



COVID-19 AND AFRICA'S GREAT APES

Challenges and Threats Amidst the COVID-19 Pandemic for Sustaining Conservation through Responsible Great Ape Tourism

POLICY BRIEF





COVID-19 AND AFRICA'S GREAT APES

Challenges and Threats Amidst the COVID-19 Pandemic for Sustaining Conservation through Responsible Great Ape Tourism

POLICY BRIEF



Bonobo



Chimpanzee



Mountain Gorilla

ALICE MBAYAHI - *International Gorilla Conservation Programme*

GLADYS KALEMA - ZIKUSOKA - *Conservation Through Public Health*





Key Messages

Tourism brings people and great apes into close contact and because of their closely matched DNA great apes are susceptible to human diseases like coronaviruses. Adherence by tourists and field staff to the **IUCN Best Practice Guidelines for Great Ape Tourism** is therefore critical.

01

African governments, donors and tour operators need to establish and/or strengthen measures that minimize the risks of infection and other related threats to the survival of great apes.

02

Responsible tourism using a One Health approach can help minimise the trade-offs between economic motives and great ape conservation.

03

Community-based long-term nature-based and nature-compatible enterprises at great ape sites should be supported by governments, donors and tour operators to promote diversified income generation to reduce direct dependence on great ape tourism.

Why this Policy Brief

This policy brief highlights the key challenges and threats facing Africa's great apes in the wake of the global COVID-19 pandemic and offers actionable recommendations for a One Health^a approach that can achieve great ape conservation, responsible tourism and community benefits.

Key Audience

Governments, tourism industry, private sector and donors.

The Challenge

Africa's great apes including bonobos, chimpanzees and gorillas face grave and growing threats including poaching, habitat loss and fragmentation and wildlife trafficking.¹ The emergence of the highly-infectious COVID-19 disease also presents great apes with a new threat additional to those posed by pre-existing transmissible human diseases.² Rangers, guides, porters, researchers, trackers, tourists and surrounding communities interact on the same land with habituated great apes and can transmit diseases to each other when they come into close proximity.³

Great Ape tourism is active at 33 sites in 13 countries across west, central and east Africa (Cameroun, Central African Republic, DR Congo, Gabon, Guinea Bissau, Ivory Coast, Liberia, Republic of Congo, Rwanda, Senegal, Sierra Leone, Tanzania, Uganda), involving seven species/populations (Mountain Gorillas, Grauer's Gorillas, Western Lowland Gorillas, Eastern Chimpanzees, Central Chimpanzee, Western Chimpanzees and Bonobo). For further details on these locations and populations see the addendum to this policy brief.

Great ape tourism generates revenue that contributes significantly to national economies and community development with as much as 60% being allocated to wildlife management in the case of Uganda.⁴ Both the survival of great apes, and all these benefits to livelihoods and economies are at risk due to the COVID-19 pandemic.

There is, therefore great urgency for African governments to strictly and consistently enforce best practices in great ape tourism⁵ to protect and manage the health⁶ of endangered and critically endangered populations of great apes. A One Health approach enables this to be done at the same time as optimizing the benefits of tourism, especially to local communities, through people-centered and nature-positive approaches.

Key Threats

Infectious Disease Susceptibility

Great apes are susceptible to a wide range of human diseases, including measles, scabies, tuberculosis, common flu, and other respiratory diseases.^{7,8} First-time exposure to an illness or virus that is

^a The 'One Health' approach aligns priorities for human health and environmental health, recognizing that each is critical for supporting the other. 'One Health' is consistent with the Sustainable Development Goals and ACBA's focus on Sustainable Use as a foundational principle for biodiversity conservation in Africa. See https://www.onehealthcommission.org/en/why_one_health/what_is_one_health/

^b Tour operators are businesses that combine two or more travel services (e.g., transport, accommodation, meals, entertainment, sightseeing) and sell them through travel agencies or directly to final consumers as a single product (called a package tour) for a global price. See <https://tourismnotes.com/tour-operators/>



relatively innocuous to humans can devastate an entire ape population. Because humans and great apes share over 98% DNA genetic material and have the same angiotensin-converting enzyme-2 protein receptors that the SARS-COV-2 virus attaches to, great apes can easily contract COVID-19 from people^{9,10}. Some apes, especially gorillas and chimpanzees, have in the past succumbed to respiratory viruses, including coronaviruses, which quickly spread within and between groups as they interact.^{11, 12, 13, 14, 15, 16, 17} If a novel disease like COVID-19 circulates in small vulnerable great ape populations causing significant morbidity and mortality, local or subspecies extinction can occur.¹⁸ Captive gorillas in zoos contracted COVID-19 from asymptomatic keepers^{29,30} providing direct evidence that great apes are susceptible to this novel coronavirus.

Although several governments have implemented policies to minimize the risk of disease transmission, enforcement of existing best practice recommendations remains weak.

The great ape visitation rules, including viewing distance guidelines, are routinely violated, increasing the risk of disease transmission from humans.¹⁹

Inappropriate tourism marketing increases potential risky behaviours instead of reinforcing risk mitigation

Due to competition for clients, some tour operators ignore the tourism standards and best practices in order to make their products more appealing, while others are not even aware

of them. Some operators post inappropriate marketing messages, including images of tourists close to or touching great apes, seemingly offering clients a similar experience.²⁰ Tourists also post similar images on social media.³¹ This kind of marketing not only sends the wrong message, it raises tourists' expectations and trivialises conservation efforts as some tour handlers may resort to unethical practices to allow their tourists to get closer to the wild animals.²¹

Lack of awareness or limited knowledge of great ape tourism rules puts great apes at risk from contagious human diseases

While some tourists are quick to disregard tourism rules in the absence of strict enforcement, others are simply unaware of them.²² Tourism site managers, tour companies, handlers and guides are sometimes reluctant to educate tourists about the great ape viewing guidelines before their adventure. Lack of knowledge leads to non-compliance to the rules, exposing the apes to both asymptomatic and visibly ill tourists. Tourists should be held accountable for failing to respect rules.

Inadequate capacity to manage disease outbreaks

With tourism revenue drastically curtailed by the coronavirus pandemic, tourism sites are struggling financially, and many are unable to provide adequate personal protective equipment, medicine, food and water to their staff. This in itself is demotivating to the teams responsible for the health of wildlife and management of tourists. Additionally, most great ape sites lack clear-cut contingency plans,²³ including operational funds and technical personnel to handle epidemics should they break out, making the situation even riskier.²⁴

Climate, economic and social vulnerability

A combination of factors creates a potential 'perfect storm' arising from increased and frequent contact between humans and great apes both inside and outside their habitats, compounded by the growing human populations surrounding most great ape habitats. Communities living adjacent to parks often lack adequate sanitation and hygiene and have limited access to basic health care services and clean water, forcing them to source many of these basic services from inside the protected areas.¹ Because of all this and more, disease outbreaks especially diarrheal and respiratory illnesses are a common occurrence.²⁴

Furthermore, these boundary communities usually survive on subsistence farming characterized by limited incomes and high food insecurity due to changing weather, adverse economic conditions, poor infrastructure and low literacy levels.²⁵

Recommendations

To African Governments:

- Develop and adopt clear guidelines for the re-opening and management of ape visitation that include mandatory wearing of masks by park staff, tourists and researchers, Consider decreasing the number of people for each daily visit from 8 to 6 and increasing the viewing distance from 7 to 10 meters.
- Enforce strict adherence to, the IUCN Best Practice Guidelines^{5, 6} for disease prevention.
- Consider testing and vaccinating park staff against COVID-19 and other preventable diseases.
- Support local communities to develop both tourism and non-tourism dependent livelihoods that are compatible with great ape conservation, through nature-based and nature-compatible enterprises.³⁵
- Enhance opportunities for transboundary collaboration and sharing of information and lessons on pandemics and conservation approaches that are people-centred and nature-positive and apply a One Health approach.

To Donor Partners:

- Channel funding to critical conservation sites and issues including; the improvement of health systems around great ape habitats, equipping park staff with necessary protective gear and supplies and capacity building of park staff on disease identification, monitoring and management.
- Support government agencies to establish an African Great Apes Emergency Fund for disease response and great ape conservation during periods of reduced tourism.
- Support and invest in research on prevention of disease transmission between humans and great apes.
- Support local communities to develop both tourism and non-tourism dependent livelihoods enterprises that are compatible with great ape conservation.

To Tour Operators:

- Heighten vigilance to ensure adherence to best practice guidelines for responsible marketing of all tourism services.
- Sensitize clients about great ape tourism best practice guidelines ahead of the visit guidelines and hold them accountable.
- Sensitize clients about great ape visitation rules in advance and hold them accountable.
- Encourage government agencies to enforce great ape tourism basic best practices.
- Encourage clients to promote conservation at great ape sites by supporting local community initiatives.

Conclusion

Evidence clearly shows that great apes can and do contract human respiratory infections. With the current availability of effective vaccines against COVID-19 that prevent severe disease, there is an urgent need to further protect great apes from infection by making vaccines available to people interacting closely or sharing a habitat with them³³, and ensure the promotion and circulation of information about vaccines with culturally-appropriate messages to combat vaccine misinformation and vaccine hesitancy. Such target people include park staff, conservation and tourism personnel, local communities and tourists.

Even after the current COVID-19 pandemic has been brought under control to the fullest extent possible, these recommendations should continue to be enforced to protect great apes and the tourism industry, against emerging zoonotic diseases and future pandemics. Respiratory disease incidences in great apes have reduced after mandatory mask usage including during the pandemic³⁴ demonstrating the benefits of continuing with these recommendations even after the COVID-19 pandemic ends to protect great apes from common flu viruses and other human related diseases.

An integrated 'One Health' response to the COVID-19 pandemic has the potential to protect great apes and other wildlife whilst safeguarding the communities with whom they share their habitats, now and in the future.

ANNEXES

ANNEX I: Acknowledgements

Annex II: Map of great ape tourism sites in Africa

Annex III: References and Notes



ANNEX I: ACKNOWLEDGEMENTS

The authors thank all the individuals who contributed their time to provide information on which this policy brief is based; Fred Kumah, Anna Behm Masozera, David Obura, Janvan Kombo, Johannes Refisch, Milena Beekmann, Kevin Barrett, Taye Taferi, and Katie Fawcett for their in-depth in-put and Liz Williamson, Angelique Todd, Lisa Truitt, Ally Jamah, Tony Goldberg, Kirsten Gillardi, Martha Robbins, David Greer, Thomas Gillespie, Dominic Travis, Lynne Gaffikin, Tatyana Humle, Marc Ancrenaz, Sian Waters, Kimberley Hockings, Chloe Chesney and Elena Bersacola for their thoughtful review.

Photo Credit: Bonobo and Chimpanzee images by Jo Thompson, Takeshi Furuichi and Budongo Conservation Field Station; Mountain gorilla images by Mgahinga Gorilla National Park, Uganda Wildlife Authority and International Gorilla Conservation Programme.

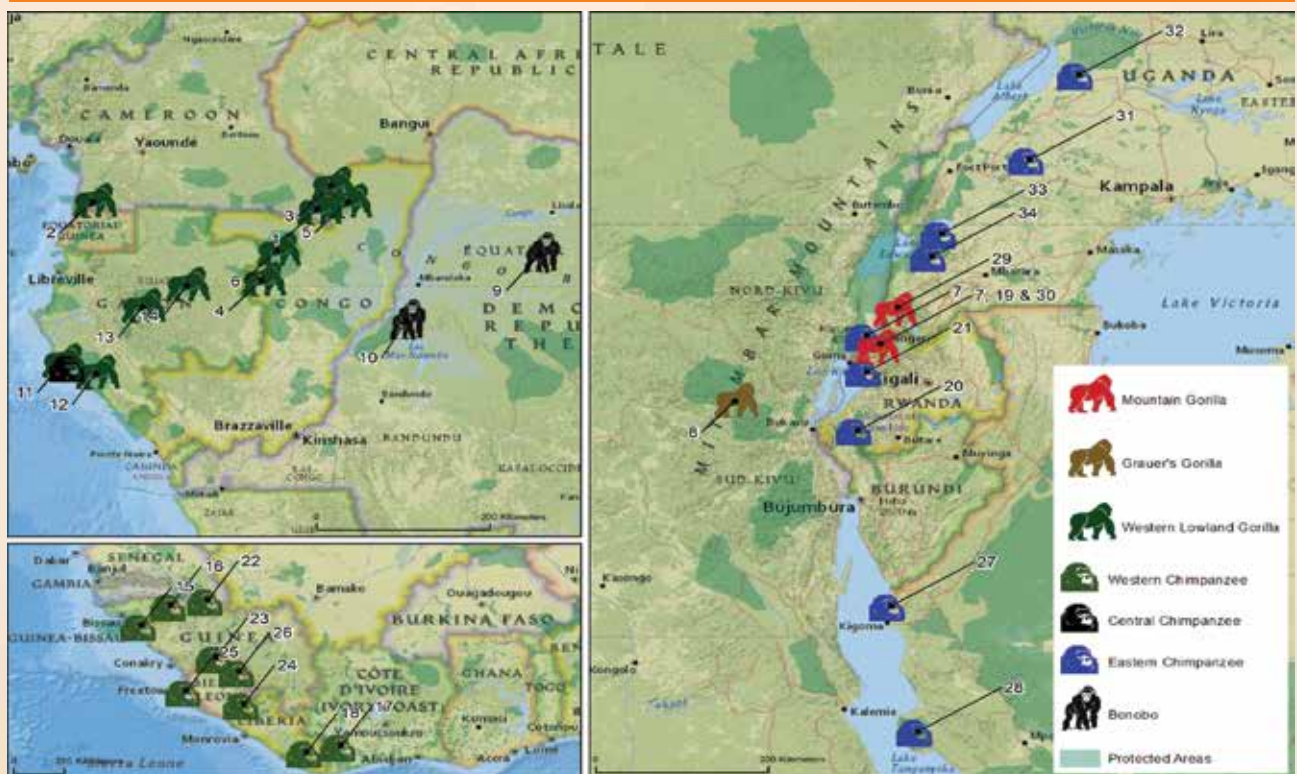
Map Credit: International Gorilla Conservation Programme/Stephen Holness; Site data compiled with support from UNEP-GRASP and IUCN SSC Primate Specialist Group Section on Great Apes; PA data from UNEP-WCMC World Database on Protected Areas (WDPA).

Translation from English to French: Tatyana Humle, Liz Williamson, Altor Musema and Innocent Djossou

The authors thank the Arcus Foundation and African Wildlife Foundation for the financial support that enabled the development and publication of this policy brief and the African CSOs Biodiversity Alliance (ACBA) for the encouragement.

The International Gorilla Conservation Programme is a coalition of Fauna & Flora International, Conservation International, and World Wildlife Fund.

ANNEX II - MAP OF GREAT APE TOURISM SITES IN AFRICA



This map represents sites that offer different types of primate viewing experiences and are at different stages of development. NOTE: We believe that Chimpanzee sites remain under represented.

ANNEX III – LIST OF COUNTRIES AND TOURISM SITES

Country	Map Code	Park	Mountain Gorillas	Grauer's Gorillas	Western Lowland Gorillas	Eastern Chimpanzees	Central Chimpanzee	Western Chimpanzees	Bonobo
Cameroun	1	Lobéké National Park							
	2	Campo Ma'an							
Central African Republic	3	Dzanga Sangha							
Republic of Congo	4	Lossi interzone							
	5	Nouabalé-Ndoki National Park							
DR Congo	6	Virunga National Park							
	7	Kahuzi-Biega National Park							
	8	Lomako-Yokokala Faunal Reserve							
	9	Lac Tumba, Malebo							
Gabon	10	Parc National du Loango							
	11	Moukalaba-Doudou National Park							
	12	Lopé National Park							
	13	Ivindo National Park, Langoué,							
Guinea Bissau	14	Cantanhez National Park							

Country	Map Code	Park	Mountain Gorillas	Grauer's Gorillas	Western Lowland Gorillas	Eastern Chimpanzees	Central Chimpanzee	Western Chimpanzees	Bonobo
	15	Boé National Park						■	
Ivory Coast	16	Taï National Park						■	
Liberia	17	Sapo National Park						■	
Rwanda	18	Volcanoes National Park	■						
	19	Nyungwe Forest National Park				■			
	20	Gishwati-Mukura National Park				■			
Senegal	21	Reserve Naturelle Communautaire de Dindefelo						■	
Sierra Leone	22	Outamba National Park						■	
	23	Gola National Park						■	
	24	Western Peninsula National Park						■	
	25	Loma Mountains National Park						■	
Tanzania	26	Gombe Stream National Park					■		
	27	Mahale Mountains National Park					■		

Country	Map Code	Park	Mountain Gorillas	Grauer's Gorillas	Western Lowland Gorillas	Eastern Chimpanzees	Central Chimpanzee	Western Chimpanzees	Bonobo
Uganda	28	Bwindi Impenetrable National Park							
	29	Mgahinga Gorilla National Park							
	30	Kibale Forest National Park							
	31	Budongo Forest Reserve							
	32	Kyambura Gorge, Queen Elizabeth National Park							
	33	Kalinzu Forest Reserve							

ANNEX IV: REFERENCES AND NOTES

1. GRASP/IUCN status report on great apes and ape populations for the CITES Secretariat: Refisch, J., Wich, S.A., Williamson, E.A. (2018): Report to the CITES Standing Committee on the Status of Great Apes. United Nations Environment Programme Great Apes Survival Partnership, Nairobi, and International Union for Conservation of Nature, Gland. <https://cites.org/sites/default/files/eng/com/ac/30/E-AC30-26.pdf>
2. Thomas R. Gillespie, Fabian H. Leendertz, Steve Ahouka, Christelle-Patricia Lumbu Banza, Marc Ancrenaz, Richard Berg, Sebastien Calvignac-Spencer, Ariane Düx, Jan F. Gogarten, Livia Victoria Patrono, Emmanuel Couacy-Hymann, Tobias Deschner, Martha Robbins, Roman Wittig, Terence Fuh-Neba, Ilka Herbing, Gladys Kalema-Zikusoka, Inza Kone, Elizabeth V. Lonsdorf, Patrice Makouloutou Nzassi, Jane Raphael, Deus Cyprian Mjungu, Johannes Refisch, Innocent B. Rwego, Dominic Travis, Martin Surbeck, Serge Wich. 2020. *COVID-19: Protect Great Apes During Human Pandemic*, <https://www.nature.com/articles/d41586-020-00859-y>
3. Woodford, Michael H., Butynski, Thomas M. and Karesh William B. 2002. Habituating the great apes: the disease risks. *Oryx* Vol 36 No 2 April 2002
4. Tenywa Gerald. 2019. Gorillas Biggest Tourism Foreign Exchange Earner <https://www.newvision.co.ug/news/1506406/gorillas-biggest-tourism-foreign-exchange-earner>
5. Macfie, E.J. et Williamson, E.A. (2010). *Lignes directrices pour de meilleures pratiques en matière de tourisme de vision des grands singes*. Groupe de spécialistes des primates de la CSE de l'UICN, Gland, Suisse. <https://portals.iucn.org/library/node/9746>.
6. Gilardi, K.V., Gillespie, T.R., Leendertz, F.H., Macfie, E.J., Travis, D.A., Whittier, C.A. et Williamson, E.A. (2016). *Lignes directrices pour de meilleures pratiques en matière de suivi de la santé et contrôle des maladies des populations de grands singes*. Groupe de spécialistes des primates de la CSE de l'UICN, Gland, Suisse. <https://doi.org/10.2305/IUCN.CH.2016.SSC-OP.56.fr>
7. Kalema-Zikusoka G, Kock R. A., Macfie E. J. 2002. Scabies in free-ranging mountain gorillas (*Gorilla beringei beringei*) in Bwindi Impenetrable National Park, Uganda. *Veterinary Record* 150 (1):12-5. doi. 10.1136/vr.150.1.12
8. Graczyk, T.K., Mudakikwa, A.B., Cranfield, M.R. et al. 2001. Hyperkeratotic mange caused by *Sarcoptes scabiei* (Acariformes: Sarcoptidae) in juvenile human-habituated mountain gorillas (*Gorilla gorilla beringei*). *Parasitol Res* 87, 1024–1028 <https://doi.org/10.1007/s004360100489>
9. Joana Damas, Graham M. Hughes,, Kathleen C. Keough, Corrie A. Painter, Nicole S. Persky, Marco Corbo, Michael Hiller, Klaus-Peter Koepfli , Andreas R. Pfenning, Huabin Zhao, Diane P. Genereux, Ross Swofford, Katherine S. Pollard, Oliver A. Ryder, Martin T. Nweeia, Kerstin Lindblad-Toh, Emma C. Teeling, Elinor K. Karlsson and Harris A. Lewin. Broad Host Range of SARS-CoV-2 Predicted by Comparative and Structural Analysis of ACE2 in Vertebrates. *BioRxiv preprint* doi:<https://www.biorxiv.org/content/10.1101/2020.04.16.045302v1>
10. Amanda D. Melin, Mareike C. Janiak Frank Marrone, Paramjit S. Arora, & James P. Higham. Comparative ACE2 variation and primate COVID-19 risk. 2020. *Biorxiv*. The Preprint server for Biology. Cold Spring Harbor Laboratory. <https://www.biorxiv.org/content/10.1101/2020.04.09.034967v2>
11. Palacios, G; Lowenstine, L.J, Cranfield, M.R., Gilardi, KVK, Spelman, L., Lukasik-Braum, M., Kinani, J.F., Mudakikwa, A., Nyirakaragire, E, Bussetti, AV, Savji, N., Hutchison, S., Egholm, M. and Lipkin. I.W. 2011. Human Metapneumovirus Infection in Wild Mountain Gorillas, Rwanda. *Emerg Infect Dis*. 2011 Apr; 17(4): 711–713. doi: 10.3201/eid1704.100883

12. Köndgen, S., M. Leider, F. Lankester, A. Bethe, A. Lubke-Becker, F. H. Leendertz and C. Ewers (2011). *Pasteurella multocida* involved in respiratory disease of wild chimpanzees. *PLoS One* 6(9): e24236.
13. Scully, E.J, Basnet, S, Wrangham, R.W., Muller, M.N., Otali, E., Hyeroba, D., Grindle, K. A., Pappas, T.E., Thompson, M. E., Machanda, Z., Watters, K.E., Palmenberg, A. C., Gern, J. E. , Goldberg, T. L. 2018. Lethal Respiratory Disease Associated with Human Rhinovirus C in Wild Chimpanzees, Uganda, 2013. *Emerging Infectious Diseases* · February 2018 DOI: 10.3201/eid2402.170778, https://wwwnc.cdc.gov/eid/article/24/2/17-0778_article
14. Coscolla, M., A. Lewin, S. Metzger, K. Maetz-Rensing, S. Calvignac-Spencer, A. Nitsche, P. W. Dabrowski, A. Radonic, S. Niemann, J. Parkhill, E. Couacy-Hymann, J. Feldman, I. Comas, C. Boesch, S. Gagneux and F. H. Leendertz. 2013. Novel *Mycobacterium tuberculosis* complex isolate from a wild chimpanzee. *Emerg Infect Dis* 19(6): 969-976.
15. Livia V. Patrono, Liran Samuni, Victor M. Corman, Leila Nourifar, Caroline Röthemeier, Roman M. Wittig, Christian Drosten, Sébastien Calvignac-Spencer and Fabian H. Leendertz. Human coronavirus OC43 outbreak in wild chimpanzees, Côte d'Ivoire. *Emerging Microbes & Infections*. 2018. 7:118 *Emerging Microbes & Infections* DOI 10.1038/s41426-018-0121-2 www.nature.com/emi
16. Grutzmacher, K. S., V. Keil, S. Metzger, L. Wittiger, I. Herbinger, S. Calvignac-Spencer, K. Matz-Rensing, O. Haggis, L. Savary, S. Kondgen and F. H. Leendertz (2018). Human respiratory syncytial virus and *Streptococcus pneumoniae* infection in wild bonobos. *Ecohealth* 15(2): 462-466.
17. Negrey, J., R. Reddy, E. Scully, S. Phillips-Garcia, L. Owens, K. Langergraber, J. Mitani, M. E. Thomson, R. Wrangham, M. Muller, E. Otali, Z. Machanda, D. Hyeroba, K. Grindle, T. Pappas, A. Palmenberg, J. Gern and T. Goldberg (2019). Simultaneous outbreaks of respiratory disease in wild chimpanzees caused by distinct viruses of human origin. *Emerging Microbes and Infections* 8: 139-149.
18. Non-Human Primate COVID-19 Information Hub, <https://umnadvet.instructure.com/courses/324>
19. Annalisa Weber, Gladys Kalema-Zikusoka and Nancy J. Stevens. (2020). Lack of Rule-Adherence During Mountain Gorilla Tourism Encounters in Bwindi Impenetrable National Park, Uganda, Places Gorillas at Risk from Human Disease. *Frontiers in Public Health*. Original Research published: 13 February 2020 doi: 10.3389/fpubh.2020.0 <https://www.frontiersin.org/articles/10.3389/fpubh.2020.00001/full>
20. Ryoma Otsuka, Gen Yamakoshi. 2020. Analyzing the popularity of YouTube videos that late mountain gorilla tourism regulations. *PLOS ONE* | <https://doi.org/10.1371/journal.pone.0232085> May 21, 2020
21. Saha and Yap. 2013. Do Political Instability, Terrorism, and Corruption Have Detering Effects on Tourism Development Even in the Presence of UNESCO Heritage? A Cross-Country Panel Estimate. November 2013. *Tourism Analysis* 18(5):587-599
22. Allison C. Hanes, Gladys Kalema-Zikusoka, Magdalena S. Svensson, and Catherine M. Hill (2018). Assessment of Health Risks Posed by Tourists Visiting Mountain Gorillas in Bwindi Impenetrable National Park, Uganda. *Primate Conservation* 2018 (32): 10 pp.
23. Kirsten Gilardi, Julius Nziza, Benard Ssebide Eddy Kambale Syaluha, Richard Muvunyi, Robert Aruho, Chantal Shalukoma, Andrew Seguya, Anna Behm Masozera. Endangered mountain gorillas and COVID-19: One health lessons for prevention and preparedness during a global pandemic. *Am J Primatology*. 2021. doi: 10.1002/ajp.23291
24. UNEP Frontiers report: preventing the next pandemic: Zoonotic diseases and how to break the chain of transmission: <https://www.unenvironment.org/resources/report/preventing-future-zoonotic-disease-outbreaks-protecting-environment-animals-and>.
25. Colin A. Chapman Bianca van Bavel, Carl Boodman, Ria R. Ghai, Jan F. Gogarten, Joel Hartter, Lauren E. Mechak, Patrick A. Omeja, Sofia Poonawala, Dan Tuli, and Tony L. Goldberg (2015). *Oryx*. 2015 Oct; 49(4):

- 636–642. Published online 2014 Aug 11. doi: 10.1017/S0030605313001592
26. Lynne Gaffikin and Gladys Kalema-Zikusoka. 2010. Integrating Human and Animal Health for Conservation and Development: Findings from a Program Evaluation in Southwest Uganda. Consultancy report to John Snow. https://publications.jsi.com/JSIInternet/Inc/Common/_download_publication?id=11196&lid=3
 27. Uganda Bureau of Statistics (UBOS) 2016. Demographic and Health survey Uganda 2016. *MEASURE DHS: Demographic and Health Surveys*
 28. Kenneth Balikoowa. 2008. Impacts of Bwindi Impenetrable National Park on local people's livelihoods: Thesis for: Msc MNRS. Advisor: Assoc Professor Espen Sjastaad. PAPIA project. <https://www.researchgate.net/publication/239538763>
 29. Ann Gibbons. 2021. Captive gorillas test positive for coronavirus. Health, Plants & Animals, Coronavirus doi:10.1126/science.abg5458, <https://www.sciencemag.org/news/2021/01/captive-gorillas-test-positive-coronavirus>
 30. Ian Willoughby. 2021. Two more gorillas at Prague Zoo test positive for Covid. Huffington Post. <https://english.radio.cz/two-more-gorillas-prague-zoo-test-positive-covid-8712362>
 31. Gaspard Van Hamme, Magdalena S. Svensson, Thais Q. Morcatty, K. Anne-Isola Nekaris, Vincent Nijman. Keep your distance: using Instagram posts to evaluate the risk of zoonotic disease transmission in gorilla ecotourism. *Journal of Zoo and Wildlife Medicine*, 44, 1027-1035.
 32. Simplicious J. Gessa, Jessica M. Rothman. The importance of message framing in rule compliance by visitors during wildlife tourism. 2021 <https://doi.org/10.1111/csp2.515>
 33. Fabian H. Leendertz and Gladys Kalema-Zikusoka. 2021. Vaccinate in biodiversity hotspots to protect people and wildlife from each other. *Nature* 591, 369 (2021) doi: <https://doi.org/10.1038/d41586-021-00690-z>, <https://www.nature.com/articles/d41586-021-00690-z#author-0>
 34. Kirsten Gilardi & Prosper Uwingeli. 2022. Keep mountain gorillas free from pandemic virus. *Nature*. 602 (2022). <https://www.nature.com/articles/d41586-022-00331-z#author-0>
 35. Gladys Kalema-Zikusoka, Stephen Rubanga, Alex Ngabirano and Lawrence Zikusoka. 2021. Mitigating Impacts of the COVID-19 Pandemic on Gorilla Conservation: Lessons From Bwindi Impenetrable Forest, Uganda. *Frontiers in Public Health*. Perspective published: 12 August 2021 doi: 10.3389/fpubh.2021.655175; <https://pubmed.ncbi.nlm.nih.gov/34490176/>

