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The Nexus of Climate Change, Ecological Disruption, Stability, and Security

Climate and Forests 2030

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CLIMATE AND FORESTS 2030: RESOURCES FOR FUNDERS

Background

The Climate and Land Use Alliance (CLUA), with the support of Meridian Institute, is exploring the integration of climate and land use with justice, equity, health, and economic recovery through Climate and Forests 2030: Resources for Funders. This focus is intended to inspire innovation and investment in integrated work on forests, rights, and sustainable land use and will inform a new strategic plan for CLUA for the period 2021 to 2030.

To inform the thinking, CLUA commissioned a series of "thought pieces" to provide diverse inputs into developing a more integrated approach for forests and land use. These are meant to stimulate discussion and debate and are not intended to reflect the views of CLUA, its member foundations, or Meridian Institute. The views expressed in this paper are those of the authors. They have been informed by commentary and input by a range of other experts.

This paper was developed by Erin Sikorsky, Andrea Rezzonico, and Yong-Bee Lim of The Council on Strategic Risks (CSR). CSR is dedicated to anticipating, analyzing and addressing core systemic risks to security in the 21st century, with special examination of the ways in which these risks intersect and exacerbate one another.

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Introduction

As the Covid-19 pandemic has made all too clear, a redefinition of national security is overdue. As we look to 2030, some of the biggest security risks the world faces will come not from states and governments alone, but also from complex transnational risks. This paper examines how climate change and ecological degradation, particularly deforestation and poor land use practices, intersect to undermine security and create instability. Within many states, these drivers are contributing to resource stress (e.g., food and water insecurity), governance strains, and internal migration. Between states, competition and nationalism are rising in response to these challenges. Extremists and violent non-state actors are also benefiting, which in turn threatens political stability and cross-border relations. Biological risks — stemming from greater human-animal interactions, and the accelerated emergence of infectious diseases — are woven through all of these interrelated issues.

This paper begins by describing the relationship between forests, land use, and insecurity at the nexus of ecological disruption and climate change. It then proceeds to discuss how this nexus affects security in four categories: the intra-state, inter-state, and non-state actor levels, as well as looking at Indigenous and vulnerable populations through a lens of justice and equity. It concludes with concrete recommendations aimed at both managing existing risks while also preventing catastrophic risks in the longer-run.

Terminology

Climate security refers to climate change impacts that meet one of the following criteria: 1) where human security risks spill over into higher-order security risks, such as political instability, intra-state conflict, major natural disasters involving significant military responses, mass displacements of peoples, or threats to critical resources and infrastructure; 2) Inter-state tensions and conflicts related to climate change; or, 3) Impacts of climate change on military and defense, including military infrastructure, force readiness, military operations and military strategy.[1]

Ecological security describes the elements of human, national, and global security that arise from ecological destruction and disruption, and the collapse of ecosystems. This term includes water and food security, trafficking and exploitative use of wildlife, protection from natural disasters, and the threats to economic interests from illegal timber trade and fisheries as well as those arising from other forms of ecological disruption such as species and population extinctions, zoonotic disease, and threats to critical ecological processes.[2]

Relevance of Topic for Forests and Land Use

Improper forest management and land use practices contribute to ecological security risks and are made worse by climate change. Deforestation and land degradation can both lead to and occur as a result of security and instability within and between states. For example, an increase in deforestation can result in the loss of stable access to a resource or geography, increased economic and socio-political tensions, a rise in irregular migration, or the emergence of new zoonotic infections that test public health capabilities. At the same time, rising insecurity can lead to increased deforestation, improper land use, and environmental crime, as governments are overwhelmed, desperation among populations increases, and illicit groups take advantage.

Current Status, Emerging Trends, and Areas of Uncertainty and Risk

Ecological and climate security risks related to forests and land use can be organized into three main areas: political instability within states; rising tensions between states; and empowerment of non-state armed groups and other nefarious actors.

Political Instability Within States

The combined effects of ecological degradation and climate change are increasing strains on governments around the globe, contributing to higher risks of instability and conflict. These effects are simultaneously causing populations to demand more from their governments (e.g., humanitarian aid and disaster response; new avenues of economic

development; protection from biohazards) while also reducing the supply of resources governments have at their disposal to meet these demands. Especially when these dynamics are layered on top of other existing challenges — such as ethnic or sectarian divisions, weak or corrupt security forces, poor or non-existent social services, or exclusionary governance structures — they can create a combustible mix.

Corruption and Political Instability

Powerful elites in many countries, including politicians and senior members of security forces, benefit from environmental crime and ecological degradation. These elites often engage in corrupt activities and behaviors including accepting bribes, underfunding oversight institutions to weaken their effectiveness, and aligning business interests like mining with the highest levels of government. Unfortunately, there is often little incentive for corrupt officials and governments to crack down on illegal practices due to the personal, political, and monetary benefits they can reap.[3] Lax conservation policies and enforcement practices allow deforestation to flourish.

Corrupt activities and practices also erode citizen trust in government institutions.[4] This erosion creates a gap that illicit and/or non-state groups can fill. Insurgents have used these gaps to foster goodwill with citizens by providing basic infrastructure that addresses education, health care, or judicial institutions.[5] During the current pandemic, non-state actors in several cities around the world publicly enforced curfews and other restrictions when the state was unable to do so.[6,7] These occurrences exacerbate and take advantage of local and state-wide corruption, further undermining trust in government institutions in the process.

Misinformation and Political Instability

Societies have experienced significant levels of mis- and disinformation in recent years. These campaigns, which have both domestic and international origins, erode trust in official government messaging and expert recommendations through contradictory information that uniquely resonates with targeted audiences.[8] For example, ideologically-driven misinformation campaigns have played an important role in stymying collective action to address climate change issues.[9] Governments and experts are also forced to continue dealing with the dual-use characteristics of far-reaching social platforms like Instagram, Facebook, and Twitter in an age of Covid-19: platforms that can spread messages to keep people safe and informed, while simultaneously amplifying messaging that undermines the global response and jeopardizes measures to contain the spread of the disease.[10] Mis- and disinformation campaigns can erode trust in governments and undermine belief in observable, scientific evidence of ecological degradation. Most governments have not devised successful regulatory responses to these rising threats.

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The connections between land use change, misinformation, and democratic backsliding are perhaps most apparent today in Brazil. After roughly a decade of a steady decrease in deforestation, recent government action under President Bolsonaro reversed much of that progress. Brazil's national environmental enforcement agency fined violators 20% less in 2020 — a year when deforestation reached a 12 year high — signaling a weakening of government supported conservation efforts.[11] In 2019, as the Amazon was engulfed in flames, the Brazilian president publicly stated (without evidence) that non-governmental organizations (NGOs) were responsible for the uptick in fires in the rainforest in retaliation against his government.[12] That same year, the administration fired the head of the INPE (Instituto Nacional de Pesquisas Espaciais) after the national agency published satellite images and data spotlighting the rampant deforestation in the country. Memes and images perpetuating this narrative continue to spread on Facebook and WhatsApp, both widely used in Brazil, including by President Bolsonaro's supporters to spread mis- and disinformation.[13] Like many countries, Brazil is embroiled in a battle of truth — and by undermining the science and facts behind the nation's well-documented ecological destruction, the government risks irreparably eroding the Brazilian populace's trust in governance.

Resource Stress and Political Instability

Resource insecurity and stress can contribute to political instability. A government's ability to provide adequate services and fulfill the basic needs of its citizens can often falter when it finds itself with fewer resources, especially when such change is rapid. At the same time, poor governance practices can contribute to resource stress, particularly when coinciding with the increasing threat of climate change. This is not an insignificant problem: 1.2 billion people live in environments of physical water scarcity, nearly 1 billion are undernourished, and global energy consumption varies wildly based on region.[14] Countries that rely heavily on food imports run the risk of food insecurity if ecological or climate challenges wreak havoc on breadbasket export-oriented regions.

The deforestation-water security-energy cycle in Brazil exemplifies the links between resource stress and political instability. Rapid rates of deforestation, along with climate change, have and will continue to severely impact Brazil's hydrological cycle.[15] This combination has the potential to convert large swaths of forested territory into dry savannah, interrupting the region's largest freshwater resource system. The security implications of such developments are potentially severe. For a country so heavily dependent on hydropower electricity, its energy security is under increasing risk of periodic disruption and has already been strained in the past due to a severe regional drought in 2013-2015.[16] Its powerhouse agricultural sector, a principal instigator of deforestation in the country and a major employer, experienced a notable economic decline during that same period.[17]

Brazil has engineered a system built to withstand some disruptions: its adaptive electricity generation and distribution network can compensate under-performing hydro-electric plants with distant hydrographic basins.[18] However, this system was constructed under vastly different conditions; economic and energy interruptions are virtually guaranteed as ecological destruction increases, impacting local livelihoods as well as eroding government capacity to respond. Urban areas dependent on the Amazon's freshwater generation, such as São Paulo, are at high risk of resource insecurity — and these disruptions could result in severe water shortages throughout key Brazilian cities.

Biological Hazards, Health Security, and Political Instability

The causes and effects of deforestation also increase the risks of zoonotic diseases. As deforestation continues, the likelihood that humans will disrupt and engage with previously undisturbed ecologies increases. One pathway by which this occurs is increased human-animal interactions in places that are a fertile breeding ground for emerging and reemerging infectious diseases, which has significant implications for health security initiatives.[19]

Brazil illustrates how deforestation can trigger instability via biological hazards. The link between land use change and pathogen spread is well established — and it is extremely likely that if deforestation rates continue unabated, another global pandemic will emerge from the belly of the Amazon. According to some studies, Brazilian bats harbor over 3,000 types of coronavirus, suggesting that the "high rate of Amazon forest loss may prompt the region as another deforestation-coronavirus nexus."[20] Following that scenario thread, a pathogen could take root in the country's large and/or strategically important cities such as São Paulo, Rio de Janeiro, Manaus (a strategic river port in the Amazon), and Brasilia, the nation's capital. Governance mechanisms would be quickly shut down if a more destructive virus outbreak overtook essential hubs and disrupted disaster response networks.

Internal Migration and Political Instability

Poor land use practices and climate change are driving changes to internal migration in multiple ways that increase security risks. Generally, internally displaced populations (IDPs) face risks of violence, extremist recruitment, and other security challenges. Additionally, female IDPs face increased risks of gender-based violence.

Altering the migration patterns of traditionally mobile populations can also contribute to security problems. These changes can cause competing groups to come in to contact more often, in some cases risking conflict. For example, in the Sahel the combination of climate change effects with poor land use practices and governance has negatively impacted the traditional livelihoods of both farmers and herders and changed their migration patterns. A lack of viable economic prospects, combined with low levels of

trust and education, has contributed to increased localized violent conflicts between different groups.[21]

Another connection between internal migration and state stability is increasing urbanization. While urbanization has traditionally been a pathway for countries to grow their economies and raise populations out of poverty, that link appears more tenuous in strained developing countries around the globe. As people increasingly leave their rural bases in part because of the effects of climate change and environmental degradation to seek opportunity in urban areas, this can lead to overcrowded slums, straining government resources and potentially contributing to political instability. These movements can also lead to habitat fragmentation through encroaching urbanization, which in turn damages ecosystem services and heightens the risk of novel disease spread.[22]

Rising Tensions and Risk of Conflict Between States

Many of the same dynamics around land use, deforestation, and climate change that drive instability and conflict risk within states also contribute to conflict risks between states.

Competition and Potential Conflict over Resources

As poor land use and climate change diminish natural resources and economic prospects, it is likely that groups, either independently or with explicit or tacit state approval, will range into other countries to secure needed resources. One example of this dynamic is the border area between the Dominican Republic and Haiti. This situation serves as a warning of what is in store globally if more action is not taken to prevent land degradation. Seventy-five percent of energy demand in Haiti is met by firewood or charcoal, but less than 3% of the country remains forested.[23] To meet this demand, Haitians illegally produce and sell charcoal from forests in the Dominican Republic. Furthermore, some Haitian farmers use land in the Dominican Republic illegally, including in protected areas. These developments are contributing to tensions between the two countries, and are exacerbated by the fact that Haitian governance and security forces are practically non-existent in the border areas.[24] As of February 2021, the Dominican Republic planned to build a fence along the border between the two countries,[25] which could both further tensions and cause greater harm to the natural environment. Further complicating this type of issue in many countries is the presence of transnational illicit groups that exploit diminishing natural resources for economic gain, at times in partnership with governments or at least some corrupt government officials (see next section for more details).

An additional cross-border security risk linked to deforestation and improper land use is the exploitation of poorer countries by wealthier ones as the latter seek to secure everything from food supplies to rare earth minerals. For example, in recent years Saudi Arabia and the United Arab Emirates have bought significant amounts of land in East Africa. In some cases African governments have sold the land and then pushed local populations out without compensation. Government land seizures led to massive protests in Sudan in 2016, as the country was on the cusp of a food crisis.[26] Around the same time, protestors in Ethiopia attacked foreign landholders' vehicles and infrastructure; the government crack-down in response led to the death of 55 protestors.[27]

Risks of Nationalism

As states grapple with the effects of ecological degradation and climate change, there is a growing risk of rising nationalist or protectionist measures that can contribute to inter-state tensions. Some states will look to protect increasingly scarce resources or attempt to prevent the spread of infectious disease by closing borders or stepping back from international cooperation. For example, in the wake of a pandemic or infectious disease outbreak due to ecological degradation, a limited number of vaccines or other forms of life-saving medical treatment could incite nationalistic and protectionist measures. Another related risk is that states that already have low levels of trust blame one another for negative outcomes that are actually due to climate change or ecological degradation. Related to the earlier point about misinformation, it's likely that some governments will increasingly blame rival states for climate and ecological hazards, to avoid the domestic political consequences of land mismanagement and deforestation practices or deflect criticism for not preparing for climate change effects.

Biological Risks

Climate change affects the biological landscape through pathogen migration — as climate conditions change, the distribution and geography of pathogens are also changing. These shifts in distribution may cause certain diseases to become endemic in other, more accommodating regions for the pathogen.[28] The redistribution of the pathogen landscape may offer unique opportunities to nation-states interested in biological weapons. States could gain access to a pathogen of interest that has recently migrated into the country's borders. The state could then research, develop, and deploy a biological weapon against a rival state and explain away the attack as a natural disease outbreak. For example, the Soviet Union repurposed a special division of its public health system to harvest pathogen samples in nature for its biological weapons program.[29] While some experts believe this may be a relatively low risk in the near term, dropping barriers to the tools for genetic engineering may augment an actor's ability to take advantage of newly-available pathogen strains that may otherwise pose less of a threat to humans.

Along similar lines, an unintentional biological event with origins in a specific country has the potential to turn nations against each other, incite xenophobia, and lead to serious political ramifications — as we are currently witnessing. Layering a natural disaster fed by ecological disruption or a biological hazard over pre-existing diplomatic tensions may sour strategically important relations and undercut negotiations.

Empowerment of Non-State Extremist Groups and Organized Crime

Organized crime groups, extremists, and terrorist groups are perpetrators and benefactors of illegal deforestation and corrupt or improper land use practices. These groups have found that involvement in illegal logging, mineral extraction, and wildlife smuggling are profitable and relatively low-risk endeavors, particularly when governments can be convinced to turn a blind eye through corruption and bribery. A 2018 report found that environmental crime was the largest source of income for non-state armed groups and terrorist organizations.[30] Additionally, deforestation and ecological degradation occurs as a result of other illicit activities, including drug trafficking. For example, in parts of Latin America, illicit groups regularly clear forested areas for uses such as airstrips and access roads in and out of clandestine sites.

In all of these activities, these groups not only increase their exposure to wildlife and associated biohazards, but they also increase the risk of biohazard spread throughout the regions in which they operate. They simultaneously complicate efforts to combat or manage biohazard risks because they regularly attack government, NGO, and health workers who attempt to work in regions controlled or threatened by illicit groups. These complex security dynamics can be seen clearly in the cases of the Democratic Republic of Congo, al-Shabaab in Somalia, and illicit groups in Colombia, as described below.[31]

Democratic Republic of Congo (DRC)

Profits from illegal logging and other environmental crimes allow the more than 100 armed groups operating in the Eastern DRC to continue violence and the subsequent displacement in the region.[32] A 2017 UNEP report found that every year timber, charcoal, and wildlife products, as well as precious minerals such as gold, valued between 0.7-1.3 billion USD annually, are illegally smuggled out of conflict zones and surrounding areas in the eastern DRC. Transnational organized criminal networks operating both in and outside DRC benefit from this trade. A smaller portion of the funding goes directly to armed groups that operate only within the DRC. UNEP found that they retained enough to fund at least 8,000 fighters per year, allowing groups thought to be defeated or disarmed to reemerge and undermine stabilization efforts in the region.[33]

The behavior of non-state actors in the DRC also multiplies health and food security risks. The deforestation they perpetrate increases the likelihood of infectious disease outbreaks, while the violence they precipitate interrupts efforts to manage and treat health crises. During the Ebola outbreak in eastern DRC from 2018-2020, research institution Insecurity Insight documented more than 450 attacks on healthcare workers.[34] Similarly, violent groups' contributions to deforestation and displacement undermines food security. The armed groups also regularly attack UN workers providing food assistance. In February 2011, the Italian Ambassador to the DRC was killed when the food aid convoy he was traveling with was attacked by an armed group.[35]

Somalia

In Somalia, extremist group al-Shabaab has profited from the charcoal trade for many years, finding ways around the 2012 UN ban on Somali charcoal, including by shipping the product through Iran. Charcoal, a Somali export for decades, has all but decimated the *Acacia bussei*, a slow-growing hardwood, in the country.[36] The loss of this tree, which has traditionally provided feedstock for pastoralists and helped them stay resilient to drought, has jeopardized their livelihoods and changed the opportunity cost of joining an extremist group. Many pastoralists in the country have had to leave their land and resettle in new communities or camps, where al-Shabaab focuses its recruitment efforts.[37]

Colombia

A slightly different perspective is provided by looking at deforestation, conflict, and armed extremist groups in Colombia. Studies show that deforestation actually increased after the Colombian government brokered peace with the Revolutionary Armed Forces of Colombia (FARC) in 2016 and took over land the group had once controlled. This has allowed cattle ranchers to move into previously untouched forests, often with military protection focused on protecting the ranches, not ensuring environmental compliance.[38,39] At the same time, criminal and paramilitary non-state groups continue to benefit from illegal logging and other environmental crimes in Colombia, preventing the 2016 peace agreement from fully taking hold. In 2019, the country led the world in the number of land and environmental defenders killed.[40] The government's lack of focus on improving land governance practices in the wake of the peace agreement has undermined the peace agreement itself, underscoring the importance of integrating ecological security considerations into conflict mitigation and peacebuilding efforts.

Equity and Justice Intersections

Economic and political inequality can be both a driver and an outcome of climate and ecological security risks.[41] Those that experience the brunt of these security risks are often the poorest and most vulnerable members of societies, including women and children. A UNDP policy brief in 2020 noted that the intersection of high levels of poverty and high levels of exposure to climate-related hazards leads to higher risk of conflict.[42] This section briefly examines the intersection of security with equity and justice for traditionally underrepresented groups — Indigenous people and women. This intersection has both local implications but also regional and global security implications as vulnerabilities among these populations will expand over time.

As discussed above, land degradation can remove sources of income for certain groups, increasing the risk of conflict between groups that are increasingly in competition over scarce resources. This can be a particular problem in states with exclusionary or discriminatory governance structures and practices, which marginalize specific groups. This behavior can create "structural scarcity," when different groups in society face different resource access, and potentially lead to violence and insecurity as groups seek to ensure more equitable access to resources. If the effort to secure these resources becomes intertwined with a broader campaign for rights — including recognition of identity and social status, conflict resolution becomes more difficult.[43] Additionally, structural scarcity can be exploited by extremist groups who may try to provide marginalized groups services and resources that would otherwise be provided by a government.

One example of this dynamic is the intersection of land use, conflict, and inequality of Indigenous groups in Indonesia. A report released by the Indonesian Consortium for Agrarian Reform in February 2021 found that more than 200 new agrarian conflicts erupted in 2020. Of these, 163 were linked to the oil palm plantation and forestry sectors, the largest contributors to land conflicts in Indonesia in 2020. The report found that land belonging to local communities through customary law is frequently taken by large companies to develop palm oil concessions. These companies often employ threats of violence and intimidation toward Indigenous people and local communities.[44]

Violence and security threats against women frequently coincide with environmental degradation and intense climate change effects. A 2020 study by the International Union for Conservation of Nature found that gender inequality, state fragility, and climate vulnerability are positively correlated with one another — in other words, a state with high levels

of climate vulnerability is also likely to have high gender inequality and fragility.[45] These conditions contribute to higher security risks for women and girls, and can compound the drivers of conflict in risk-prone states. For example, deforestation can force women and girls to travel further and into more remote regions to gather firewood or food, putting them at risk of gender-based violence.[46] At the same time, women can face increasing intimate partner violence as poor land use hampers women's ability to put food on the table and care for their families.[47] Attempts to defend land from extractive industries also puts women at risk. As a female activist in Guatemala recounted, "When they threaten me, they say that they will kill me, but before they kill me, they will rape me. They don't say that to my male colleagues. These threats are very specific to Indigenous women."[48]

> *Violence and security threats against women frequently coincide with environmental degradation and intense climate change effects.*

A Blue Sky Vision for 2030

The vision for 2030 includes concrete recommendations aimed at both managing existing risks while also preventing catastrophic risks in the long term. Many of these risks exist on a spectrum. The overarching goal is to prevent as many risks as possible from entering the "unmanageable" stage. Examples of this point include the permanent loss of primary growth forests, the catalytic threshold that permits a regime shift in an ecosystem, and the introduction of invasive species. There is a premium on urgent action to halt or reverse the trends that otherwise bring us to these highly uncertain new baselines.

However, it is impossible and unrealistic to avoid all interactions with ecosystems and the services they provide. Examples include logging, agriculture and farming, soil degradation, mining, urbanization, or the broader effects of climate change. In these instances, the approach should instead be to adapt or improve management capabilities, in order to preserve these resources or better respond to these conditions on long time horizons.

Prioritizing Security Threats Arising at the Nexus of Climate Change and Ecological Disruption

The best tools for addressing the complex security risks at the nexus of deforestation, degraded ecology and climate change in 2030 start from humble beginnings. First, **there needs to be acknowledgement and mainstream recognition of the security issues related to this nexus in the policy arena.** These areas have historically been neglected and sidelined in the security conversation for more traditional nation-state threats such as nuclear weapons and specific violent non-state actor activities. In addition, the effects and interactions of these areas are not as visible as some of these more traditional threats but the speed at which they are converging threatens to overwhelm traditional national security response systems. There are signs that the Biden Administration will take steps to change this in the United States; its interim National Security Strategy guidelines notes that, "many of the biggest threats [the United States] faces respect no borders or walls, and must be met by collective action," and specifically calls out climate change and pandemic risks.

Second, **scholars and stakeholders need to continue to study this nexus and its security implications in further depth**. This paper offers an initial perspective on key areas where there are clear security implications at the intersection of ecological and climate change security risks. Researchers and experts need to explore this intersection further, to deepen understanding of the causal pathways to insecurity, potential feedback loops, policy implications, and potential solutions.

Third, **stakeholders across all sectors and regions need to come together to take swift and decisive action, including by rapidly increasing funding**. Unfortunately, the window to address many of these security challenges brought about by deforestation, ecological devastation, climate change, and existing and emerging biological threats is rapidly closing. This means that governmental and non-governmental entities must race against the clock to ameliorate existing and future security challenges at this nexus. The best plans remain just that — plans — without financial support. Climate, land-use, and bio-focused philanthropic organizations and private actors, including corporations, must engage with non

-traditional stakeholders, such as security stakeholders, to move the agenda forward.

Addressing the Issues at All Levels of Analysis

To address **intra-state political instability**, we offer the following three recommendations:

1. To address resource stress issues, we suggest building a coalition of ecologists, technologists, social scientists, and other stakeholders to inform state and regional efforts to adopt practices that encourage ecological renewal while simultaneously meeting the needs of the state.

2. We recommend that the international community more fully integrate an ecological security lens into existing conflict prevention and peace-building mechanisms, to ensure that the issues discussed in this paper are addressed when developing local interventions in at-risk states.

3. As corrupt practices play a significant role in ecological degradation and civilian trust in government institutions, we also recommend interventions aimed at promoting good governance and preconditioning aid on the adoption of robust anti-corruption measures.

To address **inter-state tensions and competition**, we offer the following three recommendations focused on better information-sharing among countries and within regions:

1. We recommend innovating new diplomatic and information sharing channels aimed at relieving tensions between states driven by resource-stress issues. Initial steps could include technical exchanges to facilitate data sharing.[49]

2. We recommend that multilateral institutions and/or regional entities consider developing robust biological early warning systems for states or regions. These systems could help detect microbial migration and disease outbreak trends, which can help significantly relieve public health infrastructure stresses. At minimum, they could help mitigate the impact of biological threats

3. High-level security organizations such as the United Nations Security Council (UNSC), the North Atlantic Treaty Organization (NATO), and others need to incorporate, discuss, and address ecology as a security issue in its own right by 2030. The UNSC and the United Nations Framework Conventions on Climate Change (UNFCC) have already established and are consistently integrating climate change in their deliberations — therefore, expanding their focus into the ecological security realm would not be far-fetched.

To address the **empowerment of non-state actors and organized crime**, we propose the following three recommendations:

1. We recommend that stakeholders target transnational criminal markets to minimize incentives for illicit ecological disruption and wildlife trade.[50]

2. States and the international community should develop innovative mechanisms to integrate the protection of forests and strategic ecological areas into counter-narcotics and counter-extremism campaigns.

3. These efforts need to be reinforced with effective prosecution and penalties to both act as deterrents and provide legal recourse when the law is violated.[51]

Finally, it is imperative that stakeholders understand how these issues disproportionately affect **vulnerable populations** like Indigenous people, women, children, and the politically and/or economically disenfranchised. To help address this issue, we strongly recommend that Indigenous leaders, women, and other disenfranchised individuals and groups are actively incorporated into governance processes and conflict prevention mechanisms to minimize both ecological disruption and the resulting economic disturbance to their lives.

In summary, it is increasingly urgent for the global community to research, understand, and address the complex security issues that emerge at the nexus of ecology and climate change. Stakeholders should take advantage of the growing recognition of these risks to build a broader communications campaign and political movement aimed at making the shift to a new definition of national security permanent and ensuring the world not only manages the current challenges but changes course to prevent longer-term catastrophic outcomes.

Endnotes

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