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ADAPTATION AS MITIGATION

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Abstract

The damage from wildfires and hurricanes in recent years has resulted in extensive emergency and longer-term responses. This Article identifies an overlooked and inconvenient truth about these types of disasters: many climate adaptation efforts should also achieve climate mitigation. This is not a popular conclusion. Scientists have recognized the importance of the adaptation-mitigation nexus for over a decade, but the climate change legal literature typically treats adaptation (adjusting to or reducing the harm of climate change) and mitigation (reducing the causes of anthropogenic climate change) as discrete alternatives. Adaptation will often occur in the midst of short-term emergency responses in which achieving mitigation is far from the minds of policymakers, and including mitigation in long-term adaptation planning could create bureaucratic obstacles that bog down decision-making. Yet future generations will ask whether we accounted for their well-being as we responded to protect the well-being of the current generation or whether we dismissed these concerns and made future disasters worse. The Article argues that adaptation scholarship and policies should reflect the fact that reducing climate risks will often be far more difficult and expensive if mitigation opportunities are missed. As a first step, the Article offers two principles to guide research and policymaking on this topic: mitigate-while-adapting and adapt-to-mitigate. The Article explores the basis for these principles and their implications for public and private governance.

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“If you find yourself in a hole, the first thing you must do is to ‘stop digging.’” – Warren Buffett¹

I. INTRODUCTION

The exceptional severity of the Los Angeles wildfires and damage caused by Hurricane Helene in Florida, North Carolina, and other states has called attention to the need to adapt to climate change. In a world of increasing temperatures, rising sea levels, and more severe storms, the need for adaptation or resilience will only increase in the future. These events will require government and private sector responses, but the political and economic interests of affected individuals, localities, and states, the availability effect arising from dramatic photos in media coverage,² the tendency to avoid polarized topics like climate change,³ and the disproportionate harm to vulnerable groups and communities will induce decision-makers to focus exclusively on delivering assistance as quickly as possible.

Yet climate adaptation efforts can emit large emissions, further contributing to the global warming that requires adaptation in the first place.⁴ Adaptation efforts can waste government resources if they generate emissions that will make future climate problems worse, miss opportunities to install efficient, low carbon technologies, or yield post-disaster communities that have high carbon emissions and that need to be modified or moved in the future. If adaptation needs continue to mushroom, the economic,

¹ THE MONEY COACH, ZERO DEBT: THE ULTIMATE GUIDE TO FINANCIAL FREEDOM at <http://creditcarddebt2010.com/tag/if-you-find-yourself-in-a-hole-stop-digging-warren-buffet/>.

² Timur Kuran & Cass R. Sunstein, *Availability Cascades and Risk Regulation*, 51 STAN. L. REV. 1 (1999).

³ Michael P. Vandenbergh, *Environmental Law in a Polarized Era*, 38 J. OF LAND USE & ENVT'L LAW 51-89 (2023).

⁴ It is possible that climate stabilization goals will not be achieved if adaptation efforts fail to account for mitigation, but it is not possible to fully anticipate the effects of actions such as adaptation, carbon emissions reductions, carbon removal, and solar radiation management. See discussion *infra*, Part II. See also MARTIN PARRY ET AL., CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY. CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE CH. 18 (2007) (reviewing 70 research reports on interactions between adaptation and mitigation, which some finding win-win synergies and others finding conflicts that require trading off adaptation versus mitigation); RICHARD J.T. KLEIN ET AL. CLIMATE CHANGE 2022: IMPACTS, ADAPTATION, AND VULNERABILITY. CONTRIBUTION OF WORKING GROUP II TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 925 (2014) (“While there could be potential for mitigation and adaptation substitutability under scenarios where catastrophic climate change is avoided, the thresholds for the onset of any tipping elements (anticipated to drive some systems to the limits of adaptation) are not known.”).

social, and political resources necessary for successful adaptation and mitigation may not be available.

Adaptation and mitigation are thus closely intertwined, and neither can be achieved by ignoring the other. For the purposes of this Article, we use the term adaptation to mean efforts to adjust to or reduce the harm arising from climate change and the term mitigation to mean efforts to reduce the causes of climate change.⁵ Within adaptation, there are two kinds of responses: first, proactively implementing measures to reduce the impact of future extreme events (e.g., raising buildings, increasing storm sewerage capacity); and second, adaptations in the wake of disaster that make minimal or no changes to improve resilience.

Although policymakers and scholars have explored how we should adapt to climate change, and scientists have explored the adaptation-mitigation nexus, the legal literature has often treated adaptation and mitigation as discrete alternatives. Mitigation has been viewed principally as a matter of international, national, and state policy,⁶ with a growing focus on private governance.⁷ Adaptation in the science literature has been treated, by contrast, as having an international and national focus, although the legal literature has had a more state and local, context-specific focus,⁸ with a more limited role for private sector action.⁹ Legal and public policy scholars have noted the need for managed retreat, adaptive development, and other flexible concepts, emphasizing the need to

⁵ PARRY ET AL., *supra* note 4, at 6 (“Adaptation is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”); Nives Dolsak & Aseem Prakash, *The Politics of Climate Change Adaptation*, 43 ANN. REV. ENV’T RES. 317, 319 (2018) (defining climate adaptation as policies that “seek to reduce the biophysical, social, and economic vulnerability (or enhance resilience) of a given area, organization, population group, or individuals to climate change.”); B. DeAngelo, J. Edmonds, D.W. Fahey, & B.M. Sanderson, *Perspectives on Climate Change Mitigation*, in 1 CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT 393, 393-94 (D.J. Wuebbles et al. eds., 2017) (describing the aim of mitigation policies as to reduce carbon and other greenhouse gas emissions to decrease the magnitude and rate of climate change).

⁶ A focus of both federal and international mitigation efforts has been power generation and the transition away from coal and toward renewables. See, e.g., David A. Dana & Michael Barsa, *A “Switching Costs” Approach: EPA’s Clean Power Plan As A Model for Allocating the Burden of Carbon Emissions Reductions Among Nations*, 7 SAN DIEGO J CLIMATE & ENERGY LAW 1 (2016).

⁷ See Michael P. Vandenberg, *Private Environmental Governance*, 99 CORNELL L. REV. 129, 197 (2013).

⁸ For an example of public sector adaptation initiatives, see Stephanie Stern, *Climate Transition Relief: Federal Buyouts for Underwater Homes*, 72 DUKE L.J. 161 (2022). But see E. Lisa F. Schipper et al., *Climate Resilient Development Pathways*, in CLIMATE CHANGE 2022: IMPACTS, ADAPTATION AND VULNERABILITY. CONTRIBUTION OF WORKING GROUP II TO THE SIXTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 2655, 2688 (H.O. Pörtner et al. eds., 2022) (emphasizing the national and international role of adaptation in the context of transformational national development strategies).

⁹ For a review of private sector climate adaptation initiatives, see Michael P. Vandenberg & Bruce Johnson, *The Role of Private Environmental Governance in Climate Adaptation*, 3 FRONTIERS IN CLIMATE 715368 (Sept. 2021).

build and rebuild not for the current climate, but for the coming climate.¹⁰ These scholars have noted that as the climate changes and sea levels rise, governments and private actors will need to develop adaptively to decrease vulnerability to future climate-related heat waves, wildfires, sea level rise, flooding and other phenomena. The focus, though, has been on adaptation, not on the nexus between adaptation and mitigation.

Our examination of widely accepted carbon emissions reduction targets and projected business-as-usual emissions suggests a daunting and ultimately more important challenge: it will be difficult if not impossible to achieve widely accepted emissions targets over the near term unless we reduce emissions from adaptation activities and ultimately treat adaptation as an opportunity to achieve mitigation.¹¹ At the national level and in many states, however, the policymaking process is years – and perhaps decades – away from fully accepting the idea that adaptation should be part of national climate policy at all, much less that mitigation should be considered in adaptation decision-making. Indeed, the prospects for any significant national policy in the US on either adaptation or mitigation seems remote for the next several years, and many states that are most in need of adaptation are eschewing any climate policy, whether adaptive or mitigative. Some efforts have been made to account for mitigation in adaptation science policy reports and in national and subnational laws, but the efforts have been limited so far.¹²

In this Article, we suggest that an important initial step for climate law and policy is to recognize and embrace the concept of adaptation as mitigation. To do so, the Article identifies two overarching principles that can clarify and begin to frame the discourse and ultimately guide public and private adaptation activities: mitigate-while-adapting and adapt-to-mitigate. These are

¹⁰ Leah A. Dundon & Mark Abkowitz, *Climate-Induced Managed Retreat in the U.S.: A Review of the Current Research*, 33 CLIMATE RISK MGMT. 1, 2 (2shipp021); A.R. Siders, *Managed Retreat in the United States*, 1 ONE EARTH 216, 216-20 (2019); Chris Serkin, *Managed Retreat* (work in progress); Sander van Alphen, *Room for the River: Innovation, or Tradition? The Case of the Noordwaard*, in ADAPTIVE STRATEGIES FOR WATER HERITAGE: PAST, PRESENT, AND FUTURE 309, 309 (Carola Hein ed., 2020) (describing the Dutch Room for the River plan for residential living, which is designed around water flow).

¹¹ See discussion *infra*, Part II.

¹² Peter E. Thornton, Ch. 6 Land Cover and Land-Use Change, in FIFTH NATIONAL CLIMATE ASSESSMENT 6-18 (A.R. Crimmins et al. eds., 2023), (describing how certain land use actions can produce adaptation and mitigation benefits while others produce only adaptation and mitigation); City of Boston, Boston Zoning Code §25A-7(4) (d) (“Wherever feasible, proposed flood resilience upgrades [in the coastal flood resilience overlay district] should also enhance a building’s energy efficiency [and] greenhouse gas reduction potential”); Stern, *supra* note 8 at 151 (discussing FEMA).

two closely related principles, but the differences between them can provide a level of conceptual clarity that will enhance the ability of scholars and policymakers to conduct research and develop adaptation laws and policies that account for mitigation. We define the mitigate-while-adapting and adapt-to-mitigate principles below, discuss the physical or scientific case for each principle, and explore what these principles might mean for research and practice. We also outline conceptual shifts at the international, federal, state, and local levels that build on these principles to reflect the intertwining of adaptation and mitigation.

II. PRINCIPLE ONE: MITIGATE-WHILE-ADAPTING

Our first principle is “mitigate-while-adapting.” By mitigate-while-adapting, we mean that governments and other organizations should seek to reduce the carbon emissions arising from the specific activities undertaken to achieve adaptation, such as the repair of buildings after floods and the building of sea walls. This approach seeks to reduce the carbon generated from the inputs and activities associated with adaptation, and disclosure of those emissions is likely to be a valuable aspect of the response to the mitigate-while-adapting principle. For example, if a government agency plans to build cooling centers in cities with extreme heat or repair flood-damaged roads, the mitigate-while-adapting principle would suggest adoption of laws, policies, and programs that induce the agency to use lower-carbon building and road repair materials.¹³ In practice, most initiatives to mitigate-while-adapting target lower-carbon materials, construction practices, equipment, and possibly workforce practices.

We begin by examining the technical or scientific considerations that establish the need to reduce emissions from adaptation activities. We do not present an exhaustive analysis, but we use case studies and more general assessments to show why, on plausible assumptions, near- and mid-term emissions mitigation goals will be difficult to achieve, and long-term mitigation goals may be impossible to achieve, if adaptation activities do not reduce carbon emissions as well.

Near-term reductions in carbon emissions are necessary to slow the rate of global warming and climate damage. Many reports suggest that achieving the goal of a 50% or better likelihood of not

¹³ See, e.g., Hessam Azarijafari et al., *Solutions To Achieve Carbon-neutral Mixtures For the U.S. Pavement Network*, 28 *Int J Life Cycle Assess* 877, 877–890 (2023)(describing advances in carbon neutral pavement).

exceeding 2 degrees C goal requires stabilization of atmospheric concentrations at roughly 450 ppm CO₂ (500 to 550 ppm CO₂eq).¹⁴ Atmospheric concentrations are over 420 ppm CO₂ and concentrations are going up at a rate of approximately 2 ppm per year. Although no one emissions path is necessary to achieve the 2 degrees C goal, global emissions probably need to level off in the next decade and decline by 50% from 1990 levels by 2050. The 50% reduction from 1990 levels must occur against the backdrop of substantial global growth since 1990¹⁵ and a projected doubling of economic activity between 2010 and 2050, with 80% of that growth occurring in the developing world.¹⁶

If we fail to account for the effects of adaptation on mitigation, near-term (2030 to 2050) emissions reduction targets in the range of 20 to 50 percent reductions from 1990 levels will be more expensive and difficult to achieve. For example, an Australian report suggests that to have a probability of about 75% of limiting temperature rise to 2 Celsius degrees or less, total global emissions can be no more than one trillion tons of CO₂ between 2000 and 2050.¹⁷ It will be very difficult to achieve this total, given the roughly 40 billion ton annual emissions total, and the task will be far more difficult if adaptation contributes large emissions or leaves behind adapted communities with large emissions. At the current annual emissions rate, we will achieve the one trillion-ton total well before 2040, and the annual emissions rate is projected to increase, not decrease, over this period.

The challenge arises in part because adaptation activities themselves may generate large carbon emissions (e.g., cement

¹⁴ Leon Clarke et al., *Assessing Transformation Pathways*, in CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE. CONTRIBUTION OF WORKING GROUP III TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [O. Edenhofer et al. eds., 2014]; "(high confidence) . . . In most scenarios collected for this assessment that reach concentrations of about 550 ppm CO₂eq by 2100, global CO₂eq emissions are reduced by more than 50% %, and in some cases by more than 100%, by the end of the century relative to 2010 levels.").

¹⁵ Emissions increased 45% between 1990 and 2010. See European Commission Joint Research Centre and PBL Netherlands Environmental Assessment Agency, Long Term Trend in Global CO₂ Emissions (Sept. 2011) at http://edgar.jrc.ec.europa.eu/news_docs/CO2%20Mondiaal_%20webdef_19sept.pdf.

¹⁶ See, e.g., WORKING GROUP II, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, FOURTH ASSESSMENT REPORT: SUMMARY FOR POLICYMAKERS 16 fig.2 (Parry et al. eds., 2007), available at <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf> (identifying temperature targets and atmospheric concentrations); see also U.N. Human Development Report 2007/2008, Fighting Climate Change: Human Solidarity in a Divided World 26, 46 (2007) [hereinafter U.N. Development Report], available at http://hdr.undp.org/en/media/HDR_20072008_EN_Overview.pdf (suggesting that 2 degrees C is a "potential 'tipping point' for long-run catastrophic outcomes").

¹⁷ CLIMATE COMM'N, DEP'T OF CLIMATE CHANGE & ENERGY EFFICIENCY OF AUSTRALIA, CLIMATE CHANGE 2011: UPDATE OF SCIENCE, RISKS AND RESPONSES 53 (2011), available at http://climatecommission.gov.au/wp-content/uploads/4108-CC-Science-WEB_3-June.pdf.

production will be necessary for new seawalls and repairing bridges, but each ton of cement production currently yields roughly one ton of CO₂).¹⁸ Moreover, as climate impacts rapidly accelerate, adaptation projects will multiply. Using conservative projections, the U.S. Fifth National Climate Assessment noted that by 2030 adaptation costs for developing countries were projected to total \$140-300 billion annually and by 2050 should reach \$280-500 billion.¹⁹ The steep upward trajectory of adaptation investment, much of which entails construction, repair, and upgrading, will emit massive quantities of carbon.

Mitigating-while-adapting also advances intergenerational justice (as does adapt-to-mitigate, our other adaptation principle). Edith Brown Weiss, a founding scholar of climate justice in international law, describes intergenerational justice as occurring when, “each generation pass[es] on the planet in no worse condition than received and [has] equitable access to its resources.”²⁰ The discount rate for climate damage is critical to the question of intergenerational equity, with discount rates at the market rate of return strongly favoring current generations and lower discounting better safeguarding the interests of future generations. For example, as David Weisbach and Cass Sunstein observed, carbon-reduction projects to prevent sea-level rise from destroying the state of Florida in 200 years would not survive cost-benefit analysis under even modest discounting.²¹ Adaptation policy, which confronts grave inequities in the present, has tended to neglect equity for future generations— to endorse higher discount rates—and thus to underproduce mitigation measures.

A challenge for mitigating-while-adapting is that the need for the adaptation (whether building sea walls, repairing bridges, or replacing equipment in homes and businesses) sometimes occurs in the heat of the moment, immediately after catastrophes, when worrying about carbon emissions often seems like a trivial concern. For example, following the 2025 Los Angeles fires that destroyed or damaged over 10,000 buildings, Los Angeles mayor Karen Bass

¹⁸ For cement production, the U.S. average in 2001 was 0.97 tons CO₂/ton cement. See EPA at <http://www.epa.gov/ttnchie1/conference/ei13/ghg/hanle.pdf>. It also is possible to examine the potential carbon emissions from rebuilding homes in or outside of flood-prone areas by using floor area per person (e.g., 20 m²/person) and CO₂ emissions per unit of floor area constructed (e.g. 0.66 tons/m² for a typical U.K. house; U.S. houses would be higher). Under this scenario, home construction emits more than 10 tons of CO₂ per person (20 x 0.66 = 13.2).

¹⁹ FIFTH ASSESSMENT, *supra* note 4, at 17-18.

²⁰ Esther Brown Weiss, *Climate Change, Intergenerational Equity, and International Law: An Introductory Note*, 15 CLIMATIC CHANGE 327, 330 (1989).

²¹ David A. Weisbach & Cass R. Sunstein, *Climate Change and Discounting the Future: A Guide for the Perplexed*, 27 YALE L. & POL’Y REV. 433, (2009).

issued an executive order that waives local requirements that all new construction be electric, a climate mitigation measure that had been adopted by Palisades and other communities.²² There is no complete corrective to exigency, however, in Part III we note some strategies that federal, state, and local policymakers can use to prepare for lower-carbon responses in advance of disasters.

Opportunity costs are also a concern for the mitigate-while-adapting principle: funds spent on adaptation will compete for priority with funds for mitigation. This concern applies equally to the adapt-to-mitigate principle, as discussed below. At the federal level, efforts have already begun to tie concerns about federal spending on disaster relief to broader deficit concerns, which in turn has generated calls for reductions in federal funding for new technologies to generate low-carbon power, data collection for climate science, and related issues.²³ Opportunity costs also arise, though, for *not* mitigating carbon within adaptation projects. It may be possible to level off emissions in the near term and achieve 50% emissions reductions by 2050 without treating adaptation as an opportunity to achieve mitigation, but achieving these goals will likely be more difficult, costly, and uncertain if we do not seek to limit the carbon emissions from adaptation activities.

III. PRINCIPLE TWO: ADAPT-TO-MITIGATE

Of the two principles, the adapt-to-mitigate principle represents the biggest departure from the current mental models and discourse among legal scholars. By adapt-to-mitigate, we mean not the short-term reduction of carbon emissions arising from the adaptation activities themselves (which we call “mitigate-while-adapting” above) but the use of adaptation initiatives to leave in their wake lower carbon communities. In other words, the adapt-to-mitigate principle suggests the need to reduce not just the carbon emissions of the adaptation activities themselves, but also the long-term carbon emissions arising from the infrastructure, technologies,

²² Los Angeles, Emergency Executive Order 1: Return and Rebuild (Jan. 13, 2025), <https://mayor.lacity.gov/news/mayor-bass-issues-sweeping-executive-order-clear-way-angelenos-rebuild-their-homes-fast>; Times Staff, *L.A. Fire Updates: Fire Victims Seek Answers About Rebuilding, Cleanup Timeline*, L.A. TIMES (Jan. 29, 2025) (describing property damage and lives lost from 2025 fires), <https://www.latimes.com/california/live/la-fire-updates-floods-mud-rain-closures-laguna-eaton-palisades>.

²³ See, e.g., John McArdle & Elana Schor, *With Cuts to DOE Solar Loan Program as Sweetener, House GOP Passes CR*, ENERGY & ENVIRONMENT DAILY (Sept. 23, 2011) (noting that a \$100 million cut from a Department of Energy solar loan program was needed to “lure enough support to pass this bill”); Jason Palutz, *Rand Paul Proposes Diverting Bike, Pedestrian Money for Bridge Repair* (Sept. 23, 2011) (noting that “Sen. Rand Paul is gathering support for a plan to divert funding for bike and pedestrian projects to emergency bridge repair” following Hurricane Irene).

and communities that are in place after adaptation activities have concluded (e.g., the post-move carbon footprint of New Orleans following its eventual relocation). The principle suggests that if we are to take the need to mitigate to reduce long term climate risks seriously, in addition to reducing the emissions that arise from adaptation actions, adaptation planning should ensure that the technologies, land uses, and other societal attributes that are in place after adaptation has occurred will generate lower carbon emissions than those that they replaced. Examples of adapt-to-mitigate include government-funded managed retreats to lower-carbon or net-zero homes or communities and post-disaster energy restorations that increase the supply of renewable energy. For instance, following the destruction of Puerto Rico's power grid from Hurricane Maria in 2017, the U.S. Department of Energy provided an \$860 million dollar loan for industrial-scale solar projects large enough to power 43,000 homes.²⁴

Carbon emissions must continue to decline toward zero over the decades following 2050 just as widespread adaptation activities will become more necessary. As a result, adaptation activities that leave behind new, high carbon communities will just contribute to the inability to achieve climate mitigation goals. Instead, adaptation activities will need to achieve not only better-adapted communities, but also climate mitigation. In addition, although in a perfect world scholars and policymakers would develop and deploy decision-making tools that account for the combined needs to mitigate and to adapt, the features of adaptation problems that we identified at the outset—the claim on our attention arising from vivid destruction from wildfires, floods and other natural disasters, the political expediency of dealing with immediate problems while ignoring long-term problems, and the justice concerns arising from the asymmetric distribution of harms to disadvantaged populations—all will make rigorous research and rational, intergeneration-regarding policymaking difficult at best.

The articulation of the adapt-to-mitigate principle thus reflects the need to overcome barriers to rational, public-interested decision-making. In the absence of widespread engagement with the adapt-to-mitigate principle, the long-term future and the risks to a hundred future generations will likely be an easily overlooked inconvenient truth. As a result, we suggest explicit articulation of the

²⁴ Living on Earth, Puerto Rico's Solar Power Problem (Nov. 15, 2024), <https://loe.org/shows/segments.html?programID=24-P13-00046&segmentID=5>. (revealing the complications of balancing mitigation and adaptation by noting that some residents are advocating for distributed solar as a more resilient option for storm-prone Puerto Rico than the large-scale solar installations subsidized by the federal government).

adapt-to-mitigate principle: adaptation policies should ensure that the technologies, buildings, and transformed or re-located communities are configured over the long term to have a smaller carbon footprint than the ones they replace.

We understand that the concept that adaptation activities should put in place lower-carbon communities is difficult to accept, and the common response will be motivated reasoning and confirmation bias – picking and choosing facts that refute this concept while accepting those that reinforce existing beliefs and policy positions that enable business as usual regarding adaptation to continue. We also acknowledge that consideration of mitigation in adaptation planning and implementation should not simply result in the types of delays and decisional dysfunction that Derek Thompson and Ezra Klein have criticized in their popular book, *Abundance*, and that J.B. Ruhl and James Salzman have referred to as the “Greens’ Dilemma.”²⁵ The challenge for adapt-to-mitigate will be to create low-footprint practices within adaptation that do not introduce harmful amounts of bureaucratic review and red tape. Here we provide an initial examination of the scientific or technical case for the adapt-to-mitigate principle. Long-term mitigation goals are unlikely to be achieved with or without adapt-to-mitigate,²⁶ but implementing the adapt-to-mitigate will limit the overshoot by which the world misses its long-term goals.

The magnitude of the often-ignored long-term emissions reductions necessary to avert catastrophic climate change coupled with the acceleration of demands for climate adaptation drive this need to achieve mitigation via adaptation. Many analyses of anticipated climate change and recommendations for emissions reduction targets understandably focus only on 2020 or 2050. Climate model runs sometimes extend to 2100, and emissions targets do on rare occasions. But the climate problem will not go away in 2050 or 2100.²⁷

²⁵ See DEREK THOMPSON & EZRA KLEIN, *ABUNDANCE* (2025); J.B. Ruhl & James Salzman, *The Greens’ Dilemma: Building Tomorrow’s Climate Infrastructure Today*, 73 EMORY L. J. 1 (2023).

²⁶ James E. Hansen et al. *Global Warming Has Accelerated : Are the United Nations and the Public Well-Informed?* 67 ENVIRONMENT: SCIENCE & POLICY FOR SUSTAINABLE DEVELOPMENT 6-44 (2025) (reporting that it is no longer possible to achieve the 1.5 degrees Celsius long-term mitigation goal adopted in the Paris Agreements).

²⁷ See Susan Solomon, Gian-Kasper Plattner, Reto Knutti, & Pierre Friedlingstein, *Irreversible Climate Change Due to Carbon Dioxide Emissions*, 106 PROC. NAT’L. ACAD. SCI. 1704, 1704 (2009) (“[T]he climate change that takes place due to increases in carbon dioxide concentration is largely irreversible for 1,000 years after emissions stop.”); Nathan S. Lewis & Daniel G. Nocera, *Powering the Planet: Chemical Challenges in Solar Energy Utilization*, 103 PROC. NAT’L ACAD. SCI. 15,729, 15,730 (2006) (“[W]hatever environmental effects might be caused by this atmospheric CO₂ accumulation over the next 40–50 yr will persist globally for the next 500–2,000 yr or more.”).

The point often missed in policy debates, but important for a full understanding of the adaptation-mitigation nexus, is that anthropogenic emissions must decline steeply after 2050, reaching near-zero levels, perhaps by 2100, as the sources that currently remove carbon from the atmosphere become saturated.²⁸ The leading studies in peer-reviewed journals reach the same conclusion: to reduce the likelihood of temperature increases of over 2 degrees C above pre-industrial levels, in addition to steep declines during this century, anthropogenic carbon emissions must ultimately approach zero and probably must do so by 2100 or soon thereafter.²⁹ Importantly, anthropogenic carbon emissions must then remain at near-zero levels for many centuries.³⁰

This analysis suggests that steep long-term emissions reductions are necessary to reduce the risk of catastrophic climate change, and it will be very difficult if not impossible to achieve these reductions if the adaptation activities fail to yield communities with substantially lower ongoing carbon footprints. Although we agree with the need for managed retreat and adaptive development in response to failures in mitigation, building adaptively is not enough. Instead, we should favor adaptation options that also reduce the future carbon footprint of the building or activity that will be produced from adaptation, such as ensuring that the new communities that emerge when existing communities are re-configured or moved in response to sea level increases have substantially smaller carbon footprints than their predecessors. This can occur from using adaptation activities to adopt low-carbon technologies (e.g., the replacement of damaged heating and cooling systems after flooding with more efficient systems) and low-carbon land use patterns (e.g., development in re-built or re-located areas with increased walkability, electric vehicle, and mass transportation options, and the use of vegetation and tree cover as part of a

²⁸ See, e.g., S. Pacala & R. Socolow, *Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies*, 305 SCI. 968, 968--69 (2004) (describing 2050 emissions projections and targets under a business-as-usual trajectory, i.e., those "likely to occur in the absence of a focus on carbon").

²⁹ IPCC, *Summary for Policymakers*, in GLOBAL WARMING OF 1.5°C. AN IPCC SPECIAL REPORT ON THE IMPACTS OF GLOBAL WARMING OF 1.5°C ABOVE PRE-INDUSTRIAL LEVELS AND RELATED GLOBAL GREENHOUSE GAS EMISSION PATHWAYS, IN THE CONTEXT OF STRENGTHENING THE GLOBAL RESPONSE TO THE THREAT OF CLIMATE CHANGE, SUSTAINABLE DEVELOPMENT, AND EFFORTS TO ERADICATE POVERTY (V. Masson-Delmotte et al. eds., 2018). Natural processes can absorb natural carbon emissions and are in a rough equilibrium, but anthropogenic carbon emissions are in excess of natural emissions and cannot be accommodated without increases in atmospheric carbon concentrations.

³⁰ Matthew Collins et al., *Long-term Climate Change: Projections, Commitments and Irreversibility*. In: *Climate Change 2013: The Physical Science Basis*, in CONTRIBUTION OF WORKING GROUP I TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (T.F. Stocker, T.F. et al. eds., 2013).

development, all of which should reduce the long-term carbon footprint of the area post-adaptation).

Although implementing the adapt-to-mitigate principle should reduce carbon concentrations and the magnitude of temperature increase, adapt-to-mitigate (or any single mitigation strategy) will not reduce emissions sufficiently to cabin temperature increase to 2 degrees Celsius. Silver bullet technology solutions are attractive and widely discussed in the legal and policy literature,³¹ but even a remarkable technological advance in low-carbon energy production cannot achieve near-zero emissions. The reason is that even if a new technology could generate electricity and other useful forms of energy with no carbon emissions and could be universally adopted by 2100, that solution would only address two-thirds of the global carbon emissions. Fossil fuel emissions currently contribute roughly two-thirds of global emissions, and land use (agriculture, deforestation, etc.) contributes the remainder.³² Land use will be heavily affected by adaptation policies but is not amenable to silver-bullet technology strategies.

One way to examine the adapt-to-mitigate problem is to consider just one type of adaptation: responses to increasing sea levels. Table 1 provides an early, conservative estimate of displacement from flooding, and more recent assessments suggest much greater levels of displacement.³³ Nevertheless, even the conservative estimate provided in Table 1 suggests that the anticipated sea level rise by 2100 in the peer-reviewed literature (one meter or more)³⁴ on a global level could affect land now occupied by

³¹ ROGER PIELKE JR., *THE CLIMATE FIX: WHAT SCIENTISTS AND POLITICIANS WON'T TELL YOU ABOUT GLOBAL WARMING* 117-42 (2010); Jonathan H. Adler, *Eyes on a Climate Prize: Rewarding Energy Innovation to Achieve Climate Stabilization*, 35 HARV. ENV'T L. REV. 1, 11-12 (2011).

³² For a discussion of land use issues, see ERIC POSNER & DAVID WEISBACH, *CLIMATE CHANGE JUSTICE* (2010).

³³ Estimates vary but the average would be much higher. At the very low end, Oceans at MIT estimates that 150 million people will be affected by one meter of sea level rise. Oceans at MIT, *Sea Level* (last visited Feb. 1, 2025), <http://oceans.mit.edu/research/oceans-and-climate/present-and-future-oceans/sea-level.html#:~:text=An%20estimated%20150%20million%20people,substantially%20in%20the%20coming%20decades>. A 2018 report estimates that 800 million people will be living in cities that are "at risk" from .5 meter rise by 2050. UCCRN TECHNICAL REPORT, *THE FUTURE WE DON'T WANT* 36-38 (2018), https://www.c40.org/wp-content/uploads/ThenAAI2023/04/1789_Future_We_Dont_Want_Report_1.4_hi-res_120618.original-compressed.pdf. A study using LIDAR measures of elevation projects that 410 million people will be affected by 2100 if sea level rises one meter above the 2020 level. A. Hooijer & R. Vernimmen, *Global LiDAR Land Elevation Data Reveal Greatest Sea-Level Rise Vulnerability In the Tropics*, 12 NATURE COMMUN 3592, at 2 (2021). <https://doi.org/10.1038/s41467-021-23810-9>.

³⁴ Stefan Rahmstorf, *A New View on Sea-Level Rise*, 4 NATURE REP. CLIMATE CHANGE 44, 44 (2010) (concluding that the most probable value for sea-level rise by 2095 is 114 centimeters – more than a yard -- and the worst-case is close to 200 centimeters, and emphasizing that this is likely an underestimate because the models neglected the possibility of nonlinear acceleration of ice-flow).

108 to 175 million people, and it could lead to the need to build sea walls around or relocate 29-45 cities roughly the size of Miami, Florida. More recent research published in Nature conservatively estimates roughly 400 million people could be affected by sea-level rise by 2100, although estimates range widely.³⁵

Table 1. Sea Level as a Driver of Adaptation³⁶

Sea Level Rise (m)	Population at Risk of Inundation (million)	Land Area (1,000 km ²)		Number of cities/towns if average size = 150 km ² (roughly the size of Miami City)
		Total	Urban & Built-up	
1	108	1055	4.42	29
2	175	1313	6.76	45
3	234	1539	8.72	58
4	308	1775	10.89	72
5	376	2004	13.19	88
6	431	2193	14.85	99

The precise amount of carbon emissions that will arise from adapting to this range of sea level rise is difficult to estimate, but ten tons per person relocated is a plausible assumption (for example, ten tons of CO₂ arise from producing roughly 10 tons of cement, and cement is used in projects ranging from sea walls to new or modified buildings and bridges).³⁷ Even if responding to these sea level changes only generates ten tons per person, just this form of adaptation would yield roughly 1 to 2 billion tons of CO₂ emissions. Global emissions in 2024 equaled roughly 40 billion metric tons of CO₂ emissions, so just this adaptation activity alone could yield an amount equal to 2% to 5% of current emissions, or an amount

³⁵ The finding of 410 million people potentially impacted assumes no increase in coastal population from 2020 to 2100, which makes it a conservative estimate. Hooijer & Vernimmen, *supra* note 32, at 2. For other articles estimating the impact of sea-level rise, see *supra* note 32.

³⁶ The results in the table are approximations. For the purposes of this analysis, we assume that the sea will rise the same amount around the world and that areas at risk of inundation are those that are below the anticipated sea level rise. The source for population and land area data is: Li et al., *GIS Analysis of Global Inundation Impacts from Sea-Level Rise*, 75 *PHOTOGRAMMETRIC ENGINEERING & REMOTE SENSING* 807 (2009), http://www.asprs.org/a/publications/pers/2009journal/july/2009_jul_807-818.pdf. These calculations assume 150 km² as the rough size of Miami, which covers about 143 km², of which 51 km² is actually water. The number of affected cities would be larger if the assumption were changed to the number of cities using the net land area of Miami (92 km²).

³⁷ It may be possible to generate cement with far fewer emissions, but the point of this discussion is that the need for adaptation suggests that such activities are not just a good idea but are necessary if long-term targets are to be met.

roughly equal to the annual emissions of Japan or Germany.³⁸ In simpler terms, adapting without mitigating is like building the Keystone XL pipeline and operating it for oil transport and consumption until 2100 (about 1 to 2 billion metric tons of total CO₂-e emissions).³⁹

Furthermore, although projections for sea level rise often focus on sea levels in 2100, there is little reason to believe that sea levels will stop rising in 2100. Increases may continue for centuries even if emissions are sharply curtailed in the 21st century, leading to an ongoing need for construction of higher sea walls, re-location efforts, and other high-carbon activities. It will be very difficult to achieve 80% to near 100% emissions reductions from current levels with these types of adaptation-generated emissions, and sea level adaptation is only one of many types of adaptation efforts.

Shanghai, China, provides an example of the kinds of adaptation activities that are underway or under consideration. Shanghai's current adaptation strategy for sea-level rise includes major investments in reinforcing its 300-km-long flood barriers.⁴⁰ Officials assert that existing levees can accommodate a sea-level rise of 59 centimeters (roughly 2 feet) by 2100 while rejecting recent studies that predict a higher sea level rise⁴¹ (although the government has started to consider building a floodgate at the

³⁸ The emissions are from fossil fuels, cement, and land-use change. See CO2Now at <http://co2now.org/Current-CO2/CO2-Now/> (citing 2009 Global Carbon Budget).

³⁹ Estimate based on total annual petroleum volume of Keystone XL pipeline. See DEP'T OF STATE, FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED KEYSTONE XL PROJECT 3.14-50 (2011) (summarizing CO₂-e emissions at various life-cycle stages of oil consumption). Note that the Final Environmental Impact Statement for Keystone XL prepared by the Department of State did not disclose the total amount of CO₂-e that will be generated from the petroleum that flows through the pipeline. Instead, based on a consultant's report prepared for the Department of Energy, the Department of State concluded that all of the oil or tar sands petroleum will be burned whether or not the pipeline is constructed, thus the only disclosure necessary under the National Environmental Policy Act is the marginal increase in emissions associated with the tar sands-based oil, as opposed to other forms of oil. That assumption reduced the disclosed amount of CO₂-e emission from in the 100-million-ton range if all emissions are calculated to the 10-20 ton range if only marginal emissions are calculated.

⁴⁰ See *Rising Sea Levels Threaten Shanghai*, WASHINGTON TIMES (Oct. 23, 2009), <http://www.washingtontimes.com/news/2009/oct/23/rising-sea-levels-threaten-shanghai/?page=all>; *300-km-long Protection on the Pujiang River*, SINA (May 29, 2003), <http://sh.sina.com.cn/news/20030529/094911806.shtml> (in Chinese). Shanghai has employed other adaptation solutions to address flooding from sea-level rise, including relocations, a "sponge city" approach that strategically locates and maximizes green and other water-absorbing spaces, and an integrated flood information warning system. See, e.g., Guangtao Fu et al., *Are Sponge Cities the Solution to China's Growing Urban Flooding Problems?* 10 WIREs WATER e1613 (2023) (describing how national Sponge City Programme to control flooding and manage stormwater invested the U.S. equivalent of 28 billion dollars in 30 pilot cities including Shanghai between 2014 and 2020).

⁴¹ See *Shanghai Is Not Going to Be Inundated*, CHINANEWS (Dec. 3, 2009), <http://www.sh.chinanews.com/pageurl/2009123953535.html> (in Chinese).

estuary adjacent to Shanghai).⁴² A peer-reviewed study suggests that the 2100 sea level increase may be closer to a meter, not 59 centimeters, with a potential for substantially larger increases.⁴³ If raising the Shanghai levees by 1 meter requires materials that would emit 0.3 million tons of CO₂-e,⁴⁴ then efforts to accommodate a sea-level rise of 1 to 2 meters would at least emit 0.12-0.42 million tons of CO₂-e. Building the floodgate instead also would result in emissions. These sea level-based adaptation activities alone will not prevent Shanghai from achieving very large reductions in its total emissions, but they, in combination with a range of other likely adaptation efforts, will make it difficult if not impossible to approach the long-term goals of 80% to near-zero emissions reductions.

Adaptation activities also may represent some of the lowest-cost opportunities for long term emissions reductions. For example, replacing inefficient business and household heating and cooling systems after a flood may be an inexpensive way to reduce annual carbon emissions for decades. Ensuring that this occurs will require planning in advance to ensure the availability of large amounts of efficient equipment and trained installers after catastrophic events, as well as the incentives to adopt more efficient equipment as compared to alternatives with higher energy use but lower up-front costs.

Adapt-to-mitigate, like mitigate-while-adapting, addresses intergenerational equity concerns by lessening the climate damage bequeathed to future generations. Adapt-to-mitigate also can increase equity for *current* generations by lessening certain costs, such as utility bills. It is well-established that many of the communities most vulnerable to climate change and in need of adaptation interventions tend to be poorer and often the subject of historic discrimination.⁴⁵ Communities facing reconstruction,

⁴² See SHANGHAI WATER AUTH., INVITATION FOR BID FOR THE FEASIBILITY STUDY OF A FLOODGATE (2011), available at http://www.shanghaiwater.gov.cn/web/zhaobiao_detail.jsp?fileId=20141770 (in Chinese).

⁴³ See Rahmstorf, *supra* note 33.

⁴⁴ For example, to build a 6-m-high, 13.4-km-long seawall, Abu Dhabi used 310,000 tons of concrete and 14,000 tons of steel. See *Al Raha Beach Development*, RLH CONSULTING, http://www.rlh.co.za/index.php?option=com_content&view=article&id=59:featured-projects-sample-2&catid=1:latest-news&Itemid=65 (last visited Sept. 30, 2011). The materials would account for 80,000 tons of CO₂-e emission, given the life-cycle emissions of concrete and steel, see ENERGY STRATEGY, REVIEW OF CO₂-E EMISSIONS FROM CONCRETE VERSUS TIMBER SLEEPERS 2 (2007), available at <http://www.enerstrat.com.au/lib/documents/Review-of-CO2-Emissions-from-Concrete-versus-Timber-Sleepers.pdf>.

⁴⁵ This is true in the parts of New Orleans that flooded most dramatically during Katrina, of the Isle de Jean Charles tribe that is now in the process of resettling to a newer, higher ground location in Louisiana, and of the Inuit village of Kivalina, which continues to struggle to find a way to maintain itself in the face of rising temperatures and reduced ice cover in Alaska. See

repairs, or relocation from climate damage or increased costs related to warming temperatures may benefit from certain low-carbon technologies and infrastructure. For example, those most in need of air conditioning-related assistance in the US are low-income households. Providing these individuals with high-efficiency cooling is not only good from a climate change mitigation perspective but also will lower utility bills and have distributive justice benefits.⁴⁶

Similarly, providing the Isle de Jean Charles tribe or the Kivalina Inuit community with new, physically compact, climate-smart, residential housing after their forced relocation due to climate damage would not only reduce their long-term carbon emissions, but also help alleviate the economic stress they bear and promote the independence and cohesion of these communities. In the recent federal-state voluntary relocation of the Isle de Jean Charles tribe, the tribe negotiated for solar panels and a solar farm, which the state initially incorporated into the development plan.⁴⁷ A civil rights complaint filed by EarthRights International on behalf of the tribe to the federal Housing and Urban Development describes, among other alleged violations, how the Louisiana Office of Community Development created financial burdens for the tribal members by removing the solar panels from the project plan while building larger replacement houses.⁴⁸

In some cases, cultural beliefs and tribal sovereignty may necessitate an adapt-to-mitigate (or mitigate-while-adapting)

Craig E. Colten, *Vulnerability and Place: Flat Land and Uneven Risk in New Orleans*, 108 AM. ANTHROPOLOGIST 731, 733 (2006); Daniel A. Farber, *Disaster Law and Inequality*, 25 LAW & INEQ. 297, 302-04 (2007) (describing the vulnerability of poor and Black residents during Hurricane Katrina and other disasters); Jean Charles Choctaw Nation, *Our Resettlement* (last visited Jan 12, 2025), U.S. Climate Resilience Toolkit, Relocating Kivalina (May 10, 2024), <http://www.isledejeancharles.com/our-resettlement>; <https://toolkit.climate.gov/case-studies/relocating-kivalina>.

⁴⁶ Sungyop Kim & Dohyung Kim, *Climate Change and Cooling Equity: Spatial Dynamics of Vulnerable Populations*, 55 GROWTH & CHANGE e12701(2024) (finding that low-income households of color are less likely to have air conditioning and are more likely to experience extreme heat as global temperature warms based on their housing locations).

⁴⁷ Tristan Baurick, *The Last Days of Isle de Jean Charles: A Louisiana Tribe's Struggle To Escape the Rising Sea*, NOLA (Aug. 28, 2022), https://www.nola.com/news/environment/the-last-days-of-isle-de-jean-charles-a-louisiana-tribe-s-struggle-to-escape/article_70ac1746-1f22-11ed-bc68-3bde459eba68.html.

⁴⁸ Jean Charles Choctaw Nation, *Re: Complaint Under Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d, and 40 C.F.R. Part 7 Against the Louisiana Division of Administration, Office of Community Development for Discriminatory Implementation of the Federally Funded Isle de Jean Charles Resettlement Program* (December 21, 2023), <https://earthrights.org/wp-content/uploads/2023/12/IDJC-Resettlement-Title-VI-Complaint-for-website.pdf> (noting among other civil rights violations and harms that the state's decision to eliminate the solar features "will likely place financial strain on New Isle residents; even if the new homes utilize energy efficient technologies, the homes are larger than most homes on Isle de Jean Charles and therefore may incur higher utility costs.").

approach. For example, some Tribal Nations believe that the interests of people are not severable from or superior to those of the environment and may object to human-centered adaptation proposals.⁴⁹ Accordingly, some tribal members balk at adaptation projects that don't respond to environmental needs and perpetuate the damage from carbon.⁵⁰

In sum, adaptation efforts, when completed, will either leave behind a society with a similar carbon footprint to the pre-adaptation society or one with a very different footprint. The newly configured communities, new transportation infrastructure, and new equipment in households, businesses, and government offices will form a large part of the carbon footprint of society in 2050, 2070, 2100, and beyond. We view that carbon footprint as encompassing both day-to-day emissions from energy, transportation, etc. and the effect of adaptation on vulnerability to future extreme events that require carbon-intensive rebuilding. If that carbon footprint is not substantially lower than the current one, we will be further from reaching the near-zero emissions goal, and thus the 2 degree C goal. The discussion above suggests that just the sea level-driven change to low-lying urban areas will involve hundreds of millions of people and potentially dozens of urban areas. What will be the carbon emissions footprints of these communities after adaptation efforts have modified or moved them? If the answer is that the footprints will be the same as before adaptation occurred, adaptation will not have enabled us to achieve the mitigation targets and will violate the adapt-to-mitigate principle.

IV. Implications and Objections

The concept that adaptation initiatives should account for mitigation, and that legal research and the development of laws and policies should reflect this concept, has important implications for legal scholars and policymakers. The mitigate-while-adapting and adapt-to-mitigate principles can be applied across a breadth of adaptation actions, singly or together. Translating these concepts into specific laws and policies is a complex, often politically unwieldy, and uncertain process that will not be fully achieved in the near term. Yet, as we discuss below, emerging laws and policies provide examples of the importance of accounting for the

⁴⁹ Id.; Annie L. Booth, *We Are the Land: Native American Views of Nature*, in *NATURE ACROSS CULTURES: VIEWS OF NATURE AND THE ENVIRONMENT IN NON-WESTERN CULTURES* 329, 331-34 (Helaine Selin ed., 2003) (describing how several tribes, including the Navajo, view their relationship with nature as reciprocal and equal and as a person-to-person relationship).

⁵⁰ Baurick, *supra* note 46.

adaptation-mitigation nexus. This Part considers the potential for mitigation within adaptation to change climate policy and to inform climate research.

A. *Implications for Climate Policy*

Mitigate-While-Adapting. A handful of examples demonstrate how the mitigate-while-adapting principle can guide adaptation laws, policies, and programs. As discussed in more detail below, the Inflation Reduction Act (IRA) provided funding for federal agencies to offset the additional costs of low-carbon building materials in federally funded adaptation and disaster grant projects, and some of this funding was allocated to grant recipients before the Trump Administration blocked the payment process.⁵¹ Other policies support low-carbon construction but are not specific to adaptation projects. The former Biden-era federal Buy Clean initiative committed the federal government and states that have voluntarily joined the partnership to purchase low carbon steel, concrete, asphalt, and flat glass in any federal procurement and federally-funded projects.⁵² These four materials are responsible for nearly half of U.S. manufacturing emissions of carbon.⁵³ Although the Trump administration discontinued the Buy Clean program, some state and local governments will continue to prioritize the use of low carbon materials.⁵⁴ For instance, Marin, California requires the use of lower-carbon concrete in all new public and private construction to receive a building permit.⁵⁵

Adapt-to-Mitigate. Over the long term, adaptation activities will include building or moving sea walls, building more “cool rooms,” adopting white or bright roof requirements, switching pavement types, re-locating communities, shifting agricultural production, creating human and animal migration corridors, and other actions. Deploying the adapt-to-mitigate principle for these types of activities will often be difficult. For example, immediately after floods, businesses and households in affected communities desire prompt replacement of heating and cooling equipment. If federal, state and local disaster response efforts promote replacement of inefficient flood-damaged equipment with far more efficient equipment, the emissions reductions can be substantial. Yet

⁵¹ See discussion *infra* notes 55-56.

⁵² The White House, *FEDERAL-STATE BUY CLEAN PARTNERSHIP PRINCIPLES 3* (May 2023), <https://www.sustainability.gov/pdfs/federal-state-partnership-principles.pdf>.

⁵³ *Id.*

⁵⁴ Exec. Order [Executive Order 14154](#) (Jan. 20, 2025) (rescinding Biden’s executive order establishing the Buy Clean initiative and stating that “agencies shall prioritize cost-effectiveness, American workers and businesses, and the sensible use of taxpayer money.”).

⁵⁵ Marin County, CA Municipal Code, chp. 19.07 Carbon Concrete Requirements (2022), https://library.municode.com/ca/marin_county/codes/municipal_code?nodeId=TIT19MACOBUCO_CH19.07CACORE_19.07.020DE.

in the absence of prior planning with adapt-to-mitigate in mind, the supply of efficient equipment available in the affected area may be insufficient. In addition, individuals and businesses damaged by a flood may have acute cash flow problems, and programs to finance energy efficient equipment may not be available in amounts or in forms that enable large numbers of applicants to apply quickly and with a limited amount of paperwork. If the mitigation is considered in advance, however, many of these adaptation actions in the disaster-response context can quickly and cheaply deploy low-carbon options.

A leading example of the adapt-to-mitigate principle is the use of nature-based solutions to respond to flooding, storm surges, and sea-level rise, initially advocated by the Biden administration and now of growing interest to state and local governments.⁵⁶ Nature-based solutions, such as enhanced wetland and other buffer zones from flooding, potentially offer greater long-term resilience against climate change-related effects, ecosystem services (providing habitat, water cleaning, etc.), and, for our purposes, far fewer carbon emissions than hard infrastructure solutions. As another example, the resilience mission for FEMA – the mission to Build Back Better – took on a climate mitigation valence during the Biden administration, expressed not through binding rules or clear policies, but rather an expression of intention to fund projects that put weight on climate mitigation even if the question of how much weight and how consistently was left open, as in this January 2024 announcement:

For the first time, FEMA will fund net-zero energy projects, including solar, heat pumps and efficient appliances, through its largest grant program – Public Assistance, which covers rebuilding of schools, hospitals, fire stations and other community infrastructure post-disasters.

The FEMA initiatives trace back to the IRA, which essentially merged our principles of mitigate-while-adapting and adapt-to-mitigate into a provision that authorized (but did not mandate) federal agencies to pay for the cost of technologies and construction that produced net-zero carbon or used low carbon materials within a host of adaptation and disaster grant programs, including the Hazard Mitigation Grant Program

⁵⁶ White House Archives, Biden-Harris Administration Expands Use of Nature-Based Solutions to Better Protect Communities From the Impacts of Climate Change (Dec. 9, 2023), <https://bidenwhitehouse.archives.gov/ostp/news-updates/2023/12/09/biden-harris-administration-expands-use-of-nature-based-solutions-to-better-protect-communities-from-the-impacts-of-climate-change/>; Environmental & Energy Study Institute, Cities Leading the Way on Nature-Based Solutions (May 23, 2024), <https://www.eesi.org/briefings/view/052324cities>.

(HMGP), HMGP Post-Fire, Pre-Disaster Mitigation Program (PDM), Public Assistance, and the recently cancelled Building Resilient Infrastructure and Communities (BRIC) program.⁵⁷ Many of these federal low carbon initiatives are in jeopardy following the November 2024 presidential election, but they demonstrate how the federal government can act when it takes the need to account for mitigation in adaptation seriously, and are examples of the types of options available to state and local governments.

B. Challenges of Adaption for Mitigation

Conceptual and political challenges can be expected to generate resistance to our core concept of the need to account for mitigation in adaptation. As we have discussed above, a policy approach that incorporates mitigation practices and adaptation will often reduce carbon more quickly and cost-effectively and may be the only way to achieve the long-range reductions of carbon necessary to stabilize the climate. But acceptance of the core concept, as well as our two principles, will be difficult. The tendency to assume that the decision to mitigate can be deferred or that tradeoffs need not be made will be strong. The fallacy of hypothetical alternatives—the concept that an option should not be pursued because a possible alternative exists, even if that alternative is infeasible—is just one of many ways that some interests will advocate against accounting for mitigation in adaptation.⁵⁸ False choices will be offered, such as the argument that the choice is between investing funds or decision-making time

⁵⁷ FEMA, Utilizing Net-Zero Energy in FEMA Projects (Sept. 2024), https://www.fema.gov/sites/default/files/documents/fema_net-zero-energy-fact-sheet.pdf. (“Use of net-zero building practices in FEMA funded projects helps implement the agency’s 2022–2026 Strategic Plan goal of leading the “whole of community in climate resilience” and encourages state, local, tribal, and territorial applicants to make strategic investments to enable community resilience.”). Specifically, the Inflation Reduction Act authorizes reimbursement for the increased cost of low- or zero-carbon materials, technologies, and construction, subject to any cost-share requirements (e.g., hazard mitigation funding following a national disaster typically requires the state or locality to pay 25%). FEMA, Low-Carbon Materials and Net-Zero Energy: An Overview for Public Assistance and Hazard Mitigation Assistance 8 (Sept. 2024), https://www.fema.gov/sites/default/files/documents/fema_low-carbon-net-zero-energy-overview.pdf. On a much smaller scale, New York state has expanded adaptation funding for homeowners at risk of flooding to encompass investments in mitigation such as heat pumps, insulation, and energy-efficient appliances. A recent New York “flood mitigation” grant offers homeowners up to \$50,000 in the form of a 50/50 grant and low-interest loan to alter their homes to reduce flood risk. However, as long as the homeowner makes at least one flood mitigation investment (e.g., sump pump, flood vents, elevation), they can use the balance of the funding for carbon mitigation, including energy saving measures NY Homes & Community Renewal, Resilient Retrofits (last visited Dec. 18, 2024), <https://hcr.ny.gov/resilient-retrofits>.

⁵⁸ In theory, we might compare the use of these funds to all other potential uses of the funds, but it is important to avoid the fallacy of hypothetical alternatives. See Daniel A. Farber, *Climate Justice*, 110 MICH. L. REV. 985, 989 (2011).

in achieving mitigation through adaptation versus investing in other mitigation measures or deferring mitigation until a more comprehensive response can be adopted.

Many advocates will succumb to Disney's Law, which leads to rejection of difficult but viable strategies on the ground that "wishing will make it so."⁵⁹ Another way to think of this is that predictive limitations also constrain our assertion that adaptation laws and policies should seek to achieve mitigation. It is plausible that other responses, such as a carbon tax or cap-and-trade system, technological developments, or carbon capture and storage systems will achieve the necessary emissions reductions (or will do so more efficiently) without a policy that integrates mitigation into adaptation. The successful development, rapid deployment, and durable operation of these responses, though, seems unlikely at best, and even if some are successful, they are unlikely to obviate the need for reducing emissions through adaptation.

Exigency can frustrate efforts to account for mitigation in adaptation activities. Opportunities to mitigate-while-adapting, as well as to adapt-to-mitigate, often arise following climate-related extreme events that have created emergencies requiring timely disaster relief. Mechanisms should be put in place for quickly operationalizing choices made in the context of scenario analysis once an actual emergency happens. For instance, a readily accessible list of specific steps and simple protocols that can be employed on an emergency basis would enable adapt-to-mitigate responses during floods, storms and other crises. This is critical because our history of emergencies from Katrina to the 2008 financial crisis suggests shows that thoughtful deliberation is unlikely in the midst of crisis.

Formal legal requirements for environmental review and even substantive adaptation and adapt-to-mitigate requirements are likely to be "waived" under an emergency rationale unless there is quick, ready operationalization that can blunt calls for action in the face of crisis, no matter the undesirability of such action from an adaptation and mitigation perspective.⁶⁰ Emergency plans need to reflect in advance the pressure to quickly operationalize responses and the risk that opportunities will be missed in the midst of crisis-based media coverage and decision-making. For example, one useful

⁵⁹ See Vandenberg, *supra* note 3, at 52.

⁶⁰ For a recent example of this type of phenomenon, see Kevin A. Stack & Michael P. Vandenberg, *The One Percent Problem*, 111 COLUM. L. REV. 1385, 1440 (2011)(noting the opposition to applying NEPA requirements to actions taken pursuant to the American Recovery and Reinvestment Act, commonly known as the stimulus bill).

component of adapt-to-mitigate emergency planning regarding flooding would be an updated list of the available equipment and supplies to be used in emergency response and reconstruction, along with contingency plans to ensure the availability of large quantities of efficient equipment in the days immediately following an emergency.

Perhaps the most daunting challenge is that the current political situation demonstrates little or no appetite for public policies supporting climate adaptation or mitigation, much less a coordinated combination of the two. This is true both in federal policy and in many of the states that are at highest risk, in need of adaptation, and also emit large quantities of greenhouse gases, and thus are essential for effective mitigation. In response to these policy feasibility constraints, this Article focuses on what might be possible in the future, bearing in mind that political landscapes shift over time. We recognize that by the time such political opportunities arise, it may be too late to avoid catastrophic climate change by mitigation, and too late for adaptation to be feasible in the face of catastrophic risks, but in the interim we can focus on state, local, and private sector action and ensure that conceptual clarity emerges that can increase the speed and effectiveness of climate responses when climate actions are feasible.

Although public policies mitigating carbon in adaptation currently face headwinds, there is significant potential for private environmental governance to integrate mitigation into adaptation. Insurance companies and banks have an interest in adaptation that reduces insurance claims and property losses, as well as an interest in mitigation that decreases future threats to the profitability of hazard insurance and mortgage lending. As a result, private organizations may advance mitigation during adaptation through their policies with customers, their internal policies, or even by lobbying public officials.

C. Social and Political Advantages of Merging Adaptation and Mitigation

An advantage of accounting for mitigation in adaptation efforts (both mitigate-while-adapting and adapt to mitigate) is that doing so can reduce the risk that adaptation will undercut support for mitigation—historically a major concern of environmental interests. This is an advantage that will become important over the longer term, as policies for including mitigation in adaptation develop. Our research suggests that framing responses to climate

change only in terms of adaptation may reduce support for mitigation unless individuals understand that adaptation alone is not a complete solution.⁶¹ When adaptation is connected to mitigation under the adapt-to-mitigate principle, that risk may be reduced, although we believe that further empirical research is necessary on this issue.

A plausible psychological account explains how learning about adaptation options, especially when those options are portrayed as relatively “easy” or “cheap,” could undercut appreciation of the risks of climate change and reduce support for mitigation.⁶² Recent research outside the climate change context suggests that persons who engage in and enjoy a risky behavior will lower their assessments of the risks from that behavior if they are informed about remedies that are available to address the effects from engaging in the behavior. According to this account, when consumers who engage in highly risky behaviors such as smoking and overspending learn about “remedies” such as nicotine replacement products and debt consolidation loans, they “reduce risk perceptions and increase risky behavior” in a “boomerang effect” whereby “remedies undermine risk-avoidance among those most at risk”⁶³ For the same reason, people who learn about and are offered anti-lock brakes or other safety devices may perceive driving as less risky and drive more recklessly. Extrapolating to climate change, one might suppose that people who engage in risky behaviors – behaviors that tend to contribute to climate change – will lessen their perception of the risks of climate change and the need to prevent it if they are told of adaptation. This is because adaptation, like the availability of debt consolidation services or better brakes, may make them feel that proceeding with the status quo is safer.

The extension of the risk compensation dynamic to the context of climate change and adaptation is based, at this point, on supposition, not empirical evidence. Although empirical research on this question is necessary, while our understanding of psychological mechanisms and dynamics improves it makes sense to take

⁶¹ See Amanda R Carrico, Heather Barnes Truelove, Michael P Vandenbergh & David Dana, *Does Learning about Climate Change Adaptation Change Support for Mitigation?*, 41 J. ENVTL. PSYCHOLOGY 19-29 (2015). Cf David Dana & Janice Nadler, *Regulation, Public Attitudes, and Private Governance*, JOURNAL OF EMPIRICAL LEGAL STUDIES, 16(1), 69-93 (2019) (exploring the hypothesis that private governance can reduce support for public governance by persuading people that the problem at issue has been addressed).

⁶² Of course, other psychological constructs suggest alternative views. For example, adaptation measures could lead to enhanced support for mitigation measures by making climate change more available or by triggering cognitive dissonance among climate skeptics.

⁶³ Lisa E. Bolton, Joel B. Cohen, & Paul N. Bloom, *Does Marketing Products as Remedies Create “Get Out of Jail Free Cards”?*, 33 J. OF CONSUMER RES. 71 (2006).

pragmatic measures to avoid the possibility that adaptation information and programs will further the current underappreciation of the risks from climate change and erode the current limited support for meaningful mitigation strategies. From this vantage point, adaptation framed as adaptation-as-mitigation would seem to be the clear “no regrets” better alternative to adaptation framed as adaptation-and-not-mitigation. Framing adaptation as mitigation underscores the need for mitigation, which underscores the seriousness of the threat posed by climate change. This framing makes it much harder for people observing or participating in adaptation programs to think of adaptation as a get-out-of-jail-free-card easy remedy that stands wholly apart from the need to prevent climate change as much as possible. Unlike debt consolidation loans, adaptation as mitigation communicates not just the availability of a response to risky behavior but instantiates and demands a reduction in that behavior and thus affirms the importance of taking the risks posed by that behavior seriously.

In addition, interweaving mitigation into adaptation projects may increase political support for mitigation, at least by the recipients of adaptation funding. As the impacts of climate change worsen, communities increasingly compete for federal and state grants, which fund as much as 75% of selected adaptation projects and often 100% in the case of HUD disaster and adaptation grants to low-income communities.⁶⁴ Localities whose residents desire an adaptation project funded with a majority of federal or state dollars are more likely to support mitigation when it is a prerequisite to receiving those funds.⁶⁵ To date, no study has investigated national public opinion for hybrid adaptation and mitigation policies.

Empirical evidence suggests, though, that combining policies that are popular with voters can increase political support for carbon mitigation. In a 2020 experiment using conjoint analysis, Parrish Bergquist, Matto Mildemberger, and Leah Stokes found that bundling some types of social and economic policies such as affordable housing, college tuition, and job retraining with

⁶⁴ 42 U.S.C. § 5170c(a) (Stafford Act disaster relief); 240 C.F.R. § 570 (2025) (CDBG-DR regulations).

⁶⁵ See Rachael Shwom et al., *Understanding U.S. Public Support for Domestic Climate Change Policies*, 20 GLOB. ENV'T CHANGE 472, 477, 479 (2010) (finding that personal costs anticipated from climate change policies were associated with lower support and that values and beliefs were the strongest predictors of policy support overall); Cf. Linda Shi, Eric Chu, & Jessica Debats Garrison, *Explaining Progress in Climate Adaptation Planning Across 156 U.S. Municipalities*, in PLANNING FOR CLIMATE CHANGE: A READER IN GREEN INFRASTRUCTURE AND SUSTAINABLE DESIGN FOR RESILIENT CITIES 345-46 (Elisabeth M. Hamin Infield, Yaser Abunnasr, & Robert L. Ryan eds., 2019) (finding that communities with no recent experience of climate-related temperature changes and other impacts are less likely to engage in local land use planning for climate adaptation).

mitigation measures such as carbon taxes and carbon-reducing energy and transportation policies in a single, hypothetical policy increased public support for the mitigation measures.⁶⁶ For adapt-to-mitigate, it seems plausible that residents in a climate-impacted community will view federal or state funding for adaptation investments similarly to a social program or even an economic program if the project creates jobs or improves valuable infrastructure—and thus may be more receptive to embedded mitigation requirements. However, missteps in aggregating climate mitigation with other policies that turn out to be less popular or more controversial can have the opposite result, as the historical demise of the New Green Deal and attacks on ESG (Environmental, Social and Governance in private organizations) based on its diversity, equity, and inclusion metrics demonstrate.

As we have previously observed, though, even when a majority of the public supports policy action on climate, both federal and state governments are often paralyzed by partisan gridlock and unable to respond effectively to public opinion.⁶⁷ Increasing public support for adaptation and mitigation alone thus is unlikely to result in near-term policy adoption and implementation. Instead, this Article provides the conceptual foundation for change when more fundamental shifts in the political system enable federal policy to better reflect public support for climate mitigation and adaptation.

C. Existing Law

Very little “law” exists at the intersection of adaptation and mitigation. For that matter, very little law is explicitly labelled as adaptation law at all. An enormous swath of law and law-constrained programs implicate climate adaptation, including (for example) almost all zoning and building codes, without ever using the word adaptation. On the other hand, some international, federal, and state and local law and statements of policy specifically address

⁶⁶ Parrish Bergquist, Matto Mildenerberger, & Leah C. Stokes, *Combining Climate, Economic, and Social Policy Builds Public Support for Climate Action in the US*, 15 ENV'T RES. LETTERS 054019, at 3-5 (2020). Conjoint analysis, a statistical methodology traditionally employed for marketing research, allows climate opinion researchers to assess preferences for different elements and combinations of elements in climate policy bundles (e.g., combining a carbon tax, new energy standards, and an increased minimum wage in a single law). Joining social policies (housing, health, etc.) with mitigation measures increased policy approval overall, with democrats more strongly in support and republicans more strongly opposed to combined social programs-carbon mitigation policies; bundling carbon mitigation with economic measures such as programs to retrain fossil fuel workers and provide unionized clean energy jobs increased support by democrats and did not change support by republicans. See *id.* at 4-5.

⁶⁷ See MICHAEL P. VANDENBERGH & JONATHAN M. GILLIGAN, *BEYOND POLITICS: THE PRIVATE GOVERNANCE RESPONSE TO CLIMATE CHANGE* (2017).

climate change adaptation or would apply to some adaptation projects or initiatives. Even in the most climate-change-oriented governments, though, there is no clear articulation of the mitigate-while-adapting or adapt to mitigate principles as a matter of law or policy.

International, federal, and some state law regarding adaptation projects does at least encourage decisionmakers to assess the GHG emissions associated with adaptation proposals before deciding which proposals to pursue. A proposal before the World Bank's Adaptation Fund and California's GHG-CEQA (greenhouse gas-California Environmental Quality Act) regulations provides examples. At the international level, the main focus of adaptation has been the provision of funding to less-developed, vulnerable countries and communities to finance projects designed to address adaptation needs, such as flood management and increased power capacity to meet cooling needs.

The key institution in this effort has been the World-Bank-administered Adaptation Fund, which was created under the United Nations Framework Convention on Climate Change and was designed to finance climate change adaptation projects and programs based on the priorities of eligible developing countries.⁶⁸ The Adaptation Fund has been criticized for not considering the carbon emissions of the adaptation projects it funds, and in an effort to address that criticism, the Adaptation Fund Board has recommended some very limited measures in that direction: "To publish a report on the carbon footprint of the Fund for Scopes 1, 2 and 3 [emissions]," "procedurally adding a carbon footprint to the criteria of its activity selection or prioritization," "encourag[ing] implementing entities to voluntarily communicate to the Fund information on the carbon footprint and carbon management initiatives that are in place within the entities for the Adaptation Fund projects and programmes."⁶⁹ It remains to be seen if these recommendations will be adopted and how much effort will be made to calculate carbon emissions from adaptation projects and select projects that prioritize carbon management. Notably, the Adaptation Board has expressed the reservation that too much attention to carbon management would hamper its ability to meet its adaptation mission.

⁶⁸ World Bank Group: Financial Intermediary Funds (FIFs): Adaptation Fund (AF) (Feb. 8, 2025), <https://fiftrustee.worldbank.org/en/about/unit/dfi/fiftrustee/fund-detail/adapt>

⁶⁹ Adaptation Fund, Options for Reducing the Carbon Footprint of the Adaptation Fund 7 (April 12, 2024), https://www.adaptation-fund.org/wp-content/uploads/2024/04/AFB.B.42.10_Options-for-reducing-Carbon-footprint-of-AF_final.pdf.

As to the U.S., the federal government has not adopted a substantive adaptation law, and no federal agency has a statutory obligation to address climate adaptation. The Federal Emergency Management Agency (FEMA) takes the lead with federal responses to “natural disasters” that are increasing and increasingly tied to climate change. Historically, FEMA operated largely with indifference to the adaptation issues both to a changing long-term climate, as well as indifference to any climate mitigation imperative. During the Biden Administration, FEMA and federal policy was sensitive to building “resilience” in the face of long-term climate change, which OMB has defined as “climate-induced or climate-related natural hazards and impacts ... the term ‘resilience’ means the ability to prepare for threats and hazards, adapt to changing conditions and withstand and recover rapidly from adverse conditions and disruptions.”⁷⁰ Indeed, FEMA declared a Year of Resilience in 2024. Resilience is not the same thing as climate change mitigation, however, and the Trump Administration has been reversing recent efforts by FEMA to focus on climate mitigation in its adaptation activities.⁷¹

Developments at the local level are somewhat more promising. A large number of major cities and states within the United States have issued climate action plans,⁷² and some of these jurisdictions have produced either a separate adaptation plan or have devoted a portion of a climate action plan to adaptation.⁷³ For instance, an early review of all plans adopted by 2011, using the list maintained on the International Council for Local Environmental Initiatives (ICLEI)-Local Governments for Sustainability website,⁷⁴ provided insights into the adapt-to-mitigate problem. Several plans referenced the desirability of pursuing win-win measures that include both mitigation and adaptation measures, such as green or white roofs. Several also referenced the importance of considering both adaptation and mitigation and their effect on each other. The

⁷⁰ White House Office of Management and Budget, Memorandum, Nov. 29, 2023.

⁷¹ Similarly, although California’s environmental review regulations could be read as requiring at least qualitative assessments of the mitigation impacts of adaptation projects, see Cal. Code Regs. tit. 14 § 15064.4 (requiring a “determination of the significance of greenhouse gas emissions” from the wide range of public and private action covered by the California Environmental Quality Act), it remains to be seen whether California will disregard such regulations in practice, as it appears to be doing in the aftermath to the Los Angeles fires. See <https://www.gov.ca.gov/2025/01/12/governor-newsom-signs-executive-order-to-help-los-angeles-rebuild-faster-and-stronger/> (summarizing executive order suspending CEQA regulation compliance).

⁷² See ICLEI, THE MITIGATION-ADAPTATION CONNECTION: MILESTONES, SYNERGIES AND CONTRADICTIONS, available at www.icleiusa.org.

⁷³ Id. at 5.

⁷⁴ Id. at 10-14.

guidance offered by ICLEI provides limited clarity on this topic but acknowledges the nexus between adaptation and mitigation, stating that “[t]he key is to consider BOTH . . . How much, and at what cost, a particular action will reduce greenhouse gas emissions; and . . . How effective a particular action will be at reducing climate-related risks to lives, health, property and ecosystems.”⁷⁵

D. Implications for Research

The concept that adaptation activities should account for mitigation suggests several implications for research in law and policy as well as climate science. First, the principles we have described support a new approach for adaptation and climate research. A consistent theme of the academic literature is the lack of a well-developed framework for combining adaptation and mitigation into a single analysis. In 2007, the IPCC Fourth Assessment’s Chapter on Inter-relationships between adaptation and mitigation synthesized the academic literature regarding adaptation and mitigation, and it was authored by some of the leading economists and other researchers on this topic. The chapter analyzed the inter-relationships between adaptation and mitigation as including three categories that clearly have relevance for the adapt-to-mitigate principle: “Adaptation actions that have consequences for mitigation,” “Decisions that include trade-offs or synergies between adaptation and mitigation,” and “Processes that have consequences for both adaptation and mitigation.”⁷⁶ The chapter did not reach strong conclusions regarding these categories, but it made a powerful case about what was not known:

Analytic frameworks for evaluating the links between adaptation and mitigation are inadequate, or in some cases competing. A suite of frameworks may be necessary for particular stakeholders and levels of decision-making. Decision frameworks relating adaptation and mitigation (separately or conjointly) need to be tested against the roles and responsibilities of stakeholders at all levels of action. . . . The suitability of [integrated Assessment Models] needs to be evaluated for exploring multiple metrics, discontinuities and probabilistic forecasts. . . . Hybrid approaches to integrated assessments across scales (top-down and bottom-up) should be further

⁷⁵ Id.

⁷⁶ Id. at 16.

developed Quantitative evaluation of direct trade-offs is missing: the metrics and methods for valuation scaling up from isolated, local examples to systemic changes [is] part of the required knowledge base.⁷⁷

In other words, according to the IPCC, in 2007 the research base did not support insights about the relationship between adaptation and mitigation, let alone about the role of mitigation in the context of adaptation measures (i.e. adapt-to-mitigate). This state of affairs has not changed much since 2007. The Sixth Assessment, produced in 2022, similarly finds that adaptation, mitigation, and sustainable development have synergies and tradeoffs and recommends prioritizing strategies that are most likely to produce synergies (18.2.5.3.1).⁷⁸ The Sixth Assessment notes that early research is emerging on methods to assess synergies in mitigation-adaptation projects and also describes urban areas as particularly rich in mitigation-adaptation synergies (8.2.3).⁷⁹

Although there is a dearth of research, waiting for research to accumulate will take time, and the urgency of both adaptation and mitigation counsel for developing conceptual frameworks that will make policy assessment and implementation feasible when public support begins to drive more active government mitigation and adaptation. In the absence of greater conceptual clarity, there is a chicken and egg problem: without guidance as to how to go about thinking about adaptation and mitigation together, policymakers are less likely to try to do so, and there is less likely to be a rich body of case studies to inform academic research and subsequent decision-making.

The legal and policy literature includes a number of calls to focus on “win-win” policies that promote mitigation, adaptation, and other co-benefits, although it recognizes that there may be few obvious “win-wins” to choose from in certain policy contexts.⁸⁰ In a leading article on climate policy, J.B. Ruhl and Robin Kundis Craig advocated for “concurrent governance” with respect to adaptation

⁷⁷ Id.

⁷⁸ The Sixth Assessment echoes the Fourth Assessment, stating that “Synergies between adaptation, mitigation and sustainable development might be promoted by prioritizing those CRD strategies most likely to generate synergies (very high confidence).” See Schipper et al. at 2655 - 2688.

⁷⁹ Shuaib Lwasa et al., *Urban Systems and Other Settlements*, in CLIMATE CHANGE 2022: MITIGATION OF CLIMATE CHANGE. CONTRIBUTION OF WORKING GROUP III TO THE SIXTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (P.R. Shukla et al. eds., 2022).

⁸⁰ Thomas J. Wilbanks, *Integrating Mitigation and Adaptation as Possible Responses to Climate Change*, 45 *Environment* tbl.2 (2000).

and mitigation that must be “cognizant” of the tradeoffs and co-benefits produced.⁸¹ James E. Parker-Flynn wrote that climate policy must address synergies and tradeoffs and proposed a dedicated federal agency to gather information in cooperation with states and localities, identify and analyze mitigation-adaptation synergies, create model legal reforms, and update them.⁸² Examining adaptive mitigation in the electric power sector in 2011, Lesley McAllister supported an integrated approach to adaptation and mitigation through information sharing between public and private entities, government review of proposed projects, and planning.⁸³ Katherine Trisolini also focused on the need for more careful consideration of adaptation issues in mitigation actions, such as the development of nuclear energy.⁸⁴ She proposed that projects that combine adaptation and mitigation should receive high priority for funding and offered examples of these “holistic” opportunities.

Our framework for mitigation within adaptation departs from the prior legal scholarship. First, we argue not just that win-wins should be pursued when they are available or bubble up through adaptation planning processes, but that policymakers should seek to not only reduce the emissions from adaptation activities but should seek to develop new adaptation activities in ways that also achieve emissions reductions. And they should do this routinely, building this concept into the norms and practices of climate adaptation.

Second, we argue that the mitigate-while-adapting and adapt-to-mitigate principles can also guide research on the optimal or efficient mix of social investment in adaptation versus mitigation. A significant body of economic literature addresses the question, at the macro scale, of what the optimal or best mix of adaptation and mitigation would be. For economists looking at this scale, adaptation and mitigation are basically substitutes, in the sense that each has some potential to serve the same function: reduce the welfare costs associated with climate change.⁸⁵ Mitigation does that by reducing

⁸¹ J.B. Ruhl & Robin Kundis Craig, 4 C, 106 MINN. L. REV. 191, 196 (2021).

⁸² James E. Parker-Flynn, *The Intersection of Mitigation and Adaptation in Climate Law and Policy*, 38 U.C. DAVIS L. REV. 1, 35 (2014) (noting that “effective policy and planning requires analysis of the effect of one on the other, the synergies and trade-offs that might exist, and the possibility for integrated policy to effect a better climate change response”).

⁸³ Lesley K. McAllister, *Adaptive Mitigation in the Electric Power Sector*, 2011 BYU L. REV. 2115, 2144-54 (2011). Available at: <https://digitalcommons.law.byu.edu/lawreview/vol2011/iss6/8>

⁸⁴ Katherine Trisolini, *Holistic Climate Change Governance: Towards Mitigation and Adaptation Synthesis*, 85 U. COLO. L. REV. 615, 652-72, 679-87 (2014).

⁸⁵ In the domain of federal budget decisions, the competition for resources between adaptation (in the form of disaster relief) and mitigation (in the form of renewable energy subsidies) has been explicit, with adaptation squeezing out, rather than contributing to,

the impacts themselves; adaptation does that by reducing the welfare effects from those impacts.⁸⁶ The optimal mix idea builds on the notion that by mixing mitigation and adaptation we may be able to prevent impacts where doing so is the most cost-effective and adapt where that is a more a cost-effective strategy, with the result being the optimization of global human welfare. Not surprisingly, given the amount of information that would need to be known to enable such an approach to yield prescriptions, this literature has remained highly abstract and removed from policy debates.

The adapt-to-mitigate insight suggests that any calculation of the optimal balance of mitigation and adaptation should account for the role that adaptation may play in achieving or undermining mitigation. Few efforts have been made to put adaptation and mitigation together under the prism of cost-effectiveness, as applied to specific on-the-ground decisions. One approach is based on a simple 2 by 2 matrix approach to blending adaptation and mitigation. The matrix divides measures into high-cost adaptation measure, low-cost adaptation measures, high-cost mitigation measure, and low-cost mitigation measures. The argument for using this approach is that, given the uncertainty as to climate change effects and their impacts, policymakers should privilege low-cost adaptation and low-cost mitigation measures and avoid high-cost options.⁸⁷ This approach only makes sense, though, if one dismisses the possibility that climate change will be severe or even catastrophic in the absence of highly effective mitigation and adaptation.

The academic literature also contains case studies of actual (i.e. by policymakers) or simulated (by academics, using computer models) joint consideration of adaptation and mitigation in the context of the climate change risks facing specific places (e.g., London, England; Cochin, India; New South Wales, Australia).⁸⁸ The case studies do not address the question of how adaptation measures should be assessed and undertaken in terms of their mitigation

mitigation. See, e.g., John McArdle and Elena Schor, *With Cuts to DOE Solar Loan Program as Sweetener, House GOP passes CR*, ClimateWire (Sept. 23, 2011)(noting that funding for disaster relief was offset by cuts in technology subsidies).

⁸⁶ See supra notes 79-82 (academic research discussing definition and scope of mitigation and adaptation).

⁸⁷ Warwick J. McKibbin & Peter J. Wilcoxon, *Climate Policy and Uncertainty: The Roles of Adaptation Versus Mitigation*, Brookings Discussion Papers in International Economics, No. 161 (May 2004).

⁸⁸ Danielle Boyd et al., *Mitigation Co-Benefits of Climate Change Adaptation: A Case Study Analysis of Eight Cities*, 77 SUSTAINABLE CITIES & SOC'Y 103563, at 6-9 (2021) (case studies of eight cities), <https://doi.org/10.1016/j.scs.2021.103563>; Tyler Felgenhauer & Mort Webster, *Multiple Adaptation Types With Mitigation: A Framework for Policy Analysis*, 23 GLOB. ENV'T CHANGE 1556, 1559-64 (2013) (describing how to integrate mitigation in long-term stock, flow, and option forms of adaptation investment), <https://doi.org/10.1016/j.gloenvcha.2013.09.018>.

impacts. The case studies, however, at least highlight the possibility of benefits arising from having the same people consider adaptation and mitigation concerns regarding particular locations as part of a single review process. Also, models cannot address the most pressing research need: how to overcome the partisan gridlock that prevents national and state governments from adopting climate mitigation and adaptation policies that are favored by a majority of the population.⁸⁹

IV. CONCLUSION

This Article has argued that if climate change adaptation occurs at the likely magnitude and for the time periods anticipated, and if climate mitigation requirements are as stringent as they are likely to be in the coming decades and centuries, then the nexus between adaptation and mitigation must be accounted for in law and policy. We have offered two principles that provide a conceptual framework to drive development of prudent legal and policy reforms: mitigate-while-adapting and adapt-to-mitigate. The Los Angeles wildfires and Hurricane Helene responses demonstrate that adaptation policies are not just a vague future concern, but rather they involve major actions that respond to current environmental and human disasters and seek to reduce the climate vulnerability of people, ecosystems, the built environment, and economies.⁹⁰ Mitigation policies aim to reduce carbon emissions to decrease the magnitude and rate of climate change and thus the need to adapt.⁹¹ This Article demonstrates that the two are deeply intertwined, not the largely separate concerns that dominate much thinking on climate change.

We recognize the limited prospects for action on these principles in the near term, but it is time to begin laying the conceptual foundation to account for mitigation in adaptation. This is just an early installment in the long debate about the need to account for mitigation when achieving adaptation. Adaptation is not

⁸⁹ Jonathan M. Gilligan & Michael P. Vandenbergh, *Accounting for Political Feasibility in Climate Instrument Choice* 32 VA ENVTL LJ 1-26 (2014).

⁹⁰ MARTIN PARRY ET AL., *supra* note 4, at 6 (noting that “[a]daptation is the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”); Nives Dolsak & Aseem Prakash, *The Politics of Climate Change Adaptation*, 43 ANN. REV. ENV’T RES. 317, 319 (2018) (defining climate adaptation as policies that “seek to reduce the biophysical, social, and economic vulnerability (or enhance resilience) of a given area, organization, population group, or individuals to climate change.”).

⁹¹ B. DeAngelo, J. Edmonds, D.W. Fahey, & B.M. Sanderson, *Perspectives on Climate Change Mitigation*, in 1 CLIMATE SCIENCE SPECIAL REPORT: FOURTH NATIONAL CLIMATE ASSESSMENT 393, 393-94 (D.J. Wuebbles et al. eds., 2017).

only occurring today, it is likely to increase in magnitude and to continue for centuries. A limited body of scholarship, some empirical, most normative, addresses the relationship between climate adaptation and mitigation. One overriding theme of this literature is that synergies between adaptation and mitigation – win-win policies – should be identified and pursued, where possible. But adaptation and mitigation efforts remain largely on separate conceptual and policy tracks, and operate at different scales, so synergies are not so easy to identify or pursue. Moreover, at least as to shorter-term, more immediate adaptation needs and goals, tensions often arise between meeting the demand for adaptation as quickly and as cheaply as possible and promoting climate mitigation.

Legal scholarship, government policy, and law are all largely silent on responses and frameworks for implementing mitigation within adaptation. There is surprisingly little recognition of the core need to account for mitigation in adaptation thinking and almost no “law” – no rules – yet regarding the extent to which adaptation projects should also advance the goals of climate change mitigation. By advancing the mitigate-while-adapting and adapt-to-mitigate principles, this Article seeks to provide the conceptual framework that will provoke a more candid and productive debate among legal scholars about the relationship between adaptation and mitigation. Although it is difficult to think of mitigation in the midst of responses to wildfires, hurricanes, and other climate-related disasters, rational policymaking requires that we do so. Mitigation will not always dominate adaptation discussions, but failing to view adaptation as an opportunity – and in some cases an obligation – to mitigate will be a costly error that future generations may not forgive. The next step is to use the conceptual framework advanced in the Article to explore the implications for specific laws and policies that account for the nexus between adaptation and mitigation.⁹²

⁹² A wide range of procedural and substantive rules could be explored to instantiate the two principles we have explored in this Article. For example, nature-based adaptation solutions to flooding, beach erosion, and wildfire tend to be superior on mitigation grounds. See generally <https://iucn.org/resources/jointly-published/nature-based-solutions-climate-change-mitigation>. Possible rules regarding nature-based solutions include that such solutions enjoy a presumption whereby an affirmative justification would need to be offered and defended whenever such solutions are not employed. The larger point is that recognition of the mitigate-while-adapting and adapt-to-mitigate principles will enable these types of responses to be clearly articulated, refined, researched, and debated.