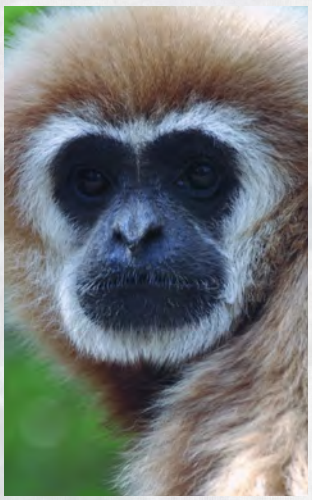
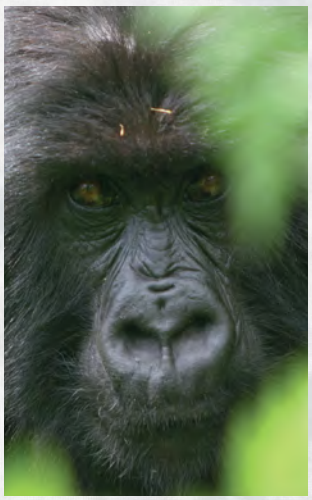
POLICY BRIEFING

State of the Apes

Disease, Health and Ape Conservation

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Content developed from *State of the Apes: Disease, Health and Ape Conservation*
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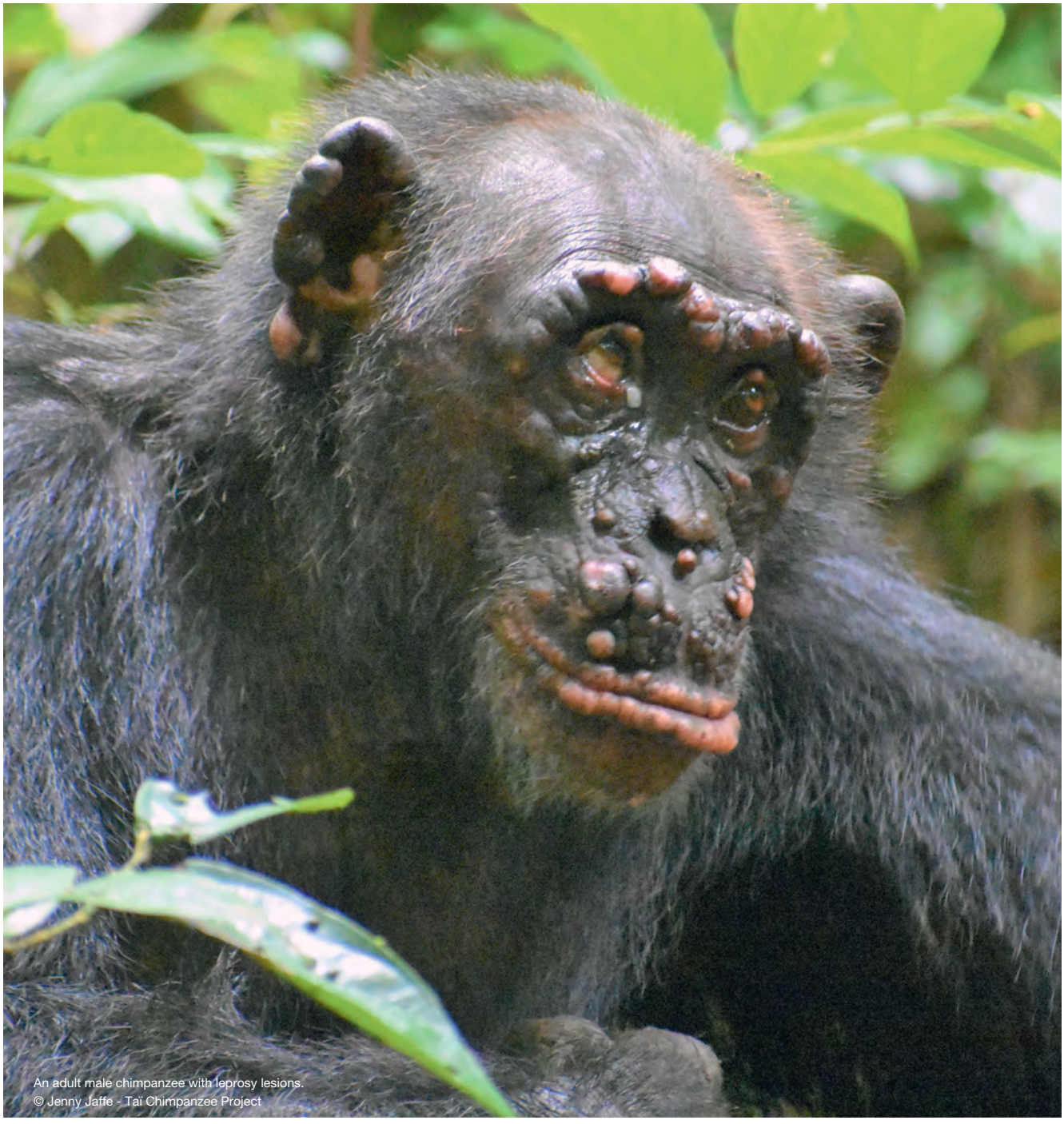
Introduction

This policy briefing draws from *State of the Apes: Disease, Health and Ape Conservation*, which is the fifth volume in the series. In addition to policymakers, other groups, including conservationists, philanthropic institutions, researchers and scientists, have roles in improving ape health and welfare. This briefing describes actions that these stakeholders can take. As all apes are endangered species, it is critically important to safeguard their health and welfare in captive, semi-captive and wild settings as a matter of urgency. Policymakers have a crucial role in catalyzing action as they have the ability to foster an enabling environment for essential action from other stakeholders.

Health Risks to Apes

Health risks to captive, semi-captive and wild ape populations include infectious diseases and non-infectious health issues. These are described in the volume's *Chapter 1: Review of Ape Disease and Health*. As these risks can lead to the illness and death of endangered individuals or groups, all stakeholders with a role in the management of ape populations and their health must understand them and their causes. Management of ape health is an important policy priority not only because apes are endangered species and have intrinsic, ecological and economic value, but because apes and humans are susceptible to similar diseases, which allows for spillovers in both direc-



An adult male chimpanzee with leprosy lesions.
© Jenny Jaffe - Taï Chimpanzee Project

tions.[1] For example, apes can suffer from diseases that affect humans, such as leprosy and yaws.[2] Similarly, some human diseases, such as Ebola, human immunodeficiency virus (HIV) and malaria, originated in or were hosted by apes.[3] Management of ape health, therefore, can have important implications for human health and should be prioritized by policymakers, as well as other stakeholder groups.

Infectious Diseases and their Impacts

Infectious diseases caused by bacteria, parasites and viruses are a major threat to apes and the leading cause of ape illness and death.[4] Disease outbreaks of human origin are common in both captive and wild settings.[5] Owing to genetic similarities, apes are highly susceptible to human diseases, for which they may not have immunity.[6] To address infectious disease risks, policymakers should place emphasis on policies that create human behavior change to lessen behaviors that can lead to health risks, while at the same time supporting more research into emerging diseases and their potential implications for apes.[7]

Wild Apes

Although information gaps remain, many pathogens are known to have a measurable effect on wild great ape health and survival. These include bacterial, parasitic and viral diseases. Bacterial infections, such as anthrax, leprosy and tuberculosis (TB), can have a devastating impact on ape populations.[8] The parasitic infectious skin disease sarcoptic mange, known as scabies, is caused by a mite. It is highly contagious and if left untreated can be fatal to apes.[9] Viruses naturally occurring in apes, such as Ebola, monkeypox and simian immunodeficiency virus (SIV), as well as respiratory pathogens transmitted from humans, can cause ape illness and death, leading to catastrophic impacts on wild populations.[10]

Differences in ape diet, social structure and ranging behavior influence the risks of exposure and disease spread between wildlife groups.[11] It is an important fact that species' social structures vary, therefore the same pathogen may not spread the same way in different species.[12] More research is needed to gain greater understanding of wild ape diseases and to inform strategies to reduce risks for apes and humans.[13]

Captive and Semi-captive Apes

Similar to wild apes, infectious diseases among captive and semi-captive apes include bacteria, parasites and viruses.[14] Additionally, many apes in sanctuaries, particularly in the USA, have been deliberately infected with various pathogens for research purposes and may need specialized care.[15] Bacterial infections among captive and semi-captive apes include air sacculitis, *Candidatus Sarcina troglodytae*, leprosy, malaria, melioidosis, *Streptococcus pneumoniae*, TB and yaws.[16] Parasites are common in apes and clinical signs have been documented among those in captivity.[17] Viruses affecting captive apes include herpes, human respiratory pathogens, monkeypox and SARS-CoV-2 (the virus associated with COVID-19).[18]

To reduce the risk of infectious disease spread among captive and semi-captive apes, those working in proximity to apes must observe strict biosafety practices and hygiene rules.[19] To support adherence to these precautions, which are important for both ape and human safety, policymakers should incorporate best management practices for captive and semi-captive ape health into domestic legal frameworks. Further, to support capacity building among facility managers, accreditation associations can facilitate networks for knowledge sharing.

Non-infectious Health Issues

In addition to infectious diseases, apes in captive and wild settings are at risk from non-infectious health issues. These issues include injury, degenerative conditions, psychological stress and physiological stress. As non-infectious health issues are largely preventable, it is important for policymakers to increase their knowledge about them and their causes to support better management practices.

Non-infectious health issues among captive and semi-captive populations are better understood. Captive apes commonly experience conditions directly or indirectly resulting from captivity that are rarely reported in wild ape populations.[20] These include issues related to age, malnutrition and psychological stress. Owing to their increased lifespans, for example, captive apes can experience age-related degenerative conditions that may be treatable but not preventable. Also, malnutrition can occur in captive apes resulting in nutritional deficiencies, obesity or both. Further, psychological stress can be signaled through abnormal behaviors such as aggression toward caretakers or other apes, body rocking, eating of feces, excessive hair plucking, and regurgitation and re-ingestion of food.[21]

Causes of Health Risks to Apes

Infectious diseases and non-infectious health issues often share similar causes.[22] For policymakers and other stakeholders, understanding these causes can enable better management of the threats they pose to ape survival. The causes of health risks to apes include the care that captive apes receive, habitat destruction and encroachment, illegal trade and illegal captivity, industrial development, natural disasters, tourism and research activities, and transfers and translocations.

Living in Captivity

Environmental challenges and behavioral restrictions can compromise the welfare of captive apes.[23] For example, apes in captivity can be subjected to confinement in small enclosures, human contact, poor hygienic practices, population density and stressful situations.[24] Professional guidance on how to assess ape welfare is sparse, inconsistent, and often left to the individual institution. Further, many captive facilities are resource scarce and challenged by limited technical capacity. Sanctuary populations are often at or over capacity, for

instance, and relatively few sanctuaries have the resources to employ scientists as staff.[25]

Lack of information sharing between institutions continues to be an impediment to the appropriate care of captive apes.[26] Barriers to information sharing include language, use of different systems, or skepticism about collaboration.[27] Additionally, welfare of captive apes often falls between the cracks of domestic animal health and wild animal conservation legislation and regulations. Some legal terminology, such as describing apes as property, commodities or resources, also devalues the intrinsic worth of animals and disassociates the use of animals from animal suffering.[28]

Habitat Destruction and Encroachment

Human presence and activities in ape habitats, such as industrial development projects, are increasing globally, and interactions between people and apes are expected to increase.[29] Human encroachment can lead to apes experiencing decreased food supply, habitat loss, poisoning and population decline.[30] It can also heighten the risk of disease transfer from people, livestock or domesticated animals.[31] Additionally, interaction can lead to human–wildlife conflict or hunting which can result in ape gunshot wounds, snare injuries and death.[32] Threats to ape health from human activities are detailed in *Chapter 7: Status of Apes: Impacts of Industrial Development Projects on Apes* in the current *State of the Apes* volume, as well as prior volumes focused on extractive industries, industrial agriculture and infrastructure development.[33]

Illegal Trade and Illegal Captivity

Illegal trade is a threat to wild and captive apes, and even where apes have legal protection there is often a disconnect between wildlife law and practice.[34] Domestic and international legal frameworks accompanied by law enforcement and deterrent penalties are integral to stopping illegal activities. However, policymakers must also address the drivers of illegal trade and captivity. These topics are covered in *State of the Apes Volume 4: Killing, Capture, Trade and Conservation*.[35]

Human activities in ape habitats, such as industrial oil palm projects, are increasing globally, and result in the destruction of ape habitat and human encroachment.
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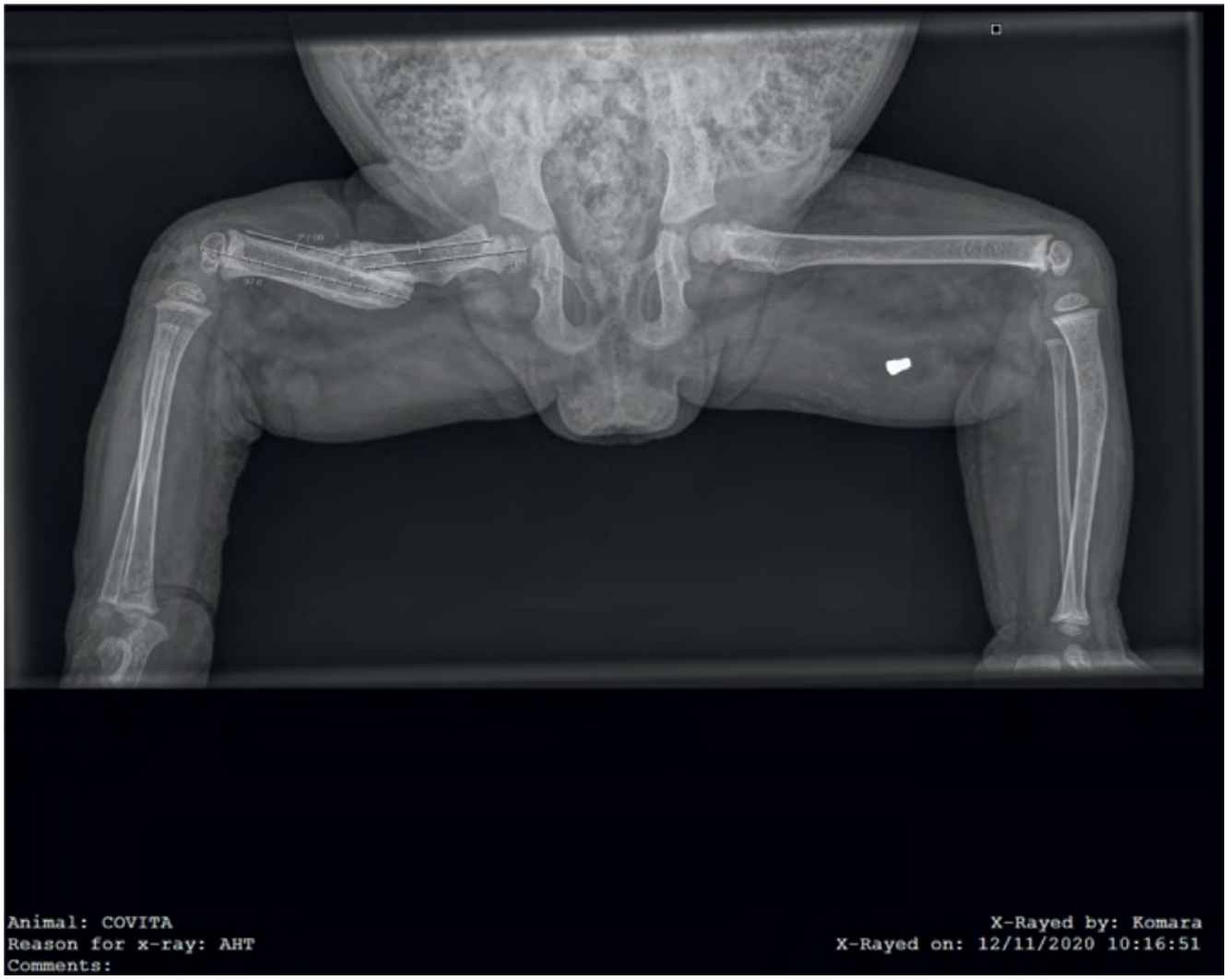

Interactions between people and apes can lead to human–wildlife conflict or hunting which can result in ape gunshot wounds, snare injuries and death. Orangutan with gunshot wound and broken leg. © IAR Indonesia (YIARI)/MoEF of Indonesia

Specific to ape health, it is important for policymakers to be aware that illegally kept apes often suffer from malnutrition due to poor husbandry and inadequate diets. These apes are also susceptible to human diseases, trauma and mental health issues due to their experiences and living conditions.[36] In cases where apes are kept in inadequate captive conditions for an extended period, physical changes may become irreversible.[37] Some illegally kept apes are used as tourist attractions and can become addicted to alcohol or drugs they are given to induce them to stay awake or perform.[38]

In ape range countries, sanctuaries and rehabilitation centers typically house orphaned primates confiscated from the wild meat/body part and live ape (for pets, zoos and entertainment facilities) trades as well as adult animals found in isolated patches of forest or cultivated fields.[39] While some individuals can be rehabilitated for release, many can never be released back to the wild owing to chronic health conditions, trauma and other reasons.[40] By caring for confiscated apes, sanctuaries and rehabilitation centers play an important, but often underrecognized, role in fighting illegal ape trafficking.[41]

Illegal capture and illegal trade negatively impact the welfare of apes as well as their health.[42] Increasing welfare-focused dialogue between conservationists, philanthropic institutions and policymakers on this neglected topic can better support both ape welfare and conservation outcomes. In the absence of an international legal framework on animal welfare, policymakers should advocate for the incorporation of appropriate and enforceable standards into institutional policies, national laws and professional accreditation programs.

Industrial Development

All species of apes are threatened by industrial development projects, as detailed in *Chapter 7: Status of Apes: Impacts of Industrial Development Projects on Apes* and *State of the Apes* volumes 1–3 on extractive industries, industrial agriculture and infrastructure development.[43] Land use changes associated with industrial projects can impact ape health through loss of habitat and food sources.[44] Additional detrimental environmental factors can include noise, poisoning or various forms of air, soil and water pollution.[45] Further, apes may be attracted to industrial sites owing to the availability of food. Increased contact between apes, people and domestic livestock that may result can lead to the transmission of diseases.[46]

Natural Disasters

The frequency and severity of natural disasters are predicted to increase, presenting risks to apes and their environments.[47] An increase in hazards caused by humans is also predicted.[48] Natural disasters can directly cause ape illness and death, such as by coming into direct contact with a forest fire, dehydration during drought, or drowning during flooding. Natural disasters can also have indirect impacts on ape health. For example, destruction of habitat can result in altered ape distribution, and changes in behavior such as competition for food.[49] Further, it can cause loss or reduction of food and shelter, which can lead to malnutrition and reductions in birth rates.[50] Animals with slow reproductive rates, like apes, or those with very specific dietary requirements can be more negatively impacted by even small drops in population due to disasters.[51] These risks are outlined in *Chapter 6: Disaster Management and the Protection of Apes* of the current volume.

Tourism and Research Activities

Apes in the wild and captivity attract local and international filmmakers, scientists, students and visitors.[52] As such, ape tourism is a potential contributor to local development and employment, source of funding for biodiversity conservation and supporter of national and regional economies.[53] However, tourism has also played a role in disease transmission since the 1970s.[54] In the wild and in captive settings within and outside ape range countries, pathogens of human origin can be transmitted to apes through contact with people.[55] Policymakers should also be aware that people involved in ape research and tourism are also susceptible to possible disease exposure when near apes.[56] For additional information on this topic, see *Chapter 3: The Impact of Tourism and Research Activity on Ape Health*.

Habituation of Wild Apes

Wild apes must be habituated to human presence before they let people approach and observe them, whether for research or tourism.[57] Habituation, therefore, constitutes a risk to apes as increased proximity between apes and humans increases the likelihood of direct infectious disease transmission.[58] In wild settings, apes risk contracting diseases from infected hunters, local communities, park staff, researchers, tourists and others.[59] This human contact has the potential to be devastating to entire groups of apes.[60] Research and tourism is often conducted without adherence to best management practices.[61] For example, tourists regularly get closer to habituated apes than the recommended distance.[62] It is important for policymakers to note, however, that most documented cases of disease spillover in wild habituated apes have originated from local communities, park staff or researchers, and not tourists.[63]

Additionally, ape visitation, even with fully habituated apes, often results in individual and group behavioral changes, higher vigilance levels, and various stress-related symptoms.[64] Even under best management practices, some human influence on behavior inevitably remains.[65] This

Every year, several hundreds of thousands of visitors visit ape facilities and this poses a considerable risk of disease transmission.
Tourists hoping that the orangutans will come for breakfast at the feeding platform, Semenggoh Wildlife Centre, Malaysia. © Alison White

behavioral disturbance may manifest as dangerous aggression toward other apes or humans.[66] As such, habituation may be considered harmful given the level of stress caused over a long period of time.[67]

Taking all of these factors into consideration, some studies suggest that the risks associated with wild ape habituation for tourism may ultimately outweigh the conservation benefits.[68] However, others argue that without the economic incentive of ape tourism, it is unlikely that any apes and their habitat would be protected. This is especially relevant for species, such as the mountain gorillas, that have experienced a gradual population increase, despite the numerous threats they face, including prolonged periods of armed conflict in their region.[69] As such, policymakers and other stakeholders should carefully consider the costs and benefits of habituation when making decisions about such projects.

Contact Between Humans and Captive Apes

Habituation of captive and semi-captive apes is often unintentional, owing to repeated exposure to human caretakers.[70] It can also be intentional, to facilitate their care or scientific research.[71] For apes in captivity, unfamiliar human presence and changes in diet or social group structure may cause apes to experience physiological stress.[72] Also, the sheer number of visitors and daily close contact between apes and caretakers pose a threat to apes in these confined environments.[73] Every year, several hundreds of thousands of visitors visit ape facilities, for instance, and this poses a considerable risk of disease transmission.[74] As some apes in range country sanctuaries are able to be released back into the wild, human contact during captivity also provides opportunities for pathogen carry-over into the wild.[75]

Policymakers should be on alert for the use of terms such as rescue center and sanctuary, as they are not legally regulated and adopting them does not mean the facility is providing good animal welfare.[76] It is concerning that the demand for animal tourism is leading to an increasing number of unregulated captive facilities.[77] Some of these have permitted direct interaction with chimpanzees, gibbons and orangutans.[78] Improperly managed facilities and inappropriate interactions with animals can have negative welfare impacts, enhance demand for exotic pets and undermine conservation.[79] Policymakers should establish domestic legal frameworks to govern the management of captive apes. Additionally, law enforcement efforts and penalties are needed to support adherence with laws.

Close encounters with great apes are extremely popular on various social media platforms.[80] The popularity of shared human–animal close contact in photographs and videos encourages tourists to engage in risky behaviors.[81] Photos of apes in close contact with humans may promote the view that these animals are suitable pets and not endangered.[82] These images also give the impression that touching apes is acceptable, obliterates the sanitary risks associated with these situations and undermines conservation objectives.[83] Communication campaigns can be used to educate social media users and influence the behavior of tourists and facility managers. Further, the operators of social media platforms should set policies against content that threatens the health or welfare of wildlife.

Transfers and Translocations

Captive apes are sometimes transferred between biomedical laboratories, breeders and dealers, entertainment or exhibition facilities, private homes, rescue or rehabilitation centers, sanctuaries and zoos, resulting in negative impacts on their health and welfare.[84] Similarly, the capture, translocation and release of wild apes can have negative impacts on the physical and mental health of individuals.[85] The disruption of a wild ape family group during a rescue also has the potential to complicate recovery.[86] Social disruptions among new neighboring wild groups can have long-term negative social effects as well.[87] Inadequate biosecurity protocols risk spreading human diseases to rehabilitant apes and wild ape populations.[88] Limited resources and carrying capacity, and pressure from authorities, may lead to animals being released without proper protocols.[89] To reduce these risks, there is a need for the development and dissemination of best management practices for ape transfers and translocations. Accreditation associations, conservation organizations, philanthropic institutions, researchers and scientists should collaborate to fill this gap.

Best Practice Recommendations for the Prevention and Management of Health Risks

Ethical Considerations

Policymakers should become familiar with the ethical dilemmas that can emerge during ape care and protection, such as around human-caused injuries, translocation and vaccination. Whether to intervene in the lives of apes in the wild represents important ethical questions that are context specific.[90] These dilemmas are explored in *Chapter 4: Managing Ape Health – Informing Interventions* and *Chapter 5: Ape Health and Ethics.*

First and foremost, it is important for policymakers and other stakeholders to acknowledge that the individual lives of apes matter, and that individuals have moral relevance in their own right.[91] There is abundant scientific evidence that apes have autonomy, emotions, language, rationality, self-awareness, sentience and sociality that are widely thought to underpin high moral importance.[92] Apes, especially great apes, are increasingly recognized in terms of individual moral and legal rights.[93] The World Declaration on Great Apes stipulates that great apes have a right to life, a right to live freely in their habitat and a right not to be subjected to intense physical or psychological pain.[94]

Apes matter ethically both as individuals and members of collectives. Both their intrinsic value and ecological value play an important role in maintaining healthy and productive

ecosystems on which humans and other species depend.[95] Their complex cognitive abilities allow apes to create unique and valuable local and population-wide cultures.[96] Seeing populations and their individuals as thoroughly interdependent encourages efforts to protect the social fabric.[97] Historically, however, the interests of individuals have become obfuscated in deference to promotion of the species or population sustainability.[98]

Conservation and welfare endeavors should start with a duty of care, for both the environment and individual patients.[99] In captive health situations, the duty of care concept emphasizes the need to intervene.[100] However, conservationists and others working in wild ape settings also have a duty to act ethically.[101] Since the outbreak of Ebola, there has been debate about human intervention in the wild.[102] More recently, with the COVID-19 pandemic it has become critically important to understand human and ape health within an interspecies health policy perspective.[103]

Ethical dilemmas have also arisen around whether it is acceptable to harm captive apes in the course of research aimed at benefiting wild members of their species.[104] To date, much of the world's understanding of health and disease in wild apes has originated from research conducted with captive apes.[105] However, weighing the harms of research against the benefits raises difficult ethical quandaries.[106] Some argue that any invasive research that imposes harm on sentient beings for the benefit of other sentient beings is morally problematic.[107] Unanswered questions include whether research should be prohibited because apes cannot consent.[108] Or whether the willingness of human volunteers to participate in research trials can be used as a proxy for apes.[109] Understanding these multifaceted ethical questions can help prepare policymakers to engage in dialogue and decision-making on ape health.

Intervening to Treat Human-caused Injuries

Veterinarians have a clear duty of care, and retaining one in any setting improves emergency response times and increases the probability of success, thus reducing suffering and improving animal welfare.[110] In the wild, the decision whether to intervene is one of the most important roles a wildlife vet can make in both animal welfare and conservation. When faced with this decision, it is important for the vet to determine whether the potential benefits of the intervention outweigh the identified risks as they relate to environmental, individual and social conditions. The vet also needs to consider the natural dynamics in a social group and the normal risks of injury or disease to an individual that may not be caused by humans. The intervention risk matrix, which provides pathways to solutions as users explore activities that can either increase effectiveness, increase feasibility or increase both, can be helpful in this regard.[111] Interventions are inherently risky and should only be attempted by qualified personnel, such as a field-trained veterinarian, accompanied by those who know the target ape, other apes in the group and the forest very well.[112]

Apes often suffer injuries caused directly by humans, such as being accidental victims of steel traps and wire snares set by hunters targeting other wildlife.[113] Severe damage such as deformity, gangrene, infection, limb loss or sepsis may occur, and death can result.[114] For survivors, in addition to prolonged suffering, severe snare wounds impose long-term damage through their effects on behavior, reproductive success and social status.[115] Because this is clearly a human induced problem, a veterinary intervention is a duty of care obligation. A rapid response can alleviate pain and suffering, mitigate the severity of the injury, preserve behavioral and social integrity and reduce the probability of permanent damage.[116] However, interventions for snare removal or other reasons require anesthesia delivered via darting.[117] To mitigate the risks associated with this process, certain criteria should be met to safely proceed with an attempt.[118] Standardized protocols are necessary to objectively evaluate each situation and determine the probability of success.

Apes often suffer injuries caused directly by humans, such as being accidental victims of steel traps and wire snares set by hunters targeting other wildlife. Mountain gorilla with missing hand from snare injury, Volcanoes National Park, Rwanda.

The decision to intervene is less clear where humans might be indirectly responsible for ape injury.[119] For example, while trauma resulting from fighting is a natural phenomenon, it may be exacerbated by human encroachment.[120] For ape species whose numbers are so low and where every individual's genetic input is important for the health of the population, a deliberate effort to intervene to save individuals may be made where the veterinary assessment indicates a guarded prognosis, including death, if no intervention is made.

Translocating Apes

Translocation of wild apes between habitats has been used as a risk mitigation tool to balance conservation needs and the need for land for development.[121] However, ethical dilemmas arise from translocation as the process can lead to death or the disturbance of social groups.[122] Translocation also requires extensive planning and stable financial sources.[123] It is expensive and difficult to conduct effective post-release monitoring of apes.[124] As such monitoring after translocation is rarely done.[125] More funds should be made available for such monitoring.

Further discussion is needed between policymakers and conservationists on the costs versus benefits of translocation.[126] Stakeholders should develop and regularly update policies to reduce disease risk and transmission, improve pathogen surveillance and implement mitigation measures to minimize the likelihood of outbreaks.[127] Although health intervention requirements are rarely formalized, the International Union for the Conservation of Nature (IUCN) offers best practice guidelines for wildlife translocations and for great ape disease risk management that can support policymakers.[128] The precautionary principle for any great ape release requires that, above all, it must not endanger resident wild populations.

Vaccinating Apes

Inoculating apes against diseases is controversial and raises ethical dilemmas associated with the safety and efficacy of vaccine delivery.[129] Disease prevention in individuals is a tool to reduce disease in populations, which for apes fulfils both conservation and welfare concerns. Currently, vaccination is uncommon in wild apes, due in part to the assumption that it is unfeasible, although this may be changing.[130] Only a few vaccines have been specifically manufactured for use in non-human apes, therefore precaution against unforeseen and unforeseeable consequences is warranted.[131]

There may be situations where a carefully coordinated reactive vaccination strategy could be considered.[132] However, it is necessary to ensure that the effects in both apes and non-target species are not disadvantageous.[133] As such, the value of vaccinating may vary by species.[134] There are challenges when considering the implementation of a vaccine among wild apes, such as ease of access to populations and mode of delivery.[135] Disadvantages of vaccines delivered through darts/blow guns or other such mechanisms can include disruption and stress further lowering immunity,

The collection of baseline data on the health status of non-habituated apes in their fast-changing environments, especially in Asia, where data are even scarcer than in Africa, is essential to fill important data gaps. Moloch gibbons, Java, Indonesia.
© Arif Setiawan, SwaraOwa

potentially reducing natural resistance to diseases; vaccinating enough of the population to develop herd immunity is an additional consideration.[136]

In the wild, vaccination has been used in specific instances, such as among habituated apes.[137] First and foremost, any vaccine must be shown to be efficacious and safe for the target ape and non-target species, including other wildlife and humans, before deployment.[138] Also, identifying potential "super spreaders" is important for conservation measures aimed at limiting the spread of epidemics, as these individuals could be targeted in vaccination programs.[139] As stakeholders consider potential vaccination of great apes, Ebola virus biology and ecology, vaccine composition and vaccination principles may be helpful.[140]

In captive settings, a decision to vaccinate is usually based on the level of risk of exposure, with vaccine regimes based on human protocols.[141] Because captive apes are still members of endangered species, it can be argued that they should not be used to test experimental vaccinations for use with wild apes.[142]

As a disease outbreak leaves little to no time for reactive decision-making, policymakers should establish best practices and ethical oversight to guide veterinarians and others tasked with protecting ape health.[143] Specifically, ape health should be proactively monitored, swift response protocols put in place and veterinarians authorized, able and equipped to administer vaccines adequately.[144]

Wild Apes

Implementing the One Health Approach

Best practices for the prevention and management of health risks to wild apes are rooted in the One Health approach. Based on the 10 Berlin Principles, One Health provides a framework for addressing ecosystem, individual, population and species health issues holistically and inclusively and aligning conservation and public health goals.[145] Policymakers and other stakeholders with a role in the health of wild apes should become familiar with the One Health approach, as it is "collaborative, multisectoral, and trans-disciplinary" and requires "working at local, regional, national and global levels."[146] It is detailed in *Chapter 2: The Role of One Health at the Human–Ape Interface* of the current volume.

The One Heath approach is appropriate for policymakers navigating the complex challenges of improving great ape conservation, health and welfare, which must be contextualized within global sustainability goals.[147] Indeed, addressing threats to animal, environmental and human health requires consideration of their interconnections and respective ecological and social environments.[148]

When considering a project, stakeholders should follow One Health's five-step process of formulating the problem, identifying those involved or likely to be affected, mapping the problem with a systems approach to understanding intersections, understanding the problem and exploring solutions.[149] This

can be difficult in the case of wild apes as data collection and health monitoring are rare.[150]

To support One Health, conservationists, governments, philanthropic institutions, researchers and scientists should prioritize the collection of baseline data on the health status of non-habituated apes in their fast-changing environments, especially in Asia, where data are even scarcer than in Africa.[151] Policymakers should be aware that collecting data using direct and visual monitoring does not require expensive equipment.[152] As these activities can reduce the many existing, important data gaps, they are well worthy of resource allocation.[153]

Knowing and cataloging pathogens that affect ape species, combined with human disease monitoring, can contribute to effective One Health approaches. Those developing studies in this area should consult the IUCN best practice guidelines for health monitoring and disease control in great ape populations.[154] Another recommended resource is the *Manual of Procedures for Wildlife Disease Risk Analysis*.[155] Further, establishing an early warning system based on monitoring protocols can support immediate intervention to prevent catastrophic outbreaks.[156] Together, using One Health, stakeholders can formulate ape conservation and health management plans and prioritize their funding and implementation.

Capacity Building and Knowledge Sharing

Globally, there is a lack of knowledge about wild ape health, particularly in gibbons, and insufficient human capacity to manage it, such as a dearth of adequately trained wildlife health professionals.[157] There is a critical need to reduce the many remaining data gaps on disease, assess disease management action and turn anecdotal clinical data into robust peer reviewed evidence.[158] To meet this need, policymakers should urge relevant stakeholders to collaborate to create and facilitate an international capacity building network that synergizes all efforts toward ape health. The network could, for instance, support education and empowerment through discussion forums, internet information hubs and practical workshops, such as veterinary led training.[159] The network could learn from the work of the Non Human Primate COVID-19 Information Hub, which pairs community-based domestic animal, human and wildlife health practitioners with academics through an online technical service.[160] It could also build from and incorporate the Orangutan Veterinary Advisory Group, a forum of academics and health practitioners in Indonesia and Malaysia.

Engaging Communities

People are an essential component of the forest ecosystem. As such, effectively managing ape health requires policymakers to integrate human behaviors, decisions and values.[161] The foundations of successful community engagement are a commitment to establishing long-term relationships — with any decisions about conservation or development initiatives based on free, prior and informed consent — and deep understanding of communities' cultural, social, economic and other needs. Policymakers should ensure that stakeholders leading the development and implementation of community engagement strategies are sensitive to local contexts.

For example, when developing human community health programs, stakeholders must understand localized health risks, as well the health beliefs and concerns within the culture and how the community functions as a social unit.[162] All communities need to be aware of the potential and actual risks of disease transmission between apes and people.[163] Therefore, community engagement programs should include culturally appropriate communication activities aimed at helping inform public perceptions and increasing acceptance of community health and hygiene services.

In ape range states, for instance, vaccines against childhood communicable diseases are routinely offered at health facilities, but there remain barriers to access, such as logistical challenges and systemic inequities.[164] Programs should address these barriers because prevention strategies, such as vaccination, employed in the human population can have a protective effect for apes as well as human communities.[165] Programs should also consider preventative health programs for livestock and pets living near ape habitat and educate owners about best animal care practices. Veterinary support, sanitation and waste management should be prioritized for communities living within or close to ape habitats.

Compassionate Conservation

Within conservation circles, there is often an emphasis on protecting biospheres, ecosystems and endangered species and their habitats.[166] Historically, conservation has valued wholes to the disadvantage of individuals.[167] However, some ethicists, philosophers and practitioners see individual, sentient beings as having moral standing, thereby suggesting that they matter morally or that they are entitled to moral consideration.[168]

Compassionate conservation has emerged over the last decade as a perspective on moral decision-making in conservation that balances collective and individual interests.[169] It recognizes the welfare of individual animals as integral to sound conservation practice.[170] Policymakers may find compassionate conservation to be helpful when formulating their national wild ape conservation agendas.

The approach is based on four general principles: 1) individuals matter; 2) first, do no harm; 3) inclusivity; and 4) peaceful coexistence.[171] Compassion, as generally defined, involves a recognition of the suffering of others paired with a motivational response to be helpful in alleviating or resolving the suffering.[172] When put into practice, conservationists and other stakeholders should ensure that the interests of individuals are not disregarded or overlooked when working to safeguard ecosystems or species.[173]

In the field, compassionate conservation should be used as a framework when navigating the moral complexities of an individual ape's health and welfare within the context of conservation. In the case of human–ape conflict, for example, compassionate conservation provides a means of exploring potential changes in the behavior of both apes and humans.

It facilitates creative inquiry into the possibilities of living peacefully together and may yield options for human behavioral change.[174]

Mitigating Impacts from Industrial Development

As policymakers explore various mitigation strategies to manage the impacts of industrial development projects on biodiversity, they will find that few strategies specifically address impacts on ape health. However, as more research has shed light on how industrial development projects affect apes, biodiversity management has improved.[175] Two main factors have led to enhanced mitigation efforts: national laws and lending standards. As such, companies are not likely to secure financing for industrial development projects unless their licensing agreements with governments consider impacts on endangered species such as apes. Stakeholders can find best practice guidance for mitigating the impacts of industrial development on wild apes in *Chapter 7: Status of Apes: Impacts of Industrial Development Projects on Apes* as well as volumes 1–3 of the *State of the Apes* series.[176]

Technology and Tools

Technological advancements have made it possible to better track and study apes in the wild, as well as to conduct health diagnostics. Funding institutions, including philanthropic, multilateral and governmental, can support ape health by providing field teams with funding for these new techniques and tools. Conservationists, researchers and scientists can use newly available approaches to study apes in their natural habitats without habituation and without the need for human observers. For example, today's tools include thermal imaging camera traps and drones, handheld data collection devices, facial recognition software applications and passive acoustic monitoring.[177] With any technology, advancements can happen rapidly, so policymakers are encouraged to stay abreast of the most recent breakthroughs that have potential to benefit wild ape health.

Managing Research and Tourism

When proper management practices are implemented and enforced, apes represent a significant economic asset through direct employment opportunities and financial revenues, as well as increased income and livelihood opportunities in local communities.[178] For example, tourism revenue can support community health facilities and schools to help minimize the risk of disease transmission between habituated apes and people.[179] Ape research and tourism may also result in fewer poaching or snaring incidents.[180]

However, as there is no single global body regulating wildlife tourism, policymakers in each national government should embed best management practices in their domestic legal frameworks. Laws and regulations should focus on disease prevention because it is far cheaper, easier and more efficient than controlling an outbreak.[181] Further, tourism and research program management should include protection

It is important for governments to critically assess the perceived versus real benefits and costs of habituation as an ape conservation tool.
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from hunting and snaring, and rapid veterinary interventions when necessary.[182]

As elaborated upon in *Chapter 3: The Impact of Tourism and Research Activity on Ape Health*, policymakers should take a cautionary approach when considering approval of ape research and tourism projects.[183] Particularly in the post COVID-19 era, it is important for governments to critically assess the perceived versus real benefits and costs of habituation as an ape conservation tool.[184] Habituating new ape populations for research or tourism requires an extensive risk assessment and feasibility study that must be site and species specific, and must consider the environmental, socio-economic and welfare characteristics of the situation.[185] When considering approval, any new habituation attempt must consider the latest scientific evidence on animal welfare and disease transmission.[186]

One argument for habituation is that having more habituated groups may dilute sanitary and other risks at any given site by providing more options for research and tourism activities.[187] However, more information is needed at the individual and species level to understand the risks of habituation.[188] Where apes are already habituated, research and management policy should focus on conservation, including closing knowledge gaps about their health and understanding linkages between the health of apes, humans and other animals. Researchers should collect baseline data on wild ape populations exposed to human presence to quantify the impact of habituation on the health of populations being used for tourism and research.[189]

Managers of protected areas with tourism or research projects must ensure that habituation and other related activities have a minimum negative impact on apes' behavior, ecosystems and overall health.[190] A careful risk management plan must guide habituation and visitation to balance costs and benefits.[191] An essential resource for park managers on this topic is the IUCN *Best Management Practice Guidelines for Great Ape Tourism*.[192]

To protect against disease transfer and other threats to ape health, management of ape research and tourism requires collaborative action among all stakeholders, including communities, conservation organizations, governments, park authorities, researchers and visitors.[193] Each stakeholder group is integral to the development and implementation of stringent biosafety protocols and appropriate practices during ape encounters.[194] Stakeholders should consult the IUCN *Best Practice Guidelines for Health Monitoring and Disease Control in Great Ape Populations* during this process.[195]

During the COVID-19 pandemic, best practice guidelines were developed for ape health monitoring and disease control.[196] These control and coordination frameworks can be used by policymakers to guide the effective use of resources for the prevention of future disease outbreaks. When an outbreak occurs, visits by humans to apes should be reduced to the minimum needed to continue the monitoring of ape health and safety.[197] Mandatory biosecurity requirements with compliance checks should be put in place, including distancing, quarantining prior to any contact with the apes and the wearing of masks.[198] Enforcing biosafety protocols would significantly reduce the risk of disease transmission to apes.[199]

Better management of tourist expectations and greater public awareness would go a long way in protecting apes.[200] If researchers, tourists and park personnel (guides, trackers, etc.) are well informed and understand the risks they pose, they are more likely to follow best practice guidelines.[201] Communication to tourists, such as through social media or outreach campaigns, should educate them about disease transmission risks. The development and dissemination of sanitary guidelines and other awareness materials should target multiple audiences, especially travel websites.[202]

Conservationists call for an end to posting images of close and physical contact between humans and wildlife.[203] Visitors should be made aware of the recommendations made by the IUCN Primate Specialist Group Section for Human Primate Interaction in the *Best Practice Guidelines for Responsible Images of Nonhuman Primates*.[204] Greater enforcement of these and best management practices is needed to address the overall lack of adherence by park personnel, researchers and tourists.[205]

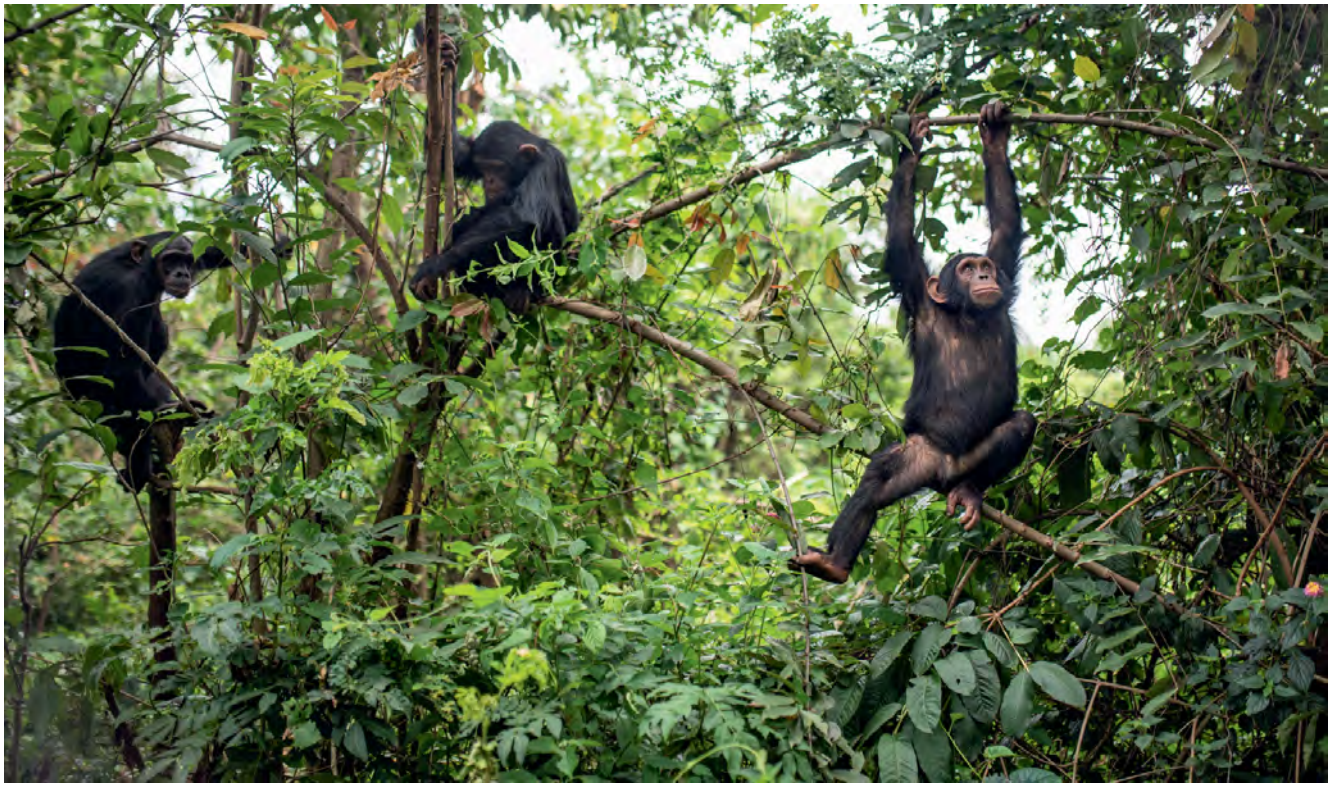
Simultaneously, more incentives should be developed for park personnel to support the implementation of best management practices. Policymakers should consider such incentives when determining where to direct revenue generated by tourism. Also, employee health programs should be established for those in contact with apes, and these programs should also be extended to the families of personnel. These should include health care, health education, health screenings, mandatory vaccinations and quarantine of those showing symptoms of infectious diseases.[206] As the presence of asymptomatic carriers poses a challenge, strict hygiene rules should accompany employee health programs.

Captive and Semi-captive Apes

Implementing the One Welfare Approach

As with wild apes, captive ape tourism can be a source of income from international and national tourists.[207] Ape facilities can provide education, learning and viewing opportunities for both local and international visitors, with orphaned apes serving as powerfully emotive messages for the plight of the apes.[208] Policymakers, as well as those caring for the health and welfare of captive or semi-captive apes, should become familiar with the One Welfare approach presented in *Chapter 8: The Welfare and Status of Captive Apes*. The approach recognizes the interconnections between animal welfare, human welfare and the environment.[209]

Animal welfare refers to how an animal is experiencing its own life and requires a balance of emotional, mental and physical components, inclusive of agency and autonomy.[210] Importantly, absence of suffering or mere survival does not equal good welfare.[211] To raise the prominence of animal welfare and to facilitate a change in societal values, advocates



Best practices for captive ape care include allowing for social interaction with other apes or their avoidance, developing naturalistic enclosures, facilitating foraging opportunities and having predictable feeding schedules. © Lwiro Primates Rehabilitation Center

need to vocally champion animal welfare with policymakers.[212] How animal welfare is spoken about and understood influences how it is assessed.[213] For example, some language currently used in policymaking undermines animal welfare and should instead reflect changes in animal law, science and public opinion on animal sentience. This could encourage greater empathy, respect and treatment for animals worldwide.

Captive ape facility managers should focus on allowing apes to live as close to a natural life as possible, maintaining their physical health and minimizing negative affective states.[214] Managers must maintain all essential welfare infrastructure comprising animal training, environmental enrichment, habitat, husbandry, nutrition, research and veterinary care.[215] Captive and semi-captive ape facilities need strong leadership capacity to manage, in the short and long term, a myriad of complex ape health and welfare issues. Appropriate institutional level standards are essential as they have the most influence on apes' quality of life. Best practice recommendations call for institutional policies and practices to include welfare assessment tools, commitments, dedicated resources, an operational framework and a supportive organizational culture.[216] A variety of approaches and tools are available to facility managers to support captive ape welfare assessments drawing on species-specific indicators.[217]

To reduce the risk of disease transmission between humans and apes, facilities must implement strong standard operating procedures, including stringent biosafety and hygiene rules for personnel and visitors.[218] Best practices for captive ape care include allowing for social interaction with other apes or their avoidance, developing naturalistic enclosures, facilitating foraging opportunities and having predictable feeding schedules.[219] Physical and social requirements may vary by species, as well as for those with trauma from laboratory life, such as posttraumatic stress disorder or depression.[220]

Acquisition, Transfer, Rehabilitation and Release

Any facility considering acquiring or transferring an ape must perform due diligence to ensure that its behavioral, physiological and psychological requirements can be met.[221] Similarly, all intervention, rehabilitation and release processes should consider animal welfare during each stage.[222] To support facility managers, the IUCN is developing tourism focused guidelines that will include a chapter on primates in captivity and release programs.[223]

As apes can grow habituated to humans, minimizing human–animal interaction is often a key requirement of rehabilitation for release.[224] All apes to be reintroduced to the wild must undergo a thorough health examination and disease screening to ensure that reintroduced individuals do not harm wild populations or impact the health of human communities living close to the release site.[225] IUCN reintroduction guidelines for great apes and gibbons describe behavioral assessment criteria, phased approaches to release and post-release support to facilitate adaptation.[226]

The guidelines state that apes with significant deficits in knowledge and skills should not be released without sufficient rehabilitation and post-release support.[227] However, little attention has been given to methods for monitoring ape welfare after release.[228] Released apes may not be fully competent, necessitating a duty of care not normally provided to

free ranging wild animals.[229] Although there are no easy answers to monitoring welfare of apes after release, explicitly naming it as an integral goal will aid policymakers and other stakeholders in the development of appropriate approaches and tools. Notably, there are examples of released apes that have survived and thrived after release from which to learn.[230]

Accrediting Captive Ape Facilities

As the institutional policies of each captive ape facility will be different, robust accreditation systems for facilities can help support animal welfare. While professional accreditation is not a substitute for national legal frameworks, which policymakers should put in place, it can provide a common benchmark for welfare management and at times transcend national boundaries. Professional accreditation systems can be more flexible than legal ones, which can enable adaptations, improvements and updates to new developments and knowledge.[231]

In countries without appropriate or enforced legislation, professional association can help improve welfare standards at captive and semi-captive ape facilities.[232] It is important to note that several accrediting systems and sanctuary networks exist and each differs in its approach and standards. Only the North American Primate Sanctuary Alliance requires third-party verification, for example. Similarly, there are several regional zoo associations, although the World Association of Zoos and Aquariums is the overarching international body with 400 members across the world.[233] Facility managers should seek out robust professional accreditation systems that include direct welfare support services, as well as compliance, governance and operational standards that support accountability.[234]

Advocates and policymakers should be aware that accreditation does not guarantee higher animal welfare standards.[235] In fact, poorly run accreditation systems can convey a false level of animal care and treatment and do more harm than good.[236] The range of protocols that currently exist across accredited institutions signals a lack of consensus and a need for further standardization.

Capacity Building and Knowledge Sharing

Policymakers should recognize that effective support for captive and semi-captive ape welfare requires multiple com-

petencies that are rarely found within a single institution.[237] As such, conservationists, facility managers, philanthropic institutions, researchers and scientists should collaborate to advocate for robust legislation and welfare accreditation, build and share welfare assessment, knowledge and practice and facilitate access to expertise and resources.[238] Available resources to support capacity building at ape range state sanctuaries include the *Primate Veterinary Health Manual*.[239] For non-range state zoos and facilities managing exotic wildlife, resources are available in the online portal *Is your facility prepared?*.[240]

Technology and Tools

Technological advancements are emerging that may be adaptable and relevant for use by captive and semi-captive ape facilities.[241] These include camera systems that can monitor captive apes without disturbance and store footage for future viewing. Digital options for data collection can save time and reduce potential errors in reports. However, they may require users to purchase commercial software and hardware, or to have the skills and time to learn and use them.[242]

Legal protection for apes varies greatly across countries, with some lacking any protection.
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Welfare assessment tools must balance being user friendly and practical for the context, but specific enough to produce useful outcomes. Once assessment indicators are agreed and validated, the development of a welfare assessment tool can be explored.[243] For those working in field-based sanctuary facilities, rugged devices with a long battery life and a simple method for backing-up data can be beneficial.[244] As technologies can be expensive, philanthropic institutions should support captive and semi-captive ape facilities with financial assistance to purchase them.

Managing Crisis and Disaster Situations

Disaster management principles provide a valuable set of tools to mitigate or reduce the impact of human made and natural hazards on both captive and wild apes. While principles specific to apes are few, policymakers and others responsible for ape health and welfare can apply existing disaster management principles as described in *Chapter 6: Disaster Management and the Protection of Apes*.

Significant knowledge gaps remain regarding best practices for managing crisis and disaster situations that have the potential to impact apes. As such, conservationists, facility managers, park authorities, researchers and scientists should collaborate to develop disaster response measures that meet the specific needs of apes. Further, when a disaster strikes, resource needs will be significant and may overwhelm local capability and capacity. Therefore, it is important for policymakers and philanthropic institutions to allocate funding and resourcing for disaster risk assessment, prevention, preparedness, response and recovery.[245]

Strengthening Domestic Legal Frameworks

Domestic legal frameworks demonstrate a country's national level of commitment to captive and wild ape health and welfare. However, legal protection for apes varies greatly across countries, with some lacking any protection.[246] Conservation law most often focuses on the management and survival of free roaming wildlife species, and animal welfare law usually focuses on domestic animals.[247] Captive ape facilities may have to adhere to laws concerning animal welfare, biological sample collection, human interactions with apes and veterinary medicine. Legal requirements that apply to captive apes may also include control procedures and health inspection measures.[248] For wild ape tourism and research, best management practices and sanitary guidelines should be made legally binding to support their enforcement and implementation.

To understand gaps in appropriate and enforceable ape welfare legislation, policymakers should commission a cross-disciplinary analysis at the national level. Ape welfare advocates, conservationists, philanthropic institutions, researchers and scientists should support governments in undertaking these analyses. Country level examples of legislation and regulations that strive to meet and surpass best practice standards for captive wildlife welfare include those in Malawi and

Costa Rica. These can serve as models to emulate. Also, the book *Model Animal Welfare Act* serves as a basic template and guidance document for policymakers interested in enacting new or improving existing legislation.[249]

Domestic policy recommendations applicable to industrial development projects and illegal trade can be found in previous volumes of the *State of the Apes* series.[250]

Establishing International Legal Frameworks

Numerous international conventions exist that directly or indirectly influence the management of nature and wildlife. However, animal welfare is generally not included at the international policy level, and currently there is no global agreement to protect the welfare of animals.[251] An exception occurred in 2022 when Member States at the UN Environment Assembly adopted the first-ever resolution making explicit reference to animal welfare, recognizing the links between animal welfare, the environment and sustainable development.[252]

As the welfare of captive wildlife is otherwise missing from important international dialogues, a dedicated treaty has the potential to mainstream animal welfare into the global environmental agenda. The Universal Declaration on Animal Welfare is a proposed inter-governmental agreement that aims to prevent cruelty and reduce suffering and to promote welfare standards.[253] It could be a step toward to a UN Convention on Animal Health and Protection, which would be legally binding upon signatories.[254]

Policymakers should collaborate with advocates, conservationists, philanthropic institutions, researchers and scientists on a feasibility study to understand the challenges and resources needed to adopt and implement a dedicated UN convention. Universally agreed species-specific welfare indicators would aid monitoring within and across captive ape facilities, help set professional standards and would make it easier for national authorities to objectively determine if a welfare crime has been committed.[255]

Conclusion

Reducing infectious disease and non-infectious health risks for captive, semi-captive and wild apes requires addressing risks originating from captive ape care, habitat destruction and encroachment, illegal trade and illegal captivity, industrial development, natural disasters, tourism and research activities and transfers and translocations. Policymakers and other stakeholders should look more deeply to the One Health and One Welfare approaches for guidance on best practices. Also, policymakers should strengthen domestic and international legal frameworks, as they are currently inadequate to protect against threats to ape health and wellbeing. Further, as significant gaps in knowledge remain, studies should be undertaken to increase understanding of all ape species and their settings with the support of policymakers.

Acronyms and Abbreviations

AZA	Association of Zoos and Aquariums
BIAZA	British and Irish Association of Zoos and Aquariums
CDC	Centers for Disease Control and Prevention
COVID-19	Coronavirus disease 2019
GHSA	Global Health Security Agenda
HIV	Human immunodeficiency virus
IUCN	International Union for Conservation of Nature
IUCN SSC PSG	IUCN Species Survival Commission Primate Specialist Group
PASA	African Association of Zoos and Aquaria
SARS-CoV-2	Severe acute respiratory syndrome coronavirus-2
SGA	IUCN Species Survival Commission Primate Specialist Group Section on Great Apes
SIV	Simian immunodeficiency virus
TB	Tuberculosis
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WAP	World Animal Protection
WAZA	World Association of Zoos and Aquariums
WFA	World Federation for Animals
ZAHP	Zoo and Aquarium All Hazards Partnership

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As the Anthropocene unfolds, the impact of humanity on all ecosystems on the planet is becoming more visible and better understood. Deforestation, encroachment into natural habitat and other human activities are driving an increase in the frequency of interactions between people and wildlife, including viruses, parasites and bacteria. One consequence is a heightened risk of disease transmission, with serious implications for biodiversity protection and human health. Indeed, infectious disease is often listed among the principal threats to ape conservation, along with habitat loss and hunting, which can also expose apes to health risks. In captive settings such as sanctuaries and zoos, apes face similar health risks from increased human contact, as well as geriatric and psychological disorders. Spillover of wildlife pathogens into sanctuaries can also occur.

This volume of *State of the Apes* brings together original research and analysis with topical case studies and emerging best practice to further the ape conservation agenda around disease and health. It provides an overview of relevant disease and health issues and explores factors such as the ethics of intervening in and managing ape health; the impact of research and tourism on apes; the One Health approach; and disaster management and the protection of apes. It shows how the welfare of apes is interrelated with that of the people who share their habitats, while also demonstrating the benefits of integrating ape conservation in health, socioeconomic activities (such as in the extractive industries, industrial agriculture and infrastructure development), and regulatory policy and practice at all levels, from the local to the international.

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Inger Andersen
Under-Secretary-General of the United Nations and
Executive Director of the UN Environment Programme

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