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Analyzing the Effectiveness of Recent Legislation in Addressing Climate Change

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***Abstract*:** In response to this question, this essay through the use of interviews examines the stakeholders' views on particular follow-up reforms as well as provides some reflections regarding how the process of framing and enacting this legislation may be utilized to possibly progress further reforms. Energy is not like any other issue and is considered political in light of its dynamics, meanings and aspects in the United States of America. Though climate change tends to stir up strong and individual emotions in most Americans regardless of their stance on climate policies, energy politicization is entrenched in identity with even very polarized issues like abortion and gun control. Still, this activity has proceeded on massive and diverse climate and energy actions across multiple fronts (at the state level, in the courts, locally, in the executive branch, and in private efforts). In contrast, that kind of effort is frequently workmanlike and incremental and has built-in constraints in that it has avoided some of the most politically fraught topics (e.g., dependency on fossil fuels) and the cultivation of common political ground (e. g., resilience). One of the most contentious dynamics has to do with activities, which seek to employ the mechanisms of the courts to attempt at least to enjoin or to repeal measures that have been passed under the other forum or passed by states to prevent further action by the federal government as new national standards. Altogether these prepare a fundamentally different political landscape concerning the climate and energy quests, as well as the efforts formulated above have significant questions and uncertainties concerning their efficacy across context.

Access this article online

***Keywords*:**
Adaptation, Climate Change, Environmental Law, Mitigation

1. Introduction to Environmental Law and Policy

Environmental (or Natural Resources) law is a specialized body of law that focuses primarily on environmental issues. It can be defined as the body of law developed by Administrative Agencies to regulate the control of pollution and other environmental ills as a result of actions taken by industrial, commercial, and governmental activities (Ruhl, 2010). Environmental policy consists of laws and regulations that protect the environment. Environmental law and policy are developing bodies of law to address these problems. These terms encompass the legal and policy framework that addresses the interaction between human activities and the natural environment. It deals with the regulation of activities that directly affect the environment, such as pollution, land use, industrial development, and resource extraction, as well as the management and protection of natural resources (Driesen, 2007). Furthermore, it can deal indirectly with the environment, as, for example, with laws regulating but not prohibiting hunting and fishing. Environmental law and

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policy also include the regulatory framework that seeks to address harm to public health from exposure to toxic substances and other chemicals.

1.1 Definition and Scope of Environmental Law

Within the broader context of environmental law and policy, which in part is a collective Western response to centuries of overreaching demands on nature and an unconscionable degradation of global, local and bio-diversity, 'Definition and Scope of Environmental Law' addresses why development in climate change law and policy is necessary, timely and desirable. It is by no means the whole of climate change law and policy, but it does provide coherent and vital coverage of an important portion of the interface between rapid climate change of as yet uncertain dimensions and implications, and the existence of law and policy fields specifically comprising 'environmental' legal, governance, planning and policy parameters, mechanisms, instruments, communities, sectors, agencies, institutions and processes (Aagaard, 2009). While the analysis set out goes some way to show that there is a fully formed and functioning field of law and policy in relation to climate change and forestry at local and global levels, there are many areas of current and developing law, governance, planning and policy that this paper does not address. It does address some key categories and aspects of climate change related environmental law and policy. These contributions are made in a practical and comprehensive context, namely an examination of the unique attributes of the climate change problem and possible responses to it that arise from and are contingent upon the materiality of ecological and environmental parameters. These attributes include the differing time and spatial scales involved; how climate change mediates developmental initiatives and state relations; the 'whole of nature' character of the climate system; and how climate change governance involves negotiated interdependencies between the rights of humanity and the rights of nature by virtue of anthropogenic global warming and climatic change and variability (Ruhl, 2010).

2. The Global Challenge of Climate Change

Climate change has become a significant global challenge. It presently combines unprecedented rates of warming with enhanced sea level rise, stronger storms, prolonged droughts, and other gift from a long-lived atmosphere and ocean. Earth warming has a deep montional and geological origin and will enrich the climate with new regimes. The (anthropogenic) climate change resultant from the excess greenhouse gases introduced into the atmosphere since the industrial revolution is unplanned (accidental), unwanted, and hard to cope with. The authors deeply believe that the social-economic parameters of the modern civilization should be strongly corrected in order to fulfill some hardly feasible conditions: ‘sustainable nature-human interaction’, ‘sustainable dawning of the new generations’ cells of civilizations’ and ‘sustainable equilibrium of all social systems’ (Schenck, 2008). The fulfillment of those conditions is quite doubtful. Nevertheless, a galaxy should be regarded as one coherent object with regard to the coming crisis. Each reasonable civilization cell on a planet (for instance, Earth or Mars) should try to leave the overcharged or dying planet (on the Earth it is prepared to be at hand) and populate the Sun system or even surrounding systems with automatons or people as shown in Fig. 1. There is a high probability that other civilizations reached the same level of challenge somewhere else in the galaxy (Abatzoglou & Parker, 2018).

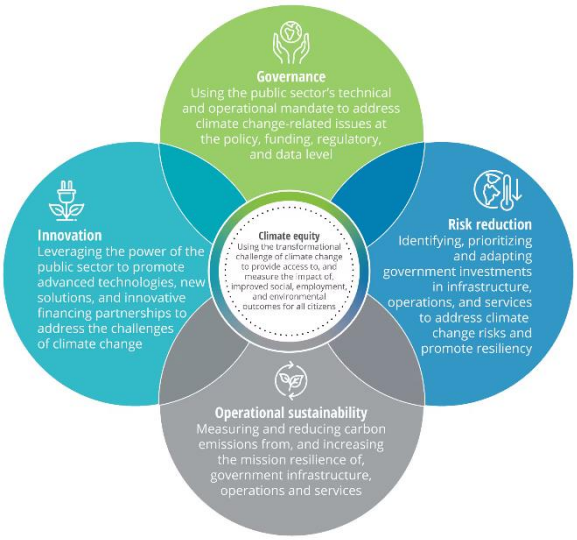

Figure 1. Five lenses for climate action

Climate should be defined as a complex-long living non-linear dynamically changing system (chaos) organized by many positive and negative feedbacks. The main major driving forces are:

1. External, astronomical (according to long living cycles of the solar activity, planetary alignment, periodic perturbations of planets on the Sun activity and others), non-predictable (fluctuation within an enormous time scales from 105 106) and influencing on the planet atmosphere, oceans and cryosphere.
2. Internal, geophysical (originated from movements of the earth mantle and initiation of volcanic eruptions or endogenic hot currents), periodic (within medium time scales 103 ‘105) or one-time impacts (for instance, a giant impact on Yucatan peninsula caused a mass extinction of living species including prehistorical dinosaurs on the boundary between the Cretaceous and the Paleogene about 66 million years ago).
3. Anthropogenic, social-economic (increased emission of the gases making a greenhouse effect

and changes in the land usage), accidental (non-predictable) and realizing since about 1750 (Industrial revolution).

2.1 Causes and Impacts of Climate Change

Climate change is largely caused by human emissions of greenhouse gases, which trap solar energy in the earth's atmosphere, and it now poses grave threats to the environment, people, and economies. Sea levels could rise by several meters, inundating major coastal cities. Floods and droughts could worsen, harming agriculture and water supply. Hundreds of millions could suffer freshwater shortages. Climate change needs to be effectively addressed by controlling greenhouse gas emissions and developing options for adaptation to the inevitable changes. Participants in climate change initiatives can benefit from understanding the scientific basis of climate change and the broad international policy framework for coordinating actions globally (Ohshita, 2007). More specifically, participants need to understand the evolving national and international context for potential initiatives, including leading proposals and the response of key stakeholders.

People are presently consuming fossil fuels and generating greenhouse gases at a rate that is without precedent in human history. Fleets of fossil-fuel-burning automobiles, ships, and airplanes now move people and goods around the earth. Industrial-scale agricultural operations facilitated by synthetic fertilizer and pesticides are radically reshaping the biosphere, and billions of people generating an urban lifestyle consume energy and materials on a scale never before approached 7. The greenhouse effect is a natural phenomenon, the result of greenhouse gases in the earth's atmosphere trapping heat. As greenhouse gases, such as CO2, are emitted in ever-stricter quantities, the natural greenhouse effect is strengthened in its turn as shown in Fig. 2.

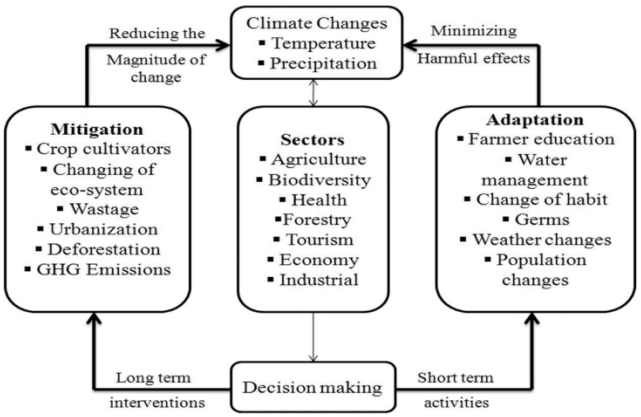

Figure 2. Sectorial impacts of climate change with adaptation and mitigation measures

3. Key Concepts in Climate Change Legislation

Climate change legislation entails a range of legal measures, regulations, and policies aimed at addressing the issue of climate change, specifically seeking to mitigate its impacts on the planet and on ecosystems. Climate change legislation holds implications for both human health and the integrity of the planet. Many polls indicate public concern about climate change and demand for state action, but states have an apparent paradox: while several have passed legislation addressing climate change, state action has not done much to alleviate the problem 7. In all, 21 out of the 36 states with power plants generated at least 10 percent of their in-state electricity from coal in 2005. The states that generate the greatest emissions, such as those with coal-fired power plants, could face greater costs from regulation than corresponding benefits. While many states have taken some action on climate change, the relatively weak nature of that action may indicate that state politicians desire to gain symbolic credit for addressing climate change without imposing significant costs on their constituents. California's experience implementing AB 32 may be instructive. Although California was willing to establish demanding emission reduction goals, the Governor pressured CARB to go slow in imposing short-term regulation, opening up regulatory and compliance uncertainty that could chill investment.

Climate change legislation has implications for human health because observed climate change, in conjunction with other stresses, contributes to ecosystem degradation, with impacts on health, safety, and quality of life (Setzer & Bangalore, 2017). Legislative efforts on climate change may not only protect human health: they may provide a needed focus for research on health impacts in view of long-term and large-scale changes to ecosystems. Climate change legislation has implications for the integrity of the planet because mankind has emitted more than 50 billion tons of carbon dioxide into the atmosphere over the last 20 years. These emissions create a blanket of gases that traps heat, leading to global warming. Climate change legislation usually contains measures and strategies intended to slow global warming in order to minimize its severity and effects on the environment and on ecosystems.

3.1 Mitigation vs. Adaptation Strategies

Climate change legislation is best understood through two lenses: mitigation and adaptation. The former involves strategies to address the causes of climate change, generally involving reductions in emissions of heat-trapping greenhouse gases, or GHGs; the latter focuses on efforts to address the effects and impacts of climate change (Ruhl, 2010). The climate change mitigation debate has raged on for decades. Previous earth could not reach agreement on binding national emissions limits. Even with recent international accords and national climate bills, the prospects for U.S. emissions limits remain uncertain at best.

The climate change adaptation agenda emerged vocally in the mid-2000s and rapidly gained mainstream acceptance in the U.S. and abroad, being embraced by a broad spectrum of stakeholders including federal, state and municipal governments, industry, NGOs, and philanthropy. Once dismissed positively as a "safety net," adaptation is now viewed by some as potentially tilting favorably the resource protection and allocation balance away from mitigation and toward adaptation. It is now being actively pursued on national and international levels and by environmental NGOs, industry, and communities (Gariano & Guzzetti, 2016).

A major scientific and policy challenge climate change poses is determining how the world will manage the unavoidable effects of a changing climate. Even under the most favorable scenarios, human injections of GHGs into the atmosphere will continue to affect climate for decades if not centuries to come. Global temperatures will rise and climate systems will change, committing some coasts to rise several feet, increasing storm damage in others, threatening ecosystems with extinction, expanding drought-prone latitudes and raising many regions' freshwater stress all regardless of human efforts to mitigate. The prospect of global climate change is daunting. Existing governance structures are not adequate to meet the problem. There is an urgent need to rethink adaptation and adaptation law, and in so doing rethink development planning itself. Adaptation and adaptation law must benefit from proactive planning to concert these structures toward future sustainable development goals. Climate change adaptation could be thought of as an interim strategy for sustainable development during the interregnum of climate change as shown in Fig. 3.

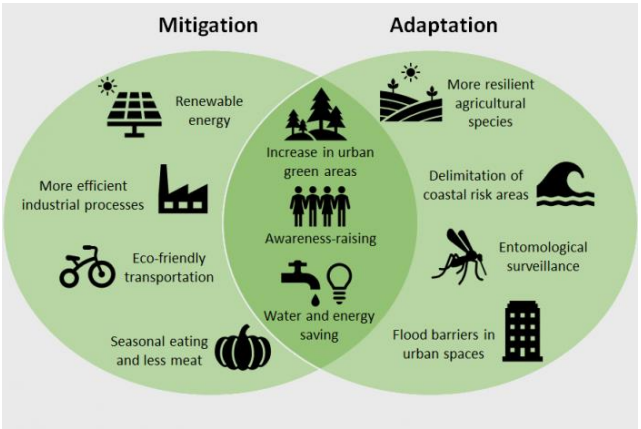

Figure 3. Climate change adaptation vs. mitigation

4. Overview of Recent Climate Change Legislation

This section presents an overview of the recent climate change legislative actions designed to address climate change. The Global Climate Change Legislation Study has been assessing the climate change legislation in 54 jurisdictions since 2007. A review of the most recent legislation, or the lack thereof, is presented in the following sections for the following six jurisdictions. The jurisdictions are International Treaties and Agreements; United States & Puerto Rico; European Union & the European Community; Asia Pacific (Australia, China, India & Japan); Canada; and Brazil, Mexico & Middle East (Israel & UAE).

The number of countries with laws addressing climate change mitigation has increased over the last decade, and there is an emerging trend of litigation against climate change in many countries. In 2020, the total stock of climate change laws (including laws with an explicit climate change focus) worldwide reached 1,842. The number of climate change laws has steadily increased for a number of reasons: the breadth and depth of the issue requires regulation; political pressure from a variety of stakeholders; and widespread public concern. Many political leaders committed to expanding – or, more likely, not retracting – climate change laws in their jurisdictions (Eskander et al., 2021).

4.1 International Agreements and Treaties

The treaties and agreements established to address climate change on a broader level, focusing on the international dimension. A summary of the major international agreements and treaties established to address climate change on a broader level, including those coming out of the United Nations Framework Convention on Climate Change and The Intergovernmental Panel on Climate Change. National policies aimed at addressing climate change with a global dimension in line with international agreements and treaties. Explanation on international agreements and treaties are successfully implemented. Commitments by sub-national jurisdictions to address climate change with a broader and more international dimension than when promoting international trade and investment will not run afoul of the Agreement on Trade-Related Investment Measures and the General Agreement on Trade in Services.

This topic investigates both the treaties negotiated under the United Nations Framework Convention on Climate Change and the Intergovernmental Panel on Climate Change, and treaties negotiated under non-UN auspices but focused broadly on addressing climate change - internationally coordinated research initiatives. The ratification process not only might generate political pressure on the federal government, but also may trigger a greater desire on the part of less developed countries to seek to bind themselves to 'soft' international standards (Outka, 2016). Nations and groups of nations which together bear a disproportionate share of global warming and other transboundary environmental problems might also be more inclined to pursue a policy of tort-like responsibility and obligations for repair.

5. Case Studies on the Implementation of Climate Change Legislation

Practical examples can be used to illustrate how climate change legislation is put into practice. Specific countries or regions and their approaches to implementing climate laws can be featured. The successes and challenges encountered in the implementation process can also be analyzed, providing insights into the real-world effectiveness of climate change legislation.

In the United States, several states have adopted legislation or regulatory policies designed to reduce GHG emissions. The efforts range in scope from policies limiting emission increases to implementation of comprehensive programs to stabilize emissions at specified levels. Market-based policies, such as emissions trading programs, are widely used but, in almost all cases, are not implemented at the scale needed to address the climate problem. Climate legislation is not universal. Outside of the United States, countries or states without some form of climate law include the oil-rich states of Saudi Arabia and Kuwait; the coal-rich but poor states of Mongolia and Mozambique; and much of Africa. Climate laws were initiated almost exclusively in high-income countries and the gradual expansion of climate laws into developing countries has been slow (Eskander et al., 2021).

At the heart of every law are compliance and enforcement provisions. They describe what entities with obligations under the law must do and what government will do to check whether mandated activities and requirements are being followed. In addition, recourse and penalties are specified for parties that violate the law. All of the laws in the examined sample specify compliance and enforcement provisions, although these range considerably in seriousness (Frank, 2015).

5.1 Country-Specific Approaches

Among the many countries adopting climate legislation, Ecuador represents an uncommon and noteworthy case. Normally associated with proponents of the “soft” approach, such as court cases claiming the right to a healthy environment, Ecuador has adopted a different, “hard” instrument (Eskander et al., 2021). In 2008 Ecuador became the world’s first country to recognize the rights of nature in its constitution. Notably, the constitution declares nature to be an entity with the right ‘to exist, persist, maintain, and regenerate its vital cycles, structure, functions, and evolutionary processes’. The clause grants individuals and collectives rights to act as legal representatives of nature (Lewis & Coinu, 2018), rendering nature itself the subject of legal protection. Unfortunately, Ecuador is a case study illustrating how progressive climate legislation can fail in practice.

The Ecuadorian constitution recognizes as rights a series of ecosystems and processes that embody functions crucial for life, such as the regulation of climate systems. The constitution also establishes a constitutional court and a system of courts for the nature rights suits. However, contradictory legal frameworks undermine their enforcement. The 2008 constitution considers a right to live in a healthy environment; however, producers are not held liable for toxins exceeding environmental thresholds. As a result, even when various climate actions comply with legal literature, producers associated with the exploitation of non-renewable resources can indirectly respond remedying this damage.

6. Challenges and Limitations of Climate Change Legislation

Despite the overwhelming consensus on climate change, it remains a major policy challenge. This is because climate change is a complex problem rooted in the commons dilemma, among other things (Ruhl, 2010). Its nature and legal ramifications have deep implications for its governance. It may explain skepticism about the politicization of science, frustration with treaty stalemate, and the timeliness and gradualism of legal responses.

Climate-induced harm has been increasing, but so has climate change adaptation (CCA) law and policy. As this body of law, policy, and practice matures, it will be tested in the courts. Framed within complex and rapidly evolving scientific, economic, policy, and contextual settings, climate change poses unique issues and questions for the courts and the law (Schang & Chan, 2010). CCA law will raise difficult questions for states, municipalities, quasi-public entities, and private actors. Seeking to reduce a planet-wide threat with too small a reaction of emissions to fundamentally alter levels of risen greenhouse gases has been the main battle.

6.1 Enforcement and Compliance Issues

Enforcement and compliance issues are critical to each facet of the statute's operation, from right-to-know provisions through compliance and enforcement molds (Schang & Chan, 2010). This function is now supercharged by "Title VI: Open Public Participation," which adds greatly to enforcement avenues and myriad citizen enforcement provisions, and with a complex web of new state pre-emption provisions. Beyond the specifics of a title-by-title or section-by-section summary, certain themes recur throughout virtually all the titles. As with other parts of the Global Climate Protection Act, rights provisions are focused on individual empowerment (with remedial citizen "standing" under all statutes); yet there is a strong counter-veiling emphasis on the cooperation of national states and stable local solutions. Closer to home, citizen participation is high, raised by the convenience of open records (with the added responsiveness of language and electronic translation). Grazing districts have slow-expanding

proposals affecting uses from subdivisions to levees (Kaswan, 2007). Similarly, municipal states have proposals with human/animal rights and municipal trust underlining a more active role in regulation.

7. The Role of Non-State Actors in Climate Change Mitigation

Addressing climate change requires action at all levels of government, as well as greater collaboration between governments, businesses, NGOs and civil society. Local and regional level governments are now partners in addressing climate change, and a plethora of non-state initiatives aim to complement such actions by national governments. Mitigation activities by non-state actors are embedded in wider governance structures and therefore unequally distributed across geographical scales and across sectors. The role of non-state actors in addressing climate change highlights opportunities and dangers that await national governments (Giese, 2017). The arguments as to why nation states need to engage with non-state actors is not as strong, as non-state mitigation activities constitute an additional governance layer. The wider implications of climate initiatives at states' own discretion are uncertain and lobbying efforts might be more pronounced with some actors having greater access to non-state covenants than others. Non-state initiatives can constitute a highly pluralistic, chaotic and uneven governance arena that threatens the integrity of the climate regime as a whole. It these non-state initiatives that national governments proactively bring on board through a climate partnership or multi-level climate governance.

Non-state actors have been involved in scientific assessments and the negotiating processes of the UNFCCC since its adoption. Outside the formal negotiating processes, UNFCCC processes are also framed through highly political side-events and lobbying activity by accredited NGOs and industry observers (Hermwille, 2018). Non-state actors within the UNFCCC fall, broadly speaking, into two categories; civil society organizations and the private sector. Civil society organizations represent a non-commercial interest and can be further sub-divided into advocacy groups or research institutions. Advocacy groups set out to influence political decisions, bearing witness of the plight of those affected by climate change (e.g. social movements, INGOs or watchdogs). Research institutions seek to influence policy through the provision of scientific evidence or undertaking studies of socio-economic calculations of policy options. The private sector, conversely, seeks to influence political decisions to protect past, present and future financial interests in carbon-intensive activities (e.g. business lobbies, associations or think-tanks).

7.1 NGOs and Civil Society Organizations

Climate change is a public policy issue involving states, the private economy, non-state actors, and global governance actors. The civil society includes non-governmental organizations (NGOs), grassroots organizations, professional associations, labor unions, industry associations, and foundations working at the local, national, and transnational levels, as well as public/private networks and arrangements that exist outside the national state with a birthright in civil society. Such organizations and arrangements play various roles in climate governance; provide or promote alternative scientific knowledge; monitor governmental actions and inactions; lobby for procedural and institutional changes; advocate innovative regulatory approaches; implement projects and provide financial assistance; and analyze, evaluate, and disseminate climate relevant international, national, and local activities (Burleson, 2015). Past international conference of the Parties (COP) meetings and United Nations (UN) climate treaties have either ignored civil society or placed heavy restrictions on their participation. However, due to civil society pressure, recent climate treaties permit greater engagement with non-state actors, including NGOs.

India has a more open approach with regard to the role of civil society in climate governance. There is public debate, protest, and discussion at civil society forums running parallel to the climate talks (Giese, 2017). NGOs engage in various ways in the climate talks including: policy and legal research on the basis of scientific assessment reports in order to expose the inadequacy of national policies; organizing press conferences and public mobilization to publicize the Findings; and filing public interest litigations to hold national governments accountable for their actions or inaction. Further efforts are directed towards influencing national public opinion through circulation of research papers, briefing packages, and publications on climate issues to policy makers, journalists, and activists among a wider outreach. Capacity-building programs are directed towards empowering local communities affected by climate change to sensitize them regarding their environment and motivate them to pursue proactive adaptation measures.

8. Evaluating the Effectiveness of Climate Change Legislation

This section provides a broad understanding on the Enabling Frameworks for Climate Change Legislation. It explores such issues as the type of enabling approach or framework that best supports climate change legislation, the non-legal conditions that must be in place if legislation is to succeed and the options available to countries that lack such conditions. The analysis of the enabling conditions and factors that must be taken into account is structured according to the five arrangements or frameworks of climate change legislation in a global perspective: unilateral legislation by individual countries; bilateral agreements between countries; regional agreements between groups of countries; multilateral agreements under UN auspices; and hybrid arrangements combining one or more of the earlier arrangements.

Historical perspectives on climate change legislation and, particularly, the types of enabling framework or approach that can be regarded as best practice seem to suggest the following conclusions. First, the most successful and durable enabling frameworks are those that were adopted and developed over time within a multi-country context. Broad and effective enabling frameworks were established with regard to international trade, traditional greenhouse gas contaminants, ozone-depleting substances, and a number of other topics. Broad and durable enabling frameworks were not created in purely domestic (unilateral) or bilateral contexts, nor in contexts driven primarily by a few key countries in the areas of such legislation. Climate change also represents a set of problems that would ideally be treated in a multi-country context. The difficulty of determining the causal link between emissions of greenhouse gases and impacts of climate change on ecosystems and economies, of readily reversible actions, and a landscape of risks and benefits that will differ from country to country add to the problems presented by climate change as a candidate topic for legislation (Eskander et al., 2021).

8.1 Assessment Frameworks and Indicators

An effective assessment framework must consider the need for a comprehensive evaluation. It should quantify carbon reductions, compliance and enforcement, business and economic impacts, transparency, out-of-state implications, and alignment with policy objectives (Burleson, 2015). Existing methodologies include simple qualitative assessments of satisfaction and the degree to which a dataset is met, complex qualitative assessments using ratings and scores of degree met, and assessments that combine simple models with qualitative assessments using relative simple but non-quantifiable descriptors (Oschlies et al., 2017). Recommended indicators include: annual verifiable carbon reductions (mtCO2e/year), degree to which states drafted and adopted intending legislation, estimates of percentage of reduction requirements met in participating states, assessment of sales of allowances (or their equivalents) in participating states for each year of the program, and degree to which intent or spirit of each provision was complied with. The comprehensive methodology is rigorous but complicated; the simple methodology is straightforward to understand but potentially flawed; and the com-promise methodology has some risk of bias and is possible to manipulate but should be robust.

9. Future Directions in Climate Change Policy and Law

Policy and law regarding climate change are often viewed as static, notwithstanding efforts to analyze the effectiveness or shortcomings of existing policy and law. Nevertheless, prospective developments and emerging trends – independent of their potential effectiveness or the socio-political context in which they may occur – have implications for assessment of the effectiveness of a given climate-related policy or law. For instance, what will be the role of emerging technologies? Will species-based approaches to climate adaptation be adopted? Or will there be continuing interest in climate-related legislative initiatives or narrowly focused addresses to climate change through existing laws, agency actions, or litigation? Such prospective developments and trends can be characterized as "future directions" on the assumption that such matters are amenable to prediction (Markell & Ruhl, 2012). In this assessment, several prospective developments and emerging trends are noted that have implications for future research, policy, and law regarding the effectiveness of efforts to address climate change, including future directions in ambiance, integration, and adoptions of climate change a planning objective.

Climate Change Adaptation and the Structural Transformation of Environmental Law are focused on adaptation to the impacts of climate change, one of the two universal responses to this phenomenon. It never ceases to amaze, while at the same time being somewhat reassuring, how on the fringes of the topic of climate change, it can be said that everyone is speaking the same language, agreeing almost in unison on what the problems are and how they should be solved. More than four years of discussion at multiple meetings led to a clear delineation of the climate change adaptation answers. The first point of general agreement, which still holds, is that the discussion proceeded in the context of what is referred to as the science-society interface. Climate change mitigation has been the attention of many law and public policy scholars to date solely from a risk management-to-action perspective. Instead, adaptation required viewing climate change issues through the lens of legal structures and legislative remedy processes (Ruhl, 2010).

9.1 Innovative Approaches and Technologies

Innovative approaches to Climate Change Policy and Law have the potential to minimize the overall consequences arising from climate change, both on human societies and on natural ecosystems. They could inspire a whole range of measures to help Nature and society to adapt, together with regulations that compel them to limit further climate change (e.g. geothermal energy, releasing gas from underground aquifers instead of CO2, ocean fertilization, solar radiation management, afforestation, developing plants resistant to rising air temperatures) (Ruhl, 2010). Afforestation has been regarded as a benign even though costly proposal because, if implemented on a large enough scale, it could absorb all future anthropogenic greenhouse gas emissions and eventually lead to new climate equilibrium. Nevertheless, this approach is fraught with environmental risks. The same is true for rising air albedo

through the implementation of various space projects. One of the lessons learned from Undaria's dismissal of biological control based on viral infection should be that intricate human-designed regulatory frameworks established in a naively optimistic manner in need of unsophisticated knowledge of Nature, are doomed to failure (Sindico, 2016).

10. Conclusion and Recommendations for Policymakers

On June 29, 2023, Congress passed a major climate bill as part of a package to secure the Democratic political party's agenda. Although far smaller than President Joe Biden's original plan, the Inflation Reduction Act of 2022 is historic in depth and breadth, authorizing roughly USD 370 billion in federal support for clean energy. A key question is whether Congress can make the most of this unprecedented investment and enact follow-up reforms, building on lessons learned from this legislation. This essay addresses this question by considering the perspectives of different energy stakeholders, exploring particular follow-up reforms, and offering some observations on how to use the lessons from the framing and enactment of this legislation to potentially advance new reforms.

Energy is a uniquely contested, symbolic, and complex political issue in the United States. While climate change generally evokes powerful and personal responses from many Americans across deep divisions over public policy, energy partisanship is stubbornly at odds with even the most contentious issues such as abortion and gun control. Despite these divisions, this activity has advanced on extensive and varied climate and energy initiatives across several forums (including states, the courts, localities, the executive branch, and private initiatives). Compared to Congress, such efforts are often piecemeal and incremental with inherent limits, but they have also avoided some of the most politically challenging issues (e.g., fossil fuel dependence) and cultivated political commonalities (e.g., resilience). Activities also have particularly contentious dynamics, including efforts to directly use the courts to potentially block or roll back initiatives enacted in another forum, or states to preclude action taken by the federal government as new national standards. Despite major uncertainties and questions about efficacy across context, these efforts together represent a fundamentally different political landscape regarding the pursuit of climate and energy initiatives (Osofsky & Peel, 2015).

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