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Eco-Crime and Green Justice: Criminological Pathways from Environmental Harm to Net-Zero Governance

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***Abstract*—Climate change is typically treated as a technical problem for scientists and policymakers, a framing that overlooks who drives the harm, who profits from it, and who is left to live with the fallout. Drawing on green criminology, state-corporate crime theory, and environmental justice, this article examines anthropogenic climate change as a form of systemic violence and eco-crime, addressing a critical gap in the literature: how to stop environmental harm once it has been diagnosed. Through a qualitative comparative analysis of six sites (Nepal, Bangladesh, the Amazon Basin, Flint (Michigan), the Canadian oil sands, and hydraulic fracturing in the Rocky Mountains), the study traces a familiar pattern: resources are extracted for profit, costs are pushed onto marginalized communities, and accountability is dodged through weak laws or outright denial. To connect this diagnosis to practical change, the article evaluates the International Energy Agency's seven pillars of decarbonization: energy efficiency, behavioral change, electrification, renewables, hydrogen and hydrogen-based fuels, bioenergy, and carbon capture, utilization, and storage (CCUS). Without enforceable rules on transparency, accountability, and fair distribution, decarbonization risks repeating the very harms it sets out to solve—through illicit critical-mineral mining, land-heavy renewables that displace local residents, and transition costs that fall unevenly on vulnerable groups. The article concludes with an integrated framework that pairs each decarbonization pillar with the criminological safeguards needed to make the transition both effective and just.**

***Index Terms*—eco-crime, green criminology, green justice, decarbonization, environmental justice, energy transition, accountability**

I. INTRODUCTION

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Climate change reaches the public mostly as carbon counts, temperature curves, and negotiated targets. None of that is wrong, but it says little about who causes the damage, who profits from it, and who absorbs it. A flood, a failed harvest, or a poisoned water supply is more than a point on a chart. It falls on particular people, who usually had almost no say in the decisions behind it. If we place climate change within the wider problem of eco-crime, environmental degradation, and illegal exploitation, there arises a question as who is responsible, and why does responsibility so rarely line up with where the harm lands?

Green criminology does not confine harm to acts the law already calls crimes. Environmental destruction which includes illegal exploitation of land, water, and minerals, is treated as organized injury produced by governments, corporations, and the rules that shelter them.[1] Accordingly, climate change concerns who can cause harm on a large scale, who can avoid its consequences, and who can do neither. Climate harm is therefore often legal even when it amounts to serious degradation making it harder to recognize as eco-crime and harder still to remedy in the name of green justice.

Most criminological work documents how emissions and extraction fall hardest on poor and low-power communities, and it shows that states and corporations sustain fossil-fuel dependence.[2] A few studies go on to build a diagnostic model of how the harm repeats across cases. Far fewer say what would end it at scale and bring green justice to the people exposed. A criminology of climate change is only as useful as the route it can point to, and the most credible route available is an existing, technically detailed, and widely adopted programme rather than a new criminological construct: the International Energy Agency's (IEA) seven pillars of decarbonization, set out in its Net Zero by 2050 roadmap[3] and carried forward in later World Energy Outlook analysis.[4]

The argument proceeds in two stages. The first revisits six cases of climate and environmental harm (Nepal, Bangladesh, the Amazon basin, Flint, the Canadian oil sands, and fracking in the Rocky Mountains) and reads them through a four-stage diagnostic heuristic: extraction, externalization, exposure, and evasion. It helps us see degradation and illegal exploitation clearly; it is not offered as a remedy. The second stage turns to the IEA's seven pillars and puts one criminological question to each: how could this pillar reproduce the four-stage pattern under a green label, and what accountability mechanism would prevent that? The result treats decarbonization as a site of criminological governance.

II. THEORETICAL FRAMEWORK

Green criminology takes environmental harm, including acts of illegal exploitation that sit outside formal criminal codes, as a legitimate object of study whether or not the law prohibits it, since

[1] Nigel South and Avi Brisman (eds.), Routledge International Handbook of Green Criminology (Routledge, London, 2013); Rob White, Climate Change Criminology (Bristol University Press, Bristol, 2018).
[2] Kramer and Michalowski, supra note 2; White, supra note 1.
[3] International Energy Agency, "Net Zero by 2050: A Roadmap for the Global Energy Sector" (IEA, Paris, 2021).
[4] International Energy Agency, "World Energy Outlook 2024" (IEA, Paris, 2024).

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legality is itself often shaped by the interests of those able to cause harm on a large scale.[5] State-corporate crime theory explains how such harm is produced: through the routine and frequently lawful cooperation of political institutions and economic organizations pursuing growth, profit, or lower costs.[6] Environmental justice theory supplies the distributive lens behind the understanding of green justice. Its central finding is that environmental risks and benefits are not spread at random but follow existing lines of race, class, colonial history, and political power.[7]

Climate harm is a failure of governance more than a technical failure, and it arises when those with the power to prevent eco-crime are insulated from the costs of causing it. This turns these six cases below into more than a list of unrelated disasters. It also explains why, from a criminological and green-justice standpoint, the IEA's technical pillars remain unfinished until they are paired with rules that keep power and responsibility aligned.

The study is a qualitative, comparative case study. For each case the same three steps have been followed: identify the harm-producing system, the institutional actors tied to it, and the community that absorbs the consequences.[8] Cases were chosen for geographic and economic range, for variety in the kind of harm (sudden disaster, slow degradation, infrastructure failure), and for their standing in the green criminology, eco-crime, and environmental justice literatures.[9] As with any document-based comparison, the design gives up statistical generalizability in exchange for a view of shared structure across very different settings.

III. A COMPARATIVE READING OF CLIMATE HARM AND ECO-CRIME: SIX CASES

The same pattern has been observed in all these six cases. A harm-producing system damaged the environment, and the damage was pushed away from the actors who benefited onto a community with comparatively little power. This has been treated as eco-crime whether or not it is formally unlawful. Table 1 sets out the system, the institutional actors, and the exposed community for each case.

Sr.No.	Case	Harm-producing system	Institutional actors	Exposed community
1.	Nepal	Global emissions from industrial economies raising temperature and destabilizing glaciers	High-emitting states and industries located elsewhere	Mountain communities facing floods and landslides
2.	Bangladesh	Sea-level rise and cyclone intensification linked to global emissions	High-emitting states; weak domestic enforcement bodies	Coastal and river-delta populations facing displacement

[5] South and Brisman (eds.), supra note 1; White, supra note 1.
[6] Kramer and Michalowski, supra note 2; Kramer, Michalowski, et.al., supra note 2.
[7] David N. Pellow, "Environmental Justice Movements and Political Opportunity Structures", in Ryan Holifield, Jayajit Chakraborty, et.al. (eds.), The Routledge Handbook of Environmental Justice (Routledge, London, 2018).
[8] Kramer and Michalowski, supra note 2; White, supra note 1.
[9] South and Brisman (eds.), supra note 1; White, supra note 1.

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Sr.No.	Case	Harm-producing system	Institutional actors	Exposed community
3.	Amazon basin	Deforestation, mining, and agribusiness expansion for global commodities	Agribusiness firms, logging operators, permissive land agencies	Indigenous and forest-dependent communities
4.	Flint, Michigan	Cost-cutting decisions in public water infrastructure	State and municipal government bodies	Low-income, majority-Black residents
5.	Canadian oil sands	Bitumen extraction for fossil-fuel energy markets	Energy corporations, permitting regulators, financiers	Indigenous communities near extraction sites
6.	Rocky Mountain fracking	Hydraulic fracturing for oil and gas	Energy corporations, permitting regulators, financiers	Rural residents and communities near wells

Table 1: Summary of Harm-Producing Systems, Actors, and Exposed Communities Across Cases

IV. NEPAL: EMISSIONS ELSEWHERE, HARM AT HOME

Nepal contributes very little to global emissions, yet it faces some of the most severe physical effects of a warming atmosphere: glacial retreat, sudden glacial lake outburst floods, landslides, and erratic rainfall, all made worse by steep terrain and thin infrastructure for early warning and recovery.[10] The emissions destabilising Nepal's glaciers come almost entirely from industrial economies elsewhere, while the physical risk stays inside Nepal's borders. High-emitting states and industries collect the economic benefit of carbon-intensive growth, and Nepal absorbs the ecological instability that growth produces.[11] Responsibility for eco-crime can thus be separated geographically from the harm itself, a separation that Bangladesh shows in a different form.

V. BANGLADESH: DISPLACEMENT AS A PREDICTABLE OUTCOME

Bangladesh faces sea-level rise, stronger cyclones, river flooding, and the gradual salting of coastal farmland, all of which push people off land that has supported their families for generations.[12] The country is densely populated and many households live directly from farming or fishing, so a small change in water levels or storm frequency can wipe out a family's entire livelihood. Weak enforcement of environmental and land-use rules adds to the exposure. Bangladesh also shows something Nepal does not fully capture: climate harm runs on two timelines at once, one slow (soil salinization) and one sudden (cyclones), while the cause (distant, high-emitting economic activity) and the reason harm becomes disaster (inadequate local protection) stay the same. Read together,

[10] The World Bank Group and the Asian Development Bank, "Climate Risk Country Profile: Nepal" (2021).
[11] White, supra note 1.
[12] Jiangchao Qiu, et.al., "From decades to years: Rising seas and cyclones amplify Bangladesh's storm-tide hazards in a warming climate" 8 One Earth 101273 (2025), available at: https://doi.org/10.1016/j.oneear.2025.101273 (last visited on Oct. 5, 2026).

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the two cases show that low-emitting states can suffer severe and foreseeable eco-harm driven mainly by decisions taken far outside their borders.

VI. THE AMAZON BASIN: EXTRACTION AND ILLEGAL EXPLOITATION

The Amazon basin shows another part of the pattern. Here the harm comes less from distant emissions than from direct, and frequently illegal, extraction inside the region. Deforestation, illegal logging, large-scale agribusiness, mining, and new roads and infrastructure turn forest into carbon emissions and lost habitat, largely to supply demand from far away for beef, soy, timber, and minerals. Indigenous communities and the forest ecosystems they depend on carry the weight of this extraction, while the economic gains are captured by firms and markets elsewhere.[13] Resistance to it is itself frequently criminalized rather than protected.

VII. FLINT, MICHIGAN: HARM INSIDE A WEALTHY STATE

Flint is not a climate case in the strict sense: its central harm was lead-contaminated drinking water, not a warming atmosphere. It belongs here because the structure of eco-crime seen in Nepal, Bangladesh, and the Amazon also operates inside wealthy, high-emitting countries. A cost-cutting decision by state and municipal authorities exposed a low-income, majority-Black community to contaminated water for an extended period, while warnings were delayed or played down. The beneficiary this time was a government trying to save money rather than a foreign industry seeking growth. Flint therefore shows that the pattern reaches beyond fossil-fuel emissions. It describes who gets protected and who gets exposed.

VIII. THE CANADIAN OIL SANDS AND FRACKING IN THE ROCKY MOUNTAINS

The Canadian oil sands and the hydraulic fracturing sites of the Rocky Mountains represent the extraction end of the fossil-fuel system in a wealthy, industrialized setting.[14] Oil sands operations are closely tied to the displacement and contamination of land used by Indigenous communities, causing lasting local damage while adding to the global emissions total. Fracking in the Rockies raises comparable concerns about water contamination, habitat fragmentation, and the reshaping of rural landscapes, with the climate effects felt globally as well as locally. Corporations holding permits issued by regulators carry out the extraction, and investors who are rarely present at the site finance it. The immediate costs fall on nearby Indigenous and rural communities. The atmospheric cost is spread across the planet, reaching places such as Nepal and Bangladesh that had no part in the decision to extract.

[13] White, supra note 1.
[14] Dale Marshall, David Tong, et.al., "Canada's Big Oil Reality Check: Assessing the Climate Plans of Canadian Oil and Gas Producers" 2 (Environmental Defence Canada and Oil Change International, Nov. 2021), available at: https://www.oilchange.org/wp-content/uploads/2021/11/BORC-Canada_final.pdf (last visited on Oct. 5, 2026).

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IX. DIAGNOSING THE PATTERN: THE 4E CYCLE OF ECO-CRIME

These six cases describe a single structure of eco-crime recurring in different places rather than six separate problems. This has been formalized as diagnostic model, the 4E Cycle: extraction, externalization, exposure, and evasion (Table 2). Its purpose is deliberately limited. It is not a policy solution, a governance body, or an implementable programme. Earlier versions of such models have sometimes added a fifth, aspirational stage, typically labelled something like "repair", as though naming the point where accountability ought to occur were the same as building the mechanism that delivers it. Describing a pattern of harm and constructing a mechanism that can stop it at global scale are different tasks. The 4E Cycle answers the first: how does eco-crime move from cause to consequence? Sections 5 to 8 take up the harder question of what a workable response looks like.

Table 2: The 4E Cycle of Climate Harm: Stages and Diagnostic Questions

Sr. No.	Stage	What happens	Diagnostic question
1.	Extraction	A resource is taken from the land or a fossil fuel is burned for profit or growth (e.g., oil sands mining, deforestation, illegal logging).	Who is doing the extracting, and who authorizes it?
2.	Externalization	The cost of the extraction (carbon, pollution, land loss) is shifted away from the actor who profits and onto people or places far away.	Who benefits from the activity, and who is made to pay its price?
3.	Exposure	A community with little power, such as a coastal village or a low-income neighborhood, absorbs the resulting harm (flood, contamination, displacement).	Who is left to face the harm, and did they have the means to avoid it?
4.	Evasion	Laws, weak regulation, denial, or delay prevent the eco-crime from being named, punished, or repaired.	What rule, gap, or silence allows the harm to continue unaddressed?

Note. No fifth, solution-oriented stage is included. Section 5 explains why, and Sections 6 to 8 build the solution around the IEA's pillars of decarbonization instead.

Applying the cycle across the cases shows that responsibility for eco-crime is both collective and unequal. It is collective because consumers, corporations, regulators, and governments all take part somewhere in the cycle. It is unequal because a small number of actors, clustered in the extraction and externalization stages, hold most of the power to prevent harm, while the communities at the exposure stage hold almost none.[15] Evasion deserves particular attention, since ordinary climate debate most often leaves it out. It covers active denial, but also simple delay, underfunded regulation, and legal gaps that keep harmful activity technically lawful even when its consequences

[15] Kramer and Michalowski, supra note 2; White, supra note 1.

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are foreseeable.[16] A government or corporation that knows of a risk and does nothing is a participant in this stage, not a neutral bystander.

X. FROM DIAGNOSIS TO SOLUTION: THE LIMITS OF A CONCEPTUAL MODEL

If harm is produced by a repeating cycle and not by a single bad decision, the obvious next question is what interrupts the cycle and delivers green justice. Earlier models usually answer by adding a fifth, aspirational stage, defined loosely as the point where recognition, redistribution, and enforceable rules break the pattern. The move is tidy, and it is also where much of the criminological literature on climate change and eco-crime stops being useful. A stage defined as "the point where accountability happens" tells no policymaker, regulator, court, or community organizer what to build, fund, permit, or litigate. It restates the problem (someone with power should be made to act responsibly) in the grammar of a solution, without saying which technologies, investments, and institutions would reduce the emissions and illegal exploitation behind the harm documented in Section 3.

Criminology's comparative advantage does not lie in engineering an emissions-reduction pathway from first principles. It lies in finding where power and responsibility come apart, and in specifying the legal and institutional guardrails that keep them aligned. Building a pathway detailed enough to be costed, sequenced, and adopted by governments has already been done, repeatedly and rigorously, by energy-systems analysts, most authoritatively in the IEA's Net Zero by 2050 roadmap and its later World Energy Outlook updates.[17] Instead of competing with that work through a parallel, criminology-only accountability construct, the seven pillars has been adopted as the substantive solution architecture. Green criminology, state-corporate crime theory, and environmental justice then do what they do best: they specify, pillar by pillar, where the 4E cycle can reappear inside the low-carbon economy and what would stop it there.

XI. THE IEA'S SEVEN PILLARS OF DECARBONIZATION AS AN ACTIONABLE ARCHITECTURE

The IEA's Net Zero by 2050 roadmap names seven pillars through which the global energy system can reach net-zero emissions: energy efficiency, behavioral change, electrification, renewables, hydrogen and hydrogen-based fuels, bioenergy, and carbon capture, utilization and storage (CCUS).[18] Table 3 summarizes the core mechanism of each. Two features of the architecture matter here. First, it is sequenced. The roadmap relies on energy efficiency, electrification, and renewables for the largest share of emissions reductions to 2030, using technology that is already commercially available, while hydrogen, bioenergy, and CCUS scale up mainly afterwards, as

[16] Kramer and Michalowski, supra note 2.
[17] IEA, Net Zero by 2050, supra note 4; IEA, World Energy Outlook 2024, supra note 5.
[18] IEA, Net Zero by 2050, supra note 4.

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technologies still moving from demonstration to deployment.[19] Second, more recent IEA analysis singles out electrification and renewables as the most cost-effective pillars going forward, with electricity's share of final global energy consumption projected to rise substantially by 2050.[20]

Sr. No.	Pillar	Core mechanism
1.	Energy efficiency	Reducing energy demand growth through efficiency gains in industry, buildings, appliances, and transport, including strict fuel-economy standards and a phase-out of new internal combustion engine sales after 2035. [21]
2.	Behavioral change	Policy-supported shifts in consumption and travel patterns (for example, reduced short-haul flying and greater use of public and active transport) that lower energy demand without new technology. [22]
3.	Electrification	Shifting end uses such as heating, transport, and industrial processes onto an increasingly decarbonized electricity grid; identified as the single most cost-effective decarbonization lever. [2324]
4.	Renewables	Scaling solar, wind, hydro, and geothermal generation to supply the large majority of global electricity by mid-century. [2526]
5.	Hydrogen and hydrogen-based fuels	Low-carbon hydrogen and derived fuels for hard-to-electrify sectors such as heavy industry, shipping, and aviation. [27]
6.	Bioenergy	Sustainable biomass and biogas use in industry (e.g., cement, paper production) and as a transitional transport fuel, alongside displacement of traditional solid-biomass cooking. [28]
7.	Carbon capture, utilization and storage (CCUS)	Capturing emissions from remaining fossil-fuel use and hard-to-abate industrial processes, largely for permanent geological storage. [29]

Table 3: The IEA's Seven Pillars of Decarbonization

XII. CRIMINOLOGICALLY GROUNDING THE PILLARS: PREVENTING ECO-CRIME FROM REAPPEARING

The seven pillars form a technically credible pathway to net zero. Any pillar can be built in a way that relocates the four-stage pattern from Section 3 into the infrastructure of decarbonization itself. The scholarship on green extractivism documents this risk. The minerals needed for electrification and renewables (lithium, cobalt, nickel, copper) are concentrated in a few territories, many of them

[19] IEA, Net Zero by 2050, supra note 4.
[20] IEA, World Energy Outlook 2024, supra note 5.
[21] IEA, Net Zero by 2050, supra note 4.
[22] IEA, Net Zero by 2050, supra note 4.
[23] IEA, Net Zero by 2050, supra note 4.
[24] IEA, World Energy Outlook 2024, supra note 5.
[25] IEA, Net Zero by 2050, supra note 4.
[26] IEA, World Energy Outlook 2024, supra note 5.
[27] IEA, Net Zero by 2050, supra note 4.
[28] IEA, Net Zero by 2050, supra note 4.
[29] IEA, Net Zero by 2050, supra note 4.

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formerly colonized, and their extraction is already producing dispossession, contamination, and criminalized resistance that closely mirror the Amazon and oil-sands cases.[30] Energy justice scholarship makes a parallel point about distribution. Without deliberate design, the costs of transition (stranded workers, new mining frontiers, land taken for large solar and wind installations) fall on communities that had little say in the plan, while the benefits go to actors already placed to capture them.[31] Decarbonization without accountability is therefore not automatically green justice. It can become a new phase of illegal or under-regulated exploitation attached to the old cycle of eco-crime.

Each pillar has been paired with a specific accountability safeguard, drawn from the same theoretical resources used to diagnose the six cases. Table 4 does this pillar by pillar, for each, it names the route by which the four-stage pattern could return if the pillar is pursued without governance, and the safeguard that would close that opening and secure green justice for the affected communities.

Sr. No.	Pillar	Risk of reproducing eco-crime	Criminological / legal safeguard (toward green justice)
1.	Energy efficiency	Compliance costs can be front-loaded onto industries and regions with the least capacity to pay for retrofits, externalizing cost onto weaker economic actors.	Tiered financing and technical-assistance obligations scaled to the regulated entity's size and emissions, not the community's ability to absorb near-term cost.
2.	Behavioral change	Framing emissions reduction as an individual or consumer choice can shift blame, and cost, from large institutional emitters onto low-power individuals.	Disclosure rules that keep corporate and state emissions data primary, with behavioral policy treated as supplementary to, not a substitute for, institutional accountability.
3.	Electrification	Battery and grid-buildout mineral demand drives new extraction frontiers concentrated in formerly colonized and Indigenous territories.	Free, prior and informed consent (FPIC) requirements, enforceable supply-chain due-diligence law, and revenue-sharing obligations tied to extraction permits. [32] [33]
4.	Renewables	Large-scale solar and wind siting can dispossess land users and rural or Indigenous communities without consultation, producing new "sacrifice zones."	Binding land-use consultation and compensation frameworks, with permitting review independent of the developer.

[30] Diego Andreucci, Gustavo García-López, et.al., "The Coloniality of Green Extractivism: Unearthing Decarbonization by Dispossession Through the Case of Nickel" 107 Political Geography 102997 (2023); Mariana Walter, Yannick Deniau, et.al., "The Politics of 'Green' Extraction Frontiers: Mapping Metals and Mineral Mining Conflicts Related to the Energy Transition in the Americas" 51 Critical Sociology 907 (2025).
[31] Benjamin K. Sovacool and Michael H. Dworkin, "Energy Justice: Conceptual Insights and Practical Applications" 142 Applied Energy 435 (2015).
[32] Andreucci, et.al., supra note 31.
[33] Walter, et.al., supra note 31.

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Sr. No.	Pillar	Risk of reproducing eco-crime	Criminological / legal safeguard (toward green justice)
5.	Hydrogen and hydrogen-based fuels	Export-oriented production can concentrate water- and land-intensive facilities in lower-income exporting countries to serve wealthier importers.	Trade and investment rules requiring domestic benefit-sharing and water-impact assessment before export approval.
6.	Bioenergy	Large-scale feedstock demand can drive land-use change and deforestation, echoing the extraction pattern seen in the Amazon case.	Land-rights protections and deforestation-linked sourcing restrictions enforced through supply-chain liability.
7.	Carbon capture, utilization and storage (CCUS)	Storage and pipeline infrastructure can be sited disproportionately near low-income or already-industrialized communities, extending existing pollution burdens under a "clean" label.	Environmental-justice siting review and long-term liability rules that assign post-closure risk to the operating company, not the host community.

Table 4: Pairing the IEA's Pillars with Criminological Accountability Safeguards

Read as a set, Table 4 makes a single argument. The pillars answer the technical question of how to cut emissions, and the safeguards answer the criminological question which starts with: who is responsible, and how is that responsibility enforced rather than merely declared? Neither half is enough alone. A decarbonization pathway without enforceable safeguards risks becoming what critical energy-transition scholars have started to call "decarbonization by dispossession", which reduces global emissions while reproducing colonial patterns of extraction, and with them eco-crime, at the local level.[34] An accountability model without a technically credible pathway remains what much of the green-criminology literature has so far produced: a persuasive diagnosis with no practical route to green justice.

XIII. APPLYING THE FRAMEWORK TO THE SIX CASES

The combined framework has concrete implications for each of the six cases.

For Nepal and Bangladesh, climate risk is driven less by domestic emissions than by pollution exported from high-emitting countries. That means the most effective "pillars" of action lie beyond their borders: rapid electrification and renewable-energy transitions in major emitting states, backed by the disclosure and finance safeguards outlined in Table 4, would cut the externalization of harm at source, while dedicated adaptation and loss-and-damage finance would address the exposure these countries already face.[35]

[34] Andreucci, et.al., supra note 31.
[35] IEA, Net Zero by 2050, supra note 4.

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In the Amazon basin, the climate-relevant pillars are bioenergy and the mineral inputs needed for global electrification. Both can drive deforestation, land conflicts, and illegal exploitation unless they are governed by strong land-rights protections and the free, prior and informed consent (FPIC) safeguards outlined above.[36] If applied in good faith, those safeguards would prevent decarbonization elsewhere from turning the Amazon into a new frontier for eco-crime.

Flint's lesson is about governance, not just emissions. The transparency and public-interest financing safeguards proposed for CCUS and hydrogen siting should apply to ordinary public infrastructure as well, because the core failure is a cost-cutting decision made without accountability to the community that bears its consequences is not unique to fossil fuels.

For the Canadian oil sands and the Rocky Mountain fracking fields, the framework treats electrification and renewables as genuine alternatives to endless extraction, while guaranteeing nearby Indigenous and rural communities binding consultation rights and enforceable caps on how much can be taken from their lands. These are the same protections now demanded for mining the minerals that power the energy transition—simply applied to the fossil-fuel industry that the transition is supposed to replace.

XIV. IMPLICATIONS FOR LAW AND POLICY

The study presents three implications for law and policy. First, climate governance must stop treating emissions-reduction technologies and accountability law as separate tracks; a pillar pursued without its safeguard does not escape the 4E cycle, it simply displaces the harm elsewhere, so every major decarbonization technology should be paired at the design stage with disclosure duties, public-interest financing conditions, and community-rights protections. Second, because electrification, renewables, and energy efficiency are the pillars most likely to scale fastest over the next decade—and will therefore drive the largest share of near-term mineral demand, land use, and infrastructure siting—they should be the first to receive the Table 4 safeguards, ensuring that the biggest engines of the transition do not become the biggest sources of new conflict and dispossession. Third, evasion-stage failures such as weak disclosure, underfunded regulation, and permitting that ignores free, prior and informed consent should be treated in law as foreseeable and preventable causes of harm rather than gaps to be closed later; state-corporate crime scholarship supports this, showing that inaction by an informed institution is itself a form of participation in eco-crime, not a neutral omission.[37]

XV. LIMITATIONS

The study relies on existing literature and case reports rather than original fieldwork, and it compares cases of very different scale, from an entire country to a single city. A further limitation concerns the central argument. The IEA's pillars are the most authoritative technical roadmap

[36] Andreucci, et.al., supra note 31; Walter, et.al., supra note 31.
[37] Kramer and Michalowski, supra note 2.

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available, but they are modelling projections, not settled outcomes, and successive editions of the IEA's analysis have revised the expected contribution of individual pillars as costs, technology, and policy have shifted.[38] The safeguards in Table 4 are best read as a framework to be tested, adapted, and enforced through actual law and policy, not as a finished governance system. Future research could examine how particular jurisdictions have, or have not, attached enforceable accountability rules to their own decarbonization pathways, moving this comparative logic from diagnosis towards policy evaluation.

XVI. CONCLUSION

The anthropogenic climate change belongs to the wider problem of eco-crime, environmental degradation, and illegal exploitation, and is more than a scientific or policy matter. A criminology of climate change stays incomplete until it links its diagnosis to a workable route towards green justice. Green criminology and state-corporate crime theory supply the diagnosis. Across six very different cases, from a Himalayan glacier to a public water system in Michigan, the same structure recurs: extraction for profit, externalized costs, exposure of a less powerful community, and evasion of responsibility through weak law or delay. The answer is to adopt the IEA's seven pillars as the substantive solution and to use criminological theory to specify where each pillar could reproduce the cycle it is meant to end, and which enforceable rule would stop it. Climate governance cannot rest on emissions counts alone, and accountability language alone will not carry it either. A technically credible pathway has to be paired with enforceable rules of responsibility at every stage, so that those with the power to decarbonize are also held accountable, in law and not only in principle, for how they do it.

[38] IEA, Net Zero by 2050, supra note 4; IEA, World Energy Outlook 2024, supra note 5.