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Sustainability or Green Protectionism? Reclaiming Developmental Policy Space in International Natural-Resource Trade: A Review

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Abstract

Sustainability has evolved from a broad normative commitment to intergenerational welfare into a powerful architecture of standards, certification, traceability, due diligence, and market-access regulation. This evolution is essential for addressing climate change, biodiversity loss, deforestation, and social harm, but it also creates distributive tensions in international trade. Developing countries frequently depend on natural-resource exports while possessing weaker financial, technological, and institutional capacities to comply with standards predominantly designed in advanced importing economies. This qualitative literature review examines the conceptual evolution of sustainability, its incorporation into international trade governance, and the conditions under which environmental measures can operate as de facto non-tariff barriers. Indonesian palm oil is used as an illustrative case because it combines substantial economic and poverty-reduction benefits with documented environmental and social risks and extensive exposure to European sustainability regulation.

The review finds that protectionist effects do not require demonstrable protectionist intent. Formally uniform regulations may impose disproportionate costs on smallholders, disregard equivalent producer-country standards, advantage competing products, and shift the financial burden of global environmental protection to exporting countries. Nevertheless, rejecting sustainability requirements altogether would be environmentally indefensible and strategically counterproductive. Developing countries should instead strengthen domestic governance, construct publicly supported traceability systems, negotiate regulatory equivalence, coordinate producer coalitions, diversify markets, and pursue downstream upgrading. Fair sustainability governance requires non-discrimination, proportionality, producer-country participation, recognition of equivalent outcomes, adequate transition periods, and shared financing of compliance. Sustainability should govern trade through partnership and differentiated responsibility rather than unilateral ecological conditionality.

Keywords: Sustainability, International Trade, Non-Tariff Measures, Green Protectionism, Natural Resources, Developing Countries, Palm Oil, European Union, Smallholders, Environmental Justice.

Introduction

Sustainability has become one of the most influential organizing concepts in contemporary public policy. It shapes national development planning, corporate strategy, international finance, environmental governance, consumer preferences, and increasingly the conditions under which products may enter major markets. Its rise reflects real and urgent ecological pressures. Climate change, biodiversity loss, chemical pollution, freshwater disruption, and land-use conversion demonstrate that economic activity cannot indefinitely expand without regard to biophysical limits. Recent updates of the planetary-boundaries framework suggest that several critical Earth-system processes have already moved beyond their proposed safe operating ranges, while consumption patterns in affluent societies remain central drivers of global resource use and environmental pressure [1-4].

Yet sustainability is not merely a scientific concept. It is also a political and economic construct whose meaning, indicators, and implementation mechanisms are shaped by institutions with unequal authority. During earlier phases of environmental governance, sustainability primarily informed domestic conservation, resource management, and development planning. It has since become embedded in product standards, voluntary certification, corporate due diligence, carbon accounting, deforestation rules, financial taxonomies, and border measures. Consequently, access to international markets increasingly depends not only on the physical characteristics of a product but also on how it was produced, where it originated, which inputs were used, whether its supply chain can be traced, and whether its production is judged consistent with environmental and social criteria defined by importing jurisdictions [5].

This article asks four questions. First, how has sustainability evolved from a general development principle into an instrument of trade governance? Second, through what mechanisms can sustainability requirements become de facto non-tariff barriers? Third, what does the palm-oil case reveal about the legitimate and potentially protectionist dimensions of environmental

trade regulation? Fourth, what can developing countries do to defend developmental policy space without weakening genuine environmental reform? The article contributes by integrating sustainability theory, ecological economics, trade regulation, global value-chain analysis, and palm-oil scholarship. It rejects two simplistic positions: that all environmental trade measures are disguised protectionism, and that any measure labeled sustainable is necessarily fair. Instead, it proposes that sustainability-related trade governance should be assessed through environmental legitimacy, scientific consistency, necessity, proportionality, non-discrimination, procedural inclusion, recognition of equivalent outcomes, and equitable burden sharing [6].

Literature Review

From Sustainable Development to Planetary and Distributive Sustainability

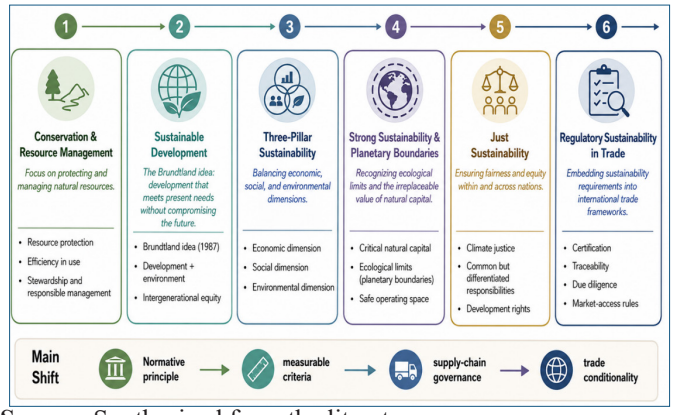
Although concerns about conserving resources are centuries old, the modern sustainability discourse developed through debates over resource scarcity, pollution, development, and intergenerational responsibility. The widely cited Brundtland formulation connected present development with the ability of future generations to meet their needs. Its significance lay in refusing to treat environmental protection and development as inherently separate agendas. Nevertheless, the definition left open how needs should be determined, how ecological thresholds should be measured, and how responsibility should be distributed among countries with profoundly different historical contributions and levels of wealth. The later three-pillar formulation organized sustainability into economic, social, and environmental dimensions. This structure helped move environmental concerns into mainstream development and corporate discourse, but its conceptual flexibility also allowed actors to invoke sustainability while prioritizing different, and sometimes incompatible, objectives. It has been shown that the familiar three-pillar model developed through diverse intellectual traditions rather than from a single coherent theory [8]. It has been similarly emphasized the contested and evolving nature of sustainable development [9,10].

A major theoretical distinction concerns weak and strong sustainability. Weak sustainability assumes that different forms of capital can, within limits, substitute for one another. Environmental depletion may therefore be acceptable when compensated by investments in infrastructure, human capital, technology, or other productive assets. Strong sustainability argues that critical natural capital performs ecological functions that cannot be replaced by produced capital. Forest ecosystems, stable climate systems, biodiversity, fertile soils, and hydrological cycles cannot simply be valued as interchangeable inputs.

The planetary-boundaries framework moved sustainability further toward a biophysical interpretation by identifying Earth-system processes within which human development should occur. It has provided a powerful scientific vocabulary for ecological limits, although critics warn that global thresholds do not automatically determine fair national allocations or politically legitimate policies [11]. The concept of a safe operating space must therefore be complemented by attention to a just operating space. Otherwise, global limits could be translated into restrictions that preserve high consumption in wealthy economies while constraining the developmental opportunities of poorer countries [12].

Recent sustainability scholarship increasingly emphasizes justice, distribution, and transformation. The Sustainable Development Goals broadened sustainability across poverty, health, education, inequality, climate, ecosystems, and institutions. However, evidence regarding their political impact is mixed, partly because implementation is voluntary and existing power structures remain largely intact [13]. It has been shown that countries satisfying more social needs commonly generate greater ecological pressure, while few nations achieve high social outcomes within equitable biophysical boundaries[14]. This tension has contributed to post-growth and degrowth debates. Limited evidence has been found for sufficiently rapid and absolute global decoupling between economic growth, resource use, and environmental pressures under prevailing economic structures [15]. It has been argued that reductions in material throughput are primarily required in affluent economies rather than being imposed uniformly on countries where basic needs remain unmet [16]. From this perspective, ecological policy becomes anti-colonial only when it reduces excessive Northern resource use and expands the ecological and developmental space available to the Global South.

The historical development of sustainability can therefore be understood as a progressive expansion of both its substantive scope and its regulatory influence. As illustrated in Figure 1, the concept initially emphasized conservation and responsible resource management before incorporating development, intergenerational equity, economic and social dimensions, planetary boundaries, and distributive justice. Its most recent phase extends beyond normative guidance by embedding sustainability into certification, traceability, due diligence, and market-access requirements. This transition is significant because it transforms sustainability from a broadly shared aspiration into a system of measurable obligations capable of determining participation in international trade [2,10,11,13].



Source: Synthesized from the literature.

Figure 1: Evoluation of the Sustainabilty Concept in Natural-Resource Governance and International Trade.

Figure 1: demonstrates that each phase of sustainability discourse has added a new layer rather than completely replacing earlier interpretations. Conservation remains relevant, but it is now connected to development outcomes, social equity, ecological thresholds, and international regulatory systems. The principal institutional shift is from sustainability as a normative principle toward sustainability as a set of measurable criteria governing supply chains and market access. This shift creates opportunities for stronger environmental accountability, but it also concentrates significant authority in institutions that define

indicators, recognize certification systems, and determine whether foreign producers have provided acceptable evidence of compliance [17].

Natural Resources, Structural Transformation, and Developmental Rights

Natural-resource dependence is frequently associated with volatility, governance problems, rent seeking, environmental degradation, and limited diversification. Nevertheless, natural resources can also finance public investment, support rural livelihoods, generate industrial inputs, and provide a foundation for structural transformation. The policy challenge is not simply to reduce resource use but to improve governance, capture greater domestic value, manage ecological limits, and convert resource rents into diversified productive capacity. For many developing economies, immediate restrictions on resource-based production can produce severe social and fiscal costs. Commodity sectors often support employment and income where alternative opportunities are limited. Sustainability strategies must therefore distinguish between reducing destructive practices and prematurely eliminating activities that remain important for development. The relevant transition is from poorly governed extraction toward higher-productivity, lower-impact, and more domestically beneficial production. The idea of common but differentiated responsibilities is relevant beyond climate negotiations. Developing countries did not create most of the historical accumulation of greenhouse gases or the consumption structures driving global material demand. It has been found that responsibility for climate breakdown is highly concentrated among countries whose cumulative emissions substantially exceed equitable shares [18].

Yet sustainability-linked trade rules may require present-day producers to bear the cost of mitigating environmental pressures partly generated by consumption in high-income markets. This does not exempt producer countries from responsibility. Governments cannot credibly defend development rights while tolerating illegal deforestation, labor exploitation, uncontrolled pollution, or land dispossession. However, development justice requires differentiation between refusing environmental responsibility and contesting unilateral, discriminatory, or inadequately financed implementation. Sustainability should constrain harmful practices while enabling developing economies to upgrade production and improve social welfare.

Trade, Environmental Footprints, and Ecologically Unequal Exchange

Conventional trade theory emphasizes gains from specialization and exchange. Environmental economics adds that differences in regulation, environmental endowments, and pollution intensity can influence comparative advantage. The pollution-haven hypothesis suggests that environmentally intensive activities may relocate toward jurisdictions with weaker regulations. In contrast, the pollution-halo hypothesis proposes that trade and foreign investment can transfer cleaner technologies and higher standards. Empirical outcomes vary by sector and institutional context [6].

Ecological-economics scholarship provides a more structural critique. The theory of ecologically unequal exchange argues that international trade allows affluent economies to appropriate materials, energy, land, and labor from poorer regions while externalizing environmental damage. It has been identified that asymmetries in embodied resource flows are persistent, while it has been argued that unequal prices and resource transfers are mechanisms through which value is appropriated from the Global South [19,20]. It has been further connected core-periphery dynamics to unequal environmental intensities and control over resource allocation [21].

Consumption-based environmental accounting supports parts of this argument. It has been found that European consumption generates substantial environmental pressures outside the European Union while much of the associated value added remains within Europe [22]. It has been similarly demonstrated that consumption in major economies produces health and pollution effects across borders [23]. These findings complicate narratives that locate responsibility only where commodities are physically produced. Trade is also a significant driver of land-use change. It has been estimated that internationally traded agricultural and forestry commodities embody a substantial share of tropical deforestation emissions [24]. The deforestation footprints of nations have been mapped, demonstrating growing pressure on tropical forests associated with imported consumption [25]. It has been cautioned that estimates vary because studies apply different definitions, time periods, and attribution methods, illustrating why trade restrictions based on environmental indicators require methodological transparency [26].

Global commodity chains distribute not only products but also power. Downstream firms often control consumer access, branding, standards, and information, while primary producers operate in competitive markets with smaller margins. It has been argued that transparency can improve commodity governance, but only when information is connected to accountability and incentives [27]. It has been similarly emphasized that zero-deforestation commitments require clear scope, implementation mechanisms, monitoring, and inclusion of vulnerable producers [28]. Thus, sustainability standards enter value chains that are already unequal. When compliance costs are passed upstream, producers may finance the sustainability claims of brands and retailers without receiving adequate price premiums. Such arrangements can improve practices, but they can also deepen buyer power, consolidate supply chains, and exclude actors unable to document compliance [17].

Non-Tariff Measures and the Regulatory Turn in Sustainability

As tariffs have declined through successive trade agreements, non-tariff measures have become increasingly important. These include technical regulations, sanitary and phytosanitary measures, conformity assessments, labeling rules, quantitative controls, licensing, and other conditions affecting trade. Non-tariff measures are not inherently protectionist. They may correct information asymmetries, protect health, reduce environmental externalities, and improve product quality. Their legitimacy depends on design and application [6].

Research shows that standards can either facilitate or restrict trade. Harmonized standards can reduce uncertainty and increase consumer confidence, while costly or duplicative requirements can exclude suppliers. It has been found that product standards affect developing-country agricultural exports through both quality-enhancing and cost-increasing channels [29]. It has been shown that sanitary and phytosanitary measures can have

particularly restrictive effects on lower-income exporters [30]. It has been reviewed likewise that identifies heterogeneous effects depending on product, measure, exporter capability, and market structure [31]. Sustainability standards differ from conventional product standards because they frequently address process and production methods. Two physically similar products may receive different treatment because of land-use history, labor conditions, carbon intensity, biodiversity effects, or supply-chain traceability. This shift expands the regulatory reach of importing markets into production systems located abroad [17].

Private certification has played a central role. Schemes initially described as voluntary can become commercially mandatory when dominant retailers or brands require them. It has been found that sustainability standards can improve some smallholder outcomes but do not automatically benefit all participants [32]. Certification costs, selection effects, weak premiums, unequal bargaining power, and variable implementation complicate the assumption that certification simultaneously delivers market access, environmental protection, and poverty reduction.
The regulatory frontier now extends beyond certification. Carbon border adjustment, deforestation-free product regulation, and corporate due diligence seek to address leakage and supply-chain externalities [33,34]. Carbon border measures can theoretically prevent firms from relocating production to jurisdictions with weaker climate policies. Yet it has been shown that such measures expose developing countries to transition risks because of emissions-intensive exports, limited monitoring capacity, and restricted access to low-carbon technology [35-37]. It has been demonstrated that border measures can generate substantial competitiveness and welfare effects, while it has been emphasized too that addressing leakage should not overshadow international cooperation [38,39].

Trade law permits environmental regulation but imposes disciplines against arbitrary or unjustifiable discrimination and disguised restrictions. The challenge is that environmental objectives and producer interests can coexist within the same regulation. A measure may reduce genuine ecological harm while also benefiting domestic industries. Legal and policy assessments must therefore consider less-trade-restrictive alternatives, consistency across comparable products, scientific evidence, procedural transparency, and the opportunities afforded to exporting countries to demonstrate equivalence [6].

Method

This study employs a qualitative literature review rather than a systematic literature review. A qualitative review is appropriate because the research questions are conceptual, interpretive, and institutional. The objective is not to calculate a pooled effect size, identify every publication within a predetermined search universe, or reproduce a PRISMA-style selection process. Instead, the study integrates findings from sustainability science, ecological economics, trade policy, global value-chain research, environmental law, and palm-oil studies to explain how sustainability has evolved and how it operates within unequal international economic relationships [40,41].

Literature was identified purposively and iteratively. Priority was given to peer-reviewed journal articles indexed in Scopus or Web of Science, particularly those published from 2020 onward. Earlier studies were included when they provided foundational concepts, empirical baselines, or established findings required to interpret recent debates. Supplementary institutional materials were used for regulatory instruments and dispute-related information that could not be adequately represented by journal literature alone. The literature was organized around five thematic domains: the conceptual evolution of sustainability; natural-resource-based development; environmental footprints and unequal exchange; non-tariff measures and sustainability standards; and palm-oil governance. Searches and citation tracing were continued until the additional literature primarily reinforced rather than substantially altered the emerging themes. This represents thematic saturation rather than statistical or exhaustive coverage.

The analysis followed an interpretive coding process. Publications were examined for how they defined sustainability, allocated responsibility, described trade effects, evaluated standards, and represented developing-country agency. Particular attention was given to contradictions between environmental effectiveness and distributive fairness. Supportive and critical studies were retained to avoid treating either sustainability regulation or protectionism as a predetermined conclusion.
The method has limitations. It does not provide exhaustive bibliometric coverage, and the selection of literature necessarily reflects analytical judgment. The rapidly changing regulatory environment means that some implementation details may evolve. Protectionist intent is also difficult to prove directly; the analysis therefore focuses mainly on regulatory effects, consistency, and political-economic incentives. Finally, palm oil cannot represent every natural-resource commodity, although it provides a strategically important case through which wider mechanisms can be observed.

Results

Sustainability Has Become a Technology of Market Governance

The literature indicates that sustainability has undergone three connected transformations. First, it moved from a broad ethical principle toward measurable indicators. Second, it shifted from primarily domestic environmental management toward supply-chain governance. Third, it evolved from voluntary commitments into mandatory conditions of market participation [42]. Measurement is necessary for accountability, but indicators also exercise power. Definitions of forest, deforestation, degradation, high-carbon-stock land, acceptable emissions, traceability, and legality determine which producers are recognized as sustainable. These definitions are not purely technical. They embody judgments regarding baselines, acceptable risks, land-use histories, and the relative importance of environmental and developmental objectives[12]. Supply-chain governance expands the jurisdictional influence of major consumer markets. Importing states may not directly regulate a farm in Indonesia, a cocoa plot in Côte d'Ivoire, or a cattle ranch in Brazil, but they can require companies selling into their markets to obtain detailed information about those production sites [43,44]. This extraterritorial reach is strengthened by private buyers that translate regulatory obligations into supplier contracts.

Mandatory due diligence represents the latest phase. Under the European Union's deforestation regulation, operators must demonstrate that covered commodities are not associated with recent deforestation and satisfy relevant legality requirements. Following amendments adopted in 2024 and 2025, application is scheduled for December 30, 2026, for large and medium

operators and June 30, 2027, for micro and small operators [5]. These requirements can improve transparency and discourage destructive production. Nevertheless, the transition from principles to mandatory evidence creates barriers when data systems are absent, land tenure is informal, plots are fragmented, or national maps and importing-country methodologies are not interoperable. Sustainability is therefore no longer only about changing practices. It is also about proving change in a form accepted by distant regulators and commercial buyers [17].

Sustainability Requirements Can Operate as De Facto Non-Tariff Barriers

Five mechanisms repeatedly emerge from the literature. The first is fixed compliance cost. Audits, certification, polygon mapping, laboratory analysis, documentation, segregated logistics, and legal verification involve expenses that do not decline proportionately for small producers. Large enterprises can spread these costs across substantial output, while smallholders face high per-unit burdens [5].

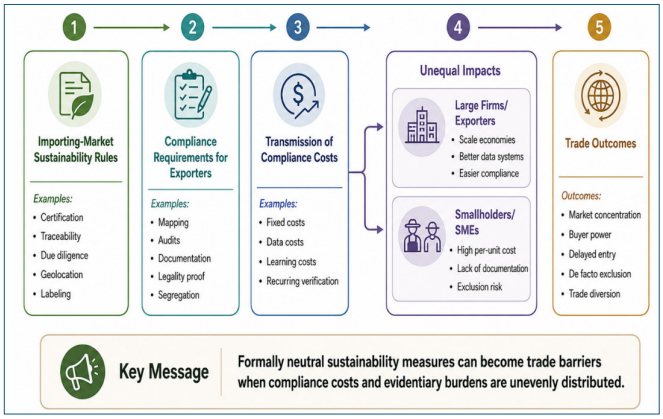
The second mechanism is **informational inequality**. Importers, multinational firms, and large plantations commonly possess legal teams, sustainability departments, digital systems, and access to consultants. Smallholders may lack formal land titles, reliable internet, geographic information systems, or familiarity with foreign regulatory language. Even when their production is environmentally compliant, they may be unable to produce acceptable evidence.

Third, **regulatory uncertainty acts as a barrier**. Standards, risk classifications, implementing guidelines, and recognized methodologies may change after producers have already invested in compliance. Uncertainty discourages buyers from sourcing from suppliers perceived as administratively difficult. Firms may simplify risk management by purchasing from large, vertically integrated estates rather than heterogeneous smallholder networks.

Fourth, **sustainability requirements can generate multiple overlapping audits**. Producers may need to satisfy national certification, private certification, buyer-specific codes, and importing-country regulations. When standards are not mutually recognized, similar objectives create duplicative costs rather than regulatory efficiency.

Fifth, **sustainability measures may alter bargaining power**. Buyers can require compliance without guaranteeing long-term contracts or price premiums. The risk and cost of transformation move upstream, while downstream firms retain the ability to change suppliers. This dynamic can turn sustainability into a mechanism of supply-chain consolidation [12].

The mechanisms discussed above form a cumulative process through which an environmentally legitimate requirement may produce a trade-restrictive outcome. Figure 2 summarizes this process by tracing how sustainability rules established in importing markets are translated into mapping, auditing, documentation, legality, segregation, and verification obligations for exporters. These requirements then generate fixed, informational, organizational, and recurring compliance costs. Because firms differ substantially in scale, technological capacity, access to data, and administrative resources, the same formal rule can produce sharply unequal effects across exporters [30-32].



Source: Synthesized from the literature.

Figure 2: How Sustainability Requirements Become De Facto Non-Tariff Barriers.

As shown in Figure 2, larger firms are generally better positioned to absorb fixed costs, establish internal compliance departments, maintain digital records, and respond to changing regulatory instructions. By contrast, smallholders and small and medium-sized enterprises often face higher compliance costs per unit of output and may lack formal land documents, geolocation capacity, or access to accredited auditors. The resulting outcome may be delayed market entry, dependence on a limited number of buyers, diversion toward less-regulated markets, or complete exclusion from premium supply chains. A formally origin-neutral measure may thus become discriminatory in practice when its evidentiary and financial burdens are not calibrated to differences in producer capacity [17].

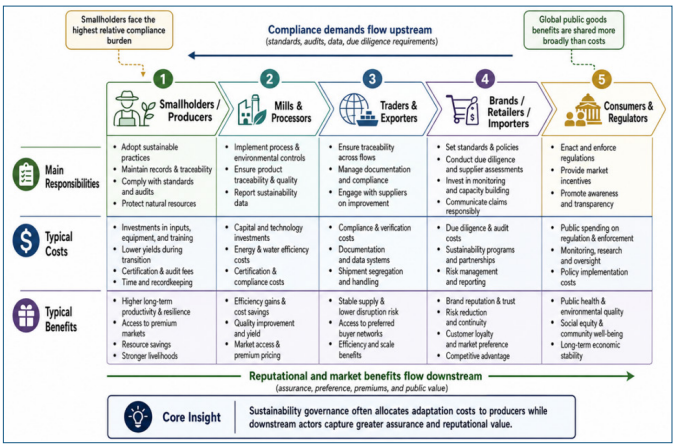
These effects do not establish that all sustainability requirements are protectionist. They demonstrate that formally neutral measures can produce trade-restrictive and distributionally regressive outcomes. The relevant test is therefore not simply whether domestic and foreign firms face identical legal language. It is whether the measure's design, evidence requirements, transition arrangements, and financial consequences impose unjustifiably different practical burdens [6].

The Costs and Benefits of Sustainability Are Unequally Distributed

The reviewed literature reveals a recurring asymmetry. Standards are frequently designed in consuming markets, compliance takes place in producing regions, and reputational value is captured by downstream businesses. Producers bear the costs of changing practices and generating data, while brands, retailers, investors, and regulators gain assurance that products meet consumer expectations.

The distributional structure of sustainability governance becomes clearer when responsibilities, costs, and benefits are mapped across the entire value chain. Figure 3 shows that compliance obligations commonly move upstream from regulators, importers, retailers, and brands toward traders, processors, and primary producers. Reputational advantages, consumer confidence, market differentiation, and regulatory assurance, however, tend to accumulate further downstream. This pattern does not imply that downstream actors bear no costs, but it highlights the disproportionate relative burden placed on

producers with limited capital, weak bargaining power, and restricted access to information [27,28,32].



Source: Synthesized from the literature.

Figure 3: Distribution of Sustainability Responsibilities, Costs, and Benifits Across the Value Chain.

Figure 3 also indicates that sustainability produces different forms of value for different participants. Smallholders may eventually benefit from higher productivity, resilience, and access to premium markets, but they must first finance changes in production, recordkeeping, certification, and verification. Processors and traders gain from efficiency, quality control, stable supplies, and access to preferred buyers, while brands and retailers obtain reputational value, customer loyalty, and reduced regulatory risk. Consumers and governments receive broader benefits through improved environmental quality, public health, and climate mitigation. The distributional problem arises when the costs of producing these public and commercial benefits remain concentrated among upstream actors, while the associated gains are more broadly or profitably captured downstream.

This allocation is particularly problematic when sustainability protects a global public good. Avoided deforestation, biodiversity conservation, and climate mitigation benefit the international community. Asking low-income producers to finance these benefits through uncompensated compliance effectively transfers the cost of environmental protection to actors with the least capacity to pay [5]. Ecologically unequal exchange deepens this concern. High-income economies have historically obtained materials, land-intensive commodities, and embodied energy from lower-income regions. Their domestic environmental indicators can improve partly because environmentally intensive production occurs elsewhere. Sustainability regulation may address this outsourced footprint, but it becomes contradictory when consumer countries demand improved production while refusing to reduce excessive consumption, share transition costs, or acknowledge historical responsibility [19,20,22].

A fairer system would allocate responsibility across the chain. Producers should prevent illegal clearing, pollution, labor abuse, and rights violations. Traders should maintain transparent chains of custody. Consumer-facing firms should finance supplier upgrading and provide stable purchasing relationships. Importing governments should recognize credible producer-country systems and support public traceability infrastructure. Consumers should bear part of the cost through prices, taxation, or public budgets rather than expecting producers to absorb all costs.

Palm Oil Illustrates the Dual Character of Sustainability Regulation

Palm oil demonstrates why both environmental complacency and indiscriminate trade exclusion are inadequate. Oil palm produces high yields per hectare and supports millions of workers and smallholders. It has been concluded that the oil-palm boom has generated income, employment, and poverty-reduction benefits while also contributing to deforestation and biodiversity loss [45]. The sector's developmental importance does not erase its environmental costs, but its environmental costs do not erase its social contribution [5]. The expansion of oil palm has been associated with forest conversion, peat drainage, fires, habitat fragmentation, and land disputes. It has been identified that plantation expansion is one of several drivers of Indonesian deforestation, interacting with logging, infrastructure, fire, and other agricultural activities [46]. Remote-sensing studies have improved understanding of plantation distribution and age, enabling more precise monitoring than commodity-wide assumptions [47,48].

Recent evidence also shows that the relationship between palm oil and deforestation changes over time. It has been reported that declining oil-palm expansion and lower prices were associated with slower Indonesian deforestation during part of the study period [49]. This suggests that policy should distinguish between historical expansion, current practices, plantation type, and location rather than treating every unit of palm oil as environmentally identical. Comparative land use is important. It has been emphasized that replacing palm oil with other vegetable oils does not automatically reduce environmental pressure because oil palm generally produces more oil per hectare [50]. A blanket boycott may shift demand toward soybean, rapeseed, sunflower, or other oils requiring more land, although actual outcomes depend on location, management, and market responses [51]. Sustainability policy should therefore compare products using consistent lifecycle and land-use criteria [52].

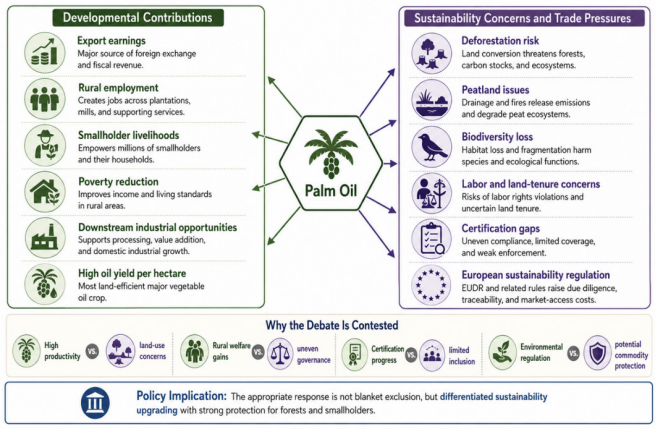
Certification has produced mixed results. It has been found that certification reduced deforestation in participating Indonesian plantations, although effects on peatland clearing and fires were limited [53]. It has been similarly cautioned that certification does not automatically achieve all environmental and social objectives [54]. It has been found that village-welfare outcomes vary, with effects varying according to pre-existing livelihood systems and regional conditions [55].

These studies undermine two extreme narratives. The first portrays **certification as sufficient proof that palm oil is sustainable.** The second assumes that **certification is meaningless and that all palm oil should be excluded.** In reality, certification can improve some outcomes while remaining limited by weak enforcement, inadequate premiums, incomplete smallholder inclusion, and fragmented governance.

European measures have intensified the controversy. Renewable-energy policies differentiated palm oil from other biofuel feedstocks based partly on indirect land-use-change risks. Deforestation regulation now imposes geolocation, legality, and due-diligence requirements across several commodities, including palm oil. These measures address genuine ecological concerns, but their legitimacy depends on whether competing oils and domestic agricultural interests are treated consistently, producer-country systems are recognized, and smallholders

receive sufficient support [12]. The risk is that sustainability rules encourage buyers to exclude independent smallholders because sourcing from large estates is easier to document. Such an outcome could create cleaner European supply chains on paper while redirecting non-compliant or undocumented production to other markets. This would improve the appearance of European consumption without necessarily transforming production across the sector.

The Indonesian palm-oil case can therefore be interpreted only by recognizing its simultaneous developmental contributions, environmental consequences, and exposure to external trade regulation. Figure 4 synthesizes these competing dimensions. On the one hand, palm oil supports export earnings, employment, smallholder livelihoods, poverty reduction, and downstream industrial development. Its comparatively high oil yield per hectare also means that direct substitution with lower-yielding vegetable oils does not automatically reduce global land-use pressure. On the other hand, historical and continuing problems involving deforestation, peatlands, biodiversity, labor conditions, land tenure, and uneven certification justify serious sustainability intervention [45,50,55].



Source: Synthesized from the Literature.
Figure 4: Indonesian Palm Oil in the Sustainability-Trade Nexus.

Figure 4 illustrates why palm oil should not be approached through either unconditional defense or blanket exclusion. The developmental benefits of the commodity do not invalidate environmental concerns, while its environmental risks do not justify treating all producers, regions, and supply chains as equally unsustainable. The central policy challenge is to differentiate between compliant and non-compliant production, strengthen protection for forests and peatlands, improve labor and land-tenure governance, and make certification and traceability accessible to smallholders. At the same time, importing markets should ensure that palm oil and competing vegetable oils are evaluated through transparent and comparable environmental methodologies. Without such consistency, sustainability regulation may simultaneously address genuine ecological problems and create competitive advantages for alternative commodities produced within importing regions [42].

Green Protectionism Is Best Identified through Effects and Design

Directly proving that policymakers intended to protect domestic industries is often impossible. Regulations typically emerge from multiple motivations, including environmental advocacy, consumer pressure, climate commitments, bureaucratic incentives, corporate lobbying, and producer interests. A measure can therefore be environmentally motivated and protectionist in effect.

Four indicators are particularly relevant. The first is **inconsistent treatment of comparable products.** When an imported commodity faces stringent lifecycle or land-use scrutiny, but domestic substitutes are assessed through less demanding methods, environmental justification becomes less convincing.

The second is **a failure to recognize equivalence.** An importing country may insist on its own procedures even when a producer country can demonstrate similar environmental outcomes through national law or certification. Requiring procedural identity rather than equivalent results unnecessarily privileges the importing jurisdiction's regulatory model.

The third indicator is **disproportionality.** A regulation may pursue a legitimate goal but impose costs far greater than the marginal environmental benefit, particularly when less-restrictive alternatives exist. Risk-based auditing, jurisdictional certification, group certification, and phased implementation may achieve environmental objectives without requiring the same documentation from every individual producer.

The fourth is **inadequate burden sharing.** If an importing region claims global environmental benefits but provides little finance for producer adaptation, the measure resembles ecological conditionality more than cooperative transformation. This is especially problematic where consumer-country demand contributed to the environmental pressure being regulated. Protectionism should therefore be understood as a continuum rather than a binary category. At one end are evidence-based, non-discriminatory, proportionate measures developed through inclusive processes and supported by transition assistance. At the other are selectively targeted, methodologically opaque, duplicative, or uncompensated requirements that favor domestic interests. Many real policies lie between these positions.

Developing Countries Possess Strategic Agency

Developing countries are not limited to rejecting or passively accepting foreign sustainability rules. The literature suggests several forms of strategic agency.

First, **governments can strengthen domestic environmental governance**. International criticism is harder to counter when illegal clearing, weak enforcement, overlapping permits, land conflicts, and unreliable data remain unresolved. Credible reform is therefore a source of negotiating power rather than a concession to foreign pressure.

Second, **traceability should be treated as public infrastructure**. Leaving geolocation and chain-of-custody systems entirely to private firms can exclude smallholders and fragment data ownership. Governments can develop interoperable registries connecting land status, producer identity, environmental indicators, mills, traders, and export documentation while protecting legitimate privacy and community rights.

Third, **countries can negotiate equivalence and mutual recognition.** National standards such as Indonesia's ISPO should be continuously improved, independently audited,

and benchmarked transparently. The objective should not be automatic recognition but evidence-based recognition when national systems produce outcomes comparable to importing-country requirements.

Fourth, **producer countries can coordinate.** Coalitions can develop common positions on definitions, transition periods, smallholder treatment, certification, and financing. Cooperation is most credible when it combines defense of trade interests with measurable commitments to forest protection and social safeguards.

Fifth, **developing countries can use WTO mechanisms strategically.** Litigation is costly and slow, but it can clarify obligations regarding discrimination, technical barriers, and environmental exceptions. Dispute settlement should be complemented by committee engagement, regulatory dialogue, and coalition building before contested measures become fully operational.

Sixth, **market diversification can reduce vulnerability.** Excessive dependence on one high-value destination increases foreign regulatory leverage. Regional markets, South–South trade, domestic biodiesel use, and diversified product applications can provide alternatives, although diversification should not become an excuse to sell environmentally harmful products elsewhere.

Finally, **downstream industrialization can improve bargaining power.** Exporting crude commodities leaves countries exposed to price volatility and external standards while capturing limited value. Processing, oleochemicals, advanced biomaterials, food ingredients, and other downstream activities can retain more income domestically. However, industrial upgrading must itself satisfy environmental and social standards to avoid simply relocating impacts.

Discussion And Analysis

Sustainability Must Be Reconstructed as a Shared Obligation

The central finding is that sustainability is indispensable but institutionally asymmetric. Environmental governance cannot rely solely on national sovereignty because production and consumption are globally connected. Yet unilateral market power is not an acceptable substitute for multilateral legitimacy.

A shared-obligation framework begins with the entire value chain. Producer governments are responsible for enforcing land, labor, and environmental law. Companies are responsible for due diligence, remediation, transparent sourcing, and fair contractual relationships. Importing governments are responsible for ensuring that their regulations do not discriminate, externalize costs, or ignore development impacts. Consumers and investors are responsible for financing, directly or indirectly, the transition they demand. This framework also requires attention to consumption. Importing countries cannot credibly focus only on the sustainability of foreign production while maintaining levels of material consumption incompatible with global ecological limits. It has been identified that affluence is a major driver of environmental pressure [4]. Sustainability regulation that leaves consumption structures unchanged may clean individual supply chains while continuing to generate high aggregate demand for land, energy, and materials [17]. Differentiated responsibility does not mean permanent exemptions. It means that the path, timing, and financing of compliance should reflect capacity and historical contribution. A smallholder should not face the same evidentiary burden as a multinational trader. A low-income producer country should not be expected to finance global biodiversity services without compensation. A regulation claiming global benefits should include resources for global implementation.

A Test for Fair Sustainability-Related Trade Measures

The findings support an eight-part assessment framework.

Environmental legitimacy asks whether the measure addresses a significant, demonstrable environmental or social harm. Purely symbolic restrictions with negligible ecological benefits should receive greater scrutiny.

Scientific robustness requires transparent data, definitions, baselines, and methodologies. Where scientific uncertainty exists, precaution may be justified, but uncertainty should not be selectively applied only to imported commodities.

Non-discrimination requires consistent treatment of domestic and imported products and of comparable commodities. Differences must be linked to environmental performance rather than origin or political influence.

Necessity asks whether the measure is reasonably required to achieve its objective and whether less-trade-restrictive alternatives could produce similar results.

Proportionality considers whether compliance burdens correspond to risk. Low-risk jurisdictions, well-governed producer groups, and certified smallholders should not face unnecessary duplication.

Procedural inclusion requires meaningful participation by producer governments, affected communities, smallholder organizations, and developing-country experts before standards are finalized.

Equivalence recognizes that countries may achieve comparable outcomes through different institutions. Importing jurisdictions should define performance objectives and allow credible alternative systems to demonstrate compliance.

Burden sharing requires finance, technology transfer, capacity building, and transition periods. Without these elements, environmental measures risk becoming mechanisms through which rich markets purchase ecological assurance at the expense of poor producers.

A measure satisfying these criteria is more likely to represent legitimate sustainability governance. A measure failing several criteria may constitute green protectionism even when environmental concerns are genuine.

Reclaiming Developmental Policy Space

Policy space should not be understood as freedom to maintain destructive production. It is the capacity to determine nationally appropriate pathways toward sustainable development, industrial upgrading, and social transformation. Developing countries can reclaim this space by moving from reactive diplomacy toward proactive regulatory strategy.

The first pillar is **evidence.** Producer countries need credible, accessible data on land cover, emissions, biodiversity, legality, supply-chain structure, and compliance costs. Without evidence, they remain dependent on methodologies produced by importing institutions or advocacy organizations.

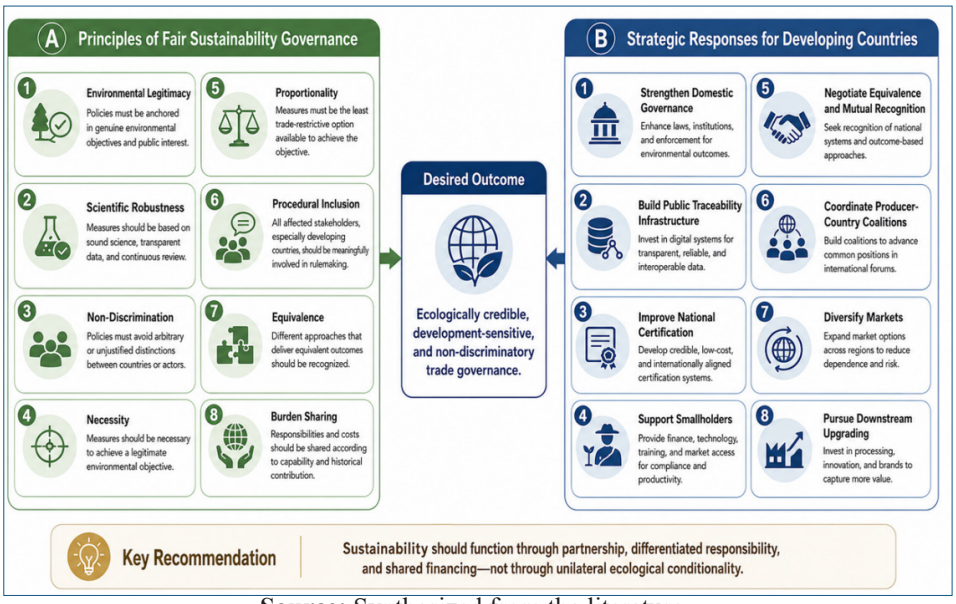
The second pillar is **institutional credibility**. Environmental enforcement, land-tenure clarification, grievance mechanisms, and transparent certification strengthen the case for regulatory recognition. Defending weak governance in the name of sovereignty ultimately reduces sovereignty by inviting foreign regulation.

The third pillar is **industrial strategy.** Sustainability requirements should be incorporated into plans for productivity, downstream processing, renewable energy, circular production, and technological development. Compliance should generate domestic capability rather than function only as an export cost.

The fourth pillar is **smallholder-centered implementation.** Smallholders need group certification, subsidized mapping, cooperative organization, affordable credit, extension services, secure tenure, yield improvement, and guaranteed market access. Excluding them may reduce traceability risk for buyers but increase poverty and environmental leakage.

The fifth pillar is **bargaining diversification.** Developing countries should combine WTO engagement, bilateral negotiation, regional coordination, producer alliances, and alternative markets. No single instrument is sufficient. Litigation can clarify rules, but long-term influence requires technical expertise and collective agenda setting.

The analysis suggests that a credible developing-country response must combine resistance to discriminatory regulation with domestic sustainability transformation. Figure 5 integrates the normative principles required for fair sustainability governance with the strategic actions available to developing countries. The left side of the framework establishes the criteria through which environmental trade measures should be assessed, including environmental legitimacy, scientific robustness, non-discrimination, necessity, proportionality, procedural inclusion, regulatory equivalence, and equitable burden sharing. The right side identifies complementary national and international strategies through which developing countries can improve their bargaining position while strengthening environmental credibility.



Source: Synthesized from the literature.

Figure 5: Policcy Framework for Fair Sustainabilty Governance and Developing-Country Response.

As summarized in Figure 5, developmental policy space is most effectively protected when producer countries improve domestic governance, establish public traceability infrastructure, strengthen national certification, support smallholder compliance, and pursue downstream industrial upgrading. These domestic measures should be combined with negotiations for regulatory equivalence, mutual recognition, producer-country coordination, and market diversification. The desired outcome is not exemption from environmental responsibility, but a trade-governance system that is ecologically credible, development-sensitive, and non-discriminatory. Such a system would recognize that countries may achieve comparable sustainability outcomes through different institutional arrangements and that the costs of protecting global environmental public goods should be shared according to capability, economic benefit, and historical contribution.

Reforming International Governance

Multilateral institutions should develop clearer principles for sustainability-related trade measures. Existing trade law provides disciplines on discrimination and unnecessary barriers, but contemporary supply-chain regulation raises questions not fully anticipated by traditional product-focused rules [17]. An international equivalence mechanism could allow producer countries to submit national systems for independent evaluation against agreed outcome-based criteria. Such a mechanism would reduce duplication and prevent every major market from imposing separate documentation systems. Environmental trade measures should also undergo development-impact assessment. Assessments should estimate compliance costs, smallholder exclusion, gender effects, trade diversion, value-chain concentration, and the risk that environmental harm shifts to unregulated markets. These effects should be monitored after

implementation rather than treated as secondary considerations.

A global sustainability compliance fund could finance geospatial mapping, data infrastructure, certification, restoration, and smallholder transition. Contributions could reflect importing-country consumption, corporate turnover, or historical emissions. Such financing would recognize that tropical forests and biodiversity provide global benefits. Transition periods should be based on actual implementation capacity, not only company size. A small European importer and a small tropical farmer may both be classified as small enterprises, yet their roles and constraints are fundamentally different. Regulation should account for conditions at the production end of the chain. Finally, grievance and correction mechanisms should be accessible. Producers affected by erroneous mapping, risk classification, or buyer exclusion need rapid channels for review. Without such mechanisms, data errors can become trade sanctions without meaningful due process.

Conclusion and Policy Recommendations

The evolution of sustainability reflects one of the most important normative achievements of modern governance. Economic development can no longer be separated from climate stability, biodiversity, ecosystem integrity, labor rights, and intergenerational welfare. Nevertheless, sustainability has also evolved into a powerful system of market classification, traceability, certification, and exclusion. Because the authority to design these systems is concentrated in major importing economies and downstream corporations, sustainability governance can reproduce international inequality.

The qualitative literature indicates that sustainability-related measures become problematic when they selectively target imported commodities, apply inconsistent methods to competing products, ignore equivalent producer-country systems, impose disproportionate fixed costs, exclude smallholders, or provide inadequate finance for transition. Such policies may produce protectionist effects even when explicit protectionist intent cannot be established. Palm oil demonstrates the complexity of the problem. The sector has generated employment, income, export earnings, and poverty-reduction benefits while contributing to deforestation, biodiversity loss, peatland degradation, and social conflict. Neither unrestricted expansion nor indiscriminate exclusion provides an adequate solution. Sustainability governance should differentiate among producers, reward verified improvement, support smallholders, protect forests, and evaluate substitute oils through consistent environmental criteria [5].

Developing countries should strengthen domestic environmental law, create interoperable public traceability systems, improve national certification, secure smallholder tenure, subsidize collective compliance, and incorporate sustainability into industrial upgrading. They should also coordinate producer-country positions, diversify export markets, use WTO institutions strategically, and demand recognition of equivalent regulatory outcomes. Developed importing countries should apply environmental rules consistently to domestic and imported products, assess development impacts, finance compliance, recognize credible national systems, and provide adequate transition periods. Their responsibility extends beyond policing foreign production to reducing excessive consumption and addressing the environmental footprint embodied in imports.

At the international level, sustainability standards should increasingly be designed through inclusive and multilateral processes. A fair system would combine ecological effectiveness with non-discrimination, proportionality, scientific transparency, procedural participation, equivalence, and burden sharing. Sustainability must not become a new vocabulary through which countries that industrialized through intensive resource use restrict the developmental options of countries still building basic productive capacity. The appropriate response is therefore neither rejection of sustainability nor passive acceptance of unilateral standards. Developing countries must pursue a strategy of transformative resistance: resisting discriminatory and disproportionate rules while transforming domestic production systems to meet credible environmental and social objectives. Sustainability will support legitimate global governance only when it is treated as a shared responsibility rather than an instrument through which powerful markets dictate the terms of development.

References

1. Persson, L. (2022). Outside the Safe Operating Space of the Planetary Boundary for Novel Entities. Environmental ScienceTechnology, 56(3), 1510-1521.
2. Richardson, K. (2023). Earth beyond six of nine planetary boundaries. Science Advances, 9(37).
3. Rockström, J. (2023). Safe and just Earth system boundaries. Nature, 619(7968), 102-111.
4. Wiedmann, T., Lenzen, M., Keyßer, L.T., Steinberger, J.K. (2020). Scientists' warning on affluence. Nature Communications, 11(1), 3107.
5. Bager, S.L., Persson, U.M., dos Reis, T.N.P. (2021). Eighty-six EU policy options for reducing imported deforestation. One Earth, 4(2), 289-306.
6. Green, J.M.H. (2019). Linking global drivers of agricultural trade to on-the-ground impacts on biodiversity. Proceedings of the National Academy of Sciences, 116(46), 23202-23208.
7. Mehling, M.A., van Asselt, H., Das, K., Droege, S., Verkuijl, C. (2019). Designing Border Carbon Adjustments for Enhanced Climate Action. American Journal of International Law, 113(3), 433-481.
8. Purvis, B., Mao, Y., Robinson, D. (2019). Three pillars of sustainability: In search of conceptual origins. Sustainability Science, 14(3), 681-695.
9. Mensah, J. (2019). Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. Cogent Social Sciences, 5(1).
10. Ruggerio, C.A. (2021). Sustainability and sustainable development: A review of principles and definitions. Science of the Total Environment, 786, 147481.
11. Biermann, F., Kim, R.E. (2020). The Boundaries of the Planetary Boundary Framework: A Critical Appraisal of Approaches to Define a "Safe Operating Space" for Humanity. Annual Review of Environment and Resources, 45(1), 497-521.
12. Dauvergne, P. (2018). The global politics of the business of "sustainable" palm oil. Global Environmental Politics, 18(2), 34-52.
13. Biermann, F. (2022). Scientific evidence on the political impact of the Sustainable Development Goals. Nature Sustainability, 5(9), 795-800.
14. Fanning, A.L., O'Neill, D.W., Hickel, J., Roux, N. (2021). The social shortfall and ecological overshoot of nations.

Nature Sustainability, 5(1), 26-36.
15. Haberl, H. (2020). A systematic review of the evidence on decoupling of GDP, resource use and GHG emissions, part II: Synthesizing the insights. Environmental Research Letters, 15(6), 065003.
16. Hickel, J. (2021). The anti-colonial politics of degrowth. Political Geography, 88, 102404.
17. Pacheco, P., Schoneveld, G., Dermawan, A., Komarudin, H., Djama, M. (2020). Governing sustainable palm oil supply: Disconnects, complementarities, and antagonisms between state regulations and private standards. Regulation Governance, 14(3), 568-598.
18. Hickel, J. (2020). Quantifying national responsibility for climate breakdown: An equality-based attribution approach for carbon dioxide emissions in excess of the planetary boundary. The Lancet Planetary Health, 4(9), e399-e404.
19. Dorninger, C. (2021). Global patterns of ecologically unequal exchange: Implications for sustainability in the 21st century. Ecological Economics, 179, 106824.
20. Hickel, J., Dorninger, C., Wieland, H., Suwandi, I. (2022). Imperialist appropriation in the world economy: Drain from the global South through unequal exchange, 1990-2015. Global Environmental Change, 73, 102467.
21. Corsi, G., Guarino, R., Muñoz-Ulecia, E., Sapio, A., Franzese, P.P. (2024). Uneven development and core-periphery dynamics: A journey into the perspective of ecologically unequal exchange. Environmental Science Policy, 157, 103778.
22. Bruckner, B. (2023). Ecologically unequal exchanges driven by EU consumption. Nature Sustainability, 6(5), 587-598.
23. Nansai, K. (2021). Consumption in the G20 nations causes particulate air pollution resulting in two million premature deaths annually. Nature Communications, 12(1), 6286.
24. Pendrill, F. (2019). Agricultural and forestry trade drives large share of tropical deforestation emissions. Global Environmental Change, 56, 1-10.
25. Hoang, N. T., Kanemoto, K. (2021). Mapping the deforestation footprint of nations reveals growing threat to tropical forests. Nature Ecology Evolution, 5(6), 845-853.
26. Pendrill, F. (2022). Disentangling the numbers behind agriculture-driven tropical deforestation. Science, 377(6611).
27. Gardner, T. A. (2019). Transparency and sustainability in global commodity supply chains. World Development, 121, 163-177.
28. Garrett, R. D. (2019). Criteria for effective zero-deforestation commitments. Global Environmental Change, 54, 135-147.
29. Ferro, E., Otsuki, T., Wilson, J.S. (2015). The effect of product standards on agricultural exports. Food Policy, 50, 68-79.
30. Murina, M., Nicita, A. (2017). Trading with Conditions: The Effect of Sanitary and Phytosanitary Measures on the Agricultural Exports from Low-income Countries. The World Economy, 40(1), 168-181.
31. Santeramo, F.G., Lamonaca, E. (2019). The Effects of Non-tariff Measures on Agri-food Trade: A Review and Meta-analysis of Empirical Evidence. Journal of Agricultural Economics, 70(3), 595-617.
32. Meemken, E.M. (2020). Do smallholder farmers benefit from sustainability standards? A systematic review and meta-analysis. Global Food Security, 26, 100373.
33. Evans, S., Mehling, M.A., Ritz, R.A., Sammon, P. (2021). Border carbon adjustments and industrial competitiveness in a European Green Deal. Climate Policy, 21(3), 307-317.
34. Mehling, M., van Asselt, H., Droege, S., Das, K. (2022). The Form and Substance of International Cooperation on Border Carbon Adjustments. AJIL Unbound, 116, 213-218.
35. Eicke, L., Weko, S., Apergi, M., Marian, A. (2021). Pulling up the carbon ladder? Decarbonization, dependence, and third-country risks from the European carbon border adjustment mechanism. Energy ResearchSocial Science, 80, 102240.
36. Perdana, S., Vielle, M. (2022). Making the EU Carbon Border Adjustment Mechanism acceptable and climate friendly for least developed countries. Energy Policy, 170, 113245.
37. Overland, I., Sabyrbekov, R. (2022). Know your opponent: Which countries might fight the European carbon border adjustment mechanism? Energy Policy, 169, 113175.
38. Zhong, J., Pei, J. (2022). Beggar thy neighbor? On the competitiveness and welfare impacts of the EU's proposed carbon border adjustment mechanism. Energy Policy, 162, 112802.
39. Jakob, M. (2021). Why carbon leakage matters and what can be done against it. One Earth, 4(5), 609-614.
40. Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. Journal of Business Research, 104, 333-339.
41. Snyder, H. (2024). Designing the literature review for a strong contribution. Journal of Decision Systems, 33(4), 551-558.
42. Scoones, I. (2020). Transformations to sustainability. World Development, 105, 102726.
43. Rajão, R. (2020). The rotten apples of Brazil's agribusiness. Science, 369(6501), 246-248.
44. Zu Ermgassen, E.K.H.J. (2020). The origin, supply chain, and deforestation risk of Brazil's beef exports. Proceedings of the National Academy of Sciences, 117(50), 31770-31779.
45. Qaim, M., Sibhatu, K.T., Siregar, H., Grass, I. (2020). Environmental, economic, and social consequences of the oil palm boom. Annual Review of Resource Economics, 12, 321-344.
46. Austin, K. G., Schwantes, A., Gu, Y., Kasibhatla, P. S. (2019). What causes deforestation in Indonesia? Environmental Research Letters, 14(2), 024007.
47. Danylo, O. (2021). A map of the extent and year of detection of oil palm plantations in Indonesia, Malaysia and Thailand. Scientific Data, 8(1), 96.
48. Descals, A., Wich, S., Meijaard, E., Gaveau, D.L.A., Peedell, S., et al. (2021). High-resolution global map of smallholder and industrial closed-canopy oil palm plantations. Earth System Science Data, 13(3), 1211-1231.
49. Gaveau, D.L.A. (2022). Slowing deforestation in Indonesia follows declining oil palm expansion and lower oil prices. PLoS ONE, 17(3), e0266178.
50. Meijaard, E. (2020). The environmental impacts of palm oil in context. Nature Plants, 6(12), 1418-1426.
51. Escobar, N., Seber, G., Skalsky, R., Wögerer, M., Jung, M. (2024). Spatially-explicit land use change emissions and carbon payback times of biofuels under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). Science of the Total Environment, 948, 174635.
52. Ziegert, R. F., Sotirov, M. (2024). Regulatory politics and hybrid governance: The case of Brazil's Amazon Soy Moratorium. Global Environmental Change, 88, 102916.

53. Carlson, K. M. (2018). Effect of oil palm sustainability certification on deforestation and fire in Indonesia. Proceedings of the National Academy of Sciences, 115(1), 121-126.
54. Morgans, C. L. (2018). Evaluating the effectiveness of palm oil certification in delivering multiple sustainability objectives. Environmental Research Letters, 13(6), 64032.
55. Santika, T. (2020). Impact of palm oil sustainability certification on village well-being and poverty in Indonesia. Nature Sustainability, 4(2), 109-119.

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