CSD Research Briefing

Covid-19 and the Environment: Addressing the "Attributability Gap"

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Introduction

The emergence of the Covid-19 pandemic has triggered a great deal of commentary in the media concerning the linkages between environmental degradation and zoonotic Emerging Infectious Disease (EID) risk. However, because so many of the circumstances surrounding the Covid-19 outbreak have yet to be confirmed, such commentary generally confronts a "missing middle", stretching to link wider environmental problems with what occurred in Wuhan in December 2019. This briefing summarises the available evidence concerning future risks and historical cases of zoonotic disease transmission to human beings. It then untangles some important complex interrelationships between different environmental drivers, and the co-benefits of taking a concurrent as opposed to a hierarchical approach in managing these risks in the future.

Covid-19: an attributability problem

Various reputable media outlets have published pieces linking environmental degradation to the heightened risks of zoonotic disease (Vidal, 2020; Bruillard, 3rd April 2020; Briggs, 8th April 2020). The basic case common to mainstream media analysis is that outbreaks of new diseases is made far more likely by the increasing interactions between human beings and animals, which in turn derive from various causes, including environmental destruction, industrial agriculture, increasing human settlements and changing wildlife distributions, combined with far greater global "connectivity".

This commentary faces two pitfalls. On the one hand linking Covid-19 to wider trends of environmental degradation involves a sense of "stretch." Due to ongoing uncertainty concerning what actually happened in Wuhan in December 2019, it is extremely difficult to state definitively that environmental degradation was the root cause. This "missing middle" is not uncommon; it is very difficult to point to any "outbreak" and say "that's a result of environmental degradation". This constitute an "attributability problem" in a similar sense to the difficulties faced in stating that climate change is responsible for specific extreme weather events. The second pitfall is to narrow the focus to the specific concern of wet markets and the wildlife trade, illegal or otherwise. This has its own problems.

First, as alluded to above, In the case of Covid-19, there is no definitive answer to the question "whodunnit?" A concrete link to the Wuhan wet market has yet to be established, and we do not know the chain of transmission, and whether or not it involved an intermediary species. Possibilities include a human or an animal infected elsewhere bringing the infection to the wet market, (Cohen, 2020 and Anderson et al, 2020, both cited in Kapelle et al, 2020). Secondly, and more problematically, a focus on these issues risks dramatically underestimating the scale of policy response required to prevent future pandemics. Based both on current forecasting and previous experience, such a response needs to encompass structural the and inter-related problems of ecosystem degradation linked to land-use change, industrial agriculture, and climate change.

Future Zoonotic Risks: Ecosystem Degradation, Land-Use Change and a Warming Climate

In general terms it is practically a consensus that "zoonotic EID risk is elevated in forested tropical regions experiencing land-use changes and where wildlife biodiversity (mammal species richness) is high" (Allen et al., 2017; see also Fornace et al, 2019; Young et al, 2017; Mendoza et al, 2020; Gottdenker et al, 2014).

Analysis by the United Nations Environment Programme's Science Division, based substantially on a 2016 report (Kappelle et al, 2020; UNEP, 2016) makes the point that 75% of all emerging infectious diseases are zoonotic and most likely to be viruses. Citing a key study by Jones et al. (2013), it notes that:

> "Human-induced environmental changes modify wildlife population structure and reduce biodiversity, resulting in new environmental conditions that favour particular hosts, vectors, and/or pathogens. Ecosystem integrity can help regulate diseases by supporting a diversity of species so that it is more difficult for one pathogen to spill over, amplify or dominate…" (Kappelle et al, 2020, citing Jones et al., 2013).

The last UK Climate Change Risk Assessment published by the statutory Committee on Climate Change identified "new pests and diseases" as one of five key areas of risk emerging from a warming climate. Higher temperatures may lead to invasion by the Asian Tiger Mosquito, a vector for malaria, dengue fever and the Zika and Chikungunya viruses. Relatively small changes in the UK climate could lead to "dramatic" changes in the presence of parasitic nermatodes in livestock (CCC, 2016).

The International Panel on Climate Change's 2014 Fifth Assessment report found that what was true for the UK applied more broadly across temperate regions of the planet. Additional zoonotic threats highlighted by AR5 include Lyme disease, Tick-Bourne Encephalitis and Haemorrhagic fever with renal syndrome (HFRS), the latter caused by the Hantavirus, with rodents being the principal vector (Smith et. al., 2014).

Case study evidence on zoonotic risks: Ecosystem degradation through land use change and industrial agriculture

Examining seven of the most important zoonotic EID outbreaks over the last thirty years, land use change and ecosystem degradation are implicated as long term risk drivers in two cases (Ebola and MERS) and intensified livestock farming in four (MERS, BSE, Swine Flue and Nipah). Climate change is very likely to increase the risks associated with the remaining two diseases which share the same vector in the mosquito (Zika and West Nile Virus).

Emerging Infectious Disease	Year	Long-Term Risk Drivers
BSE	1988 - 1996	Industrial livestock farming
Nipah Virus	1998	Intensification of livestock farming
West Nile Virus	1999	Climate Change
SARS	2003	Unclear
Mexican Swine Flu	2009	Industrial livestock farming
Middle East Respiratory Syndrome (MERS)	2012	Intensification of livestock farming, ecological degradation / land use change
Ebola	2014	Land-use change, large scale land acquisitions, ecological degradation
Zika	2015	Climate Change
Covid-19	2019	Unclear

Although the evidence base is far stronger in these cases than for either SARS or Covid-19, detailed analysis remains less than it should be. The 1998 Nipah virus outbreak in Malaysia occurred as a result of intensified pig farming with fruit orchards in close proximity, providing the opportunity for the disease reservoir, fruit bats, to transmit the virus to pigs and thence to human beings (Pulliam et al, 2011; Epstein, et al 2006; Chua et al 2002). Pulliam et al. observe that by 1980, the site of the "Index farm" for the outbreak had a standing pig population of 30,000 (Pulliam et al, 2011).

Mexican Swine Flu, which emerged in 2012 in a pig farm located in Mexico operated by the US company appears to be a case of which appears to be a case of off-shoring of industrial livestock farming specifically to avoid regulation (GRAIN, 2009). MERS provides a mixed case of land use change and intensified livestock agriculture. In 2012 the virus emerged from a context of rapid urbanisation and expansion of camel husbandry in the Gulf States. Resulting desertification from overgrazing led to the trend of raising camels in closely confined installations, including "barns" in Qatar for example, (Farag et al, 2019).

Detailed and nuanced analysis of how land use changes occur, how they degrade ecosystems and how this in turn specifically influences zoonotic spill over is comparatively rare because of the unusual combination of expertise required. The Institute for Development Studies' work on Ebola is an important exception.

Ebola in 2014: an illustrative case study

The UK's Institute for Development Studies carried out award-winning work on the 2014 Ebola crisis in West Africa, combining anthropological and land use change expertise with epidemiological and serological data (Huff and Winnebah, 2015; see also the project page, Huff and Plati, 2015). Their key findings included:

- The dominant "outbreak" narrative emphasised the role and practices of rural people, emphasising the hunting of "bush meat" and debunked colonial stereotypes of locals causing deforestation for short-sighted reasons related to subsistence.
- This narrative bore scant relation to reality. While West African landscapes have comprised complex, anthropogenic combinations of savannah and forest for centuries, with human activity preserving and expanding forest islands (Fairhead and Leach, 1996) recent disturbances have come in the form of substantial land purchases by transnational actors.
- This trend is associated with the "Global Land Grab" that emerged from the sustained increase in food prices following the 2008 Great Financial Crisis.
- These purchases have seen large scale land use changes, implicating structural transformations in the global food system in the emergence of the Ebola crisis.

Conservation and Biodiversity and the need for pro-poor approaches

This is not an argument to ignore the wildlife trade, the importance of which has been recently emphasised by the Center for American Progress (Doshi and Gentile, 2020), nor to marginalise the need for intensified direct conservation and biodiversity approaches. At the same time, it remains the case that measures taken to "protect" the natural world are often hostile to forest-dwelling populations. Any intensification of conservation measures, from the Amazon to Sumatra, will do so in decades-old battlegrounds between often highly militarised state

agencies and rural people living in and around the forest. Such tensions often overlap with and reinforce the pre-existing ethnic or religious marginalisation of the former group. Indeed, there is a close historical association globally between conservation initiatives and counter-insurgency (Dunlap and Fairhead, 2014).

The literature detailing the simultaneous failure of conservation outcomes with the repression of forest dwelling populations is substantial enough to demonstrate that a genuinely people-centred approach to ecosystem preservation and restoration is vital, both for success in its own terms and to avoid inflicting further suffering on marginalised groups (Marijnen and Verweijin, 2016; Fairhead et al, 2013; Dorr et al. 2013; Ghazoul et al., 2010; Li, 2007; Amanor, 2005; Tsing, 2005; Vandergeest, 1996). Similar concerns need to guide policy action concerning issues like the illegal wildlife trade: reliably expeditious approaches like imprisoning poor hunters are of doubtful effectiveness as long as the demand for wildlife products exists among wealthy elites at home and abroad.

On wicked problems and "nexus"

Analysis of how each of the factors listed above is as important as examining these problems in isolation. Discussion of how complex, interrelated and interdependent human and environmental systems interact at the global scale, how problems in one area lead to problems in another, and the emergence of cascading and compound risks, have led to a proliferation of terms like "nexus" and the phrase "wicked problems" in the scientific and public policy literature. This captures a sense of the almost overwhelming complexity of the issues at stake, as well as the importance of looking beyond proximate causes for an individual instance of a general problem. Some of the more important examples include:

- Climate change exacerbates ecosystem degradation: a warming climate will lead to increasing degradation of ecosystems, with forests being more vulnerable to wildfires and drought for example (IPCC, 2019).
- In turn, land use change in the form of large-scale deforestation exacerbates climate change, both through the long-term loss of carbon sinks, but also in the increased likelihood and severity of sudden onset events like wildfires. It is estimated that the 1997 – 1998 Indonesian Wildfires, for example, emitted an amount of carbon equivalent to 13 – 40% of mean annual global emissions (Page et al, 2002).
- Industrial agriculture is itself a major driver of land-use change and carbon emissions (IPCC, 2019).
- Large-scale land acquisitions are a major driver of poverty (de Schutter, 2010).

The complexity of the interconnections between different problems has a positive aspect, and this is the fact that spending in one area will have knock-on benefits in other areas. This phenomenon is most carefully analysed in the climate change debate where it is termed "co-benefits". A good summary by Urge-Borsatz et al. has highlighted how the ancillary positive impacts of spending on climate change is so substantial that in many cases "non-climate benefits are likely to be the primary reasons for pursuing interventions" (Urge-Borsatz et al., 2014: 551). They cite the example of the Delhi subway system, which was originally embarked upon to relieve traffic congestion, but also enhances air quality, *in addition* to reducing GhG emissions.

An illustration of this in practice can be seen by simply reversing the chain of negative secondary impacts noted above. Regulating and reducing industrial livestock farming, for example, will reduce the chances of zoonotic spill over events. It will also reduce ecosystem degradation caused by land-use change, which will in turn further reduce the risk of a major novel disease outbreak further, while simultaneously advancing climate change mitigation goals, reducing ecosystem degradation therefore zoonotic risks. In aggregate, the literature on risk and reward pertaining to complex systems problems suggests that concurrent and interlinked across multiple policy domains is more likely to be effective than a hierarchical risk management approach that addresses problems sequentially in order of their perceived seriousness.

Conclusion

It is possible that the long-term structural causes of the Covid-19 outbreak will never be identified: seventeen years after the SARS outbreak, the international community is none the wiser. Focusing on the transmission chain alone is analogous to attributing World War One to the actions of Gavrilo Princip. While there is without doubt the requirement for further research on human-environment interactions and their underlying drivers on the model of IDS' Ebola programme, the evidence base is sufficiently robust to demonstrate the need for urgent policy action across the global food system. This must include the wildlife trade and scaling up direct conservation and biodiversity interventions that are genuinely pro-poor. Evidence on co-benefits also demonstrates the need to act across a range of policy domains concurrently rather than sequentially, as well as the efficacy and cost-effectiveness of doing so.

References

Allen, T., Murray, K.A., Zambrana-Torrelio, C., Morse, S.S., Rondinini, C., Di Marco, M., Breit, N., Olival, K.J., and Daszak, P. (2017) "Global hotspots and correlates of emerging zoonotic diseases", *Nature Communications*, 8: 1124.

Amanor, Kojo, 'Night Harvesters, Forest Hoods and Saboteurs: struggles over land expropriation in Ghana', in: Sam Moyo and Paris Yeros (eds.), Reclaiming the Land: the resurgence of rural movements in Africa, Asia and Latin America (London: Zed Books, 2005).

Andersen, K.G., Rambaut, A., Lipkin, W.I., Holmes, E.C. and Garry, R.F. (2020) "The proximal origin of SARS-CoV-2." *Nature Medicine* 26, (450 – 452).

Briggs, H. (2020) "Coronavirus: Exploiting nature 'drives outbreaks of new diseases'", *BBC*, 8th April, available at https://www.bbc.com/news/science-environment-52204724, (last accessed 10th April 2020).

Bruillard, K. (2020) "The next pandemic is already coming, unless humans change how we interact with wildlife, scientists say", *The Washington Post,* 3rd April, available at https://www.washingtonpost.com/science/2020/04/03/coronavirus-wildlife-environment/?fbclid=IwAR1XogFxqsKcXcfKaUdPPDaPBF8mgNEU62vTXBJyOzJZQ5-k1fgwLybKx5g , (last accessed 10th April 2020).

Chua, K.B., Chua, B.H. and Wan, C.W. (2002) "Anthropogenic deforestation, El Niño and the emergence of Nipah virus in Malaysia", *Malaysian J. Pathol.* 24 (1): 15 – 21.

Cohen, J. (2020). "Wuhan seafood market may not be source of novel virus spreading globally", *Science*, 26th January.

Dorr, T.F., Heskamp, A.B., Madison, I.B., and Reichel, K.D. (2013) "Missing the Poorest for the Trees? REDD+ and the Links between Forestry, Resilience and Peacebuilding", *International Alert* http://www.internationalalert.org/publications/missing-poorest-trees.

"Doshi, S. and Gentile, N. (2020) "When confronting a pandemic, we must save nature to save ourselves", Center for American Progress,April 20th, available at https://cdn.americanprogress.org/content/uploads/2020/04/17124900/Conservation-And-Pandemics.pdf (last accessed 26th April 2020).

Dunlap, Alexander and Fairhead, James, 'The Militarisation and Marketisation of Nature: An Alternative Lens to "Climate-Conflict"', Geopolitics 19: 4 (2014) 937 – 961.

Fairhead, J. and Leach, M. (1996) *Misreading the African Landscape: Society and Ecology in a Forest-Savannah Landscape* (Cambridge: Cambridge University Press).

Fairhead, James, Leach, Melissa and Scoones, Ian, 'Green grabbing: a new appropriation of nature?', in James Fairhead, Melissa Leach and Ian Scoones (eds.), Green Grabbing: a new appropriation of nature (Abingdon: Routledge, 2013) 1 – 25.

Farag, E., Sikkema, R., Vinks, T., Islam, Md. M., Nour, M., Al-Romaihi, H., Al Thani, M., Atta, M., Alhajri, F., Al Marri, S., Al Hajri, M., Reusken, C. and Koopmans, M., (2019) "Drivers of MERS-CoV Emergence in Qatar" *Viruses* 11 (1): 22.

Fornace, K.M., Alexander, N., Abidin, T.R., Brock, P.M., Chua, T.H., Vythilingam, I., Ferguson, H.M., Manin, B.O., Wong, M.L., Ng, S.H., Cox, J., and Drakeley, C. (2019) "Local human movement patterns and land use impact exposure to zoonotic malaria in Malaysian Borneo", *eLife* 8.

Ghazoul, J., Butler, Mateo-Vega, J. and Koh, L.P. (2010) "REDD: a reckoning of environment and development implications", Trends in Ecology and Evolution 25, 396 – 402.

Gilchrist, M.J., Greko, C., Wallinga, D.B., Beran, G.W., Riley, D.G., Thorne, P.S. (2007) "The Potential Role of Concentrated Animal Feeding Operations in Infectious Disease Epidemics and Antibiotic Resistance", *Environ Health Perspect.* 115(2): 313–316.

Gottdenker, N.L., Streicker, D.G., Faust, C.L. and Carroll, C.R. (2014) "Anthropogenic Land Use Change and Infectious Diseases: A Review of the Evidence", *EcoHealth* 11, 619–632.

"GRAIN (2009) "A food system that kills - Swine flu is meat industry's latest plague", GRAIN 28th April, available at: https://www.grain.org/article/entries/189-a-food-system-that-kills-swine-flu-is-meat-industry-s-latest-plague (last accessed 14th April 2020).

Huff, A. and Plati, L. (2015) "Ebola: lessons for development", *Institute of Development Studies* available at https://www.ids.ac.uk/projects/ebola-lessons-for-development/, (last accessed 12th April 2020).

Huff, A. and Winnebah, T. (2015) "Ebola, Politics and Ecology: Beyond the 'Outbreak Narrative'", *IDS Practice Paper in Brief 20* available at https://www.ids.ac.uk/publications/ebola-politics-and-ecology-beyond-the-outbreak-narrative/, (last accessed 12th April 2020).

IPCC (2019): "Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems" [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)].

Jones, B.A., Grace, D., Kock, R., Alonso, S., Rushton, J., Said, M.Y., McKeever, D., Mutua, F., Young, J., McDermott, J. and Pfeiffer, D.U. (2013). Zoonosis emergence linked to agricultural intensification and environmental change. Proceedings of the National Academy of Science, 110: 21, 8399 – 8404.

Kappelle, M., Sarasas, P. and Lelei, A. (2020) **"**Emerging Zoonotic Diseases and COVID-19", *United Nations Environment Programme*, available at https://www.unenvironment.org/news-and-stories/story/six-nature-facts-related-coronaviruses, (last accessed 10th April 2020).

Lebvedev, E. (2020) "Banning wildlife markets will help protect us all from the next great health crisis", *The Independent*, 10th April, available at https://www.independent.co.uk/voices/animal-markets-virus-wildlife-trafficking-ban-conservation-coronavirus-a9460186.html, (last accessed 11th April 2020).

Li, Tania Murray, *The Will to Improve: Governmentality, Development, and the Practice of Politics* (Durham: Duke University Press, 2007).

Marijnen, Esther and Verweijen, Judith, 'Selling green militarization: The discursive (re)production of militarized conservation in the Virunga National Park, Democratic Republic of the Congo', Geoforum 75 (2016) 274 – 285.

Mendoza, H., Rubio, A.V., García-Peña, G.E., Suzán, G. and Javier A. Simonetti, J.A. (2020) "Does land-use change increase the abundance of zoonotic reservoirs? Rodents say yes", *Eur J Wildl Res* 66: 6 (2020).

Page, S., Siegert, F., Rieley, J., Boehm H-D., Jaya, A. and Limin, S. (2002) "The amount of carbon released from peat and forest fires in Indonesia during 1997", *Nature* 420, 61–65.

Smith, K.R., Woodward A., Campbell-Lendrum, D., Chadee, D.D., Honda, Y., Liu, Q., Olwoch, J.M., Revich, B. and Sauerborn, R. (2014)"Human health: impacts, adaptation, and co-benefits", in Climate *Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y .O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P .R. Mastrandrea, and L.L. White (eds.)]. (Cambridge University Press: Cambridge).

Tsing, Anna Lowenhaupt, Friction: and Ethnography of Global Connection (Princeton: Princeton University Press, 2005).

UNEP, (2016) "Zoonoses: Blurred Lines of Emergent Disease and Ecosystem Health", in *Frontiers 2016: Emerging issues of environmental concern* (18 – 30), available at https://www.unenvironment.org/resources/frontiers-2016-emerging-issues-environmental-concern, (last accessed 10th April 2020).

Ürge-Vorsatz, D., Herrero, S.T., Dubash, N.K., and Lecocq, F. "Measuring the Co-Benefits of Climate Change Mitigation", *Annual Review of Environment and Resources* 39: 549-582.

Vandergeest, Peter, 'Mapping nature: territorialisation of forest rights in Thailand', Society and Natural Resources 9: 2 (1996): 159 – 175.

Vidal, J. (2020) "'Tip of the Iceberg': is our destruction of nature responsible for Covid-19?", *The Guardian*, 18th March, available at https://www.theguardian.com/environment/2020/mar/18/tip-of-the-iceberg-is-our-destruction-of-nature-responsible-for-covid-19-aoe, (last accessed 10th April 2020).

Young, H., McCauley, D.J., Dirzo, R., Nunn, C. and Lambin, E. (2017) "Interacting effects of land-use and climate on rodent-borne disease in central Kenya", *Philosophical transactions of the Royal Society of London. B* (372).

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