

<https://www.nytimes.com/2019/08/19/science/elephants-climate-change.html>

The Thick Gray Line: Forest Elephants Defend Against Climate Change

By Rachel Nuwer

Aug. 19, 2019

Poaching destabilizes nations, disrupts ecosystems and threatens biodiversity. A recent study suggests still another consequence: some types of poaching may also accelerate climate change.

Forest elephants — the smaller, endangered relatives of African savanna elephants — promote the growth of large trees that excel at storing carbon, according to research published in the journal *Nature Geoscience*.

Should forest elephants disappear, scientists estimated, Central Africa's rain forest will lose about three billion tons of carbon — the equivalent of France's total CO₂ emissions for 27 years.

"This new paper points to something that we in Central Africa have suspected for a long time, but now this group has thrown some serious science at the issue," said Fiona Maisels, a conservation scientist at the Wildlife Conservation Society and at the University of Stirling in Scotland.

"With the loss of forest elephants," she added, "loss of carbon stocks can be added to the list of ecosystem services that are no longer provided by these animals."

Over recent years, researchers have gained a more detailed understanding of the links between animals and climate. Wild grazers, for instance, can reduce the intensity and frequency of fires that emit greenhouse gases. Methane emissions from livestock significantly contribute to global warming.

Scientists have also known for decades that large herbivores such as elephants play important short-term roles in ecosystems by promoting biodiversity, recycling nutrients and dispersing seeds.

Fabio Berzaghi, an ecologist at the Laboratory of Climate and Environmental Sciences in France and the lead author of the new study, suspected that elephants might also play a profound long-term role in shaping Africa's rain forest, second in size only to the Amazon's.

The Amazon lost its large herbivores 12,000 years ago, among them ground sloths that weighed over three tons, elephant-like creatures called gomphotheres, and armadillo-like glyptodonts that were the size of small cars.

The loss of these and other large herbivores likely contributed to the Amazon's higher density of smaller trees, with a lower overall amount of vegetation compared with Africa's rain forest.

“We were thinking elephants may play a role in the differences between these two continents’ forests,” Dr. Berzaghi said. “We also really wanted to know what the long-term consequences of losing this species would be.”

Dr. Berzaghi and his colleagues selected two field sites. One lies in the Democratic Republic of Congo, from which elephants disappeared 30 years ago because of poaching; the other is the Republic of Congo, where elephants lived at high numbers until recently.

Both sites were relatively pristine and differed only in the presence or absence of elephants. The researchers measured the trunk size of all the trees in the study areas and noted the species, giving them an idea of the short-term effects of elephant loss.

To determine the long-term effects, they created a computer model that simulated the basic functions of the African rain forest, including tree growth and death, competition, photosynthesis and reproduction. The model allowed them to include or exclude elephants.

Forest elephants almost exclusively stomp down trees with a diameter of 12 inches or less, and they prefer to eat fast-growing softwood trees. By clearing the understory of vegetation, the researchers found, elephants not only alter plant composition but also affect light penetration and water availability.

This results in an ecosystem that favors large, slow-growing hardwood trees. Such species store significantly more carbon than the equivalent volume of smaller softwood trees.

“As a tree, there’s a trade-off — you can’t have it all,” Dr. Berzaghi said. “You either invest in growing fast, or in building a lot of structure with carbon to be more resistant.”

Extrapolating their findings to the whole of Africa’s rain forest, Dr. Berzaghi and his colleagues found that the disappearance of elephants would result in a 7 percent loss of vegetation — the equivalent of 3 billion tons of carbon storage.

Put another way, elephants provide a carbon storage service valued at \$43 billion.

“This is the first study I have seen attributing large, multi-megaton changes in carbon to a particular species,” said Rosie Fisher, a scientist at the National Center for Atmospheric Research in Boulder, Colo., who was not involved in the research. “It really opens a new frontier in how we think about interactions between large animals and carbon storage.”

Save for a few surviving populations, forest elephants are functionally extinct in almost all of their former 850,000-square-mile habitat. The species declined by 62 percent from 2002 to 2011, Dr. Maisels and her colleagues found, and poaching has largely continued unchecked since then.

According to Iain Douglas-Hamilton, the founder of Save the Elephants, a conservation organization based in Kenya, the killing has most recently spread to Gabon, which holds half of the world’s remaining forest elephants and was previously protected from poaching by its relative isolation.

“This study comes at a time when forest elephants are threatened as never before,” Dr. Douglas-Hamilton said. “It is appalling that just as we are beginning to understand how elephants might have a key role in Africa in sequestering carbon, they are under real threat of eradication.”

One limitation of the study, Dr. Berzaghi said, is that we do not know how much carbon has already been lost because of the elephants’ decline. But it does seem certain, he added, that putting a stop to poaching and restoring forest elephant populations would bring climate benefits.

“There’s evidence mounting that elephants are a key species that benefit not just their ecosystem, but all ecosystems,” he said. “Climate change is a complex issue that will probably require a lot of small solutions, and this might be one of those solutions.”

<https://www.weforum.org/agenda/2019/08/elephants-fight-climate-change>

Why Forest Elephant Extinction Will Make Climate Change Much Worse

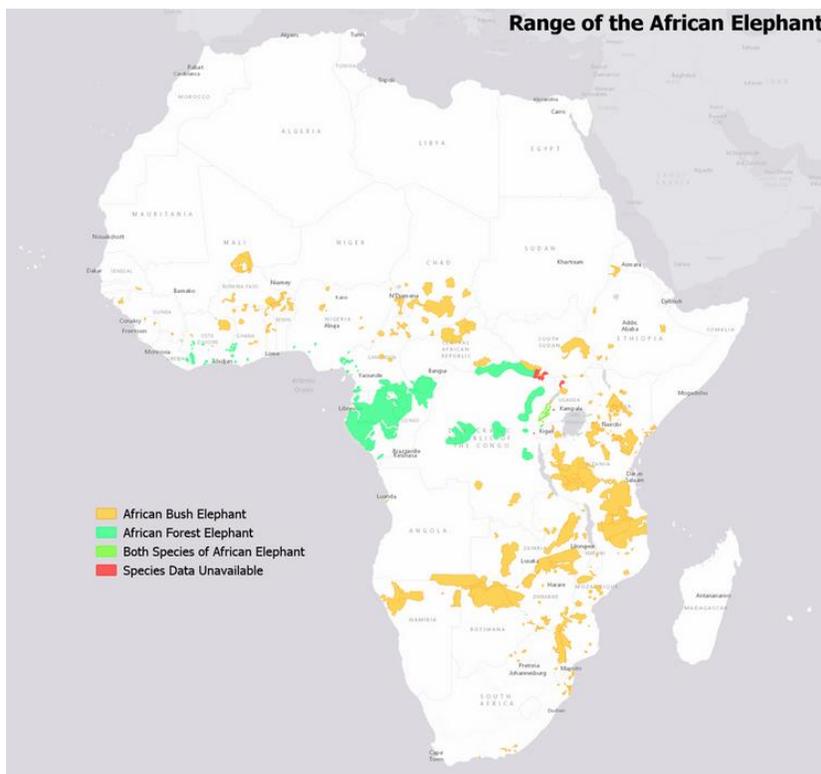
By **Ahimsa Campos-Arceiz** Professor in Tropical Conservation Ecology , University of Nottingham

06 Aug 2019

Forest elephant extinction would exacerbate climate change. That's according to a new study in Nature Geoscience which links feeding by elephants with an increase in the amount of carbon that forests are able to store.

The bad news is that African forest elephants – smaller and more vulnerable relatives of the better known African bush elephant – are fast going extinct. If we allow their ongoing extermination to continue, we will be also worsening climate change. The good news is that if we protect and conserve these elephants, we will simultaneously fight climate change.

Elephants are fascinating animals, and I have studied them for more than 15 years. They are intelligent, sentient, and highly social. But their single most remarkable feature is their size. Evolutionarily, elephants gambled on becoming massive enough to deter predators like lions and tigers.



African forest elephant range is highlighted in light green. The largest surviving population is in Gabon, on the coast of central Africa. Image: IUCN / u/DarreToBe, CC BY-SA

In exchange, they became slaves to their appetite. Elephants need huge amounts of food everyday, something like 5-10% of their body mass. A typical three-tonne female could eat 200 kg of plant material in one day. Her family may need to consume more than a tonne of food per day.

It is not easy to find so much food, especially in tropical rain forests, where plants have high concentrations of chemical defences (toxins) to avoid being eaten. Elephants spend most of their life eating and looking for food. We can think of them as “eating machines”. African forest elephants are particularly fond of saplings, young trees, and the plants that first grow into newly opened gaps in the forest. These “early succession” plants are specialised in growing fast following a disturbance and they invest less in chemical defences. Early succession trees also have lower wood density than slow-growing late-succession tree species.

Elephant eating manners are also remarkable. They feed by breaking stems and branches, pulling down lianas, uprooting whole plants, stripping leaves off twigs, and so on. It is easy to notice their presence because of the mess they leave behind.

How elephant disturbance affects carbon stocks

The key novelty of the new study, by the ecologist Fabio Berzaghi and colleagues, is they include, for the first time, the effect of elephant feeding disturbances in a computer model that simulates demographic processes in forest ecosystems. They found that “elephant disturbance” – all that messy eating – results in forests having fewer, larger trees. Elephants filter out small early-succession (i.e. low wood density) trees, promoting the dominance of late-succession (high wood density) trees, which ultimately leads to long-term increases in the total biomass. Berzaghi and colleagues were able to validate their model predictions with data from real forest plots in the Congo Basin.

By promoting these larger, woodier trees, elephant feeding disturbances therefore mean the forest stores more carbon. These results have important and far reaching implications for elephant conservation and carbon policy. The authors estimate that the disappearance of African forest elephants would result in a loss of as much as 7% of the carbon stocks in Central African forests, which they valued at around US\$43 billion, based on a conservative carbon stock price. In short, forest elephants are our allies in the fight against climate change and their existence saves us tens of billions of dollars in climate responses.

Forest elephants could soon disappear

The situation of African forest elephants is particularly dramatic. Once numbered in the millions, their population is now less than 10% of its potential size and, in the decade from 2002 to 2011, as many as 62% of forest elephants might have been killed. This decline is mostly due to poaching to feed Asian demand for ivory as well as increasing human encroaching of their habitats. What a sad reason for a massacre and an ecological disaster.

Scientists largely recognise African bush (*Loxodonta africana*) and forest (*L. cyclotis*) elephants as different species. However because of practical challenges (such as dealing with abundant hybrid populations), the International Union for the Conservation of Nature (IUCN), which officially tracks endangered species, has kept the two together. The problem is that the more populous bush elephants have masked a drastic reduction in their forest cousins.

Berzaghi and colleagues emphasise the need for forest elephants to be finally acknowledged as their own species. This would give them a separate IUCN Red List status – probably marked as “endangered” – and trigger important policies and actions.

Conserving elephants helps fight climate change

Berzaghi and colleagues show that forest elephants produce ecosystem services in the form of climate stability from which we all benefit, including people like you and me who might never visit the forests of Central Africa. If we are all beneficiaries of elephant conservation, we should be also responsible for it. It is very important that more affluent societies assume a bigger share of the responsibility to conserve the elephants and other tropical biodiversity from which we benefit.

In the past decade we have learned a lot about how important elephants and other large animals are for functioning ecosystems. It is time to apply this knowledge. Berzaghi and colleagues produced evidence linking the behaviour of a single species – feeding disturbances by African forest elephants – to global-scale climatic impacts. As mentioned earlier, the bad news is that we humans are killing elephants and ruining our planet. The good news is that we could synergise efforts and fight climate change by effectively protecting and restoring forest elephant populations and their habitats. The choice seems obvious to me.

<https://news.mongabay.com/2018/10/loss-of-forest-elephant-may-make-earth-less-inhabitable-for-humans/>

Loss of Forest Elephant May Make Earth 'less Inhabitable for Humans'

By Emily Clark

October 8, 2018

- *A new review paper finds that the loss of Africa's forest elephants has broad impacts on their ecosystems, including hitting several tall tree species, which play a key role in sequestering carbon dioxide.*
- *Forest elephants disperse large seeds, keep the forest canopy open, and spread rare nutrients across the forest, benefiting numerous species across the African tropics.*
- *While the IUCN currently defines African elephants as a single species, scientists believe it long past time to split them into two distinct species, savanna and forest, to bolster protection for both from the ivory trade.*

Children in every corner of the globe can identify an elephant in a wildlife lineup. They are as recognizable as any basic shape and as endearing as any household pet. Yet the same cannot be said for the hundreds of tropical flora and fauna that are liable to disappear should forest elephant populations continue to crash.

"[Elephants] have a disproportionately large impact on their ecosystem and the organisms living in it," says John R. Poulsen, assistant professor of tropical ecology at Duke University's Nicholas School of the Environment. "If people are aware of the potential result of losing elephants [...] perhaps they can transfer that understanding to less well known species."

Poulsen and his colleagues recently published a study in *Conservation Biology* examining how the loss of forest elephants would impact the rest of their natural habitat. After diligently reviewing dozens of papers on Afrotropical flora and fauna, they predict that the loss of forest elephants will reshape the ecological processes at work in their environment. Species composition will change, in addition to the size and abundance of large tree species — and, by extension, the ability of these ecosystems to store carbon dioxide.

"[The] killing of elephants for their ivory is not only depriving the world of one of its most charismatic species, but might also be making the Earth less inhabitable for humans," Poulsen says.

A Tale of Two Species

Although many people are familiar with elephant conservation, few know that the African elephant is not one, but two distinct species: forest (*Loxodonta cyclotis*) and savanna (*Loxodonta africana*). The two are different in their anatomy, reproduction, even their social structures.

When most people think of Africa's elephants they are actually picturing savanna elephants: those that live out in the open, in places like the Serengeti, and are therefore easier to study. Forest elephants are comparatively smaller and weave their way through vibrant Afrotropical forests, such as in the Congo,

forging elephant-wide paths as they do so. Scientists looking at genetic markers estimate the two species split between 2 million and 6.5 million years ago; humans and chimpanzees, by comparison, diverged between 5 million and 7 million years ago.

Despite such differences, the International Union for Conservation of Nature (IUCN) does not currently recognize forest and savanna elephants as distinct species. Both fall under the title of African elephant.

“The two-species question is pretty much accepted by the taxonomists but has yet to be officialized by IUCN,” says Fiona Maisels, surveys and monitoring adviser at the Wildlife Conservation Society (WCS) in Gabon.

Scientists generally define species as a group of organisms that can successfully mate and produce fertile offspring. The primary holdup in the case of the African elephant is that forest and savanna elephants can interbreed and produce fertile offspring, and occasionally have. However, this is also the case with wolves and coyotes, which are universally considered distinct species. And many bacteria and plants reproduce without mating at all, which provides further confusion.

But, according to Poulsen, treating the two African elephant species as one has had dire implications for their respective conservation. When forest and savanna elephants are bundled together as “African elephants,” it inflates the true population of each species.

“With a larger population, the conservation status of the ‘African elephant’ can be listed as ‘Vulnerable,’” Poulsen says, “which allows some [southern] African countries the possibility of trading ivory.”

If the IUCN recognized forest and savanna elephants as distinct, both species would be considered “endangered,” likely necessitating stricter rules for trading ivory.

According to Poulsen, the current unified conservation assessment is a barrier to the protection of forest elephants in particular. In Central Africa, 62 percent of forest elephants were lost between 2002 and 2011, primarily due to poaching. However, as they are considered the same species as the savanna elephant, the IUCN recorded a smaller overall loss in the “African elephant” population. A study in 2013 by Maisels found that current forest elephant populations are only at 10 percent of their potential size.

We are losing these elephants without knowing much of what their extinction might mean for Afrotropical forests, for Central Africa, and even for global climate.

“The problem is that elephant populations are doing poorly in most places and allowing the sale of ivory has traditionally grown the demand, rather than saturating it, leading to killing across the entire range of both species,” Poulsen says.

Big Feet, Big Footprint

Forest elephants are ecosystem engineers, meaning their various behaviors heavily alter their habitat.

Their size matters. Although smaller than their savanna counterparts, forest elephants are still just that: elephants. Simply by walking around, they can shape their environment. By moving in herds, their

impact is multiplied. By stomping saplings, peeling bark, breaking limbs, clipping branches and trampling vegetation, forest elephants generate trail systems that can stretch tens of kilometers.

All of that elephant activity shapes the forest canopy. Poulsen and his colleagues say that, although destructive, the elephants clear the understory of the forest, allowing large trees to spread their roots and grow to their greatest heights. Without this service, greater competition for light and soil could slow tree growth and reduce trees' potential size.

Elephants are also the largest fruit-eating animals on the planet, and they aren't picky about their food. They consume more than 500 plant species in Central Africa. Plants that produce fruit often rely on animals to disperse their seeds far and wide. Since elephants are so large, they can eat and carry seeds that are too big, hard or fibrous for other, smaller animals. Forest elephants, and forest elephants alone, disperse the seeds of at least 43 plant species in Central Africa.

By doing so, they also boost the odds that the seeds will take root. The digestive tract of elephants improves the germination time and growth rates of seedlings that pass through it.

Additionally, the wide swaths of forest floor that elephants open up provide ample space for new seedlings to settle.

Dung is another important contribution from forest elephants. Although poop may seem an unlikely gift, it is a critical ingredient for lush forests. Besides light and water, the most important thing for forest health is nutrients. As elephants chew, swallow, digest and excrete, they unlock and redistribute nutrients like sodium and nitrogen that would otherwise stay put. And when they excavate termite mounds and salt licks, they unearth rare nutrients like potassium, calcium, magnesium and sodium, which would have been previously inaccessible to the rest of the forest. Elephants in the forest unlock and redistribute the building blocks of life, broadly dispersing ingredients both rare and critical throughout the forest.

"I have walked through forests with healthy elephant populations and forests that have been elephant-free for decades. There is a stark difference," Poulsen says. "Elephant-free forests can have a thick understory and middle story with lots of herbaceous vegetation and thorny vines, visibility is limited and it is difficult to walk through. Forests with elephants can look like a park with good visibility and well-worn trails to walk along."

Park-like forest in Gabon with a relatively large, active forest elephant population. The under- and id-stories are absent, visibility is good, and traversing the forest would be easy. Image by John Poulsen.

Making Molehills of Mountains

The great footprint of the forest elephant doesn't tread on just Central African forests. Tropical forests are an integral component of global carbon storage. The larger the tree, the more carbon it sequesters over its lifetime.

"While there is a big focus on stopping deforestation, we speculate that the loss of elephants might also affect the ability of forests to store carbon," Poulsen says.

Because forest elephants are key to the growth and survival of large trees, the loss of elephants means less carbon sequestration by Africa's forests — and a warmer planet, according to the paper.

To conserve both African elephant species — and every plant, animal and fungus that relies on the ecosystem services they provide — the demand for ivory must end. Poulsen is adamant that the two species must be listed as distinct in order to have the proper restrictions in place for the ivory trade.

Poulsen says the U.S. public can help by expressing concern for elephant conservation to their congresspersons. Although Central Africa may seem distant, the U.S. Fish and Wildlife Service (USFWS), as well as other federal agencies, delegate a portion of funding to international conservation in the African tropics. Poulsen also encourages speaking out against allowing tusks and elephant body parts to be imported into the United States and elsewhere.

This spring, the Trump Administration allowed elephant parts to be imported via the USFWS on a case-by-case basis.

“The only way to stop the ivory trade and the killing of elephants,” Poulsen says, “is to shut down all trade of ivory, everywhere.”

Citations

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Forest Elephants are Allies in the Fight Against Climate Change

By Ahimsa Campos-Arceiz, Professor in Tropical Conservation Ecology, University of Nottingham
July 16, 2019

Forest elephant extinction would exacerbate climate change. That's according to a new study in Nature Geoscience which links feeding by elephants with an increase in the amount of carbon that forests are able to store.

The bad news is that African forest elephants – smaller and more vulnerable relatives of the better known African bush elephant – are fast going extinct. If we allow their ongoing extermination to continue, we will be also worsening climate change. The good news is that if we protect and conserve these elephants, we will simultaneously fight climate change.

Elephants are fascinating animals, and I have studied them for more than 15 years. They are intelligent, sentient, and highly social. But their single most remarkable feature is their size. Evolutionarily, elephants gambled on becoming massive enough to deter predators like lions and tigers.

In exchange, they became slaves to their appetite. Elephants need huge amounts of food everyday, something like 5-10% of their body mass. A typical three-tonne female could eat 200 kg of plant material in one day. Her family may need to consume more than a tonne of food per day.

It is not easy to find so much food, especially in tropical rain forests, where plants have high concentrations of chemical defences (toxins) to avoid being eaten. Elephants spend most of their life eating and looking for food. We can think of them as “eating machines”. African forest elephants are particularly fond of saplings, young trees, and the plants that first grow into newly opened gaps in the forest. These “early succession” plants are specialised in growing fast following a disturbance and they invest less in chemical defences. Early succession trees also have lower wood density than slow-growing late-succession tree species.

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long-term increases in the total biomass. Berzaghi and colleagues were able to validate their model predictions with data from real forest plots in the Congo Basin.



Forest elephants are smaller than their savanna cousins, have straighter tusks and different shaped ears. Sergey Uryadnikov / shutterstock

By promoting these larger, woodier trees, elephant feeding disturbances therefore mean the forest stores more carbon. These results have important and far reaching implications for elephant conservation and carbon policy. The authors estimate that the disappearance of African forest elephants would result in a loss of as much as 7% of the carbon stocks in Central African forests, which they valued at around US\$43 billion, based on a conservative carbon stock price. In short, forest elephants are our allies in the fight against climate change and their existence saves us tens of billions of dollars in climate responses.

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Climate mitigation policy, in the Central African Republic. GUDKOV ANDREY / shutterstock

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<https://www.peacefuldumpling.com/african-forest-elephants-fight-climate-change>

African Forest Elephants Fight Climate Change— But they Need Our Help

By Kat Kennedy
August 6, 2019

There's something truly humbling about standing in the presence of earth's last remaining megafauna. Carnivores and herbivores alike, dominating the land and seas sometimes with terror, but always with grace. The tragic reality is that the majority of us will only get the in-the-flesh experience at a zoo, populations dwindle. From deforestation to climate change-induced desertification to poaching, we find ourselves at a critical time where our every move defines us as a species committed to either diversity or destruction.

It's no secret that every organism in a given habitat fulfills a particular role or "niche." That's the beauty of evolution and it offers some hope if we're to contemplate life after the Anthropocene (assuming the planet survives it, of course). The interconnectedness of these niches is rather complex; the effects of removing top predators and resulting trophic cascades is relatively well-documented, but what about the gentle vegetarian giants? You might be surprised to know that these might well be playing the most important role of all.

African forest elephants are the smallest of the three elephant species alive today. They are found in the lowland tropical rainforests of central and western Africa and forage in family groups of up to 20 individuals on seeds, leaves and bark. Unfortunately numbers have been reduced by over 60% since 2002 as a result of habitat loss and poaching and today they are thought to occupy less than a quarter of their potential habitat range. This is a huge problem, not just for the loss of a beloved species, but also because these elephants play a vital role in sequestering carbon from the atmosphere.

As it turns out, these elephants are somewhat picky when choosing what to chow down on for their next meal. They prefer to bulldoze and snack on fast-growing plant species, leaving the more dense, slow-growing flora in place. These species continue to sequester CO₂, serving as important carbon sinks.

Aptly-named "forest gardeners" or "engineers" in a recent study, biologists at Saint Louis University demonstrated using a novel simulation that the forests do much better with the presence of these elephants. Their strategic disturbance of native vegetation boosts above ground biomass by 7%. That figure may not seem significant, but in financial terms that translates to roughly \$43 billion! Furthermore, their presence is thought to have shaped the current profile of African rainforests in ways not seen in Central America or Asia. This suggests a knock-on effect for other animal and plant species if their absence becomes reality.

Charismatic and known to possess tremendous depth of feeling, forest elephants need our help. Here are some ways that you can further the cause from many thousands of miles away:

Dja Faunal in Cameroon is one of the best protected areas of African rainforest and a UNESCO World Heritage Site. Approximately 90% of the area remains undisturbed, allowing the 100+ animal species that call it home able to survive and thrive. Donations to UNESCO or the Central Africa World Heritage Initiative help to protect this land for generations to come.

The African Wildlife Foundation focuses on wildlife conservation, land preservation and community empowerment to help protect animals like forest elephants. Donations to AWF furthers critical research on these animals so that we are better equipped to help protect them. They also have a Canines for Conservation program that I find particularly glorious. Highly trained dogs are used to sniff out poachers and contraband. This has boosted the number of arrests and prosecutions made since the scheme was implemented.

If you're searching for a gift for an elephant lover in your life, consider the WWF's Back A Ranger or Adopt An Animal schemes. Or, support one of the many important projects funded by Save The Elephants—a charity committed to boosting education and innovative technology such as geo-fencing. Geo-fencing is an environmentally-friendly way of deterring elephants from trampling crops by using beehives that put them off and make them head in the other direction. This allows elephants and farmers to live side by side harmoniously.

It goes without saying that supporting the ivory trade is a no-no, but if you're traveling to tropical Africa, consider the wider impacts of your tourism beyond only this. Are your choices helping or hindering local communities? How could you make a more ethical choice via your consumption habits? Be mindful, be aware and be a part of the solution in protecting these climate change warriors so they can do their job and create a better world for us all