


Moyen Bafing National Park as an Offset for Chimpanzees

Ecological and Financial Considerations

A review by the ARRC Task Force of the IUCN SSC Primate Specialist Group

Disclaimer

This work is based on publicly available information. The Guinea Alumina Corporation (GAC) and Compagnie des Bauxites de Guinée (CBG) were sent the report and given an opportunity to correct any inaccuracies but declined to comment.

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ACRONYMS

ARRC:	Avoidance, Reduction, Restoration & Conservation
CBG:	Compagnie des Bauxites de Guinée
CH:	Critical Habitat
COP:	Conservation Offset Paradox
CTF:	Conservation Trust Fund
GAC:	Guinea Alumina Corporation
GN:	Guidance Note
IFC:	International Finance Corporation
ITP:	Interim Technical Panel
IUCN:	International Union for Conservation of Nature
MBNP:	Moyen Bafing National Park
NG:	Net Gain
NGO:	Non-Governmental Organization
NL:	Net Loss
NNL:	No Net Loss
PS:	Performance Standard
PSG:	Primate Specialist Group
WCF:	Wild Chimpanzee Foundation
SGA:	Section on Great Apes
SSC:	Species Survival Commission

THE ARRC TASK FORCE OF THE IUCN SSC PRIMATE SPECIALIST GROUP

The International Union for the Conservation of Nature (IUCN) is "the global authority on the status of the natural world and the measures needed to safeguard it."[1] IUCN has six commissions. The Commission concerned with the protection of species is the Species Survival Commission (SSC)[2], which comprises more than 160 Specialist Groups that focus on different species and conservation issues, one of them being the Primate Specialist Group (PSG)[3]. The PSG has a Section on Great Apes (SGA) dedicated to orangutans, chimpanzees, gorillas, and bonobos. Making up this section are 144 of the world's leading experts in great ape conservation. The SGA has a number of task forces and one of them, the "ARRC" Task Force, deals specifically with the major threats to apes, present and arising from large-scale energy, extractive and associated infrastructure projects. It was launched in 2016 with the goal of ensuring Avoidance (A), Reduction (R), and Restoration (R); measures needed to address impacts on great apes and their habitat, contributing positively, as such, to their Conservation (C).

[1] "IUCN is a membership Union composed of both government and civil society organisations. It harnesses the experience, resources and reach of its more than 1,400 Member organisations and the input of more than 17,000 experts. This diversity and vast expertise makes IUCN the global authority on the status of the natural world and the measures needed to safeguard it." <https://www.iucn.org/>

[2] "The IUCN Species Survival Commission (SSC) is a science-based network of more than 9,000 volunteer experts from almost every country of the world, all working together towards achieving the vision of, *"A just world that values and conserves nature through positive action to reduce the loss of diversity of life on earth"*. Working in close association with IUCN's Global Species Programme, SSC's major role is to provide information to IUCN on biodiversity conservation, the inherent value of species, their role in ecosystem health and functioning, the provision of ecosystem services, and their support to human livelihoods. This information is fed into the IUCN Red List of Threatened Species. SSC members also provide scientific advice to conservation organisations, government agencies and other IUCN members, and support the implementation of multilateral environmental agreements." <https://www.iucn.org/commissions/species-survival-commission/about>

[3] <http://www.primate-sg.org/>

ABOUT THE AUTHORS

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SUMMARY

The Moyen Bafing National Park (MBNP)[4] is a *c.* 6,400 km^2 protected area that has recently been created in Guinea, West Africa, by a partnership between the Office Guinéen des Parcs et Réserves (OGUIPAR), the Wild Chimpanzee Foundation (WCF), the International Finance Corporation (IFC), and two bauxite mining companies: Guinea Alumina Corporation (GAC) and Compagnie des Bauxites de Guinée (CBG). The park is meant to serve as a biodiversity offset to compensate for the negative impacts of the companies' bauxite mining activities on Critically Endangered Western Chimpanzees (*Pan troglodytes verus*), a subspecies of chimpanzee that has suffered an 80% decline in the last 25 years[5]. GAC and CBG are supported by loans from the IFC and are therefore bound to adhere to the lender's Performance Standards (PS) requiring that they achieve the goal of No Net Loss (NNL) for Natural Habitat where feasible, and a Net Gain (NG) for impacts to biodiversity values for which the critical habitat was designated. The Guidance Note for the IFC PS6 states that "Any area where there are great apes is likely to be treated as critical habitat," and GAC and CBG, therefore, are aiming to demonstrate a NG in chimpanzee numbers overall.

To offset the impacts on an estimated 73–143 chimpanzees within their concession, GAC and CBG will support the creation and management of the MBNP for 20 years[6]. The MBNP is home to about 4,365–5,393 chimpanzees[7] (*c.* 8–10% of the estimated 53,000 chimpanzees remaining in West Africa[8]). This is one of the most viable populations of chimpanzees in the region, living in contiguous habitat in an area of Guinea where chimpanzees are not generally hunted due to religious and cultural prohibitions. GAC and CBG aim to achieve NG through increased legal status and protection of the Moyen Bafing National Park, and therefore decrease future threats to the chimpanzees in this area. Management of the MBNP will also involve restoration of degraded habitats to help the park's chimpanzee population increase over time, which will also support GAC and CBG's goal of achieving a NG in chimpanzee numbers.

GAC and CBG's efforts in chimpanzee conservation are unprecedented for the private sector and represent a significant contribution to the protection of Western Chimpanzees. The creation and support of the MBNP is absolutely critical in preventing the extinction of chimpanzees in West Africa, protecting one of the last strongholds for their survival in the region. The MBNP offset is cutting-edge in its level of support for chimpanzee protection. As such, this

[4] Presidential decree 5232 in 2017

[5] Kühl, H. S., Sop, T., Williamson, E. A., Mundry, R., Brugière, D., Campbell, G., et al. (2017). The Critically Endangered western chimpanzee declines by 80%. *Am. J. Primatol.* 79:e22681. doi: 10.1002/ajp.22681

[6] It is our understanding that 20 years of funding will be provided over 15 years.

[7] All conclusions of this study are based on the currently available estimates of chimpanzee numbers within the MBNP

[8] IUCN SSC Primate Specialist Group (2020). Regional action plan for the conservation of western chimpanzees (*Pan troglodytes verus*) 2020–2030. Gland, Switzerland: IUCN.

offset represents a significant step in both chimpanzee conservation, and biodiversity offset design and implementation. A major question remains however: Will this level of support and funding to the MBNP result in a NG in chimpanzee numbers during the 20 years of support from mining companies?

This question is of critical importance as it creates a precedent for future ape offsets. For this reason, this report was commissioned by the ARRC task force of the IUCN SSC Primate Specialist Group Section on Great Apes that works at the interface of mining, road and dam projects, and great ape conservation. To write this report, members of this group partnered with some of the world's leading experts in great ape population dynamics, conservation finance, and protected area management. We examine both ecological and financial aspects of this offset. We draw on the advice of IUCN experts and conservation finance experts to make concrete recommendations for possible ways to address the identified challenges for future great ape offsets. We reviewed publicly available information, including reports from the Biodiversity Consultancy (TBC) and Wild Chimpanzee Foundation (WCF). Our assessment does not cover an in-depth review of the management and governance of the park, as this was the beyond the scope of this study.

Our study found that even though the creation of the MBNP represents a tremendous contribution to chimpanzee conservation, as currently structured, GAC and CBG are unlikely to achieve a NG for chimpanzees within the timeframe of 20 years, primarily because of the following:

1. The uncertainties, probable underestimation of the chimpanzee baseline number estimates, and number of chimpanzees impacted, would result in a subsequent under-estimate of offset requirements.
2. The time needed to reach a "gain" in chimpanzee numbers was underestimated since calculations that forecast the annual increase in numbers of chimpanzees within the MBNP assumed an exponential growth rate without taking into account population density dependence. Density-dependence means that the growth rate of a population is a function of its size given an area and associated carrying capacity.
3. The Koukoutamba hydroelectric dam and mining permits overlapping with the MBNP could impact a large proportion of its chimpanzee population. This could in turn negate temporary protection efforts supported by the offset.
4. Short term protection through offset funding (e.g., only twenty years) of the MBNP is insufficient compensation for the permanent loss of chimpanzees in mining concessions.

The Government of Guinea, IFC, GAC, CBG and the WCF have a tremendous opportunity to create a flagship biodiversity offset for a high-profile species, while contributing to Guinea's Aichi targets for terrestrial protected areas, and the MBNP is the ideal location for this biodiversity offset.

To achieve their goal of NG however, we recommend that:

1. GAC and CBG provide sufficient funding to protect the MBNP in its *entirety*.
2. Any development or private sector projects planned within the MBNP that would

negatively impact chimpanzees should be cancelled. The MBNP needs to have adequate protection status to prevent any private sector development that would result in negative impacts on chimpanzees, as this would be incompatible with the viability of the offset.

3. The MBNP should be protected *in perpetuity.*

In summary, we do not believe that international financial institutions should permit hundreds of Critically Endangered chimpanzees to be impacted by their investments with a commitment to their temporary protection elsewhere, without putting additional efforts to ensure that an offset persists over the long-term. This is especially important for the MBNP biodiversity offset given imminent threats from hydroelectric dam and mining activities in MBNP. Providing funding upfront into a Conservation Trust Fund (CTF) to support biodiversity offset sites in perpetuity to compensate for damages to great apes and their habitat is a requirement that should be integrated into all loan agreements for projects in great ape habitat. Neither lenders nor governments should allow a project to go forward in critical habitat with impacts on highly threatened species without internalizing the true costs of those impacts. Furthermore, financing such project or granting a license should proceed only when financing guarantees that the project can deliver NG. Failing to set up or contribute to an offset plan that ensures financing in perpetuity for the MBNP could actually pose very significant risks to habitat and wildlife therein down the line.

Finally, we also recommend that the MBNP should align its strategy within the framework of the IUCN Green List of Protected and Conserved Areas. This is becoming the global standard and provides a clear measure of impact. Figure A illustrates gaps identified and recommendations to improve the MBNP offset for chimpanzees.

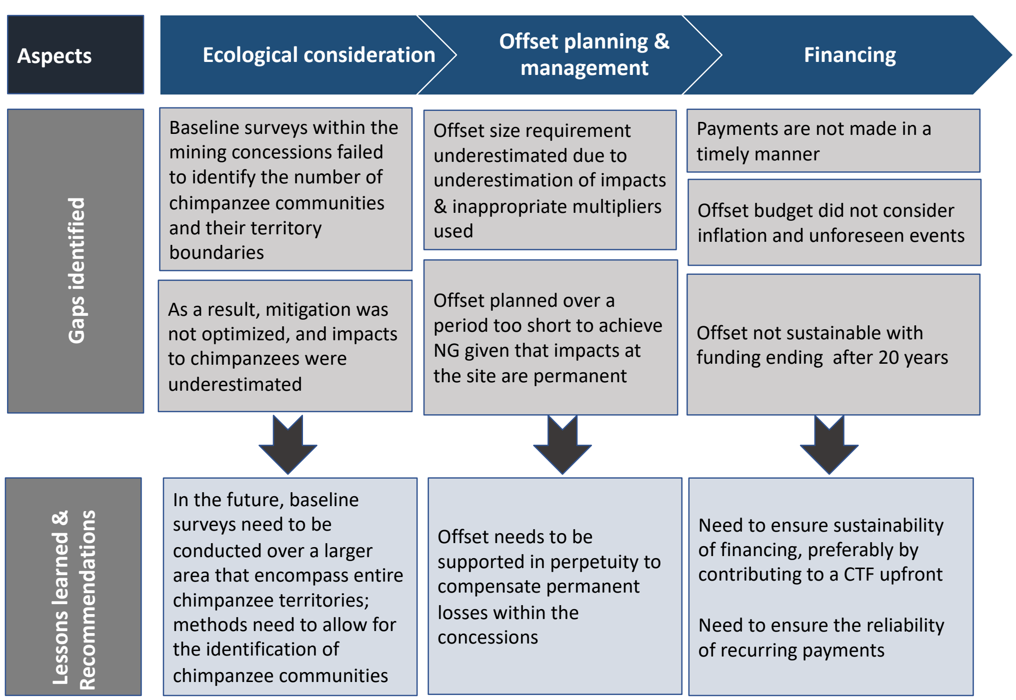

Figure A: Gaps identified and recommendations to improve the MBNP offset for chimpanzees

The experience of the MBNP offset also reveals important general lessons learned for designing offsets for great apes:

- **Promoting avoidance measures** - Even a small impact on great apes and their habitat can result in the need for a company to invest in a large offset in perpetuity. We, therefore, recommend an emphasis on avoidance measures of great ape habitat in the first place.
- **Permanent protection** - All great apes reproduce very slowly, so the time to achieve NG will almost always be very long, and therefore protecting biodiversity offsets for only several decades will always result in a NL. Given the longevity of all great apes, their slow growth rates, the inability of populations to bounce back quickly from disturbances, and the fact that all species of great apes are either Endangered or Critically Endangered, offset sites for apes should be legally protected in advance of impacts and receive sufficient financial support to ensure their effective protection in perpetuity. Lending banks and governments should require permanent protection and financing of offset sites and an associated sustainable finance mechanism such as a CTF). CTFs need to have sufficient capital to allow for annual payments covering annual conservation costs and accounting for unforeseen events.
- **Improve survey data quality** - To estimate baseline populations of great apes, methods that overcome some of the limitations of the transect nest-count distance sampling should be used, including genetic surveys[9] and camera-trap distance sampling[10,11]. These methods can help improve the collection of data to answer questions related to the spatial arrangement and socio-demographic structure of chimpanzee communities overlapping with concession boundaries.
- **Account for all types of impacts** - Impacts on an ape population not only include the reduction in population size but include a number of other levels of impacts that are often underrepresented in efforts to compensate for the damages done to a population. Additional levels of project impacts need to be accounted for, including impact on ecological processes, emerging impacts in the long-term, impacts from interactive effects, net reduction in habitat diversity, net reduction in behavioral diversity, net reduction in population connectivity, reduction in extent of occurrence, and genetic loss.
- **Factor in uncertainties** - The large uncertainties associated with protecting ape population growth dynamics into the future and density-dependent effects all need to be taken into account when estimating requirements of offset size and offset design to avoid overly optimistic population growth scenarios and underestimates of necessary offset size.
- **Scenario modeling** - In the absence of more precise data on (1) population growth within the offset site, (2) effectiveness of conservation efforts, (3) uncertainty of achieving NG, and (4) time lag between impacts and gains, it would be useful to have a science-based recommendation or "calculator" for predicting an appropriate multiplier for great apes

[9] Arandjelovic, M., Head, J., Rabanal, L. I., Schubert, G., Mettke, E., Boesch, C., *et al.* (2011). Non-invasive genetic monitoring of wild central chimpanzees. *PLoS One*, *6*(3), e14761.

[10] Cappelle, N., Després-Einspenner, M. L., Howe, E. J., Boesch, C., and Kühl, H. S. (2019). Validating camera trap distance sampling for chimpanzees. *Am. J. Primatol.* 81(3): e22962.

[11] Howe, E. J., Buckland, S. T., Després-Einspenner, M. L., and Kühl, H. S. (2017). Distance sampling with camera traps. *Methods Ecol. Evol.* 8(11): 1558-1565.

under different situations. Such an approach should incorporate additional levels of compensation for damage to an ape population beyond compensating for population size, including, but not limited to, habitat and great ape ecological diversity and population connectivity.

- **Conservation Offset Paradox (COP)** - There is a discrepancy between the preference to protect large, intact populations of great apes for conservation, and the need for companies to quickly achieve NG by protecting populations that are moderate in size, far below the carrying capacity, inhabit degraded habitat, and were reduced in size by a threat that is manageable by conservation interventions. We are calling this the Conservation Offset Paradox (COP). To address this, it would be advisable for nations to have not only a single population for achieving offset requirements, but to calculate with larger 'envelopes' and consider investments into two populations living under different conditions. This reduces the chances of being trapped in density-dependent effects or unmanageable sources of mortality, as different populations are unlikely to follow the same population dynamics. Offsets should invest in i) rapidly growing populations of great apes below carrying capacity with few, manageable threats to achieve NG, and ii) sites with viable intact populations that may be approaching or at carrying capacity. For the latter, habitat regeneration can increase the carrying capacity of the area and averted loss can contribute to NG. If the habitat is already pristine and the area not under imminent threat, then demonstration of ape population growth within the offset site would not be required **as long as such areas were supported and protected in perpetuity**. These areas would need to be well managed, part of a national biodiversity offset plan[12] and deliberately contribute to jurisdictional targets for great ape conservation[13] without any loss of the great ape populations they harbor. For some countries, this may come with the risk of not having enough funding for two sites. In this case, it would be better to concentrate on fully supporting one site to begin with before investing in another. Also, for countries with few great apes, having more than one offset site might not be feasible. Not all countries have a large number of large chimpanzee populations remaining.
- **Portfolio of potential sites** - Given the long preparation phase for establishing a great ape offset, including the collection of longitudinal data, it is important to develop a portfolio of candidate offset sites, in advance, from which a site (or sites) can be chosen. These should exist as part of a larger strategic national great ape action plan. Given the narrow timelines under which private sector companies work, this would help to overcome some of the issues observed in MBNP, such as initiation of project work before full implementation of the offset. It would also help countries and companies, early on, identify important areas for avoidance. A national offset plan should be validated only after such information is available.

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[12] Kormos, R., Kormos, C. F., Humle.], T., Lanjouw, A, Rainer, H., Victurine. R., Mittermeier, R. A., Diallo, M. S., Rylands, A. B., Williamson, E.A. (2014). Great apes and biodiversity offset projects in Africa: the case for national offset strategies. *PLoS One* 9(11): e111671. doi: 10.1371/journal.pone.0111671.

[13] Simmonds, J. S., Sonter, L. J., Watson, J. E., Bennun, L., Costa, H. M., Dutson, G. *et al.* (2020). Moving from biodiversity offsets to a target-based approach for ecological compensation. *Conserv. Lett.* 13: e12695. doi.org/10.1111/conl.12695

- **Aggregated offsets** - As not all projects will develop their own independent offset, it is important to establish mechanisms whereby smaller projects can provide their compensation to aggregated offsets. This will have the added value that less cost will go into the management of independent offset establishment and will therefore be more cost effective. Aggregation of offsets offers the opportunity to protect larger sites, and also for smaller companies to buy into ongoing schemes rather than having to invest resources in starting up a new offset site. Protected areas (PAs) offer excellent sites for aggregating offsets. A measurement or assessment system would need to be created to determine or define a kind of "offset unit" (measure of exchange) and assess the number of such units provided by the PA. The same measurement system would determine the number of units impacted by each company and the total number of those units each company would be required to purchase to meet NNL or NG goals. The purchase of the total number of units would result in the financing of the PA in perpetuity. By developing the discreet units and accounting for them, double counting can be avoided and companies are not allowed to pay for the same offset.
- **Research programs for offset site**s - Research programs should be immediately established in potential offset sites to measure population size and growth rates. Understanding population growth dynamics at the offset site, including density dependence is essential for estimating feasibility, size and design of biodiversity offsets for great apes.

INTRODUCTION

As a result of human activities, we are currently experiencing an extinction crisis – species extinction rates are hundreds of times higher than background rates. One million species are currently threatened with extinction[14] and many more are expected to disappear within decades[15]. Because of the close ecological interactions between species, when one species becomes extinct, this tends to have knock on effects of moving other species toward extinction as well. "Extinction breeds extinction"[16]. The consequences of this destruction have never been more evident. The most urgent and catastrophic issues of our time, including climate change and the current COVID-19 pandemic, are a direct result of the destruction of nature[17]. Yet, despite this, extractive and infrastructure projects are accelerating across the globe, occurring within and impacting national parks, World Heritage Sites, and critical habitats of Endangered and Critically Endangered species, including our closest living relative – the chimpanzee.

Of the four subspecies of chimpanzees, the Western subspecies (*Pan troglodytes verus*) is the most endangered of becoming extinct according to the International Union for the Conservation of Nature (IUCN). Western Chimpanzees have suffered catastrophic declines in the last two decades. Western Chimpanzees used to live in 11 countries across west Africa, but have disappeared completely from Benin, Burkina Faso, and Togo (**Figure 1**). Today their overall population is only 20% of what it was in the mid-1990s[18], Guinea is an important country for the conservation of Western Chimpanzees because it has by far the largest population of all countries in the region. In some countries there are only a handful of chimpanzees left, while there are an estimated 33,000 individuals in Guinea – almost two thirds of the total population of the subspecies[19] (**Figure 2**).

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[14] IPBES (2019). Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio, H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56 pp.

[15] IPBES (2019). Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio, H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56 pp.

[16] Ceballos, G., Ehrlich, P. R., and Dirzo, R. (2017). Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines. *Proc. Natl. Acad. Sci. U.S.A.* 114(30): E6089-E6096. doi: 10.1073/pnas.1704949114.

[17] Brancalion, P. H. S., Broadbent, E. N., de-Miguel, S., Cardil, A., Rosa, M. R., Almeida, C. T., *et al.* (2020). Emerging threats linking tropical deforestation and the COVID-19 pandemic. *Perspect. Ecol. Conserv.* 18(4): 243–246. doi.org/10.1016/j.pecon.2020.09.006

[18] Kühl, H. S., Sop, T., Williamson, E. A., Mundry, R., Brugière, D., Campbell, G., *et al.* (2017). The Critically Endangered western chimpanzee declines by 80%. *Am. J. Primatol.* 79: e22681. doi: 10.1002/ajp.22681

[19] Heinicke, S., Mundry, R., Boesch, C., Amarasekaran, B., Barrie, A., Brncic, T., *et al.* (2019). Advancing conservation planning for Western chimpanzees using IUCN SSC A.P.E.S.—the case of a taxon-specific database. *Environ. Res. Lett*. 14(6): 064001.

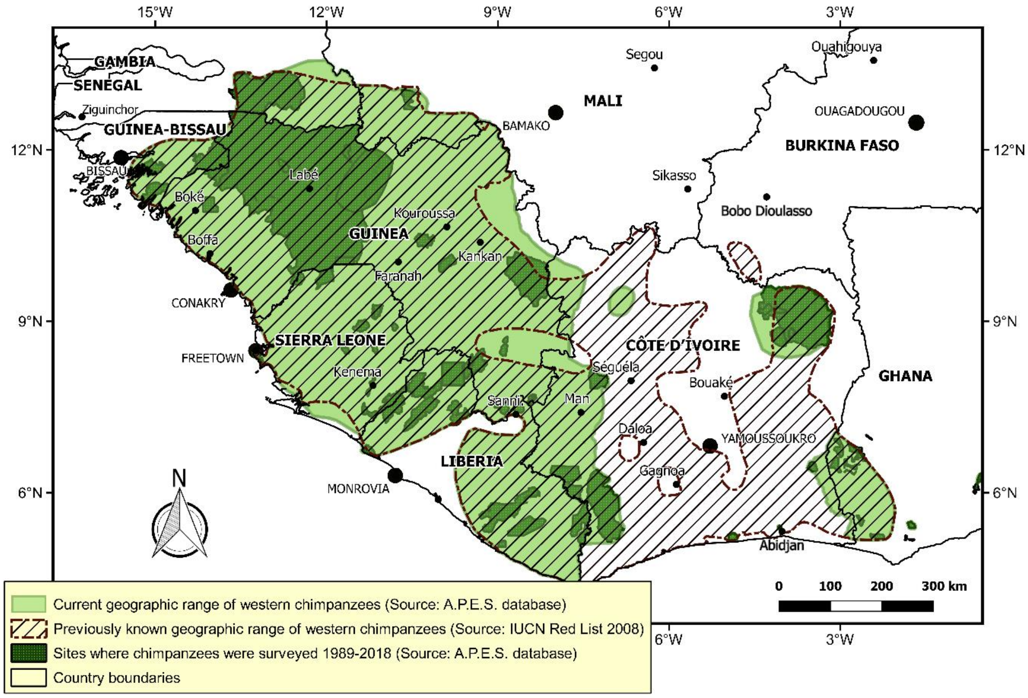

Figure 1. Current and previously known geographic range of western chimpanzees based on Kühl et al. 2017 (map Tenekwetche Sop)

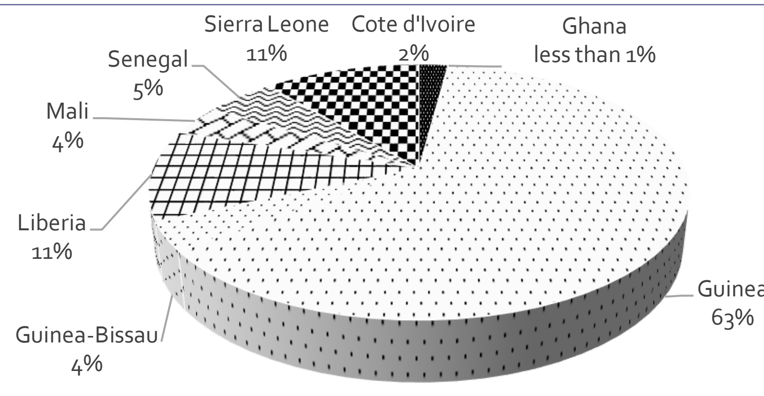

Figure 2. Percent of Western Chimpanzees in each country within their remaining range

As well as having the largest chimpanzee population in West Africa, Guinea has the largest bauxite deposits (used to make aluminum) in the world. Companies from Australia, the United Arab Emirates, France, England, India, Russia and China are leasing adjacent concessions in the bauxite rich area of the country (**Figure 3**). While each mining project may only result in the demise of a small number of chimpanzees, collectively, the impact from all mining projects planned in Guinea will be catastrophic. It is, therefore, vital that governments, lending banks, and companies strengthen the application of their standards and safeguards to ensure that they do not continue to cause species losses from these megaprojects within the habitat of great apes.

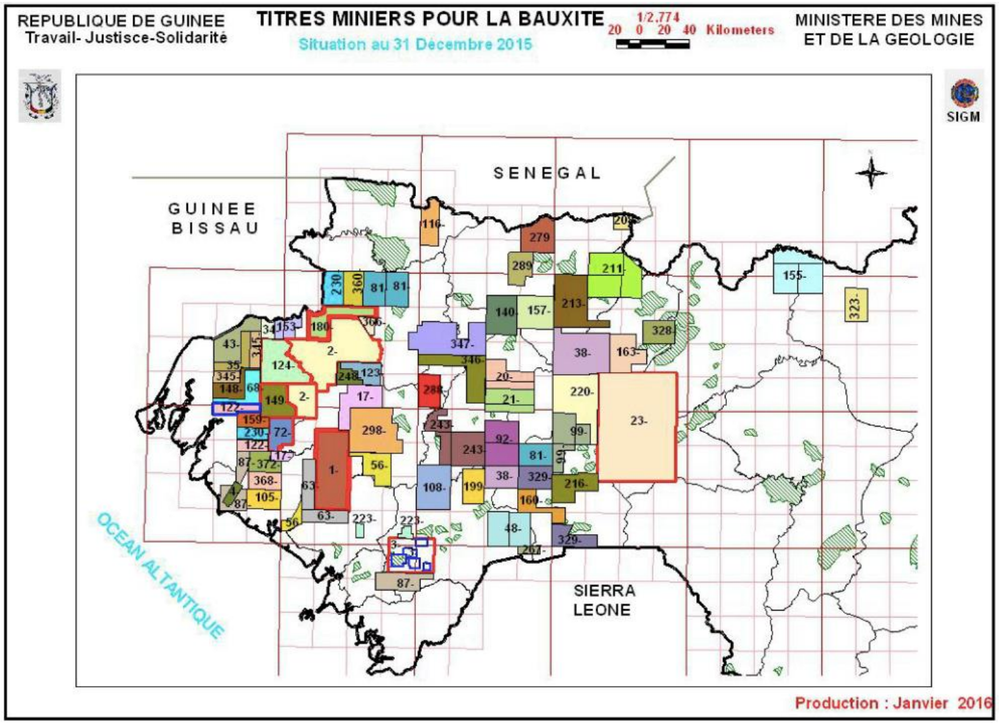

Figure 3. Bauxite mining map of Guinea (https://mines.gov.gn/en/media/maps/). The Global Alumina Corporation concession is #124 and the CBG concession is #2

IUCN has global policy on biodiversity offsets, adopted in 2016 by IUCN Members at the IUCN World Conservation Congress. Some of the key elements of IUCN offset policy can be found in **Box 1.** Importantly, IUCN requires that "the offset gain should last at least as long as the impact being addressed which in most cases means in perpetuity."

Box 1. Key elements of biodiversity offsets included in IUCN's Policy:

Measuring and exchanging biodiversity, defensible and replicable measures and units of exchange, sufficient baseline surveys, and established exchange rules governing which residual impacts can be offset by what type of gains?
Additionality, biodiversity offsets must secure additional conservation outcomes that would not have happened otherwise.
Timeframe, the offset gain should last at least as long as the impact being addressed which in most cases means in perpetuity.
Uncertainty, offsets must account for uncertainty by clearly documenting data sources, assumptions, and knowledge gaps.
Monitoring and evaluation, continued surveys of impacts and offset activities to measure the losses and gains that have actually transpired.
Governance and permanence, legal, institutional and financial measures must be in place to ensure the effective design and implementation of offset schemes. The mitigation hierarchy framework should be embedded in landscape and seascape level planning and legislation.

The Performance Standards of the International Finance Corporation (IFC), the private lending branch of the World Bank, and the IUCN offset policy generally align. These Performance Standards specify their clients' responsibilities for managing their environmental and social risks.[20] As the IFC is a major supporter of private sector projects in the tropics, having provided more than $285 billion in financing for businesses in developing countries since 1956[21] and because many other banks, including the Equator Banks[22] (113 of the world's largest banks in 37 countries) align their Equator Principles closely with the IFC Performance Standards, the IFC has the power to have tremendous influence on the protection of biodiversity.

The IFC Performance Standard 6 pertaining to biodiversity conservation specifies that clients working in Critical Habitat (CH) satisfy six criteria[23] (Box 2), notably that the project "does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time." The IFC allows for biodiversity offsets as a tool to avoid net reduction in Endangered Species and specifies that offsets must be "designed to achieve **net gains** of those biodiversity values for which the critical habitat was designated.''

BOX 2. International Finance Corporation Performance Standard 6 <https://www.ifc.org/wps/wcm/connect/3baf2a6a-2bc5-4174-96c5-eec8085c455f/PS6_English_2012.pdf?MOD=AJPERES&CVID=jxNbLC0>

17. In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:
- No other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical;
- The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;
- The project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time; and
- A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program.

18. In such cases where a client is able to meet the requirements defined in paragraph 17, the project's mitigation strategy will be described in a Biodiversity Action Plan and will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated.

In 2019, the IFC took the unprecedented step of incorporating language specific to Great Apes into the Guidance Note (GN)[24] for PS6, notably that "any area where there are great apes is

[20] <https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards>

[21] https://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/home

[22] <https://equator-principles.com/members-reporting/>

[23] "In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated: 1) No other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical; 2) The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values; 3) The project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time; 4) A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program."

[24] "GN73. Special consideration should be given to great apes (gorillas, orangutans, chimpanzees and bonobos) due to their anthropological significance. Where great apes may potentially occur, the IUCN/Species Survival Commission (SSC) Primate Specialist Group (PSG) Section on Great Apes (SGA) must be consulted as early as possible to assist in the determination of the occurrence of great apes in the project's area of influence. Any area where there are great apes is likely to be treated as critical habitat. Projects in such areas will be acceptable only in exceptional circumstances, and individuals from the IUCN/SSC PSG SGA must be

likely to be treated as critical habitat," and that "projects in such areas will be acceptable only in exceptional circumstances, and individuals from the IUCN/SSC PSG SGA must be involved in the development of any mitigation strategy." This wording offers the potential for increased avoidance of great ape habitat and better mitigation of project impacts and could save the lives of many gorillas, chimpanzees, bonobos and orangutans. It also means that projects in great ape habitat will be required to achieve a Net Gain (NG) in great ape numbers.

The Compagnie des Bauxites de Guinée (CBG) and the Guinea Alumina Corporation (GAC) are two mining projects in Guinea with adjacent concessions who received financing from the IFC for projects prior to the new Guidance Note to PS6. Given that these projects are moving ahead it is reasonable to expect that IFC will work closely with the companies to ensure that NG can be achieved and that adequate resources are provided by the companies to secure the conservation outcomes required.

Bauxite mining requires clearing of all vegetation and topsoil, dynamite blasting, ripping up the ore with large bulldozers, loading it onto trucks where it is hauled to crushing facilities and then transported by trains to the port where it is loaded onto ships and taken to other countries for processing into aluminum[25]. These activities are incompatible with great ape survival (see Figure 4 below). Chimpanzees require trees for their food and shelter and will avoid noise and human activity. In addition to the direct impacts of loss of habitat, there are many other environmental consequences from bauxite mining that impact chimpanzees, including river siltation and pollution, destruction of underground aquifers, and air pollution among many others[26]. All of these also have short and long-term consequences on human health[27] as well as having an impact on wildlife populations.

Figure 4. The clearcutting and removal of topsoil involved in bauxite mining. (Photo credit Kalyanee Mam, Boke, Guinea 2018)

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involved in the development of any mitigation strategy." <https://www.ifc.org/wps/wcm/connect/9fc3aaef-14c3-4489-acf1-a1c43d7f86ec/GN_English_2012_Full-Document_updated_June-27-2019.pdf?MOD=AJPERES&CVID=mRQmrEJ>

[25] Kamble, P. H., and Bhosale, S. (2019). Environmental impact of bauxite mining: A review. *Int. J. Res. Appl. Sci. Eng. Technol.* (IJRASET), 7(1): 86–90.

[26] Sidiki, S. (2019). Bauxite mining in the Boké Region (Western Guinea): method used and impacts on physical environment. *Eur. J. Sustain. Dev. Res.* 3(3): em0087.

[27] Human Rights Watch. 2018. "What Do We Get Out of It?" <https://www.hrw.org/report/2018/10/04/what-do-we-get-out-it/human-rights-impact-bauxite-mining-guinea>

GAC) is a wholly owned subsidiary of Emirates Global Aluminium (EGA) and is the largest "premium" aluminum producer in the world. GAC owns a 690 km^2 mining concession in Guinea, West Africa – an area almost seven times the size of Paris. The area that GAC plans to develop contains almost 400 million tons of bauxite which they plan to exploit before 2040[28]. The bauxite ore is carried by rail to their port facilities in Kamsar, from where it is shipped to smelters around the world. Working at full capacity, GAC expects to produce about 12 million tons of bauxite a year.

CBG was founded in 1963 and is the largest bauxite company working in Guinea and one of the largest in the world. It is 49% owned by the Guinean government and 51% owned by Halco Mining Inc (a consortium comprised of Alcoa, Rio Tinto-Alcan and Dadco Investments). Since 1973, CBG has shipped 500 million tons of bauxite from Guinea. The company is now expanding exports to around 22.5 million tons per year by 2022 through expansion of their Sangarédi mine, their processing plant, and shared multiuser infrastructure in Guinea[29]. CBG's mining rights last until 2038. At full capacity, therefore, CBG and GAC together will be removing 34.5 million tons of bauxite– the equivalent weight of 3,400 Eiffel Towers per year.

According to Inclusive Development[30] CBG's project is financed by a series of loans issued in September 2016 amounting to $823 million[31]. GAC is supported by USD $460 million debt and guarantee package from the IFC, EDC and AfDB, for the development of GAC's bauxite project along with their associated rail and port infrastructure[32] (**Table 1**).

Table 1. GAC and CBG bauxite mining projects in Guinea

	GAC	CBG	TOTAL
Concession area	690 km^2	530 km^2	1,220 km^2
Project cost USD	$460 million	$823 million	$1,283 million
Annual amount of Bauxite removed at full capacity	12 million tons/year	22.5 million tons/year	34.5 million tons/year
Rights held until	2040	2038	–
Company ownership	Wholly owned subsidiary of Emirates Global Aluminium (EGA)	49% owned by the Guinean government and 51% owned by Halco Mining Inc. (a consortium comprised of Alcoa, Rio Tinto-Alcan and Dadco Investments).	–

Even though GAC and CBG are extracting bauxite in areas wholly separate from one another, they have sought to create an aggregated offset by working with the Government of

[30] <https://www.inclusivedevelopment.net/campaign/guinea-alcoa-rio-tinto-bauxite-mine/>

[31] These include loans of 1) $200 million from the International Finance Corporation (IFC), 2) $150 million from the US government's Overseas Private Investment Corporation (OPIC), and 3) $473 million from a syndicate of commercial banks (all Equator Banks), including French banks Société Générale, BNP Paribas, Credit Agricole and Natixis; the German branch of ING bank, ING-DiBa AG; and two Guinean banks, Société Générale de Banques en Guinee (SGBG) and Banque Internationale pour le Commerce et l'Industrie de la Guinee (BICIGUI, a member of the BNP Paribas group).

[32] <https://ifcextapps.ifc.org/ifcext/pressroom/ifcpressroom.nsf/0/7423B4D535358D1085258408004D50A2>

Guinea, the IFC and the Wild Chimpanzee Foundation to create the *c.* 6,400 km^2 Moyen-Bafing National Park (MBNP) which is home to approximately 4,365–5,393 chimpanzees[33]. The companies have committed $48 million over 20 years for the setup and management of this park.

The MBNP offset relies partially on the principle of "avoided losses," i.e., if these chimpanzees in the park were not protected by a national park status, they may be lost in the future if the area is developed or exploited for other purposes. About two-thirds of biodiversity offsets globally, rely on this principle[34], however, there is much debate about the efficacy of biodiversity offsets that rely on counterfactuals[35]. Management of the MBNP will involve restoration with the goal of creating the conditions within the park for the chimpanzee population to grow over time. With avoided loss through increased protection, and population increases through habitat restoration, GAC and CBG hope to demonstrate a NG of chimpanzee numbers within 20 years.

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[33] Starkey, M., Campbell, G., Temple, H. J., Tatum-Hume, E., Keita, M. K., Suter, J. (2017). *Moyen Bafing Chimpanzee Offset Feasibility Study.* The Biodiversity Consultancy, Cambridge, UK.

[34] Bull, J. W., and Strange, N. (2018). The global extent of biodiversity offset implementation under no net loss policies. *Nature Sustain.* 1: 790–798. doi.org/10.1038/s41893-018-0176-z

[35] zu Ermgassen SOSE, Baker J., Griffiths R. A., Strange, N., Struebig, M. J., and Bull J. W. (2019). The ecological outcomes of biodiversity offsets under 'no net loss' policies: A global review. *Conserv. Lett.* 12: e12664. doi.org/10.1111/conl.12664.

ECOLOGICAL CONSIDERATIONS

In designing biodiversity offsets, it is essential to know how many chimpanzees are present in a project's area in the first place, how many will be lost as a result of the project's activities, and how many individuals and how much habitat needs to be protected elsewhere in order to offset the losses. The following describes how GAC and CBG made these calculations. The offset design process included the companies (GAC and CBG), lenders (IFC), Government of Guinea, the Biodiversity Consultancy (TBC), and the Wild Chimpanzee Foundation (WCF).

GAC and CBG's biodiversity offset calculations

Information on the status of the chimpanzee populations in the GAC and CBG concessions was collected with several field surveys starting in 2008. The companies engaged with chimpanzee specialists from the non-governmental organization Wild Chimpanzee Foundation (WCF) to design and conduct these surveys. The GAC concession was surveyed seven times from 2008 to 2018[36,37]. The CBG concession was surveyed once in 2015[38]. The applied survey method for estimating the abundance and spatial distribution of chimpanzees was 'line transect nest count distance sampling' in combination with a 'systematic survey design' (i.e., chimpanzee sleeping nests were counted along line transects that were systematically placed throughout the concessions). During the time of application, this methodology was the standard for surveying chimpanzees and recommended by the Section on Great Apes of the IUCN SSC Primate Specialist Group[39]. This methodology relies on counting chimpanzee sleeping nests and subsequently estimating chimpanzee abundance using three auxiliary variables: nest decay time – the time a freshly built nest remains visible; nest construction rate – the number of nests built by an individual per day; and proportion of nest builders – proportion of individuals above the age of 4 years, the age when infants start building their own nests.

The estimated number of chimpanzees in the 690 km^2 GAC concession ranged between 152 and 277 individuals (0.22–0.4 individuals/km^2) averaged over a six-year period. The estimated

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[36] Escalas, A., Smuts, R., Starkey, M., Keita, M. K., & Campbell, G. (2016) Chimpanzee Offset Pre-Feasibility Study and Strategy for the GAC Bauxite Project. 172 pp.

[37] EEM Sustainable Management (2019). Development of an optimized monitoring and evaluation program and updated baseline for western chimpanzees, 131 pp.

[38] Wild chimpanzee Foundation (2015) Complementary Primate Study CBG Extension Project, Part 2 – Rapid Assessment, 36 pp.

[39] Kuehl, H. S., Elzner, C., Moebius, Y., Boesch, C., & Walsh, P. D. (2008). The price of play: self-organized infant mortality cycles in chimpanzees. PLoS One 3(6): e2440.

number of chimpanzees in the surveyed part (530 km^2) of the CBG concession in 2015 was between 33 and 188 individuals (0.06–0.22 individuals/km^2).

For the GAC project, the residual impact was forecasted by overlaying expected habitat loss (c. 7% of important habitats within the concession will be directly impacted and removed by mining) and habitat avoidance (45–82% of important habitats in the southern part of the concession will not be lost, but will be affected by mining activities in other ways, for example through noise pollution) on the distribution of chimpanzees as derived from field surveys. This assessment was complemented by estimates of additional impacts based on expert opinion, including habitat fragmentation, increased hunting, increased intergroup conflicts (which is estimated to cause a 25–75% loss of the chimpanzee population), increased vulnerability to diseases, stress and reduced reproductive rate. These calculations resulted in an estimated 30–60% reduction of the population of 152–277 chimpanzees present in the concession. This equates to about 50–160 individuals[40] (Table 2). Due to their complexity, all impacts could not be quantified in the same way as habitat loss and avoidance.

For CBG, residual impact was estimated by assuming that 70% of the 33–118 chimpanzees living in the mining concession (95% confidence interval) would be impacted, i.e., about 23–83 individuals. Following the precautionary principle, the upper confidence limit i.e., 83 chimpanzees was used[41]. **Table 2** summarizes these findings for each mining concession.

Table 2. Estimates of chimpanzee baseline population size within the GAC and CBG concessions and estimates for impact size (source Escalas *et al.* 2016 and Starkey *et al.* 2017).

	GAC	CBG	TOTAL
Estimated number of chimpanzees in concession	152–277	33–118	185–295
Estimated number of chimpanzees impacted	50–160	23–83	73–143

To calculate the necessary offset size that would be needed to achieve a NG in chimpanzee numbers, GAC and CBG used the following formula based on when (after *T* years) the difference in population size between the population under offset management and under no offset management equals or is larger than the number of individuals impacted in the mining concession:

Initial population after T years with offset growth rate – Initial population after T years without offset growth rate ≥ Population impacted

In mathematical notation, the estimation of necessary offset size (*I*) was expressed as

$$\boldsymbol{I \times (R_1)^T - I \times (R_0)^T \geq Population_{imp}} \qquad \textbf{equation 1}$$

[40] Escalas, A., Smuts, R., Starkey, M., Keita, M.K., Campbell, G. (2016). Chimpanzee Offset Pre-Feasibility Study and Strategy for the GAC Bauxite Project, 172 pp.

[41] Wild Chimpanzee Foundation (2015) Complementary Primates Study CBG Extension Project, Part 2 – Rapid Assessment, 36 pp.

or by solving for necessary offset size *I* and replacing offset growth rate R_1 by $R_0 + E \times (R_2 - R_0)$[42]

$$I = \frac{Population_{imp}}{(R_0 + E \times (R_2 - R_0))^T - (R_0)^T}$$ **equation 2**

where,

- *I* is the minimum size of the initial population of chimpanzees at the offset site (in number of individuals)
- $Population_{imp}$ is the population of chimpanzees impacted by the mine (in number of individuals)
- R_0 is rate of growth at the offset site due to existing threats without intervention (possibly negative)
- R_1 is rate of growth at the offset site due to existing threats with intervention, i.e. $R_0 + E \times (R_2 - R_0)$
- R_2 is the rate of natural growth with no threats
- *E* is the effectiveness of intervention to reduce the existing threats on chimpanzee at the offset site (0–1 without unit)
- *T* is the number of years to achieve a Net Gain (in years)

As the realization of an offset is associated with great uncertainty, multipliers are used to account for unforeseen risk. Initial offset population size needed is thus increased. Both GAC and CBG used different multipliers, including a multiplier to account for the uncertainty in the effectiveness of the offset. For the lower scenario, CBG used 2 as a multiplier, but otherwise all other calculations used a multiplier of 3. Another multiplier represented the time lag between impacts and gains, and both CBG and GAC used a value of 1.8. For details and calculation, see Table 3.

Based on the total "conservative estimate", GAC and CBG estimated that the minimum starting population required at the offset site to achieve NG within 20 years with uncertainty and time lag multipliers would be 3,404 chimpanzees.

The next step was to screen data from the GAC-funded nationwide survey conducted by WCF between 2009–2012 looking for sites (1) within the current range of the Western Chimpanzees, (2) within the Guinean Forest – Savannah Mosaic ecoregion, 3) with either an estimated chimpanzee population >250 individuals according to WCF data or available literature, or confirmed chimpanzee presence in an area >500 km^2. All of the candidate sites were screened and then ranked according to (1) ecological equivalence, (2) technical feasibility of offset gains to reduce threats and having a population that is able to grow, (3) social feasibility of gains, suggesting a favorable socio-economic context, (4) alignment with the Government of Guinea and other stakeholders, (5) additional conservation gains, (6) opportunities for a scaled offset and/or an aggregated offset, (7) possibility for other conservation outcomes beyond chimpanzees. The

[42] EEM Sustainable Management (2019) Development of an optimized monitoring and evaluation program and updated baseline for western chimpanzees, 131 pp.

procedure was based on good international practice for biodiversity offsets. Based on this screening process, Moyen Bafing was top ranked[43]. The site was then proposed as a suitable offset to compensate for the damage on chimpanzees occurring in the CBG and GAC concessions.

Table 3: Overview of calculations used to determine offset requirements including an optimistic, conservative, and worst-case scenario for the chimpanzee population in the GAC and CBG concessions. This table was compiled from Table 1 in the Pre-feasibility studies for GAC and CBG that were developed by the companies in collaboration with lenders (IFC), chimpanzee experts (WCF) and consultants (TBC)[44,45]

Assumptions (Scenarios)	'Optimistic' GAC/CBG	'Conservative' GAC/CBG	'Worst-case' GAC/CBG
Losses (total number of individuals)	GAC: 54 (31% impact on population of 173) CBG: 31 (50% impact on population of 62) TOTAL: 85	GAC: 98 (45% impact on population of 217) CBG: 59 (50% impact on population of 118) TOTAL: 157	GAC: 161 (58% loss of population of 277) CBG: 83 (70% loss of population of 118) TOTAL: 244
Natural population growth without threats (% per year)	GAC: 1.65		
Net population growth with existing threats WITHOUT offset (% per year)	GAC: -1.00		
Effectiveness of conservation actions to reduce threats (%)	GAC: 50		
Net growth rate WITH offset (%/yr)	GAC: 0.3		
Duration to achieve a NG (years)	GAC: 20 years		
Minimum starting population required at offset site to achieve NG within 20 years WITHOUT uncertainty multiplier (included)	GAC: 208 CBG: 124 TOTAL: 332	GAC: 392 CBG: 237 TOTAL: 629	GAC: 667 CBG: 332 TOTAL: 999
Multiplier to account for uncertainty in effectiveness of the offset	GAC: 3 CBG: 2	GAC: 3 CBG: 3	GAC: 3 CBG: 3
Minimum starting population required at offset site to achieve NG within 20 years WITH uncertainty multiplier (ind.)	GAC: 625 CBG: 248 TOTAL: 873	GAC:1,176 CBG: 710 TOTAL: 1,886	GAC: 2,001 CBG: 995 TOTAL: 2,996
Multiplier to account for time lag between impacts and gains based on discount rate of 3% per year over 20 years	GAC:1.8 CBG: 1.8		
Minimum starting population required at offset site to achieve NG within 20 years WITH uncertainty and time lag multipliers (ind.)	GAC: 1129 CBG: 450 TOTAL:1,579	GAC: 2,124 CBG: 1,280 TOTAL: 3,404	GAC: 3615 CBG: 1,800 TOTAL: 5,415

[43] Escalas, A., Smuts, R., Starkey, M., Keita, M. K., Campbell, G. (2016). Chimpanzee Offset Pre-Feasibility Study and Strategy for the GAC Bauxite Project, 172 pp.
[44] Escalas, A., Smuts, R., Starkey, M., Keita, M. K., Campbell, G. (2016). Chimpanzee Offset Pre-Feasibility Study and Strategy for the GAC Bauxite Project, 172 pp.
[45] Starkey, M., Campbell, G., Temple, H.J., Tatum-Hume, E., Keita, M. K., Suter, J. (2017). Moyen Bafing Chimpanzee Offset Feasibility Study. The Biodiversity Consultancy, Cambridge, UK.

ARRC Task Force Analysis

An estimated 4,365–5,393 chimpanzees inhabit the MBNP landscape covering about 6,400 km^2.[46] The population of chimpanzees in MBNP is likely the largest contiguous population of the Critically Endangered Western Chimpanzees remaining. There is no other Western Chimpanzee population of this size inhabiting dry forest and woodland savanna. Thus, it will be the largest population, outside of rainforest habitat, under protection. This population represents almost 10% of the total remaining population of the Western Chimpanzee, which is estimated to be 52,800 (95% CI 17,577–96,564)[47] (**Figure 5**). Furthermore, the habitat of the chimpanzees within the MBNP is still connected to other chimpanzee populations towards the west and north, extending into Mali. This landscape, therefore, is of utmost importance for the conservation of the Western Chimpanzee.

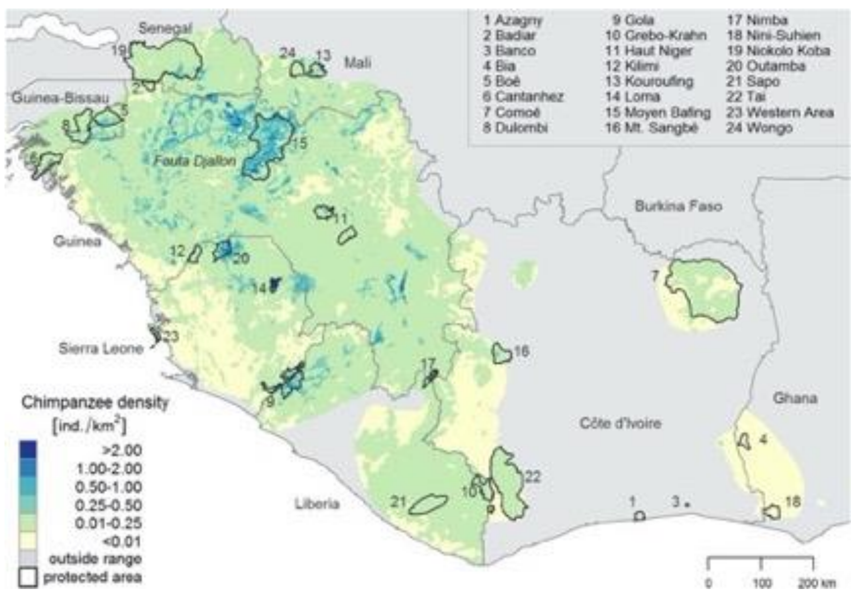

Figure 5. Modelled density distribution of Western Chimpanzees across their range (reproduced from Heinicke *et al.* 2019 CC BY 3.0)

Chimpanzees are found widely across the MBNP and even close to villages in this landscape. Hunting has not, historically, been a threat to chimpanzees in the region, unlike many other locations where great apes occur. This is due to cultural beliefs of communities in the Fouta

[46] Starkey, M., Campbell, G., Temple, H.J., Tatum-Hume, E., Keita, M. K., Suter, J. (2017). Moyen Bafing Chimpanzee Offset Feasibility Study. The Biodiversity Consultancy, Cambridge, UK.

[47] Heinicke, S., Mundry, R., Boesch, C., Amarasekaran, B., Barrie, A., Brncic, T., *et al.* (2019). Advancing conservation planning for western chimpanzees using IUCN SSC APES—the case of a taxon-specific database. *Environ. Res. Lett.* 14(6): 064001.

Djallon region of Guinea, where the MBNP is located.[48]. Elsewhere in West Africa, hunting is a major threat to chimpanzees, oftentimes more so than habitat loss. Consequently, the positive attitude and behavior of local communities towards great apes have been identified as key factors for successful ape conservation projects in this region.

We find that the MBNP is an absolutely critical site for the protection of Western Chimpanzees and an ideal location for the biodiversity offset of GAC and CBG. However, as a result of our findings, we ascertain that even though the creation of the MBNP, as currently structured, represents a tremendous contribution to the conservation of chimpanzees, GAC and CBG are unlikely to achieve a NG for chimpanzees within the timeframe of 20 years for the following reasons:

1. Underestimates in the i) baseline number of chimpanzees within the mining concessions, ii) the number of chimpanzees impacted by the mining, and iii) the multipliers, have resulted in an underestimate of the required increase in chimpanzee numbers needed to achieve a NG overall.

Accurately measuring chimpanzee populations is difficult and estimating offset size is equally challenging. We acknowledge that many of the issues we describe below arose despite the best intentions of all involved and that there were many constraints acting on all stakeholders. Below are the reasons we believe that each of the following were underestimated.

i) Baseline Surveys

Our analysis finds that although the chimpanzee baseline surveys provided important information about the mean number of chimpanzees using the concession, the surveys likely underestimated the total number of individuals in the concessions of GAC and CBG.

First, the nest count method provides reliable estimates of chimpanzee population size, if carefully applied[49], otherwise, it is prone to bias and the resulting estimates are misleading. For the GAC and CBG baseline surveys, the nest decay time was taken from the literature instead of being generated through site and survey specific estimates. This led to increased variability in abundance estimates, since nest decay time varies based on environmental and climatic conditions. Second, the methodology used by WCF on behalf of GAC and CBG is very sensitive to temporal changes in chimpanzee locations (in this case represented by sleeping nests) relative

[48] Ham, R. 1998. Nationwide chimpanzee survey and large mammal survey, Republic of Guinea. Unpublished report for the European Communion, Guinea-Conakry.

[49] Kouakou, C. Y., Boesch, C., and Kuehl, H. (2009). Estimating chimpanzee population size with nest counts: validating methods in Taï National Park. *Am. J. Primatol.* 71(6): 447–457.

to the transect lines, which results in fluctuating estimates in repeat surveys. Third, since the surveys were restricted to the concessions, the estimates only partially accounted for chimpanzee communities whose territories might not fully overlap with the concession. Thus, the surveys based on sleeping nests likely underestimated the number of chimpanzees from these overlapping communities that use the concession but might not frequently nest within it. This is compounded because the chimpanzees have not been identified individually, so tracking movement in and out of the concession was hard, if not impossible, for these estimates.

While it is true that additional impacts to chimpanzees outside the GAC and CBG concessions can be attributed to companies mining in adjacent concessions (especially when there are concessions on all sides), it does not take away from the fact that GAC and CBG are responsible for their impacts on all chimpanzees using their concession.

ii) Number of chimpanzees impacted by the mining

In this study, we did not assess whether GAC and CBG applied the mitigation hierarchy by considering all avoidance and mitigation first before considering offsets, neither did we review their plans to mitigate the impacts of mining on chimpanzees. In terms of estimating the residual impact, however, the non-identifiability of individuals by the applied methodology prevented the identification of several important population parameters fundamental for the effective mitigation of impacts, including the number of social groups using the concessions, sizes of the social groups, age and sex structure of the social groups and reproductive rates. In addition, since the number of chimpanzees in the GAC and CBG concession was underestimated, the residual impact of the mining on these chimpanzees was likely underestimated too. Again, this is because individuals in communities, whose territories overlap with concession boundaries are only captured proportionally to their time spent in the concession.

There is not yet any long-term monitoring data to reliably assess impacts of mining on chimps, so, understandably, it was only possible to "estimate" impacts. CBG estimated impacts from an "optimistic" 50% impact to a "worst case 70% impact" whereas GAC estimated an "optimistic" 31% to a "worst case" 58% loss. In the end, both used a "conservative" estimate 45% impact (GAC) and 50% impact (CBG). **There is a strong likelihood, however, that in fact 100% of the chimpanzee population using and dependent on the concession will be impacted. Even if some individuals survive, the probability of survival of these individuals in the long-term is likely very low. Had the precautionary principle, and a 100% impact been considered, the offset size needed would be even larger.**

iii) Multipliers

The multipliers used to come up with the offset requirements vary greatly between species, and are often based on approximate assumptions[50,51]. Given that Western Chimpanzees are a Critically Endangered species that have declined 80% in the last 24 years, we consider that all remaining habitat is critical for their survival. This argues that a large multiplier should be used. In addition, given i) the time it takes it takes to restore forests to a point that allows increased growth in chimpanzee numbers (trees would need to produce fruit and be large enough to nest in), and ii) the fact that chimpanzee growth rates are extremely slow (see below) due to their life history characteristics, the time lag between impacts and gains would be very long compared to most species, thus also justifying a large multiplier.

Because MBNP is a large, intact landscape, it may be less susceptible to catastrophic failure than smaller sites, which might normally justify the use of a smaller multiplier due to the high chances of success of the park in protecting chimpanzees. However, plans for mining, and a large hydroelectric dam in the middle of the park tremendously increases the risk to the site, thus decreasing the chances of successful protection of the chimpanzees within the park. This, once again, justifies the use of larger multipliers for this offset site.

2. The time needed to reach a "gain" in chimpanzee numbers was underestimated since calculations that forecast the annual increase in numbers of chimpanzees within the MBNP assumed an exponential growth rate of chimpanzees without accounting for density-dependent growth.

Chimpanzees have long generation times and long lifespans compared to most species. They typically have a maximum lifespan of 45 to 50 years[52] (similar to the earliest humans), and female chimpanzees usually give birth for the first time only after reaching 13 or 14 years of age, with a typical inter-birth interval between 3.3 and 5 years[53]. Great ape populations therefore have *very low annual growth rates*.

GAC and CBG assumed chimpanzees within the MBNP have a growth rate of -1% *without* any management interventions; however, the actual growth rate for this area is not known. This may seem like a conservative estimate compared to the overall decline of chimpanzee populations in West Africa of approximately -6% per year. But across most of West Africa, chimpanzees are hunted. The pressure from hunting combined with habitat loss is the reason for the 80% decline in chimpanzee numbers since the mid-1990s. Conversely, in the Fouta Djallon

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[50] Laitila, J., Moilanen, A., and Pouzols, F. M. (2014). A method for calculating minimum biodiversity offset multipliers accounting for time discounting, additionality and permanence. *Methods Ecol. Evol*. *5*(11): 1247–1254.

[51] South Africa, Department of Environmental Affairs and Development Planning. (2007). Provincial Guideline Biodiversity Offsets. Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town.

[52] Williamson, E. A., Maisels, F. G., and Groves, C. P. (2013). Hominidae. In: *Handbook of the Mammals of the World. Volume 3: Primates*. R. A. Mittermeier, A. B. Rylands, and D. E. Wilson (eds.). Lynx Edicions, Barcelona, Spain, pp. 792–843.

[53] Williamson, E.A., Maisels, F. G., and Groves, C.P. (2013). Hominidae. In: *Handbook of the Mammals of the World. Volume 3: Primates*. R. A. Mittermeier, A. B. Rylands, and D. E. Wilson (eds.). Lynx Edicions, Barcelona, Spain, pp. 792–843.

region chimpanzees are not generally hunted due to religious and cultural taboos, and therefore the percent annual decline in the MBNP would be considerably less than the regional rate of decline. GAC and CBG assumed a growth rate of +1.65% with interventions based on Walsh *et al.* (2003). This was an optimistic assumption of growth rate given that Walsh et al. (2003) was based on captive chimpanzees and calculations did not consider density-dependent growth[54]. The assumed "net" growth rate of +0.65% was then halved, supposing 50% effectiveness of interventions. This resulted in an overall estimate of +0.3% that was used to calculate "averted loss." In our view, such estimates would result in an *underrepresentation* of the amount of time it would take to achieve NG. The annual growth rates are likely to be lower than predicted for the offset site, and even eventually level off, due to the effects of density-dependent growth. This would greatly lengthen the duration needed to achieve NG.

Density-dependence means that the growth rate of a population is a function of its size, given the area and associated carrying capacity. A positive and negative feedback mechanism exists when population density is low or high, respectively.[55,56] Due to life-history parameters, chimpanzee populations cannot grow faster than 4–5% per year (assuming zero infant, juevenile, and adolescent mortality), unless individuals from other populations immigrate and no emigration occurs. However, in reality, the population growth rate of chimpanzees is less than 0.5% when they inhabit areas approaching carrying capacity.

Population growth rates and densities are interdependent. Great ape social groups in numbers far lower than the carrying capacity of a habitat may have the highest possible growth rates, but due to adverse effects, growth rates tend to be lower when density is low and social groups are small, besides more acute predation pressure or inferiority in aggressive conflict with larger neighboring groups. Similarly, population growth rates may be low, when density is very high due to high mortality rates from increased risk of infectious diseases or violent conflict. Populations show the highest growth rates at intermediate densities (**Figure 6 and Appendix I**). However, absolute growth rates vary between different areas and are dependent on a multitude of factors, including habitat quality, food density, area size, predation pressures or prevalent infectious agents. They can only be estimated with longitudinal data spanning an adequate observation period of the population of interest.

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[54] Walsh, P., Abernethy, K., Bermejo, M., *et al*. (2003). Catastrophic ape decline in western equatorial Africa. *Nature* 422**:** 611–614. <https://doi.org/10.1038/nature01566>: "in order to approximate a healthy wild population growing without density dependent constraint, we substituted annual mortality rate estimates from captive populations (Hill *et al*., 2001). This should provide an optimistic population projection, as wild chimpanzees should rarely survive as well as captive chimps. We then iterated the life table until it reached an approximately stable age distribution (after about 100years). Population growth rate was then estimated as the proportional difference between successive years in the abundance of chimps summed across all age classes. The estimated annual growth rate was 1.65%".

[55] Brook, B. W., and Bradshaw, C. J. (2006). Strength of evidence for density dependence in abundance time series of 1198 species. *Ecology* 87(6): 1445-1451.

[56] Kühl, H. S. (2008). *Best Practice Guidelines for the Surveys and Monitoring of Great Ape Populations* (No. 36). IUCN, Gland Switzerland.

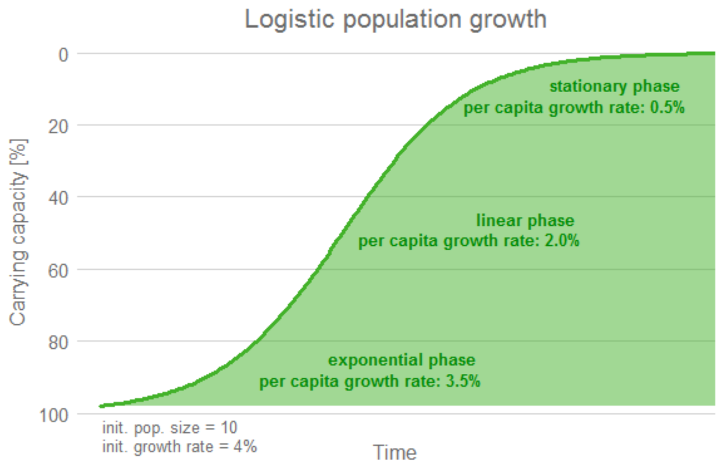

Figure 6: Logistic population growth, based on reproductive constraints of chimpanzees. Theoretically, chimpanzee populations cannot grow faster than 4–5% per year, (assuming zero infant, juvenile and adolescent mortality), unless individuals from other populations immigrate and no emigration occurs. Close to carrying capacity, population growth is below 0.5% (left). Population growth rate is highest at intermediate densities.

The MBNP population is home to a largely intact chimpanzee population that co-inhabits the landscape with humans. Characteristics of the MBNP chimpanzee population, such as the intactness of their habitat and minimal hunting pressures, suggest that the current population density has an attenuating effect on the growth rate of the population, as predicted by ecological theory. These characteristics suggest that the current density of the chimpanzee population in association with existing carrying capacity of the habitat has an attenuating effect on the growth rate of the population, as predicted by ecological theory. It is unlikely that the population will be able to grow over the next decades with an exponential growth rate as was assumed when developing population growth trajectories for determining the offset requirements. Even if population growth is observed over a short time period, this may not be sustainable in the long term. Given that the generation time for chimpanzees is 23.04 years[57], it is evident that there are strong limitations to population growth relative to project duration of 20 years.

Any accounting of NNL and NG needs to consider density-dependent effects in the offset site. This was not considered in the GAC/CBG forecasts, although the original assessment acknowledged this limitation and recommended it be improved in a future iteration. Incorporation of density-dependent growth rates would significantly lengthen the amount of time for NG to be achieved.

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[57] Langergraber, K. E., Prüfer, K., Rowney, C., Boesch, C., Crockford, C., Fawcett, K., *et al.* (2012). Generation times in wild chimpanzees and gorillas suggest earlier divergence times in great ape and human evolution. *Proc. Natl. Acad. Sci. U.S.A.* 109(39): 15716–15721.

3. The Koukoutamba hydroelectric dam and mining permits overlapping with the MBNP could impact a large proportion of its chimpanzee population. This could in turn negate all temporary protection efforts supported by the offset.

Guinea has plans to build a large hydroelectric dam, the Koukoutamba dam, in the center of the MBNP. This will pose a significant challenge to the MBNP offset, as it will eliminate a considerable proportion of the chimpanzees in the area. The scenario-based estimates of number of individuals affected by the dam ranges from a minimum of 275 individuals to a potential maximum of 1,450 chimpanzees affected[58]. With any of these scenarios, construction of the Koukoutamba dam could interfere with the NG goal of GAC and CBG. If the upper limit is correct, this could represent between one quarter and one third of the park's chimpanzees. Other analyses have also found that "Using the same assumptions about potential gains as applied for GAC and CBG, it is not feasible for the proposed protected area to serve as an offset delivering a net gain for chimpanzees for GAC, CBG and Koukoutamba simultaneously, even in an optimistic scenario for Koukoutamba's impacts"[59]. IUCN provides guidance for the conditions under which biodiversity offsets are not acceptable under article 9[60] of the Limits to Biodiversity Offsets: "In certain circumstances residual impacts on biodiversity (after completing the avoidance, minimization and rehabilitation steps of the mitigation hierarchy) cannot be offset. Additionally, there are some components of biodiversity for which impacts could theoretically be offset, but with a high risk of failure. Under these circumstances, biodiversity offsets are not appropriate, and this means that the project as designed should not proceed." The building of the dam in an area of such critical importance for Western Chimpanzees, and within an existing biodiversity offset for two mining projects would fall within this category.

In addition to the Koukoutamba dam, according to TBC, there are four other mining exploration licenses and one mining concession that overlap with the proposed MBNP. "The mining concession belonging to the Société de Bauxite de Dabola Tougué (SBDT) has the largest overlap extent with the proposed MBPA and thus present the most significant risk. WCF estimates that *c.* 800 chimpanzees (566–1,168 individuals) could be lost if we would assume total habitat loss in the proposed MBPA area that overlaps with its concession limits (WCF 2016b). This area also overlaps with the Koukoutamba dam project and its impacted area."

Given that these concessions overlap with critical habitat, even exploration should not be going on without an adequate review of potential impacts and steps to minimize them. Exploration activities are still damaging to the habitat and chimpanzees themselves, and potential future exploitation in these concessions will increase the pressure on chimpanzees in the park due to operation activities as well as the attraction of immigrants for work that may remain in the area for the long-term. Increasing human populations, in particular from diverse ethnic groups with potentially different attitudes to chimpanzees, could increase local resource demand and

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[58] Wild Chimpanzee Foundation (2016c). Demographic study for the creation of the Moyen-Bafing National Park [pdf in French]

[59] Starkey, M., Campbell, G., Temple, H. J., Tatum-Hume, E., Keita, M. K., and Suter, J. (2017). Moyen Bafing Chimpanzee Offset Feasibility Study. The Biodiversity Consultancy, Cambridge, UK.

[60] <https://portals.iucn.org/library/sites/library/files/resrecfiles/WCC_2016_RES_059_EN.pdf>

hunting. The Government of Guinea has established an inter-ministerial commission with a mandate to resolve the issue of overlaps between mining and energy and the future park. It is imperative that any mining activities, as well as the Koukoutamba dam, not proceed if the MBNP is to serve as an appropriate offset site for GAC and CBG.

4. A permanent loss of chimpanzees in mining concessions cannot be compensated with temporary protection of the MBNP

As mentioned above, due to the life history characteristics of chimpanzees, growth rate is slow, susceptible to unpredictable events, and will likely slow even further over time due to density-dependent effects. This necessitates that the MBNP be protected longer than the 20-years originally estimated for GAC and CBG to achieve NG. In addition to slow growth at the offset site, impacts at the mine site will be permanent, and therefore the offset should be permanent too.

The 2016 independent *Environmental and Social Impact Assessment for Guinea Bauxite Mining* written by SustainRisk[61] says (on page 1): *"The project will result in changes to the pre-existing landscape that will not be restored to its pre-existing condition when mining is finished"*. Even after filling in the mining pits and re-vegetating the mining area, the **impacts** of the mining operations: *"will change the local landscape **permanently**."*

Given the cumulative impact of the neighboring mining concessions throughout the Boke area of Guinea, it is doubtful whether the chimpanzees will be able to maintain a viable population in that landscape in the long run. Restoring the area to a level where it could sustain the original chimpanzee populations will take a great deal longer than 40–50 years. While it is of the utmost importance that companies continue to do all possible mitigation, protection and monitoring in the concession in hopes that populations of chimpanzees may eventually be able to repopulate the area, the long restoration time means that the chimpanzees may never recover fully. This is especially true because current rehabilitation efforts at the mine sites are mainly aimed at benefitting local human populations, with many companies planting fast-growing species to be used as building material, firewood, or cash-crop species (e.g., cashew). Thus, we are doubtful that current restoration efforts will help the chimpanzee population recover from mining impact and consider these impacts to be permanent. The companies' offset feasibility assessments also highlighted that the offset should be maintained for at least as long as the impacts. It would therefore be logical that chimpanzees in the MBNP should be protected in perpetuity. Both international and national policies regarding biodiversity offsets support this.

IUCN biodiversity Offset Policy[62] states that, "The offset gain should last at least as long as the impact being addressed. In most cases, this means in perpetuity." The World Bank's publication, *Biodiversity Offsets: A User's Guide*[63] states that, "Biodiversity offsets are normally expected to persist for at least as long as the adverse biodiversity impacts from the original project; in practical terms, this often means in perpetuity. Like other conservation projects, biodiversity offsets are ideally designed to last over the very long term…[and] should be for at

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[61] http://sustainrisk.com/wp-content/uploads/2017/11/SustainRisk-Case-Study-ESIA-in-Guinea.pdf

[62] <https://portals.iucn.org/library/sites/library/files/resrecfiles/WCC_2016_RES_059_EN.pdf>

[63] World Bank Group. (2016). *Biodiversity Offsets: A User Guide.* World Bank, Washington, DC. ©World Bank. <https://openknowledge.worldbank.org/handle/10986/25758 License: CC BY 3.0 IGO>.

least the operating life of the original project and ideally longer…for the long-term survival of their target ecosystems and species."

Guinea's offset policy also supports the idea of permanence of offset sites. In 2019, Guinea developed a *National Strategy for the Implementation of the Mitigation Hierarchy and Compensation for Impacts on Biodiversity and Ecosystems* that will guide the legal and regulatory framework on the environment. It was developed simultaneously and in synergy with the revision of the Forest Code (2017), the Protection Code de la Faune Sauvage (2018), the Environmental Code (2019) and the *General Guide for Conducting Environmental and Social Impact Studies* (2019). This Strategy also supports the idea that biodiversity offsets should be supported for as long as the impacts, and ideally in perpetuity.

MANAGEMENT & FINANCIAL CONSIDERATIONS

In order for the MBNP to be a viable offset, there are also other key factors that are necessary to take into consideration. The Park must be (1) effectively managed, (2) have good governance, (3) have an adequate annual budget for that management, and (4) have funding that is both reliable and sustainable.

The process of establishing the MBNP was initiated in 2015 with a Fiche de Projet and initial mandate from the Guinean Ministry of the Environment, Water and Forest (GMEWF). Together, the Wild Chimpanzee Foundation (WCF) and Guinean Office of Parks and Reserves (OGUIPAR) led the necessary steps towards its creation. In-depth ecological and socio-economic surveys were conducted in the region to gain better understanding of the regional context. A series of consultations and workshops were organized with stakeholders to guarantee both the socio-economic development of the area and the creation of the park.

An Arrêté de Classement Temporaire was then signed by the Ministry of Environment, Water and Forests, the Ministry of Mines and Geology, and the Ministry of Energy and Water Resources, OMVS and local communities to start the full process of consultation, land-use planning, participatory mapping, financial and institutional set-up, SEIA and community consent. This led to the final proposal of protected area status and implementation via legal instruments. The presidential decree is still needed to make the creation of the park official[64].

The MBNP Action Plan is the document that lays out all the activities needed to create and manage the park. .

Overall, the Action Plan was found to be comprehensive, well-researched and to include most of the elements expected to be in the plan. The planned activities still need to address some significant aspects of effective management that would normally be expected for a protected area. In particular:

- Details of governance structures and mechanisms, analysis of stakeholders and specifications of the ways in which the various actors will participate in management and coordinate their actions.
  Explicit principles that underpin all management activities, in particular the need for good governance, resistance to corruption, observance of rights and exemplary conduct by those employed and supported by the Park.
- Establishment of an effective and well led eco guard team

[64] Starkey, M., Campbell, G., Temple, H.J., Tatum-Hume, E., Keita, M. K. and Suter, J. (2017). Moyen Bafing Chimpanzee Offset Feasibility Study. The Biodiversity Consultancy, Cambridge, UK.

- Baselines, indicators and clearer objectives for community support.
- Awareness activities aimed at groups other than local communities (i.e., decision makers, donors, the wider public).
- Means for integration of the results of regular monitoring/data collection into cycles of review, adaptation, planning and management.
- Investment in a communications system
- Adoption and use of internationally used measures of protected area performance.

The 2019 WCF Annual Report[65] was also found to be thorough and to document well their activities towards implementing the MBNP Action Plan and demonstrated commitment to documentation and monitoring. It reflects a further evolution in thinking and demonstrates approaches and practices which suggest that a capable management team is in place. A team thatis learning and improving in the process of implementation and has the freedom to make improvements rather than blindly follow the initial plan. This is in many ways a positive example of adaptive management, essential for protected area management.

We recommend working towards IUCN Green List status for the MBNP. The IUCN Green List of Protected and Conserved Areas is a certification program for protected areas, including national parks, that are "effectively managed and fairly governed"[66] according to a globally applicable Standard. This Standard provides a benchmark for quality and encourages protected area managers to "demonstrate and maintain performance and deliver real nature conservation results."[67]

Annual funding needs

The 2019 WCF Annual Report provides extensive details of expenditure for park management, itemized and broken down by objectives and actions. The total expenditure was USD $2,808,458.31, 99.91% of the budgeted amount of USD $2,810,906.91. This amount is in line with the cost estimate in TBC's 2017 Offset Feasibility Study, which stated that the "in-the-field costs of establishing and managing a c. 7,000 sq km protected area with multiple zones over 20 years are estimated at between USD $35m and USD $64mn." This would equal USD $1.75 million to USD $3.25 million/year if these total amounts are divided by 20, or USD $2.33 million/year to USD $4.26 million/year if divided by 15 years which is the current plan.

The 2019 WCF Annual Report provides a projection of management costs for the Park over the next 15 years (see **Figure 7** below). Following the establishment phase, it is anticipated that the basic management costs will stabilize at around USD $2,500,000 per year or USD $400 per km^2. A further USD $1,000,000 dollars per year is estimated as the cost for effective support of local communities, giving a total annual cost of USD $560 per km^2. These figures do not appear to take into account inflation which could significantly increase the basic management costs. The precise rate of inflation that needs to be applied is something that needs to be discussed and

[65] <https://www.wildchimps.org/fileadmin/content_files/pdfs/reports/2019_WCF_Guinea_MBNP_Annual_Rapport_010320_eng.pdf

[66] <https://www.iucn.org/theme/protected-areas/our-work/iucn-green-list-protected-and-conserved-areas>

[67] <https://iucngreenlist.org/standard/global-standard/>

agreed on, and will strongly affect estimates of the total amount that is needed for a 20-year or longer biodiversity offset fund.

It is also not clear if this projection takes into account the need to periodically replace major capital assets (e.g., vehicles) or conduct major maintenance on infrastructure or accommodate emergencies and major unforeseen (and uninsured) expenses.

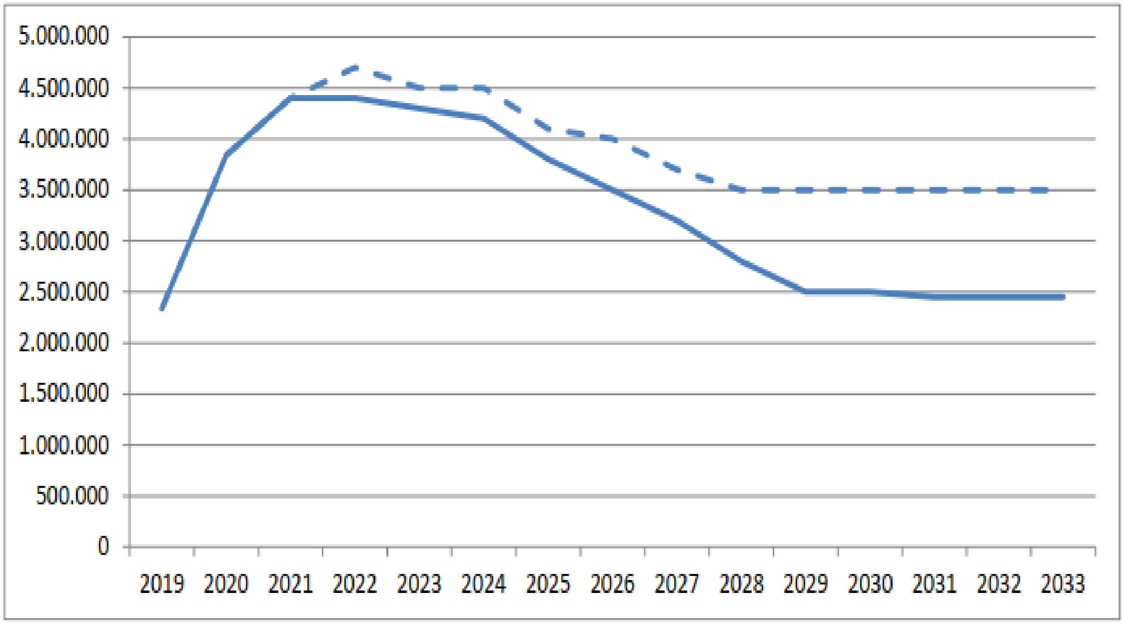

Figure 7. Estimated costs of managing the Moyen Bafing National Park, assuming a total of USD 48 million over 15 years based on 2019 and 2020 budgets (blue sold line). We know, however, that there will be additional costs for the construction of the national park infrastructure (estimated costs of approximately USD 500,000 over 3 years) and for effective support for local communities (estimated costs of approximately USD 1 million per year) (Dashed blue line) (WCF 2019)

As long as the balance of expenditure on different programs and elements is still focused on establishing the park and has not yet settled into a regular cycle of management, it is not possible to be sure whether the projected needs are adequate. **Table 4** lists a range of costs (per unit area) for effective conservation management published in the last 20 years. The MBNP is a multi-use landscape that does not exclude people, unlike some national parks, and therefore cost estimates might not be comparable, but this table at least provides a general frame of reference. Nevertheless, forecasts of USD $1.75 million to USD $3.25 million/year seem to be realistic, although probably at the lower end of what would be ideal.

The lack of a contingency or emergency funds for coping with unforeseen events and changes is a concern as well. The COVID-19 pandemic is an example of how emergencies can quickly have major impacts on protected areas; other potential events include civil unrest or other conflicts, natural disasters, displacement of human populations, uninsured losses of infrastructure, and disease outbreaks among chimpanzee populations. In summary, the annual costs are at the lower end of recommended expenditure for protected areas and these costs do not take into consideration inflation, renewal of major assets or various possible contingencies. The adequacy of the projected budget for community support (USD $1,000,000 per year) is harder to determine; to some extent one could spend any amount on this.

In addition, any funding model needs a good indication of long-term anticipated costs. A management strategy and plan (updating and extending the current Plan d'Action, which is ever a short term measure) linked to a business plan with more accurate cost projections is needed.

Also, the strategy of the MBNP should align with the framework of the IUCN Green List of Protected and Conserved Areas. This is becoming the global standard and would provide a clear measure of impact for investors.

Table 4. Published examples of protected area management costs and foreseen costs for Moyen Bafing

- NA = Figure not provided.
- Figures in parentheses are adjusted for US dollar inflation at 01/01/2021 based on the US Consumer Price Index 1913-.

Study	**Year**	**Description of study**	**Actual expenditure ($ per year per km²)** *(Adjusted for inflation at 01/01/2020)*	**Recommended expenditure ($ per year per km²)**
James *et al.*[68]	1999	Global review from 70 countries	93 *(148)*	270 *(431)*
Balmford *et al.*[69]	2003		130–5,000 *(188-7225)* Typical 1,000 *(1445)*	NA
Blom *et a*l.[70]	2004		38–92 *(54-130)*	138–336 *(176-477)*
Bruner *et al.*[71]	2004		5–90 *(7-128)*	9–300 *(13-426)*
Packer *et al.*[72]	2013	Cost required for managing unfenced PAs with large carnivores	NA	2000 *(2277)*
Lindsey *et al.*[73]	2018	Protected areas in Africa with lions	200 average *(211)*	978 average *(1034)*
African Parks Cited in Lindsey *et al.*[74]	2018	Cost of managing PAs with lions	497–1833 *(525-1937)*	NA
Waldron *et al.*[75]	2020	Global calculation based on a calculated overall global minimum cost for managing protected areas of $68 Billion	NA	1,198 *(1214)*

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[68] James, A. N., Green, M. J. B., and Paine, J. R. (1999). *A Global Review of Protected Area Budgets and Staff.* World Conservation Monitoring Centre, Cambridge, UK.

[69] Balmford, A., Gaston, K. J., Simon, B., James, A., and Kapos, V. (2003). Global variation in terrestrial conservation costs, conservation benefits, and unmet conservation needs. *Proc. Natl. Acad. Sci. USA* 100: 1046–1050.

[70] Blom, A. (2004). An estimate of the costs of an effective system of protected areas in the Niger Delta – Congo Basin Forest Region. *Biodiv. Conserv.* 13: 2661–2678.

[71] Bruner, A., Gullison, R. E., and Balmford, A. 2004. Financial costs and shortfalls of managing and expanding protected-area systems in developing countries. *Bioscience* 54: 1119–1126.

[72]Packer, C., Loveridge, A., Canney, S., Caro, T. *et al.* (2013). Conserving large carnivores: dollars and fence. *Ecol. Lett*. 16(5): 635-41.

[73]Lindsey, P. A., Miller, J. R. B., Petracca, L. S., Coad, L., Dickman, A. J., Fitzgerald, K. H., *et al.* (2018). More than $1 billion needed annually to secure Africa's protected areas with lions. *Proc. Natl. Acad. Sci. USA* 115(45): E10788-E10796. doi: 10.1073/pnas.1805048115.

[74] Lindsey, P. A., Miller, J. R. B., Petracca, L. S., Coad, L., Dickman, A. J., Fitzgerald, K. H., *et al.* (2018). More than $1 billion needed annually to secure Africa's protected areas with lions. *Proc. Natl. Acad. Sci. USA* 115(45): E10788-E10796. doi: 10.1073/pnas.1805048115.

[75] Waldron, A. *et al.* (2020). Protecting 30% of the planet for nature: costs, benefits and economic implications. Conservation Research Institute, University of Cambridge, Cambridge, UK. <https://www.conservation.cam.ac.uk/news/protecting-30-planet-nature-costs-benefits-and-economic-implications>.

Study	Year	Description of study	Actual expenditure ($ per year per km²) *(Adjusted for inflation at 01/01/2020)*	Recommended expenditure ($ per year per km²)
African Parks	2020	20 Parks in Africa. Calculated from overall expenditure and total area managed in 2019 annual report	434 *(440)*	NA
Moyen Bafing Projected annual costs	2019	Based on the Annual Report and MBNP Action Plan	NA	400 (basic management) *(415)* 560 (with community programs) *(581)*

Income reliability and sustainability

In the case of the MBNP offset, no financial scheme for the mining companies' payments was established either before the IFC loans were made or before the IFC-financed mining projects started. After CBG signed its loan agreement with the IFC in May/June 2018, CBG created a Trust Company in early 2019 for the purpose of paying a fixed offset amount of around US $1.3 million every year for 15 years. In contrast, GAC has not set up an independent vehicle for making biodiversity offset payments. Instead, GAC makes the offset payments from its normal operation budget, but only after WCF provides what GAC and CBG considers to be satisfactory operational plans and reports.

The 2019 WCF Annual Report raises the issue of delays in disbursement of funds. This should be avoided; failure to deliver on commitments and non-payment of personnel can have major and lasting impacts, especially during the early stages of an offset project when building trust and confidence is vital.

The IFC has not required CBG and GAC to provide immediate and regular offset payments as part of the companies' obligations under their loan agreements. An Interim Technical Panel (ITP) was set up to oversee some aspects of the offsets and provide recommendations. This panel consists of representatives from GAC, CBG, OGUIPAR, IFC and other lenders, and WCF. The ITP has only an advisory role and no supervisory or enforcement role with respect to the companies' payments for the offset. Nevertheless, since February 2020, the ITP has repeatedly made requests to the mining companies to resolve the offset payment issues.

In summary, offset payments are not always being made on a reliable schedule which jeopardizes effective management of the park. It is critical to resolve this issue and to have a clear governance structure to enable on-time disbursements. As seen above, IUCN, Guinean law, and IFC Performance Standards all promote the concept of offset permanence. As it is unlikely that a sustainable NG of the MBNP chimpanzee population will be achieved over the next two decades given biological constraints (i.e., density dependence), it is recommended that GAC, CBG and the

IFC should investigate a long-term solution for continuous funding that would allow implementation of the full suite of required management interventions in perpetuity.

DISCUSSION

The MBNP as an offset for GAC and CBG

GAC and CBG have gone above and beyond other mining companies in Guinea to estimate losses of chimpanzees that are expected to occur within their concessions, and to protect a much greater number of chimpanzees in an area that is strategic and of critical importance to chimpanzee conservation in West Africa. The partnership between the Government of Guinea, GAC, CBG, IFC and the WCF showcases the value of private-public partnerships. The MBNP has the potential to be the touchstone for future offsets, except for the fact that it will last for only 20 years and large industrial projects are still being permitted within its perimeters. The following, therefore, are our recommendations to strengthen and ensure the viability of the offset so that it can be the flagship project for how biodiversity offsets should be done.

Despite the technical difficulties in measuring baseline populations, impact and offset size, we do not recommend investing time and resources in recalculating loss/gain. Instead, we propose a forward-looking strategy with a focus on maintaining the MBNP chimpanzee population in perpetuity. A properly protected and financed MBNP can achieve that objective. We emphasize the salient point that the MBNP is of critical importance for ensuring the future survival of this Critically Endangered subspecies of chimpanzee. By protecting this park, GAC, CBG, WCF, the Government of Guinea and the IFC have made a significant contribution to great ape conservation. Of outstanding importance, however, is that the chimpanzees living within the park and their habitat must be protected in their entirety, and permanently, to truly offset the damages suffered by the chimpanzees affected by the mining concessions.

The key components of our recommendation are:

1. GAC and CBG should provide sufficient funding to protect the MBNP in its entirety

Given the challenges with the methodologies described in this report and using the principle of precaution, the biodiversity offset for the chimpanzees impacted by GAC and CBG should be the entire MBNP. This does not allow for any other companies to aggregate offsetting needs within the MBNP. It would also preclude other developments from taking place within the boundaries of the MBNP.

2. Any development or private sector projects planned to occur within the MBNP that would negatively impact chimpanzees should be cancelled

Several factors weigh heavily on new developments in the MBNP. First the site is established as National Park and development within the boundaries should be avoided, especially as it is critical habitat to chimpanzees. Second, the site is an offset where companies need to comply with NG requirements. Developments within the park would likely render NG infeasible. Third, any new development within the area would not be able to adequately mitigate and offset impacts, not at the site nor in other areas, given the special and particular nature of the area in terms of its dense chimpanzee population. Thus, any development projects or private sector project within the park that could result in a decrease in numbers of chimpanzees need to be cancelled if GAC and CBG are to achieve NG.

3. The MBNP should be protected in perpetuity

The best way to improve the current system of periodic partial payments for offsets by the mining companies, would be to replace it with a different arrangement using a Conservation Trust Fund (CTF)[76] or other similar mechanism to manage funds over the long term. The core functions of CTFs are to: (1) receive, raise, and invest money that will be used for supporting specific or general biodiversity conservation objectives, and (2) allocate money (by making grants) each year for particular programs and projects that have been approved by a CTFs board, and that can (in different cases) be implemented by non-governmental organizations, community based-organizations, or by government agencies such as national parks agencies. The money (i.e., assets) that a CTF receives, invests and distributes in the form of grants can come from diverse sources, including international donors, national governments budgets (especially environmental fees and taxes earmarked within these budgets), as well as contributions from international conservation NGOs and corporations. Many of the CTFs created around the world have the financing of specific protected areas as their remit. Others work with protected area systems to finance under-funded priority protected areas.

CTFs are always governed by a Board of Directors (or Board of Trustees) in accordance with the CTF's governing legal document, which is either called a Charter, Articles of Incorporation, Statutes, or Trust Deed (depending on the legal system of the country where a CTF is legally registered). Beneath the level of the governing document, a CTF will have Bylaws or

[76] Spergel, B., and Mikitin, K. 2014. *Practice Standards for Conservation Trust Funds*. Conservation Finance Alliance, updated in 2020 by P. Bath, V. L. Gallegos, and A. G. Valladares. <https://www.conservationfinancealliance.org/news/2021/1/4/practice-standards-for-conservation-trust-funds>

internal regulations, and detailed operating manuals. A CTF's Board will often create advisory committees such as a finance or investment committee, or a scientific advisory committee, which is composed of outside experts as well as CTF board members who have a special expertise in the field that is the focus of the committee.

The day-to-day operations of a CTF are handled by an executive director and a small staff. Their responsibilities include arranging Board meetings, keeping records of all decisions and grants made by the Board, monitoring and evaluating the performance of grantees based on a set of criteria approved by the Board, announcing calls for proposals and vetting those proposals for the Board, writing annual reports and reports required by government regulatory agencies, sharing information about the fund with key stakeholders and the public, communicating on the Board's behalf with outside investment managers and donors, and helping to raise additional funds.

There are many different options for designing the structure of a CTF, depending on its purposes, key stakeholders and donors, government laws and policies in the country where the CTF operates, and in some cases, depending on the country where the CTF is legally registered or incorporated. The reasons why a number of CTFs for other West African countries (including Côte d'Ivoire, Guinea Bissau, and Mauritania) have been legally registered offshore in the UK or elsewhere is because the country where a CTF is registered needs to have a law specifically for foundations or trust funds (which francophone African countries do not have, except for Madagascar). Additionally, the country where a CTF is legally registered as a charitable organization needs to have a law or regulation that makes charitable foundations and trust funds exempt from paying taxes on their earnings from passive investments. The country where a CTF is registered should also be someplace where there is widespread trust and confidence in government institutions and laws, and where a government or private individual will not be able to simply seize the CTF's assets and use them for purposes other than conservation, even in times of crisis.

The two main longer-term options for investing the assets of a CTF in order to earn money to spend on conservation projects are to (1) establish an endowment (meaning that the capital is never spent, but only the annual interest and profits from investing the money is spent), or (2) invest the money as a long-term sinking fund, whereby the CTF annually spends not only the interest and investment income it earns but also spends part of that capital, which then decreases (sinks) to zero at the end of a predetermined number of years. Given the need for the MBNP to be protected in perpetuity, we would recommend the former.

Before a CTF is legally established, a temporary steering committee composed of key stakeholders and sponsors of the CTF is usually organized in order to decide on the future composition of the CTF Board, and how Board members will be appointed as well as replaced at the end of their terms (which usually last from 2 to 5 years). In the case of a CTF for the MBNP offset, the CTF's Board could either include or not include representatives of the mining companies, and could include representatives of the IFC, conservation organizations, or government officials (as long as they do not constitute a controlling majority of the Board). All of this needs to be discussed and agreed upon by the key stakeholders before the CTF can be legally established (in the design phase of the CTF). After being established, it is also possible to expand the size of the Board in order, for example, to include new major contributors to the CTF. Any

CTF Board member who represents an NGO or other future recipient of grants from the CTF should be required to abstain from voting on Board decisions to award a grant to their own organization, otherwise it would be a conflict of interest.

Approximately 100 CTFs have been established around the world over the last 30 years. All CTFs share certain common characteristics in their governance and institutional structure, irrespective of whether a CTF manages an endowment or a sinking fund, and therefore any CTF that is established to support long-term chimpanzee conservation in MBNP would also have these characteristics. CTFs are private, *legally independent* institutions that provide sustainable financing for biodiversity conservation. They are not part of any government agency, and instead are more similar to a private foundation. They may finance part of the long-term management costs of a country's protected area system as well as conservation activities and sustainable development initiatives outside protected areas.

In the case of the biodiversity offset for MBNP, in order to create a CTF that manages an endowment, the mining companies would need to make an upfront payment to the CTF for the total remaining amount of their offset obligations. Such a CTF would hire an independent investment manager to invest this money as an endowment, and the CTF would use the resulting expected long-term stream of income to make grants each year to support activities that the Board determines are needed to conserve MBNP's chimpanzees and their habitat. The CTF's small, dedicated staff would monitor and evaluate the effectiveness of the activities and recommend to the Board any corrective actions or changes that are needed. In countries such as the US and Australia, companies are required to finance their offsets through the purchase of credits that capitalize permanent endowments. Some countries in Africa are now devising policies which will require companies to put up at least 50% of the amount of the offset costs up-front and provide guarantees for the remaining amount to be paid at a specific time. Up-front payments can facilitate the work of the CTF.

There are at least three possible options for creating a new CTF that can serve as a mechanism for financing long-term conservation of the chimpanzees in MBNP. In the case of each of the three options, the proposed CTF would be legally registered offshore (most likely in the UK, US or Europe) but it would be governed by a board or a management committee that meets quarterly or semiannually in Conakry and is composed of key MBNP stakeholders (who would need to be agreed upon).

In each proposed option, the CTF board or management committee would vote each year on which specific chimpanzee conservation-related activities to fund (based on a long-term protected area management plan), and which specific organizations will receive grants from the CTF to implement those activities. In the case of each of the four options, the CTF Board would also decide (based on the recommendations of an Investment Committee) which international investment managers to hire in order to prudently (based on a long-term time horizon) invest the money that has been paid upfront by mining companies as biodiversity offsets. The differences between the three options can be briefly described as follows:

1. Option 1 is a legally independent CTF that manages an endowment
2. Option 2 is a restricted subaccount or sub-fund of the proposed Guinea national protected areas fund
3. Option 3 is a restricted subaccount or sub-fund of the proposed Guinea national

biodiversity offsets fund.

Option 1 could be put into place in a matter of months, whereas options 2 and 3 are uncertain and likely to take at least several years. For Option 2, a legal agreement could be signed (by the mining companies, the IFC, and the national CTF to require that the money earmarked for the MBNP Offsets subaccount can only be used to fund activities in MBNP, and that the specific activities which will be funded by grants from the MBNP subaccount of the national fund (although legally part of the national PA fund) will be decided each year by the vote of an MBNP subaccount management committee that is composed of key MBNP stakeholders. This management committee could delegate to the national fund's board the responsibility for hiring investment managers, who would pool all of the national fund's assets for purposes of investing it, including the money in the MBNP subaccount. Subsequently, each year the subaccount would receive a fixed percent of the profits and interest that are earned from investments of the national account.

Option 3 is the similar to option 2 except that the money from MBNP biodiversity offsets would be managed as a special earmarked subaccount of a proposed new national biodiversity offsets fund (something that is mentioned as a possibility in Guinea's National Biodiversity Offsets Strategy) instead of being a subaccount in a national PAs fund. A national biodiversity offsets fund would include a set of separate earmarked subaccounts for various different biodiversity offsets, which would each have their own separate management committees.

In addition to creating a CTF, there are other ways in which the current system of payment for biodiversity offsets needs to be significantly improved, including:

1. requiring offset payments to be made at the beginning of each calendar quarter based on the ITC's evaluation of WCF's implementation of conservation activities during the quarter that ended 3 months prior to the start of the upcoming calendar quarter (rather than in the immediately preceding quarter);
2. imposing financial penalties (such as late fees and obligation to pay interest) for non-payment or delayed offset payment according to the agreed schedule of due dates;
3. periodically adjusting the amount of offset payment to reflect inflation (based on a specific inflation index which will need to be agreed upon).

Creating an endowment fund or long-term sinking fund requires a significant early outlay of financing. If we assume that an investment fund would have net earnings on assets of between 3% and 4% annually and that $3 million is need per year to meet all MBNP management and replacement costs, then the companies would need to commit between $75 million and $100 million to capitalize the permanent fund. If we assume a 50-year time period for a sinking fund, the amount of capital needed would decrease to between $65 million, assuming a 4% net rate of return and $78 million if the net return was only 3%. These amounts are just estimates and would need to be formalized to determine the exact amount of funding needed to ensure the viability of the offset. However, they do demonstrate the scale of funding that the companies need to consider as part of the cost of meeting their long-term requirements and contribution to great ape conservation in the country.

Given project planning cycles, it is possible that the companies together have less money than anticipated at this stage. For example, if the companies have a current budgeted amount of $40 million, and those funds could be committed up-front, the MBNP would be able to generate revenue of at least $1.2 million a year, with the potential for more if net returns are higher. Over the past two years investors have been able to enjoy returns of above 5 or 6% (and some returns have reached 10% or more). A return of 7% on the $40 million would come close to meeting the MBNP financing requirements. In addition, a decision could be made not to spend all the earning, but to reinvest part of them to increase the endowment. Moreover, the companies would still have an opportunity to increase their contributions to the endowment during operations, allowing the CTF to grow to the optimal amount and reach full potential, ensuring permanent support for MBNP.

General challenges for designing offsets for great apes

The experience of the MBNP reveals important challenges for designing offsets for apes. These are as follows:

1. Measuring baseline populations

The population size of great apes in impacted areas can easily be underestimated if administrative areas rather than ecologically relevant areas are surveyed. If a survey method is not sensitive enough to detect the relevant changes for achieving net gain, a net gain is difficult to assess. At present, there are no methods that provide estimates of abundance with very high precision (e.g. 2-3 %).

2. Measuring impacts

Industrial development project impacts may occur at different spatial and temporal scales (**Table 5**), some of which are very difficult to estimate or predict given the social and demographic characteristics of great apes.

Table 5: Overview of the different types of impact that occur as part of project activities

Type of impact	Description
Immediate impact	Direct impact by project activities that reduces the carrying capacity of an area, by e.g., habitat removal.
Delocalized impact	Impact occurring away from localities of immediate project impact. Chimpanzees from the project area may immigrate into communities that are not directly affected by project impact.
Impact on ecological processes	Impact that disrupts or alters ecological processes, such as dispersal. For example, associated infrastructures such as roads may have small direct impacts (e.g. habitat loss) but can reduce connectivity, and populations of a meta-population may be reduced to non-viable sizes, with impacts occurring over the longer term.

Type of impact	Description
Cumulative impact	Impacts resulting from the additive effects of impacts by multiple projects in the same area. The impact by a single project may be considered minor, but in combination multiple projects will have a substantial impact.
Emerging impact	Impact that is not immediately visible, but that emerges through longer lasting processes. This may happen due to hydrological alteration of an area and resulting modification of vegetation and food availability, or by the attraction of people into an area due to job opportunities which will substantially modify and put greater strain on the environment in the long-term.
Impact from interactive effects	Impact of a project that may be dramatically increased by interaction with other threats or processes, such as climate change and extreme weather events, that can cause droughts, landslides or the spread of infectious diseases.

Impacts on an ape population include not only the reduction in population size, but also a number of other levels of impacts that are often underrepresented in efforts to compensate for the damages done to a population. There is a tendency to downplay seemingly minor impacts on ape populations and only focus on major damage. Because of this, there is a risk that the cumulative effect of minor impacts is overlooked. In addition, the current offset concept focuses on compensation of damage done to great ape *numbers* whereas additional levels of project impacts need to be accounted for, including impact on ecological processes, emerging impacts in the long-term, impacts from interactive effects, net reduction in habitat diversity, net reduction in behavioral diversity, net reduction in population connectivity, reduction in extent of occurrence, and genetic loss.

3. Estimating offset size needed

Estimating the offset size needed to appropriately compensate at scale for the losses is challenging for all species, but especially for great apes. Ape densities vary substantially across their geographic ranges. For example, chimpanzee densities have been reported to be as high as 4.5 individuals/km^2 (Ngogo community, Uganda), or as low as 0.37 chimpanzees/km^2 (Fongoli community, Senegal)[77]. Extensive great ape field surveys reported even lower densities (<<0.1 individuals/km^2). Due to differences in sex-specific survival rates, resulting variation in demographic structure (i.e., number of individuals per age and sex class) and size of great ape social groups, population dynamics vary substantially across populations. Given these large variations across populations and across ape species, determining an accurate growth rate for any given population is challenging. For example, the Mitumba and Kasekela chimpanzee communities in Gombe Stream National Park have a high mean annual growth rate between 1.9–2.4%. In contrast a neighboring community had a negative growth rate of -7% due to a higher prevalence of infectious diseases[78]. Whereas positive growth rates have not been reported to be

[77] Wilson, M. L., Boesch, C., Fruth, B., Furuichi, T., Gilby, I. C., Hashimoto, C., *et al.* (2014). Lethal aggression in *Pan* is better explained by adaptive strategies than human impacts. *Nature* 513: 414–17. https://doi.org/10.1038/nature13727

[78] Rudicell, R. S., Jones, J. H., Wroblewski, E. E., Learn, G. H., Li, Y., Robertson, J. D., *et al.* (2010). Impact of Simian Immunodeficiency Virus Infection on chimpanzee population dynamics. *PLoS Pathogens* 6(9): e1001116. https://doi.org/10.1371/journal.ppat.1001116

much higher than these numbers for chimpanzees, negative growth rates can be substantially larger.

Uncertainties also exist around future ape population growth dynamics as these include strong density-dependent effects and unmanageable sources of increased mortality. In these cases, future ape-population growth may generally be limited, but unknown at present.

Given the life history of great apes (long interbirth intervals, late age of first reproduction, etc.), there are upper limits to their growth over a specified period of time. Even at maximum growth rate, the time needed to achieve a NG of individuals will be slower than most other taxa. And although life history parameters vary between populations and species, all great apes reproduce slowly. Therefore, achieving a NG will take a long time.

To date, biodiversity offsets designed to compensate for project impacts on great apes have ignored the density-dependent effects of population growth, instead assuming exponential growth rates. As populations reach carrying capacity, the growth rate will decline and eventually plateau. This phenomenon, which is not particular to great apes, will affect both the size and duration of the offset needed to achieve a NG.

In addition, growth rates are not constant, but rather fluctuate between weakly positive and highly negative. Consequently, population recovery from such demographic shocks that may occur at any time is very slow (**Figure 8**). Such demographic shocks may be caused by, for example, infectious diseases, hunting, or stochastic demographic processes.

Figure 8: A typical trajectory of an ape population characterized by rapid decrease and slow recovery.

Determining multipliers for offset size is also challenging because there are so few, if any, successful offsets from which to learn. The large uncertainties associated with projecting ape population growth dynamics into the future and density-dependent effects, all need to be taken into account when estimating requirements of offset size and design to avoid overly optimistic population growth scenarios and underestimates of necessary offset size. This issue needs to be examined in more detail to determine predictable and consistent methods for estimating multipliers used in creating offsets for impacts to great apes.

Offset Duration

Most impacts to tropical forest habitats will take a long time to return to their original state, if ever. All great apes reproduce very slowly so the time to achieve NG will almost always be very long. Protecting biodiversity offsets for one or more decades will always result in a NL. Offsets for apes should be protected in perpetuity.

Conservation-Offset-Paradox (COP)

The challenges of demonstrating NG within the MBNP has led us to question the appropriateness of this current offset concept for great apes. Even though it favors sites that have low risk of failure, the NG also disincentivizes investment in sites with healthy, large intact populations with low threat (priorities for conservation) because the potential for population growth in such sites may be low as a result of density dependence. Companies will be looking to invest in sites where offsets can quickly achieve NG. Large, intact populations have, however, inherently lower growth rates. In a strict sense and according to current offset regulations, these ''non-growing'' populations may be of less interest. Great ape biology and growth rate dynamics along with general preference towards the conservation of large populations, creates the conservation-offset paradox (COP). (**Figure 9**).

NNL and NG will be achieved most quickly with populations that are (1) moderate in size, (2) far below the carrying capacity, (3) inhabit degraded habitat, and (4) were reduced in size by a threat (or threats) that is manageable by conservation interventions. When selecting ape populations for offsets that do not fulfil these criteria, in particular point 2 and 4, it is more likely that conservation investment is 'averted loss', as it may be difficult or even impossible for conservation management to achieve a NNL or NG in healthy populations in the short term. An 'averted loss', however, also avoidance of some threat in the future, thereby also discourages investment in sites with low threat. A conservation-offset-paradox (COP) therefore emerges from great ape population growth dynamics and the offset concept: with moderately hunted populations, or populations that suffer from a single, but manageable threat that increases mortality, it is more likely to achieve NNL or NG, compared to 'healthy' populations that are the primary target of great ape conservation efforts.

The WCF recognized this paradox when first proposing the MBNP as an offset site. They have addressed this challenge by working to restore habitat critical to chimpanzees, thereby providing the conditions for the population to expand. WCF has also addressed this challenge by working with communities, the government of Guinea, and the private sector to mitigate and decrease any future threats to the park as well.

Figure 9: Comparison of populations of differing size and relative difference to carrying capacity. Absolute and relative increase can be large in smaller populations far off the carrying capacity.

General recommendations to address these challenges for future design of offset projects to compensate for impacts to great apes and their habitats

Given the above challenges, we suggest a different paradigm that places offset sites within a larger strategic plan for the conservation of great apes such as national biodiversity offset strategies[79] and target-based approaches for ecological compensation[80]. These types of frameworks help ensure that compensation is nested within an overall strategy rather than being designed on a project-by-project basis.

To address some of these challenges, we make the following recommendations for future projects seeking to compensate for their negative impacts on apes and their habitats:

1. Given the longevity of all great apes, their slow growth rates, the inability of populations to bounce back quickly from disturbances, and the fact that all species of great apes are either Endangered or Critically Endangered, *offset sites for apes should be legally protected in advance of impacts and receive sufficient financial support to ensure their effective protection in perpetuity.*
2. Methods that overcome some of the limitations of the transect nest-count distance sampling should be used, including genetic surveys[81] and camera-trap distance

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[79] Kormos, R., Kormos C. F., Humle T., Lanjouw A., Rainer H., Victurine, R., Mittermeier R. A., Diallo M. S., Rylands A. B., and Williamson, E. A. (2014). Great apes and biodiversity offset projects in Africa: the case for national offset strategies. (2014) *PLoS One.* 9(11): e111671. doi: 10.1371/journal.pone.0111671.

[80] Simmonds, J. S., Sonter, L. J., Watson, J. E., Bennun, L., Costa, H. M., Dutson, G. *et al.* (2020). Moving from biodiversity offsets to a target-based approach for ecological compensation. *Conserv. Lett.* 13: e12695. doi.org/10.1111/conl.12695

[81] Arandjelovic, M., Head, J., Rabanal, L. I., Schubert, G., Mettke, E., Boesch, C., *et al.* (2011). Non-invasive genetic monitoring of wild central chimpanzees. *PLoS One*, *6*(3), e14761.

sampling[82,83]. These methods can help improve the collection of baseline data, in particular to answer questions related to the spatial arrangement and socio-demographic structure of chimpanzee communities overlapping with concession boundaries.

3. In the absence of more precise data on (i) population growth within the offset site, (ii) effectiveness of conservation efforts, (iii) uncertainty of achieving NG, and (iv) time lag between impacts and gains, it would be useful to have a science-based recommendation or "calculator" for predicting an appropriate multiplier for great apes under different situations. Such an approach should incorporate additional levels of compensation for damage to an ape population beyond compensating for population size, including, but not limited to, habitat and great ape ecological diversity and population connectivity.
4. To buffer future risks, it is also advisable for nations to have not only a single population for achieving offset requirements, but to calculate with larger 'envelopes' and consider investments into two populations living under different conditions. This reduces the chances of being trapped in density-dependent effects or unmanageable sources of mortality, as different populations are unlikely to have the same population dynamics. Offsets should invest in (i) rapidly growing populations of great apes below carrying capacity with few, manageable threats to achieve NG, and (ii) a category of sites with viable intact populations that may be approaching or at carrying capacity. For the latter, habitat regeneration can increase the carrying capacity of the area and averted loss can contribute to NG. If the habitat is already pristine and the area not under imminent threat, then demonstration of ape population growth within the offset site would not be required, **as long as such areas were supported and protected in perpetuity**. These areas would need to be well managed, part of a national biodiversity offset plan[84] and deliberately contribute to jurisdictional targets for great ape conservation[85] without any loss of the great ape populations they harbor. For some countries, this may come with the risk of not having enough funding for two sites. Or in other scenarios, a second offset site might not be feasible because the country does not have a large number of large chimpanzee populations remaining. In these cases, it is better to concentrate on full support of one site before investing in another, when possible.
5. Given the long preparation phase for establishing a great ape offset, including the collection of longitudinal data, it is important to develop a portfolio of candidate offset sites, in advance, from which a site (or sites) can be chosen. These should exist as part

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[82] Cappelle, N., Després-Einspenner, M. L., Howe, E. J., Boesch, C., and Kühl, H. S. (2019). Validating camera trap distance sampling for chimpanzees. *Am. J. Primatol*. 81(3): e22962.

[83] Howe, E. J., Buckland, S. T., Després-Einspenner, M. L., and Kühl, H. S. (2017). Distance sampling with camera traps. *Methods Ecol. Evol*. 8(11): 1558-1565.

[84] Kormos, R., Kormos, C. F., Humle.], T., Lanjouw, A, Rainer, H., Victurine. R., Mittermeier, R. A., Diallo, M. S., Rylands, A. B., Williamson, E.A. (2014). Great apes and biodiversity offset projects in Africa: the case for national offset strategies. *PLoS One* 9(11): e111671. doi: 10.1371/journal.pone.0111671.

[85] Simmonds, J. S., Sonter, L. J., Watson, J. E., Bennun, L., Costa, H. M., Dutson, G. *et al.* (2020). Moving from biodiversity offsets to a target-based approach for ecological compensation. *Conserv. Lett.* 13: e12695. doi.org/10.1111/conl.12695

of a larger strategic national great ape action plan. These sites should also assess other biodiversity, particularly threatened and restricted-range species that may also be at risk. Given the narrow timelines under which private sector companies work, this would help to overcome some of the issues observed in MBNP, such as initiation of project work before full implementation of the offset. It would also help countries and companies, early on, identify important areas for avoidance. A national offset plan should be validated only after such information is available, allowing for objective rather than subjective offset planning and financing.

6. As not all projects will develop their own independent offset, it is important to establish mechanisms whereby smaller projects can provide their compensation to aggregated offsets. This will have the added value that less costs will go into the management of independent offset establishment and will therefore be more cost effective. Aggregation of offsets offers the opportunity to protect larger sites, and for smaller companies to buy into ongoing schemes rather than having to invest resources in starting up a new offset site. PAs offer excellent sites for aggregating offsets. A measurement or assessment system would need to be created to determine or define a kind of "offset unit" (measure of exchange) and assess the number of such units provided by the PA. The same measurement system would determine the number of units impacted by each company and the total number of those units each company would be required to purchase to meet NNL or NG goals. The purchase of the total number of units would result in the financing of the PA in perpetuity. By developing discreet units and accounting for them, double counting can be avoided and companies will not be allowed to pay for the same offset.
7. Research programs should be immediately established in potential offset sites to measure population size and growth rates. Understanding population growth dynamics at the offset site, including density dependence, is essential for estimating feasibility, size and design of biodiversity offsets for great apes.
8. CTFs need to have sufficient capital to allow for annual payments that cover conservation costs and account for unforeseen events

CONCLUSION

Table 6 summarizes the main conclusions from this study concerning the MBNP specifically and for offsets in general for impacts to great apes and their habitats.

Table 6. Challenges and recommendations for the MBNP as an offset for the chimpanzees impacted by GAC and CBG's mining activities, as well as general challenges recommendations concerning offsets for great apes.

Challenges	Recommendation
MBNP as an offset for chimpanzees impacted by mining activities of CBG and GAC	
-Underestimates in the baseline number of chimpanzees within the mining concessions, the number of chimpanzees impacted by the mining, and the multipliers, results in an underestimate also of the required increase in chimpanzee numbers needed to achieve a NG overall.	GAC and CBG should provide sufficient funding to protect the MBNP in its entirety.
-The time needed to reach a "gain" in chimpanzee numbers was underestimated since calculations that forecast the annual increase in numbers of chimpanzees within the MBNP each year assumed an exponential growth rate of chimpanzees whereas projections need to take into account density-dependent growth. -A permanent loss of chimpanzees within mining concessions cannot be compensated with temporary protection of the MBNP.	The MBNP should be protected in perpetuity.
Threats posed by mining and the Koukoutamba hydroelectric dam construction within the boundaries of the MBNP put the long-term viability of the offset site into question. If these projects proceed, the population of chimpanzees within the MBNP will not be sufficient to achieve the required NG.	Any development or private sector projects planned to occur within the MBNP that would negatively impact chimpanzees should be cancelled.
Offsets for Great Apes in General	
Population size of great apes in the impacted area can easily be underestimated if administrative areas rather than ecological relevant areas are surveyed.	Baseline surveys need to extend beyond administrative boundaries to capture the full population that is impacted by a project.
Limitations of certain survey methods (e.g., transect nest count distance sampling) can underestimate baseline populations.	Baseline surveys and monitoring need to be conducted with methods that allow identification of chimpanzee communities and their territories (e.g., non-invasive genetic surveys).
Impacts on an ape population do not only include the reduction in population size but	Additional levels of project impacts need to be accounted for, including impact on ecological processes, emerging impacts in the long-term, impacts from

include a number of other levels of impacts that are often underrepresented in efforts to compensate for the damages done to a population.	interactive effects, net reduction in habitat diversity, net reduction in behavioral diversity, net reduction in population connectivity, reduction in extent of occurrence, genetic loss.
Most impacts to tropical forest habitats will take a long time to return to their original state, if ever. All great apes reproduce very slowly so the time to achieve NG will almost always be very long. Protecting biodiversity offsets for one or more decades will always result in a NL.	Offsets for great apes should be protected in perpetuity.
Determining multipliers for offset size is challenging because there are so few, if any successful offsets, from which we can learn. The large uncertainties associated with projecting ape population growth dynamics into the future, density-dependent effects all need to be taken into account when estimating requirements of offset size and offset design to avoid overly optimistic population growth scenarios and underestimates of necessary offset size.	This issue needs to be examined in more detail for great apes to determine a predictable and consistent method for estimating multipliers for offsets for impacts to apes.
There is a discrepancy between the preference for large, intact populations by ape conservation initiatives and the needs for offsets to quickly achieve NNL and NG – the Conservation Offset Paradox (COP).	Offsets should involve investment in either (or both, see below) i) rapidly growing populations of great apes under carrying capacity with few, manageable threats to achieve NG, or ii) a category of sites with viable intact populations that may be approaching or at carrying capacity. For the latter, demonstration of ape population growth within the offset site would not be required as long as such areas were supported and protected in perpetuity. These areas would need to be well-managed, part of a national biodiversity offset plan and deliberately contribute to jurisdictional targets for great ape conservation without any loss of the great ape populations they harbor.
Offset sites are supported for a limited duration.	Lending banks and governments should require permanent protection and financing of offset sites and an associated sustainable finance mechanism such as a Conservation Trust Fund (CTF).

All conclusions of this study are based on the currently available estimates of chimpanzee numbers within the MBNP. In the case that these estimates change, some of our conclusions (but not all) may need to be revised. Our major conclusion however, that 20 years of protection is not enough, will not change with new numbers.

This study has important implications not only for the MBNP, but for future efforts to mitigate the impacts on great apes. It provides a warning that, when projects are not able to avoid or minimize impacts to great ape populations, the size, amount, and duration of funding is going to be far greater than previously believed if the goal of NG is to be achieved. Mitigation and offset costs represent the cost of doing business in a way that complies with both government and lender requirements. In the future, we hope that companies and banks can build these costs into their project risk assessments and planning well in advance of implementation. Otherwise, biodiversity offsets may be a useful tool in slowing the decline of great apes, but they will still result in a Net Loss (NL) overall and should not be used to justify international financing of projects detrimental to species survival.

Globally there are at least 12,983 offsets in 37 countries covering approximately 153,679 km^2.[86] Analyses of these offset are also finding that biodiversity offsets continue to fall short of achieving their goal of NG and even NNL, and that the timeframe for achieving NG is much longer than originally expected – often taking many generations.[87]

Species extinctions are taking place at an accelerating rate, resulting in the degradation and destruction of entire ecosystems. Today, 75% of the Earth's terrestrial area has experienced significant human disturbance. Global biomass of wild mammals has declined 82% since prehistory and, for the first time, human biomass outweighs wild mammal biomass. The biodiversity crisis has taken a huge financial toll and has impacted human health and well-being in all regions of the planet. COVID-19, Ebola and other disease spillovers from wildlife to human populations are direct consequences of habitat loss and degradation. To reverse this global trend, there needs to be an increase in cross-sectoral collaborations and commitments from the private sector and governments to adhere to strict safeguards.

It is a significant advance that the IFC PS6 Guidance Note says that (1) special consideration will be given to great apes, (2) any area where great apes occur is likely to be treated as critical habitat, and (3) projects in such areas are acceptable only in exceptional circumstances. Yet, the World Bank Group continues to support projects that are cumulatively resulting in the death of thousands of Critically Endangered chimpanzees – a subspecies for whom we have already lost 80% in the last few decades. There is a disconnect between policy and practice that needs to be addressed.

Countries are under significant pressure to develop in order to help their populations deal with issues of poverty, but at the same time these governments are also committing to conservation targets and maintenance of natural capital. There needs to be national strategies that effectively balances development and conservation. Such strategies would emphasize better planning and coordination at a national level to identify sites that need to be protected and others where development projects can occur, but with a commitment to avoid and minimize impacts to important biodiversity. Further development in MBNP does not achieve that balance.

An estimated $60–70 trillion dollars will be committed by banks to worldwide infrastructural expansion by 2030[88], yet financial flows into biodiversity conservation represent only 0.1–0.2% of that amount[89]. Greater investment in great ape conservation is needed if we are to truly protect them long-term.

According to Inclusive Development[90], the bauxite from the CBG's mining is shipped to North America and Europe, where it is processed into primary aluminum. Inclusive Development cites several companies that use aluminum from the CBG mine, including Coca-Cola, Anheuser-Busch, Red Bull, Coors, Crisco, Campbells Soup, Audi, BMW, Fiat-Chrysler, Ferrari, Ford, General Motors, Hyundai, Jaguar, Land Rover, Mercedes-Benz, Porsche, Volvo, and Honda. These companies, too, should be making significant contributions to conservation of

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[86] Bull, J. and Strange, N. (2018). The global extent of biodiversity offset implementation under no net loss policies. *Nature Sustain.* 1(12): 790–798. 10.1038/s41893-018-0176-z.

[87] Gibbons, P., Macintosh, A., Constable, A., and Hayashi,, K. (2017). Outcomes from 10 years of biodiversity offsetting. *Glob. Change Biol.* 24(2): e643-e654. Doi: 10.1111/gcb.13977.

[88] Laurance,W. F., Peletier-Jellema,A., Geenen, B., Koster, H.,Verweij, P.,Van Dijck, P., *et al.* (2015). Reducing the global environmental impacts of rapid infrastructure expansion. *Curr. Biol.* 25: R259–R262.

[89] <https://www.paulsoninstitute.org/key-initiatives/financing-nature-report/>

[90] <https://www.inclusivedevelopment.net/campaign/guinea-alcoa-rio-tinto-bauxite-mine/>

wildlife and ecosystems. Negative environmental and social impacts need to be factored into all levels of the supply chain.

To truly protect chimpanzees from going extinct in Guinea, we are going to need commitments from all levels of the supply chain, and partnerships between all those profiting from the mining of bauxite and iron-ore in the country – from the mining companies all the way to the consumers using aluminum products. Investing in key sites to protect the habitat in perpetuity will be essential for the future of the Western Chimpanzee. These players will need to be joined by the lenders, government, and civil society, all of whom can play a role in influencing policy on integrating conservation and development needs and the ultimate impact on chimpanzee populations in the country.

We end with a reminder that great apes are intelligent, sentient beings and compensating their death in one area, by averted loss in another area should never be described as a "gain". Thus, avoiding any loss of great apes or destruction of their habitat is by far the preferred and most effective strategy.

Photograph by Kalyanee Mam, 2021

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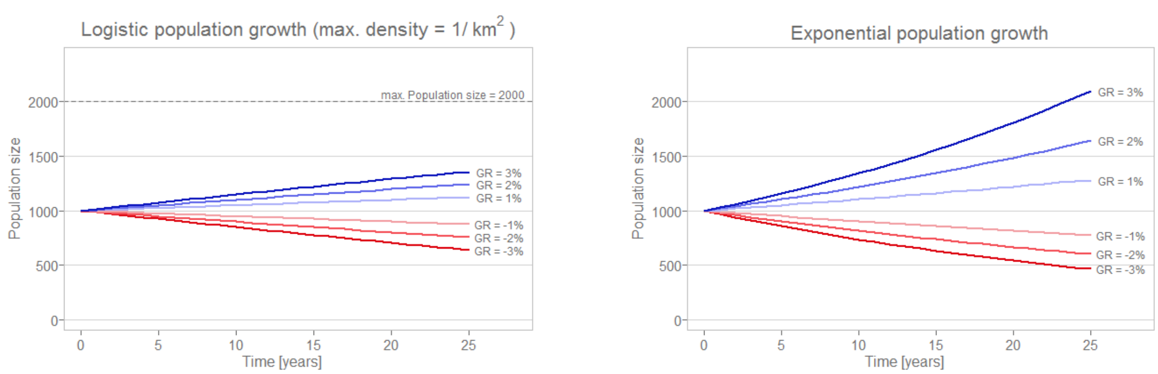
Appendix I. Density-Dependent Growth

In its simplest form, density-dependent growth can be described by the Lotka-Volterra equation.

$$\mathbf{N = N_0 + r * N_i * (1- \frac{Ni}{K})} \qquad \textbf{equation 3}$$

Where N_0 is the size of start population, r is the growth rate, N_i is the size of population at a time i and K is the maximum population size.

The figure below illustrates the difference in population growth rates with and without density dependence. When current density (e.g., 0.5 individual/km^2) is already close to carrying capacity (e.g., 1 individual/km^2), population growth over 25 years is very limited, even when applying highest observed growth rates of 3% in this example. Under density-independent growth, i.e., when density is intermediate, the same intrinsic growth rates lead to much larger populations over the same time period.



Difference in population growth rates with (left) and without (right) density dependence. When current density (e.g., 0.5 individual/km^2) is already close to carrying capacity (e.g., 1 individual/km^2), population growth over 25 years is very limited, even when applying highest observed growth rates of 3% in this example. Under density-independent growth, i.e., when density is intermediate, the same intrinsic growth rates lead to much larger populations over the same time period.

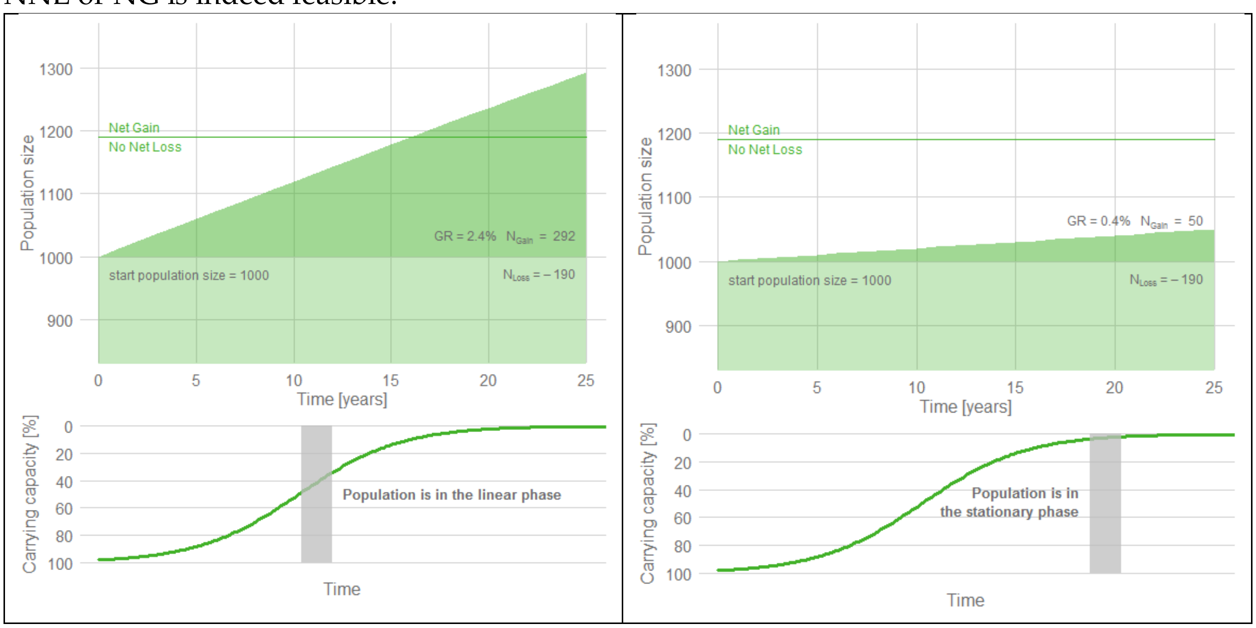
Some sources of mortality at an offset site may be unmanageable (e.g., infectious diseases, social conflicts, climate change) and thus only a small proportion of the overall mortality rate may be reduced, such as hunting, making a predictable population increase unforeseeable. Given these uncertainties of ape population growth dynamic, achieving NNL or NG with great ape populations is linked to a number of challenges. For great apes, these measurements are often associated with high uncertainty as a result of methodological constraints, but also fluctuating density populations, caused by demographic dynamics, disease, or anthropogenic impact. For any candidate offset population not studied previously, intrinsic growth dynamics will be unknown. The increase of a population over a specified time period can be defined as

$$\boldsymbol{N_1 = N_0 + B - D + I - E} \qquad \textbf{equation 4}$$

Where N_1 is the population size after the specified time period, N_0 is the size of the start population, *B* is the number of births and *D* the number of deaths, *I* the number of immigrations and *E* the number of emigrations in the population. *B,D,I,E* in combination specify the intrinsic growth of a population.

Current *B,D,I,E* will be unknown for most populations, but could in principle be assessed empirically. Future *B,D,I,E* will always be unknown and will therefore be associated with great uncertainties, given, (1) very slow great ape population growth rates, even under the most ideal conditions, (2) density-dependent growth and uncertainty about magnitude of density-dependent effect at the time of offset implementation, i.e., the relative distance of current population size to maximum population size when reaching carrying capacity, (3) uncertainty about future 'demographic shocks' to the population of interest, from which recovery is always slow, (4) uncertainty about potential to reduce mortality (D) in the population, as only some causes of mortality may be reduced by management, such as hunting, whereas others such as infectious diseases or climate change may not and additional causes of mortality may only emerge in the future

As N_0 is the only parameter that can be estimated with some level of certainty, it becomes clear that any attempt to predict time periods over which NNL or NG will be achieved, would ideally require: (1) an assessment whether population growth is possible at all due to potentially restricting density dependence, (2) an assessment of whether causes of mortality can indeed be reduced by management interventions to ensure that offset implementation and achievement of NNL or NG is indeed feasible.



Under the same initial conditions of population size N_0, offset implementation and achievement of NNL or NG may be feasible (left) or not (right), depending on the magnitude of effect of density dependence.

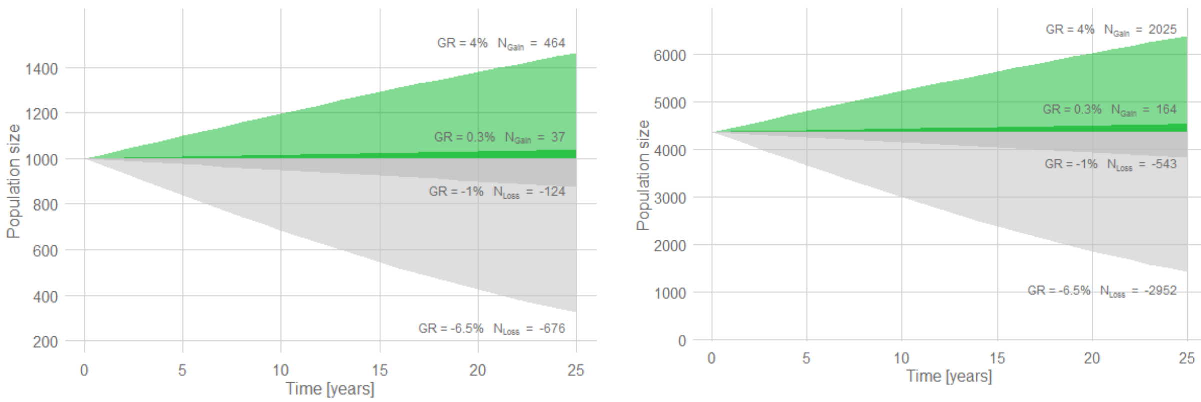


Illustration of the uncertainty of the outcome of an offset action for a) fictitious population of about 1000 individuals, located at about 50% carrying capacity. The growth rates range between the maximally biologically possible growth rate (assuming all individuals survive until the age of about 50 years) (light green) and decline rates observed across the Western Chimpanzee range over the last decades (light grey). The darker shapes depict a reduced growth rate of about 0.5% and a decline rate of 1% per year. b) the same ranges applied to the observed chimpanzee abundance in MB National Park of about 4365 individuals.