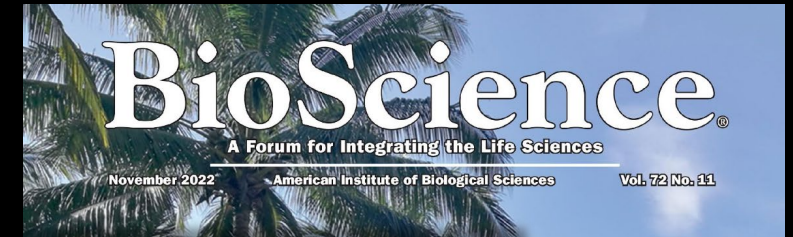


Over-simplified Communication of Disease Spillover Risk during the COVID-19 Pandemic

André D. Mader

Institute for Global Environmental Strategies (IGES)



Messaging Should Reflect the Nuanced Relationship between Land Change and Zoonotic Disease Risk

ANDRÉ D. MADER, NEIL A. WATERS, ERIN C. KAWAZU, MICHELLE MARVIER, NOÉMIE MONNIN, AND DANIEL J. SALKELD

A hallmark of the media publicity surrounding COVID-19 has been the message that land change causes zoonotic diseases to spill over from wild animals to humans. The secondary peer-reviewed literature sends a similar message. However, as indicated in the primary peer-reviewed literature, the complexity of interacting variables involved in zoonotic disease spillover makes it unlikely for such a claim to be universally applicable. The secondary peer-reviewed literature and the mainstream media also differ markedly from the primary peer-reviewed literature in their lack of nuance in messaging about the relationship between land change and spillover risk. We advocate accurate, nuanced messaging for the sake of the local communities at greatest risk from zoonotic diseases, for the sake of scientific credibility, and so that proportionate attention may be given to other possible drivers of spillover risk.

Keywords: COVID-19, degradation, habitat fragmentation, land use, science communication

Although the source of SARS-CoV-2 remains uncertain, the most widely publicized theory of its origin has been zoonotic spillover from a wild animal or animals at a Wuhan wet market (World Health Organization 2021a). This theory has, unsurprisingly, directed attention toward the potential risks to human health posed by direct contact with wildlife (Halbwax 2020). Between 40% and 50% of emerging infectious diseases in human beings are believed to have come from wild animals, feral animals, or captive or farmed wildlife (Jones et al. 2008, Billinis 2013, Haider et al. 2020), including 71.5% of viruses known to infect humans (Olival et al. 2017) and possibly all seven of the human-infecting coronaviruses (Ye et al. 2020).

For less obvious reasons COVID-19 and emerging infectious diseases more generally have been linked with the way humans degrade or destroy nature. A headline in *The New York Times Magazine* posed the question "What do COVID-19, Ebola, Lyme, and AIDS have in common?," answering confidently with "They jumped to humans from animals after we started destroying habitats and ruining ecosystems" (Jaber 2020). CNN reported experts as having said that "rampant deforestation will only uncoil more novel viruses" (Weir 2020). A *Guardian* headline announced, "Pandemics result from destruction of nature, say UN and WHO" (Carrington 2020). Considering the world's astounding

diversity of ecosystems, pathogens, vectors, and forms of land change and the almost infinite combinations of these variables, one might expect some variety in the direction of messages on this topic and a little more nuance. However, all 37 news webpages that we sampled (see the supplemental material for our methodology) associated land change (a catch-all phrase that we use here for the many forms of land-use change, land cover change and habitat destruction) with increased spillover risk. We also sampled 95 webpages of organizations, from the World Health Organization (2021b) to the World Bank (Estavão and Kemper 2021). All but one of them conveyed a similar one-sided message.

The validity, accuracy, and implications of messaging that links land change to spillover risk are the focus of the present article. We are not arguing for a different consensus on the relationship between land change and spillover risk. Rather, we are cautioning against the widespread implication that a consensus exists. Our appeal is aimed at scientists, journalists, and anyone else communicating scientific knowledge.

Why question messaging that links land change to disease spillover?

To begin with, the term *land change* includes various discrete states and processes that may have divergent implications for spillover risk. The form of land change that is perhaps most

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Science Authorship
st of Deforestation

Overview

- Media around COVID-19: land change causes zoonotic spillover
- Secondary peer-reviewed similar
- But...
 - it's not clear why
 - primary literature differs
- Meanwhile this messaging can...
 - put local communities at risk
 - discredit science
 - distract from other drivers of spillover risk

Coronavirus pandemic linked to destruction of wildlife and world's ecosystems

How Humanity Unleashed a Flood of New Diseases

What do Covid-19, Ebola, Lyme and AIDS have in common? They jumped to humans from animals after we started destroying habitats and ruining ecosystems.

FOREST LOSS MAKES DISEASES LIKE COVID-19 MORE LIKELY

Mankind will suffer worse pandemics than coronavirus if we do not protect the environment and halt deforestation, scientists warn

no rain. Rampant deforestation v only uncork more novel viruses, experts say,

How Deforestation Increases the Risk of Disease Outbreaks Like COVID-19

Planetary Health and COVID-19: Environment the Origin of the Current Pandemic

Pandemics result from destruction of nature, say UN and WHO

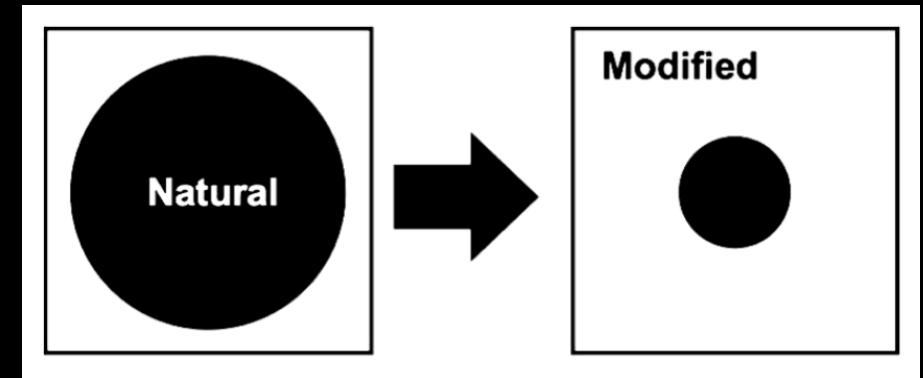
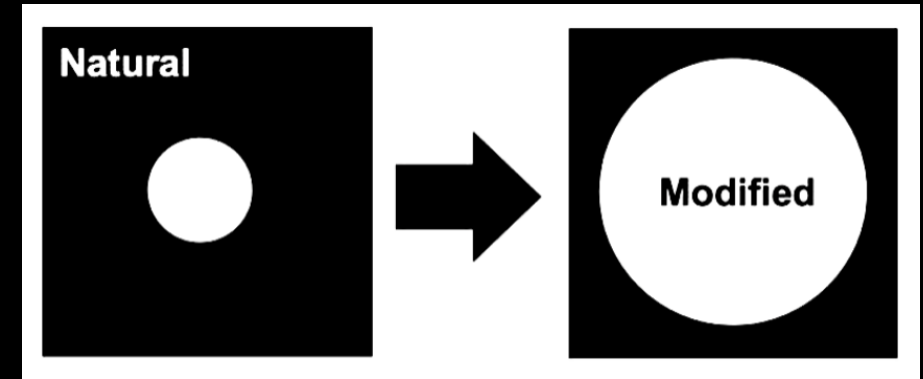
Coronavirus: Exploitation of nature 'drives outbreaks of new diseases'

EU must tackle deforestation to reduce the risk of pandemics

COVID-19 and Biodiversity Loss: How Destruction of the Environment Leads to Pandemics

Complexity

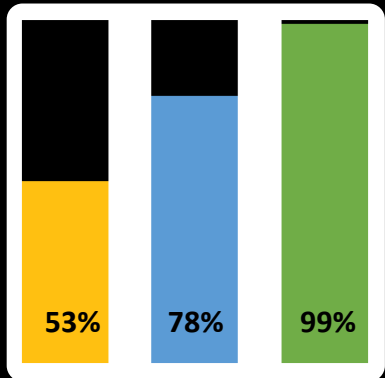
- **Multiple** variables, infinite combinations
- Exceptions, depending on land change **configuration**
- Unclear why wildlife move to modified landscapes
- Different **processes** may pose different risks



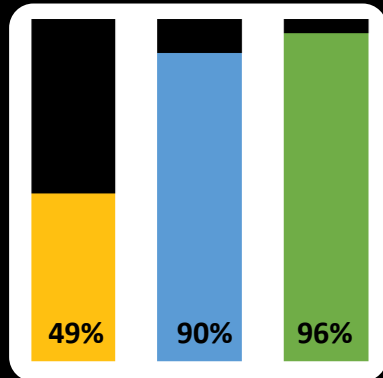
Review

- 852 papers \square 145 (43 primary)
- 132 webpages

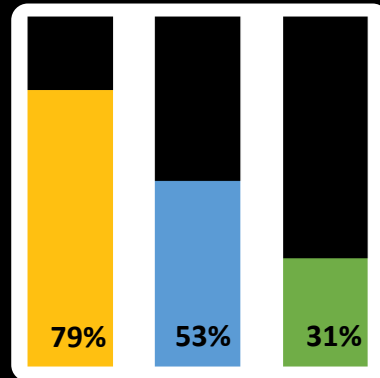
Direction



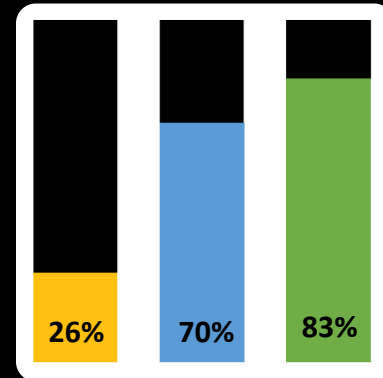
Causality



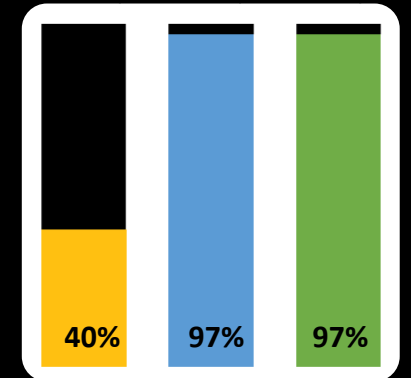
Uncertainty



Pathogen



Location



Implications

- Decisions based on simplistic messaging, neglect the importance of **local context**
- Bold messaging turns out to be wrong can erode **credibility**
- Implying that land change is the sole reason for spillover can detract from **other important drivers** of spillover risk

Recommendations

- Specify **context** and acknowledge generalizations
- Use **consistent terminology**
- Explain **mechanisms**
- Acknowledge **uncertainty & exceptions**
- Readers: Be **wary** of generalizations