191, 1195 (2019).

41. *See* Hansen et al., *supra* note 32 (supporting the assertion that a large amount of land globally will be required for NCS to work at the scale needed); *see also* Griscom et al., *supra* note 24 (same).

42. Griscom et al., *supra* note 24, at 11649.

43. *See id.* at 11645–46 (explaining that although oceans hold the largest carbon pool on Earth, they are not susceptible to the same management and are generally excluded from NCS's literature).

44. *See* Bronson W. Griscom, et al., *National Mitigation Potential from Natural Climate Solutions in the Tropics*, ROYAL SOC'Y, Jan. 27, 2020, at 1, 6.

45. Law et al., *Creating Strategic Reserves*, *supra* note 11, at 2.

generally a key focus in all four ecotypes and constitutes 25% of the overall drawdown potential of NCS.[46] Of that overall potential, 40% is achievable through preserving existing soil carbon, and the remaining 60% is achievable through restoration of depleted soil.[47] Within each of the four categories, some scientists segregate measures into three types of endeavor: (1) avoided-conversion NCS (i.e., preventing forests from being converted to development or grasslands from being converted to croplands, as both measures reduce the soil's ability to store carbon); (2) land-management NCS (such as planting cover crops on fields or establishing longer forest-harvest rotations); and (3) restoration NCS (such as reforesting an area that has been cut or removing a dike to re-water a former estuary).[48] Accelerated silicate weathering is an emerging method that straddles the natural and technological approaches and may hold promise within the farmland category as explained below.[49]

1. Forests

The trees and plants of a forest pull down carbon dioxide from the atmosphere and, as part of photosynthesis, increase the amount of carbon stored in the soil and in biomass.[50] Globally, forests comprise 92% of all terrestrial biomass, and the Pacific Northwest has some of the most carbon-dense forests in the entire world.[51] When forests are cut, they lose significant amounts of carbon—stored over decades or even centuries of life—and emit it directly into the atmosphere.[52] NCS strategies harnessing forests' immense power to store carbon generally include three methods: (1) conservation of

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46. D.A. Bossio et al., *The Role of Soil Carbon in Natural Climate Solutions*, 3 NATURE SUSTAINABILITY 391, 391 (2020).

47. *Id.*; *see also* Griscom et al., *supra* note 24, at 11645.

48. *See* Rose A. Graves et al., *Potential Greenhouse Gas Reductions from Natural Climate Solutions in Oregon, USA*, 15(4) PLOS ONE, 1, Table 1 (Apr. 10, 2020).

49. *See* Johannes Lehmann & Angela Possinger, *Removal of Atmospheric CO_2 by Rock Weathering Holds Promise for Mitigating Climate Change*, 583 NATURE 204, 204-05 (2020).

50. *See* Rod Taylor et al., *What COP26 Means for Forests and the Climate*, WORLD. RES. INST. (Nov. 12, 2021), https://www.wri.org/insights/what-cop26-means-forests-climate [https://perma.cc/2DMF-E4T3] (noting that vast forest estates remain "globally important storehouses of carbon," storing more carbon than anything else but the oceans).

51. *Id.*; Beverly E. Law et al., *Land Use Strategies to Mitigate Climate Change in Carbon Dense Temperate Forests*, 115(14) PNAS 3663 (2018) [hereinafter Law et al., *Land Use Strategies*]; *see also* Mary Christina Wood, *The Oregon Forest Trust: An Ecological Endowment for Posterity*, 101 OR. L. REV. 515 at n. 57 and accompanying text (2023) [hereinafter Wood, *Oregon Forest Trust*].

52. *See* Statement of Dr. Beverly Law, *Wildfire in a Warming World: Opportunities to Improve Community Collaboration, Climate Resilience, and Workforce Capacity* 2, before the U.S. House of Representatives Subcommittee on National Parks, Forests and Public Lands (Apr. 29, 2021), https://www.congress.gov/117/meeting/house/112540/witnesses/HHRG-117-II10-Wstate-LawB-20210429.pdf ("More carbon is stored longer in forests than in wood products because about half of the harvested carbon is emitted soon after logging.").

forests; (2) reforestation of areas that have been cut; and (3) afforestation (foresting areas that have not been forests in recent history).[53]

Of these, the conservation approach holds the greatest potential to store carbon.[54] As one team of scientists explained, "[m]ature and old forests generally store more carbon in trees and soil than young forests, and continue to accumulate it over decades to centuries, making them the most effective forest-related climate mitigation strategy."[55] A recent study indicated that half of the living forest carbon stored above ground was in the largest (typically correlating with oldest) 1% of trees studied, and a study of Oregon forests similarly found that large (53 cm DBH or greater)[56] trees held 43% of the carbon despite comprising just 3% of the trees in the forest.[57] Even extending the harvest rotation of trees would result in increased storage during the time of deferred harvest.[58] Forests on private land are typically harvested well before they reach maturity, so extending the rotation period from the typical 40 years to 80 years would capture significantly more carbon until more permanent solutions can be found.[59] Scientists lament the logging practices that waste the potential of carbon-dense forests (such as the Westside forests in Oregon and Washington) to accumulate carbon, and they urge policies and practices that allow such forests to stand.[60] Conserving the forests also serves other purposes, including promoting biodiversity, protecting water sources, building climate resilience, and controlling erosion and overland flow.[61]

Reforestation can store only a third of the carbon that can be stored by forest conservation[62] but nevertheless provides impressive potential over time. On the global level, it is estimated that reforestation alone may accomplish as much as 10.1 GtC per year in drawdown potential if action is taken soon and proper management practices are employed to maintain the long-term health of forests.[63] Global reforestation potential exists on 0.9

53. Law et al., *Creating Strategic Reserves*, *supra* note 11.

54. *Id.* at 724 (providing a comparison estimating the potential of all three measures).

55. *Id.*

56. DBH refers to Diameter at Breast Height, a silvicultural standard for measuring trees.

57. Law et al., *Creating Strategic Reserves*, *supra* note 11, at 724.

58. Law et al., *Land Use Strategies*, *supra* note 51, at 3667; *see also* Kate Anderson, *Yes, Long Rotations Can Yield Real Climate Gains for Cascadia*, SIGHTLINE INST. (Mar. 17, 2022), https://www.Sightline.Org/2022/03/17/Yes-Long-Rotations-Can-Yield-Real-Climate-Gains-For-Cascadia/.

59. Law et al., *Creating Strategic Reserves*, *supra* note 11, at 722.

60. *Id.* at 723.

61. *See* Polly C. Buotte et al., *Carbon Sequestration and Biodiversity Co-Benefits of Preserving Forests in the Western United States*, ECOLOGICAL APPLICATIONS, Dec. 4, 2019, at 1, 6, https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/eap.2039.

62. Law et al., *Creating Strategic Reserves*, *supra* note 11, at 723.

63. *See* Kelly Levin, *How Effective Is Land at Removing Carbon Pollution? The IPCC Weighs In*, WORLD RES. INST. (Aug. 8, 2019), https://www.wri.org/blog/2019/08/how-effective-land-removing-carbon-pollution-ipcc-weighs.

billion hectares across the world, and, once mature, may have the potential to remove as much as 25% of the current atmospheric carbon.[64] Of course, to fully capitalize on the potential that reforestation presents, further deforestation must end.[65] Lastly, afforestation accomplishes some carbon drawdown, but only about a tenth of the amount gained by conservation techniques.[66] Moreover, afforestation must be limited to areas that do not compete with other important societal uses like food production.

2. Farmlands

Agriculture provides other well-established pathways for carbon sequestration.[67] Regenerative agriculture, for example, seeks to capitalize on the soil's natural ability to store carbon.[68] This potential has been greatly diminished by destructive farming practices that trigger soil loss and degrade soil quality.[69] Over time, global soil stocks have lost as much as 150 GtC, but these soils, aided by regenerative agriculture practices, can be used to draw down as much as 4.8 GtC per year.[70] General principles guide the development of NCS on farmlands: (1) maximize continuously living roots; (2) minimize soil disturbance; (3) maximize biodiversity; and (4) maximize soil cover.[71] The agriculture NCS pathways include projects such as nutrient management, no-till or minimized-till practices, crop variation, cover-crop use, livestock and animal integration, precision irrigation, mulching, integrated pest management (IPM), agroforestry, and increased perennial

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64. *See* Jean-Francois Bastin et al., *The Global Tree Restoration Potential*, 365 SCIENCE 76, 79 (July 5, 2019), https://science.sciencemag.org/content/365/6448/76.

65. *See* Jeremy Hance, *Ending Deforestation Won't Stop Carbon Emissions from Land Use Change*, MONGABAY (Nov. 17, 2014), https://news.mongabay.com/2014/11/ending-deforestation-wont-stop-carbon-emissions-from-land-use-change/.

66. Law, *Creating Strategic Reserves*, *supra* note 11, at 723.

67. *See* RATTAN LAL ET AL., THE POTENTIAL OF U.S. CROPLAND TO SEQUESTER CARBON AND MITIGATE GREENHOUSE EFFECT 401 (1998) ("Sequestering soil [carbon] in grazing lands is important for enhancing soil and water quality and reducing the rate of emissions of radiatively active gases (greenhouse gases) to the atmosphere.").

68. *See* Judith D. Schwartz, *Soil as Carbon Storehouse: New Weapon in Climate Fight?*, YALE ENV'T 360 (Mar. 4, 2014), https://e360.yale.edu/features/soil_as_carbon_storehouse_new_weapon_in_climate_fight.

69. *Id.*

70. Pete Smith et al., *How to Measure, Report and Verify Soil Carbon Change to Realize the Potential of Soil Carbon Sequestration for Atmospheric Greenhouse Gas Removal*, 26 GLOB. CHANGE BIOLOGY 219, 220 (2020), https://doi.org/10.1111/gcb.14815. "Regenerative agriculture" is a broad term that not all farmers use, but it is a standard term used in NCS literature. For one rancher's elaboration of the term, *see Regenerative*, ALDERSPRING RANCH, https://www.alderspring.com/regenerative/ (last visited Mar. 2, 2024).

71. *Soil Health Principles*, CLIMATE HUBS, U.S. DEP'T OF AGRIC., https://www.climatehubs.usda.gov/image/soil-health-principles (last visited Mar. 2, 2024).

plantings.[72] Not only will these practices improve carbon drawdown, but many of them provide benefits to farmers and communities, such as more fertile soil and better water retention, which can boost crop productivity and help meet society's food demands.[73] Cover-crop usage, in particular, offers a number of significant benefits to producers yet is not widely implemented.[74]

Recent science points to another method that could be incorporated as an agricultural pathway. While far from honed and validated to the level necessary for regional adoption, a technique known as accelerated basalt weathering may have unique potential in some areas. Grinding basalt into small particles accelerates weathering of its primary minerals, launching chemical reactions that draw down atmospheric CO_2.[75] Such basalt could be added as a soil amendment to farmlands. The PNW region may have singular suitability for this potentially promising method as a result of its ample basalt geological stores, which provide local availability of silicate material (thus avoiding significant transportation-based emissions). Used as a soil amendment for PNW farmers, this method would not only sequester (in the soil) the added carbon from weathering but could also substitute for other soil amendments, such as lime, the production of which generates large emissions.[76]

3. Grasslands and Rangelands

In some regions, prairie systems contain far more soil organic carbon than other ecotypes due to the deep root systems and other characteristics of the grassland vegetation.[77] In America's Great Plains, for example,

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72. *Id.* (explaining the techniques); *see also* Graves et al., *supra* note 48; Griscom et al., *supra* note 24.

73. Mark A. Bradford et al., *Soil Carbon Science for Policy and Practice*, NATURE SUSTAINABILITY, Nov. 11, 2019, at 1, https://www.nature.com/articles/s41893-019-0431-y.

74. Cover crops may stabilize soil, reduce runoff, increase nutrients, and enhance soil carbon but in some cases may reduce crop yields. The outcome is dependent on the type of crop and the land characteristics. *See* Scott McFetridge, *Cover Crops Help the Climate and Environment, but Most Farmers Say No. Many Fear Losing Money*, AP (Nov. 2, 2023), https://apnews.com/article/cover-crops-farming-carbon-nitrogen-1648449f90b7072be50b95a21d733618.

75. For an explanation of the method, *see* Lucas C.R. Silva et al., *A Generalizable Framework for Enhanced Natural Climate Solutions*, 479 PLANT & SOIL 3, 11 (2022) (citing David J. Beerling et al., *Potential for Large-Scale CO_2 Removal via Enhanced Rock Weathering with Croplands*, 583 NATURE 242 (2020)); Peter Kelemen et al., *An Overview of the Status and Challenges of CO_2 Storage in Minerals and Geological Formations*, FRONTIERS CLIMATE, Nov. 15, 2019, at 1, 7 https://www.frontiersin.org/articles/10.3389/fclim.2019.00009/full.

76. Silva et al., *supra* note 75, at 12 (citing Johannes Lehmann & Angela Possinger, *Removal of Atmospheric CO_2 by Rock Weathering Holds Promise for Mitigating Climate Change*, 583 NATURE 204 (2020)).

77. *See Carbon Sequestration in Grasslands*, MINNESOTA BD. OF WATER & SOIL RES., https://bwsr.state.mn.us/carbon-sequestration-grasslands (last visited Dec. 12, 2023) (explaining that prairie grasslands have adapted to fire and grazing by retaining more carbon).

grasslands and shrublands hold 34% of all the carbon stored in the region.[78] Thus, a broad category of NCS focuses on both the natural grasslands and the rangelands on which livestock roam. An important strategy is to avoid conversion of natural prairies to cropland or pastures, both of which can release carbon.[79] Other pathways seek to restore sagebrush-steppe systems, which can also boost habitat for species.[80] To achieve the natural potential of these areas, encroachments must be monitored and thwarted—both human-caused (such as urban sprawl) and Nature-caused (such as juniper and other invasive-species intrusion).

On rangelands and grazed grasslands, overgrazing has significantly decreased above-ground biomass carbon.[81] Accordingly, much of the NCS techniques in this category focus on reforming grazing practices[82] and deploying methods that move livestock frequently.[83] Moving livestock leaves more vegetation on rangeland, which in turn can promote carbon drawdown and storage.[84] Methods include creating long intervals without grazing to promote strong root systems and practicing more intensive grazing for shorter periods to support plant growth.[85] Some also suggest mimicking historic natural grazing processes of wild ungulates like buffalo to restore carbon and important nutrients to barren, overgrazed grasslands and pasturelands.[86] Ranchers are innovating new practices tailored to their unique land base. In Idaho, the Alderspring Ranch has instituted a practice of "inherding," described as "a unique management of cattle on extensive wild

78. *Id.*

79. Graves et al., *supra* note 48, at 7.

80. *Id.* at 12.

81. *See* J. Boone Kauffman et al., *Livestock Use on Public Lands in the Western USA Exacerbates Climate Change: Implications for Climate Change Mitigation and Adaptation*, 69 ENV'T MGMT. 1137, 1137 (2022) ("[Domestic livestock] defoliate native plants, trample vegetation and soils, and accelerate the spread of exotic species[,] resulting in a shift in landscape function from carbon sinks to sources of greenhouse gases. . . .").

82. *Id.*

83. *See* Benjamin Ryan, *Keeping Cattle on the Move and Carbon in the Soil*, N.Y. TIMES (Oct. 31, 2021), https://www.nytimes.com/2021/10/31/climate/cows-grassland-carbon.html (explaining that livestock ranchers who practice regenerative grazing keep their herds concentrated and move them often to support soil health).

84. *See id.* (explaining that regenerative grazing encourages livestock to consume different types of grasses, leaving a variety of plant species in place after the livestock has grazed); *see also* Lina Aoyama et al., *Using Ecological Site Descriptions to Make Ranch-Level Decisions About Where to Manage for Soil Organic Carbon*, 76 CAL. AGRIC. 85, 91 (2022) (emphasizing that site-specific variables should form basis of plans).

85. *See Rotational Grazing for Climate Resilience*, CLIMATE HUBS, U.S. DEP'T OF AGRIC., https://www.climatehubs.usda.gov/hubs/international/topic/rotational-grazing-climate-resilience (last visited Mar. 2, 2024) (explaining how rotational grazing's frequent movement allows plants to rest and regrow to grazing height while livestock graze other paddocks, and that the length of grazing and rest periods is ecosystem dependent and differs depending on forage yield).

86. *See* Darrell J. Bosch et al., *Farm Returns to Carbon Credit Creation with Intensive Rotational Grazing*, 63 J. SOIL & WATER CONSERVATION 91, 91 (2008) (explaining that rotational grazing systems produce soil health benefits).

rangelands" in which "[a]ll cattle on the entire landscape are managed as a single controlled group, and penned each night near a cow camp."[87] In-herding not only promotes carbon sequestration but also eliminates wolf conflicts (by having human presence) and restores riparian habitat for salmon (by keeping cattle away from streams).[88]

If the potential for restorative grazing is fully met, some researchers project that nearly 295 million metric tons of CO_2 could be stored in the soils globally each year.[89] Nevertheless, NCS techniques in this category stir scientific controversy concerning the methane emissions associated with cattle production.[90] About 20% of the total anthropogenic methane release in the U.S. is attributable to cattle production.[91] However, the methane releases may be substantially tied to the animal's time spent in feedlots to "finish" the animal prior to slaughter.[92] Nearly 95% of cattle in the U.S. are fattened in their last stage of life on grain-based diets characteristic of feedlots, while only about 5% are grass-finished, spending their entire lives on pasture.[93] Scientists are evaluating methane emissions associated with adaptive management techniques deployed for livestock spending their entire lives feeding on grasses.[94]

4. Blue and Teal Carbon Areas

Blue and teal carbon ecosystems provide a fourth reservoir for atmospheric carbon. The term "blue-carbon" refers to coastal and marine

87. *See* ALDERSPRING RANCH, *supra* note 70.

88. *Id.*

89. Benjamin B. Henderson et al., *Greenhouse Gas Mitigation Potential of the World's Grazing*, 207 AGRIC., ECOSYSTEMS & ENV'T 91, 98 (2015). The estimate is premised on grazing reform combined with legume sowing and fertilization practices, which entail risk of N_2O emissions that can offset the gains from reduced carbon emissions. *Id.* The authors emphasize the need for more research to "identify amenable areas, based on their biophysical and management attributes, to avoid sowing of legumes in pasturelands with the potential for large increases in soil based GHG emissions." *Id.* The call for more localized research underscores the need for Regional Frameworks that can identify suitable lands for regenerative grazing.

90. *See* Kate Lajtha & Lucas Silva, *Grazing Cattle, Well-Managed or Not, Is Unlikely to Increase Soil Carbon Sequestration*, PNAS, July 6, 2022, at 1, 2, https://www.pnas.org/doi/epdf/10.1073/pnas.2203408119.

91. Joseph Mangino et al., *Development of an Emissions Model to Estimate Methane from Enteric Fermentation in Cattle*, EPA, https://www3.epa.gov/ttnchie1/conference/ei12/green/mangino.pdf (last visited Jan. 10, 2024); *see also* Amy Quinton, *Cows and Climate Change*, U.C. DAVIS (June 17, 2019), https://www.ucdavis.edu/food/news/making-cattle-more-sustainable (noting that scientists are developing seaweed dietary supplements for beef cattle to significantly reduce the methane emissions).

92. Christopher D. Lupo et al., *Life-Cycle Assessment of the Beef Cattle Production System for the Northern Great Plains, USA*, 42 J. ENV'T QUALITY 1386, 1386 (2013).

93. Allison Kosto, *The Complexities of Grass Fed Beef*, MONT. STATE UNIV. EXTENSION (Mar. 18, 2022), https://www.montana.edu/extension/broadwater/blog-article.html?id=21908.

94. Paige L. Stanley et al., *Impacts of Soil Carbon Sequestration on Life Cycle Greenhouse Gas Emissions in Midwestern USA Beef Finishing Systems*, 162 AGRIC. SYS. 249, 255 (2018).

ecosystems, including intertidal marshes, coastal estuaries, seagrass beds, and in some parts of the world, mangroves.[95] Blue-carbon ecosystems are structured around highly productive plant species which pull carbon from the atmosphere and trap it in sediments.[96] These ecosystems may sequester carbon at higher proportional rates than forests and for longer periods of time.[97] Despite covering only 2% of the ocean's surface area, blue-carbon ecosystems have gained significant attention for their contribution to NCS global drawdown potential.[98] For intact natural blue-carbon areas, NCS focuses on avoided conversion, i.e., conservation and permanent legal protection.[99]

Blue-carbon sinks have been destroyed and degraded worldwide. For example, in Oregon alone, over half of the historic tidal wetlands have been lost since Oregon attained statehood.[100] In Washington's Puget Sound, 80% of tidal wetlands have disappeared.[101] For these ecosystems, NCS approaches focus on restoration. Strategies often involve the removal of dikes and other structures that have impeded tidal flows.[102] When the tides return, marshes may revive with restored sediment accretion, pH, water salinity, and nutrient and organic-matter content.[103]

Marine scientists also focus on the carbon sequestration benefits of nearshore ecosystems like seagrass, kelp forests, algae beds, and coastal

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95. *Protecting Coastal Blue Carbon Through Habitat Conservation*, NOAA FISHERIES (Oct. 25, 2022), https://www.fisheries.noaa.gov/national/habitat-conservation/protecting-coastal-blue-carbon-through-habitat-conservation [hereinafter *Protecting Coastal Blue Carbon*].

96. Sofia Metzler Concepción, *What Is Blue Carbon?*, SUSTAINABLE OCEAN ALL. (Feb. 28, 2022), https://www.soalliance.org/soablog/what-is-blue-carbon.

97. *See Blue Carbon Science & Projects: Carbon Stored and Sequestered by Coastal Wetlands*, RESTORE AM.'S ESTUARIES, https://estuaries.org/bluecarbon/blue-carbon-science-projects/ (last visited Sept. 23, 2022) (demonstrating that, in the first meter of soil, seagrass contained approximately double the amount of Mg CO_2e/ha as a tropical forest).

98. *See What You Need to Know About Blue Carbon*, WORLD BANK (Nov. 21, 2023), https://www.worldbank.org/en/news/feature/2023/11/21/what-you-need-to-know-about-blue-carbon; (explaining that blue-carbon coastal ecosystems account for 50% of the ocean's carbon absorption); Micheli Duarte de Paula Costa & Peter I. Macreadie, *The Evolution of Blue Carbon Science*, 42 WETLANDS 109 (2022).

99. *See Protecting Coastal Blue Carbon*, *supra* note 95.

100. Andy Kerr, *Oregon's Blue Carbon, Part 2: Coastal Wetland Loss and Restoration*, ANDY KERR'S PUB. LANDS BLOG (July 9, 2021), https://www.andykerr.net/kerr-public-lands-blog/2021/7/9/oregons-blue-carbon-part-2-coastal-wetland-loss-and-restoration.

101. *See* BRIAN D. COLLINS & AMIR J. SHEIKH, HISTORICAL RECONSTRUCTION, CLASSIFICATION, AND CHANGE ANALYSIS OF PUGET SOUND TIDAL MARSHES 73 (2005) (describing how tidal wetlands in Puget Sound have disappeared compared to the pre-Euro-American settlement levels).

102. *See* Kevin D. Kroger et al., *Restoring Tides to Reduce Methane Emissions in Impounded Wetlands: A New and Potent Blue Carbon Climate Change Intervention*, SCI. REPS., Sept. 20, 2017, at 1, 2, https://www.nature.com/articles/s41598-017-12138-4 (explaining that tidal restoration includes removing water-impeding technology so water can return to its natural level and salinity).

103. CHRISTOPHER JANOUSEK ET AL., EARLY POST-RESTORATION RECOVERY OF TIDAL WETLAND STRUCTURE AND FUNCTION AT THE SOUTHERN FLOW CORRIDOR PROJECT, TILLAMOOK BAY, OREGON 25 (Research Gate 2021).

dunes.[104] Plants in these ecosystems accumulate carbon rapidly and, due to their slower decomposition, hold the carbon for longer periods of time compared to terrestrial carbon.[105] Kelp forests, a subcategory of these blue-carbon stocks, may store as much as 7.5 to 20 teragrams of carbon.[106] Approximately 10% of the kelp will be shed and reach the deep sea, where it can store carbon for the long term.[107] Restoring lost kelp forests entails seeding and cultivating areas and controlling urban runoff and other ocean pollution.[108]

Beyond carbon storage, healthy blue-carbon ecosystems provide several key co-benefits. The physics of healthy vegetation in blue-carbon systems dampens wave energy as it pushes toward the coast, thereby offering protection from storm surge and associated flooding, erosion, and resulting property damage.[109] Additionally, blue-carbon ecosystems provide crucial nurseries for many marine species, support coral reefs, and help combat ocean acidification.[110] Coastal vegetation also filters runoff, trapping and processing pollutants in vast, tangled root systems to purify water as it flows back into the ocean.[111]

The teal carbon ecosystems—inland wetlands, marshes, and swamps—are also vital sinks. Wetlands may hold between 20–30% of global terrestrial carbon, yet they occupy just 5–8% of the planet's land-surface area.[112]

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104. *See, e.g.*, *How Seagrass and Kelp Support Habitats' Resilience in a Changing Ocean*, MONTEREY BAY AQUARIUM, https://www.montereybayaquarium.org/stories/seagrass-kelp-help-climate-change-ocean-acidification (explaining that seagrass can help fight ocean acidification); *see generally* Vishal Paul et al., *Role of Algae in CO_2 Sequestration Addressing Climate Change: A Review*, *in* RENEWABLE ENERGY & CLIMATE CHANGE 257, 257–65 (2019).

105. Jill T. Greiner et al., *Seagrass Restoration Enhances "Blue Carbon" Sequestration in Coastal Waters*, PLOS ONE, Aug. 14, 2013, at 1, 1, https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0072469.

106. DANIEL M. ALONGI, BLUE CARBON: COASTAL SEQUESTRATION FOR CLIMATE CHANGE MITIGATION 2, 36 (2017).

107. Dorte Krause-Jensen & Carlos M. Duarte, *Substantial Role of Macroalgae in Marine Carbon Sequestration*, 9 NATURE GEOSCIENCE 737, 738–39 (2016).

108. *See Planting Hope: Seagrass*, WORLD WILDLIFE FUND UK, https://www.wwf.org.uk/what-we-do/planting-hope-how-seagrass-can-tackle-climate-change (last visited Dec. 12, 2023) (describing seagrass-restoration projects in the UK).

109. *See* MARK SPALDING ET AL., WETLANDS INT'L & NATURE CONSERVANCY, MANGROVES FOR COASTAL DEFENCE: GUIDELINES FOR COASTAL MANAGERS & POLICY MAKERS 16 (2014), https://www.nature.org/media/oceansandcoasts/mangroves-for-coastal-defence.pdf (explaining that mangroves lessen wave damage during intense weather events).

110. *See Kelp and Ocean Acidification*, WASH. SEA GRANT, https://wsg.washington.edu/wordpress/wp-content/uploads/Kelp_Brochure.pdf (last visited Dec. 12, 2023) (illustrating the benefits of blue-carbon systems to ocean acidification).

111. *Why Are Estuaries Important? Ecosystem Services*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., https://oceanservice.noaa.gov/education/tutorial_estuaries/est03_ecosystem.html (last visited Feb. 29, 2024).

112. Amanda M. Nahlik, *Importance of Teal Carbon to Wetland Carbon Monitoring and Assessment*, NASA, https://cce-

Globally, a fifth of natural wetlands have been destroyed.[113] While wetlands are considered part of an NCS strategy, they also release methane and nitrous oxide, both potent greenhouse gases.[114] NCS strategies focus on conserving natural, undisturbed wetlands and restoring the hydrology and other functions of disturbed wetlands.[115] Functioning wetlands provide a myriad of benefits, including flood control, water purification, water storage (and increased supply), bank stabilization, fish and wildlife habitat, and recreational amenities.[116] These areas are particularly crucial to biodiversity, as a third of imperiled species listed under the Endangered Species Act rely on wetland habitat.[117]

II. A META-STRATEGY FOR ORGANIZING SKY CLEANUP

In a functional political world, national leaders around the globe would create a vision and framework for a global collaborative supporting sufficient carbon drawdown and biodiversity recovery. Regional and local governments would follow through on these commitments by coalescing a land management movement to the four corners of their jurisdictions. But while international and U.S. ambition for carbon drawdown is growing, there has been no broad follow-through on the regional and local levels. Even as the science proceeds at a rapid pace, demonstrating the potential of NCS for mitigation, a gap widens between the science and on-the-ground application. Much of the research stops at the conceptual stage and does not proceed into the next phase of designing implementation pathways. Though proof of concept occurs through scattered pilot projects, these lack a framework to bring the techniques to scale. An organizing nucleus is necessary to identify the data, protocols, and tools needed so that working-land professionals may implement, monitor, and continue to refine carbon-sequestration techniques.

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datasharing.gsfc.nasa.gov/files/conference_presentations/Talk_Nahlik_49_29.pdf (last visited Dec. 12, 2023).

113. Eric Roston, *A Fifth of the World's Species-Rich Wetlands Have Been Destroyed*, BLOOMBERG (Feb. 8, 2023), https://www.bloomberg.com/news/articles/2023-02-08/a-fifth-of-the-world-s-species-rich-wetlands-have-been-destroyed?leadSource=uverify%20wall.

114. Martino E. Malerba et al., *Methane and Nitrous Oxide Emissions Complicate the Climate Benefits of Teal and Blue Carbon Wetlands*, 5 ONE EARTH 1336, 1336 (2022), https://www.sciencedirect.com/science/article/pii/S2590332222005796/pdfft?md5=02cb45e7852bba6434f8746eb0a0ee9d&pid=1-s2.0-S2590332222005796-main.pdf.

115. *Id.* at 1338 ("Natural wetlands are best left undisturbed to conserve long-term carbon storage and maintain a net cooling effect on the atmosphere. Conversely, disturbed wetlands require active management to lessen their impacts on climate change and improve other essential benefits, including biodiversity, cultural significance, flood protection, and drought resilience. Typical management actions for controlling GHG emissions are restoring natural hydrology, revegetation, and reducing eutrophication.").

116. *Why Are Wetlands Important?*, NAT'L PARK SERV., https://www.nps.gov/subjects/wetlands/why.htm# (May 5, 2016).

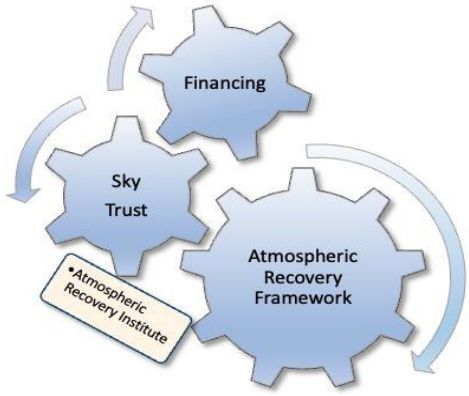
117. *Id.*

Financing must materialize to induce landowners and land managers to adopt these practices. Finally, a new form of institution must emerge to develop projects and implement them across the landscape rapidly and effectively.

The drawdown project must be defined regionally, incorporating enough jurisdictions to make the project practical. While ideally tied to a national strategy, a regional blueprint can capture the scale necessary for landscape restoration and minimize inefficiencies caused by smaller efforts. It also provides opportunities for collaboration between neighboring sovereigns. While a region may encompass varied ecosystems, all with their own complexity, a regional strategy remains manageable in terms of ecological differentiation. But even on a regional scale, harnessing NCS capabilities and equipping communities to pursue restoration projects is a massive undertaking.

A. The Three-Gear Approach

The urgent project of catalyzing and sustaining a regional atmospheric recovery effort requires a rapid coalescence of legal frameworks, financing, land-management decisions, scientific expertise, and community buy-in. This Article offers a meta-strategy that takes shape around a three-gear design suitable for deployment on the regional level—wherever NCS opportunity exists. By providing a common strategy between regions, the three-gear approach aims to catalyze a global effort that is uniquely localized, yet formidably unified and urgent in its principled resolve.



This approach anticipates an iterative endeavor, not structured in the familiar style of top-down regulation but rather designed to harness incentives and expertise to create opportunity. Envisioned as interlocking "gears," momentum on any one gear may propel the other gears as well. The

three gears driving regional atmospheric recovery are: (1) the Atmospheric Recovery Framework; (2) the Financing; and (3) the Sky Trust.[118] Ideally, this structure would replicate across different regions of the nation—or even the world—simultaneously.

1. The Regional Framework

The Framework provides the first "gear" in the meta-strategy. It presents a conceptual template to organize and recruit communities into a broad regional enterprise of restoration and drawdown. Broadly speaking, the Framework is a synthesis research endeavor that aggregates and characterizes the ongoing initiatives and NCS potential across a region. The Framework should not reinvent the wheel or duplicate work being done but instead should offer a coherent organizing platform for situating presently disconnected efforts—and thereby draw synergy from them.[119] The Framework should identify gaps, needs, and scientific uncertainties.

As a key point, the Framework is neither government-initiated nor government-enforced. Governments have thus far failed to move with all deliberate speed on the urgent climate front, and some observers point to the need for new organizing institutions and approaches.[120] The Framework is devised through a transdisciplinary effort involving scientists, economists, conservation lawyers, land managers, and community and youth leaders. It aims to match the sequestration potential of a jurisdiction with the resources, needs, and incentives of the local communities positioned to undertake restoration. As a tangible and operable blueprint for restoration, the Framework will map and define key areas of sequestration potential, estimate costs of NCS projects, announce opportunities across landscapes using techniques in all four ecotypes of natural climate solutions, and address barriers and justice issues. By capturing a region's NCS potential, the Framework represents the necessary first step in region-wide NCS restoration. Part III below describes the specific components of regional

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118. *See* Mary Christina Wood, *Atmospheric Recovery Litigation: Making the Fossil Fuel Companies Pay for Cleaning Up the Atmosphere*, *in* BEARING WITNESS: THE HUMAN RIGHTS CASE AGAINST FRACKING AND CLIMATE CHANGE 285, 290–94 (Thomas A. Kerns & Kathleen Dean Moore eds., 2021) (describing in detail the three driving gears of regional atmospheric recovery).

119. *See Natural & Working Lands Proposal 2021*, OR. GLOB. WARMING COMM'N 9, https://static1.squarespace.com/static/59c554e0f09ca40655ea6eb0/t/6148a9d36431174181e05c7c/1632 15 2029009/2021+OGWC+Natural+and+Working+Lands+Proposal.pdf (describing work of the Oregon Global Warming Commission's Natural and Working Lands Advisory Committee in developing a methodology for carbon sequestration across Oregon that would either directly plug into or inform a PNW-FAR); *see also infra* Part IV (discussing the PNW-FAR as part of an accelerated, scaled-up regional approach devised outside of government processes).

120. *See* Matto Mildenberger, *The Development of Climate Institutions in the United States*, 30 ENV'T POL. 71, 83–88 (2021) (discussing the different periods of climate change institutions in America, their shortcomings, and how to overcome them).

Frameworks in more detail. Notably, the Frameworks will constantly evolve as NCS knowledge and experience mount. Therefore, as a practical matter, while regional Frameworks begin as written guides, they must quickly become iterative web-based resources that are publicly accessible and readily updated and revised.

2. Atmospheric Natural Resource Damages and Other Financing

A second "gear" of the meta-strategy focuses on financing atmospheric cleanup NCS projects. Recognizing that a transformative project of this scale can only be jump-started and sustained with major funding,[121] this gear develops funding avenues gained from various sources. Funds will provide financial incentives to land managers to engage in carbon forestry, regenerative farming, carbon ranching, and blue and teal carbon restoration. This gear anticipates a diverse assortment of funding sources, including government programs and private philanthropy. Importantly, it also turns the spotlight to one particularly obvious "deep pocket" that has not yet been tapped for any climate cleanup: the fossil-fuel industry.

Access to deep financing by fossil-fuel corporations may be gained through a theory of legal liability for natural-resource damages (NRDs). Bearing a strong analogy to marine oil spills, a new form of litigation (Atmospheric NRD Litigation) would seek to hold fossil-fuel companies accountable for polluting the atmosphere with carbon in the same way that oil companies are held accountable for cleaning up marine oil spills. The approach would use damages paid by defendants to fund climate mitigation—cleaning up the excess atmospheric carbon dioxide that is fueling climate disruption. While the marine oil-spill cases typically invoke statutory grounds for liability (and there is no equivalent statutory authority for an atmospheric-pollution suit), a robust line of emerging case law holds chemical manufacturers responsible for financing cleanup of polluted natural resources under common-law (non-statutory) theories grounded in the

121. *See* Minal Pathak et al., Intergovernmental Panel on Climate Change, Climate Change 2022: Mitigation of Climate Change, Technical Summary, 51, 108–09 (2022) (indicating the need for more funding sources beyond government grants to promote landscape sequestration and noting that "[f]inance forms a critical barrier" for such efforts).

public-trust and public-nuisance doctrines.[122] Under an existing approach,[123] sovereign entities (foreign nations, federal agencies, states, counties, and tribes) stand positioned to invoke these same grounds to pursue Atmospheric NRD Litigation against the fossil-fuel industry to fund sky carbon cleanup projects within the applicable Regional Frameworks for Atmospheric Recovery. Because this litigation strategy is based on the standard model of cleaning up an oil spill, fossil-fuel corporations themselves are likely to foresee it.[124]

Another line of litigation against fossil-fuel companies, quickly gaining momentum, offers another potential source of major financing. Over two dozen lawsuits have been filed by cities, counties, and states against carbon majors, primarily to fund adaptation costs.[125] These plaintiff sovereigns are constitutionally charged by virtue of their police power to provide for public health and safety. Yet they cannot do so in the face of soaring costs caused by climate disasters. In effect, fossil fuels, by contributing to the disruption of Earth's energy imbalance, have also upended the infrastructure that cities, counties, and states rely on to provide for the general welfare.[126] Some of the adaptation lawsuits seek full "disgorgement of profits" from the fossil-fuel defendants.[127] These cases against Climate Liable Parties[128] rest on producer liability. They assert state common-law claims, and all have a centerpiece public-nuisance claim, with several presenting additional claims sounding in product liability and negligence.[129] These suits have established important

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122. *See* Mary Christina Wood, *Atmospheric Recovery Litigation Around the World: Gaining Natural Resource Damage Awards Against Carbon Majors to Fund a Sky Cleanup for Climate Restoration*, *in* RESEARCH HANDBOOK ON CLIMATE CHANGE LAW AND LOSS & DAMAGE 303, 307–09, 320–23 (Meinhard Doelle & Sarah L. Seck eds., 2021) [hereinafter Wood, HANDBOOK] (explaining the public trust doctrine and common law causes of action such as nuisance and trespass, and how each can be used as a framework for litigating pollution of the atmosphere).

123. *See id.* at 312–20 (applying common law causes of action under the public trust doctrine and theories of nuisance and trespass to atmospheric pollution to identify which parties would be liable for pollution of the atmosphere under these theories and the potential claims); *see also* Mary Christina Wood & Daniel Galpern, *Atmospheric Recovery Litigation: Making the Fossil Fuel Industry Pay to Restore a Viable Climate System*, 45 ENV'T L. 259, 297–320 (2015) (describing how the public trust doctrine gives sovereign entities the authority to pursue Atmospheric NRD litigation).

124. *See* Ira Gottlieb et al., *Natural Resource Damages for Climate Change—An Idea Whose Time Is Not Yet Come, Part I: NRD Claims Are Not Currently Viable Under CERCLA*, 20(4) ENV'T CLAIMS J. 256, 256–57 (2008) (acknowledging that "it may only be a matter of time before natural resources trustees file actions for NRD[s] based upon climate change effects").

125. Patrick Parenteau & John Dernbach, *More than Two Dozen Cities and States Are Suing Big Oil over Climate Change – They Just Got a Boost from the US Supreme Court*, CONVERSATION (May 23, 2023), https://theconversation.com/more-than-two-dozen-cities-and-states-are-suing-big-oil-over-climate-change-they-just-got-a-boost-from-the-us-supreme-court-205009.

126. *Id.*

127. Wood, HANDBOOK, *supra* note 122, at 306.

128. *See id.* at 314 (originating the term "Climate Liable Parties" to broadly categorize all defendants, not just fossil-fuel defendants, in climate litigation, a term roughly analogous to Potentially Responsible Parties (PRPs) in the hazardous waste realm).

129. *Id.* at 306.

cornerstones of sky cleanup by pursuing crucial evidence of industry culpability and crafting legal approaches to industry liability. They allege jaw-dropping factual characterizations of what the companies knew would be the damage likely caused by their continued fossil-fuel production.[130] While these suits have been tangled in judicial removal issues for years, appellate courts have recently allowed such suits to proceed under state-law theories.[131]

Recent complaints in suits filed against fossil-fuel companies by Multnomah County, Oregon and the State of California ask the respective courts for abatement funding to finance necessary adaptation to the heating world.[132] Such funds can represent a massive infusion of money—the Multnomah County complaint, for example, seeks $50 billion.[133] Broadly speaking, the remedy sought in adaptation lawsuits can be thought of as financing a bifurcated set of responses: (1) "engineered adaptation," such as seawalls, new roads, and cooling centers; and (2) "natural adaptation," which deploys natural climate solutions.

Nearly all natural climate solutions have an adaptation benefit. Protecting forests secures water supplies in a drought-stricken region. Increasing soil carbon allows more water storage and guards against the parched conditions that farmers increasingly face. In-herding livestock keeps cattle away from streams, thereby restoring essential riparian functions needed by salmon and other species to survive in warmer waters. Reconnecting historic tidal estuaries with their natural water sources protects against flooding and storm surges. Proceeding apace, these lawsuits could present a potential funding mechanism for NCS. Nevertheless, the costs of such natural adaptation measures must be clearly delineated if such measures are to gain attention at the remedy stage of adaptation litigation. The Framework is necessary to earmark such natural adaptation measures in a manner that will be recognizable to the courts.

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130. *See, e.g.*, Complaint at 2, Cnty. of Multnomah v. Exxon Mobil Corp., (Or. Cir. Ct. 2023) (No. 23CV25164) (asserting common-law claims to seek damages for fossil-fuel companies' "scheme to rapaciously sell fossil-fuel products and deceptively promote them as harmless to the environment, while they knew that carbon pollution emitted by their products into the atmosphere would likely cause deadly extreme heat events like that which devastated Multnomah County . . .") [hereinafter Multnomah County Complaint].

131. *See* Jonathan Adler, *D.C. Circuit Rejects Oil Company Attempt to Remove District's Climate Suit to Federal Court*, REASON (Dec. 19, 2023), https://reason.com/volokh/2023/12/19/d-c-circuit-rejects-oil-company-attempt-to-remove-districts-climate-suit-to-federal-court/ (reporting on the decision in *District of Columbia v. Exxon Mobil Corporation* to remand the case back to the state court system and allow it to proceed there under state and common-law causes of action).

132. *See* Multnomah County Complaint, *supra* note 130, at 174; Rebecca Picciotto, *California Suit Against Chevron, Exxon, Shell, Others, Alleges Public Deception on Climate Change*, CNBC (Sept. 18, 2023), https://www.cnbc.com/2023/09/18/california-sues-chevron-exxon-oil-giants-on-climate-change-deception.html.

133. Multnomah County Complaint, *supra* note 130, at 174.

Even apart from contemplated atmospheric NRD suits and adaptation lawsuits that may yield NCS financing, many other environmental suits often settle for large sums of penalty money that is then put into various environmental-mitigation funds.[134] Such funds may support a variety of environmental projects,[135] and presumably, such pollution settlements can direct funds toward financing atmospheric cleanup. This would be most suitable where opportunity mapping (developed in the Framework described below) shows a co-benefit from the drawdown project to the damaged environmental resource. For example, a defendant corporation settling a case for river pollution may agree to dedicate the settlement money to a forest-carbon project that also improves water quality in the river basin.

In sum, multiple avenues exist for funding the Framework. Some are well established, while others involve litigation that has not yet been brought. Funders may include defendants in climate or other pollution litigation, philanthropic organizations, or government agencies with funding programs. Once a Regional Framework is in place, it is expected to draw some funding streams to atmospheric cleanup that would otherwise go elsewhere.

3. The Sky Trust

The regional project of atmospheric drawdown requires an administrative structure to accept funds, solicit projects, create eligibility requirements, dispense the funding, and supervise the completion of work. A third gear envisions a funding entity (or regional Sky Trust) that undertakes these functions and essentially serves as the institutional broker for landscape NCS projects under the Framework. Many landowners and organizations seeking to participate in carbon sequestration describe a barrier of cumbersome and fragmented funding processes.[136] The regional Sky Trust would aggregate funders, facilitate landowner participation, and help match

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134. These suits may arise, for example, under citizen suit provisions of pollution statutes like the Clean Air Act and Clean Water Act. *See, e.g.*, *Enforce the Law*, COLUMBIA RIVER KEEPER, https://www.columbiariverkeeper.org/stopping-pollution/law (last visited Mar. 29, 2024) ("As part of the lawsuit settlement, the penalty funds support projects by other organizations that benefit water quality.").

135. *See Puget Sound Stewardship & Mitigation Fund*, ROSE FOUND., https://rosefdn.org/puget-sound-stewardship-mitigation-fund/ (last visited Mar. 29, 2024) (reporting that funds gained from environmental litigation are used to support projects relating to "conservation, restoration, citizen science, environmental justice, shoreline access, and environmental education.").

136. *See generally* Puskar N. Khanal et al., *Obstacles to Participation in Carbon Sequestration for Nonindustrial Private Forest Landowners in the Southern United States*: *A Diffusion of Innovations Perspective*, 100 FOREST POL'Y & ECON. 95 (2019) (identifying through survey the major obstacles forest landowners face when attempting to participate in carbon sequestration market programs); *see also* Melissa Kreye & Calvin Norman, *What Is Selling Forest Carbon Like? Three Landowners' Experiences*, PENN STATE EXTENSION (2021), https://extension.psu.edu/what-is-selling-forest-carbon-like-three-landowners-experiences (describing case studies of landowners considering and navigating different forest carbon sequestration market programs and the hurdles they sometimes encountered).

projects with financial opportunities to accelerate and scale up regional sequestration. Where sponsoring organizations, such as land trusts or tribes, exist for projects, the Sky Trust may provide partnership capacity to carry out carbon sequestration. The Sky Trust may be an existing or newly created institution, but it must have the administrative capability and organizational competence to handle funds; approve or co-design projects; enter into contracts with landowners; negotiate the necessary conservation easements or covenants (to provide durability of sequestered carbon); administratively supervise completion of NCS projects; carry out monitoring; and seek third-party verification of key project components.

Several national models exist for a restoration-focused trust, including four discussed below that were established and supervised by courts. These judicially established trusts may have aspects that will prove instructive for disbursing the abatement funds sought by plaintiff sovereigns or sub-sovereigns in current litigation against fossil-fuel defendants. In litigation arising from the illegal installation of faulty emissions controls on automobiles, defendant Volkswagen AG, Inc. (VW) and the U.S. Department of Justice entered into a multistage, multi-billion dollar settlement to mitigate the tons of NO_x pollution caused by VW's alleged wrongdoing.[137] The court ordered VW to pay $2.9 billion into an Environmental Mitigation Trust and appointed an independent trustee to administer the funds to finance projects across states, territories, and Indian reservations based on the number of affected vehicles sold in their jurisdictions.[138] Another model emerges from the BP oil spill, which discharged millions of barrels of oil into the Gulf of Mexico across an area larger than the State of Idaho.[139] As part of a $20-billion settlement with the U.S. Department of Justice, BP paid $7.1 billion to the Deepwater Horizon Oil Spill NRD Fund.[140] The Department of the Interior manages this fund for the joint purpose of cleaning up oil and restoring natural resources in the

137. *Volkswagen Clean Air Act Civil Settlement*, EPA, https://www.epa.gov/enforcement/volkswagen-clean-air-act-civil-settlement (Jan. 23, 2024).

138. *Id.*; *Volkswagen (VW) Settlement: DERA Option*, EPA, https://www.epa.gov/dera/volkswagen-vw-settlement-dera-option (Apr. 28, 2023); Jim Motavalli, *How VW's Diesel Settlement is Changing Fleets, From Schools to Seaports,* N.Y. TIMES (Sept. 22, 2021), https://www.nytimes.com/2020/11/05/business/vw-diesel-settlement-states.html.

139. *See U.S. and Five Gulf States Reach Historic Settlement with BP to Resolve Civil Lawsuit Over Deepwater Horizon Oil Spill*, U.S. DEP'T OF JUST. (Oct. 5, 2015), https://www.justice.gov/opa/pr/us-and-five-gulf-states-reach-historic-settlement-bp-resolve-civil-lawsuit-over-deepwater (describing the $20.8 billion settlement between the U.S. Department of Justice and B.P. for damages caused by an oil spill of "more than three million barrels of oil into the Gulf of Mexico . . . extend[ing] across more than 43,000 square miles").

140. *Id.*

jurisdictions of five Gulf state trustees.[141] A third model comes from litigation brought by the State of California and several counties against lead-paint manufacturers that resulted in a $305 million settlement.[142] The court ordered funds to be used to remove lead paint from affected homes under a four-year program supervised by the state of California and those counties.[143] A final model arises from litigation that ensued after a pipeline explosion in Bellingham, Washington killed three young boys in 1999.[144] At the behest of the boys' families and local leaders, the presiding federal district-court judge directed $4 million in criminal fines to endow a new Pipeline Safety Trust, a non-profit organization created to promote pipeline safety through research, outreach, education, and advocacy.[145]

While these four examples derive from litigation settlements, a Sky Trust could also be created by sovereigns or even non-profit groups. Regardless of its origin, the Sky Trust must display efficiency, credibility, and scrupulous transparency to justify confidence on the part of private funders, courts, and the public in the Trust as the primary apparatus for implementing the drawdown vision in the region for the century (or longer) it will take to regain balance of the planet's climate system. Moreover, in a departure from traditional failed models of environmental decision-making, the Trust should have a representative of the future dedicated to assessing the impact of today's decisions on both young people and future generations.[146]

B. Not an Offset Program

A Regional Framework for Atmospheric Recovery guides active land management to maximize the region's contribution towards drawdown of legacy carbon, which will be necessary to return atmospheric concentrations to below 350 ppm and thereby regain climate stability. To be clear, this is not an offset program but rather a sky cleanup program. Many governments and businesses worldwide now use NCS techniques as "offsets," which are arrangements to finance carbon-sequestration projects anywhere in the world

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141. *Deepwater Horizon Oil Spill Settlements: Where the Money Went*, NOAA, https://www.noaa.gov/explainers/deepwater-horizon-oil-spill-settlements-where-money-went (Apr. 20, 2017).

142. Joshua Schneyer, *Paint Makers Reach $305 Million, Settlement in California, Ending Marathon Lead Poisoning Lawsuit*, REUTERS (July 17, 2019), https://www.reuters.com/article/us-usa-lead-settlement/paint-makers-reach-305-million-settlement-in-california-ending-marathon-lead-poisoning-lawsuit-idUSKCN1UC26J.

143. *Id.*

144. Mike Carter, *Families Settle for $75 Million in Bellingham Pipeline Explosion*, SEATTLE TIMES (Apr. 10, 2002), https://archive.seattletimes.com/archive/?date=20020410&slug=webolympic10.

145. *See Pipeline Safety Trust History*, PIPELINE SAFETY TR., https://pstrust.org/about/history-of-the-pipeline-safety-trust/ (last visited Mar. 29, 2024).

146. *See* ROMAN KRZNARIC, THE GOOD ANCESTOR 238 (2020) (stating that there is "an absence of institutional mechanisms that give voice to the interests of tomorrow's generations").

to justify continued fossil-fuel pollution at an altogether different location—in other words, a "pay to pollute" approach.[147] The theory is that the forest or farm will draw down and absorb an amount of carbon equivalent to that emitted as part of the offset. Indeed, many scientists and organizations have promoted NCS as a way to meet emissions-reduction goals.[148]

Some programs are voluntary, whereby corporations entice customers into purchasing offsets to justify the carbon emissions embedded in their purchase, as is the case with airline offsets.[149] Other offsets are tied into government pollution programs, wherein a polluter can continue emitting greenhouse gases if it purchases carbon credits from an approved land-sequestration program—these are compliance-based offsets.[150] California, for example, has a "cap-and-trade" program that uses carbon offsets.[151] In either case, the offset justifies further pollution purportedly through drawing down and sequestering carbon dioxide elsewhere. The simple fact is that NCS techniques can be used either to offset further pollution or to clean up legacy pollution in the sky, but not both: the atmosphere does not allow for double-counting. The land processes used to remove carbon are the same for both offsets and drawdowns, but the aim is vastly different. Offsets remain profoundly misguided as a climate strategy and have come under heavy criticism for multiple reasons.[152]

First and most fundamentally, offsets simply make the climate problem worse—legalizing or legitimizing continued pollution—without making any dent in the legacy pollution that continues to destabilize the climate system. By allowing business-as-usual fossil-fuel pollution to continue, offsets

147. *See, e.g.*, Robin Pomeroy, *Carbon Offsets – How Do They Work, and Who Sets the Rules?*, WORLD ECON. F. (Sept. 2, 2022), https://www.weforum.org/agenda/2022/09/carbon-offsets-radio-davos/ (questioning the dubious premise of some assertions of carbon neutrality through offsets).

148. Griscom et al., *supra* note 24, at 11645–46.

149. *See Mandatory and Voluntary Offset Markets*, CARBON OFFSET GUIDE, https://www.offsetguide.org/understanding-carbon-offsets/carbon-offset-programs/mandatory-voluntary-offset-markets/ (last visited Mar. 29, 2024) (explaining voluntary offsets used by industries like air travel, which entice customers to purchase them in the name of reducing carbon emissions).

150. *See Compliance Offset Programs*, CARBON OFFSET GUIDE, https://www.offsetguide.org/understanding-carbon-offsets/carbon-offset-programs/compliance-offset-programs/ (last visited Mar. 29, 2024) (defining compliance-based offsets).

151. *See* Lisa Song & James Temple, *Lawmakers Question California Cap and Trade Policies, Citing ProPublica Report*, PROPUBLICA (Aug. 20, 2021), https://www.propublica.org/article/lawmakers-question-california-cap-and-trade-policies-citing-propublica-report (explaining that the California program is under review after receiving enormous criticism for a failed offset policy).

152. *See, e.g.*, Patrick Greenfield, *Rainforest Carbon Credit Schemes Misleading and Ineffective Finds Report*, GUARDIAN (Sept. 15, 2023), https://www.theguardian.com/environment/2023/sep/15/rainforest-carbon-credit-schemes-misleading-and-ineffective-finds-report (referring to the offset schemes that took place in the Amazon Rainforest); Heidi Blake, *The Great Cash-for-Carbon Hustle*, NEW YORKER (Oct. 16, 2023), https://www.newyorker.com/magazine/2023/10/23/the-great-cash-for-carbon-hustle (elaborating on how carbon offset initiatives in their current form are misguided attempts at curtailing carbon emissions).

prolong the necessary transition toward a renewable-energy economy and undermine the rank urgency of decarbonization.[153] Leading climate scientists recently warned that the world has only six years of emissions left in the carbon budget before dangerous temperatures above 1.5 degrees Celsius are essentially locked in.[154]

Second, as a regulatory tool used to justify and legalize carbon pollution, land-based offsets are deeply flawed because they fail to achieve direct-carbon compensation for the ongoing pollution. Unlike *direct emissions offsets* achieved through actual averted pollution—where the pollution allowed in one place can be calibrated to be equal to or less than the pollution avoided in another place—there is no equal and concurrent carbon refund accomplished through land-based processes. The quantification of carbon sequestered from land-based processes is simply too indeterminate.[155] There is also a fundamental mismatch in terms of timing. A source's contributions to atmospheric pollution are immediate and certain, but drawing down the same amount of carbon through land-based measures elsewhere is comparatively quite slow, taking years, decades, or centuries.[156] During this time lag, the buildup of atmospheric carbon dioxide pushes the planet and Humanity closer to irreversible tipping points that could trigger runaway heating.

Third, during that same time lag, terrestrial systems may degrade from the planetary heating already underway, a dynamic that can hinder the effectiveness of certain land-based processes that were relied upon to justify further pollution. Trees may burn, soils may lose the capacity to support microorganisms necessary to sequester carbon, and grasses may perish in drought. While these processes will undermine the effort of sky cleanup as well, the difference, of course, is that offsets send further pollution to the sky. Put differently, even as offsets rely on NCS, they make the NCS strategy more precarious over the long term.

Fourth, the sequestration of additional carbon pollution is not permanent. The soils, trees, and vegetation will slowly release the carbon back into the

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153. *See generally* Christa M. Anderson et al., *Natural Climate Solutions Are Not Enough*, 363 SCIENCE 933, 933–34 (2019), https://www.science.org/doi/10.1126/science.aaw2741 (explaining that natural climate solutions alone are insufficient to avert climate disaster).

154. Chris Smith & Robin Lamboll, *Carbon Budget for 1.5°C Will Run Out in Six Years at Current Emissions Levels, Says New Research*, PHYS.ORG (Oct. 31, 2023), https://phys.org/news/2023-10-carbon-15c-years-current-emissions.html.

155. Quantification is a challenge in sky cleanup strategies as well, as some funders may need to see quantified progress in carbon storage, but the margin of error in this context does not carry the stakes it does in the offset context because land management is not used as a justification to add to the sky's pollution load.

156. *See* Anderson et al., *supra* note 153 ("Every hectare of forest that is cleared generates a carbon debt that requires decades to centuries for repayment."); Baldocchi & Penuelas, *supra* note 40, at 1195 (explaining that carbon sequestration is a slow process).

sky over time. Thus, while regenerative processes form a needed and urgent measure to draw down legacy carbon and sequester it for the next several decades as these processes begin to reclaim Nature's carbon cycle, they do not permanently remove ongoing pollution entering the atmosphere on the tails of offset schemes.

Fifth, the administrative mechanisms of verifying the land-based sequestration and assuring "additionality" (that is, additional carbon sequestered as a result of the measure)[157] remain highly questionable, if they even exist at all.[158] Recent research suggests that some major offset programs have, when actually monitored, failed to yield additional benefits over what would otherwise have occurred.[159] The entire California cap-and-trade regulatory program is widely criticized as resting on a "faulty offset program."[160] A *New Yorker* investigative inquiry into carbon-offset schemes revealed the minimal government oversight, lack of transparency, inflated benefits, unaccounted-for funds, and failed promises that often plague such schemes.[161] Many leading scientists have expressed justifiable skepticism at the use of soil-based measures to offset further carbon-dioxide pollution,[162]

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157. *See Additionality*, CARBON OFFSET GUIDE, https://www.offsetguide.org/high-quality-offsets/additionality (last visited Apr. 29, 2024) (explaining that "additionality" only credits land managers for GHG reductions that would not have occurred in the absence of a carbon market, which complicates the verification process and limits compensation for practices that are actively sequestering carbon).

158. *See* Lisa Song & James Temple, *The Climate Solution Actually Adding Millions of Tons of CO2 into the Atmosphere*, PROPUBLICA (Apr. 29, 2021), https://www.propublica.org/article/the-climate-solution-actually-adding-millions-of-tons-of-co2-into
-the-atmosphere (questioning the existence of administrative mechanisms verifying the additionality of carbon sequestration); *see also* Shane R. Coffield et al., *Using Remote Sensing to Quantify the Additional Climate Benefits of California Forest Carbon Offset Projects*, 28 GLOB. CHANGE BIOLOGY 6789, 6790 (2022) (examining additionality from California's cap-and-trade program). Some question whether carbon-offset financing has even implemented the projects it promised. *See* Patrick Greenfield & Nyasha Chingono, *'We Don't Know Where the Money is Going': The 'Carbon Cowboys' Making Millions from Credit Schemes*, GUARDIAN (Mar. 15, 2024), https://www.theguardian.com/environment/2024/mar/15/money-carbon-credits-zimbabwe-conservation-aoe.

159. *See* Coffield et al., *supra* note 158 at 6790 (examining California's cap-and-trade program); Blake, *supra* note 152 ("[I]t is extraordinarily difficult to quantify how much carbon these schemes really save. . . . There are also issues of "leakage": even if the agents of deforestation are driven out of one area, they may cut down trees someplace else. . . . Twenty years after Applied Energy Services funded the Guatemalan tree-planting project, researchers found that it had largely failed.").

160. Jonah Valdez, *Is California's Cap-And-Trade Program Hurting the Environment More than Helping It?*, L.A. TIMES (Mar. 22, 2022), https://www.latimes.com/california/story/2022-03-22/what-has-california-cap-and-trade-accomplished.

161. Blake, *supra* note 152.

162. *SNAPP Team: Managing Soil Organic Carbon*, SCI. FOR NATURE & PEOPLE P'SHIP, https://snappartnership.net/teams/managing-soil-organic-carbon/ (last visited Mar. 29, 2024); *see also* Beverly E. Law et al., *Strategic Forest Reserves Can Protect Biodiversity in the Western United States and Mitigate Climate Change*, COMMC'NS EARTH & ENV'T, Dec. 14, 2021, at 1, 7, https://www.nature.com/articles/s43247-021-00326-0 ("Forest carbon accumulation should not be considered as an offset that allows additional fossil fuels to be burned.").

and some have suggested that these measures simply amount to shameful greenwashing without any net benefit to the planet.[163]

Sixth, justice issues pervade these offset schemes, particularly in areas inhabited by Indigenous people who rely heavily on the lands and resources.[164] The big-money carbon deals all too often transpire without any involvement of the local population and may seriously damage the people's survival resources or their access to them.[165] Displacement and exploitation of Native people mark the methods of some notorious carbon-trading firms, and in the Amazon region, some view the firms as "carbon pirates" that prey on the local Indigenous communities.[166]

And finally, land-based offset schemes will compete with and undermine sky cleanup by monopolizing key lands capable of sequestering carbon dioxide.[167] Dedicating a land parcel to an offset scheme precludes it from being an engine of sky cleanup because its carbon sequestration cannot be double-counted. As previously explained, the cleanup of legacy carbon remains vital to regaining climate stability. Securing meaningful drawdown levels requires total, uncompromised maximization of all ethically available land areas.[168] But offset schemes increasingly lock up huge swaths of forestlands and other ecotypes for the purpose of allowing further pollution. Recently, for example, a firm paid $1.8 billion to put 1.7 million acres of

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163. *See, e.g.*, KIRTANA CHANDRASEKARAN ET AL., FRIENDS OF THE EARTH INT'L, NATURE BASED SOLUTIONS: A WOLF IN SHEEP'S CLOTHING 3 (2021), https://www.foei.org/wp-content/uploads/2021/11/Nature-based-solutions_a-wolf-in-sheeps-clothing.pdf ("[B]eneath the veneer[,] NBS is firmly based in carbon and nature neo-colonialism, discredited market mechanisms and corporate greenwashing. NBS instrumentalizes nature as a so-called solution without defining who created the problem."); Pomeroy, *supra* note 147.

164. *See* India Bourke, *"A Further Act of Colonisation": Why Indigenous Peoples Fear Carbon Offsetting*, NEW STATESMEN, https://www.newstatesman.com/spotlight/sustainability/climate/2021/11/a-further-act-of-colonisation-why-indigenous-peoples-fear-carbon-offsetting (Oct. 24, 2022) (discussing prevalent environmental justice issues embedded in carbon cap-and-trade programs that often exploit Indigenous communities: "Planting new forests requires land, as does flooding valleys for new hydro-power projects. And those already living and using that land fear that scaled-up 'land-grabs' will put the security of their livelihoods and cultures at risk.").

165. *New Analysis Reveals Risks of Investment in Carbon Offsets Without Community Rights*, RTS. & RES. INITIATIVE (Feb. 6, 2021), https://rightsandresources.org/blog/new-analysis-reveals-risks-of-investment-in-carbon-offsets-without-community-rights/.

166. *See* Patrick Greenfield, *The 'Carbon Pirates' Prey on Amazon's Indigenous Communities*, GUARDIAN (Jan. 21, 2023), https://www.theguardian.com/environment/2023/jan/21/amazon-indigenous-communities-carbon-offsetting-pirates-aoe (coining the term "carbon pirates" in reference to firms that exploit Indigenous communities in the Amazon); Patrick Greenfield, *Rainforest Carbon Credit Schemes Misleading and Ineffective Finds Report*, GUARDIAN (Sept. 15, 2023), https://www.theguardian.com/environment/2023/sep/15/rainforest-carbon-credit-schemes-misleading-and-ineffective-finds-report (examining carbon-credit schemes in the Amazon region).

167. *See* Griscom et al., *supra* note 24, at 11646 (estimating the global drawdown potential "constrained by a global land cover scenario with safeguards for meeting increasing human needs for food and fiber").

168. *See* Baldocchi & Penuelas, *supra* note 40, at 1194; *see also* Anderson et al., *supra* note 152, at 933 (explaining the importance of maximizing all ethically available land area).

forest stretched across 17 Eastern states into an offset scheme, effectively removing that forest from the land base that could be dedicated to sky cleanup.[169]

For all of these reasons, a regional Framework must reject any offset application of natural climate solutions. The NCS carbon sequestration accomplished through the regional Framework must be singularly dedicated to sky cleanup.[170] This remains important for another reason: to access a line of funding from the fossil-fuel industry based on its legacy pollution liability for atmospheric NRDs, plaintiff sovereigns must apply any funds gained from successful litigation or settlements to actual sky cleanup, not offsets. In other words, no legal theory of NRDs justifies anything other than restoration of the resource, which offset schemes certainly do not advance.

Despite the foregoing critique, the purely descriptive use of offset terminology to quantify NCS potential may be innocuous as long as sequestration achievements are not tied to a regulatory or market allowance for further emissions. For example, the assertion that NCS techniques can "offset the equivalent of 21% of current net GHG emissions in the United States" may be far more effective as an appeal to policymakers than characterizing NCS potential in terms of metric tons of carbon sequestration. The latter terminology remains meaningless to many if not expressed as a milestone towards an overall goal. Importantly, however, the characterization cannot be taken too far. Increasingly, governments use a "net zero" concept to justify further emissions on the illusory basis that emissions will be drawn down and sequestered through natural climate solutions.[171] As emphasized at the outset, emissions must be entirely phased out, *and* the legacy carbon must be drawn down and sequestered as part of a sky cleanup. The concept of "net zero" ignores the reality that Humanity needs both full decarbonization and legacy-carbon cleanup. A climate-true approach would limit offsets to *direct emissions offsets* from a comparable emissions source, using strategies involving electric vehicles, solar panels, windmills, or other energy and transportation measures.

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169. *See* Ryan Dezember, *Wall Street Firm Makes a $1.8 Billion Bet on Forest Carbon Offsets*, WALL ST. J. (Nov. 2, 2022), https://www.wsj.com/articles/wall-street-firm-makes-a-1-8-billion-bet-on-forest-carbon-offset-11667390624 [https://perma.cc/P9WG-TW23].

170. In theory, markets and regulatory schemes offering offsets could continue to operate if, moving forward, they entirely decoupled the land-based carbon sequestration they offer from future emissions and dedicated their purpose and accounting to legacy carbon cleanup. Climate Liable Parties responsible for atmospheric-carbon cleanup could engage such entities to begin to diminish their cleanup liability. They could not at the same time, however, justify ongoing or future emissions through NCS sequestration.

171. *See* Robert Watt, *Carbon Offsets Offer a Fantasy of Capitalism Without Crises*, CONVERSATION (Mar. 12, 2021), https://theconversation.com/carbon-offsets-offer-a-fantasy-of-capitalism-without-crises-155730; U.S. DEP'T OF STATE, THE LONG-TERM STRATEGY OF THE UNITED STATES: PATHWAYS TO NET-ZERO GREENHOUSE GAS EMISSIONS BY 2050, at 3 (2021), https://www.whitehouse.gov/wp-content/uploads/2021/10/US-Long-Term-Strategy.pdf.

Offset markets using NCS have proliferated around the globe, recruiting enormous amounts of land. While this offset movement lacks coherence and overall accountability, it is nevertheless true that offset-market entities remain significant players in international climate policy.[172] Some organizations have pioneered effective ways of reaching out to communities and structuring projects, even where the basis of the carbon-offset market as a climate strategy is fundamentally unsound.[173] While the offset policy outbreak may be facing its twilight due to widespread criticism, market players may devise ways of switching the purpose of future NCS projects to gear them to sky cleanup rather than sky pollution. That initiative would productively steer the expertise and techniques used in the carbon markets toward actual atmospheric recovery.[174]

III. FUNCTION AND COMPONENTS OF REGIONAL FRAMEWORKS FOR ATMOSPHERIC RECOVERY (FARS)

An organizing framework for atmospheric recovery (FAR) across a sovereign bioregion requires several components, each informed by a convergence of scientific, land-management, legal, and leadership expertise. A regional FAR must draw on transdisciplinary teams that can match the needs of tribes, private landowners, industry, and rural communities with the knowledge that guides carbon sequestration. In doing so, the FAR serves multiple functions and overcomes identified barriers to NCS implementation[175]—particularly if it becomes a living, iterative, web-based resource that moves through time with the communities it serves. Section III(A) describes the functions of Regional Frameworks; Section III(B) explores the role of Native leadership and knowledge in this modern paradigm of regional land recovery; and Section III(C) inventories the components of the Regional Frameworks.

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172. *See generally* Robert Watt, *The Fantasy of Carbon Offsetting*, 30 ENV'T POL'Y 1069 (2021) (explaining why carbon offsetting is an illusory solution for carbon emissions); *What Are Carbon Markets and Why Are They Important?*, UNDP (May 18, 2022), https://climatepromise.undp.org/news-and-stories/what-are-carbon-markets-and-why-are-they-important; *see also* Watt, *supra* note 171 (explaining that grave uncertainties exist in the accounting process for carbon offsets).

173. *See, e.g.*, *Carbon Markets: Helping Ranchers Profit While Improving Soil Health*, W. SUSTAINABILITY EXCHANGE, https://westernsustainabilityexchange.org/carbon-markets/ (last visited Mar. 30, 2024) (explaining Western Sustainability Exchange's work with ranchers on carbon sequestration).

174. Some lands presently sequestering for offset purposes could perhaps be rededicated to the drawdown of future emissions under complicated transactional and funding scenarios beyond the scope of this Article.

175. Pathek et al., *supra* note 121, at 108 ("The economic and political feasibility of implementing [NCS measures] is hampered by persistent barriers.").

A. Functions of Regional Frameworks

Regional Frameworks could serve as crucial catalysts for region-wide NCS and ecosystem recovery. They first establish a regional vision for drawdown measures and announce the opportunity to land managers, aiming to jumpstart an epic project. By creating a platform of knowledge, the Frameworks open a forum in which to draw critical input from tribal leadership and Indigenous knowledge, as discussed more in Section III(B). Second, using an implementation blueprint that delves into the actual impediments to NCS adoption, the Frameworks can help actualize and accelerate drawdown. Third, by pairing biodiversity goals with climate-recovery goals, the Frameworks can advance solutions to both crises simultaneously. Fourth, the Frameworks can motivate and propel programs for sequestration that are not tied to offsets, directing land commitments towards atmospheric cleanup rather than promoting further carbon pollution—as offsets invariably do. Fifth, by aggregating NCS efforts, the Frameworks can collect the varied experiential lessons that will evolve on the ground from multiple dispersed, synchronous projects. The Framework is the conceptual hub that draws those efforts together and collects their forms of synergy (biological, economic, cultural, and political) into a forward-moving enterprise. Communications experts can harvest the projects' results and benefits and interpret them back into the Framework, thereby building regional momentum. Projects will inevitably generate costs and mistakes as well, and those can become the platform for adaptive management and innovation. Sixth, the Framework can become a model for other regions worldwide, thereby proliferating the drawdown effort well beyond one region.

Finally, the Framework may open major funding avenues for NCS. One such avenue is through court-awarded atmospheric natural-resource damages from carbon majors who are responsible and potentially liable for the legacy carbon in the atmosphere. If regional sovereigns (tribes, states, and counties) sue carbon majors based on their proportionate liability for pollution,[176] courts can turn to the Framework to award a monetary remedy tied to the region's share of atmospheric cleanup. In other fossil-fuel litigation seeking

176. Multiple suits against fossil-fuel companies for damages are pending but seek remedies related to adaptation financing. *See* Parenteau & Dernbach, *supra* note 125. The liability of these companies is generally premised on theories of public nuisance. The proportionate contribution of each company to the overall legacy carbon has been established and would be applied in atmospheric NRD litigation. *See* discussion *supra* Section II(A)(2). If a company is responsible for X GtC of legacy carbon in the atmosphere and finances cleanup under the Framework, the carbon removed becomes a subtractable amount from the company's remaining liability. In an open-use legal domain, such company liabilities can be accounted for over time as they diminish, even as they are applied to multiple regional endeavors.

adaptation costs, the Framework can identify NCS measures with adaptation benefits. Other potential sources of funding include government and philanthropic funds, a carbon tax, or new bonds. In many of these contexts, the funding entity or court seeks to know how much carbon sequestration will be accomplished through the funding. A Framework can quantify the projected carbon drawdown correlating to projects or practices that implement the protocols in various sectors. Moreover, these protocols can provide a gold standard for practices that are tailored to the locality and therefore serve a validating function.

B. Seeing the Future with Two Eyes: Incorporating Native Sovereignty and Indigenous Wisdom

At this time of climate emergency and biodiversity crisis, it is hard not to juxtapose the Indigenous management of ecological systems for millennia with the abrupt, relentless eradication of Nature accomplished by the state and federal governments in just two centuries.[177] The insatiable economic model of capitalism and the Western cultural approach of conquering and exploiting land and natural bounty—and then studying the disastrous consequences without actually mustering the political will to reverse ecological losses and recover functioning systems—stands in stark contrast with Native models and cultural approaches that have sustained innumerable human societies on every continent since time immemorial. At this juncture, incorporating tribal wisdom and management structures into the regional enterprise of recovering natural systems to bring the carbon cycle back into balance is imperative. A leading report on Blue Carbon in Canada underscored this need:

> For millennia, Indigenous Peoples have cultivated respectful relationships with their lands and waters. Indigenous Peoples' legal, governance, and knowledge systems have contributed to successful environmental stewardship practices in Canada and around the world. Indeed, these long-standing practices have often shaped the blue carbon ecosystems that scientists, conservationists[,] and governments increasingly wish to manage and protect. Because of

177. *See* Mary Christina Wood, *The Politics of Abundance: Towards a Future of Tribal-State Relations*, 83 OR. L. REV. 1331, 1335 (2004) [hereinafter Wood, *Politics of Abundance*] (comparing, in the context of Columbia River salmon management, the "politics of abundance" as practiced by tribal leaders with the "politics of scarcity" as practiced by federal and state fisheries managers).

> this long-standing expertise that is rooted in place, Indigenous Peoples are well positioned to lead blue carbon conservation.[178]

Indeed, as the Report warns, without the participation of tribal governments or representatives, NCS initiatives risk dispossessing Native people of their lands and resources or limiting their access to vital areas—in essence, spreading "climate colonialism."

Beyond that, Western society desperately needs to learn a holistic and compatible approach to living on the land. The land-recovery imperative is so pervasive and urgent that it cannot be accomplished by adhering to the same legal, social, and economic structures that abused Nature. Perhaps nothing short of a cultural sea change can inspire the necessary ecological recovery worldwide to save Humanity and other species. The eminent Native legal scholar Rennard Strickland once said that "[i]f there is to be a post-Columbian future—a future for any of us—it will be an Indian future . . . a world in which this time, . . . the superior worldview . . . might even hope to compete with, if not triumph over, technology."[179]

Standing alone, NCS initiatives may further commodify the natural world, never getting at the cultural root of the environmental crisis.[180] The ancient teachings of Indigenous communities emphasize the duty to other living creatures as animate beings—relatives—as well as the steadfast duty to future generations.[181] As the Canadian Blue Carbon Report states, "NCS can be enhanced by Indigenous worldviews that emphasize reciprocity and relationships between people and ecosystems. This framing is different from the market-based approaches to climate-change mitigation typical of NCS."[182] The Report notes the distinction between NCS as practiced by non-Native entities and individuals, which often revolves around jurisdictional and economic considerations, with Indigenous-led conservation efforts:

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178. Kelly B. Currie et al., COASTAL BLUE CARBON IN CANADA: STATE OF KNOWLEDGE 23 (2023), https://wwf.ca/wp-content/uploads/2023/06/BlueCarbon_StateofKnowledge_Report.pdf [hereinafter COASTAL BLUE CARBON].

179. Rennard Strickland, *Tonto's Revenge: Reflections on American Indian Culture and Policy*, 23 AM. INDIAN CULTURE & RSCH. J. 130 (1999).

180. For a leading essay contrasting "industrial thinking" with "Indigenous thinking," *see* Winona LaDuke, *Voices from White Earth: Gaa-Waabaabiganikaag* (1993), https://centerforneweconomics.org/publications/voices-from-white-earth-gaa-waabaabiganikaag/ ("Industrial language has changed things from being animate, alive, and having spirit to being inanimate, mere objects, and commodities of society. When things are inanimate, 'man' can view them as his God-given right. He can take them, commodify them, and manipulate them in society.").

181. *See* COASTAL BLUE CARBON, *supra* note 178 ("Blue carbon exists in animate ecosystems in the territories of coastal Indigenous Peoples.").

182. *Id.* at 22; *see also How We Work with Carbon Markets*, THE NATURE CONSERVANCY, https://www.nature.org/en-us/what-we-do/our-priorities/tackle-climate-change/climate-change-stories/carbon-market-credits-offsets/ (last visited Mar. 30, 2024) (explaining the approach for working in carbon markets).

> Indigenous-led conservation offers insight into how to care for blue carbon and coastal ecosystems in ways that honor the interconnections of the land, the sea[,] and the people who live there. [T]he tendency to treat Indigenous knowledge as supplemental to western environmental management approaches can miss the deeper understandings, values[,] and contexts inherent in Indigenous knowledge systems. Missing this bigger picture, proponents of NCS may also miss opportunities to approach blue carbon solutions from a place of collaboration rooted in principles of respect and reciprocity. As Reed *et al.* (2022) suggest, it is essential "not only to advance the self-determination of Indigenous Peoples, but also *to create the ceremonial ground for Indigenous visions of nature-based solutions*."[183]

This ceremonial ground of recovery is missing in Western culture. Promises of ecological recovery remain unrooted in cultural and spiritual imperatives, causing political leaders to indulge powerful business interests at the expense of fellow species and future generations. This perpetuates a Western "politics of scarcity" with respect to resource management.[184] This contrasts with the Native philosophy around resource management described by traditional tribal leaders:

> [T]he trust responsibility towards future generations is heartfelt. Restraint is created not by a written code, but by a culture of reverence towards Nature, reinforced by natural law—a spiritual set of laws—expressed in ceremonies. Ceremonies continually affirm a connection with Nature, with ancestors, and with future generations, and they fortify the *will* to make good on those connections. Tribal elders and leaders go out to the rivers, where they sing and pray for the return of the salmon just as their ancestors did. There is *will* created in that act to preserve this marvelous species, and there is a turning away from indulgence that satisfies only the present generation. Ceremonies engrain the wisdom of self-restraint that keeps guiding leaders towards the politics of abundance. That wisdom shapes the Native art of governance in natural resources law.[185]

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183. COASTAL BLUE CARBON, *supra* note 178, at 24–25 (emphasis added).

184. Wood, *Politics of Abundance*, *supra* note 177, at 1344 ("Every devastated watershed, every new mile of sprawl, and every new clearcut reflects excessive indulgence. This is a very deep failure in government, and its effects will be felt by every citizen living today and tomorrow.").

185. *Id.* at 1345.

The regional NCS endeavor presents a historic opportunity for cultural exchange and infusion of tribal wisdom into Western land-management conversations and decision-making. The possibility is captured by a term coined by Elder Albert Marshall of the Mi'kmaq, an Indigenous First Nations people of Canada. He offers "Two-Eyed Seeing" to invite a "collaborative, integrative approach of 'knowledge creation, mobilization and translation":[186]

> Two-eyed seeing refers to learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of western knowledges and ways of knowing—and learning to use both of these eyes together for the benefit of all.[187]

In some (or perhaps most) regions, strong tribal institutions exist to bring "two-eyed seeing" into NCS opportunities. Many tribal agencies have emerged in response to the need to recover populations of treaty-protected fish and wildlife species decimated by industrialization. By necessity, all these tribal sovereigns and their agencies now engage in climate work and are able to synergize NCS approaches with their other goals to promote species recovery, strengthen cultural practices, and provide for their people. In the Pacific Northwest, for example, the Columbia Inter-Tribal Fish Commission (CRITFC) represents the four major treaty-fishing tribes of the Columbia River Basin and co-leads fish recovery throughout the Basin. For decades, CRITFC has presented a model of regional ecological leadership, devising and promoting an ambitious and visionary region-wide plan to recover the salmon to historical abundance levels, while protecting these tribes' sacred right to fish.[188] In the Puget Sound area, the Northwest Indian Fisheries Commission plays a similar role, as does the Great Lakes Indian Fish and Wildlife Commission in the Northeast and Midwest. On a national level, the National Indian Carbon Coalition was created to develop tribal carbon-sequestration projects.[189]

A Regional Framework for Atmospheric Recovery offers a singular opportunity to bring tribal leadership and perspectives into the collaborative process of envisioning land restoration and carbon sequestration. As a non-

186. COASTAL BLUE CARBON, *supra* note 178, at 35.

187. *Id.* at 49.

188. Wood, *Politics of Abundance*, *supra* note 177, at 1342.

189. *See Economic Opportunity: Carbon, Climate and Indian Country*, NAT'L INDIAN CARBON COAL., https://www.indiancarbon.org (last visited Mar. 30, 2024) (showing that NICC offers independent information and technical assistance to tribal nations, communities, and individual members to develop carbon projects).

governmental program, the Framework offers a flexible forum for participation from the outset. Each component of the Framework (described below) will benefit from attention to tribal needs, perspectives, values, and opportunities. In particular, to maximize the "two-eyes" management concept, a focus throughout the FAR should be on developing tribal opportunities for co-management outside of the present tribal land base, as well as prospects for funding significant tribal work aimed towards ecological recovery. As the Canadian Blue Carbon report concludes, "[b]lue carbon initiatives are more likely to be just and effective if we support Indigenous-led initiatives and co-develop new initiatives with Indigenous Nations and communities."[190] The next Section delves into the components of regional FARs.

C. Components of Regional FARs

As noted throughout this Article, a Regional Framework builds a conceptual bridge between NCS opportunity and actual implementation. It announces a new form of social enterprise responsive to the urgency presented by the climate emergency and the biodiversity crisis. Accordingly, the Framework must explore the opportunities and barriers to NCS in a very practical way. It must address the challenge as it unfolds, from the initial vision to the landowner buy-in to the implementation of monitoring and durability tools that will ensure lasting carbon sequestration. While Regional Frameworks will naturally differ, several basic components are cataloged below.

It should be noted that decarbonization, while not the focus of this Article, could well be considered a necessary and integral part of a Regional Framework. The reason is plain: without decarbonization, there will be little or no actual *sky cleanup*—just the maintenance of a highly elevated and dangerous level of atmospheric CO_2. Many analogize the atmosphere to an overflowing bathtub: returning manageable water levels requires both stopping the faucet and unplugging the drain.[191] If the carbon sinks increase their productivity (through NCS), the gains will simply be negated by additional carbon added to the atmosphere. But decarbonization, while a necessary part of cleanup, involves its own complex set of policy, funding, and legal initiatives and falls outside the scope of the present Article.

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190. COASTAL BLUE CARBON, *supra* note 178, at 25.

191. *Bathtub Model*, CARNEGIE MELLON UNIV., https://www.cmu.edu/gelfand/lgc-educational-media/succeed/climate-environment-lesson-plans/bathtub-model.html (Sept. 22, 2013).

1. Regional Restoration Potential and Regional Climate Injury

A Regional Framework must provide an overview to contextualize the restoration enterprise by (1) depicting the region's relative carbon-sequestration opportunities at a macro-level (i.e., juxtaposed against the global carbon cycle); and (2) inventorying the massive harm the region will suffer due to climate disruption. This overview is generally important for funders, as many may be making choices between various regions to support and will consider not only the opportunity for sky cleanup, but also the gravity of present and future harm. These two categories of information are also important for courts presiding over litigation against Carbon Liable Parties, as explained below.

As to the first category of information, the Framework should bring the sky-cleanup effort to a tangible level that courts and funders will understand. The report must clearly explain the Earth's carbon cycle, identify the "engines" of sky cleanup as land-based methods, and delineate the restoration potential of the particular sovereign or sovereigns. Depending on their ecotypes, regions naturally differ in their capabilities for drawdown. Some regions, like the Pacific Northwest, have ancient forests with massive carbon-sequestering trees, while other regions, like the Great Plains, have sprawling prairie lands. Global maps exist to show the restoration capacity associated with various landscape categories, such as forests, wetlands, mangroves, and agricultural soils.[192] From that global overview, scientists can extrapolate the carbon-drawdown potential for a particular region, identifying the existing carbon sinks that must be protected or restored.

The second category of information—summarizing climate damage to the region—is important not only for funders and the public but also for grounding any lawsuit against Carbon Liable Parties. Courts provide remedies only for tangible "harms," and every lawsuit must detail both the harm and potential remedies for that harm. In a climate lawsuit, the claimed regional harm may be sea-level rise, raging reoccurring wildfires, mega-storms, heat domes, parching drought, or any of the above and more. Whether the lawsuit seeks damages for adaptation or atmospheric natural resource damages, courts may look to the Framework as a credible report to connect this regional harm with natural climate solutions that can simultaneously help abate the climate heating (through carbon sequestration) and protect the human population (through adaptation).

192. *See, e.g.*, Jonathan Sanderman et al., *A Global Map of Mangrove Forest Soil Carbon at 30m Spatial Resolution*, ENV'T RSCH. LETTERS, Apr. 30, 2018, at 1, 1, https://iopscience.iop.org/article/10.1088/1748-9326/aabe1c ("The resulting map products from this work are intended to serve nations seeking to include mangrove habitats in payment-for-ecosystem services projects and in designing effective mangrove conservation strategies.").

2. Opportunity Mapping

Maps are a tool to inform, connect, empower, and engage. A Regional Framework can capitalize on the power of mapping and data synthesis to specifically target NCS investments. The Framework should develop a spatially explicit "opportunity map" to announce opportunities for participation in drawdown projects. Databases compiling information related to soil types, vegetative cover, land uses, land ownership, and zoning present basic information for assessing opportunity.[193] At a more detailed and interactive level, this format can incorporate specific protocols and pricing, reflecting the Framework components described below.

Beyond the integral base layer dedicated to carbon-sequestration potential, other map layers can signal targets of opportunity for funders to address the biodiversity crisis and advance a range of co-benefits associated with restoration. Maps of fish and wildlife habitat, flood plains, and water courses exist for most regions.[194] As such, the Framework may draw funders who are primarily interested in drinking water-source protection, wolf recovery, or scenic-lands protection, but who wish to simultaneously advance climate recovery because they recognize that climate stability is a necessary predicate to their primary conservation goal.[195] The opportunity map provides a mechanism responsive to a full array of ecological interests and, in that manner, can attract a broader set of funding opportunities. Because the Framework operates regionally, it may invite organizations to make strategic programmatic investments in landscape restoration rather than invest in an assortment of individual, disconnected projects.[196] Maps of

193. *See* Silva et al., *supra* note 75, at 8, Table 2 (providing "examples of available data sources to be harmonized for opportunity mapping").

194. *See, e.g.*, *Flood Maps*, FEMA, https://www.fema.gov/flood-maps (last visited Mar. 30, 2024) (providing flood plain maps); *Forest Atlas of the United States*, U.S. FOREST SERV., https://www.fs.usda.gov/sites/default/files/fs_media/fs_document/Forest-Atlas-of-the-United-States.pdf (last visited Mar. 30, 2024) (providing maps of forested areas of the U.S.); *Maps*, USGS, https://www.usgs.gov/mission-areas/water-resources/maps (last visited Mar. 30, 2024) (providing links to maps of watersheds and aquifers in the U.S.); *Download Species Range and Predicted Habitat Data*, USGS, https://www.usgs.gov/tools/download-species-range-and-predicted-habitat-data (last visited Mar. 30, 2024) (providing maps of wildlife habitats).

195. For example, in Oregon, the Oregon Watershed Enhancement Board (OWEB) distributes funds aimed at watershed restoration and enhancement. *See Oregon Watershed Enhancement Board Will Consider Climate in Grantmaking and Launch Inclusive Engagement Effort*, OR. WATERSHED ENHANCEMENT BD. (Feb. 28, 2022), https://content.govdelivery.com/accounts/ORWEB/bulletins/309bf16 ("The resolution also commits the agency to add climate-focused criteria to restoration grant applications. . . ."). OWEB has also gained climate expertise and now advances climate objectives as part of its grant programs. *Id*.

196. Moreover, with full climate recovery in mind, NCS opportunity maps can also show lands needed for solar and wind projects to minimize competition between decarbonization and drawdown goals and to enable complementary approaches on the ground.

ceded aboriginal territory form a crucial part of this component as they underscore tribal interests across the landscape.

3. Operable Blueprint for NCS: The Land Management Protocols

Scientific expertise forms a foundation of the sky-cleanup effort, as carbon-drawdown opportunities must be tied to specific protocols and monitoring parameters. A Regional Framework must synthesize existing science to formulate field protocols that can guide the design and implementation of NCS projects and also serve as eligibility parameters for proposals. In doing so, the "two-eyes" approach is vastly important, as it brings in Indigenous knowledge that provides historical perspective, ground-truthing through generations of observation, and a holistic approach that incorporates human needs and broader ecological objectives. Drawdown protocols reflecting the "best practices" for carbon management in each sector should be written in a form accessible to a broad array of implementers. For example, protocols will address guidelines and criteria around reforestation, nutrient management, silvo-pastoralism, no-till agriculture, improved forest management, estuary restoration, multi-paddock grazing, and cover cropping, to name just a few (in different ecotypes). Some natural climate solutions may remain too uncertain to form a basis for recommended pathways[197] but may be formulated into prescriptions for pilot projects to build the evidence base for future evaluation.[198]

The scientific community has produced generalized strategies to accomplish NCS across the forest, farmland, grassland and rangeland, and blue carbon landscapes.[199] As noted earlier, scientists divide the NCS approach into three types of action: (1) "Avoided Conversion NCS"; (2) "Land Management NCS"; and (3) "Restoration NCS."[200] In an analysis specific to Oregon, a team led by Dr. Rose Graves applied all three approaches and estimated CO_2 sequestration from various pathways within each category.[201] Such work provides an impressive start to a Framework's delineation of specific protocols.

197. *See, e.g.*, Mark A. Bradford et al., *Soil Carbon Science for Policy and Practice*, 2 NATURE SUSTAINABILITY 1070, 1070–72 (2019) (noting uncertainty).

198. Some analysts note the need to move forward despite uncertainty. *See, e.g.*, COASTAL BLUE CARBON, *supra* note 178, at 26 ("Ensure that current knowledge gaps do not delay action on the ground. No regret actions, such as protected and conserved areas, can meaningfully benefit biodiversity and climate, regardless of the magnitude of the benefit.").

199. *See* Fargione et al., *supra* note 25, at 1 (outlining the NCS methods researchers examined); Griscom et al., *supra* note 24, at 11645–46 (providing a table and discourse analyzing the climate mitigation potentials of these NCS practices).

200. *See* Graves et al., *supra* note 48 (explaining each type of action); *see also* Silva et al., *supra* note 75 (generalizing different types of NCS).

201. Graves et al., *supra* note 48, at 6.

The "Avoided Conversion" category generally involves conserving and protecting existing carbon sinks. This is vastly important because vulnerable ecosystems contain (on a global level) at least 260 Gt of "irrecoverable carbon" that intrusive land-use practices could release into the atmosphere.[202] Nevertheless, this category is inherently murky because conservation measures largely boil down to legal mechanisms to protect a carbon sink. For example, to protect a forest sink that remains in private ownership, a project manager would devise a conservation easement or other legal instrument to restrict harvest or clearcutting and subsequent conversion to urban development in legal perpetuity. But in Oregon, where land-use measures strictly prohibit much conversion of forest land to urban land, NCS measures preventing urban development may not result in much "additionality," though measures restricting clearcutting on private lands outside riparian buffers certainly could, in light of Oregon's notoriously lax forest-protection laws.[203] In other words, to count carbon sequestration resulting from conservation measures, one must explore whether the land-conservation protocol adds protection (additionality)—an analysis that is primarily legal, not scientific, in nature. Nevertheless, with that caveat in mind, the category of "Avoided Conversion NCS" in Oregon includes (for various ecotypes): (1) preventing forests from succumbing to urban development; (2) protecting sagebrush steppe from invasive annual grasses, which typically encroach because of fire disturbance; and (3) preventing carbon-rich grasslands from becoming cropland.[204]

The remaining two NCS categories contemplate positive human intervention to rebuild depleted carbon pools.[205] Within the "Land Management NCS" category, the team identified, *inter alia*: (1) timber-harvest deferral; (2) use of cover crops in farming; (3) adoption of no-till agriculture; and (4) adjusting cropland-nutrient management to decrease nitrogen fertilizer.[206] Within the "Restoration NCS" category, the team identified, *inter alia*: (1) reforestation after wildfires; (2) tidal-wetland restoration; (3) riparian reforestation; and (4) sagebrush-steppe restoration.[207]

Many protocols and data sets from which future protocols could be developed already exist but require further extrapolation tailored to the particular region. For example, the USDA's Natural Resource Conservation

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202. Silva et al., *supra* note 77, at 7 (citing Allie Goldstein et al., *Protecting Irrecoverable Carbon in Earth's Ecosystems*, 10 NATURE CLIMATE CHANGE 287 (2020)).

203. *See* Wood, *The Oregon Forest Trust*, *supra* note 51, at Part II (discussing Oregon forest management policies and laws prioritizing timber harvest).

204. Graves et al., *supra* note 48, at 3–7.

205. *See* Bossio et al., *supra* note 46 ("25% of natural carbon capture gains depend on rebuilding carbon pools.").

206. Graves et al., *supra* note 48, at 7–10.

207. *Id.* at 10–12.

Service offers very general protocols for farmers and ranchers to store carbon.[208] Additionally, leading scientists have specified general forest management protocols to store carbon.[209] Building on this platform, the next basic step requires translating these identified pathways into a level of specificity necessary for actual implementation across recruited working lands in the particular region. For example, while the use of cover crops is a suggested NCS pathway for farmland carbon sequestration, specific protocols address precise plant species suitable for use, timeframes for planting, tending needs, and so forth—the kind of detail a land manager needs for implementation. Similarly, the NCS pathway for wetlands restoration must identify specific restoration protocols according to soil type and geographic location, and restoring sagebrush-steppe systems requires protocols describing characteristics of suitable land (e.g., concerning elevation and moisture gradients).[210] Moreover, each protocol must be accompanied by an individualized monitoring mechanism, which is detailed in Section III(C)(8) below. Ultimately, the Framework should synthesize and evaluate existing science to develop a detailed set of protocols for each NCS pathway.

One area that warrants further examination is the urban role in carbon drawdown and sequestration. Although typically lacking the vast consolidated acreage of rural landscapes, urban areas nonetheless can aggregate smaller plots that collectively may provide meaningful carbon sequestration. Moreover, urban areas might supply key elements necessary for some of the other pathways—such as urban compost used in carbon farming[211]—or may pose key threats to other pathways, such as urban encroachment on grassland or farmland. Urban drawdown may also yield socio-economic and justice co-benefits, such as increased climate resiliency through efforts like tree planting, which provides shade canopies in heat waves. And on an entirely different level, educating the urban populations and recruiting them into the regional vision of sky cleanup may help bridge the notable urban-rural divide and enlist a region's power centers in support of the atmospheric-drawdown and biodiversity-recovery effort.[212]

As to all of the protocols across the four sectors, adaptive change is key to the success of any regional atmospheric-recovery effort. As new pathways

208. *NRCS Climate-Smart Mitigation Activities*, U.S. DEP'T OF AGRIC., https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/climatechange/?cid=nrcseprd1881023#soil (last visited Mar. 31, 2024).

209. *See* Law et al., *Land Use Strategies*, *supra* note 51, at 3663 (listing established methods of storing carbon through forest management).

210. *See* Graves et al., *supra* note 48, at 12.

211. *See Compost*, MARIN CARBON PROJECT, https://marincarbonproject.org/compost/ (last visited Mar. 31, 2024) (explaining the role of compost in carbon farming).

212. Silva et al., *supra* note 75, at 9 ("A new paradigm of collective action is needed to devise synergistic urban and rural strategies toward shared goals.").

draw scientific inquiry, and as science reveals success or failure from existing pathways, updated information must adroitly enter the Framework. An essential function of the Framework, therefore, is not only to delineate practices with the precision needed to guide land managers, but also to provide the apparatus to amend protocols in a rapidly changing world. In other words, the Framework itself must be flexible and aim towards regular revision.

One example of emerging NCS science involves the well-established NCS pathway of no-till agriculture. Because tilling the soil releases soil carbon into the atmosphere, it was long thought that no-till practices could sequester significant carbon across farmlands.[213] That assumption has come into question as a result of more recent science.[214] Namely, while the Graves team included no-till agriculture as one of the drawdown pathways available in Oregon, it also noted that "no consensus exists on the effects of no-till on SOC (soil organic carbon) in the PNW" and that at least two studies found "no significant effect of tillage on SOC."[215] Whether or not the practice is useful in the PNW region or in other regions, this serves as an example of the need to regularly modify the Framework as science emerges based on the data collected from existing projects. Another area of rapidly developing NCS science that has the potential to open new pathways for sequestration explores accelerated-weathering techniques, which could be combined with agricultural soil amendments described above.[216]

4. Biodiversity Analysis and Assessment of Ecological Co-Benefits and Drawbacks

As noted at the outset, the converging crises of climate instability and biodiversity impoverishment require an urgent and coordinated response. The two cannot be addressed separately because protocols for carbon

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213. *See* Stephen M. Ogle et al., *No-Till Management Impacts on Crop Productivity, Carbon Input and Soil Carbon Sequestration*, 149 AGRIC., ECOSYSTEMS & ENV'T 37, 37 (2012) (explaining that "many publications and reports during the last two decades have recommended no-till as a practice to mitigate greenhouse gas emissions through soil [carbon] sequestration").

214. *Id.* ("The efficacy of no-till agriculture for increasing [carbon] in soils has been questioned in recent studies.").

215. Graves et al., *supra* note 48, at 9; *see also* William R. Horwath & Yakov Kuzyakov, *Chapter 3: The Potential for Soils to Mitigate Climate Change Through Carbon Sequestration*, 35 DEV. SOIL SCI. 61, 66 (2018), https://www.sciencedirect.com/science/article/abs/pii/B978044463865600003X ("[O]f more than 100 studies, about half reported SOC sequestration rates greater in tilled than no-tilled systems."). Horwath and Kuzyakov conclude that "no-till systems have limited potential for climate change mitigation due to limited SOC sequestration." *Id.* at 67. For additional analysis, *see* KATE LAJTHA ET AL., *The Second State of the Carbon Cycle Report*, 469–506 (Cavallaro et al. eds., 2018), https://doi.org/10.7930/SOCCR2.2018.Ch12.

216. *See supra* text accompanying note 76 (explaining the role of geologic carbon storage in NCS methods).

sequestration, if not designed with biodiversity in mind, may further exacerbate biodiversity loss.[217] For example, planting monoculture tree farms for the purpose of seizing sky carbon comes at the expense of biodiversity, which requires a far more complex ecological arrangement to thrive.[218] One component of the Framework must analyze the effect of the protocols on biodiversity. This analysis is increasingly becoming standard practice in developing NCS, and some use the biodiversity screen to roundly eliminate otherwise promising carbon-directed protocols.[219]

Other pressing ecological needs of society—for example, clean drinking water, a stable food supply, and flood protection—also require attention. Beyond the opportunity map described above that depicts various ecological values, a Framework should provide information and analysis linking particular protocols to an array of expected co-benefits. For example, regenerative-agriculture protocols sometimes eliminate pesticides, herbicides, and other chemical applications in the production of crops so as to encourage thriving soil-microbial systems that process and sequester carbon. This measure can boost food production by enriching the soil, and it also reduces toxic water pollution which harms humans, fish, and wildlife.[220] Protecting coastal wetlands may provide a buffer to storms, create habitat for fish and wildlife, and offer recreational opportunities for the community.

Some studies have indicated that co-benefits may, in some circumstances, be the driving force behind the adoption of NCS protocols, possibly even more so than direct economic benefits like funding. One analysis that synthesized previous studies related to farmers' positions on soil-carbon sequestration revealed that co-benefits such as soil fertility, reduced erosion risk, and water-holding capacity were often more important to farmers than financial incentives.[221] Because land managers may reap benefits far beyond monetary compensation alone, it is critical to identify and evaluate these co-benefits so they can be fully leveraged for NCS adoption.

The Framework's examination of co-benefits will allow land managers and funders to form partnerships along a multitude of parameters beyond carbon sequestration. But at the same time, the Framework must also encompass a rigorous inquiry exposing ecological drawbacks and uncertainties associated with certain protocols. For example, techniques of

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217. Law, *Creating Strategic Reserves*, *supra* note 11, at 722 ("[F]unctionally separating carbon, water, and biodiversity and considering them independently leads to actions that inadvertently reduce the values of each, and can increase caron emissions.").

218. Steffan Messenger, *Climate Change: Corporate Mass Tree Planting Damaging Nature*, BBC (Nov. 9, 2021), https://www.bbc.com/news/uk-wales-59220669.

219. Graves et al., *supra* note 48, at 3.

220. SCI. FOR NATURE & PEOPLE P'SHIP, *supra* note 162.

221. Holly Jean Buck & Alexis Palumbo-Compton, *Soil Carbon Sequestration as a Climate Strategy: What Do Farmers Think?*, 161 BIOGEOCHEMISTRY 59, 62 (2022).

intensive grazing, while seemingly offering promise in certain contexts, may impose substantial harm if the grazing occurs near riparian areas.[222] Or, if not near riparian areas, they may require new water-delivery systems carrying an additional ecological footprint. In sum, the Framework must strive for an unvarnished assessment of the ecological trade-offs and risks associated with the protocols in addition to an evaluation of the potential co-benefits.

5. Justice, Socioeconomic, and Community Needs and Opportunities

NCS approaches should draw forth core justice inquiries and analysis of equity issues, particularly when choices arise as to allocating the benefits of restoration investment or imposing a negative burden on communities. It is critical to involve community interests when devising solutions and allocating program benefits. Importantly, the process must consider all community interests—not just those of the resource users and land managers—with concerted outreach to Indigenous communities, communities of color, historically impoverished communities, children, and marginalized peoples who could be affected. For too long, those communities have suffered harm related to hazardous pollutants and resource degradation and may benefit from landscape recovery. But also, a transition from an extractive economy to regenerative and sustainable practices must be a *just transition*, considering the vital need for economic stability in resource-dependent communities. Finally, a core justice requirement centers on the role of youth in devising a vision for landscape recovery, as youth and future generations will inherit the responsibility of a drawdown project—and will either bear the consequences of failure or reap the benefits of its success.

Opportunity assessment requires weighing the benefits and drawbacks of restoration on social, economic, and cultural scales. Such an approach responds to the UN Intergovernmental Panel on Climate Change's (IPCC) call for land-based measures to be informed by "more realistic assessments that take into account local circumstances and socio-economic factors and cross-sector synergies and tradeoffs. . . ."[223] Many questions concerning potential drawbacks exist. For example, will the conversion of agricultural land to forest shrink the available land base necessary for a local food supply? Will forest protection compromise timber supply to local mills and result in economic dislocation and, if so, are there mitigating courses of action, such as sourcing alternative supplies? Will forest conservation preclude using

222. *See generally* AM. FISHERIES SOC'Y, AFS POLICY STATEMENT #23: THE EFFECTS OF LIVESTOCK GRAZING ON RIPARIAN AND STREAM ECOSYSTEMS (2015), https://fisheries.org/wp-content/uploads/2015/05/policy_23f.pdf (outlining the many ways that grazing can impact aquatic and riparian ecosystems).

223. *IPCC Working Group III: Technical Summary*, *supra* note 121, at 88.

wood products as a substitute for carbon-intense steel and concrete in construction and, if so, are there alternative products on the horizon?[224] Re-engineering human systems requires forthright exploration of these drawbacks. Embedded in the Framework, therefore, must be justice-oriented criteria for ensuring protection of human rights, access to food, observance of Indigenous land rights, and respect for cultural prerogatives.[225]

Conversely, as to social, economic, and cultural benefits, some projects and protocols may greatly augment the community's ability to adapt to climate disruption while also boosting the community's economy and strengthening its self-sufficiency. Some protocols may provide job opportunities in an emerging restoration economy. Some protocols may help protect the open space so integral to rural culture. Other protocols may provide opportunities for important tribal practices, such as cultural burning or root-gathering. Some may be the basis of job creation on reservations. By exploring and weighing these favorable aspects, this part of the Framework can generate substantial positive interest on the part of these communities.

In sum, the Framework's vision requires its designers to scrutinize protocols in terms of justice safeguards, biodiversity protection, and societal co-benefits and drawbacks. Nevertheless, a guiding principle must be that difficult dilemmas remain inevitable and are not for the Framework itself to solve. A Framework analysis operates on the regional scale, and localized actuation initiates its own procedural pathway that is necessarily unique to each context. Where the Framework's regional analysis ends, a site-specific implementation discussion begins.

6. Pricing and Funding NCS Projects

Ecosystem protection and regeneration do not typically happen free of charge on working lands. Cost is a driving factor for regional NCS implementation, so it must be assessed. Moreover, determining

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224. *See* Daniel Strain, *Building Materials Come Alive with Help from Bacteria*, CU BOULDER TODAY (Jan. 15, 2020), https://www.colorado.edu/today/2020/01/15/building-materials-come-alive (reporting on alternative building materials).

225. *See, e.g.*, Fargione et al., *supra* note 25, at 1–4 (constraining carbon-sequestration estimates to be compatible with human needs and addressing co-benefits such as crop resilience, coastal defense from storms, and wildfire harm mitigation). A University of Oregon team called this strategy an *Enhanced Natural Climate Solutions* ("NCS+") approach, defining NCS+ as "activities that can be coordinated to increase carbon drawdown and permanence on land while improving livelihoods and the provision of natural resources in vulnerable communities and ecosystems." Silva et al., *supra* note 75, at 1. The team explains that "[t]he framework builds on interdisciplinary scientific convergence, including critical socioecological interactions, to inform both top-down policy incentives and bottom-up adoption by industries and managers." *Id.*; *see also* Lucas C.R. Silva & Mary Christina Wood, National Science Foundation (NSF), *Landscape Carbon Sequestration for Atmospheric Recovery White Paper: A Perspective on Convergence to Accelerate Carbon Sequestration*, University of Oregon, Eugene, Oregon (2019) (hereinafter Silva & Wood, NSF White Paper).

"additionality" is a key part of any project pricing and not a straightforward exercise. The Regional Framework harnesses the expertise of rural economists, land managers, transactional lawyers, and landscape architects to devise a general price structure for the Framework's protocols and additionality standards. This structure will guide opportunity probes by landowners and investment searches by funders, but these NCS protocol price tags will vary according to the circumstances.[226] For example, a farmer implementing cover crops as an NCS measure across a large, dry area will have different costs than a farmer taking the same action across a small, moist area. A landowner establishing a conservation easement on a wetland near a high-development urban area may receive a different price than a landowner pursuing a conservation easement on the same-sized acreage located in a rural corner of the state.

Different NCS approaches—avoided conversion, land management, and restoration—involve different kinds of pricing analysis. Many of the protocols in the second and third categories involve active human intervention, requiring labor, tools, equipment, and other supplies, such as seeds or saplings. Inducing land managers to engage in NCS requires quantifying these costs as well as lost opportunity costs; conversely, on the other side of the ledger, pricing should account for expected monetary benefits associated with the change. Almost always, a landowner will need a "risk buffer" to induce change in management. If a farmer adopts an NCS technique but suffers declined crop yield, a risk buffer would offset the financial loss for a specified period of time.

One cost inherent in all three categories involves dedicating the land to a regenerative purpose to ensure the durability of the action. For example, farming techniques that store carbon must generally persist, or the carbon stored will be lost back to the atmosphere upon cessation of the technique. Because trees lose significant carbon upon cutting, carbon forestry relies primarily on forest conservation. Thus, some NCS methods require a legal instrument—usually a conservation easement or deed restriction—to assure durability of the action. By limiting what the landowner can justifiably do, that legal instrument will likely carry a price tag. Here, the cost analysis differs between public and private lands. Dedicating public land to conservation does not entail this kind of up-front cost, as these lands are owned (in the United States) by the American people and generally reserved

226. It should be noted that the pricing of NCS protocols has no relation to another common climate parameter, the social cost of carbon. Whereas the social cost of carbon is a market tool to assign a price for the harm caused by the carbon pollution, *see* Elijah Asdourian & David Wessel, *What Is the Social Cost of Carbon?*, BROOKINGS INST. (Mar. 14, 2023), https://www.brookings.edu/articles/what-is-the-social-cost-of-carbon/, the protocols represent the cost of atmospheric recovery measures.

from the same market forces that constrain private lands.[227] But price plays a significant role in decision-making about private-land conservation across ecotypes. If an owner seeks to impose a conservation easement protecting existing grassland from conversion to cropland (an "avoided conversion NCS"), the conservation easement will be priced out, and the landowner will either require payment or decide to gain tax benefits through a charitable contribution—regardless, it will be monetized. If a timberland owner is paid to extend harvest rotations from the standard 40 years to 120 years (a "land management NCS"), for example,[228] the 80-year interim dedication to carbon sequestration requires monetary assessment. If an owner of wetlands or farmland agrees to put a carbon conservation easement or covenant across the property, that must be priced out, and so forth.

It would be a gross oversimplification, however, to price these restraints assuming a free-for-all world of landowner prerogative. The pricing analysis must go hand in hand with an evaluation of the legal context because it represents a purchase of activity in which the landowner could otherwise engage. In reality, landowners face a host of regulatory restraints on activities affecting crucial ecology, which invariably tighten as ecology edges ever closer towards collapse—a situation we now face on a global level. For example, grazing in riparian areas, chemical spraying in industrial forests, land-use development, and an array of other activities have encountered increasingly stringent restrictions over the years.[229] One obvious area of more rigid regulation, for example, will be industrial-forest management, which entails clearcutting practices that have harmed local water supplies, unraveled habitat, and emitted carbon during the harvesting process. The regulatory context will inevitably tighten as public pressure mounts to ban clearcutting on private lands, extend harvest rotations, and hold timber companies responsible for damage to water supplies.

The price of conservation measures calibrates to this fluctuating regulatory context. Prices will decrease as regulatory restrictions increasingly constrain harmful activities on private land because, theoretically, the landowner no longer has the right to engage in these activities due to the new regulatory limits. The price of conservation will theoretically never reach zero, however, because conservation easements or

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227. As such, public lands can be put to conservation use by public trustees acting to safeguard the public's ecological endowment. President Biden, for example, has announced a proposal to protect old-growth forests from logging as a climate measure. *See* Anna Phillips, *Biden Moves to Ban Most Old-Growth Logging in National Forests*, WASH. POST (Dec. 20, 2023), https://www.washingtonpost.com/climate-environment/2023/12/19/old-growth-logging-forest-service/.

228. *See* Anderson, *supra* note 58 (explaining the implementation of longer timber-harvest rotations as a carbon-sequestration measure).

229. *See, e.g.*, 36 C.F.R. § 219.8(a)(3) (2024) (giving special protection for riparian areas included in land-management plans under federal regulations); OR. REV. STAT. § 527.672 (2024) (limiting aerial herbicide applications in forest operations under Oregon law).

covenants transfer durable property rights in the subject land and carry their own monetized value. Thus, these conservation tools endure changing regulations and thereby hedge against regulatory relaxation.[230] The overall point is that, when considering the price of conservation measures, the analysis must involve a convergence of market and legal expertise.

Taking a macro approach, the pricing section will monetize—in a very general way—the aggregate potential for implementing the regional Framework. Such analysis, while inevitably subject to change, will present an idea of the scale of funding needed—not unlike a cost estimate for Pacific Northwest salmon recovery, wolf reintroduction to the Northern Rockies, or cleanup of a massive oil spill.[231] Such summary economic analysis can include price estimates for benefits to the region as well, an approach taken by the PNW salmon-recovery program.[232] The umbrella cost of materializing a region's atmospheric potential can serve as a guidepost for funders seeking to make large investments in climate recovery.

Key to this part of the Framework is also a compilation of funding sources. A vast number of funding streams that could potentially support NCS actions already exist at the state, federal, and local levels, and more are being developed as a result of new legislation and initiatives.[233] For example, a substantial amount of federal funding is available through the Inflation Reduction Act and could be leveraged for projects implementing NCS. Through this Act, $2.8 billion is available for Environmental and Climate Justice Block Grants, which may be used for climate-resilience and

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230. In Oregon, land use restrictions generally forbid residential development outside urban areas. A landowner, however, can still enter into a conservation easement with a land trust and receive value for relinquishing the right to develop land. The price for such an easement will not be as high as in an area where development is allowed, because theory holds that the landowner is not giving up as much if they do not have the regulatory right to engage in the activity. There is nevertheless monetary value in that easement because it is a transfer of a property right to the land trust designed to last in perpetuity. Because regulations do change, sometimes becoming less stringent, the conservation easement serves as ecological insurance against that contingency, and the land trust gains an actual property right in the land to enforce it. So, in theory, conservation easements are never devoid of market value.

231. *See* NAT'L OCEANIC & ATMOSPHERIC ADMIN., PACIFIC COASTAL SALMON RECOVERY FUND: FY 2020 REPORT TO CONGRESS (2020), https://media.fisheries.noaa.gov/2021-07/pcsrf-fy-2020-annual-report.pdf?VersionId=null [hereinafter *Pacific Coastal Salmon Recovery Fund*] (explaining how the Pacific Coastal Salmon Recovery Fund disburses funds to states, tribes, and individuals for salmon-restoration projects); *see* U.S. FISH & WILDLIFE SERV., NORTHERN ROCKY MOUNTAIN WOLF RECOVERY PLAN (1987), https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1018&context=wolfrecovery.

232. *Pacific Coastal Salmon Recovery Fund*, *supra* note 231.

233. *See, e.g.*, Graves et al., *supra* note 48, at 11. Programs proliferate on the state level. For example, in Oregon, the Oregon Watershed Enhancement Board (OWEB) has funds for riparian restoration projects that can implement the NCS blue carbon pathway of riparian restoration. The Oregon Conservation Reserve Enhancement Program (CREP) provides funds for practices on agricultural lands. While beyond the scope of this Article, numerous federal programs already exist, and new ones are coming online as a result of the recently passed Inflation Reduction Act of 2022. *See* Chris Chyung et al., *How States and Cities Can Benefit from Climate Investments in the Inflation Reduction Act*, CTR. FOR AM. PROGRESS (Aug. 25, 2022), https://www.americanprogress.org/article/how-states-and-cities-can-benefit-from-climate-investments-in-the-inflation-reduction-act/.

adaptation projects; $2.6 billion is available through the National Oceanic and Atmospheric Association for climate-resilience projects in coastal areas to conserve and restore habitat and allow communities to prepare for the climate crisis; and $1.5 billion is available through the USDA to support tree-planting activities by local governments, tribes, states, and non-profit organizations through the Urban and Community Forestry Assistance Program.[234]

Though numerous, these funding sources are not yet compiled in a clearinghouse style that would promote scaled-up adoption across landscapes. Moreover, the requirements of these grants are all singularly tied to their unique program purpose, yielding a complicated maze of financial hoops and cumbersome application requirements that may limit uptake in working-lands sectors. The Framework can organize and distill these in a manner designed to streamline the flow of money towards NCS, make recommendations for bundling where appropriate, and develop a role for the Sky Trust in aggregating and facilitating funding sources for large landscape projects where possible.

7. Investment Portfolio: Data-Driven Investment

Each category of NCS entails different payoffs, drawbacks, and uncertainties. Each carries a degree of risk as to whether it will succeed and its anticipated level of permanence. For example, accelerated weathering may have enormous impact,[235] but it is the least studied of the natural climate solutions and therefore carries significant risk. Forests carry a different kind of risk. Their sequestration potential is well established, but they could succumb to fire and lose some of their stored carbon; the risk depends partly on whether the forests are in low- or high-probability fire zones. On the low-risk side, carbon-farming agricultural practices remain well established and have high permanence if durability instruments are applied, but they may not offer as much sequestration potential as other methods.[236]

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234. *See* Amy Turner, *Cities & The Inflation Reduction Act*, COLUMBIA L. SCH.: SABIN CTR. FOR CLIMATE CHANGE L. (Aug. 22, 2022), https://blogs.law.columbia.edu/climatechange/2022/08/22/cities-the-inflation-reduction-act/ (explaining Inflation Reduction Act federal funding for projects implementing NCS).

235. *See IPCC Working Group III: Technical Summary*, *supra* note 121, at 94 (enhanced weathering may have potential to draw down nearly 100 GtC globally, which far exceeds any other category and theoretically comprises nearly two-thirds of the drawdown presently needed); Silva et al., *supra* note 75, at 11–12.

236. *See generally* T. J. Mattila et al., *How Farmers Approach Soil Carbon Sequestration? Lessons Learned from 105 Carbon-Farming Plans*, 215 SOIL & TILLAGE RSCH. (2022), https://www.sciencedirect.com/science/article/pii/S0167198721002774; *see also* Janet Ranganathan et al., *Regenerative Agriculture: Good for Soil Health, but Limited Potential to Mitigate Climate Change*, WORLD RES. INST. (2020), https://www.wri.org/insights/regenerative-agriculture-good-soil-health-limited-potential-mitigate-climate-change.

The Framework should create a generalized carbon-stock investment portfolio depicting risk-yield assessments of NCS sectors and pathways calibrated to the general pricing described above. It can also depict added value for investments in the form of co-benefits. This carbon portfolio must aim to: (1) inform private and philanthropic investment; (2) provide direction to a Sky Trust dispersing court-ordered funds; and (3) create guidance for investment through public bonds, tax programs, grants, and subsidies. The portfolio will also highlight the need for additional funding of NCS science to increase the certainty associated with practices that are high-potential but also high-risk. Just as financial stock positions migrate on the spectrum of risk and yield, the carbon portfolio will change over time as science develops to show the benefits and drawbacks of various strategies. Using the map, portfolio, protocols, and pricing details together, investors and implementers can maximize sequestration and co-benefits while striving to minimize the cost, risk, and uncertainty of various approaches.

8. Monitoring Mechanisms

The success of the Framework rests on wide adoption of the protocols as well as their correct implementation and durability. Essential to the drawdown effort, carefully crafted monitoring mechanisms must assess the effectiveness of each protocol in relation to its stated purpose. Monitoring for carbon drawdown and sequestration can be assessed generally through interval measurements of soil and forest carbon.[237] Quantifying such carbon will indicate trends of sequestration or loss. Depending on the project, other monitoring may evaluate success or failure in achieving co-benefits. Species presence, water-quality characteristics, and ambient-air temperatures, for example, may all be subject to monitoring, as envisioned in the project purpose. Such monitoring procedures must be tightly woven into project contracts and agreements as administered by the Sky Trust (or local partners). In a crisis-laden world that needs rapid adaptive management to respond to emerging science and changing ecological conditions, monitoring results should feed directly into a broader system of regional information analysis and drive adjustments to the Framework and implementing programs.

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237. *See* Erin Berryman et al., *Soil Carbon*, FOREST AND RANGELAND SOILS OF THE UNITED STATES UNDER CHANGING CONDITIONS: A COMPREHENSIVE SCIENCE SYNTHESIS 13 (2020); Raisa Mäkipää et al., *How Does Management Affect Soil C Sequestration and Greenhouse Gas Fluzed in Boreal and Temperate Forests? - A Review*, FOREST ECOLOGY & MGMT., Feb. 2023, at 1, https://doi.org/10.1016/j.foreco.2022.120637 (explaining how carbon drawdown and sequestration can be assessed through interval measurements of soil and forest carbon).

9. Technology and Workforce Training

Technology remains key to implementing a region-wide restoration effort and operates on at least two levels. First, technology can enable or facilitate some science-based practices. For example, farmers implementing regenerative-agriculture practices can rely on apps on hand-held devices to calibrate the protocols to site-specific circumstances.[238] Other protocols may require new mechanical technology. Second, technology is vital for monitoring the carbon sequestered in trees and soils and for measuring other parameters of ecosystem recovery.[239] In either respect, the ideal technology may not presently exist.

The Framework should identify how technology can optimize regional deployment of NCS on multiple scales. This alone will broadcast the need to innovators and may spur research-and-development partnerships that would otherwise lag. As new technologies develop, the Framework may incorporate them.

Integrating new NCS land-management methods across forests, farms, grasslands, and wetland areas and then monitoring and reporting the results requires a sweeping workforce-training effort. The Framework will identify areas of skills development, new professional pathways, and partners in the training endeavor. Some organizations situated to carry forth the occupational-training component are the extension services associated with state universities, as well as community colleges, tribal programs, Future Farmers of America, and 4H clubs.

New expertise will also prove necessary to carry out adaptive revision of Framework components—particularly the protocols—as monitoring shows their success and failures, and as worsening climate conditions force re-evaluation. Interdisciplinary degree programs may emerge in the region's flagship universities to meet this need. These programs could include components of landscape architecture, soil science, forestry, planning, business, economics, humanities, communications, law, ecological engineering, data management, and others. On the project level, the NCS effort will require a new type of environmental professional who can serve as a leader of individual carbon-sequestration projects, designing and

238. The U.S. Department of Agriculture's Natural Resources Conservation Service has developed such a tool, COMET-FARM, for general use. COMET-FARM allows landowners to enter details on their land and management such as location, soil characteristics, land uses, tillage practices, and nutrient use through a secure online interface. The tool then estimates carbon sequestration associated with conservation practices for cropland, pasture, rangeland, and livestock operations. *See* SPENCER MILLER, *COMET-FarmTM: Conservation Calculation*, U.S. DEP'T OF AGRIC. (Aug. 21, 2013), https://www.usda.gov/media/blog/2013/08/21/comet-farmtm-conservation-calculation.

239. *See Pathfinder Tool*, CLIMATE POSITIVE DESIGN, https://climatepositivedesign.com/pathfinder/?utm_medium=website&utm_source=archdaily.com (last visited Mar. 31, 2024) (discussing a first-generation app with a focus on sequestration potential).

organizing them from conception to completion. Potentially, NCS project leaders carrying out programs funded through the Sky Trust would (in collaboration with relevant professionals) design the project protocols, price the projects, arrange funding, negotiate with land managers, craft the durability mechanisms, create monitoring systems, and supervise and report results over time. The field of landscape architecture may be particularly poised to gain this new professional proficiency.[240]

10. Durability: The Carbon Storage Easements and Responsive Revision

Part of the implementation challenge will be to create legal mechanisms that provide durability to the carbon-storage enterprise. These instruments must anticipate and compel necessary revisions in NCS practices as a result of monitoring. One important tool to accomplish these ends is a new form of conservation easement called a "carbon storage easement."[241]

A conservation easement is a widely used tool in land- and water-conservation efforts. It essentially amounts to a property right voluntarily conveyed by a property owner to a land trust, tribe, or government entity for the purpose of protecting values or resources on the property.[242] These resources could be scenic vistas, open spaces, fish or wildlife habitats, cultural resources, or a host of others. Generally, the landowner retains ownership of the property and nearly all of the privileges of ownership but relinquishes the right to harm or destroy the resources.[243] The restrictions are always a matter of negotiation between the receiving entity and the landowner; thus, easements vary greatly. Working-lands easements allow the landowner to continue deriving economic benefits from the enterprise but within limits arrived at through mutual agreement. Carbon-storage easements would include provisions ensuring carbon storage either in perpetuity or for a specified time, and the easements would allow monitoring by the entity holding them. Under the three-gear approach delineated above, the Sky Trust could be a receiving entity for these easements.

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240. *See* Deanna Lynn, *Landscape Design for Carbon Sequestration, Master's Thesis Presentation*, UNIV. OF OR. (June 5, 2020), https://scholarsbank.uoregon.edu/xmlui/handle/1794/26127 (explaining that landscape architects are increasingly becoming professionally knowledgeable about carbon sequestration).

241. Zachary Griffith, *The Carbon Storage Easement*, UNIV. OF OR. (2021) (on file with author). Other durability tools exist in the form of deed restrictions and contractual obligations.

242. *See* UNIF. CONSERVATION EASEMENT ACT § 1(1) (NAT'L CONF. OF COMM'RS ON UNIF. STATE L. 1982) (providing examples of the types of purposes for which conservation easements may be established).

243. *Id.*

11. Announcement and Outreach

Scaling up the NCS effort depends on recruiting managers of working lands and suitable urban spaces across the region. A core function of the Framework is to announce this epic drawdown challenge in ways that call to tribes, communities, landowners, and leaders to join the effort. The methods for gaining tribal interest will differ from those aimed towards non-Indian rural communities. Tribal outreach characteristically focuses on tribal agencies, tribal leaders, and inter-tribal coalitions. As to the non-Indian rural communities, the success of gaining participants will likely rest on co-creating a compelling narrative coupled with written materials, social media, YouTube videos, and a full range of communications tools to catalyze interest. Carbon is not typically the calling card for engaging rural communities; they may instead be more interested in soil health, water conservation, and local job creation. Experts from the humanities are instrumental in conveying the stories of individuals already engaged in the drawdown project, reporting personal success, surprises, and challenges to inspire others. Community leaders, local influencers, and tribal leaders will be crucial to growing engagement in regions that may otherwise be resistant to or not interested in climate initiatives alone (but interested in the co-benefits drawdown projects may provide). Extensive community-outreach efforts can benefit from broad databases crossing multiple sectors—including rural working-lands associations, granges, community groups, agencies, political offices, philanthropic organizations, food-security groups, and others.

IV. THE PACIFIC NORTHWEST FRAMEWORK FOR ATMOSPHERIC RECOVERY: A MODEL FOR OTHER REGIONS

The process of developing a regional Framework for the PNW is underway and provides a potential model for other regions seeking to launch a similar effort. The PNW is well-positioned to initiate this urgent sky-cleanup project in North America, as it holds vast natural landscapes with all four ecotypes capable of catalyzing a broad drawdown effort.[244] In particular, the PNW's old-growth forests rival the Amazon rainforest in carbon storage, and they also contain immense biodiversity.[245] Without a drawdown project, the region's old-growth forests remain vulnerable to massive carbon releases

244. Silva et al., *supra* note 75, at 3 ("The PNW is a valuable model system because it encompasses extensive forests, prairies, and riverine wetland systems in public and private ownership as well as rapidly expanding rural-urban interfaces across strong natural climate gradients.").

245. Law, *Creating Strategic Reserves*, *supra* note 11, at 731 ("The PNW and Alaska stand out as having mature and old forests with immense carbon stores and high biodiversity."); *see also* Wood, *The Oregon Forest Trust*, *supra* note 51, at 726 and accompanying text.

through clearcutting.[246] The PNW also has human capacity geared towards carbon drawdown and landscape recovery. Tribal sovereigns across the PNW have exercised leadership in resource protection and recovery and remain at the forefront of national climate leadership.[247] The PNW holds top-flight research universities, non-profit organizations, and land managers that are researching NCS techniques, educating the public about these techniques, and implementing them on a pilot scale.[248] But it still lacks the coordinated effort essential to accelerate this process.

The PNW Framework for Atmospheric Recovery (PNW-FAR) project, led by the University of Oregon's Environmental and Natural Resources Law Center, commenced in 2021 and is expected to culminate in a draft Framework in the Fall of 2024. The discussion below describes the PNW-FAR process after first summarizing the choices involved in defining its regional scope.

A. Defining the "Region" to Catalyze an NCS Enterprise

The first step to embarking on a regional Framework is defining the geographic scope of the region subject to the drawdown effort. In the PNW-FAR process, the organizing team explored different configurations of the "Pacific Northwest." For example, if the bioregion alone defined the framework boundaries, a target area might encompass the old-growth coastal forests, stretching from northern California to southern British Columbia but stopping at the crest of the Cascades. However, that delineation would involve onerous jurisdictional complexities, as the PNW-FAR would reach internationally yet not capture the full state jurisdictions of Oregon, Washington, and California. That bioregional focus would also exclude the NCS opportunities east of the Cascade mountains within the state jurisdictions. If, as another possibility, the region was to be defined as Oregon and Washington alone, the team would exclude much of the salmon's range and leave out tribes in Idaho leading important efforts related to this work.

While dilemmas arise with every possible configuration, the team settled on a Framework region encompassing the traditionally defined Pacific Northwest: the states of Oregon, Washington, and Idaho. This region shares cultural and historic ties stemming back to time immemorial in Indigenous culture and, in non-Indian society, dating back to the establishment of the

246. *See* Law, *Land Use Strategies*, *supra* note 51.

247. Stephanie Gutierrez, *Taking Action Now: The Tribal Climate Change Project*, ECOTRUST (June 20, 2018), https://ecotrust.org/tribal-climate-change-project/.

248. *See, e.g.*, ALDERSPRING RANCH, *supra* note 87 (providing an example of land managers using regenerative practices).

Oregon Territory in 1848. The region encompasses all four ecosystem drivers of NCS: forests; farmlands; grasslands and rangelands; and blue and teal carbon areas.[249] This region largely coincides with the reach of the Pacific salmon.[250] In terms of jurisdictional and inter-sovereign considerations, the tribes of Oregon, Washington, and Idaho have nationally recognized environmental programs and intertribal agencies as well as firm relationships with the respective states; several tribes are already developing NCS programs on their lands or aboriginal territory outside of reservations.[251] On the state level, Oregon and Washington have established legislative goals on climate policy, and Oregon is exploring NCS potential.[252] While Idaho remains an outlier on climate policy,[253] it has remarkable potential to align NCS strategies with biodiversity-protection goals, as it holds a rich array of land and water habitats for a multitude of species.

B. The Process of Developing a Pacific Northwest Framework for Atmospheric Recovery (PNW-FAR): A Convergence Acceleration Approach

As already emphasized, time is of the essence in developing regional Frameworks, as the crises of today require an urgent response. Typically, environmental policymaking develops in an atomized fashion: knowledge creation begins in the science realm; then eventually reaches the policy realm, where concrete proposals are fashioned; then finally arrives at the leadership level, where policies are enacted as laws or find their way into the marketplace through corporate or private adoption. This process may take many years and often succumbs to political stagnation in the later stages. Abruptly changing circumstances may eclipse work that takes too long and is not amendable to adjustment. The PNW-FAR experiment took another route, seeking to combine multi-disciplinary expertise, tribal knowledge and

249. *See 2023 Natural and Working Lands Report*, OR. GLOBAL WARMING COMM'N, https://www.keeporegoncool.org/natural-working-lands (last visited Mar. 31, 2024) (providing that the four ecosystem drivers are forests, agricultural lands, grasslands and rangelands, and blue and teal carbon).

250. *West Coast Salmon and Steelhead Fisheries Management*, NAT'L OCEANIC & ATMOSPHERIC ADMIN. (Oct. 12, 2022), https://www.fisheries.noaa.gov/west-coast/sustainable-fisheries/west-coast-salmon-and-steelhead-fisheries-management.

251. PNW intertribal agencies and organizations include the Columbia River Inter-Tribal Fish Commission, the Northwest Indian Fisheries Commission, and the Affiliated Tribes of Northwest Indians.

252. S.B. 1534, 81st Legis. Assemb. (Or. 2022), (Proposed Natural and Working Lands Carbon Sequestration bill) (failed).

253. *See Idaho Profile*, CLIMATE XCHANGE, https://climate-xchange.org/network/map/idaho/ (last visited Mar. 31, 2024).

perspective, community insights, and leadership outlooks at once—an "accelerated convergence" approach.[254]

1. The Prospectus

After organizing the core PNW-FAR team at the University of Oregon,[255] the Framework process began with a draft Prospectus capturing the effort ahead. [256] The Prospectus defines the purpose and components of the regional Framework, intended as a platform for bringing people and communities together around the collective vision of land restoration and carbon drawdown. It describes the components above to organize individuals and ideas around different parts of the drawdown-implementation challenge. In the case of the PNW-FAR, the Prospectus became an iterative document undergoing constant revision as perspectives from around the region informed the organizing team.

2. The Prelude Meetings, the Chronicle, and the Collective[257]

After the Prospectus was completed, the organizing team engaged in a three-month period of outreach to individuals and organizations involved in various components of drawdown across the four ecotypes. The team held "Prelude Meetings" through Zoom to engage with scientists, land managers, tribal leaders, agency officials, conservation lawyers, economists, and non-profit organizations across the forest, farmland, grass- and rangeland, and blue- and teal-carbon ecotypes. A working document (called the "PNW-FAR Chronicle") kept track of contact information, organized by ecotype. As information flowed to the organizing team, it was incorporated into the Framework Outline, which would form the backbone of later drafting. This outreach period was crucial to the project as a whole because it announced the effort and began to bring together a community of individuals and organizations around the project. As the Chronicle gained contacts, a loose "Collective" was identified around each ecotype. These are identified

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254. *See* Silva & Wood, NSF White Paper, *supra* note 225 ("The task of implementing NCS is urgent and requires accelerated convergence across multiple sectors. Convergence that can transform the promise of NCS into real-world implementation is defined as fundamental research likely to trigger advances through partnerships across multiple disciplines, sectors, and stakeholders (e.g., industry, non-profits, government entities, and the general public) to propel CO_2 drawdown.").

255. Law schools across other regions may serve as ideal Framework organizers due to their research focus, interdisciplinary expertise, and wide-ranging connections. The preliminary effort at University of Oregon began in 2019 with a workshop led by several academics across multiple disciplines at UO, funded by the National Science Foundation's Convergence Accelerator Program. *See id.*

256. Prospectus, *supra* note 2.

257. The description in this section was based on a process led by the author along with Research Associate Tom Housel.

individuals and organizations—potentially hundreds in each ecotype—positioned to coalesce around the regional enterprise of carbon drawdown and ecosystem recovery. The Forest Collective, Farmland Collective, Grassland/Rangeland Collective, and Blue Carbon Collective could form the beginnings of a region-wide movement. Creating the data set encompassing these individuals and organizations forms a core step in the FAR process.

At the same time that this regional outreach took place, the Oregon State Legislature was considering legislation to fund drawdown projects state-wide, and a legislative task force was developing NCS protocols.[258] Similar legislative efforts are likely to start in other regions. The question is inevitable: is the university-led PNW-FAR duplicative of such legislative efforts? The answer should be a confident "no." First, a regional Framework such as the PNW-FAR extends beyond just one state; the PNW-FAR includes the three states of Oregon, Washington, and Idaho. Second, the Framework's wide focus on all implantation barriers and opportunities inevitably integrates aspects not included in state legislative initiatives. Third, legislative efforts may not come to fruition in states (like Oregon) where the rural communities may distrust government climate initiatives.[259] Therefore, a non-governmental effort may access far more individuals who are positioned to catalyze drawdown in their communities. Fourth, a university-led regional Framework is essentially a research project. When developments transpire in the legislative realm, they can be incorporated into the Framework. Indeed, the Framework serves as a broad clearinghouse of information and can explain government programs and funding opportunities in a manner accessible to the communities that can benefit from them.

3. The Working Groups

The next step in the PNW-FAR process was creating "Working Groups" for each ecotype to assist the University of Oregon team in drafting the Framework. The Working Group size was small—8 to 10 people—and individuals were chosen from the broader Collective for each ecotype. The Working Groups help develop the vision of evaluating, accelerating, and scaling up the NCS opportunities in an ecotype. The scientific expertise required in each Working Group is highly interdisciplinary. Some members focus on the Earth's carbon cycle and the atmospheric-terrestrial exchange

258. *See* S.B. 530, 82d Legis. Assemb. (Or. 2023) (proposing to fund NCS projects in Oregon) (failed); *see also 2023 Natural and Working Lands Report*, *supra* note 249 (explaining goals for carbon and storage in Oregon).

259. That was indeed the case in Oregon, where legislative initiatives focused on natural climate solutions have failed two years in a row. *See* S.B. 1534, 81st Legis. Assemb. (Or. 2022) (Natural and Working Lands Carbon Sequestration bill) (failed); S.B. 88, 82d Legis. Assemb. (Or. 2023) (proposing to increase net carbon-sequestration storage in natural and working lands) (failed).

and soil-microbe interactions. Others bring expertise from conservation biology, hydrology, and other disciplines. While the full community of scientists and other experts working on NCS cannot be included in developing the Framework, Working Group participants are positioned to tap and assemble the science from their sectors, much as members of UN working groups (like the IPCC) draw upon international expertise.

Because of the need for accelerated solutions, the Working Group members chosen were individuals that fuse *opportunity expertise* with *implementation and leadership expertise*. In other words, members were selected not only for their professional background and accomplishments, but also for their connections to broader groups and their ability to bring the Framework into multiple forums, including policy circles, rural communities, and administrative agencies. Tribal representatives participated in three of the four Working Groups,[260] and rural-landowner participation was also prioritized. Importantly, members were selected from across the three states of the region, with the goal of roughly spreading geographic representation. Recognizing that the small size of the Working Groups precluded others with valuable expertise and connections, the organizing team created broader "Advisory Groups" for each ecotype as well.

4. The Convening Workshop

A three-day Convening of the four Working Groups was sponsored by the University of Oregon's Environmental and Natural Resources Law Center in May 2023. Held at a lodge with breathtaking views of the Columbia River, the Convening inspired a visionary quest and community-building toward a regional restoration enterprise. The workshop was highly structured, with table participants all contributing to a group OneDrive document that aggregated their input.

The Convening was divided into segments focused on each Framework component described above. In advance of this intensive workshop, the organizing team prepared detailed worksheets with guided questions building upon the protocols. These worksheets provide a model for, and are available to, other regions engaged in the NCS enterprise.

Following the Convening, the next stage is drafting the Framework—a concerted amount of work for one or two individuals in coordination with the Workshop participants. This initial drafting will be followed with dissemination to the Working Groups and Advisory Groups for revision.

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260. Those Working Groups were forest, blue carbon, and farmland. The Framework team could not find PNW tribal engagement in NCS dealing with the rangeland ecotype.

5. Unveiling the PNW-FAR

The dissemination stage culminates the Framework process. In this vein, the Chronicle of interested groups (described above) becomes a database for dissemination and, ultimately, for building a movement around NCS. Because the Framework is not a regulatory or legislative proposal, it lacks the formal adoption and agency administration process that lawmaking would entail. Instead, leading institutions, government entities, and community leaders must build the imprimatur of the effort by formally endorsing the Framework. This is essential, as credibility remains crucial to funders, including courts that award damages for harm to the atmosphere and for adaptation. Later, adoption and funding commitments will confer standing and validity to the Framework.

V. SUSTAINING AND PROLIFERATING THE EFFORT: THE REGIONAL ATMOSPHERIC RECOVERY INSTITUTE

As the world faces the unprecedented climate challenge, new institutions must emerge to tackle the global imperative of regaining the planet's energy balance. The atmospheric-drawdown endeavor is projected to continue through the end of the century. Ultimately, to maintain this effort and create a mechanism for adaptation to both changing natural conditions and evolving scientific understanding, regional Atmospheric Recovery Institutes (ARIs) are necessary. An ARI need not be a governmental entity—it may best function as an independent institution created by a consortium of partners from research universities, tribes, agencies, and non-profits. As the institutional home for the Framework, the ARI will verify, aggregate, and amplify emerging best available NCS science as it evolves, incorporating Indigenous knowledge as explained above.

Supporting regional landscape restoration into the future requires continually updating and expanding the Framework. The ARI will regularly revise the field protocols, maintain and update the regional-opportunity map, shape the investment portfolio in response to new information and changing climate conditions, provide education and training, and assess the overall progress of the NCS strategies. Operating as a regional information hub, the ARI will not generate all or even most of the research needed for the drawdown endeavor[261] but rather will serve as a catalyzing, organizing entity that synthesizes information produced by others and steers a transdisciplinary endeavor from concept to practical implementation.

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261. For example, scientific studies examining the effectiveness of NCS techniques will be produced by the scientific community outside of the ARI.

The ARI must have the institutional capacity and longevity to: (1) serve as a third-party monitor verifying the carbon removal achieved by the drawdown projects; (2) evaluate terrestrial processes and conduct a macro carbon accounting on the regional scale to estimate drawdown; (3) assess the progress under the Framework against the benchmark goals and report progress to the regional community of leaders, scientists, analysts, and citizens; (4) modify the Framework according to adaptive-management principles, taking into account opportunities from emerging methods and technology; (5) develop, support, and synthesize science that forms the backbone of NCS; (6) promote narratives from landowners engaged in NCS projects; and (7) serve as a model, proliferating the regional atmospheric recovery project to other regions both nationally and internationally.[262]

In any given region, top-flight research universities already engaged in climate research may be best situated to host a Regional ARI on their campuses. The benefits to any institution of higher education are obvious. The Institute would enjoy an enviable position at the center of a historic collaborative scientific endeavor, researching and advancing projects to protect the planet's habitability and promote the well-being of all generations to come. Such a university would seemingly attract students from around the world who are drawn to the crucial public mission of the Institute and who wish to engage in the applied educational opportunities it offers. A robust educational and experiential component would train a league of professionals to deploy the strategies and techniques comprising the Regional FAR. The Institute would create new career paths for students dealing with carbon accounting, ecosystem modeling, carbon-storage technology, and carbon landscape architecture, among others. Through the Institute, in-house researchers, professors, and students at the university would have the opportunity to interact and collaborate with top professionals and visionaries worldwide. The Institute could also serve as a launch pad for products designed by university researchers to promote carbon sequestration.

Impressive institutional models outside of higher education exist as well. One possible model is an independent think tank similar to the Stockholm Institute, which plays a role in climate policy on the global level, or the Woods Hole Oceanographic Institution, an independent research entity that partners with the Massachusetts Institute of Technology to offer programs and degrees to undergraduate and graduate students.[263] Another model is a government-created institution, such as the Pacific Northwest National

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262. Notably, these functions differ greatly from—and reach well beyond—those carried out by two other existing climate centers in the Pacific Northwest such as the Oregon Climate Change Research Institute or the Northwest Climate Adaptation Science Center.

263. STOCKHOLM ENV'T INST., https://www.sei.org (last visited Mar. 31, 2024); WOODS HOLE OCEANOGRAPHIC INST., https://www.whoi.edu (last visited Mar. 31, 2024).

Laboratory (and similar institutions across the U.S.).[264] But while each model has distinct advantages, a university consortium forming an independent entity holds the advantage of a continually replenishing student body, which can form the lifeblood of a multi-generational project. An inspired, well-trained student body may create incalculable ripple effects across the world through the natural outreach that students extend to their communities. In that way, students may become the agents through which exponential impact from the regional ARI can be realized on a global level.

Crucially, the ARI must be designed such that it is not wholly embedded within, or governed by, a single university, as it must not be servient to any institutional objectives or structure other than its own. An ARI having allegiance to the region may best materialize as a consortium of institutions affiliated with a primary "hosting" university that provides the physical locus. Regardless of the Institute's composition, the ARI must remain fiercely independent, transparent, have unimpeachable integrity, and stay nimbly positioned to detect and rapidly incorporate the dynamic forces of natural and social change in the regional atmospheric recovery effort.

CONCLUSION

Amidst a clear planetary emergency, the next few years will prove critical to preserving the habitability of Earth for the world's children and future generations. To bring atmospheric CO_2 below 350 ppm, global society must accomplish a massive sky cleanup of excess legacy carbon pollution. As this Article has explained, the current offset market defeats necessary cleanup by justifying the addition of more pollution to the atmosphere, thus negating any progress towards actual sky cleanup of legacy carbon. This Article has focused on catalyzing and scaling up natural climate solutions to begin CO_2 drawdown and sequestration across four ecotypes—forests, farmlands, grasslands and rangelands, and blue and teal carbon areas (such as estuaries and wetlands). While many tribes, land managers, organizations, and research institutions across the world have been researching and implementing many of these NCS techniques on a site-specific basis, the efforts remain disparate and disconnected. A coherent, aggregating approach is needed to accelerate and scale up the carbon-cleanup effort, harnessing regional capacity around the world.

This Article proposed the development of regional Frameworks addressing opportunity in the four ecotypes. The Frameworks will announce opportunities to land managers; provide an implementation blueprint and pricing for NCS techniques; discern co-benefits and biodiversity goals as

264. PAC. NW. NAT'L LAB'Y, https://www.pnnl.gov (last visited Mar. 31, 2024).

well as drawbacks; identify justice issues and opportunities; provide methods to monitor progress; evaluate legal mechanisms (such as conservation easements) to ensure the durability of NCS projects; identify major funding sources for NCS projects; and develop communications and outreach approaches to gain buy-in from landowners. A process developing such a Framework is underway in the Pacific Northwest with the aim of becoming a model for the world.

The Framework is not a regulatory or legislative proposal but rather a research initiative. As such, it becomes the platform around which a regional movement can grow. The Framework calls broadly for society to recover degraded natural systems across all communities, which increasingly face existential threats from the droughts, floods, storms, fires, heat domes, and human dislocation that climate disruption brings. While sequestering carbon, many NCS techniques will stabilize soils, improve food productivity, reduce erosion and water pollution, protect against coastal flooding, and recover biodiversity. Ultimately, the Regional Framework suggests a different way of living on the landscape by recommending that Humanity harmonizes with the processes that support our own survival. To this end, future frameworks should draw upon the wisdom of tribal people gained over generations of ecological experience on their aboriginal lands.

Developing Regional Frameworks is no small undertaking. The process requires convening experts from multiple disciplines and thought leaders from various sectors, drawing them into a collaborative enterprise to envision a fundamental shift in land management across a region. Of course, any such effort inevitably confronts societal inertia that can hinder progress. But the tangible prospect of land and resource recovery may create its own irresistible social momentum, particularly when juxtaposed against the increasingly recognized prospect of runaway planetary heating and incalculable human loss and suffering. As Winston Churchill famously declared, *"It's not enough that we do our best; sometimes we have to do what's required."*[265]

265. FORBES: QUOTES, https://www.forbes.com/quotes/10319/ (last visited Mar. 31, 2024).

NATURE-BASED SOLUTIONS: APPLYING A LEGAL PRINCIPLE OF SOLIDARITY TO PROTECT HUMAN AND MORE-THAN-HUMAN COMMUNITIES THROUGH AN "ECOLOGICAL EDUCATION AND SERVICE PROGRAM"

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INTRODUCTION

In theory, nature-based solutions (NBS) should be an attractive proposition. Projects that fully embody the tenets behind NBS acknowledge that human communities can work collectively with nature to conserve and restore ecosystems. In practice, this proposition is less clear. This paper's

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purpose is to explain how the concept of NBS has been developed and promoted and how we can re-imagine community residents' duty as a basis for enhancing engagement in NBS work.

Part I of this Article will explore the range of concepts informing NBS policy. The next section of the paper (Part II) examines two working definitions of NBS in the context of current efforts to develop principles and practices. Part II also raises the specter of financialization of NBS where investment dollars decide what projects will be done and for what purposes. For example, "blue carbon" projects with the primary objective of carbon sequestration create a situation where financialization can pose a real threat to the potential for achieving NBS objectives. NBS-based markets raise legitimate questions about whether a project can achieve real gains for multiple beneficiaries and not just for human interests. Gains in one habitat driven by desirable market outcomes can lead to losses and impacts on another sensitive habitat. Depending on location, for example, restoring seagrass beds may increase blue carbon sequestration, but might also reduce onshore sediment transport and decrease sedimentation for inshore wetlands.[2] Because of all this interconnectivity across landscapes and seascapes, this Part argues that NBS should not operate on the primary basis of economic logic.

Instead, as suggested in Parts III and IV, we need an infusion of a legal principle of solidarity to be a guiding principle for NBS. Part III discusses the roots of solidarity in "communitarianism" and "care ethics" and its development into a legal principle. Part IV offers an unconventional but needed intervention. If NBS is to make sense as a coherent ecological policy that protects both human communities and more-than-human communities, NBS proponents should seek out non-market approaches. One potential approach would be to create opportunities to practice solidarity through implementing a regular and funded "ecological education and service" program for all residents.

I. THE ZEITGEIST OF NATURE-BASED SOLUTIONS

In the past few years, governments have prioritized increasing efforts to achieve NBS in different sectors. In a 2022 United States White House report, the Biden-Harris Administration called on agencies to prioritize NBS-related investments and infrastructure, providing more funding under the Infrastructure Law and Inflation Reduction Act, more leadership at federal

2. Carmine Donatelli et al., *Seagrass Impact on Sediment Exchange Between Tidal Flats and Salt Marsh, and The Sediment Budget of Shallow Bays*, 45 GEOPHYSICAL RSCH. LETTERS 4933, 4933–34 (2018).

facilities, and more workforce development.[3] U.S. agencies have responded to this challenge. The Federal Emergency Management Agency, for example, under its climate resilience information, champions NBS as part of "sustainable planning, design, environmental management, and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience."[4] On the same page, the agency authors note that NBS can also encompass the "related terms" of "green infrastructure, natural infrastructure, [and] natural and nature-based features" or refer to the U.S. Army Corps of Engineers program "Engineering with Nature."[5]

NBS has become a catch-all term that means different things to different groups. Terms used synonymously and flexibly with NBS include "ecological engineering," "ecosystem-based adaptation," "ecosystem-based disaster risk reduction," "green/blue infrastructure," [6] "integrated land management," "sustainable land management," "catchment management," "ecosystem approach," "agroforestry," "agro-ecology," "forest and landscape restoration," "reduced emissions from deforestation and degradation," "natural climate solutions," and "managed realignment" (referring to the practice of breaching coastal defenses to create flood protection zones that can also have habitat benefits).[7] Other terms regularly used in conjunction with NBS include "blue carbon," "natural capital," "ecosystem services," "nature's contribution to people," and "nature's contribution to adaptation."[8] Some researchers have proposed that "old types of NBS" can be characterized as "new types of NBS," such that "ecosystem services" become "green/blue/hybrid" NBS and "natural capital" becomes

3. THE WHITE HOUSE, OPPORTUNITIES TO ACCELERATE NATURE-BASED SOLUTIONS: A ROADMAP FOR CLIMATE PROGRESS, THRIVING NATURE, EQUITY, & PROSPERITY 27 (2022); *see generally* Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818 (2022) (codified as amended in scattered sections of 26 U.S.C. §§ 45, 48) (showing how the federal government has incentivized the use of certain energies); *see generally* Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, 135 Stat. 429 (2021) (codified as amended in scattered sections of 23 U.S.C. §§ 101, 151) (showing how the federal government has granted funds in certain instances).

4. *Nature-Based Solutions*, FED. EMERGENCY MGMT. AGENCY, https://www.fema.gov/emergency-managers/risk-management/climate-resilience/nature-based-solutions (Oct. 13, 2023).

5. *Id.*

6. *See generally Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Green Infrastructure (GI)—Enhancing Europe's Natural Capital*, at 2–3, COM (2013) 249 final (May 6, 2013) (noting how green/blue infrastructure is a term used by the European Union to refer to natural, semi-natural, and man-made ecological features including agricultural land, urban parks, forest reserves, wetlands, coasts, and aquatic ecosystems).

7. Nathalie Seddon et al., *Getting the Message Right on Nature-Based Solutions to Climate Change*, GLOB. CHANGE BIOLOGY 1518, 1520, tbl.1 (2020).

8. *Id.*

"green" NBS.[9] NBS now appears to encompass everything from massive government-sponsored tree planting to corporate restoration pledges focused on achieving net carbon neutrality or zero emissions.[10]

While one could argue that the proliferation of words being used to describe the concept should not matter if the outcome leads to people respecting nature, the use of so many different terms to describe NBS is a recipe for confusion. NBS as a concept has become more than just an umbrella term to describe projects linked by a shared philosophy—it has become incoherent. At best, NBS has become an all-hands effort to accelerate adaptation; at worst, it appears to be a buzzword.

In a moment of environmental consciousness, policymakers have acknowledged that we have a litany of problems that existing technology has failed to address. Now, as communities become increasingly exposed to natural hazards, we need solutions to a range of transboundary problems, from food security to climate mitigation. While it is easy to understand the desire for "solutions," what is potentially fraught is which problems are being prioritized and how governments and the private sector define what constitutes a solution.

In pursuing NBS, are humans extracting from nature or managing nature for chiefly human desires? Or are humans instead trying to design and implement projects to restore ecological relationships that may not primarily serve human interests? Given the recent enthusiasm for the concept and the limited performance of NBS as a "silver bullet" for complex problems, researchers urge that the concept of NBS not be "misappropriated, co-opted[,] or corrupted."[11] Whether a particular project should qualify as an NBS project fundamentally depends on the mindset with which the project is designed. This concept of mindset is discussed further in Part III. If NBS is to have a transformative impact to restore abundant biodiversity, then it must do something different than pre-existing efforts, which largely focused on identifying the economic value of nature. Part IV of this paper explores the work of the European Union (EU) and the International Union for the

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9. Sisay E. Debele et al., *Nature-Based Solutions for Hydro-Meteorological Hazards: Revised Concepts, Classification Schemes and Databases*, 179 ENV'T RSCH. 108799, 108808, tbl.3 (2019) (showing how green infrastructure refers to "green ecosystems" like marshes and coral reefs, blue infrastructure to water spaces such as ponds and oceans, and hybrid infrastructure include "grey infrastructure" or ecological engineered structures such as green roofs and porous pavement).

10. *About the One Billion Trees Programme*, N.Z. MINISTRY FOR PRIMARY INDUS., https://www.mpi.govt.nz/forestry/funding-tree-planting-research/one-billion-trees-programme/about-the-one-billion-trees-programme/ (last visited Mar. 21, 2024); *Enhanced National Greening Program*, PHIL. DEP'T OF ENV'T & NAT. RES. (May 27, 2019), https://denr.gov.ph/priority-program/enhanced-national-greening-program/; *Nature-Based Solutions*, SHELL: SPECIAL REPORT (2019), https://reports.shell.com/sustainability-report/2019/special-reports/nature-based-solutions.html; Seddon et al., *supra* note 7, at 1523, tbl.3.

11. Seddon et al., *supra* note 7, at 1521.

Conservation of Nature (IUCN) to define NBS as something more than existing ecosystem-service efforts.

II. CONCEPT OF NBS AND FINANCIALIZATION

Nature-based solutions are intended to be multipurpose, no-regret solutions.[12] The term was popularized in the early 2000s but received even more global attention with the World Bank's 2008 report titled *Biodiversity, Climate Change, and Adaptation: Nature-Based Solutions from the World Bank Portfolio*.[13] While recognizing the broader goals of NBS, including maintaining and restoring ecosystems, enhancing ecosystem services, and mitigating and adapting to climate change, the report also proposed a distinctly human-first approach to the concept of NBS. For example, in describing the designation of a National Park in Indonesia and a conservation area in Laos, the World Bank authors observed that the park was formed "to protect a major irrigation investment" and the conservation area was created for "extending the lifespan of the hydropower generation facility."[14] While protecting undeveloped lands and building ecological corridors for conservation is a net good,[15] the report's attitude towards ecosystem services was grounded in fundamental utilitarian values. In the case of this early report, nature-based solutions were construed as nature engineering solutions (e.g., mangroves as coastal disaster risk reduction) and nature production solutions (e.g., coastal nurseries as food stocks). Arguably, NBS was simply a rebranding of ecosystem services.

Later definitions of NBS offer more nuance than the World Bank's initial effort to secure support for its investment projects in the name of NBS. For example, IUCN's definition from 2016 defines NBS as:

> actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges [e.g., climate change, food and water security, or natural disasters] effectively and

12. Christian Schleyer et al., *Opportunities and Challenges for Mainstreaming the Ecosystem Services Concept in the Multi-Level Policy-Making Within the EU*, 16 ECOSYSTEM SERVS. 174, 174–75 (2015).

13. THE WORLD BANK, BIODIVERSITY, CLIMATE CHANGE, AND ADAPTATION: NATURE-BASED SOLUTIONS FROM THE WORLD BANK PORTFOLIO 39 (2008), https://openknowledge.worldbank.org/server/api/core/bitstreams/5a3ca700-5c7e-5670-bb6c-dd9247a60d7c/content.

14. *Id.*

15. *Id. at* 40. Ecological corridors are natural lands connecting habitat areas that may be fragmented across a landscape. *See* Andrew Gregory et al., *Toward Best Management Practices for Ecological Corridors*, LAND, Feb. 1, 2021, at 1, 1, https://www.mdpi.com/2073-445X/10/2/140 (describing best management practices for ecological corridors).

> adaptatively, simultaneously providing *human well-being and biodiversity benefits*.[16]

In a slight variation on the IUCN definition, the European Commission defined NBS as those solutions that:

> are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social[,] and economic benefits[,] and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes, and seascapes, through locally adapted, resource-efficient and systemic interventions. Nature-based solutions *must benefit biodiversity and support the delivery of a range of ecosystem services.*[17]

A final and quite similar definition offered by the United Nations Environmental Assembly (UNEA)—the world's highest environmental decision-making body, with the membership of all 193 UN member states—equates NBS with those actions:

> to protect, conserve, restore, sustainably use[,] and manage natural or modified terrestrial, freshwater, coastal[,] and marine ecosystems which address social, economic, and environmental challenges effectively and adaptively, while simultaneously providing *human well-being, ecosystem services and resilience and biodiversity benefits.*[18]

Each of these definitions provides a variation on the same theme: humans act strategically within a natural system to improve some aspect of that natural system that will benefit humans and deliver "biodiversity benefits." While there is no further description of what "biodiversity benefits" entail in any of the definitions, it can be inferred that IUCN, the European Commission, and UNEA intended for NBS to encompass and benefit more-than-human interests. This reading conforms with IUCN efforts to draft a set

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16. INT'L UNION FOR CONSERVATION OF NATURE, DEFINING NATURE-BASED SOLUTIONS 1 (2016), https://portals.iucn.org/library/sites/library/files/resrecfiles/WCC_2016_RES_069_EN.pdf (emphasis added).

17. *Nature-Based Solutions*, EUR. COMM'N, https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions_en (last visited Mar. 21, 2024) (emphasis added).

18. Env't Assembly Res. 5/5, UNEP/EA.5/Res.5 (Mar. 7, 2022), https://www.unep.org/environmentassembly/unea5/unea-5.2/outcomes-resumed-session-unea-5-unea-5.2 (scroll down to UNEA-5 Resolutions and download UNEP/EA.5/Res.5) (emphasis added).

of NBS guiding principles, which provide that an NBS project should "embrace nature conservation norms" and maintain "biological and cultural diversity and the ability of ecosystems to evolve over time."[19]

While the NBS theory reflected in each of these definitions is sound as an effort to promote the value of ecosystems for both human and more-than-human communities, in practice, NBS implementation is less expansive than the definitions and leans heavily towards human-first priorities. One example of implemented NBS described by IUCN includes the restoration of wetlands to improve fish stocks for fishing livelihoods, reduce flooding, and increase tourism.[20] Another example includes using barrier islands and oyster reefs to protect shorelines and communities from impacts of sea-level rise.[21] In some ways, these practical examples that prioritize human needs are not surprising, despite the various definitions that specifically identify the need to provide for "biodiversity benefits."[22] Existing projects, which seem to largely draw on traditional international development projects, reflect a largely utilitarian perspective of NBS, with benefits to biodiversity in these case studies operating as co-benefits and not design priorities. Human adaptation and development are the primary focus of many existing NBS projects.

A recent European research project, FutureMARES, proposes using NBS not just for human priorities, such as sequestering carbon and ecosystem-based harvesting, but for preserving the integrity of food webs and protecting endangered species by restoring or conserving habitat-forming species and designating marine protected areas.[23] Most of the proposed NBS projects have not yet been implemented and are in the visionary stage. The project is noteworthy because in reflecting on the future of habitat restoration, conservation, and seafood harvesting, the research team has created three long-term scenarios based on different climate models, which they label "global sustainability," "national enterprise," and "world markets."[24] The "world markets" scenario, in particular, is interesting because it predicts full financial support only for restoring degraded marine ecosystems that produce market-valuable resources or services. This scenario expects "exploitation of

19. INT'L UNION FOR CONSERVATION OF NATURE, NATURE-BASED SOLUTIONS TO ADDRESS GLOBAL SOCIETAL CHALLENGES xii (E. Cohen-Shacham et al. eds., 2016), https://portals.iucn.org/library/sites/library/files/documents/2016-036.pdf.

20. *Id.* at 7.

21. *Id.*

22. *Id.* at 5.

23. *Climate Change and Future Marine Ecosystem Services and Biodiversity*, NETWORK NATURE, https://networknature.eu/ridb/climate-change-and-future-marine-ecosystem-services-and-biodiversity (last visited Mar. 21, 2024).

24. FUTUREMARES, E.U., IMPLEMENTATION SCENARIOS FOR MARINE NATURE-BASED SOLUTIONS (NBS) 5 (2021), https://www.futuremares.eu/_files/ugd/550799_217acea195334527905c08bf0e9999d2.pdf.

marketable ecosystem services such as blue carbon."[25] With current trends to commodify NBS, the "global markets" scenario is "business as usual." The FutureMARES project suggests that, depending on the mindset with which NBS is pursued, NBS may do very little for more-than-human communities needing "biodiversity benefits."

Efforts to accelerate NBS as it has been conceived normatively by the EU and UNEA seem constrained by these business-as-usual mindsets. In 2023, the High-Level Panel for a Sustainable Ocean Economy—established in 2018 by several coastal states, including small and large states—commissioned a *Blue Carbon Handbook: Blue Carbon as a Nature-Based Solution for Climate Action* (Handbook).[26] Focusing on tidal marshes, mangroves, and seagrasses, the Handbook identifies the key ecosystem services of "blue carbon" as carbon sequestration and storage, coastal protection, fisheries enhancement, water purification, and biodiversity.[27] The blueprint proposed in the Handbook calls for upscaling blue carbon through functional interventions including innovative financing, carbon markets, standard methodologies, advanced research, institutional capacity, transparency, and participatory process.[28] Apart from the "participatory process," most of the blueprint is administrative and managerial, and blue carbon as an NBS is treated akin to any other implementation of a utilitarian technology. The theory behind blue carbon as a primarily carbon-sequestration-and-storage approach diverges from a holistic seascape-restoration endeavor. The Handbook authors do not directly engage with the topic of biodiversity benefits but simply remark that the mandated review and update of national biodiversity strategy and action plans under the Convention on Biological Diversity, planned for 2024, should address the "biodiversity" aspect of NBS for blue carbon.[29]

The above commentary on the Handbook is not intended as a critique but rather as an illustration that much of the emerging guidance for NBS projects, including blue carbon projects, has been aimed at operationalizing NBS within the logic of capitalism and the confines of financialization. To succeed

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25. *Id.* at 7, 9.

26. Lisa Schindler Murray & Ben Milligan, *The Blue Carbon Handbook: Blue Carbon as a Nature-Based Solution for Climate Action and Sustainable Development*, HIGH LEVEL PANEL FOR A SUSTAINABLE OCEAN ECON. (2023), https://oceanpanel.org/wp-content/uploads/2023/06/Ocean_Panel_Blue_Carbon_Handbook-1.pdf. Panel membership includes Australia, Canada, Chile, Fiji, France, Ghana, Indonesia, Jamaica, Japan, Kenya, Mexico, Namibia, Norway, Palau, Portugal, and the United States. *Id.* at ii.

27. *Id.* at 3, fig.1.

28. *Id.*

29. *Id.* at 23. Under Article 6 of the Convention on Biological Diversity, June 5, 1992, 1760 U.N.T.S. 79, parties must "develop national strategies, plans, or programmes." Secretariat of the Convention on Biological Diversity, *Convention on Biological Diversity Text and Annexes* 6 (2011), https://www.cbd.int/doc/legal/cbd-en.pdf. Article 26 of the treaty requires states to report on measures which have been taken to implement the treaty. *Id.* at 20.

in conservation and restoration, the argument goes, the government will need to create financial incentives and markets to attract financial investors, particularly private investors. The Handbook authors suggest that such an approach is potentially misinformed:

> The economic value of blue carbon ecosystems is often unknown or poorly communicated. Thus, they are seen only for their conservation or mitigation value, which vastly underappreciates their asset value. This is why establishing ocean accounts [estimates of blue carbon stocks and carbon sequestration potential], national capital taxonomies[,] and economic valuation exercises can be important for aligning national policymaking and investment.[30]

This logic of NBS financialization to scale up NBS efforts is also later reflected in a different report commissioned by the High-Level Panel for a Sustainable Ocean Economy, *The Ocean as a Solution to Climate Change*. Report authors encourage governments to develop by 2025 "a robust value of blue carbon sequestration services" and to legally devise biodiversity-related incentives that will encourage the private sector to increase investments in coastal and marine conservation projects.[31] While the report acknowledges the value of the government supporting "non-market-based approaches,"[32] the report does not develop this point further. As will be suggested below in Part IV, national and subnational efforts in support of NBS should start with non-market-based approaches to create conditions for changing relationships between people and places.

In cooperation with the Friends of Ocean Action, World Economic Forum, the Ocean Risk and Resilience Action Alliance, Salesforce, the Nature Conservancy, and Meridian Institute, Conservation International perpetuates the logic of the financialization and capitalization of ecosystem recovery with its publication of *High-Quality Blue Carbon Principles and Guidance*.[33] The report offers five principles, "each of equal importance": to "safeguard nature"; "empower people"; "employ the best information, interventions, and carbon accounting practices"; "operate locally and contextually"; and "mobilize high-integrity capital."[34] While this is a well-

30. Schindler Murray & Milligan, *supra* note 26, at 31.

31. OVE HOEGH-GULDBERG & ELIZA NORTHROP, THE OCEAN AS A SOLUTION TO CLIMATE CHANGE: UPDATED OPPORTUNITIES FOR ACTION, OCEAN PANEL 49, tbl.5 (2023), https://oceanpanel.org/wp-content/uploads/2023/09/Full-Report_Ocean-Climate-Solutions-Update-1.pdf.

32. *Id.*

33. CONSERVATION INT'L ET AL., HIGH-QUALITY BLUE CARBON PRINCIPLES AND GUIDANCE 1, 10–11 (2022), https://climatechampions.unfccc.int/wp-content/uploads/2022/11/HQBC-PG_FINAL_11.8.2022.pdf.

34. *Id.* at 14–16, 18, 22–23.

intentioned document, it contains internal contradictions. On the one hand, the authors call upon efforts to "safeguard nature" with projects that "do no harm" but also to mobilize "high-integrity capital."[35] The authors do not answer what constitutes "high-integrity capital" in this context. Instead, there is a presumption that all investment sources are equal because money is fungible. Does "high-integrity" refer to the reliability of the funding source? Or does "high-integrity" refer to the originating source of the money? Does it make sense for NBS projects to be funded by the fossil-fuel industry if the source of the money is continued fossil-fuel production?[36]

Further explanation of the principles does not offer much clarity or factor in the accepted definitions of NBS offered by IUCN, European Commission, and UNEA that explicitly reference "biodiversity benefits." The Conservation International document calls upon industries to have a decarbonization strategy as part of NBS blue-carbon principles.[37] Industries do not have any guidance under the principles about the quality of any biodiversity benefits delivered by a particular project. Project developers are expected to "prioritize conservation of current systems" and design restoration projects to "recover ecological integrity and connectivity and to enhance opportunities for natural regeneration"[38] without any measure of achievement for these general objectives. As the document observes, conservation of current systems that already offer biodiversity benefits will not actually bolster a blue carbon market because such systems will not provide additionality.[39] Markets depend on additionality as a pre-requisite for selling legitimate credits or offsets. The document, however, still pushes for the development of markets and calls upon governments to "provide robust regulatory and policy frameworks for the issuance and sale of blue carbon credits." They can do this by "accelerat[ing] public investment financing . . . to grow the marketplace by underwriting the development of blue carbon projects."[40] Part of the challenge inherent in using the Conservation International document to define NBS principles is posed by its singular reliance on capital-based economic justifications. A conceptualization of NBS that considers benefits to both human and more-than-human

35. *Id.* at 10–11, 15, 23.

36. One example of an NBS program that may have questionable financing is Shell's NBS Programme (2019-2021), which invested in the restoration of forests, grasslands, and wetlands as an offset for fuel use by customers at 1400 fuel stations in the Netherlands and the UK. ROYAL DUTCH SHELL, DELIVERING ENERGY RESPONSIBLY: SUSTAINABILITY REPORT 2019, at 80 (2019).

37. CONSERVATION INT'L ET AL., *supra* note 33, at 24.

38. *Id.* at 15.

39. *Id.*

40. *Id.* at 26.

communities would be better sustained under different logics, such as the principle of solidarity discussed in Part III.

When NBS depends on the generation of financial capital but no regulatory regime requires entities to measure "biodiversity benefits," the ability of an NBS project to benefit "biological diversity" is less certain.[41] At present, ecosystem services for human well-being are the priority interests for most NBS efforts. For example, the EU Handbook authors conceive of NBS as being responsive to climate resilience, water management, natural and climate hazards, green-space management, biodiversity, air quality, place regeneration, knowledge and social capacity-building for urban transformation, participatory planning and governance, social justice and social cohesion, health and well-being, and new economic opportunities and green jobs.[42] "Biodiversity" is just one among many issues for NBS projects and is not identified as a priority issue. What biodiversity benefits will emerge from these programs is uncertain because even projects that intend to support better biodiversity outcomes, such as coastal mangrove-restoration efforts, often experience challenges with implementation. For example, after years of mangrove planting in the Philippines, fewer than 20% of the mangroves have survived, in part because of poor site choices.[43] Likewise, in Sri Lanka, only three out of 23 mangrove restoration sites had survival rates of more than half; the other sites had no survival.[44]

Yet enthusiasm to build out more blue markets and blue infrastructure remains high even when outcomes are difficult to achieve or measure. While existing blue-carbon markets have reliably quantified carbon sequestration from mangroves, seagrass, and wetland restoration, there are recurring proposals to include seaweed farming as part of blue carbon. Leaving aside any of the technical questions of sequestration in seaweed, including the quantity and duration of sequestration,[45] questions remain about whether

41. Alexandre Chausson et al., *Going Beyond Market-Based Mechanisms to Finance Nature-Based Solutions and Foster Sustainable Futures*, PLOS CLIMATE, Apr. 6, 2023, at 1, 2, https://journals.plos.org/climate/article?id=10.1371/journal.pclm.0000169.

42. EUR. COMM'N, EVALUATING THE IMPACT OF NATURE-BASED SOLUTIONS 17 (Adina Dumitru & Laura Wendling eds., 2021).

43. Jurgenne Primavera & J.M.A. Esteban, *A Review of Mangrove Rehabilitation in the Philippines: Successes, Failures and Future Prospects*, 16 WETLANDS ECOLOGY MGMT. 354, 363 (2008), https://www.researchgate.net/publication/227247550_A_review_of_mangrove_rehabilitation_in_the_Philippines_Successes_failures_and_future_prospects; Shing Yip Lee et al., *Better Restoration Policies Are Needed to Conserve Mangrove Ecosystems*, 3 NATURE ECOLOGY & EVOLUTION 870, 871 (2019), https://www.researchgate.net/publication/332744475_Better_restoration_policies_are_needed_to_conserve_mangrove_ecosystems.

44. Kodikara Arachchilage Sunanda Kodikara et al., *Have Mangrove Restoration Projects Worked? An In-Depth Study in Sri Lanka*, 25 RESTORATION ECOLOGY 705, 709 (2017), https://bluemangrove.fund/wp-content/uploads/2021/03/Have-mangrove-restoration-projects-worked_-An-in-depth-study-in-Sri-Lanka_-Evaluation-of-mangrove-restoration-in-Sri-Lanka.pdf.

45. Catriona L. Hurd et al., *Forensic Carbon Accounting: Assessing the Role of Seaweeds for Carbon Sequestration*, 58 J. PHYCOLOGY 347, 348 (2022).

farming seaweed at scale would be detrimental to biodiversity.[46] In cases such as these, market development is ahead of the science.

What do these varied examples from recent NBS documents mean? They suggest that there is an increasing need for clarity to draw boundary lines about what should or should not qualify as NBS so that investments go to projects with multiple benefits and not merely projects that are rebranded ecosystem-service projects. One group of researchers recently proposed a four-group typology for "marine nature-based solutions."[47] Group A includes solutions that improve sustainable use and protection of natural marine ecosystems and ecosystem services.[48] This includes large marine protected areas and rebuilding of marine ecosystems.[49] Group B includes solutions that improve the multifunctionality of a marine ecosystem and includes seagrass restoration and shoreline protection using reefs and seagrass.[50] Both groups have a high potential to provide some biodiversity benefits. The researchers proposed two other NBS groups: Group C consists of novel, restored, or deliberately designed artificial marine ecosystems (e.g., artificial reefs and low trophic aquaculture),[51] and Group D is nature-inspired designs that reduce environmental pressures (e.g., wind-powered ships).[52] It is unclear whether or how these two latter groups will directly contribute to biodiversity benefits. The authors provide some Group C examples that seem to encourage biodiversity benefits, such as "purposely designed artificial reefs" that decrease trawling and increase habitat variety,[53] but they also provide examples such as sea ranching of abalones with the primary purpose of food production.[54] Aquaculture, however, does not necessarily maintain or benefit biodiversity unless limited to some carefully designed multitrophic mariculture projects.[55]

Categorizing Group D as NBS appears to potentially undermine the NBS definition requiring that projects provide "biodiversity benefits." While

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46. Wouter Visch et al*., Environmental Impact of Kelp (*Saccharina Latissima*) Aquaculture*, 155 MARINE POLLUTION BULL. 110962, 110967, 110970 (2020) (finding a shading effect of 40% at 5-meter depth during peak growth and concluding that, although shading is likely to have only limited functional and ecological effects on seabed floor communities, increased farm sizes could cause "unforeseen ecological impacts").

47. Christian Riisager-Simonsen et al., *Marine Nature-Based Solutions: Where Societal Challenges and Ecosystem Requirements Meet the Potential of the Oceans*, MARINE POL'Y, June 2020, at 1, 3–4, fig. 1, (2020) https://doi.org/10.1016/j.marpol.2022.105198.

48. *Id.*

49. *Id.*

50. *Id.*

51. *Id.*

52. *Id.*

53. *Id.* at 6.

54. *Id.* at 7.

55. Adam D. Hughes, *Defining Nature-Based Solutions Within the Blue Economy: The Example of Aquaculture*, FRONTIERS MARINE SCI., July 2021, at 1, 3, https://doi.org/10.3389/fmars.2021.711443.

Group D projects arguably benefit biodiversity by not further harming it, it is hard to believe that NBS should be considered so broad as to encompass a variety of projects that do not cause further harm to biodiversity but also do not "benefit" it.[56] The process of determining which projects qualify as NBS projects must be more selective. Otherwise, we end up with the proverbial slippery slope, where projects can be considered "nature-based" merely because they do not actively harm nature.

The researchers who developed the four-group typology emphasized several key lessons from analyzing existing NBS cases, including the need for alignment with environmental policies, prioritization of ecosystem targets, and ensuring environmental sustainability of NBS.[57] In spite of this sensitivity, the authors then observe that even though there is something "intuitive" about promoting Type A NBS projects, one should not "dismiss alternative types of NBS . . . in certain contexts" because "it could potentially be more cost-effective to apply a type C or D NBS to reduce a specific environmental pressure, rather than, e.g., restocking a naturally occurring population of animals, seaweed or similar . . . type A or B NBS."[58]

The authors suggest that this is pragmatic because policy efforts such as those being undertaken by the EU in adopting an NBS strategy should not "exclude many key stakeholders who will be needed to deliver the transformational change which, e.g., [the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services] emphasizes is needed to halt the present loss of biodiversity."[59] While the authors may be correct that enlarging the concept of NBS could be more inclusive and more cost-effective, Group C or D actions would not necessarily provide the multiple benefits, including biodiversity benefits, that NBS projects must provide. The proposed four-part typology might prove problematic if it were relied on by policymakers as a potential menu of NBS options.

Without a shared working definition, the effort to promote NBS as a policy pathway becomes problematic, much like the concept of "carbon neutrality" and "net zero" meaning many different things to different interest groups is problematic.[60] In trying to find a working definition, researchers who collected 20 different definitions of NBS from research papers and reports observed that although the concept of NBS can appear difficult to

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56. All three of the definitions discussed in this section (from IUCN, the European Commission, and UNEA) explicitly identify "benefits" to biodiversity as part of an NBS project. *See* IUCN, *supra* note 16; EUR. COMM'N, *supra* note 17; Environmental Assembly Res. 5/5, *supra* note 18.

57. Riisager-Simonsen et al., *supra* note 47, at 2.

58. *Id.* at 8.

59. *Id.* at 9.

60. Rahul Tongia, *Net Zero Carbon Pledges Have Good Intentions. But They Are Not Enough.*, THE BROOKINGS INST. (Oct. 25, 2021), https://www.brookings.edu/articles/net-zero-carbon-pledges-have-good-intentions-but-they-are-not-enough/.

articulate, there must be some shared definitional boundaries for the concept to be meaningful.[61] They conclude that an action cannot qualify as an NBS action without "clearly defined goals, partners, beneficiary groups[,] and management systems," even if there are environmental benefits.[62] Likewise, NBS projects cannot simply have "no impact on biodiversity" but rather must "provide biodiversity gain" and "clearly and measurably set and monitor biodiversity conservation outcomes," preferably over the long term.[63] Biodiversity should not be an afterthought, and NBS projects need "to be designed explicitly to demonstrate how they will deliver measurable benefits for biodiversity."[64]

Although it is beyond the scope of this paper to comprehensively review the pool of existing self-identified marine NBS projects,[65] a short review of a 2020 report titled *Blue Nature-Based Solutions in Nationally Determined Contributions* highlights the challenge of ensuring that projects offer at least some identifiable additional "biodiversity gain" or prioritized management for biodiversity-related goals.[66] This brief review in no way suggests that the projects described in the report are not worthwhile projects as measured by criteria of sustainable development or community development. This review instead raises the question of which multi-benefit projects should really qualify as NBS projects for potential investors. As illustrated in Appendix 1 below, managed "biodiversity gains" are often not stated objectives for projects that are categorized under NBS. Ecosystem-based biodiversity gains received little attention in many of the general project-impact descriptions. Most of the focus in these descriptions was instead on human-based outcomes. Of the 24 projects reviewed by the report, only 7 clearly described

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61. Hughes, *supra* note 55, at 4.

62. Barbara Sowińska-Świerkosz & Joan García, *What Are Nature-Based Solutions (NBS)? Setting Core Ideas for Concept Clarification*, NATURE-BASED SOLS., Dec. 2022, at 1, 6, https://doi.org/10.1016/j.NBSj.2022.100009.

63. *Id.*

64. Seddon et al., *supra* note 7, at 1532 (adding that how to design each project to deliver benefits will differ by project but that, at a minimum, project proponents working on restoration or conservation should choose diverse mixes of native species, avoid destruction of existing species-rich habitats, conduct baseline assessments, set quantitative targets, monitor progress, and manage any unintended negative consequences).

65. *See generally* Isabel B. Key et al., *Biodiversity Outcomes of Nature-Based Solutions for Climate Change Adaptation: Characterising the Evidence Base*, FRONTIERS ENV'T SCI., Oct. 2022, at 1, https://doi.org/10.3389/fenvs.2022.905767 (noting the limited selection of metrics used for assessing biodiversity outcomes and the limited taxonomic coverage of most interventions).

66. *See generally* MORITZ VON UNGER ET AL., BLUE NATURE-BASED SOLUTIONS IN NATIONALLY DETERMINED CONTRIBUTIONS (2020), https://gridarendal-website-live.s3.amazonaws.com/production/documents/:s_document/610/original/NbS_in_NDCs._A_Booklet_for_Successful_Implementation.pdf?1606858312 (outlining 24 NBS projects, most of which are mangrove restoration projects); *see infra* pp. 25–31 (analyzing each of the 24 projects' biodiversity benefits and scope).

the expansive and additional biodiversity benefits that would result from implementing the projects.[67] Eleven of the other projects described biodiversity benefits but only did so with respect to one species (e.g., coastal mangroves) or one activity (e.g., replanting).[68] There were no further references to other specific biodiversity objectives, so it was unclear whether the mangrove reforestation was managed for broader biodiversity gains or whether broader biodiversity gains (e.g., restored coastal nurseries) were actually achieved. Six of the projects had no meaningful descriptions of biodiversity benefits and seemed to be preliminary projects for pursuing a NBS project (e.g., building participatory governance) rather than NBS projects in their own right.[69]

The rationale for regularly prioritizing human-first projects over multiple benefit projects seems to make sense in a world where human-first development seems more politically achievable than broader multipurpose projects. It is unclear, however, whether we will be able to work our way out of the problems for which NBS is being recommended as an intervention with the same attitudes that we used to create such problems. When NBS becomes a tool to offset emissions from airlines and oil and gas companies without requiring those entities to shift their business practices, then NBS is a distraction. NBS can still potentially support legitimate ecological goals, but any approach to NBS projects must avoid the current relationship, in which humanity believes that somehow "nature" will save us where technology has failed to do so. What will save us and our more-than-human world, rather, will be our mindsets and attitudes towards what it means to be in relation with each other.

As suggested by the 2022 White House Report on NBS, insufficient awareness of NBS, regulatory and policy hurdles, difficulty accounting for costs and benefits, insufficient and uncoordinated funding, limited workforce knowledge, and gaps in evidence of effectiveness are legitimate challenges but are not the true hurdle.[70] The ultimate challenge is figuring out how to awaken human communities to care about NBS with consequences for more-than-human communities. In focusing on humanity's climate problems (e.g., greenhouse gas emissions, urban heat islands, inland flooding, stormwater overflow, shoreline erosion, wildfire, drought, crop loss, loss of culture and jobs, obesity, and stress),[71] we continue to fail to make the long-term,

67. *See generally* VON UNGER ET AL., *supra* note 66 (summarizing the 24 projects); *see infra* pp. 25–31 (taking stock of biodiversity benefits and their scope in the 24 projects described in the von Unger report).

68. VON UNGER ET AL., *supra* note 66; *infra* pp. 25–31.

69. VON UNGER ET AL., *supra* note 66; *infra* pp. 25–31.

70. WHITE HOUSE COUNCIL ON ENV'T QUALITY ET AL., *supra* note 3, at 15–16.

71. *Id.* at 13–14.

fundamental cultural changes that provide an alternative path forward for society—one in which humanity takes a more holistic approach to its relationship with the more-than-human world. We remain victims to our systems that do not see the more-than-human world as a reciprocal partner.

The next Part of the Article focuses on the possibilities of developing the legal principle of solidarity as a mechanism for transforming attitudes, such that NBS can develop in a different direction than the current trend towards market-based financialization and capitalization of NBS. Current NBS efforts depend on emphasizing what nature can do for us rather than helping us reintegrate with our more-than-human world.

III. THE PRINCIPLE OF SOLIDARITY IN ENVIRONMENTAL CONSERVATION AND RESTORATION

Conservation and restoration efforts intended to both improve human well-being and benefit biodiversity are often stymied by a combination of technical, financial, and governance barriers.[72] Technical barriers depend on understanding the larger implications of restoration interventions and unanticipated system changes.[73] Financial barriers include undervaluing the benefits of restoration and failing to attract revenue generation.[74] Finally, governance barriers include decision-making inertia, conflicting stakeholder preferences, and a preference for achieving short-term objectives that interfere with longer-term efforts.[75] While these are all substantial challenges, our mindsets need to change before we can overcome financial and governance barriers to conservation. Even when properly governed, markets will only provide a partial solution if conservation and restoration are reduced to transactions.

What is needed is a non-transactional approach to being with nature that includes fewer demands of nature and more respect for the non-human world in which we reside. These norms are beginning to emerge in the form of a legal principle of solidarity. The normative concept of "solidarity" first emerged as a moral and ethical principle. The Sections below discuss the roots of "solidarity" in the context of communitarianism followed by a discussion of the legal principle derived from human rights.

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72. Agustín Sánchez-Arcilla et al., *Barriers and Enablers for Upscaling Coastal Restoration*, NATURE-BASED SOLS., Dec. 2022, at 1, 2 (*see* Table 1), https://doi.org/10.1016/j.NBSj.2022.100032.

73. *Id.* at 5–6.

74. *Id.* at 6.

75. *Id.*

A. Roots of Solidarity in Communitarianism

"Solidarity" is grounded in ideas of communitarianism, which advances the concept that what we can achieve as a human community depends on the health of our social relations. Communitarianism presents an alternative to populism,[76] which focuses on boosting individualism in the name of freedom. Communitarian writers identify community as located within place, memory, and psychology.[77] Communitarian thinkers call for a change to our "habits of the heart" so that we can communally protect and identify with a community of place as a "home" as well as connect with "communities of memory."[78] The so-called "communities of memory" offer an opportunity to connect to a shared history but also to a future common good.[79] A final form of community relevant to the concept of solidarity is the "psychological communities" of people who, "based on face-to-face interaction, are governed by sentiments of trust, cooperation, and altruism in the sense that constituent members have the good of the community in mind and act on behalf of the community's interest."[80] Collectively, these three types of communities—communities of place, memory, and shared psychology—offer important possibilities for thinking about how we can live in an emergent relationship with our human communities but also with more-than-human communities.

NBS that provides biodiversity gains is an ideal that currently operates in a "community of memory" to help bring us back some of our "lost legacy" of functional landscapes and seascapes. Success for any NBS project, however, will depend on being located within a defined community of place, where there is a shared communal psychology that is based on trust, cooperation, and altruism for the good of the community, including the more-than-human community.[81] While most NBS projects operate in a community of place, there may not be a shared communal psychology around the values inherent in the project, such as benefiting biodiversity. This aspect of "community" may be lost or missing because many human communities are fragmented or detached due to social and political disruptions. Restoring belonging and support within human communities may be a necessary precursor for NBS to achieve long-term goals for both human well-being and biodiversity benefits.

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76. Daniel Bell, *Communitarianism*, STAN. ENCYC. OF PHIL., https://plato.stanford.edu/archives/fall2023/entries/communitarianism/ (May 15, 2020).

77. *Id.*

78. *Id.*

79. *Id.*

80. *Id.*

81. *Id.*

Related to communitarian ideals is care ethics, which calls upon individuals to cultivate nurturing and caring relationships. In the context of care ethics, rules and their consequences may only provide certain kinds of reductionist responses to otherwise highly contextual challenges.[82] A care ethicist, for example, endeavors to think not just about "abstract individuals and their actions" but "concrete, situated people with feelings, friends, and dreams—persons who can be cared about."[83] Jane Addams, in her applied social-ethics work, captured the spirit of care ethics as she called upon individuals to express care for each other through their neighborly relationships in social settlements.[84]

While Addams never worked on biodiversity, her work on the need to understand, learn, and respond to context through care is central to NBS. The concept of care empowers human communities to invest in existing and future generations without the need for the intervention of a market. Care ethicists call for "care respect," which encourages individuals to both value nature for its unique qualities and to protect nature because it has special care needs.[85] Humans can exercise this "care respect." The shared communal psychology for NBS needs to be one grounded in "care ethics"; that is, one that reflects our responsibility to care for the natural world for its own sake and to protect it for future generations. It is this notion of shared responsibility that is captured in the legal "principle of solidarity."

B. Principle of Solidarity and its Relevance to NBS

"Solidarity" has been recognized as both a value and a principle within international law, and, more recently, there have been efforts to recognize it as a right. International solidarity is the collective basis for the formation of the United Nations (UN). This principle has been refined over time and was encompassed in the 2000 UN Millennium Declaration.[86] Designed to assist states with achieving a broad implementation of human rights, this document described solidarity as a value shared across the international legal system. International solidarity addresses global challenges by emphasizing a fair distribution of costs and burdens "in accordance with basic principles of

82. *See* Maurice Hamington, *Jane Addams*, STAN. ENCYC. OF PHIL., https://plato.stanford.edu/archives/fall2022/entries/addams-jane/ (July 7, 2022) (explaining Addams's desire to improve society through communities built on trust, care, altruism, and cooperation).

83. *Id.*

84. *Id*.

85. *See* Robin S. Dillon, *Respect and Care: Toward Moral Integration*, 22 CANADIAN J. PHIL. 105, 112 (1992) (suggesting that by respecting individuals' particularities, we in turn respect nature and its value to individuals).

86. *See* G.A. Res. 55/2, UN Millennium Declaration, ¶ 6 (Sept. 8, 2000), https://www.ohchr.org/en/instruments-mechanisms/instruments/united-nations-millennium-declaration (declaring the concept of solidarity "fundamental" to 21st-century international relations).

equity and social justice," meaning that "[t]hose who suffer or who benefit least deserve help from those who benefit most."[87] In this same declaration, states agreed that "[w]e must spare no effort to free all of humanity, and above all our children and grandchildren, from the threat of living on a planet irredeemably spoilt by human activities, and whose resources would no longer be sufficient for their needs."[88] State signatories agreed to adopt a "new ethic of conservation and stewardship."[89]

From these values of equity, social justice, care, and collective stewardship, a principle of "international solidarity" has emerged. As a precondition for human dignity, international solidarity calls for deep cooperation to meet shared challenges. Such cooperation must include not just the delivery of humanitarian assistance or delivery financing but also "refraining from doing harm or posing obstacles to the greater well-being of others, including in the international economic system and to our common ecological habitat, for which all are responsible."[90]

While the principle of solidarity focuses primarily on addressing human rights, there is a recurring theme in many human rights documents that "solidarity" also encompasses environmental protection. The argument for environmental protection is that rights and freedoms cannot be fully realized without a healthy environment. In a recent draft declaration on a right to international solidarity, the authors noted that "international solidarity" is essential to preventing and overcoming many challenges, including "environmental degradation."[91] In particular, the declaration observes that "reactive solidarity" by states, international organizations, and non-state actors can form the basis for addressing environmental degradation.[92] Article 9 of the draft declaration calls upon states:

> to realize international solidarity as a human right that is indivisible from, interrelated to[,] and interdependent on all other human rights, and is normatively anchored in a system of rights and corresponding obligations established by international law, relating to . . . environmental protection . . . [and] creating a global enabling environment for sustainable development that is centered on

87. *Id.*
88. *Id.* ¶ 21.
89. *Id.* ¶ 23.
90. Rudi Muhammad Rizki (Independent Expert on Human Rights and International Solidarity), *Report of the Independent Expert on Human Rights and International Solidarity*, ¶ 58, U.N. Doc. A/HRC/15/32 (July 5, 2010) [hereinafter *Report of Independent Expert Rizki*].
91. Obiora Chinedu Okafor (Independent Expert on Human Rights and International Solidarity), *Report of the Independent Expert on Human Rights and International Solidarity*, at 12, U.N. Doc. A/HRC/53/32 (May 2, 2023).
92. *Id.* annex I, art. 2.2.

> individuals and peoples and is grounded in intergenerational justice and equity.[93]

While the language from the multiple UN Independent Experts for International Solidarity is human-centric in its approach to implementing solidarity, states can extend solidarity obligations to humanity's relationship with the more-than-human world. States can avoid environmental degradation by respecting rights for international solidarity situated in human communities and acknowledging interdependence across life systems as a basis for human rights. Human-rights practitioners already contemplate ecology as a key shared foundation for solidarity rights and human well-being.[94] In particular, we have obligations "to all those within a generation, and also to those yet unborn, encompassing the idea of solidarity with humanity and its ecological habitat."[95] Behind the legal drafting to protect and promote human rights through international solidarity is a simple message: we are all in this together, and "we" includes more than humanity.

This principle of solidarity, which the declaration identifies as a right, offers a mindset change. It recognizes international solidarity as essential for overcoming environmental degradation while directing states to focus on "individuals and peoples" as a source of change. Embedded throughout the draft declaration is an implicit call for communitarianism. When Virginia Dandan served as the Independent Expert on Human Rights and International Solidarity, she delivered a key message capturing this theme:

> Solidarity should and must be a positive force in the lives of people and of nations, but we must be vigilant and protect the bonds that link us together. To build a better future requires everyone to work together and as one. Sustainable development requires international solidarity not only among the Governments of the world, but also among the peoples of the world, to actively participate in this project of building a better world.[96]

NBS can contribute to international solidarity, but only if projects do more than just offset carbon-intensive activities. NBS projects must belong

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93. *Id.* annex I, art. 9.1.

94. Promotion and Protection of All Human Rights, Civil, Political, Economic, Social and Cultural Rights, Including the Right to Development, Hum. Rts. Council, ¶ 11, U.N. Doc A/HRC/12/27 (July 27, 2009), https://www2.ohchr.org/english/bodies/hrcouncil/docs/12session/A-HRC-12-27.pdf.

95. *Id.* ¶ 31.

96. Press Release, Virginia Dandan, U.N. Hum. Rts. Off. of the High Comm'r, "Moving Together as One: Solidarity as the Foundation of the UN Development Agenda Beyond 2015" International Human Solidarity Day – Saturday 20 December 2014, U.N. Press Release (Dec. 20, 2014), https://www.ohchr.org/en/press-releases/2014/12/moving-together-one-solidarity-foundation-un-development-agenda-beyond-2015.

to a community that engages in the project not just to generate income but to restore relationships with the land, the coast, or the oceans. Recent efforts from actors like the World Business Council for Sustainable Development (WBCSD) have lost this point. WBCSD publishes technical NBS factsheets under the rubric of "natural climate solutions" for their membership, which call for investments in "core" benefits. These benefits, which include "increased biodiversity, climate adaptation, improved quality of life for rural communities[,] and many others,"[97] are intended to ensure that a "natural climate solution" is "nature positive."[98] The WBCSD includes a variety of standards to achieve these core benefits, including "verified emission reductions,"[99] "planned emission reductions,"[100] "verified carbon units,"[101] and recognition of landscape performance claims.[102] Only one of these standards directly identified biodiversity as a project objective using under Verra's Verified Carbon Standard Climate, Community and Biodiversity Standards.[103]

Where does this leave us? NBS is a conceptually powerful approach to create an equitable and just world for human and more-than-human communities by recognizing and restoring interdependence. Regrettably, the intent behind the concept has become confused. Too many purported NBS projects provide great value to human communities but only minimal value for more-than-human communities. NBS has become a buzzword, and projects focused only on the ecosystem-service values of nature have become conflated with NBS. As more so-called "NBS" projects become

97. WORLD BUS. COUNCIL ON SUSTAINABLE DEV., "CORE BENEFITS STANDARDS" AND THE IMPACT OF NATURAL CLIMATE SOLUTIONS (NCS) ON SUSTAINABLE DEVELOPMENT 3 (2022), https://www.wbcsd.org/contentwbc/download/15114/213957/1 [hereinafter *Core Benefits Standards*].

98. WORLD BUS. COUNCIL ON SUSTAINABLE DEV., THE ROLE OF NATURE-BASED SOLUTIONS IN STRATEGIES FOR NET ZERO, NATURE POSITIVE AND ADDRESSING INEQUALITY 8 (2022), https://www.wbcsd.org/contentwbc/download/15116/213973/1.

99. *Core Benefits Standards*, *supra* note 96, at 4.

100. *Id.*

101. *Id.* at 5.

102. *Id.* at 10.

103. *Id.* at 7; *see also CCB Standards*, THE CLIMATE, COMMUNITY, & BIODIVERSITY ALL., https://www.climate-standards.org/ccb-standards/ (last visited Feb. 12, 2024); *Welcome to the Verra Registry*, VERRA, https://registry.verra.org (last visited Feb. 12, 2024). Verified Carbon Standard projects are much more popular than projects under the Climate, Community, & Biodiversity Standards (CCB) requiring co-benefits. *Id*. As of October 28, 2023, Verra had issued Verified Carbon Units to 1,659 projects, but only 46 CCB projects had been validated for credit units and 82 CCB projects had been verified. *See Climate, Community, & Biodiversity Standards*, VERRA, https://registry.verra.org/app/search/CCB (last visited Feb. 12, 2024). Of the verified projects, only 47 had qualified as biodiversity projects as of February 26, 2024 (e.g., Serra do Amolar REDD Project, Pendjari and W-Benin National Parks REDD+ Project, Tahuamanu Amazon REDD Project, Guoluo Grassland Sustainable Management Project, Mindanao Tree Planting Program for our Climate and Communities, Zhanjiang Mangrove Afforestation Project, TIST Program in Kenya, TIST Program in Uganda, Blue Carbon Project Gulf of Morrosquillo "Vida Manglar"). *Id*. All of these projects have focused on reducing emissions from deforestation and degradation, avoiding conversion of grasslands and shrublands, afforestation/reforestation/revegetation, or wetland rewetting. *Id*.

commoditized within existing global markets in the name of carbon offsets or carbon credits, we face the possibility of losing a transformational opportunity to do actual restoration work, which requires not just offsetting carbon but restoring relationships between human and more-than-human communities as well as within more-than-human communities. NBS projects are hard to implement because they require much more holistic efforts than the existing commodity markets value, but they are worth community investments because they offer a different pathway. The final Part of this paper offers one possibility for instilling the emerging legal principle of solidarity within our current communities to restore a mindset of respect for interdependence.

IV. PRINCIPLE OF SOLIDARITY IN "ECOLOGICAL EDUCATION AND SERVICE"

To ensure NBS is more than a Corporate Social Responsibility effort operating within the current market system, NBS must incorporate place-based solutions that are co-created and co-produced with the communities implementing them rather than just designed by experts for private companies. To change mindsets, we need to re-engage human communities with their surrounding more-than-human communities. One potential U.S. application would be an "ecological education and service" program that involves paid community service and uses jury duty as a template.

Parties under federal and state law have the right to a jury of their peers, which originates from constitutional and state law.[104] Jury duty is a civic duty, and nearly all residents can anticipate possibly being called for service. Jury duty is a fundamental mechanism to ensure the rule of law by engaging citizens as decision-makers and agents of the law.

Drawing on international solidarity and the need to protect "our common ecological habitat, for which all are responsible,"[105] state governments might consider a new mechanism to offer individuals the opportunity to engage in long-term NBS projects. What if community members dedicated time to restoring their own communities? Restoration projects, particularly active restoration projects, are typically expensive and require long-term management and monitoring. Leadership of these community service projects will require trained specialists in biology, hydrology, or ecology. Much of this work can be done by laypersons by creating opportunities within a place-based community to support restoration efforts. Involving residents in a project facilitates a psychological community that better understands the interdependence of place-based ecological relationships.

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104. FED. R. CIV. P. 38; *cf.* CAL. CONST. art. I, § 16 (comparing California's right to trial by jury to the federal rule).

105. *Report of Independent Expert Rizki*, *supra* note 90, ¶ 58.

This proposal intends to extend current efforts, such as the American Climate Corps,[106] to all residents to increase human power in furthering restoration work and opportunities for developing new mindsets. What might this look like in practice? It could look a lot like jury duty, where adults receive a summons to appear at a location within the community to provide one day of service. Qualified individuals must appear at the service location unless excused and participate in service activities. During the day of service, a service-project leader will introduce the program and the long-term goals of the project. Part of this introduction will educate the service group for the day on the biological benefits of their work. Depending on the project's complexity, the project leader will assign individuals to various roles, which might include vegetation planting, habitat maintenance, or habitat monitoring. Government employers and large-revenue employers (i.e., employers netting a certain amount of revenue) will provide full pay and benefits for their employees engaged in ecological service. Individuals not working for a large-revenue employer or the government or who are self-employed will receive minimum wages for each hour of the service day. Failure to appear without an excused absence will result in a fine that will go to a fund used to run the service program. The program should be designed inclusively, such that individuals with health conditions can still participate in the day of service by contributing volunteer hours with preparing refreshments or taking pictures. The most important part of the project is getting people out to a site and engaged in learning about their own place-based community.

There are two primary challenges with this proposal. One will be creating the human resources needed for coordinating this program to ensure that the projects qualify as NBS projects with biodiversity benefits. This would require regional, state, and local authorities to invest substantial resources in identifying appropriate projects on public lands. In future iterations of this service, it might be possible to extend service efforts to the lands of willing private landowners whose properties provide opportunities for meritorious biodiversity projects. The second challenge is the potential for political resistance from populist groups or individuals. If we can pilot "ecological service," it may overcome political resistance as individuals experience the

106. *FACT SHEET: Biden-Harris Administration Launches American Climate Corps to Train Young People in Clean Energy, Conservation, and Climate Resilience Skills, Create Good-Paying Jobs and Tackle the Climate Crisis*, THE WHITE HOUSE (Sept. 20, 2023), https://www.whitehouse.gov/briefing-room/statements-releases/2023/09/20/fact-sheet-biden-harris-administration-launches-american-climate-corps-to-train-young-people-in-clean-energy-conservation-and-climate-resilience-skills-create-good-paying-jobs-and-tackle-the-clima/. The American Climate Corps is a Biden-Harris Administration initiative to assist youth in finding jobs in deploying low-cost and reliable clean energy; implement energy efficiency efforts; rebuild coastal wetlands; manage forests to prevent wildfires; protect public lands; enhance agricultural systems to conserve water; and advance environmental justice. *Id.*

benefits of working in their own community to protect and conserve local places for this generation and generations to come.

There are two major benefits for this proposal that justify investments to allocate human resources to support this proposal. First, there are likely to be more tangible restoration and conservation outcomes as individuals contribute their labor to reviving ecological functions for their community. Second, there are likely to be more opportunities to build solidarity, both across human communities working towards a shared place-based cause and between human communities and more-than-human communities, as individuals have the opportunity to interact outside of their habitual human-built communities. Working with people from many different backgrounds who call a particular place home offers a chance to understand other people beyond preconceived, stereotypical ideas. At the same time, groups get the chance to better understand the more-than-human communities that call particular places home.

While one day of service is minimal, a short service experience could encourage certain individuals to become further involved in their own communities by enhancing their natural knowledge of a place and perhaps conservation skills. To implement this NBS ecological service proposal, states would need to introduce legislation. A draft law is provided in Appendix 2.

CONCLUSION

The current trends in nature-based solutions offer an important opportunity to rethink what we are trying to achieve through NBS projects. Yes, we need to decarbonize. Yes, we need to create sustainable development opportunities. Yes, we need to restore our environment. And while the forces of financialization and commoditization in the form of markets can contribute to some of these goals, they can also undermine the longer-term transformations called for and the efforts to promote a "right to international solidarity" based on community care ethics. This Article argues that we need to shift to a new mindset, such as Iris Young's proposed shift from a "liability model" of the world—where responsibility exists based on linking a particular action with a particular consequence—to a "social connection model" that calls for participatory problem-solving across a community.[107]

The proposal in this Article for a legally driven "ecological education and service" effort formulated on jury duty is a modest attempt to further a principle of solidarity through a social connection model. The state would provide opportunities for individuals to reconnect themselves to a place with

107. IRIS M. YOUNG, RESPONSIBILITY FOR JUSTICE 96–97 (Samuel Freeman ed., 2011).

human communities and more-than-human communities. These are the nature-based solutions that we need but for which modern life, for many, does not afford the opportunity. One day of service in one community may seem minor in the scope of global challenges, but it offers a small root to connect people to each other and to their place.

APPENDIX 1

Review of List of "Nature-Based Solutions" from "Blue Nature-Based Solutions in Nationally Determined Contributions: A Booklet for Successful Implementation" (GIZ 2020)[108]

Project	*Stated Objective*	*Biodiversity Benefit*	*Meets NBS with Managed "Biodiversity Benefits"*
Integrated Mangrove Fishery Farming	To respond to specific vulnerabilities of coastal communities to climate change by introducing saline-tolerant plants, growing brackish water fish in ponds to generate sustainable and additional income, and planting mangroves and halophytes to protect the coastline.	Maybe - insufficient details	Maybe
Multi-Sectoral Partners for Climate Resilience	To identify specific vulnerabilities to develop adaptation strategies through partnerships with communities, private sector, academia, and NGOs.	No (increase in biodiversity was for purpose of "fish ponds" and "mangroves and halophytes farming")	No
Sustainable Management of Morocco's	To help vulnerable communities adapt to climate change	Yes ("Refinement of MPAs and	Yes

108. *See generally* VON UNGER ET AL., *supra* note 66 (summarizing the 24 projects outlined here).

Marine Resources	by creating a network of fisheries cooperatives that sustainably manage marine protected areas on the basis of scientific and local knowledge.	creation of new ones" and "Estimated 20% to 30% increase in marine species and ecosystem")	
Strengthening Community Leadership for Mangrove Restoration and Food Security of the Paz River	To strengthen adaptative capacity by restoring coastal and mangrove forests and improving com-munities self-governance and political agency.	Maybe - insufficient details	Maybe
Ecosystem-Based Coastal Protection Through Floodplain Restoration	To provide protection to people living directly behind dikes by restoring flood plains and rehabilitating mangrove forests.	Unclear - noted result of "increased biodiversity and availability of ecosystem services," but all the information focuses on human community disaster risk reduction and biodiversity management	Maybe
Coral Gardening for Climate Change Adaptation in Vanuatu	To rehabilitate coral reefs, which are essential for livelihoods, income generation, and climate change adaptation.	Yes- 3,000 coral fragments planted and spread of heat stress tolerant corals	Yes

At the Water's Edge: Enhancing Coastal Resilience in Grenada	To build social and ecological resilience through the implementation of NBS including the installation of artificial reef structure.	No - no mention of biodiversity	No
Multi-Sectoral Coastal and Marine Management Vision	To solve the general problem of ungovernability of seascapes and unsustainable management.	No	No
Lauru Ridges to Reefs Protected Area Network (PAN)	To form a network of marine protected areas to strengthen marine resources protection and use them sustainably.	Yes ("establishment of protected area sites," "coordinated monitoring of protected areas")	Yes
An Incentivized Participatory Approach to Mangrove Conservation	To restore mangroves through carbon finance.	Yes - for mangroves, uncertain for other biodiversity	Maybe
Blue Carbon Credits Financing Community-Based Mangrove Management	To protect and restore mangroves using carbon finance.	Yes - for mangroves, uncertain for other biodiversity	Maybe
Building with Nature for Safe, Prosperous and Adaptive Coastlines	To increase resilience of 20 kilometers of coastline by combining civil engineering with	Yes - for mangroves, uncertain for other biodiversity	Maybe

	mangrove rehabilitation.		
Ghana Mangrove Restoration Within the Muni-Pomadze Ramsar Site	To restore the mangrove degraded area along the Muni Lagoon and its ecological integrity while providing alternative income sources to reduce pressure on the ecosystem.	Yes - improvement of fish spawning areas and increase in migratory birds	Yes
Blue Carbon A-Z: From Small Projects to Policy Development	To facilitate the development of sound scientific and political frameworks, including carbon stock inventories, livelihoods and vulnerability studies, and assessments of land/use dynamics	No	No
Pesca Responsable: Responding to Climate Change Through Sustainable Responsible Fishing and Mangrove Rehabilitation	To foster communities' ownership and involvement in a participatory management strategy to preserve the biosphere reserve and promote the sustainable management of resources.	Yes - for ecosystem productivity, mangrove seed dispersal, and species diversity	Yes
Marine Protected Area Learning Site	To address unsustainable practices that	Yes	Yes

for the Coral Triangle	degrade ecosystems and threaten biodiversity and livelihoods.		
Empowering Island Communities: The Use of Cost-Benefit Analysis to Support Informed Climate Change Decisions	To identify and select ecosystem-based adaptation solutions through a participatory process.	No	No
Community-Based Ecological Mangrove Restoration	To restore barren, unproductive areas into healthy mangrove ecosystems to protect communities from natural disasters and sustain their livelihoods.	Yes - for mangroves, uncertain for other biodiversity	Maybe
Addressing Resource Degradation to Enhance Climate Change Resilience	To use local knowledge to reforest areas, restore degraded lands, and regulate natural resource use.	Maybe - 180 hectare of reforestation but unclear other biodiversity enhancement	Maybe
Palau National Marine Sanctuary	To dedicate the entire marine territory to conservation by protecting the Exclusive Economic Zone using traditional practices of whole domain	Yes - managing 80% of the area as a "no-take" zone	Yes

	management and promote holistic, sustainable development.		
Valuating Climate Adaptation Options on Placencia Peninsula	To conduct a cost-benefit analysis on adaptation solutions to facilitate decision making, raise awareness, and engage all stakeholders to foster collaboration with policy makers; and, ultimately, to reduce the Peninsula's vulnerability and erosion risks.	No	No
Mangrove Restoration for Sustainable Fishery in Palk Bay	To address mangrove degradation by raising community awareness of mangrove benefits by involving the community in participatory conservation practice.	Yes - for mangroves, uncertain for other biodiversity	Maybe
Private Sector Investment in Conservation of Dry Forests and Mangrove Restoration	To create an innovative financial mechanism for the conservation and rehabilitation of mangroves and the development of sustainable activities.	Maybe (money invested in restoration of mangroves and a forest reserve)	Maybe

A Multi-Actor Alliance to Reduce the Risks of Cascading Hazards in Sian Ka'an	To increase local adaptive capacity through an EbA strategy based on mangrove rehabilitation and income diversification using public financial mechanisms.	Unclear	Maybe

APPENDIX 2

Model Legislation for an "Ecological Education and Service" Program

(a) Duty of citizenship

Ecological service is a responsibility of citizenship, and citizens are expected to engage in enhancing and improving ecological connections within their community.

(b) Principles

(1) No class or category of persons may be automatically excluded from ecological service except as provided by law on the basis of undue hardship. An individual will only be granted an exemption when requested. Inconvenience is not a reason for being excused.

(2) Individuals may defer ecological service for a temporary hardship.

(c) Requests to be excused from service

All requests to be excused from ecological service that are granted for undue hardship must be put in writing and submitted to [agency responsible for summoning for service].

(d) Reasons for excusing because of undue hardship

An excuse on the ground of undue hardship may be granted for any of the following reasons:

(1) The individual has no reasonably available means of public or private transportation to the project site with carpooling with other group members impossible.

(2) The individual must travel more than one-and-one-half hours from the prospective juror's home to the site.

(3) The individual is a caretaker for another person who cannot be brought safely to the site. Where appropriate, individuals who are caretakers may participate only in the portion of the program that is educational.

(4) The individual has a disability or impairment that will prevent them from coming to the site. The disability or impairment must be documented.

(5) The individual is engaged in the protection of the public health and safety, and it is not feasible to make alternative arrangements to relieve the person of those responsibilities during the period of service without substantially reducing essential public services.

(e) Indemnity

The service site is responsible for protecting service members from foreseeable hazards and gross negligence of site leaders but is not responsible for harms arising from natural hazards or weather events.

CLEAN ENERGY AND JUSTICE FOR ALL: THE FEDERAL GOVERNMENT'S INFLUENCE ON STATE ENERGY JUSTICE LEGISLATION

Elizabeth Beairsto[1]

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1. J.D., May 2024, Vermont Law School; B.A., Political Science & Economics, 2020, Randolph College. The author extends her deepest gratitude to Professor Mark James for his invaluable feedback in guiding and refining her writing; to her partner, Brian Smith, for his unwavering encouragement and support; and to Callista Smith, more than a best friend, for her love and kindness. Thanks also to the editors and staff of the Vermont Journal of Environmental Law for their meticulous and thoughtful review.

INTRODUCTION

The United States needs a clean-energy transition and needs it now. As the world grapples with the escalating climate crisis, America must take decisive action to significantly reduce greenhouse gas (GHG) emissions; this involves embracing low-carbon technologies and diversifying energy resources.[2] While federal investments in clean energy are increasing, state governments bear the responsibility to implement equitable laws and policies.[3] Nevertheless, this transition is not without its challenges. If not managed with foresight and careful planning, the clean-energy transition could exacerbate existing inequities rooted in America's fossil fuel-based power system.[4] Therefore, a balanced approach is necessary—one that ensures energy security, affordability, and sustainability while upholding principles of equity and justice.[5] America's energy transition must be fast and just.[6]

Navigating the complex "trilemma" of energy security, affordability, and environmental sustainability, energy laws and policies are pivotal in shaping the nation's transition. Central to resolving this trilemma is the concept of a "just transition," which adopts a holistic approach that prioritizes worker protection, economic stability, and environmental justice.[7] This approach integrates the four tenets of energy justice: recognition justice, procedural

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2. *See generally* Bjarne Steffen et al., *State Ownership and Technology Adoption: The Case of Electric Utilities and Renewable Energy*, MIT CEEPR 2 (MIT Ctr. for Energy & Env't Pol'y Rsch., Working Paper No. 2020-016, 2020), https://ceepr.mit.edu/wp-content/uploads/2021/09/2020-016.pdf (acknowledging that the prevention of "dangerous levels of global warming require[] a rapid and deep decarbonization of many industries by means of socio-technical transitions" and that "the adoption of low-carbon technologies also needs to be accelerated to this end").

3. *Clean Energy*, U.S. DEP'T OF ENERGY, https://www.energy.gov/clean-energy (last visited Mar. 16, 2023).

4. *See generally* Bethel Tarekegne et al., *Energy Storage as an Equity Asset*, 8 CURRENT SUSTAINABLE RENEWABLE ENERGY REP. 149, 149–55 (2021) (discussing the importance of careful planning according to energy-justice principles for the clean-energy transition).

5. WORLD ENERGY COUNCIL, WORLD ENERGY TRILEMMA INDEX 2022, 4 (2022), https://www.worldenergy.org/assets/downloads/World_Energy_Trilemma_Index_2022.pdf?v=1669842216; *see, e.g.*, Raphael Heffron et al., *Balancing the Energy Trilemma Through the Energy Justice Metric*, 229 APPLIED ENERGY 1191, 1191 (2018) (identifying why there is a need for a modeling tool such as the Energy Justice Metric, "which focuses on the full energy life-cycle and also has a distributive (inequality-correcting) oriented approach").

6. *See* Shalanda H. Baker, *Anti-Resilience: A Roadmap for Transformational Justice Within the Energy System*, 54 HARV. C.R.-C.L. L. REV. 1, 16 (2019) (emphasizing the need for renewable resources and a just transition).

7. This progression reflects a growing understanding of the interconnectedness between environmental policies and social equity. *See, e.g.*, J. MIJIN CHA ET AL., LABOR NETWORK FOR SUSTAINABILITY, WORKERS AND COMMUNITIES IN TRANSITION: REPORT OF THE JUST TRANSITION LISTENING PROJECT 2 (2021), https://www.labor4sustainability.org/files/JTLP_report2021.pdf ("[The] 'just transition' has recently become more mainstream in climate discourse.").

justice, distributive justice, and restorative justice.[8] Implementing a just transition is crucial for redistributing resources fairly and addressing long-standing racial and economic disparities.[9]

Energy justice stands out as an essential framework to address inequalities within America's existing energy systems. This method emphasizes the welfare and interests of all stakeholders, ensuring no one is left behind in the pursuit of a sustainable future.[10] Notably, energy justice extends beyond environmental considerations and embraces the principles of fairness, inclusivity, and equity—each fundamental to a just transition.[11] Recognizing this approach, President Biden affirmed the nation's commitment to a just transition in January 2021 by signing Executive Order No. 14008, which established the Justice40 Initiative.[12] This Initiative serves as the cornerstone for integrating principles of equity and justice into recent federal expenditures aimed at tackling the climate crisis.[13]

Following the establishment of the Justice40 Initiative, the Biden Administration enacted two climate-focused bills, demonstrating a robust commitment to adopting low-carbon technologies. The bipartisan Infrastructure Investment and Jobs Act of 2021 (IIJA)[14] and the budget reconciliation Inflation Reduction Act of 2022 (IRA)[15] both recognize the imperative for a clean-energy transition. These Acts work in tandem, providing billions of dollars to advance America's shift towards sustainable energy through direct investments and tax credits. Moreover, the IIJA and the IRA stand out as the first major legislative actions applying the principles of the Justice40 Initiative. These legislative actions present a unique

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8. *See generally* Richard J. Wallsgrove, *Restorative Energy Justice*, 40 UCLA J. ENV'T L. & POL'Y 133, 134–42 (2022) (discussing the evolution of energy justice and its relationship to environmental justice).

9. Baker, *supra* note 6, at 12.

10. *Just Transition: A Framework for Change*, CLIMATE JUST. ALL., https://climatejusticealliance.org/just-transition/ (last visited Mar. 16, 2024); *see also* SHALANDA BAKER ET AL., INITIATIVE FOR ENERGY JUST., THE ENERGY JUSTICE WORKBOOK 5 (2019), https://iejusa.org/wp-content/uploads/2019/12/The-Energy-Justice-Workbook-2019-web.pdf ("[T]he goal of achieving equity in both the social and economic participation in the energy system, while also remediating the social, economic, and health burdens on marginalized communities.").

11. BAKER ET AL., *supra* note 10; *see, e.g.*, Ann M. Eisenberg, *Just Transitions*, 92 S. CAL. L. REV. 273, 280 (2019) (noting that the term "just transition" arises in the context of the energy transition as well as the nexus between labor and environmental reform).

12. *See* Exec. Order No. 14008, *Tackling the Climate Crisis at Home and Abroad*, 86 Fed. Reg. 7619, 7631 (Jan. 27, 2021) (introducing the Justice40 Initiative at Section 223); *see generally* INTERAGENCY WORKING GRP., INITIAL REPORT TO THE PRESIDENT ON EMPOWERING WORKERS THROUGH REVITALIZING ENERGY COMMUNITIES 1 (2021), https://netl.doe.gov/sites/default/files/2021-04/Initial%20Report%20on%20Energy%20Communities_Apr2021.pdf (discussing the establishment of the Interagency Working Group to promote "job-creating investments in communities already impacted" by coal-industry changes as a direct result of this Executive Order).

13. Exec. Order No. 14008, *supra* note 12, at 7632.

14. Infrastructure Investment and Jobs Act of 2021, Pub. L. No. 117-58, 135 Stat. 429 (2021).

15. Inflation Reduction Act of 2022, Pub. L. No. 117-169, 136 Stat. 1818 (2022).

opportunity to reshape America's energy landscape, fostering a unified drive towards equity and sustainability.

This Note advocates for strong, equitable energy laws and policies at the state level—building upon recent federal legislation—to effectively navigate the transition to low-carbon technologies. Part I explores the energy trilemma and the just transition framework and illustrates how energy justice tenets can harmonize the trilemma's competing demands. Part II examines the legislative impacts of the Justice40 Initiative, the IIJA, and the IRA. Part III outlines strategies for states to actively implement a just transition and emphasizes the role of energy justice principles throughout this process.[16]

I. BACKGROUND

Energy transitions have historically driven societal progress. The evolution and expansion of modern society is tied to its ability to find, capture, and utilize various energy resources. Since the Industrial Revolution, "society's proficiency at burning things" has generated wealth and maintained inequalities.[17] Unfortunately, the distribution of environmental, economic, and social costs and benefits has been unjust, with marginalized communities often bearing disproportionate burdens.[18]

The clean-energy transition is an opportunity to correct past injustices and unsustainable practices. Unlike energy revolutions of the past, the clean-energy transition is not driven by scarcity or the discovery of new energy resources—it is propelled by the urgent need to combat climate change.[19] By thoughtfully managing this shift, the United States can tackle inequality, promote social justice, and mitigate the effects of global warming. However,

16. The International Labor Organization defines Just Transition as "greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind." *Frequently Asked Questions on Just Transition*, INT'L LAB. ORG., https://www.ilo.org/global/topics/green-jobs/WCMS_824102/lang--en/index.htm (last visited Mar. 16, 2024). This transition seeks to maximize economic and social opportunities from climate action while mitigating any challenges that arise. *Id.*

17. Namit Sharma et al., *The Decoupling of GDP & Energy Growth: A CEO Guide*, MCKINSEY & CO. (Apr. 24, 2019), https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-decoupling-of-gdp-and-energy-growth-a-ceo-guide.

18. *See generally* ARIEL DREHOBL ET AL., AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., HOW HIGH ARE HOUSEHOLD ENERGY BURDENS? AN ASSESSMENT OF NATIONAL AND METROPOLITAN ENERGY BURDEN ACROSS THE UNITED STATES ii (2020) (discussing how economic, environmental, and social costs are dispersed inequitably, adversely affecting marginalized groups).

19. *See* U.N. Secretariat of the High-Level Dialogue on Energy, *Theme Report on Energy Transition: Towards the Achievement of SDG 7 and Net-Zero Emissions*, 1 (Sept. 2021), https://www.un.org/sites/un2.un.org/files/2021-twg_2-062321.pdf (arguing for a rapid energy transition in response to climate change).

a poorly managed transition risks exacerbating energy insecurity, widening inequality, and accelerating the climate crisis.[20]

As the federal government disperses funds from the IIJA and IRA, state-level policies and programs become vital in accelerating the clean-energy transition. While the IIJA allocates funding across the states, the IRA primarily offers tax incentives to various entities, including organizations and state governments.[21] The success of these investments and incentives relies on state-level policies and decision-making processes, which are crucial for propelling a just transition. To effectively tackle the energy trilemma, these policies must incorporate tenets of energy justice. As such, this Part is divided into two Sections. Section I(A) explores the energy trilemma's three challenges: ensuring energy security, maintaining affordability, and promoting environmental sustainability. Section I(B) delves into the four pillars of energy justice—recognition, procedural, distributive, and restorative justice—underscoring the importance of an efficient, equitable, and inclusive energy transition.

A. The Energy Trilemma

The energy trilemma of energy security, affordability, and environmental sustainability presents a multifaceted challenge to the pursuit of clean energy. Balancing these competing demands is vital for a successful transition, one that ensures reliable, cost-effective, and ecologically sound energy.[22] Geopolitical tensions, such as Russia's invasion of Ukraine and unrest in the Middle East, underscore the fragility of energy security.[23] Fatal blackouts in Texas, Tennessee, and North Carolina further highlight this fragility, exposing system reliability concerns.[24] Simultaneously, rising inflation and

20. *See generally* WORLD ENERGY COUNCIL, *supra* note 5 (explaining the risks of a poorly managed clean-energy transition).

21. *See* discussion *infra* Sections III(A)–(B) (exploring the role of states and other entities in federal energy initiatives).

22. *Trilemma and Transition: Energy Industry Insights 2023*, ENERGY INDUS. REV. (Mar. 2, 2023), https://energyindustryreview.com/analysis/trilemma-and-transition-energy-industry-insights-2023/.

23. *See generally* Cosmo Sanderson, *Middle East Conflict Fuels Fresh Energy Security Concerns, Warns IEA*, ENERGY TRANSITION (Oct. 24, 2023), https://www.rechargenews.com/energy-transition/middle-east-conflict-fuels-fresh-energy-security-concerns-warns-iea/2-1-1540084 ("War between Israel and Hamas has the *potential* to deliver *another* shock to global oil markets.") (emphasis added).

24. *See* Naomi Albert, *Reliance on Fossil Fuels Was Last Year's Grinch that Stole Christmas—and the Real Cause of Winter Storm Elliot Blackouts*, APPALACHIAN VOICES (Dec. 21, 2023), https://appvoices.org/2023/12/21/winter-storm-elliot/ (noting the consequences of Winter Storm Elliot's impact on Southern utilities).

deepening energy poverty stress the importance of energy affordability.[25] While environmental degradation disproportionately impacts disadvantaged communities, rising GHG emissions intensify climate change.[26] Addressing these challenges demands immediate and comprehensive reforms in energy production, distribution, and consumption.[27] As America aims to lower emissions, the clean-energy transition presents an unparalleled opportunity to reform energy systems, harmonize the trilemma, and ensure secure, affordable, and clean energy for all.

1. Energy Security

Energy security is central for a stable transition away from fossil fuels, requiring reliable and resilient access to diverse energy sources. Adapting to short-term supply-and-demand changes and ensuring a sustainable energy supply for the long term are essential components of this strategy.[28] As GHG emissions rise, renewable sources like wind, solar, and hydropower, alongside low-carbon alternatives, such as nuclear power and carbon capture and sequestration, critically influence America's future energy security. However, this shift faces a multitude of challenges, such as power disruptions, dated distribution systems, climate change impacts, cyber-attacks, and geopolitical uncertainties.[29] These challenges not only affect the energy sector's capacity to meet current demand, but also the ability to transition to clean energy.

Integrating renewable energy into the grid is vital for sustainable progress yet introduces complex operational challenges. For example, the variability of wind and solar energy requires nuanced planning and

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25. Shuchen Cong et al., *Unveiling Hidden Energy Poverty Using the Energy Equity Gap*, 13 NATURE COMMC'NS 2456, 2461 (May 4, 2022), https://www.nature.com/articles/s41467-022-30146-5; *see, e.g.*, Dylan D. Furszyfer Del Rio et al., *A Cross-Country Analysis of Sustainability, Transport and Energy Poverty*, NPJ: URB. SUSTAINABILITY, June 30, 2023, at 1, https://www.nature.com/articles/s42949-023-00121-0 (investigating whether low-income households and minorities experience "double vulnerability," a heightened risk of both transport and energy poverty).

26. *Causes and Effects of Climate Change*, UNITED NATIONS, https://www.un.org/en/climatechange/science/causes-effects-climate-change (last visited Mar. 16, 2024).

27. *See The Energy Trilemma*, POWERSTAR, https://powerstar.com/energy-trilemma/ (last visited Mar. 16, 2024) ("[U]ltra-reliable energy is of no use if it's unaffordable for businesses and consumers. Likewise cheap energy is no good for businesses if it doesn't work 50% of the time or generating it destroys the planet as a consequence.").

28. *Energy Security: Reliable, Affordable Access to All Fuels and Energy Sources*, INT'L ENERGY AGENCY, https://www.iea.org/topics/energy-security (last visited Mar. 16, 2024); *see also* Gita Bhatt, *Energy Security and the Path to Green*, INT'L MONETARY FUND (Dec. 2022), https://www.imf.org/en/Publications/fandd/issues/2022/12/editor-letter-energy-security-and-the-path-to-green (presenting a mix of clean-energy technologies that will aid in long-term security, "from solar and wind power to nuclear, 'green' hydrogen, electric vehicles, and carbon capture").

29. *See generally* INT'L ENERGY AGENCY, POWER SYSTEMS IN TRANSITION: CHALLENGES AND OPPORTUNITIES AHEAD FOR ELECTRIC SECURITY 9–19 (2020) (reporting on the ongoing transitions and challenges facing the electricity sector).

management to maintain grid stability, particularly during periods of peak demand.[30] The growing demand for electricity further strains the nation's power grid, emphasizing the need for significant upgrades and new energy sources to maintain a reliable power supply. The 2023 Summer Reliability Assessment by the North American Electric Reliability Corporation highlights the risk of energy deficits, which are driven by fluctuating wind energy output and temperature variations.[31] Innovations in energy-resource management and grid development are fundamental to overcoming these obstacles.

Climate change amplifies threats to national energy security and underscores the need for robust and stable grid infrastructure. Alarmingly, about "70 percent of transmission lines are at least 30 years old and approaching the end of their lifecycle."[32] Similarly, "60 percent of the [nation's] circuit breakers are over 35 years old," surpassing their useful lives of 20 years.[33] These aging components contribute to vulnerabilities in the energy sector, as seen in events like the 2018 California Camp Fire,[34] Winter Storm Uri in 2021,[35] and the 2023 wildfire on the island of Maui, Hawaii.[36] Strengthening grid resilience is not only necessary to withstand extreme

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30. *See What is Peak Electricity Demand?*, HOLYOKE GAS & ELEC., https://www.hged.com/smart-energy/what-is-peak-electricity-demand.aspx (last visited Mar. 16, 2024) ("[T]he specific time when consumer demand for electricity is highest . . . usually occurs on a weekday evening, when people are returning home from work and turning on . . . appliances. . . .").

31. *Summer Reliability Assessment Announcement*, N. AM. ELEC. RELIABILITY CORP. 1 (May 17, 2023), https://www.nerc.com/news/Headlines%20DL/Summer%20Reliability%20Assessment%20Announcement%20May%202023.pdf.

32. Chuck Brooks, *3 Alarming Threats to the U.S. Energy Grid - Cyber, Physical, and Existential Events*, FORBES (Feb. 15, 2023), https://www.forbes.com/sites/chuckbrooks/2023/02/15/3-alarming-threats-to-the-us-energy-grid--cyber-physical-and-existential-events/?sh=3f27032d101a.

33. *Id.*

34. *See* Brandon Rittiman, *ABC10 Investigation: PG&E Knew Old Power Line Parts Had 'Severe Wear' Months Before Deadly Camp Fire*, ABC 10 (Feb. 17, 2021), https://www.abc10.com/article/news/local/wildfire/run-to-failure-what-pge-knew-and-when/103-e4654585-1036-47bb-9078-137893ac242d#:~:text=The%20Camp%20Fire%20was%20sparked,years%20old%20when%20it%20failed (discussing the 154,000 acres burned and 85 lives claimed due to a faulty powerline).

35. *See* Erin Douglas et al., *Texas Leaders Failed to Heed Warnings that Left the State's Power Grid Vulnerable to Winter Extremes, Experts Say*, TEX. TRIB. (Feb. 19, 2021), https://www.texastribune.org/2021/02/17/texas-power-grid-failures/ (detailing the events leading to millions of residents losing power due to record low temperatures and poor grid weatherization planning); *see also Frozen Out: Minorities Suffered Four Times More Power Outages in Texas Blackouts*, UNIV. OF MASS. AMHERST (Apr. 14, 2021), https://www.umass.edu/news/article/frozen-out-minorities-suffered-four-times ("[There is a] striking correlation between racial status where blocks with a higher proportion of minorities were more likely to experience a power outage: predominantly white areas had an 11% chance of suffering an outage compared to a 47% chance in high minority share areas.").

36. *Hawaiian Electric Says Power Lines Sparked Fire but Firefighters Fell Short*, GUARDIAN (Aug. 28, 2023), https://www.theguardian.com/us-news/2023/aug/28/maui-wildfires-hawaiian-electric-company.

weather events, but also to strengthen defenses against cyberattacks and geopolitical uncertainties.[37]

Geopolitical dynamics further influence national energy security. Conflicts in key areas, such as Russia's invasion of Ukraine, disrupt oil and gas supplies while showcasing global dependence on fossil fuels.[38] The COVID-19 pandemic intensified this reliance, exposing the vulnerability of energy systems to global crises.[39] Consequently, transitioning to clean energy becomes strategically imperative to mitigate geopolitical uncertainties and reduce dependence on foreign oil and gas. A well-implemented energy transition, despite its short- and long-term challenges, is essential to modernize energy systems for current and future resilience and reliability.

2. Energy Affordability

Energy affordability is vital for economic development and equitable access to energy. Nevertheless, the transition towards cleaner energy can increase disparities, benefitting some while burdening others, particularly through "energy insecurity."[40] Energy insecurity encompasses energy poverty—i.e., lack of energy access—and energy burden—i.e., the high cost of energy relative to household income.[41] Disadvantaged Americans commonly experience these challenges, which threaten limited access to clean-energy technologies, job losses, and environmental injustices.[42] Tackling affordability issues is essential to mitigate these disparities as the nation transitions away from fossil fuels.[43]

The inequitable distribution of benefits and burdens within the current energy system undermines a just transition. A lack of energy affordability,

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37. *Energy Independence and Security*, OFF. OF ENERGY EFFICIENCY & RENEWABLE ENERGY, U.S. DEP'T OF ENERGY, https://www.energy.gov/eere/energy-independence-and-security# (last visited Mar. 16, 2024).

38. *Russia's War on Ukraine*, INT'L ENERGY AGENCY, https://www.iea.org/topics/russias-war-on-ukraine (last visited Mar. 16, 2024); *see also* Shannon Osaka, *The Russian Invasion of Ukraine Has Left a Hole in the Global Energy Market*, GRIST (Feb. 28, 2022), https://grist.org/article/the-russian-invasion-of-ukraine-has-left-a-hole-in-the-global-energy-market/ (discussing Russia's role as a major energy exporter and the energy uncertainty created by the Russia-Ukraine war).

39. *See* Mahmudul Alam et al., *World Energy Economics and Geopolitics amid COVID-19 and Post-COVID-19 Policy Direction*, WORLD DEV. SUSTAINABILITY, June 2023, at 1, 2 (reporting the pandemic's immediate impacts on energy demand, especially oil markets, leading to fluctuations in energy prices and exposing weaknesses in the energy sector).

40. Sanya Carley & David M. Konisky, *The Justice and Equity Implications of the Clean Energy Transition*, 5 NATURE ENERGY 569, 571 (2020).

41. BAKER ET AL., *supra* note 10, at 10.

42. *See generally Low-and Moderate-Income Solar Policy Basics*, NAT'L RENEWABLE ENERGY LAB'Y, https://www.nrel.gov/state-local-tribal/lmi-solar.html (last visited Mar. 16, 2024) (describing the disadvantages some communities face from unequal distribution of clean energy, specifically solar energy).

43. *See* DREHOBL ET AL., *supra* note 18 (estimating that 15 million U.S. households experienced energy insecurity in 2020, forcing families to choose between paying for energy or other essential needs).

closely linked with social inequity and public health, frequently leaves disadvantaged households without the energy required for routine activities like refrigeration, cooking, lighting, heating, and cooling.[44] The issues of energy poverty and energy burden intensify these challenges. Disadvantaged Americans spend disproportionately on energy bills, limiting their access to clean-energy technologies, such as rooftop solar, electric vehicles (EVs), and home batteries.[45] These obstacles emphasize the complexity of achieving energy affordability.

Ensuring the proactive inclusion of disadvantaged communities is essential for an equitable clean-energy transition. Historically affected by the fossil fuel industry, these communities need a just transition that remedies environmental injustices and energy insecurities.[46] Strategic planning and equitable resource distribution are key to overcoming existing disparities.[47] State laws and federal programs present opportunities to ensure no community is left in the dark.

3. Environmental Sustainability

Environmental sustainability strives to balance economic growth with climate change mitigation and ecological preservation. This approach demands a departure from past regulatory choices, in which the focus on energy security and affordability often led to environmental neglect.[48] In

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44. *See* Sanya Carley, *Energy Insecurity During the Time of COVID*, KLEINMAN CTR. FOR ENERGY POL'Y (Apr. 5, 2023), https://kleinmanenergy.upenn.edu/research/publications/energy-insecurity-during-the-time-of-covid/ ("[E]nergy insecure individuals . . . face difficult and in some cases life threatening tradeoffs: live in thermal discomfort or sacrifice other essential needs that allow them enough money to pay their energy bills. When they cannot cover their bills, they face the threat of utility disconnection, whereby their electricity or gas is cut off.").

45. Marilyn A. Brown et al., *High Energy Burden and Low-Income Energy Affordability: Conclusions From a Literature Review*, PROGRESS ENERGY, Oct. 2020, at 1, 1, https://iopscience.iop.org/article/10.1088/2516-1083/abb954/pdf; *see also* Deborah A. Sunter et al., *Disparities in Rooftop Photovoltaics Deployment in the United States by Race & Ethnicity*, NATURE SUSTAINABILITY, Jan. 2019, at 71, 71 (2019) (discussing how rooftop solar panels are distributed unequally across different racial and ethnic groups in the U.S.).

46. *See* Fatima Abdul-Khabir*, Energy for Everyone: What Is Energy Equity and How Do We Achieve It?*, GREENLINING INST. (Nov. 15, 2022), https://greenlining.org/2022/energy-for-everyone-what-is-energy-equity-and-how-do-we-achieve-it/ (noting that the fossil fuel industry's impact on vulnerable communities reveals the need to prioritize equity in the shift to a clean-energy economy, with a focus on ensuring affordability, promoting equitable decarbonization, and broadening access to green job opportunities).

47. *See generally* Claire Wang et al., *Ensuring an Inclusive Clean Energy Transition: A Two-Part Series on Supporting Coal Workers & Communities*, ROCKY MOUNTAIN INST. (2022), https://rmi.org/insight/ensuring-an-inclusive-clean-energy-transition/ (discussing ways of supporting coal workers and communities transitioning away from fossil-fuel energy sources through vocational opportunities).

48. *See* Jeffery Pierre & Scott Neuman, *How Decades of Disinformation About Fossil Fuels Halted U.S. Climate Policy*, NPR (Oct. 27, 2021), https://www.npr.org/2021/10/27/1047583610/once-

recognizing the environmental costs of industrialization, regulators must embrace sustainable, clean, and reliable energy systems.[49] Focusing on the prudent use of energy resources, this aspect of the energy trilemma calls for enhanced energy efficiency, decarbonization efforts, and pollution control.[50]

Historically, a regulatory emphasis on energy security and affordability resulted in environmental degradation. This emphasis led to a legacy of GHG emissions and air and water pollution due to the pursuit of low-cost, reliable power sources.[51] Recent legislation, notably the IIJA and IRA, represent a paradigm shift. These laws encourage investments in low-carbon technologies while aiming to address previous regulatory shortcomings.[52] Such policy changes highlight the need for collaborative efforts in achieving environmental sustainability.[53]

The accelerating clean-energy transition merits a reevaluation of contemporary energy policies. At this crucial juncture, the United States's choices will determine its ability to meet environmental challenges and secure a sustainable future. Addressing the energy trilemma within this transition is complex. A balanced approach requires regulators to carefully weigh the costs and benefits of diverse energy policies and technologies and involve affected communities in decision-making processes. As the United States embraces low-carbon technologies, embedding tenets of energy justice into the transition becomes essential for ensuring security, affordability, and environmental quality for all.[54] This is an opportunity the nation cannot afford to miss.

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again-the-u-s-has-failed-to-take-sweeping-climate-action-heres-why ("It's the most recent [disaster] in a string of defeats to aggressive climate action that stretches back more than 25 years.").

49. *See* Luisa Marti & Rosa Puertas, *Sustainable Energy Development Analysis: Energy Trilemma*, SUSTAINABLE TECH. & ENTREPRENEURSHIP, Spring 2022, at 1, 1, https://doi.org/10.1016/j.stae.2022.100007 ("Sustainable development is perceived as a socioeconomic system focused on meeting human needs while making long-term progress, with the end goal of ensuring well-being and improving quality of life.").

50. *See generally* Masoud Shirazi et al., *Sustainable Economic Development and Geopolitics: The Role of Energy Trilemma Policies*, 31 SUSTAINABLE DEV. 2471, 2471–75 (2023), https://onlinelibrary.wiley.com/doi/epdf/10.1002/sd.2523 (noting that "[e]nvironmental preservation is essential to sustainable economic development" and analyzing related findings).

51. *The Sources and Solutions: Fossil Fuels*, EPA (Nov. 29, 2023), https://www.epa.gov/nutrientpollution/sources-and-solutions-fossil-fuels.

52. *See* Pierre & Neuman, *supra* note 48 ("[T]he U.S. has contributed more heat-trapping pollution than any other country over time and has been the prime driver of climate change. The national debate about how to address the problem has raged for decades, but progress toward a solution has been slow.").

53. *See generally Innovation, Investment & Inclusion: Accelerating the Energy Transition & Creating Good Jobs*, THE WHITE HOUSE (Apr. 23, 2021), https://www.whitehouse.gov/cea/written-materials/2021/04/23/innovation-investment-and-inclusion-accelerating-the-energy-transition-and-creating-good-jobs/ (identifying "the barriers that inhibit private actors alone from sufficiently investing in clean energy innovation," i.e., "why Federal policy and public-private partnerships are crucial").

54. *See* Haiyang Liu et al., *Roles of Trilemma in the World Energy Sector and Transition Towards Sustainable Energy: A Study of Economic Growth and the Environment*, 170 ENERGY POL'Y 113238 (2022).

B. The Just Transition

The just transition integrates tenets of energy justice and offers a comprehensive solution to harmonize the trilemma. Energy justice "seeks to identify when and where injustices occur and how best law and policy can respond."[55] This framework addresses existing inequities and facilitates the equitable adoption of low-carbon technologies.[56] The just transition should integrate the four tenets of energy justice: recognition, procedural, distributive, and restorative justice. Doing so reshapes social values towards racial and economic equality to ensure the fair distribution of benefits and burdens.[57]

1. Recognition Justice

Recognition justice emphasizes the importance of valuing diverse societal groups, especially those historically overlooked. This tenet acknowledges that injustices in the energy sector often disproportionately affect groups based on their social, cultural, ethnic, racial, and gender identities.[58] Recognition justice advocates for the inclusion of diverse perspectives into clean-energy discourse, aiming to prevent the perpetuation or emergence of disparities.

The role of recognition justice in the clean-energy transition is multifaceted. Recognition justice addresses not only the technical and economic facets of the transition but also its social aspects.[59] This approach demands attention to the rights and needs of all communities, especially those traditionally excluded from energy decision-making processes. For instance, site selection for energy infrastructure projects, like power plants or transmission lines, must assess such projects' effects on nearby

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55. Raphael Heffron et al., *Resolving Society's Energy Trilemma Through the Energy Justice Metric*, 87 ENERGY POL'Y 168, 169 (2015), https://www.sciencedirect.com/science/article/abs/pii/S030142151530077X.

56. *See* BAKER ET AL., *supra* note 10, at 63 ("[A]n energy just approach to energy policy would aim to remediate the financial burdens of energy by making clean energy affordable and accessible to those most burdened under the existing system.").

57. *Id.* at 61 (noting that the field of energy justice has seen substantial contributions, particularly from Benjamin Sovacool, Darren McCauley, Raphael Heffron, and Kirsten Jenkins, who have collectively authored more than 100 articles since 2014).

58. Kirsten Jenkins et al., *Energy Justice: A Conceptual Review*, 11 ENERGY RSCH & SOC. SCI. 174, 179 (2016), https://core.ac.uk/display/188257864?utm_source=pdf&utm_medium=banner&utm_campaign=pdf-decoration-v1.

59. *See id.* at 177 (describing recognition justice's desired perception shift, which aims to "counteract[] a long-standing tendency to stereotype the 'energy poor' and their 'inefficient' use of scarce energy and monetary resources").

communities.[60] Recognition justice seeks to elevate the voices of these communities, ensuring their concerns are heard and addressed in the planning and execution phases.

As the nation adopts greener energy solutions, recognition justice highlights the importance of fairly distributing the transition's benefits. By acknowledging existing inequalities, this tenet champions fair treatment and inclusive representation, which are necessary for overcoming obstacles related to energy insecurity.[61] Recognition justice demands the creation of policies that are responsive to the diverse needs of the population, ensuring everyone has a seat at the table during the energy transition.

2. Procedural Justice

Procedural justice underscores the importance of fairness and inclusivity in decision-making processes. Procedural justice values local knowledge, improves information disclosure, and enhances institutional representation.[62] Advancing a grassroots-oriented approach, this tenet reinforces the importance of local stakeholder engagement at every stage of energy policy. Simply put, "a fast and fair transition to renewable energy will not be achieved if U.S. policymakers and energy developers do not anticipate and respond . . . to the full array of sources of local opposition."[63]

The existing energy-policy landscape reveals procedural shortcomings, particularly in institutional accountability. These weaknesses intensify the challenges of the energy trilemma, highlighting the importance of transforming communities from passive or excluded participants into active, informed stakeholders. Procedural justice thus becomes essential in empowering local knowledge and perspectives, particularly in the context of the clean-energy transition.[64] Effective stakeholder engagement is vital for a just transition to ensure that policies reflect the diversity of societal needs and values.

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60. *See* BAKER ET AL., *supra* note 10, at 11 ("[T]he poor and people of color in this country will suffer the deepest impacts of climate change, given legacies of legalized segregation, redlining, and disinvestment that have left communities of color and the poor on land and in economic circumstances that make them most vulnerable. . . .").

61. *See* Aladdine Joroff, *Energy Justice: What it Means and How to Integrate it into State Regulation of Electricity Markets*, 47 ENV'T L. REP. 10927, 10928 (2017) ("[L]ow-income households devote up to three times as much income to energy-related utility costs as do higher income households; in more than one-third of the cities studied, one-quarter of low-income households had an energy burden greater than 14%.").

62. Jenkins et al., *supra* note 58, at 178.

63. Lawrence Susskind et al., *Sources of Opposition to Renewable Energy Projects in the United States*, ENERGY POL'Y, Apr. 2022, at 1, 2, https://doi.org/10.1016/j.enpol.2022.112922.

64. Jenkins et al., *supra* note 58, at 175–76 (emphasizing "three mechanisms of *inclusion*" to "achieving just outcomes through local knowledge mobilization, greater information disclosure, and better representation").

Procedural justice is fundamental in shaping modern energy policies. Efforts to increase the accessibility of EVs serve as practical examples of procedural justice in action.[65] For instance, an EV pilot program tailored to specific community needs in Dorchester, Massachusetts demonstrates the value of engaging with individuals belonging to diverse socioeconomic backgrounds.[66] Approaches to policy that center on community involvement are key to a fair transition. As the energy sector evolves, so must America's methods of policy formulation. Embracing procedural justice is not merely a policy choice; it is a commitment to equity and sustainability, crucial for navigating the complexities of the energy trilemma.

3. Distributive Justice

Distributive justice plays a central role in ensuring that the energy transition's burdens and benefits are apportioned equitably. Distributive justice focuses on a fair allocation of resources, capital, pollution, and poverty to address economic inequality and the costs of climate change.[67] This tenet particularly affects underserved communities bearing a disproportionate share of these burdens, building on the principles of recognition justice. Distributive justice draws attention to existing disparities, seeking to resolve and correct the burdens facing less powerful and disadvantaged social groups.[68]

Electric generation resources serve as a prime example of distributive justice's key elements. They offer benefits such as reliable, affordable energy; lower emissions; and a cleaner environment. However, electric generation resources also impose significant burdens—including air and water pollution, GHGs, and broader climate change impacts—that disproportionately affect vulnerable communities.[69] These disparate impacts reflect longstanding inequities in energy production and consumption.[70]

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65. Aaron Pressman, *Dorchester Program Aims to Make EVs Affordable*, BOS. GLOBE (Sept. 19, 2023), https://www.bostonglobe.com/2023/09/19/business/dorchester-program-aims-make-evs-affordable/.

66. *Id.*

67. BENJAMIN K. SOVACOOL & MICHAEL H. DWORKIN, GLOBAL ENERGY JUSTICE: PROBLEMS, PRINCIPLES, AND PRACTICES 10–11 (2014).

68. Darren McCauley et al., *Advancing Energy Justice: The Triumvirate of Tenets*, 32 INT'L ENERGY L. REV. 107, 108 (2013) ("[Objections] can contribute to rectifying injustices and should not always be considered as detrimental to a project in terms of contributing to delay. In some cases, they can restore a sense of equity within a project.").

69. *See generally* Andrzej Bielecki et al., *The Externalities of Energy Production in the Context of Development of Clean Energy Generation*, 27 ENV'T SCI. & POLLUTION RSCH. 11506, 11523 (2020) (assessing the externalities of electricity generation).

70. *See* LESLEY FLEISCHMAN & MARCUS FRANKLIN, FUMES ACROSS THE FENCE-LINE: THE HEALTH IMPACTS OF AIR POLLUTION FROM OIL & GAS FACILITIES ON AFRICAN AMERICAN

Energy efficiency programs, including those that provide special rates for EVs and net metering for rooftop solar, may inadvertently disadvantage low-income ratepayers who cannot access such benefits.[71] Furthermore, the historical siting of electric generation facilities in disadvantaged communities demands a more equitable distribution of environmental benefits and burdens.[72]

Distributive justice is also key to addressing past injustices and fostering an equitable future. This tenet illuminates the unequal distribution of costs and benefits among different social groups, which leads to various forms of injustice. Distributive justice emphasizes the significance of including community perspectives into policymaking for a more balanced and just energy future.

4. Restorative Justice

Restorative justice seeks to correct the deep-rooted inequities in energy systems. This principle recognizes and addresses the disproportionate health and environmental burdens faced by marginalized communities.[73] As such, the restorative approach transcends the mere elimination of fossil fuels, directly tackling systemic injustices.[74]

Restorative justice is essential for an equitable energy transition. One instance of a restorative approach entails targeted investments in energy efficiency and weatherization assistance programs within redlined communities.[75] Moving beyond energy-bill support and providing direct assistance to historically disenfranchised communities offers a sustainable and equitable remedy to affordability challenges.[76] By integrating restorative justice with procedural, distributive, and recognition justice, a comprehensive framework for energy justice emerges.[77]

COMMUNITIES 3 (2017) ("[T]he life-threatening burdens place on communities of color near oil and gas facilities are the result of systemic oppression perpetuated by the traditional energy industry, which exposes communities to health, economic, and social hazards.").

71. Brown et al., *supra* note 45, at 3.

72. FLEISCHMAN & FRANKLIN, *supra* note 70.

73. *See* BAKER ET AL., *supra* note 10, at 62.

74. *Id.*

75. Jenny Heeter & Tony Reames, *Incorporating Energy Justice into Utility-Scale Photovoltaic Deployment: A Policy Framework*, RENEWABLE ENERGY FOCUS, Sept. 2022, at 1, 2 (noting that structural racism—exemplified by residential segregation—has significantly hindered African Americans' access to socioeconomic opportunities).

76. *Id.*

77. *See* SOVACOOL & DWORKIN, *supra* note 67, at 11. In addressing the fundamental nature of justice, Michael Sandel notes that "to ask whether a society is just is to ask how it distributes the things [society] prize[s] . . . A just society distributes these goods in the right way; it gives each person his or her due." *Id.*

The clean-energy transition not only stands to revamp the energy landscape and harmonize the trilemma but also fosters healing and empowerment in communities bearing the brunt of historical injustices. Through integrating tenets of energy justice, policies evolve into tools for communal healing and empowerment. Restorative justice, by complementing and enriching recognition, procedural, and distributive justice, paves a comprehensive route toward an equitable energy transition.[78] This all-encompassing approach is vital for states aiming to harmonize the trilemma and provide clean energy and justice to all.

II. FEDERAL FOUNDATIONS FOR THE ENERGY TRANSITION

As energy systems evolve, the interplay of federal legislation and state action paves the path for a sustainable future. This Part, broken down into three Sections, examines the transformative impact of three recent federal directives: the Justice40 Initiative, the IIJA, and the IRA. These federal actions are fundamental to advancing the United States's commitment to a resilient, affordable, and sustainable energy future.

A. The Justice40 Initiative

The Justice40 Initiative, which is central to Executive Order 14008, exemplifies the Biden Administration's commitment to promoting a just transition. This marks a paradigm shift by channeling at least 40% of the overall benefits of federal investment—including investments in clean energy and energy efficiency—to disadvantaged communities.[79] This redirection of resources is a pivotal step towards rectifying historical disparities and fostering sustainable growth in these areas.

The Justice40 Initiative operates within the confines of federal jurisdiction. The Climate Policy Office (CPO), established in the Executive Office of the President and led by the National Climate Advisor (Climate Advisor), works to integrate climate considerations into federal governance.[80] Furthermore, Executive Order 14008 establishes the National Climate Task Force (Task Force), chaired by the Climate Advisor.[81] This

78. *See* BAKER ET AL., *supra* note 10, at 62 (explaining that applying the restorative justice tenet requires "decision-makers to engage with justice concerns and consider the full range of issues, as any injustice caused by an energy activity would have to be rectified").

79. *See* Exec. Order No. 14008, 86 Fed. Reg. 7619, 7632 (Jan. 27, 2021) (requiring "recommendations on how certain Federal investments might be made toward a goal that 40 percent of the overall benefits flow to disadvantaged communities").

80. *Id.* at 7622.

81. *Id.* at 7623.

Task Force unites representatives from 21 federal departments, advancing a coordinated "government-wide approach to combat the climate crisis."[82]

The cooperative efforts of the CPO and the Task Force are essential for achieving the Justice40 Initiative's ambitious goals. Together, they aim to reduce climate pollution, enhance resilience to climate change, protect public health, conserve natural resources, promote environmental justice, and generate sustainable development.[83] By engaging with state, local, and tribal governments, this effort seeks to ensure that community perspectives shape the outcome and success of the Justice40 Initiative.[84] Moreover, the Task Force's role extends to guiding investments in clean energy, efficient transit, sustainable housing, workforce development, pollution remediation, and critical water-infrastructure development.[85] By aligning federal resource procurement and resource management with these areas, it incentivizes private investments.[86] This approach fosters a resilient national supply chain, retains union jobs, and encourages energy-efficient government practices.[87]

The Justice40 Initiative requires that any federal investments made within a covered federal program comply with its policies. These investments—spanning grants, financing, and direct spending—present the challenge of equitable distribution to the communities that need them most.[88] Federal agencies must rigorously oversee these funds' distribution to ensure that they reach their intended destinations.[89] Though confined to federal jurisdiction, the Justice40 Initiative sets a benchmark for state and local governments as well as the private sector to follow in championing a just and equitable approach to the clean-energy transition.

B. The Infrastructure Investment and Jobs Act

The IIJA, enacted in November 2021, signifies a transformative moment in U.S. infrastructure development.[90] Allocating $1.2 trillion, with $550 billion reserved for new federal investments, the IIJA promises to transform

82. *Id.*

83. *Id.*

84. *Id.*; *see also* Mikyla Reta, *How States Can Help Implement the Justice40 Initiative*, NAT. RES. DEF. COUNCIL (Jan. 27, 2023), https://www.nrdc.org/experts/mikyla-reta/how-states-can-help-implement-justice40-initiative (noting challenges "from figuring out how to identify which communities should receive Justice40 funds to designing methodologies for calculating benefits").

85. Exec. Order No. 14008, 86 Fed. Reg. 7619, 7631–32 (Jan. 27, 2021).

86. *Id.* at 7623–24. The strategy aligns federal procurement and resource management with these sectors in hopes of reaching a carbon pollution-free electricity sector by 2035. *Id.* at 7624.

87. *Id.* at 7624.

88. *See, e.g.*, THE WHITE HOUSE, JUSTICE40 INITIATIVE COVERED PROGRAMS LIST 3–20 (Version 1.3, Aug. 18, 2022) (noting that more than 400 covered programs identified by federal agencies exist, each aimed at delivering investments to frontline communities).

89. *Id.* at 3.

90. Infrastructure Investment and Jobs Act, Pub. L. No. 117-58, 135 Stat. 429 (2021).

the nation's transportation, energy, water, and broadband infrastructure.[91] This Act enhances the nation's global competitiveness and commits to fostering a sustainable, resilient, and just economy.[92]

Central to the IIJA's transformative agenda is its dedication to fortifying the nation against climate change. As the largest environmental-justice investment in U.S. history, the IIJA concentrates on key areas like public transit, access to clean water, pollution remediation, and infrastructure modernization.[93] By channeling investments towards these areas, the IIJA demonstrates a strong commitment to environmental justice and a healthier future for all communities.[94]

Furthermore, the IIJA tackles the urgent need to modernize and reform the U.S. energy sector. With power outages costing the nation "up to $70 billion annually" and one in three households struggling with energy bills, the Act pioneers the largest clean-energy infrastructure investment to date.[95] The Act includes measures aimed at modernizing the power grid, enhancing energy efficiency, and promoting clean-energy technologies.[96] These measures are vital for transitioning to a low-carbon economy and fostering economic growth.[97]

Notably, the IIJA introduces the first substantial funding directive for federal agencies to integrate the Justice40 Initiative's principles. Through coordinated efforts among federal, state, and local governments, the IIJA transcends traditional infrastructure development, serving as a catalyst for equitable and environmentally just transformations. This comprehensive

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91. *Updated Fact Sheet: Bipartisan Infrastructure and Jobs Act*, THE WHITE HOUSE (Aug. 2, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/02/updated-fact-sheet-bipartisan-infrastructure-investment-and-jobs-act/; *see also Infrastructure Investment & Jobs Act (IIJA) Implementation Resources*, GOV'T FIN. OFFICERS ASS'N, https://www.gfoa.org/the-infrastructure-investment-and-jobs-act-iija-was (last visited Feb. 12, 2024) (containing up-to-date references to all ongoing IIJA implementation measures).

92. *Bipartisan Infrastructure and Jobs Act*, *supra* note 91.

93. *See id.* (noting that the IIJA represents the largest federal investment in public transit and passenger rail "since the creation of Amtrak," and the "largest investment in clean drinking water and wastewater infrastructure in American history").

94. *See The Bipartisan Infrastructure Law Advances Environmental Justice*, THE WHITE HOUSE (Nov. 16, 2021), https://www.whitehouse.gov/briefing-room/statements-releases/2021/11/16/the-bipartisan-infrastructure-law-advances-environmental-justice/ (discussing the IIJA's efforts to target communities historically affected by pollution and underinvestment by investing in the cleanup of "Superfund and brownfield sites, reclaiming abandoned mine land[s], and capping orphaned oil and gas wells").

95. THE WHITE HOUSE, BUILDING A BETTER AMERICA 150 (May 2022), https://www.whitehouse.gov/wp-content/uploads/2022/05/BUILDING-A-BETTER-AMERICA-V2.pdf.

96. *Id.* at 3; *see also* Abinaya Vijayaraghavan & Jarrett Renshaw, *White House Announces $13 Bln. in Funding to Modernize Power Grids*, REUTERS (Nov. 18, 2022) (noting that investments in the nation's grid infrastructure include $10.5 billion to strengthen power systems against climate related threats and $2.5 billion for developing new transmission lines).

97. THE WHITE HOUSE, *supra* note 94.

approach solidifies the IIJA as a vehicle for infrastructure renewal and a beacon for achieving broader societal and environmental justice goals.

C. The Inflation Reduction Act

The IRA, enacted in August 2022, revolutionizes America's approach to climate change. Initially projected at $370 billion in tax credits, the IRA's allocation for climate and clean-energy initiatives has increased, with 2023 estimates suggesting a potential doubling or tripling to meet its objectives.[98] The IRA employs tax incentives to stimulate the adoption of low-carbon technologies, favoring carrots over sticks.[99] This strategy, aimed at stimulating economic growth from the "bottom up and middle out," marks a significant step forward for communities historically overburdened by environmental injustices.[100] The Act's financing stems from tightening tax loopholes, enhancing tax code enforcement, and increasing fees on large corporations.[101]

At the heart of the IRA lies its commitment to aiding disadvantaged communities. The Act uses adders from Production Tax Credits (PTCs) and Investment Tax Credits (ITCs) to spur investments in "energy communities," creating valuable job opportunities.[102] Additional adders for specific types of

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98. *Inflation Reduction Act: One-Page Summary*, DEMOCRATIC SENATE, https://www.democrats.senate.gov/imo/media/doc/inflation_reduction_act_one_page_summary.pdf (last visited Feb. 28, 2024); *see also Fact Sheet: How the Inflation Reduction Act's Tax Incentives Are Ensuring All Americans Benefit from the Growth of the Clean Energy Economy*, U.S. DEP'T OF THE TREASURY (Oct. 20, 2023), https://home.treasury.gov/news/press-releases/jy1830 (explaining the implications of different tax credits made available under the IRA).

99. *See* Alex Muresianu, *The Sticks: Inflation Reduction Act's Energy Related Tax Increases*, TAX FOUND. (Sept. 22, 2022), https://taxfoundation.org/blog/inflation-reduction-act-energy-tax-increases/ (discussing three key sticks contained in the IRA: a methane fee targeting oil and gas emissions, a reinstated Superfund tax on petroleum, and a permanent increase in coal excise taxes to support the Black Lung Disability Fund).

100. *See Fact Sheet: Inflation Reduction Act Advances Environmental Justice*, THE WHITE HOUSE (Aug. 12, 2022) https://www.whitehouse.gov/briefing-room/statements-releases/2022/08/17/fact-sheet-inflation-reduction-act-advances-environmental-justice/ (noting that the IRA serves as the most significant climate legislation in U.S. history, delivering for "[o]verburdened [c]ommunities").

101. Jean Ross & Jessica Vela, *The Inflation Reduction Act Would only Raise Taxes from Wall Street and Big Corporations*, CTR. FOR AM. PROGRESS (Aug. 2, 2022), https://www.americanprogress.org/article/the-inflation-reduction-act-would-only-raise-taxes-from-wall-street-and-big-corporations/.

102. THE WHITE HOUSE, *supra* note 94, at 12; *see also* DANIEL RAIMI & SOPHIE PESEK, RES. FOR THE FUTURE, WHAT IS AN "ENERGY COMMUNITY?" ALTERNATIVE APPROACHES FOR GEOGRAPHICALLY TARGETED ENERGY POLICY iii (2022), https://www.rff.org/publications/reports/what-is-an-energy-community-alternative-approaches-for-geographically-targeted-energy-policy/ (describing energy communities defined in the IRA as "communities that will be most heavily affected by the transition away from fossil fuel energy"); *see also* Julie M. Lawhorn, *Interagency Working Group (IWG) on Coal and Power Plant Communities and Economic Revitalization*, CONG. RSCH. SERV. (Jan. 17, 2023), https://crsreports.congress.gov/product/pdf/IF/IF12238 (tracking IRA funding and tax credits aimed at revitalizing America's energy communities).

investments bolster these credits.[103] The IRA extends its impact by offering household credits for purchasing EVs, energy-efficient home improvements, and residential clean-energy solutions.[104] These credits aim to cut down legacy pollution, enhance clean-energy accessibility and affordability, and improve living standards, particularly in disadvantaged areas.[105] Thus, the IRA aligns with the Justice40 Initiative and IIJA by expanding investment programs across all communities to foster a just transition.[106]

The Justice40 Initiative, IIJA, and IRA exemplify the federal government's commitment to a resilient, affordable, and sustainable energy future. By focusing on equitable economic distribution, the Justice40 Initiative aims to uplift historically marginalized communities. Concurrently, the IIJA channels investments into low-income communities, modernizes the country's energy infrastructure, and bolsters America's climate resilience. Moreover, the IRA employs tax incentives to motivate states and other entities to embrace low-carbon technologies, complementing investment projects funded by the IIJA. Nevertheless, the federal government cannot implement this transition alone. To avoid worsening existing disparities and effectively implement the shift to clean energy, state action is crucial.

III. PATHWAYS TO AN EQUITABLE ENERGY TRANSITION

As America transitions to low-carbon energy sources, the emphasis on environmental sustainability and conscious energy use grows. This Part explores state governments' roles in adopting the just transition. Utilizing the framework of energy justice, states are poised to shape policies that address historical disparities and champion "fairness, equity, equality, and inclusiveness."[107] Section III(A) analyzes state initiatives aligning with federal directives. Section III(B) suggests state strategies for enacting tenets of energy justice to advance the just transition while harmonizing the competing demands of the energy trilemma.

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103. RMI & EVERGREEN COLLABORATIVE, IMPLEMENTATION GUIDANCE FOR STATES AND PUBLIC UTILITY COMMISSIONS: ELECTRICITY INCENTIVES IN THE INFLATION REDUCTION ACT 3 (2023), https://www.evergreenaction.com/state-guidance/ElectricityProvisions-Feb2023.pdf.

104. *See How the Inflation Reduction Act Will Save Households Money in 2023*, CTR. FOR AM. PROGRESS (Jan. 5, 2023), https://www.americanprogress.org/article/how-the-inflation-reduction-act-will-save-households-money-in-2023/ (explaining that the IRA includes credits for households to save money on energy expenses, such as driving and home heating and cooling).

105. *Environmental Justice in the Inflation Reduction Act*, DEMOCRATIC SENATE, https://www.democrats.senate.gov/imo/media/doc/environmental_justice_in_the_inflation_reduction_act.pdf (last visited Mar. 16, 2024).

106. Hannah Perls, *Breaking Down the Environmental Justice Provisions in the 2022 Inflation Reduction Act*, HARV. ENV'T & ENERGY L. PROGRAM (Aug. 12, 2022), https://eelp.law.harvard.edu/2022/08/ira-ej-provisions/.

107. RAPHAEL J. HEFFRON, THE CHALLENGE FOR ENERGY JUSTICE: CORRECTING HUMAN RIGHTS ABUSES 2 (2021).

A. The Role of States in Federal Energy Initiatives

State governments play a central role in the clean-energy transition, connecting federal investments to local application. With jurisdiction over project planning, siting, permitting, and rate-setting, states are uniquely positioned to customize federal incentives to meet specific community needs.[108] This positioning enables states to use investments from the IIJA and incentives from the IRA to combat climate change and rectify historical inequalities.

State public-utility commissions are poised to maximize the IIJA's investment programs. For example, the 2022 Climate Solutions Now Act (CSNA) in Maryland requires the state's Public Service Commission (PSC) to assist "electric companies [in] applying for and obtaining access to federal . . . funds" to achieve Maryland's climate objectives.[109] This mandate led to the creation of a PSC-managed docket system, requiring utilities to submit monthly reports on their efforts to obtain IIJA funding.[110] The PSC's diligent oversight ensures that utilities consistently and transparently seek federal grants, supporting Maryland's vision for an affordable and equitable energy transition. By extension, the utilities' success in securing federal funding has the potential to reduce ratepayers' energy costs.

The IRA offers states additional opportunities to foster savings and boost energy efficiency. With initiatives like Renewable Portfolio Standards and Clean Energy Standards, states have historically driven market growth and job creation in the power sector.[111] The IRA enhances states' momentum by providing long-term, improved renewable-energy tax credits and new financing options.[112] These tax credits aim to reduce the economic viability of fossil-fuel generation, with analyses showing clean-energy portfolios

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108. Chris Chyung et al., *How States and Cities Can Benefit from Climate Investments in the Inflation Reduction Act*, CTR. FOR AM. PROGRESS (Aug. 25, 2022), https://www.americanprogress.org/article/how-states-and-cities-can-benefit-from-climate-investments-in-the-inflation-reduction-act/.

109. MD. CODE ANN. PUB. UTILS. § 7-803(B).

110. *See* MD. PUB. SERV. COMM'N, Order No. 90272 at 6–10 (June 29, 2022) (establishing the docket system to serve as a platform for utilities to disclose their progress, challenges, and strategies in tapping into IIJA resources).

111. *See generally State Renewable Portfolio Standards and Goals*, NAT'L CONF. OF STATE LEGISLATURES (Aug. 13, 2021), https://www.ncsl.org/energy/state-renewable-portfolio-standards-and-goals.

112. *See* RMI & EVERGREEN COLLABORATIVE, *supra* note 103, at 2 ("[F]orward-thinking power sector policy . . . has driven affordable clean energy with Renewable Portfolio Standards (RPS), Clean Energy Standards (CES), net metering, and other programs spurring market growth and job creation."); *see, e.g.*, IRA, Pub. L. No. 117-169, H.R. 5376, 117th Cong. (2022), https://www.congress.gov/bill/117th-congress/house-bill/5376 (explaining that, in serving as the basis for electric sector incentives, the IRA's Section 45 includes the renewable-energy PTC while Section 48 includes the ITC).

outcompeting new gas plants in affordability.[113] Furthermore, the IRA introduces financing programs to spur transitions from uneconomic fossil-fuel assets to clean-energy technologies.[114]

For the Maryland PSC and other state public-utility commissions, the IRA's financing programs promise further reductions in electric bills. Notably, the IRA enables tax-exempt entities, including non-profits and state governments, to directly benefit from clean-energy tax credits.[115] In contrast, for-profit entities, such as investor-owned utilities, can use transferable credits to lower monetization costs and create additional savings for ratepayers.[116] Enhanced by bonuses for projects meeting specific criteria for low-income areas, domestic content, or energy communities, the IRA's tax credits become even more valuable.[117] Paired with tax credits for households, the states' active involvement with the IRA seeks to stimulate private investment, create jobs, propel clean-energy projects, and expand access to clean-energy technologies.[118] The strategic acquisition of federal investments and incentives is crucial for states to meet America's carbon emission reduction goals.

B. Implementing Energy Justice at the State Level

States play an instrumental role in the just transition. By embedding tenets of energy justice into their regulatory frameworks, states can ensure a fair distribution of the benefits of the clean-energy transition. This approach addresses inequities stemming from historical energy practices, becoming increasingly relevant as the adoption of low-carbon technologies evolves.[119]

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113. *See* Lauren Shwisberg, *The Business Case for New Gas Is Shrinking*, ROCKY MOUNTAIN INST. (Dec. 8, 2022), https://rmi.org/business-case-for-new-gas-is-shrinking/ ("[T]aking the full advantage of tax credits in the [IRA], clean, renewable sources will be cheaper than 99 percent of proposed gas plants.").

114. RMI & EVERGREEN COLLABORATIVE, *supra* note 103 (explaining that the Energy Infrastructure Reinvestment Financing Program enables investor-owned utilities to "refinanc[e] uneconomic fossil plants while reinvesting in cheap renewable energy with storage and repurposing the grid interconnection from the retired plant").

115. *Id.*

116. *Id.*; *see also Energy Asset Monetization*, AMERESCO, https://www.ameresco.com/asset-monetization/ (last visited Feb. 14, 2024) (explaining energy asset monetization as "an effective way to offset annual utility infrastructure expenses or develop new sources of revenue for government and industrial expenses").

117. THE WHITE HOUSE, *supra* note 94, at 9–12; *see also Energy Community Bonus Credit Amounts Under the Inflation Reduction Act of 2022*, https://www.irs.gov/pub/irs-drop/n-23-29.pdf (last visited Dec. 12, 2023) (acknowledging that these PTCs and ITCs are not solely restricted to state governmental investments and that anyone can utilize them).

118. THE WHITE HOUSE, *supra* note 94, at 12.

119. THE WHITE HOUSE, BUILDING A CLEAN ENERGY ECONOMY: A GUIDEBOOK TO THE INFLATION REDUCTION ACT'S INVESTMENTS IN CLEAN ENERGY AND CLIMATE ACTION 7 (2023), https://www.whitehouse.gov/wp-content/uploads/2022/12/Inflation-Reduction-Act-Guidebook.pdf

Accordingly, states face the complex task of fairly allocating energy benefits from the IRA and IIJA while crafting decision-making policies that tackle the competing demands of the energy trilemma.

Recognition justice compels states to identify and acknowledge communities historically disadvantaged by existing energy systems. A key strategy advancing this tenet could involve expanding grid access, particularly for those unable to afford self-generation of electricity.[120] States might require energy utilities to offer community solar projects to low-income households, thereby bypassing the cost barriers of private solar installations.[121] Such measures ensure broader energy security and stimulate the adoption of low-carbon solutions in the most marginalized areas while taking advantage of IIJA investment opportunities and IRA tax incentives.

Procedural justice motivates states to develop transparent and inclusive energy policies. Collaborative efforts with stakeholders, such as co-designing energy assistance programs with low-income communities, ensures the integration of disadvantaged groups' voices into energy policymaking.[122] This inclusive approach mitigates risks related to energy affordability, such as energy insecurity and poverty. Thus, procedural justice supports the development of energy systems that bolster economic growth and social well-being while aligning with the Justice40 Initiative.

Distributive justice requires states to proactively address disparities in the allocation of energy resources and environmental pollution. Building on recognition justice, this approach should actively involve impacted communities in policy development to ensure equitable distribution of burdens and benefits. States can implement policies that direct renewable energy projects to underserved communities, integrating IRA tax incentives or subsidies to boost local employment and fair distribution of public benefits.[123] Additionally, states must tackle inequalities in energy-efficiency programs. Despite increased funding and savings from 2015 to 2019, energy-efficiency programs offered to low-income households by utilities have reached only about 5% of eligible households.[124] This is disproportionate, as low-income households constitute approximately 27.5% of the United

("[T]argeted investments to cut localized pollution from port operations, heavy duty trucks, and transportation infrastructure . . . directly support communities working to address local pollution concerns by creating a new $3 billion environmental justice grant program for community-based organizations and their partners.").

120. BAKER ET AL., *supra* note 10, at 63.

121. *See id.* at 34 (noting that the provision of financial access and benefits is a key step to increase access to community solar for marginalized communities).

122. *Id.* at 49.

123. *Id.*

124. DIANA MORALES & STEVEN NADEL, AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., MEETING THE CHALLENGE: A REVIEW OF ENERGY EFFICIENCY PROGRAM OFFERINGS FOR LOW-INCOME HOUSEHOLDS vi (2022), www.aceee.org/research-report/u2205.

States's population but receive only about 13% of the median energy-efficiency program budget.[125] States must urgently increase funding and restructure these programs to achieve a more equitable distribution of energy resources and foster sustainable, resilient energy systems.

Restorative justice addresses deep-rooted imbalances in existing energy systems. To achieve this, states could launch initiatives to empower communities most affected by climate change and employ infrastructure improvements and investments within historically disinvested areas.[126] Additionally, upholding Indigenous communities' decision-making rights on relevant energy projects further exemplifies restorative justice; this approach promotes inclusive community engagement and informed consent in energy projects that impact them.[127] Implementing restorative justice effectively demands the active integration of recognition, procedural, and distributive justice tenets, culminating in a comprehensive strategy for energy justice.

Recognizing that these burdens are often a result of systemic issues requires states to address disparities originating from the energy trilemma. Policies and programs that integrate tenets of energy justice enable states to ensure that no community is left in the dark. By embedding energy justice at the core of their strategies, states can effectively harmonize the energy trilemma, thereby paving the way for a just transition.

CONCLUSION

Achieving a just transition is critical to addressing the energy trilemma's competing challenges. While the federal government has made historic investments in clean energy, states are responsible for developing and implementing equitable energy laws and policies. Embracing tenets of energy justice enables state governments to ensure that the clean-energy transition is characterized by fairness, inclusivity, and equity. This approach prioritizes all stakeholders. Failure to incorporate energy justice as a guiding principle risks further isolation and exploitation of marginalized communities. Incorporating tenets of energy justice within state laws and policies is essential to achieving clean energy and justice for all.

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125. *Id.*

126. *See* BAKER ET AL., *supra* note 10, at 66 ("[E]quitably distributing both the benefits and harms of energy infrastructure across all communities and stakeholders . . . will remedy the current disproportionate harm being done to low-income and minority groups.").

127. *Id.*