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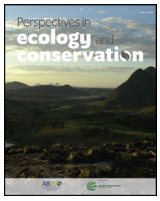

Policy Forums

Emerging threats linking tropical deforestation and the COVID-19 pandemic

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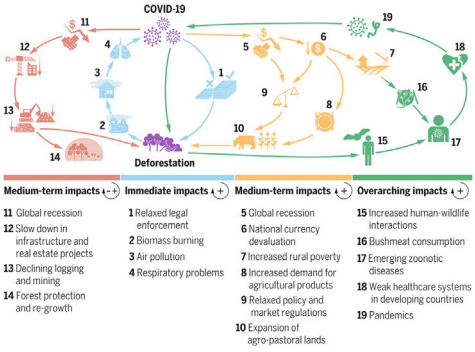
HIGHLIGHTS

- Pandemics can become a new indirect driver of tropical deforestation.
- Halting illegal deforestation should be considered an essential activity during the pandemic.
- Forest fires could aggravate the health risks of COVID-19.
- Tropical deforestation will increase the risks of emerging zoonotic diseases.
- Indigenous people should be especially protected during the current pandemic.

GRAPHICAL ABSTRACT



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ABSTRACT

Tropical deforestation drivers are complex and can change rapidly in periods of profound societal transformation, such as those during a pandemic. Evidence suggests that the COVID-19 pandemic has spurred illegal, opportunistic forest clearing in tropical countries, threatening forest ecosystems and their resident

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human communities. A total of 9583 km^2 of deforestation alerts from Global Land Analysis & Discovery (GLAD) were detected across the global tropics during the first month following the implementation of confinement measures of local governments to reduce COVID-19 spread, which is nearly double that of 2019 (4732 km^2). We present a conceptual framework linking tropical deforestation and the current pandemic. Zoonotic diseases, public health, economy, agriculture, and forests may all be reciprocally linked in complex positive and negative feedback loops with overarching consequences. We highlight the emerging threats to nature and society resulting from this complex reciprocal interplay and possible policy interventions that could minimize these threats.

The importance of tropical forest conservation has gained new contours with the COVID-19 outbreak, as tropical deforestation increases the risks of emerging zoonotic diseases with pandemic potential (Allen et al., 2017; Rulli et al., 2017; Rohr et al., 2019). Country governmental policies have played a key role in maintaining the pressure against the conversion of native forests to agro-pastoral land, yet the level of commitment to enforce or discourage deforestation varies largely among tropical nations (Nepstad et al., 2014; Lambin et al., 2018). However, this pressure may have been released during the current pandemic. For instance, shutdowns and budget restrictions of environmental agencies during the COVID-19 pandemic may have constrained field operations for legal enforcement, which logistics are particularly complex in deforestation frontiers (Guardian, 2020). In addition, former sustainability agreements may have been relaxed during the pandemic to safeguard the provision of agricultural products to importing countries (FAO, 2020; Guardian, 2020; Tracker, 2020).

In order to address how tropical deforestation has been impacted during the current pandemic, we compared satellite imagery of deforestation over a four week period in 2020 to data in the same corresponding period in 2019 across the global tropics. A deforestation increase during the COVID-19 period would not necessarily imply a causal linkage, as forest loss could have increased due to other factors, as country political changes. Yet, changes in deforestation rates could be one potential consequence of COVID-19 pandemic on the environment, as broadly reported in the international media. We used this analysis as a starting point for presenting a broader conceptual framework linking tropical deforestation and the current pandemic, including multiple positive and negative feedback loops with overarching consequences for nature and human wellbeing, in the expectation that this framework could be further employed for a comprehensive assessment of the impacts of zoonotic diseases on the environment, and vice versa.

We first obtained deforestation alert area from Global Land Analysis & Discovery (GLAD; (Hansen et al., 2016), and country and continent of center point, on a weekly basis for each cell in a 100 km × 100 km grid distributed across the global tropics. We then calculated, using Google Earth Engine and R, the total deforestation for 2020 and 2019 per country in the period of four weeks after which each country had reached a 50% maximum value of the Government Response Stringency Index to COVID-19 developed by Oxford University (OxCGRT, 2020). This composite index accounts for nine response indicators, like travel bans and workplace closures, and was used here as a surrogate of the level of restrictions to people's movement established by local governments. We considered that such restrictions could potentially affect governments' capacity to control for illegal deforestation, which often relies on field operations in remote places involving several enforcement agents. For 27 out of the 118 countries in our study where either no SI information was present, or the country had not reached the 50% value, the median week of the continent was used. Since we mostly focused on the variation of deforestation rates at the continental level, we considered that the continent median week could represent well the regional context of countries without SI estimates.

This analysis provides evidence that signs of immediate increase of tropical deforestation are showing up at the global level following national and international policies aimed at minimizing the impact of the COVID-19 pandemic on human health. A total of 9583 km^2 of deforestation alerts were detected during the first month following the implementation of government confinement measures to reduce COVID-19 spread, which is nearly double that of 2019 (4732 km^2). Overall, deforestation increased by 63%, 136%, and 63% in America, Africa, and Asia-Pacific, respectively, and impacted most countries within these regions (America: 24 of 28 countries; Africa: 30 of 47 countries; and Asia-Pacific: 15 of 28 countries). Although the causal linkage between COVID-19 and tropical deforestation still has to be confirmed, our results suggest that the capacity of tropical countries to address conservation – and potentially humanitarian – concerns have been undermined by the health and economic crisis resulted from the current pandemic.

Tropical deforestation increase following government responses to the pandemic may have been a reflex response to the longer-term reciprocal interplay between deforestation driven by land-use changes and the COVID-19 outbreak. This initial fast cycle of deforestation is favored in tropical areas where legal enforcement historically has been of great importance to reduce forest loss, illegal deforesters have higher chances of obtaining land titles for invaded lands in the future, and farmers have good prospects for trading the additional yields resulting from a larger production area (Lambin et al., 2018; Seymour and Harris, 2019). COVID-19 pandemic may have also compromised the independent, often community-driven, on-the-ground monitoring that prevents land grabs and tenure conflicts. Less important drivers here may be volatile food prices and global demand, which, when linked to urban-to-rural migration motivated by COVID-19, may have encouraged farmers in other areas to opt for cash crop-driven land clearing.

Furthermore, the particulate matter emitted by biomass burning during land clearing – the most widespread driver of premature human mortality in tropical regions (Lelieveld et al., 2015) – could aggravate the health impacts of the current pandemic, as air pollution exacerbates the respiratory problems resulting from COVID-19 infection (Wu et al., 2020) and could overburden the fragile healthcare system of many tropical countries. In turn, the more stringent and long-lasting government responses to the potential aggravation of the COVID-19 health crisis during the forest fire season are likely to distract attention from forest protection policies, thus creating a perverse positive deforestation feedback loop (Fig. 1).

In the medium-term, the upcoming global economic downturn should force developing countries to increase their economic dependency on commodity exports, favored by the devaluation of national currencies and the increasing domestic and international demands for agricultural products. The political and trading environments will likely relax previous regulations and agreements that protect forests (Degnarain, 2020; FAO, 2020), thus opening the door for further deforestation (Fig. 1). Conversely, global trade disruptions intensified by the COVID-19 pandemic (Organization,

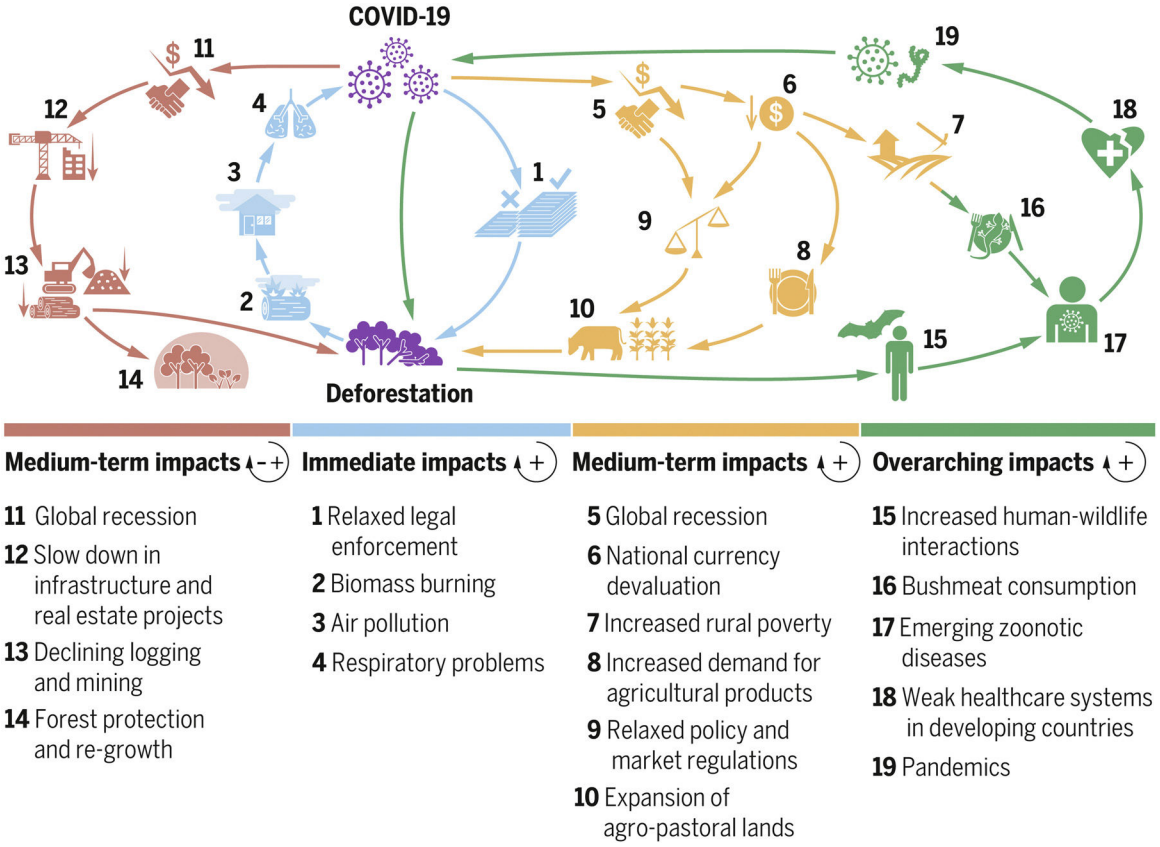

Fig. 1. Feedback loops between tropical deforestation and the COVID-19 pandemic. Zoonotic diseases, public health, economy, agriculture, and forests may all be reciprocally linked in complex positive and negative feedback loops with overarching consequences for nature and society.

2020) may slow down infrastructure and real estate projects, thus reducing the pressure of key drivers of tropical deforestation, such as road and dam construction, logging, and mining, consequently resulting in a negative feedback loop (Fig. 1). This negative loop may, however, become positive if governments adopt measures to incentivize these sectors to stimulate their economies during the recession (Fig. 1).

Lastly, the risks of infectious disease outbreaks are higher in rapidly deforested tropical regions. Nearly 50% of zoonotic diseases that have emerged in humans are associated with agricultural drivers (Rohr et al., 2019). The upcoming recession driven by the COVID-19 pandemic may also increase poverty and food insecurity in deforestation frontiers, leading to greater bushmeat consumption and increased chances of new zoonotic diseases. In this context, it will be challenging for governments to protect people's lives and tropical forests, as well as to provide assistance to local communities living at the margins of the cash economy in deforestation frontiers (Ferrante and Fearnside, 2020), which can be crucial to preventing new pandemics (Everard et al., 2020).

Policy recommendations

To turn the tide of these deleterious reinforcing mechanisms, governments should develop policy interventions aiming to minimize these emerging threats linking tropical deforestation and the COVID-19 pandemic:

Focus on livelihoods in rural communities and indigenous lands: Tropical forest protection should be viewed as a cost-effective opportunity to mitigate pandemic impacts on the most vulnerable societal groups, including rural communities and indigenous people. Indigenous lands should be a priority for legal enforcement operations, as well and legal and technical tools to empower community land tenure. Many indigenous groups, which are particularly more vulnerable to infectious diseases, are located in regions of land conflicts and high invasion pressure, where invaders may introduce the SARS-CoV-2 virus and worsen the already fragile situation of these groups (Ferrante and Fearnside, 2020). In addition, rural communities in tropical forest areas usually have very limited access to health care and will require special attention from national governments during the pandemic.

Consider halting deforestation an essential activity: The potentially emerging new wave of tropical deforestation will require societal leaders and institutions to move beyond the public health-economy dualism in tackling the profound consequences of the pandemic (Guerriero et al., 2020). Tropical countries facing increasing rates of forest loss should include environmental oversight and control within their list of essential activities. At the same time, governments should encourage strategies that boost legal timber markets and supply chains in order to prevent opportunistic actors from accessing both national and global markets (FAO, 2020).

Anticipate an increase in forest fires: Widespread forest fires, like those observed in 2019 in the Brazilian Amazon, could increase air concentration of fine particulate matter and worsen COVID-19 infection, overburdening the fragile healthcare system of many tropical countries (Cardil and de-Miguel, 2020; Londoño et al., 2020). Health authorities must be prepared for this threat as the dry season is about to begin in many tropical forest regions, and will have to address both the cause (i.e., forest fires) and the symptoms (i.e., increased demand for healthcare) of this emerging problem simultaneously.

Encourage strategies to boost legal timber markets and supply chains: By creating obstacles to illegally extracted timber, government institutions will discourage opportunistic actors from accessing both national and global markets. Under the expected

disruptions to global trade of this pandemic, domestic markets, encouraged through economic incentives, could boost economic resilience (FAO, 2020). In the long term, forest product market diversification may also prevent the collapse of supply chains.

Innovate to protect forests

Alternative strategies, which rely less on field personnel, should be used to combat deforestation. For example, satellites can now track deforestation quite rapidly based on alerts produced with optical imagery (Finer et al., 2018). However, the challenge remains what to do with these alerts, as identifying the problem is only the first step towards resolving it. The technology for border patrolling has advanced quickly in recent years and could be benchmarked to prioritize remote areas where controlling deforestation is most critical. This will be essential if further self-isolation and 'lockdown' interventions are required to control the COVID-19 pandemic or in the case of new pandemics.

In spite of the still numerous uncertainties regarding the impacts of the COVID-19 pandemic on society and the environment, governments must act urgently to tackle the interplay between pandemics and climate change while ensuring safeguarding tropical forests and their people.

Conflict of interest

The authors declare no conflict of interest.

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