

Transboundary Haze and the Call for a Global Forest Convention

Hendra Arjuna¹, Atika Thahira²

^{1,2}Universitas Maritim Raja Ali Haji, Indonesia

Email: hendraarjuna@umrah.ac.id

Abstract

Existing global agreements related to forest governance indicate that the current approach centered on promoting synergy among various instruments is insufficient to address the persistent regulatory gaps. One of the most pressing issues is the recurring transboundary air pollution caused by forest fires in Indonesia, which significantly affects neighboring countries. Indonesia's tropical rainforests, often dubbed the lungs of the world, contribute to approximately 40% of the earth's oxygen supply, underscoring their global environmental importance. Despite the existence of numerous international treaties that partially regulate forest-related activities, there remains no single, comprehensive international legal instrument that fully integrates all three pillars of sustainable development environmental, social, and economic in the context of forest ecosystems. This study employs a doctrinal legal research method using statutory, conceptual, and case study approaches. It concludes that the fragmented and sectoral nature of existing agreements hinders the achievement of sustainable forest management. Accordingly, this article advocates for a paradigm shift by expanding the scope and mandates of existing frameworks such as the Convention on Biological Diversity (CBD) and the World Trade Organization (WTO) to explicitly include sustainable forest governance. Furthermore, the article emphasizes the importance of cooperative mechanisms in addressing transboundary hazardous air pollution and proposes the establishment of a single, unified international convention on forests. Such a convention would provide a holistic and legally binding framework to strengthen forest protection, promote sustainable use, and enhance international collaboration.

Keywords: *Transboundary Haze, Forest Fires, Air Pollution, International Convention.*



A. INTRODUCTION

The intersection of law, forest governance, and climate policy presents urgent challenges in both global and national contexts. A significant body of scholarship has highlighted the complex legal dimensions surrounding tropical forests, carbon management, and the rights of indigenous peoples and local communities (Law, Tropical Forests and Carbon, 2013). Among the most critical environmental threats emerging within this domain is the increasing prevalence and severity of forest fires. In recent years, the frequency and intensity of wildfires have reached unprecedented levels, inflicting widespread destruction on ecosystems and human settlements alike. This alarming trend is closely linked to rising global temperatures, making wildfire risk reduction a pressing priority in the context of climate adaptation and resilience strategies (Environment, 2022).

Projections indicate that extreme wildfire events will become more common, even in regions previously unaffected. This escalation is driven by a combination of climate change and land-use transformations, both of which exacerbate the underlying conditions that fuel uncontrollable wildfires. These extreme fire events

pose severe threats to biodiversity, ecological stability, and human health, while simultaneously releasing vast quantities of greenhouse gases into the atmosphere thereby further accelerating global climate change (Environment, 2022).

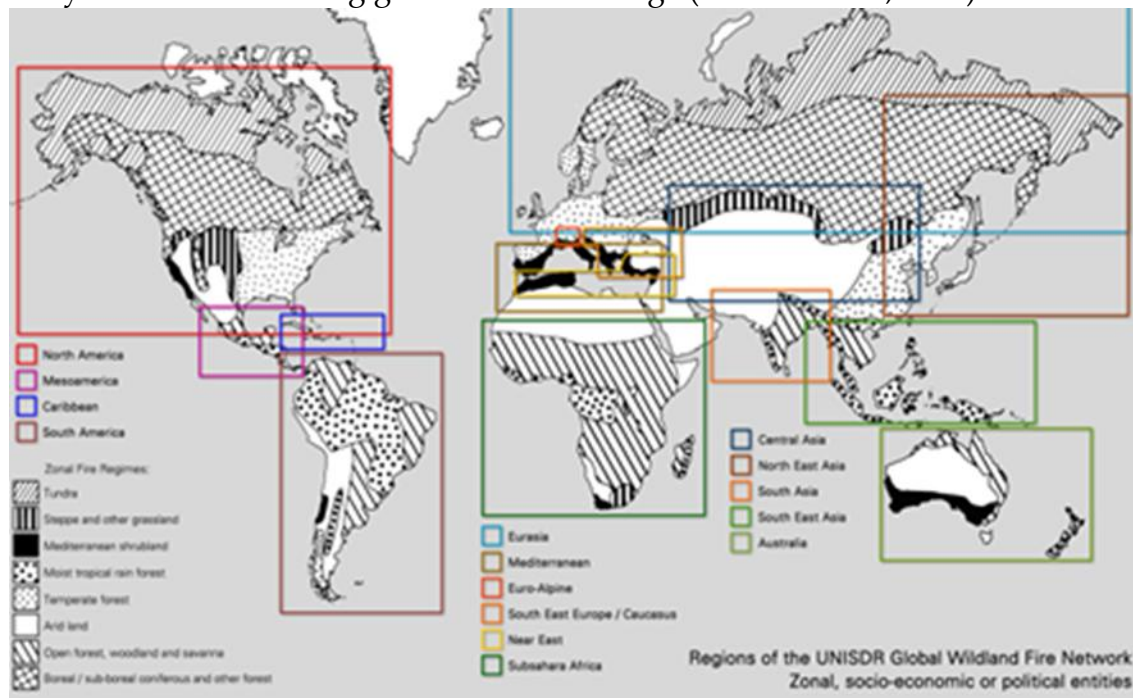


Figure 1 UNISDR Global Wildland Fire Network (UNISDR, 2024)

Several factors contribute to the occurrence and spread of forest fires, with environmental and anthropogenic variables playing significant roles. Temperature and annual precipitation are critical climatic parameters influencing fire ignition and propagation. In addition to these natural factors, human activities such as the development of roads, settlements, and agricultural expansion substantially increase fire risks by altering land cover and introducing ignition sources (Haydar et al., 2024). A particularly complex consequence of large-scale forest fires is transboundary haze, which refers to air pollution that travels across national borders. This phenomenon, predominantly caused by smoke from forest and land burning, poses a major environmental and public health threat in Southeast Asia (Tan et al., 2017). Driven by slash-and-burn agricultural practices and worsened by changing climatic conditions, transboundary haze highlights the urgent need for coordinated regional efforts. Effective mitigation strategies are essential to reduce emissions and improve air quality across affected regions (Tan et al., 2017).

Addressing the increasing threat of forest fires is critical to minimizing their environmental, economic, and social impacts (Haydar et al., 2024; Weishaar & De Graaf, 2023). A unified international legal framework through the consolidation of existing forest-related regulations into a single convention could play a pivotal role in enabling the development and enforcement of robust national-level forest management strategies. Such an approach would not only support the sustainable use of forest resources but also promote the well-being of local communities dependent on forest ecosystems.

B. METHOD

This study employs a non-doctrinal legal research method with an empirical and qualitative approach. Empirical legal research investigates how law operates within society, focusing on aspects such as legal effectiveness, compliance, institutional functions, and societal impacts (Salim & Nurbani, 2013). The study adopts an inductive epistemological stance, aiming to uncover legal truths grounded in observable reality (Guba, 1990). Both primary and secondary data are utilized. Primary sources include legislation, court rulings, and official regulations, while secondary sources comprise scholarly analyses such as law reviews and legal commentaries (Olson, 2021; Leeuw & Schmeets, 2016).

Legal data were gathered through a combination of fieldwork and literature review, processed via standard qualitative procedures: data collection, validation, editing, and coding (Creswell, 2016). Online and print legal resources were integrated throughout the research process (Sloan, 2018), with online searches conducted systematically selecting platforms, search techniques, executing queries, and filtering results to obtain reliable evidence of increasing forest loss. This evidence supports the study's central aim: to advocate for the establishment of a unified international convention on forests.

C. RESULTS AND DISCUSSION

1. Forest Degradation Caused by Forest Fires

The rapid degradation of tropical forests has become a global concern over the past five decades, largely due to their critical role in preserving biodiversity, sustaining indigenous and traditional communities, and providing essential ecosystem services and livelihoods for over one billion of the world's poorest people. Among the primary drivers of this degradation are forest fires, which are increasingly influenced by land-use change and climate change. According to a recent analysis by the United Nations Environment Programme (UNEP), the frequency and intensity of wildfires are expected to rise significantly. Projections estimate a global increase in extreme wildfire events by 14% by 2030, 30% by 2050, and up to 50% by the end of the century (UNEP, 2022). This trajectory underscores the urgent need for coordinated international and national responses to mitigate fire-related forest loss and its far-reaching ecological and socio-economic consequences.

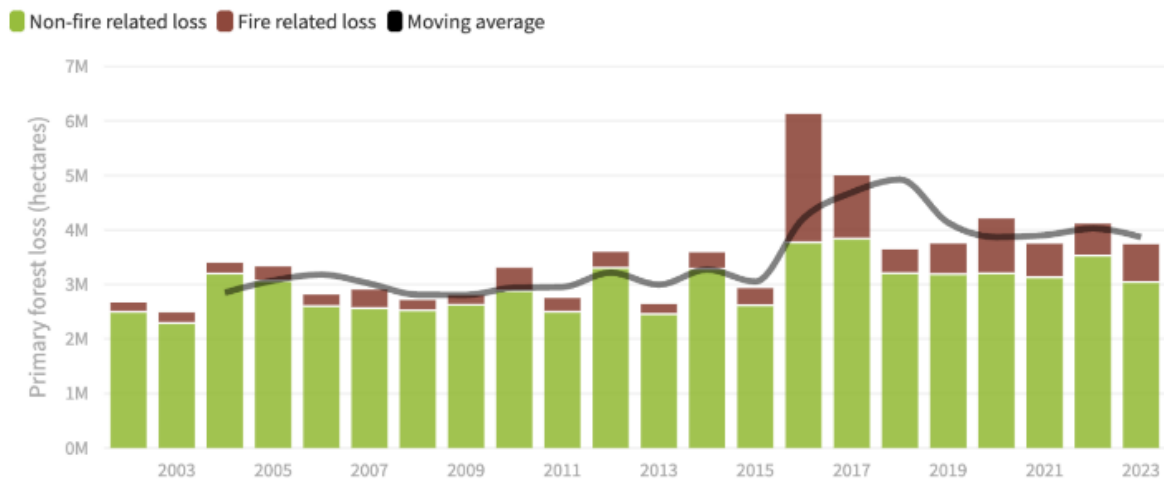


Figure 2 Tropical Primary Forest Lost (Forest Pulse, 2024)

One of the major contributors to forest degradation is wildfire. Forest fires not only lead to the immediate destruction of ecosystems, but also have profound implications for the global carbon cycle. As vegetation represents the most dynamic component of the terrestrial carbon system, disturbances such as fires or logging rapidly alter carbon fluxes and significantly increase atmospheric CO₂ concentrations (Law, Tropical Forests and Carbon, 2013). These emissions contribute to the acceleration of climate change, creating a feedback loop that further intensifies the frequency and severity of forest fires.

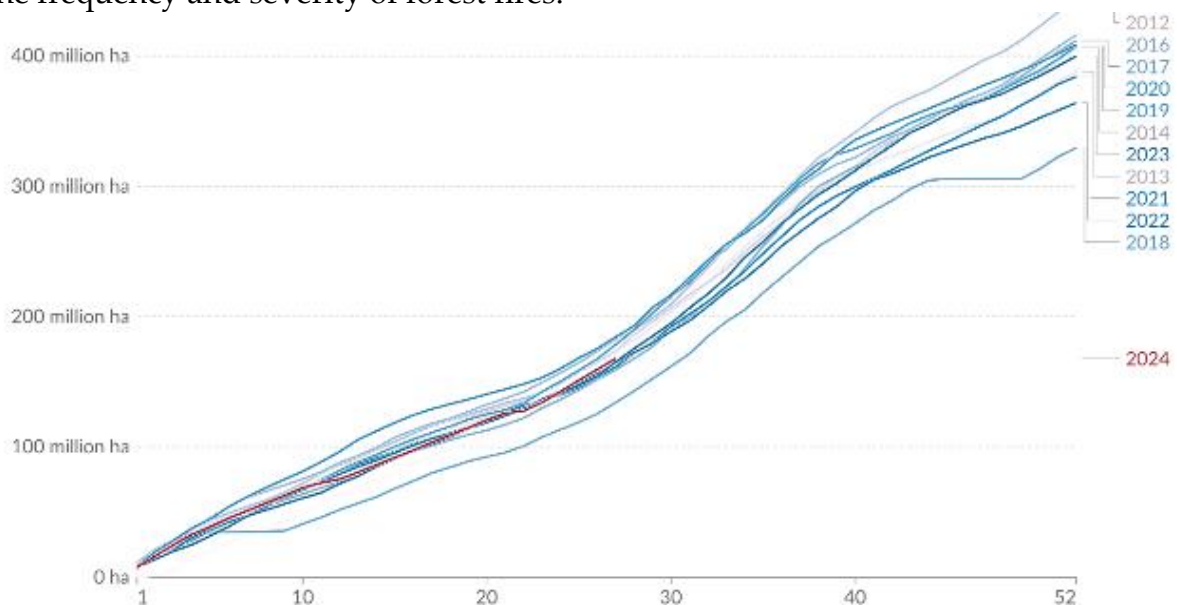


Figure 3 Cumulative Area Burnt by Wildfires (Cumulative Share of the Land Area Burnt by Wildfires by Week, 2024)

Effective management of transboundary hazardous air pollution—particularly haze resulting from forest fires requires robust cooperation among neighboring states. Cross-border environmental challenges cannot be addressed unilaterally; they demand coordinated legal and institutional frameworks that facilitate joint monitoring, information sharing, and enforcement mechanisms. Given the recurring and intensifying nature of transboundary haze events, especially in

Southeast Asia, there is an urgent need to institutionalize regional cooperation through binding international instruments. In this context, the proposal to establish a comprehensive international convention on forests emerges as a strategic and necessary step. Such a convention could provide an integrated legal framework for forest governance, fire prevention, and sustainable land management while also enhancing accountability and promoting global environmental justice.

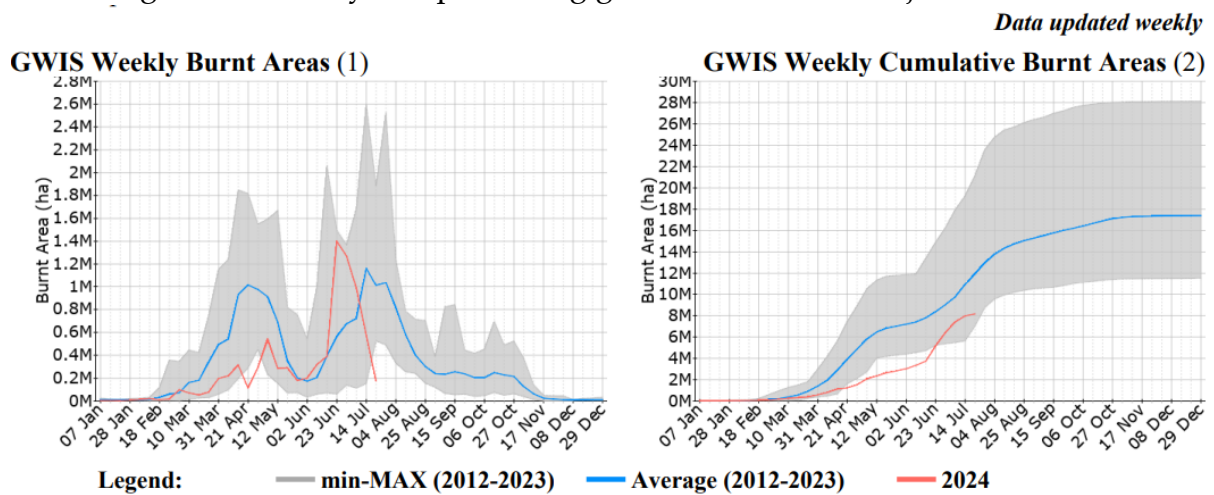


Figure 4 Burn Area (GWIS - Statistics Portal, 2024)

As demonstrated by the data and analysis presented above, the establishment of a dedicated international convention on forests is critically important in addressing contemporary environmental challenges (Eikermann, 2015). At present, there is no single, comprehensive international legal instrument governing forest management. Instead, fragmented and non-binding international forest-related arrangements exist, often embedded within broader environmental or climate agreements, lacking the specificity and enforceability required to address pressing forestry issues effectively. This legal gap has significant implications for transboundary environmental problems, particularly those involving hazardous air pollution caused by forest fires. In the case of Indonesia and its regional neighbors, the absence of a binding global forest convention has hindered effective international cooperation and accountability in managing cross-border haze pollution. Without a coherent and enforceable legal framework, efforts to mitigate the impacts of forest degradation and transboundary air pollution remain fragmented and insufficient.

2. Special Measures to Address Forest Fires in Special Areas

This study identifies specific areas within the region that are at heightened risk of forest fires, emphasizing the urgent need for targeted and location-specific mitigation strategies. The findings contribute to the development of predictive tools and preparedness measures that support informed decision-making for reducing the threat of wildfires. Empirical analysis indicates that ensemble learning models particularly the Random Forest (RF) algorithm outperform other predictive models such as XGBoost and logistic regression in assessing wildfire vulnerability. Evaluation metrics, including the F1-score and AUC, reinforce the effectiveness of

RF in accurately identifying fire-prone areas (Sohail et al., 2023). These insights hold significant value for researchers, fire management professionals, and policymakers by offering evidence-based guidance for the development of strategic, data-driven fire prevention and response plans.

Moreover, this study assessed wildfire risks not only in ecological terms but also in relation to human populations and infrastructure, underlining the multifaceted impact of such hazards. Future research is recommended to incorporate additional environmental and anthropogenic variables to further refine wildfire risk modeling, particularly in high-risk regions such as Pakistan. A useful regulatory parallel can be drawn from maritime law, specifically the International Convention for the Prevention of Pollution from Ships (MARPOL), which designates “special areas” where stricter operational standards are enforced (Thahira, 2023). A similar framework for forest fire-prone zones could enable the application of mandatory protective measures in ecologically sensitive or high-risk terrestrial areas. This highlights the necessity of establishing an international regulatory mechanism that recognizes and governs such special areas with enhanced legal and environmental safeguards.

3. Haze Pollution and Its Effects

If current levels of greenhouse gas emissions persist, tropical forest regions such as those in Indonesia and the southern Amazon are projected to experience a substantial increase in fire activity (Environment, 2022). The escalation in forest and peatland fires, particularly in Indonesia, has become a recurring environmental crisis. These fires generate thick, toxic haze that extends beyond national borders, severely impacting ecosystems, infrastructure, agriculture, and public health across equatorial Southeast Asia (Astuti & Fatimah, 2024). The environmental damage caused by these fires is multifaceted. They disrupt ecological processes, destroy biodiversity, and contribute significantly to land-based carbon emissions. Historical parallels can be drawn from pre-industrial Europe, where unchecked deforestation by the mid-1800s had led to the near-collapse of forest ecosystems and posed a threat to economic stability (Fisher, 2016). Such lessons underscore the urgency of forest conservation in developing regions facing similar pressures today.

Haze pollution has increasingly transboundary implications. Malaysia, for instance, is frequently affected by haze originating from large-scale vegetation fires in Sumatra, Indonesia. These fires release substantial amounts of particulate matter, especially PM₁₀, leading to critical air quality deterioration, particularly in Malaysia’s southern and central regions (Rahim et al., 2023). The haze poses serious risks to respiratory health and exacerbates existing environmental vulnerabilities. This situation illustrates a broader environmental governance gap. While the effects of transboundary haze are regional, the underlying causes land burning, inadequate regulation, and climate change require a coordinated international response. The persistence and severity of haze pollution highlight the urgent need for a comprehensive international convention on forests. Such a framework could

standardize regulations, enhance monitoring and enforcement mechanisms, and promote sustainable land management practices across borders to mitigate the occurrence and impact of forest fires and associated air pollution.

4. The Ambiguity of Forest Fire Management

The global rise in the frequency and severity of forest fires highlights significant shortcomings in the existing governance structures, particularly the lack of a cohesive international regulatory framework. The Tanzanian case exemplifies how ambiguity in fire management emerges from fragmented responsibilities and uncoordinated initiatives among diverse actors. Despite numerous strategies and interventions to control wildfires, efforts remain largely disjointed, hindered by conflicting understandings of fire's role in forest ecosystems and land-use practices (Erkkilä et al., 2024). This divergence in knowledge framing creates institutional ambiguity, which obstructs collaboration and impedes the transition toward sustainable forest-based economies. Effective forest fire management requires not only technical expertise but also a shared understanding of causes, consequences, and mitigation strategies. The increasing intensity of fires globally demands the development of robust methodologies to assess, predict, and respond to wildfire risks (Mehmood et al., 2024). A comprehensive grasp of both natural and anthropogenic fire drivers equips agencies and policymakers with the tools necessary to implement targeted prevention and mitigation measures.

The case of Turkey further underscores the urgent need for regulatory reform. The country experiences approximately 2,000 forest fires annually, with human activity accounting for nearly half of all incidents. When unknown causes are included, the percentage rises to 71%, highlighting the significant role of weak legal enforcement and the absence of comprehensive fire management strategies (Elvan et al., 2021). Similarly, Ferretti et al. (2024) emphasize the necessity of enhancing fire risk assessment frameworks and institutional capacity especially in light of compounding factors such as climate change and natural disasters. Currently, the governance of forest fires is addressed through fragmented and sectoral international regimes. As noted in section 2, there is no single international legal instrument specifically dedicated to forests. This regulatory dispersion leads to uncertainty regarding applicable norms, undermining the effectiveness of forest fire prevention and management at both national and global levels. The lack of a unified international framework results in policy gaps, inconsistent standards, and ineffective enforcement, ultimately exacerbating the risks posed by forest fires.

5. The International Regulation for Forests

The establishment of a comprehensive international convention on forests remains a critical yet unrealized objective in global environmental governance. Despite increasing recognition of the ecological, economic, and social importance of forests, regulatory efforts remain fragmented and insufficiently coordinated. Wildfires driven by both anthropogenic and natural causes exemplify the urgency of

such a convention. Human-induced fires result from intentional land clearing, negligence in extinguishing open burns, and uncontrolled prescribed burns. Natural causes, such as lightning strikes, also contribute. These events have wide-ranging and escalating consequences: direct fatalities, large-scale displacement, destruction of property and ecosystems, and the release of harmful particulates that deteriorate air quality and human health. Moreover, wildfires emit significant amounts of carbon dioxide, exacerbating climate change and threatening long-term ecological stability (Samborska et al., 2024).

Although numerous international frameworks have emerged since 2011 such as those addressing ecosystem services, REDD+ (Reducing Emissions from Deforestation and Forest Degradation), resilience, urban forestry, the bioeconomy, and global public health none have culminated in a single, legally binding forest convention (Park et al., 2023). These initiatives, while valuable, are sectoral and limited in scope. The absence of a unified, enforceable international legal instrument dedicated to forest governance hampers global efforts to address deforestation, wildfire management, transboundary pollution, and climate-related risks. Establishing such a convention would provide the necessary legal infrastructure to harmonize forest protection efforts across borders, strengthen international cooperation, and embed forest governance more firmly within the broader climate and sustainable development agendas. To date, no comprehensive international convention specifically dedicated to forest governance has been established. Instead, forest-related issues are addressed through a patchwork of loosely defined arrangements and scattered references within broader international agreements. These fragmented provisions lack binding force and coherence, thereby limiting their effectiveness in addressing the complex and transboundary nature of contemporary forestry challenges.

Table 1 Selected Multilateral Environmental Agreements (MEAs) Relevant to Forest Governance

Convention	Adoption Date	Entry into Force	Number of Parties (as of specified date)	Website
Most Important in Terms of Forests				
UN Framework Convention on Climate Change (UNFCCC)	09/05/1992	21/03/1994	186 (as of 01/05/2001)	www.unfccc.org
Convention on Biological Diversity (CBD)	05/06/1992	29/12/1993	180 (as of 21/06/2001)	www.biodiv.org
UN Convention to Combat Desertification (UNCCD)	17/06/1994	26/12/1996	174 (as of 15/06/2001)	www.unccd.int
Other Conventions of Relevance (by adoption date)				
Ramsar Convention on Wetlands	02/02/1971	21/12/1975	124 (as of 12/08/2001)	www.ramsar.org
World Heritage Convention (WHC)	16/11/1972	17/12/1975	164 (as of 15/05/2001)	www.unesco.org/whc
CITES (Trade in Endangered Species)	03/03/1973	01/07/1975	154 (as of 08/05/2001)	www.cites.org
Vienna Convention for the Protection of the Ozone Layer	22/03/1985	22/09/1988	177 (as of 15/06/2001)	www.unep.org/ozone
ILO Convention 169 on Indigenous and Tribal Peoples	27/06/1989	05/09/1991	14 (as of 01/05/2001)	www.ilo.org

International Tropical Timber Agreement (ITTA)	26/01/1994	01/01/1997	56 (as of 01/05/2001)	www.itto.or.jp
World Trade Organization (WTO)	15/04/1994	01/01/1995	141 (as of 03/05/2001)	www.wto.org

As illustrated in Table 1, the pressing and existential nature of environmental issues has prompted an urgent call for action at both the national and international levels. Once agreed upon as policy responses to environmental challenges, environmental principles are expected to serve a significant function in addressing such issues. Action is now imperative in order to apply these principles effectively (Scotford, 2017). One such principle the principle of international cooperation—is particularly relevant in the context of transboundary haze pollution caused by forest fires. Managing this form of hazardous air pollution can be advanced through cooperative mechanisms that support the creation of an international convention on forests. At the regional level, significant developments have already occurred. For instance, the ASEAN Agreement on Transboundary Haze Pollution, which builds upon the 1995 ASEAN Co-operation Plan on transboundary pollution, represents a proactive regional approach. This agreement aims to regulate atmospheric pollution and establish procedures for cooperation among member states to prevent, reduce, and mitigate the effects of haze and forest fires (Bodansky et al., 2021). However, while this is a promising model, it underscores the need for a more unified and global framework for forest governance.

The legal structure governing such matters is primarily formed at the international level, where environmental principles are embedded into broader frameworks of international environmental law. These legal rules often pursue multifaceted objectives and must be incorporated into environmental treaties due to their significant ecological implications. Historical examples include early fisheries agreements, originally intended to prevent conflict and protect coastal economies, which have subsequently contributed to the sustainable use of marine resources. Similarly, EU regulations on internal combustion engines, initially adopted for trade facilitation, have resulted in reduced emissions and environmental impacts. These examples demonstrate how international legal norms—though not always conceived with ecological purposes in mind can yield substantial environmental benefits (Dauvergne, 2005; Kiss & Shelton, 2007).

In the realm of international law, bilateral and multilateral treaties whether referred to as conventions, protocols, agreements, or covenants are the primary instruments for developing new legal norms. Over 2,500 international environmental treaties are currently in force, reflecting the global community's evolving commitment to environmental governance. At the core of many of these treaties lies the foundational principle of good neighborliness, articulated in the Latin *maxim sic utere tuo ut alienum non laedas* ("use your own property so as not to harm the property of others"). This concept, closely aligned with the Golden Rule of reciprocity, forms the legal and moral basis for managing transboundary environmental harms, including forest fires and haze (Nanda & Pring, 2013).

This study therefore contributes to ongoing discourse by offering new insights into the need for a unified global forest policy. It proposes the formulation of a single, comprehensive international convention on forests one that integrates ecological, legal, and socio-political dimensions of forestry. Such a framework would provide a foundation for the implementation of sustainable forestry, including revegetation projects, carbon sink preservation, and biodiversity protection. Ultimately, the establishment of a globally binding forest convention is not only timely but essential for ensuring forest governance that is legally coherent, ecologically effective, and globally inclusive (Scotford, 2017).

D. CONCLUSION

This study highlights the urgent need for a comprehensive international framework to effectively address the growing issue of air pollution resulting from forest fires, particularly those that cross national boundaries. The findings reveal that current international agreements are insufficient in capturing the complex dimensions of forest governance and the transboundary impacts of haze pollution. In response to these shortcomings, the research proposes the establishment of a unified international convention on forests. Such a convention would serve as a legal and institutional platform for enhancing cross-border cooperation, standardizing forest management practices, and fostering accountability among nations. It would also provide much-needed clarity and consistency in the global regulatory landscape governing forests.

Moreover, this study stresses the importance of integrating scientific data and empirical evidence particularly concerning forest degradation and loss—into policy-making processes. This evidence-based approach is critical for designing effective strategies to prevent and mitigate the ecological, social, and economic impacts of forest fires. Ultimately, the research concludes that only through collaborative international action and the development of a legally binding, globally accepted convention can the international community ensure the protection and sustainable management of the world's forests. Such a framework is essential not only for safeguarding ecosystems and biodiversity but also for securing a healthier and more resilient environment for present and future generations.

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