**Review Article**

**Open Grazing and Agricultural Decline in the Sahel: Economic Costs, Legal Challenges, and Environmental Impacts**

**Abstract**

Open grazing remains one of the most contentious land-use practices in the Sahel region, contributing to widespread agricultural, economic, and environmental instability. This manuscript investigates the economic effects of open grazing by synthesizing cross-disciplinary evidence from policy reports, empirical research, and legal documents. The study utilizes qualitative analysis through literature review and identifies key impact areas including crop destruction, reduced agricultural investment, household income loss, ecological degradation, and governance failures. It reveals that grazing-induced land conflicts and crop damage result in significant economic losses, with cascading effects on food security, labor productivity, and rural livelihoods. Furthermore, the research uncovers how weak enforcement of anti-grazing laws and absence of alternative pastoral systems hinder effective reform. Ecological assessments demonstrate that overgrazing leads to biodiversity loss, erosion, and declining soil fertility, worsening the region’s vulnerability to climate change. Legal analysis shows fragmented policies and resistance from national elites undermine local regulatory efforts. In response, the manuscript proposes multi-dimensional reform strategies including rotational grazing systems, land tenure security, legal harmonization, and inclusive conflict resolution frameworks. Through this holistic analysis, the study underscores the urgent need for policy integration and sustainable land management to address the intersecting economic, social, and environmental crises exacerbated by open grazing in the Sahel.

**Keywords:** Open Grazing; Agricultural Loss; Food Insecurity; Conflict Escalation; Sahel Region

**1. Introduction**

The Sahel, a transitional zone between the Sahara Desert and the more humid savannas to the south, is one of Africa's most ecologically fragile and socioeconomically dynamic regions. It hosts millions of pastoralists and agro-pastoralists whose livelihoods depend on the availability of pasture and water for livestock, and arable land for food production (Asresie and Zemedu, 2015). In recent decades, the region has become a hotspot for conflict, food insecurity, and ecological degradation problems often linked to the increasing prevalence and unsustainability of open grazing practices (McGuirk and Nunn, 2020; Hiernaux et al., 2009). Traditionally, nomadic and transhumant pastoralism thrived in the Sahel through a reciprocal relationship with sedentary farming communities. Livestock grazed crop residues, fertilized farmland, and supported seasonal economic exchange (Ducrotoy et al., 2016; Jia et al., 2020). However, climate variability, expanding cultivation, and demographic growth have undermined this symbiosis. Pastoralists increasingly encroach on farmlands due to shrinking grazing corridors, leading to violent disputes and economic disruption (Kleisner et al., 2019; Chukwuemeka et al., 2018). In Nigeria alone, thousands of lives and millions of dollars in agricultural value are lost annually due to farmer-herder clashes (Fadare et al., 2024).

Simultaneously, open grazing has contributed to soil degradation, loss of biodiversity, and declining agricultural yields. High grazing intensity alters vegetation composition, depletes biomass, and accelerates erosion (Fashir et al., 2016; Gebregergs et al., 2019). In many Sahelian countries, attempts to transition to ranching or regulated systems face sociopolitical resistance and institutional fragmentation (Adejumo, 2021; Kwaja and Ademola-Adelehin, 2017). Anti-open grazing legislation has been met with opposition from groups citing constitutional rights to free movement and economic participation (Agbo, 2021; Akoni et al., 2021). Others argue that poor enforcement and political interference render such laws ineffective (Akinrefon, 2021; John et al., 2021).

This paper investigates the economic consequences of open grazing in the Sahel region by integrating ecological, institutional, and household-level perspectives. It aims to demonstrate how grazing-induced land degradation and conflict reduce food production, raise transaction costs, and destabilize livelihoods. Using a synthesis of empirical and policy literature, the study underscores the need for coordinated reforms in land governance, livestock management, and conflict resolution strategies.

**1.1. Justification for the Study**

The persistence of open grazing in the Sahel represents a critical development paradox. While livestock remains a central pillar of rural economies and nutrition, its current mode of production undermines long-term agricultural sustainability and inter-communal peace (Amole et al., 2022). Across countries like Nigeria, Mali, and Sudan, the expansion of cultivation into grazing lands and the southward shift of herders have exposed the region to escalating conflict and institutional strain (Balarabe, 2021; Mbih, 2020). Moreover, agricultural losses due to grazing-related destruction are underreported and rarely monetized in policy evaluations. This study fills a significant research gap by systematically analyzing the economic impacts of open grazing beyond the physical realm of land use. It considers income loss from crop damage, the opportunity cost of diverted agricultural labor, conflict management expenditures, ecological restoration needs, and broader market distortions. It also situates the open grazing challenge within regional and global debates on sustainable food systems, biodiversity protection, and environmental justice (Alkemade et al., 2013; Ogboru and Adejonwo-Osho, 2018). By synthesizing findings from across the Sahel and using authoritative scientific and policy references, this work provides a holistic assessment that can guide future land-use planning, agricultural policy, and livestock reform agendas.

**2. Methodology**

This study employed a scoping review approach to systematically explore the economic and ecological effects of open grazing in the Sahel. The methodology was adapted from the foundational framework of Arksey and O’Malley (2005), which emphasizes mapping the key concepts and evidence sources relevant to a research domain. The process was further guided by enhancements proposed by Levac et al. (2010) to incorporate stakeholder relevance and iterative data refinement, and by Tricco et al. (2016) to ensure rigorous reporting standards for scoping studies. The review involved identifying and retrieving literature from peer-reviewed journals, grey literature, and policy reports spanning agriculture, environment, and conflict studies. Databases such as Scopus, Google Scholar, and institutional repositories were used, with Boolean combinations of terms like “open grazing,” “pastoralism,” “Sahel,” “agricultural productivity,” and “household welfare.” Literature published between 2000 and 2025 was prioritized to ensure contemporary relevance. Inclusion criteria focused on studies that explicitly examined the intersection of grazing systems and economic, social, or ecological outcomes. Excluded were works that addressed livestock production in non-Sahelian contexts or those lacking empirical or policy-based insights. The selected literature was subjected to thematic analysis to extract patterns across dimensions such as productivity, labor use, land degradation, and legal frameworks. The methodological rigor of each source was evaluated based on transparency, relevance, and citation quality. This scoping methodology enabled the synthesis of diverse perspectives and supported the holistic framing of the research problem as presented in this manuscript.

**3.1. Economic Impacts on Agricultural Productivity**

The encroachment of livestock on cropland is a major source of economic loss in the Sahel. Open grazing facilitates uncontrolled movement of herders and animals across farmlands, leading to direct destruction of growing crops and post-harvest produce. Studies in Nigeria have shown that such destruction reduces yields by up to 35 percent in affected zones, particularly during the dry season when fodder is scarce (Gever, 2019; Fashir et al., 2012). Farmers lose not only harvests, but also future planting capacity, as compacted soils and uncollected manure inhibit regrowth and soil regeneration (Hiernaux et al., 1999; Gebrekiros and Tessema, 2018). Further compounding these losses are indirect effects on agricultural investment. Many farmers in Benue, Plateau, and Taraba states in Nigeria have abandoned cultivation or switched to less profitable crops to reduce conflict risk (Kwaja and Ademola-Adelehin, 2017). In Ethiopia and Sudan, similar trends are observed where households avoid farming plots near known grazing routes (Gebremedhn et al., 2022; Abdelrahim and Abdalla, 2015). This displacement reduces agricultural intensity and undermines national food security efforts as seen in **Table 1.**

**Table 1: Economic Impacts of Open Grazing**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Impact Category** | **Estimated Effect** | **Impact Type** | **Location/Region** | **Reference** |
| Crop Yield Losses | 10-30% reduction in yield | Agricultural Productivity | South Kordofan | Fashir et al., 2016 |
| Livestock Productivity Decline | Lower milk/meat production due to stress and disease | Livestock Health | Kachia Grazing Reserve, Nigeria | Ducrotoy et al., 2016 |
| Conflict-related Economic Losses | Millions lost annually in displaced production | Conflict Economics | Northwest Cameroon | Mbih, 2020 |
| Market Disruptions | Blockade of trade routes in conflict zones | Market Access | Nigeria | Fadare et al., 2024 |
| Household Income Reduction | Income decline in conflict-affected zones | Rural Livelihood | Nigeria | Chukwuemeka et al., 2018 |

Long-term degradation of croplands by repeated grazing can lead to desertification. In Senegal’s Sahelian plains, Miehe et al. (2010) documented a 40 percent loss in productive biomass over 27 years due to continuous livestock pressure. Vegetation becomes dominated by unpalatable forbs and invasive species, reducing both crop viability and grazing value (Gemedo-Dalle and Isselstein, 2006). Such changes undermine ecological resilience and reduce land productivity, which in turn affects regional gross domestic product from agriculture.

**3.2. Household Welfare and Labor Allocation**

Open grazing also impacts households through welfare and labor distortions. In the absence of adequate fencing or grazing regulation, rural families are often forced to patrol their farmlands, diverting labor from productive agricultural or income-generating activities (Hadush, 2019). Women and children are disproportionately affected, as they are often tasked with guarding fields or fetching water for livestock displaced by encroaching herds (Cooke et al., 2008; Tangka and Jabbar, 2005). In Ethiopia, Hadush (2019) used a two-stage least squares model to show that grazing and water scarcity negatively influence per capita food consumption expenditure. Households experiencing resource competition from livestock diverted time from food preparation and agricultural work to forage collection. In Nigeria, studies by Fadare et al. (2024) show that livestock diversification mitigates some of these impacts but does not fully shield families from the economic shocks of conflict-induced grazing disruptions. The cost of conflict-related food price inflation further reduces household purchasing power. Data from Anambra and Benue states show that food prices increased by up to 20 percent in regions affected by open grazing, largely due to damaged supply chains and increased cost of production (Muoneke and Okoli, 2020). These shifts disproportionately harm low-income households, exacerbating inequality and food insecurity.

**3.3. Conflict, Security, and Governance Costs**

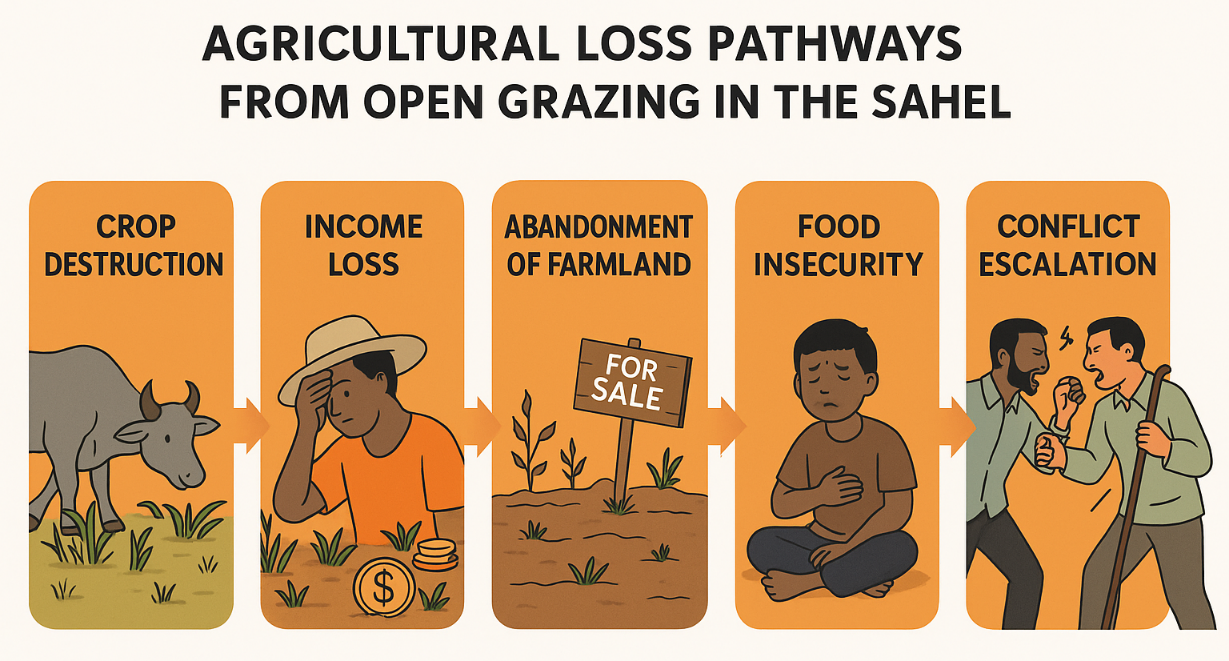
Farmer-herder conflicts linked to open grazing have become one of the deadliest and economically damaging security challenges in the Sahel. In Nigeria alone, nearly 8,000 people were killed in such conflicts between 2000 and 2016 (Usman and Nichol, 2022). Beyond human loss, these clashes destroy farm equipment, livestock assets, and local infrastructure such as storage facilities and irrigation networks (Odoh and Chilaka, 2012; Ojewale, 2021). Security expenditures in affected regions have escalated, with states deploying police and military forces to contain violence. Local governments also invest in conflict mediation mechanisms, compensation funds, and crisis relief for displaced communities (Ogo-Oluwa, 2017). In many cases, however, these interventions are reactionary rather than preventive, lacking structural solutions to land-use competition and pastoral regulation. Open grazing also fuels ethnic and political tensions. Legislative responses such as the Open Grazing Prohibition and Ranches Establishment Law in Benue State have faced constitutional challenges, resistance from herder organizations, and uneven federal support (Adejumo, 2021; Balarabe, 2021). The failure to enforce these laws or provide alternative livelihoods for pastoralists has led to widespread defiance and erosion of public trust in institutions (John et al., 2021; Akoni et al., 2021).

**3.4. Ecological Degradation and Long-term Soil Value**

Grazing pressure contributes significantly to environmental degradation across the Sahel. High livestock density compacts soil, reduces moisture retention, and alters nutrient cycling (Amiri et al., 2008; Gebregergs et al., 2019). Vegetation shifts from palatable grasses to woody plants and invasive forbs are commonly observed under high grazing pressure, leading to reduced forage quality and loss of biodiversity (Gebremedhn et al., 2023; Vesk and Westoby, 2001). Studies in Ethiopia and Mali have demonstrated that unmanaged grazing reduces the carbon sequestration potential of drylands, contributing to greenhouse gas emissions and undermining global climate goals (Gao et al., 2007; Gebremedhn et al., 2022). The Sahel is already vulnerable to desertification due to erratic rainfall and overexploitation, and open grazing accelerates these processes by stripping the land of vegetative cover (Le Houérou, 2002). Restoration of degraded rangelands through exclusion or rotation systems can reverse some of this damage, as seen in community-led initiatives in Tigray and Borana (Noulèkoun et al., 2021; Mekuria et al., 2018). However, these strategies require strong local institutions, incentives for compliance, and support from national policy frameworks.

**3.5. Legal Frameworks and Political Economy of Enforcement**

The legal and institutional responses to open grazing in the Sahel have been fragmented and politicized. In Nigeria, while several southern and Middle Belt states have enacted anti-open grazing laws, their enforcement is undermined by federal centralization of security powers and elite interests in pastoral systems (Nnamani et al., 2024; Gever, 2019). National actors often block sub-national initiatives on the grounds of ethnic discrimination or constitutional overreach (Agbo, 2021; Akoni et al., 2021). This tension reflects a broader political economy in which the state apparatus serves the interests of dominant groups, including urban-based livestock traders and powerful pastoral unions (Kwaja and Ademola-Adelehin, 2017; Opejobi, 2021). Judicial ambiguity and inconsistent messaging from federal officials worsen the policy vacuum. While courts have upheld the legality of state-level bans (Agbo, 2021), federal ministers have issued statements declaring such laws unconstitutional (Adejumo, 2021), creating uncertainty and emboldening resistance. Beyond legality, the absence of economic alternatives for pastoralists limits the viability of transition to ranching. Establishing grazing reserves, water points, and mobile veterinary systems requires investment and stakeholder buy-in. Without inclusive planning and compensation mechanisms, any enforcement is likely to provoke social unrest (Fashir et al., 2016; Ogboru and Adejonwo-Osho, 2018).



**Fig 1. Flow diagram illustrating how open grazing affects the Sahel Region**

**Source: author’s creation**

**4. Proposed Strategies for Reform and Transition**

Addressing the economic and environmental consequences of open grazing in the Sahel requires multi-level, interdisciplinary reforms that combine legal regulation, infrastructural investment, and socio-cultural transformation. The following strategic directions are proposed:

**4.1. Institutionalizing Rotational and Enclosed Grazing Systems**

One of the most practical pathways toward sustainable livestock production is the shift from open grazing to managed, rotational, or enclosed systems. Research has shown that such practices restore soil structure, improve vegetation regrowth, and enhance carbon sequestration (Gebremedhn et al., 2022; Mekuria et al., 2018). In countries like Ethiopia, the use of grazing enclosures has increased soil organic carbon stocks and improved biodiversity (Noulèkoun et al., 2021). Rotational grazing also reduces herd migration distances, minimizing contact with croplands and decreasing conflict risk (Amole et al., 2022). To institutionalize this, governments must provide subsidies and incentives for communities and private investors to establish ranches, paddocks, and community-managed pastures. Technical support for fodder cultivation, water harvesting, and disease control will enhance uptake, particularly if embedded in broader rural development frameworks (Ash et al., 2011; Oba et al., 2000).

**4.2. Strengthening Land Tenure and Land-Use Zoning**

Ambiguity in land rights is a root cause of farmer-herder conflict in the Sahel. In many regions, pastoralists move based on customary routes without formal recognition, while sedentary farmers cultivate on unregistered or communally held land. This lack of codified land tenure leads to disputes and complicates enforcement of grazing bans (Ogo-Oluwa, 2017; Ogboru and Adejonwo-Osho, 2018). Land-use zoning and mapping of transhumance corridors, combined with digital land registries, can clarify ownership and permissible use. In regions such as northern Ghana and Niger, participatory land-use planning has improved cooperation between user groups (Seid et al., 2016; Gebremedhn et al., 2023). Such initiatives should be scaled across the Sahel and integrated with regional frameworks like the ECOWAS Transhumance Protocol.

**4.3. Legal Harmonization and Intergovernmental Coordination**

Conflicting messages from different arms of government undermine effective regulation. In Nigeria, for example, state-level grazing bans face obstruction from federal ministries citing constitutional guarantees of free movement (Adejumo, 2021; John et al., 2021). This contradiction emboldens herders to defy laws and encourages forum shopping for favorable jurisdictions. To overcome this, a harmonized national policy on grazing and livestock management must be negotiated through stakeholder consultations. This policy should clarify federal and state responsibilities, align with constitutional provisions, and reflect regional realities. It must also be supported by enabling legislation, conflict resolution mechanisms, and penalties for non-compliance (Balarabe, 2021; Akoni et al., 2021).

**4.4. Economic Diversification for Pastoralists**

Without viable alternatives, pastoralist communities will resist any restriction on their movement. Government and development agencies must prioritize education, livestock value chain development, and access to credit to enable transition. Support for milk processing, leather production, and veterinary service entrepreneurship can open non-pastoral income streams (Ducrotoy et al., 2016; Asresie and Zemedu, 2015). Moreover, incorporating pastoralists into early warning systems for drought and market prices can reduce their vulnerability and reliance on long-distance migration. Information and communication technologies (ICTs) such as mobile-based herd tracking, e-vouchers for fodder, and GPS-enabled grazing maps can support this integration (Gebremedhn et al., 2023; Koerner et al., 2018).

**4.5. Environmental Restoration and Monitoring**

Restoring degraded lands is not only environmentally necessary but economically beneficial. Exclusion zones, tree planting, erosion control, and reseeding of native grasses can enhance land productivity and reduce downstream effects on food systems (Miehe et al., 2010; Fashir et al., 2016). Monitoring through satellite imagery, ecological surveys, and community reporting should be institutionalized in national environmental management systems (Zainelabdeen et al., 2020; Hayes and Holl, 2003). International partners should also support these efforts through climate adaptation funds and biodiversity offset schemes. Given the global importance of the Sahel as a climate-vulnerable region, such investments serve both local and planetary interests (Alkemade et al., 2013; Le Houérou, 2002).

**5. Discussion**

The findings of this manuscript indicate a multi-dimensional burden imposed by open grazing on the socio-economic and environmental systems of the Sahel. From reduced crop yields to heightened inter-communal conflicts, the cumulative impacts threaten regional food security and sustainable land use. Gebremedhn et al. (2022) demonstrated that unregulated grazing significantly deteriorates soil organic matter and lowers vegetation cover, thereby compounding yield losses. Moreover, the labor diversion from agricultural activities to conflict mitigation and asset protection further undermines household economic resilience (Mbih, 2020). An additional consequence lies in the failure of governance mechanisms. While laws banning open grazing exist in several states, their implementation is weak due to federal-state conflicts and lack of political will (Adejumo, 2021; Akoni et al., 2021). The legal vacuum exacerbates the problem, as enforcement remains fragmented and inconsistent, often shaped by elite capture and ethnic biases (Kwaja and Ademola-Adelehin, 2017; Opejobi, 2021). The case of Benue State illustrates that despite strong anti-open grazing laws, the herder defiance continues (John et al., 2021), leading to violent flashpoints and declining agricultural investment.

Ecologically, open grazing acts as a stressor that interacts with climate variability to accelerate desertification. Le Houérou (2002) emphasizes that vegetation loss reduces carbon sequestration, aggravating climate vulnerability. Gao et al. (2007) also suggest that reduced vegetative cover increases albedo and soil erosion, leading to long-term ecological degradation. These ecological changes feed back into the economic system by diminishing land value, increasing the costs of rehabilitation, and restraining the recovery of ecosystem services (Gebrekiros and Tessema, 2018). Finally, the resilience strategies available to households and communities remain insufficient. While some adapt through livestock diversification or seasonal migration, these strategies only partially mitigate economic risks. The study by Ducrotoy et al. (2016) showed that even in grazing reserves, livestock production is hindered by inadequate infrastructure and lack of veterinary services. For long-term sustainability, a coordinated multi-stakeholder framework that integrates local knowledge with institutional support is essential (Fadare et al., 2024; Gever, 2019).

**6. Conclusion**

Open grazing in the Sahel undermines agriculture, worsens land conflicts, and degrades the environment. This study found that it reduces crop yields, discourages agricultural investment, increases insecurity, and harms livelihoods. Weak governance, land scarcity, and unregulated livestock movement intensify conflicts, threatening economic stability. Farmers face crop destruction, lost labor hours, and rural migration, weakening food systems. Overgrazing also accelerates climate instability and biodiversity loss, worsening long-term development challenges. The crisis stems from governance gaps, historical neglect of pastoralists, and unsustainable land policies. Resolving it requires addressing socio-political, legal, and ecological factors to ensure sustainable agricultural systems.

**7. Future Prospects and Way Forward**

Moving forward, addressing the challenges associated with open grazing in the Sahel requires a paradigm shift in policy, governance, and rural development strategies. First, there must be a clear and enforceable transition from open grazing to regulated, sustainable pastoralism. This involves investing in the development of ranches, grazing reserves, and pastoral infrastructure that support the mobility and productivity of herders without infringing upon the rights of crop farmers and the herders. Such investments should also include veterinary services, water access, and extension programs tailored to local ecological realities. Second, land tenure and property rights must be clarified and strengthened across the region. In many cases, the absence of secure land rights has led to contestations and the breakdown of traditional conflict resolution mechanisms. Community-based land management systems should be supported with legal recognition and institutional backing to enable local ownership and peaceful coexistence between land users.

Third, traditional leaders of herders should be properly educated, and the governments and civil society organizations must prioritize conflict mitigation strategies that go beyond military responses. Dialogue platforms, peacebuilding initiatives, and early warning systems are essential to prevent violence and create an atmosphere of mutual trust between pastoralist and farming communities. These mechanisms should also involve traditional rulers, women, and youth in conflict-sensitive development planning. Fourth, climate-smart agricultural practices and restoration of degraded lands should be promoted through public-private partnerships and donor support. The Sahel's vulnerability to climate shocks makes it essential to implement adaptive strategies that combine reforestation, soil management, rotational grazing, and crop diversification to improve ecosystem resilience.

Lastly, effective governance, inclusive policymaking, and transparent enforcement mechanisms are key. For future prospect, the policymakers must ensure that laws such as anti-open grazing legislations are not only passed but are properly implemented, monitored, and evaluated. This calls for harmonization between national, state, and local authorities, as well as collaboration with international partners to create a coherent policy environment conducive to peace, growth, and sustainability. Through these integrated and inclusive strategies, it is possible to transform the open grazing crisis into an opportunity for ecological restoration, rural transformation, and long-term regional stability.

**Disclaimer (Artificial intelligence)**

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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