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THE EFFECTS AND SUCCESS RATES OF DIFFERENT CONSERVATION EFFORTS ON THE VIABILITY OF ELEPHANT AND RHINOCEROS POPULATIONS ON THE AFRICAN CONTINENT

A thesis submitted to

Regis College

The Honors Program

in partial fulfillment of the requirements

for Graduation with Honors

by

Katherine Raper

May 2024

Thesis written by

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Accepted by

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ACKNOWLEDGEMENTS

I offer my thanks and appreciation to the many family members and friends that have supported me throughout this entire thesis writing process. Whether it has been my softball team, my parents, or my fellow honors cohort, this thesis could not have been completed without their willingness to listen to my random elephant and rhinoceros' facts. They have pushed me through and challenged me to complete this full process and I would have been lost without them.

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ABSTRACT

Name: Katherine Raper Major: Biology

THE EFFECTS AND SUCCESS RATES OF DIFFERENT CONSERVATION EFFORTS ON THE VIABILITY OF ELEPHANT AND RHINOCEROS POPULATIONS ON THE AFRICAN CONTINENT

Advisor's Name: Dr. Amy Schreier

Reader's Name: Dr. Tyler Imfeld

Over the past few centuries, there has been a serious decline in elephant and rhinoceros' populations on the African continent. No matter the species, the drop in habitat range and population size has been drastic. This decline has ultimately been caused by the increase in the human population. Whether it be habitat fragmentation, habitat loss, or poaching, humans have had a direct impact on the forest and savanna elephant, and the black and white rhinoceros. While the relationship between these animals and the human population started as one founded in respect and reverence, the human need for land and resources has turned elephants and rhinoceroses into pests and problems. Many current conservation techniques for these species do not take this complex relationship into account. Modern conservation tactics focus strictly on the wellbeing of the animal and do not encourage comradery between the African human populations that interact with these animals daily. Moving forward, it is vital for the success of conservation that these tactics encourage support and involvement of the African communities in elephant and rhinoceros range areas. In non-elephant and rhinoceros range countries, education, funding, and government policy should be used to uplift and inspire the proper conservation tactics involving the African communities in the elephant and rhinoceros range areas.

Introduction: A Crash Course in What This Thesis Is All About

Elephants and rhinoceroses are two very important species to their African environments (Wiltshire & Macdonald, 2022). They are known as keystone species and without them, many other species living in the same areas would lose access to their habitats and resources, thus leading to death (Wiltshire & Macdonald, 2022). On the continent there are two species of both elephant and rhinoceros: the African forest elephant, the African savanna elephant, the African black rhinoceros, and the African white rhinoceros. The African savanna elephant is larger than the African forest elephant, with a geographic range that stretches across twenty-four countries in central to southern Africa (Gobush et al., 2022). The African forest elephant has a geographic range that stretches across twenty countries in central and western Africa (Gobush et al., 2021). As for both species of rhinoceros, they are smaller than the elephant, with the white rhinoceros being larger than the black rhinoceros (Kingdon, 1997; Owen-Smith & Smith, 1973; Emslie & Brooks, 1999). These two rhinoceros' species have a geographic range across thirteen African countries mainly in central and southern Africa (Emslie, 2020). Both the elephant and rhinoceros prefer forests, savannas, shrublands, and grasslands where they can roam and graze on the vegetation that grows in these environments (Gobush et al., 2021; Gobush et al., 2022; San Diego Source).

Both the elephant and rhinoceros have large structures that seem to protrude from their faces. For the elephant, it is their tusks, and for the rhinoceros, it is their horns. While these structures are often used for communication, aggression, and protection, they have also made elephants and rhinoceroses extremely likely to fall victim to poaching (Poaching and Habitat Loss, 2021). Many poachers will hunt these magnificent animals for their tusks and horns to sell them illegally on the black market (Emslie, 2020). In this way, the structures that aid these

animals have also been a cause of their downfall. Furthermore, the habitats that elephants and rhinoceroses depend upon are also prime habitats for human civilization. The open grasslands and savannas are very easy for humans to develop. The elephant and rhinoceros' populations have thus faced a significant loss in habitat, in both number and size, leading to a loss in resources, and an ultimate decrease in population size. With poaching and habitat loss combined, the population of African forest elephants has decreased by more than 86% over a period of 31 years and African savanna elephant populations have decreased by 60% over the last 50 years (Poaching and Habitat Loss, 2021). The white rhinoceros' population currently sits at 10,080 mature individuals, a 24% decline from the last decade, and the black rhinoceros' population currently sits at 3,142 mature individuals, which represents a population decline of 85% over the past three generations (Emslie, 2020; International Rhino Foundation, 2023).

Due to this extensive population decline, and the fact that African elephants and both white and black rhinoceroses are key species in their African environments whose presence is required to improve the viability of differing plant and animal species sharing the habitat with them, the conservation of these two species is vital. The elephant creates paths in dense forests, disperses seeds in their dung (dung that also works as a fertilizer), breaks trees and grasses to allow for new growth, and digs for water in ways that ultimately create watering holes (Hiscox, 2020). The rhinoceros does similar ecosystem engineering, with their wallowing behavior creating natural watering holes, their dung being used for seed dispersal and fertilization, and their dietary preference leading to the creation of grazing lawns that allow for the growth of short grasses that create a safe space for other grazing animals (Wiltshire & Macdonald, 2022).

To limit the elephant and rhinoceros' chances of extinction, and increase the survival of these ecosystem engineers, human involvement has become necessary. Differing conservation

techniques should thus be used and funded to protect these populations and encourage their survival. These techniques, such as park patrolling styles and trophy hunting, should focus on involving African communities and should contain an element that benefits these communities as well, as they are the ones interacting with elephants and rhinoceroses daily. Moving forward, it is vital to listen to the needs and requirements of African communities for different conservation efforts to encourage their involvement in and support of the conservation of elephants and rhinoceroses. However, the involvement of non-elephant and rhinoceros range countries is still a large and critical part of elephant and rhinoceros' conservation. As the path to successful elephant and rhinoceros conservation continues, the role of non-elephant and rhinoceros range countries must shift from being the drivers of conservation, to being the supporters of whatever conservation techniques work best for and are the most beneficial to the African people within elephant and rhinoceros range countries.

Chapter One: A Crash Course in Elephant and Rhinoceros Behavioral Ecology

When visiting the zoo, it is almost guaranteed to hear a child beg to see an elephant (family: Elephantidae). Children become obsessed with wanting to see the large and majestic mammals and will often imitate the trunk of the elephant with their own arm. Although the human arm and elephant trunk are different structures, they complete very similar tasks. Like the arm, elephants can use the trunk to grab objects, pick them up and move them, or to reach for objects the elephant may want that are out of reach (Knight & Shoshani, 1992). Along with using the trunk for movement, elephants use their trunks to search for and bring food into their mouth (Knight & Shoshani, 1992). However, when it comes to diet, elephants completely outdo and overpower humans. On average, the African elephant eats about 165-330 pounds of food each day, which is only 4-6% of their total bodyweight (Eltringham, 1982; Estes, 1991; Jeheskle, 1992). Elephants also spend an average of 16 hours per day eating, with most of that activity taking place in the morning, afternoon, and around midnight (Estes, 1991).

This large intake of food consists of grasses, forbs, and woody vegetation for the grazer-browser African savannah elephants (*Loxodonta africana)*, and leaves, fruits, seeds, branches, and bark for the browser-frugivore African forest elephants *(Loxodonta cyclotis)* (Eltringham, 1982; Estes, 1991; Jeheskle, 1992; Figure 1; Figure 2). Due to a diet that is so high in cellulose, the elephant's colon and expanded caecum contain protozoans and bacteria that produce cellulase to digest these foods by fermentation (Eltringham, 1982; Estes, 1991; Jeheskle, 1992). This digestion process can take up to twelve hours and often only fully digests 34% of the food, with the other 66% leaving the body undigested in the elephant’s feces (Eltringham, 1982; Estes, 1991; Jeheskle, 1992). This long digestion period does not hinder the elephants, as they only sleep 4-5 hours out of the 24 total hours within a day and do not always sleep in a single

continuous session, allowing them to complete different tasks throughout the remaining hours (Estes, 1999; Eltringham, 1982). These sleeping hours are usually from 03:00-07:00, with sleeping and waking synchronized within the herd (Eltringham, 1982). When it comes to water, elephants drink 20-50 gallons of water per day, all of which is taken in about once per day due to the sometimes-limited availability of water in more arid areas (Eltringham, 1982; Estes, 1991; Jeheskle, 1992).

Figures 1-2. African forest elephant (top) and African savanna elephant (bottom) (Gobush et al., 2021; Gobush et al., 2022).

The main reason African elephants require so many nutrients is their large body size. African savannah elephants range from 4,000-6,300 kg for adult males and 2,400-3,500 kg for adult females (San Diego Zoo Global Library staff, 2023). African forest elephants are smaller than the savannah elephants, with the forest elephants having a size range of 2,700-6,000 kg for both adult males and females (San Diego Zoo Global Library staff, 2023). When it comes to length, the average adult elephant from the tip of the trunk to the tip of the tail ranges from about 23-29 feet (San Diego Zoo Global Library staff, 2023). African forest elephants also have a straighter back than their savannah counterparts, who have a more concaved back shape (San Diego Zoo Global Library staff, 2023). Both populations have an extensive home range of 102-5,527 square kilometers that can often overlap and vary between intraspecies groups depending on the quality and quantity of food sources within the region and the age and sex of elephants within the region (Thouless, 1996; Jeheskle, 1992).

Elephant groups consist mainly of a matriarch (head female) and her sisters and offspring, as the male elephants leave the family group in their teens (Eltringham, 1982; Estes, 1991; Estes, 1999). While males are mostly solitary individuals, when it comes to mating season, they have been known to create bachelor groups, with age and lower levels of competition for mates being the main factors in determining which male elephants' group with one another (Goldenberg et al., 2014). Rank within elephant groups is determined by seniority, with the oldest female often being the one in charge (Eltringham, 1982; Estes, 1991; Estes, 1999). This female will also seem to be the “tallest” in the group because other individuals will show submission by flattening their ears, keeping their heads lowered, and moving in backwards and sideways patterns even if they measure out to be the larger animal (Eltringham, 1982; Estes, 1991; Estes, 1999). Many “bond groups” will also form and split off from a group when it

becomes too large but will still maintain a loose association with the group it split from (Eltringham, 1982; Estes, 1991; Estes, 1999). In the African savannah elephant, groups consist of extended family and contain 4-14 individuals while the African forest elephant groups consist of nuclear family and hold 2-4 individuals (Eltringham, 1982; Estes, 1991; Estes, 1999).

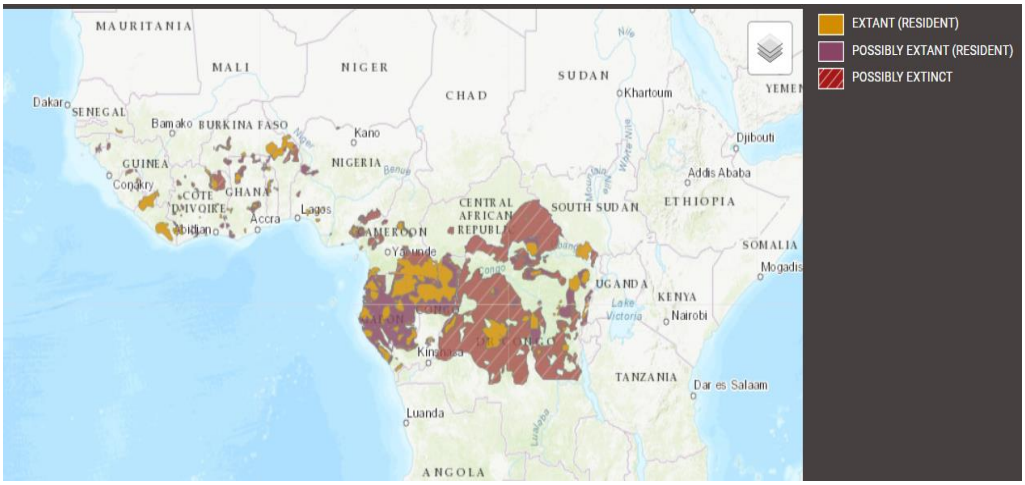
High intensity aggression is very rare between individuals, as many disputes are settled with threat or fight behaviors that include spreading the ears to stand as tall as possible, head nodding or jerking, trunk swishes with trumpeting or air blasts, trunk-wrestling, pushing, and tusking (Eltringham, 1982; Estes, 1991; Estes, 1999). This behavior is not to be confused with play behavior (usually between calves or older females), which is demonstrated by head mounting, charging, shoving, chasing, or "attacking" imaginary enemies (Eltringham, 1982; Estes, 1991; Estes, 1999). Within this play and social interaction, family members will communicate through touch, mainly using their trunks to greet, caress, lead, or intertwine with one another (Eltringham, 1982; Estes, 1991; Estes, 1999). Elephants also use four main sounds in their communication processes. These sounds include rumbling, which is sometimes too low for the human ear to hear and is used in times of comfort and stress, trumpeting, which indicates excitement, squealing, a juvenile distress call, and screaming, an adult distress call that is combined with trumpeting and can also be used to intimidate other individuals within the group (Eltringham, 1982; Estes, 1991; Estes, 1999). African elephants move across home ranges by walking, running, or swimming, and often use their trunks as snorkels to both cross bodies of water and find food on the floors of the aquatic environments (Caloi & Palombo, 1992).

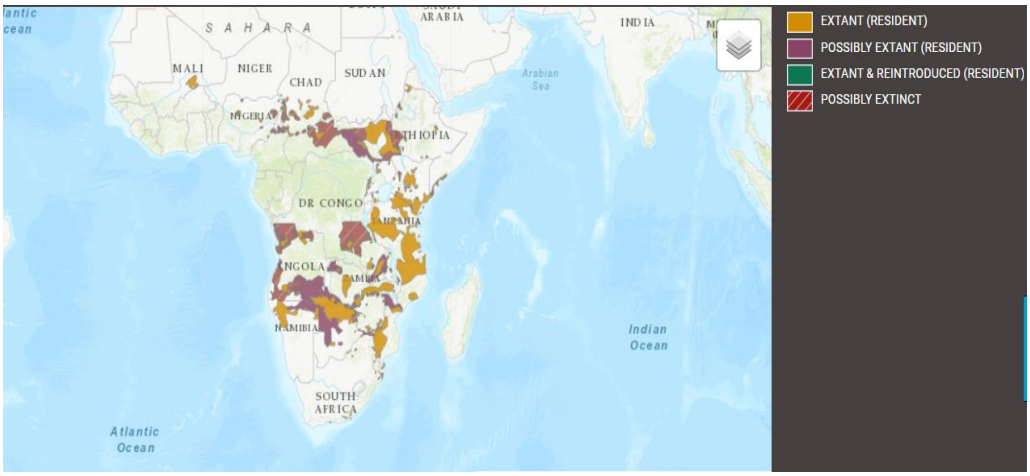
On a more pessimistic note, elephants are also one of the animal families in Africa most negatively affected by human threats such as poaching and habitat loss. There are currently only 415,000 elephants remaining across the continent of Africa when as recently as 1980 there were

around one million (Poaching and Habitat Loss, 2021). This number includes both the African forest and savanna elephant populations. Specifically, the population of African forest elephants has decreased by more than 86% over a period of 31 years and African savanna elephant populations have decreased by 60% over the last 50 years (Poaching and Habitat Loss, 2021). These decreasing numbers have led to the classification of critically endangered for the African forest elephant and endangered for the African savanna elephant, as determined by the International Union for Conservation of Nature's (IUCN) Red List of Threatened Species (Gobush et al., 2021; Gobush et al., 2022). Both species have a decreasing population trend, and continuing declines of mature individuals and their habitats and surrounding areas (Gobush et al., 2021; Gobush et al., 2022).

Of those areas, African forest elephant populations currently stretch across many countries, with a majority of these populations located in central or western Africa and some residing in eastern African nations (Gobush et al., 2021; Figure 3). Specifically, these countries range from western Cameroon to the eastern border of the Democratic Republic of Congo and into Uganda, with the western African populations found to the west of the Cameroon-Nigeria border (Maisels et al., 2013). However, these habitats have become significantly fragmented, with half of the surviving elephant populations residing in Gabon, a fifth of the population residing in the Democratic Republic of the Congo, and the rest spread throughout the remaining western and central African countries (Maisels et al. 2013). These habitats make up an estimated 25% of the historic pre-agricultural range (Maisels et al., 2013). When it comes to the African savanna elephants, they are currently found in twenty-four countries stretching from central to southern Africa (Gobush et al., 2022; Figure 4). Their habitats are also becoming extremely fragmented, and currently make up 15% of the historic pre-agricultural range (Chase et al.,

2016). There is some overlap in the ranges of these species, as both species of elephant prefer forests, savannas, and shrublands, but the African savanna elephant also reside in grasslands, inland wetlands, and deserts (Gobush et al., 2021; Gobush et al., 2022). With this overlap, both species are affected by the creation of wood and pulp plantations, livestock farming and ranching, tourism and recreation areas, human recreational activities, and war/civil unrest within a specific country (Gobush et al., 2021; Gobush et al., 2022). Savanna elephants specifically also fall victim to residential and commercial development, as their open grassland and open savanna habitats are also sustainable environments for the growing human population as well (Gobush et al., 2022). This human involvement with the ecosystems surrounding elephants has become a major reason behind the decline in elephant population sizes, simply adding to the negative effects of poaching and demonstrating different factors underlying elephant habitat loss.





Figures 3-4. The current geographic range of the African forest elephant (top) and the African savanna elephant (bottom) (Gobush et al., 2021; Gobush et al., 2022).

When it comes to poaching specifically, the effect on elephants can be devastating. For example, in the Mid-Zambezi Valley in Zimbabwe, researchers looked at the direct effect of poaching on elephant population decline, proving that 40,000 elephants are poached each year in Africa alone (Ngorima et al., 2022; Figure 5). However, on a more positive note, the researchers discovered that elephant poaching within the Mid-Zambezi Valley has decreased by at least 0.055 elephants per year from 2015 to 2019 (Ngorima et al., 2022). Although this number is small, it is a step in the right direction. Along with this, in the Gorongosa National Park in Mozambique, researchers discovered that a decrease in the tusk gene of female African elephants in this area was directly related to the increase in poaching during the Mozambican Civil War (Campbell-Staton et al., 2021). Both sides of the war were working to gain money for their cause and did so by poaching the elephants and selling their tusks on the ivory trade in the black market. As a result, natural selection favored the individuals without tusks, as they were the elephants most likely to survive (Campbell-Staton et al., 2021).

Figure 5. An African park ranger standing in front of piles of illegally trafficked elephant tusks (CNN, 2019).

Similarly, humans also affect the African rhinoceros (Rhinocerotidae) species, mainly by poaching and habitat shifting or alteration. There are two main species of rhinoceros living on the African continent: the white rhinoceros (*Ceratotherium simum*) and the black rhinoceros (*Diceros bicornis*). Although the rhinoceros does not have any tusks, it does have horns that sit upon the top of its snout that have become major selling points for poachers and others on the black market, placing the rhinoceros on a target list with the elephant for similar reasons (Emslie, 2020; Figure 6). The white rhinoceros resides mainly in grasslands or savannas, avoiding closed forests, thick woody bushes, mesic areas with taller grass, and open plain fields without shade trees, leaving them in open areas as a target for poachers (Kingdon, 2015). This habitat openness, along with the large body size of the white rhinoceros, can increase their general vulnerability. On the other hand, the black rhinoceros tends to avoid canopy forests and open grasslands but does inhabit savannas with a high diversity of woody shrubs and herbaceous plants, making their

home ranges easy to predict for poachers as well (Emslie, 2012; Emslie & Brooks, 1999; Harley et al., 2005).

Figure 6. The white rhinoceros (Emslie, 2020).

These geographic ranges, although diverse, consist of nine main African countries for the white rhinoceros (Figure 7). This includes South Africa, where most of the white rhinoceros' population now resides, Botswana, Eswatini, Namibia, Uganda, and Zimbabwe, where the white rhinoceros is both resident and has been reintroduced, Mozambique, where the white rhinoceros is extant and has been reintroduced, and finally Kenya and Zambia, where the white rhinoceros is extant and has gone through assisted colonization (Emslie, 2020). For the black rhinoceros, the overall population size may be smaller, but there is an increased number of resident countries when compared to the white rhinoceros due to different conservation efforts and attempts to save the species. These countries include Angola, Kenya, Mozambique, Namibia, South Africa, Tanzania, and Zimbabwe, with populations also being extant and reintroduced in Botswana, Eswatini, Malawi, Rwanda, and Zambia (Emslie, 2020; Figure 8).

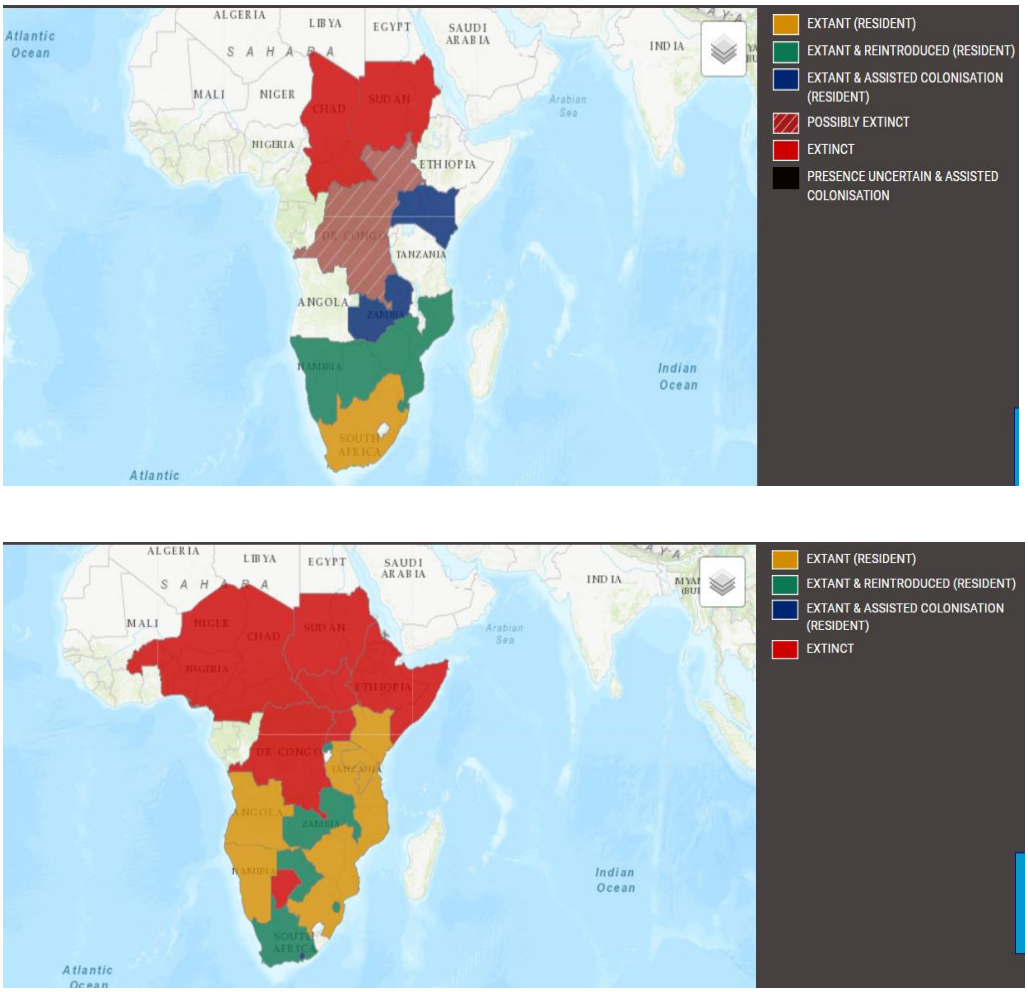


Figure 7-8. The geographic range of the white rhinoceros (top) and the black rhinoceros (bottom) (Emslie, 2020; Emslie, 2020).

The male white rhinoceros weighs an average of 2,300 kg and females weigh 1,800 kg on average (Kingdon, 1997; Owen-Smith & Smith, 1973). They also have an average body length of 12-14 feet, with an additional three feet added to that for their tails (Kingdon, 1997; Owen-Smith & Smith, 1973). The black rhinoceros, however, is slightly smaller than the white rhinoceros, with an average body size of 1,000-1,800 kg for both males and females (Kingdon, 1997; Emslie & Brooks, 1999; Figure 9). The black rhinoceros has an average length of 9.5-12.3 feet, with only 2.0-2.3 feet added on for their tails (Kingdon, 1997; Emslie & Brooks, 1999).

Within their given habitats, black rhinoceroses feed mainly on and favor leaves, twigs, and branches, with grass consumption usually extremely low and only experiencing the occasional increase depending on season, amount of rainfall, and the availability and diversity of the food sources they favor (Kingdon, 1997; Merz, 1999). White rhinoceroses on the other hand, feed almost exclusively on short grasses, pulling them with the lips to clip the grass and gather it into the mouth (Owen-Smith & Smith, 1973). The white rhinoceros drinks water every 1-4 days in the dry season and the black rhinoceros can go up to five days without water while remaining within a day's travel to their water source when only dry forage is available (Owen-Smith & Smith, 1973).

For the black rhinoceros, proximity to food resources and water sources allows them to rest for most of their day, especially during the hours of 10:00 to 15:00, when the hottest temperatures occur (Estes, 1991; Goddard, 1967; Merz, 1999; Schenkel & Schenkel-Hulliger, 1969). Most feeding occurs right before or right after this time with most travel to water sources completed in the late afternoon (Estes, 1991; Goddard, 1967; Merz, 1999; Schenkel & Schenkel-Hulliger, 1969). The black rhinoceros also partakes in wallowing behavior. Wallowing is the act of standing or moving through mud pools or dust to reduce body temperature, protect the rhinoceros' skin from the sun, and protect the rhinoceros against ectoparasites or other bugs (Estes, 1991; Goddard, 1967; Merz, 1999; Schenkel & Schenkel-Hulliger, 1969). Interestingly, the white rhinoceros will only wallow in mud or shallow water, not dust (Owen-Smith & Smith, 1973).

Figure 9. The black rhinoceros (AnimalSpot, 2024).

The black rhinoceros does not tend to form large social groups, but individuals will often congregate in smaller groups for short periods of time (Estes, 1991; Goddard, 1967; Merz, 1999; Schenkel & Schenkel-Hulliger, 1969). Females with calves often socialize with other adults, forming the main and often only associations within a group between adults, while adult males do not make associations but will tolerate the presence of other individuals (Estes, 1991; Goddard, 1967; Merz, 1999; Schenkel & Schenkel-Hulliger, 1969). Black rhinoceroses exhibit little overall aggression but are territorial with home ranges that can range from 3.9-133 km^2 in size, with their main aggressive behaviors including horn-jousting and head pushing (Estes, 1991; Goddard, 1967; Merz, 1999; Schenkel & Schenkel-Hulliger, 1969). Black rhinoceroses have poor eyesight and therefore use scent marking as one of their main sources of communication and territory identification (Estes, 1991; Goddard, 1967; Merz, 1999; Schenkel & Schenkel-Hulliger, 1969). They also make many different sounds in response to different situations, including long and short snorts, long or short breaths, or squeals and screams, with the length signifying the amount of danger or threat that may be near (Merz, 1999). When it comes

to interspecies relationships, the black rhinoceros identifies humans as a threat and will often perform defensive or aggressive behaviors in combination with alerting sounds if a human scent is picked up (Estes, 1991; Goddard, 1967; Merz, 1999; Schenkel & Schenkel-Hulliger, 1969).

The white rhinoceros is active both day and night, with most activity occurring in the early morning and late afternoon (Owen-Smith & Smith, 1973). A significant amount of feeding occurs during this time as well. White rhinoceroses are least active during the mid-day hours and will alternate between feeding and resting during nighttime hours (Owen-Smith & Smith, 1973). Resting periods often last 1.5-3 hours while sleeping periods can last up to ten hours (Owen-Smith & Smith, 1973). These periods can also vary based on season and weather, with temperature and cloud cover affecting how long and how often they rest and sleep (Owen-Smith & Smith, 1973). White rhinoceroses prefer bare ground that is under shade and rest in a lying down position as opposed to standing (Owen-Smith & Smith, 1973). For travelling, the white rhinoceros will move along established trails and will move as far as 5 km to gain access to water (Owen-Smith & Smith, 1973). The white rhinoceros travels less commonly to access resting areas and mainly uses scent markings to create, find, and follow trails (Owen-Smith & Smith, 1973).

Female white rhinoceroses have a core home range of 3-9 km^2 and male white rhinoceroses have a core home range of 0.75-4.2 km^2 (Rachlow et al., 1999). Many factors can affect these home ranges including both season and population density. As the dry season continues, the white rhinoceros travels farther and for longer periods of time to search for and utilize specific water sources (Owen-Smith & Smith, 1973). As population density increases, and more rhinoceroses are present in a given area, the home range size of a rhinoceros increases as well (Pienaar, 1994). Female and male home ranges can overlap but male home ranges will not

overlap with one another (Rachlow et al., 1999). So, while females do not defend their own territories, males are highly territorial, as opposed to the calmer black rhinoceros (Rachlow et al., 1999). White rhinoceroses will use defecation or “dung-piles” and urination to mark territories and indicate territorial borders (Rachlow et al., 1999). The borders of male territories are marked with urine and there is always the occasional non-territorial male passing through a territorial male's habitat, usually when looking for food or water resources (Rachlow et al., 1999). Many water sources are often located at the edges of multiple territories, allowing many different white rhinoceros individuals to access water and thus causing the occasional male to enter another male's territory (Rachlow et al., 1999).

The white rhinoceros' social structure is made up of four main groups: the adult female with its own calf, an adult female with unrelated adolescents, groups of adolescents, and solitary males that will pair up with an adult female (Pienaar, 1994). The final pairing listed typically lasts about a day for subordinate males and can last up to 2-3 weeks for dominant males (Pienaar, 1994). Many of these groups also coalesce while foraging or resting (Pienaar, 1994). When it comes to aggression between groups, the white rhinoceros is typically less aggressive and temperamental than the black rhinoceros, even though the white rhinoceros is more territorial (Owen-Smith & Smith, 1973; Pienaar, 1994; Rachlow et al., 1999). This difference comes into play with females, as the white rhinoceros does not typically exhibit any aggression between males and females except for when the female is in estrus, which includes the male prohibiting the female from leaving its territory (Owen-Smith & Smith, 1973; Pienaar, 1994; Rachlow et al., 1999). Playful behavior occurs specifically within calves, who participate in both solitary and group play behaviors while their mothers watch close by (Owen-Smith & Smith, 1973; Pienaar, 1994; Rachlow et al., 1999). These behaviors include prancing and running back and forth for

solitary play and gentle horn jousting for group play (Owen-Smith & Smith, 1973; Pienaar, 1994; Rachlow et al., 1999).

The white rhinoceros also uses different sounds and vocalizations as a way to communicate between individuals. Many white rhinoceroses use confrontational signals, including horn prodding, rubbing, or clashing during direct interactions and charging to intimidate in non-direct interactions (Owen-Smith & Smith, 1973; Pienaar, 1994; Rachlow et al., 1999). Charging is performed mainly by one territorial male towards another (Owen-Smith & Smith, 1973; Pienaar, 1994; Rachlow et al., 1999). Vocalizations include snorts and snarls, which they use as a cautionary signal to other rhinoceros individuals or other species to keep away, pants, hics, and squeals, which communicate messages between individuals with a positive relationship (such as mothers and calves or males and receptive females), and shrieks, whines, and gasps, all of which indicate fear or distress (Owen-Smith & Smith, 1973; Pienaar, 1994; Rachlow et al., 1999).

The white rhinoceros is fairly sedentary and does not disperse rapidly (Owen-Smith & Smith, 1973). They have a walking speed of 3.0-3.8 km/hr when walking towards a water source, a trotting speed of 29 km/hr to escape a threat, and a charge speed of 40 km/hr that males utilize when provoked by another male (Owen-Smith & Smith, 1973; Pienaar, 1994; Rachlow et al., 1999). As the speed of the rhinoceros increases, the ability to sustain the given speed for long periods of time decreases (Owen-Smith & Smith, 1973; Pienaar, 1994; Rachlow et al., 1999).

Even with the diverse habitat ranges, communication techniques, warnings, and the ability to intimidate by running at high speeds, the African rhinoceros' populations have been shifting at an alarming rate. The white rhinoceros' population currently sits at 10,080 mature

individuals, with an overall population trend that is decreasing, classifying them as near threatened on the International Union of the Conservation of Nature's Red List of Threatened Species (Emslie 2020). White rhinoceroses are also experiencing a continuing decline in habitat ranges within the countries they reside in, whether that be total range distance or number of ranges within that given area (Emslie, 2020). Their black rhinoceros' counterparts, however, are currently classified as critically endangered with only 3,142 mature individuals but do have an overall population trend that is increasing and are not experiencing the same decline in habitat ranges (Emslie, 2020).

From the 2000's to now there has been a large increase in rhinoceros poaching (Anderson & Jooste, 2014; Figure 10). From 2007-2014, there was a major increase in the hunting and killing of white and black rhinoceroses in hopes of making a personal profit (Emslie, 2020). The majority of this was due to the increasing number of trades within the black market, allowing poachers to make immense amounts of money from whatever body parts they could acquire. Some poachers would even go to the extent of participating in "Pseudo-Hunting," where they would try and pass as sport-hunting companies to kill the rhinoceros but would then sell the rhinoceros horn on the black market (Emslie, 2020). At one point, this type of poaching made up 18% of illegal horn production globally (Emslie et al., 2012). Currently, of the total amount of rhinoceros horn sold on the illegal market, 95% is obtained through the illegal poaching of white and black rhinoceroses in Africa, and the main area of purchase is southeast Asia, with the main uses for the horns being ornamental and inclusion in traditional Chinese medicines (Emslie, 2020). Many rhinoceros' horns also make up intricate and expensive items such as bowls, bangles, and the handles of ceremonial daggers, with the horns becoming the main tool for carving these items in countries outside of Africa (Emslie, 2020).

Figure 10. A poacher cutting rhinoceros' horn off a dead rhinoceros (BBC News, 2013).

With the rise of the COVID-19 pandemic, there was also a decrease in tourism in African countries. Prior to the pandemic, law enforcement, tourists, hunters with permits, and their guides were some of the main frequenters of national parks and open areas where these animals reside. Without as many of them in place, poachers were able to roam more freely and attack specific species with ease (Roth, 2020). In the northern province of South Africa, just days after the country shut down due to COVID-19, nine rhinoceros were poached, and in Botswana six rhinoceros were poached just days after that country shut down (Roth, 2020). Both the white and black rhinoceros populations reside in central and southern African countries, most of which contain savanna, shrubland, and grassland habitats (Emslie, 2020). These spaces are mostly open areas, making rhinoceroses easier to track, hunt, and kill. Furthermore, civil wars within the Democratic Republic of the Congo and South Sudan have had devasting effects on the white rhinoceros' populations as both sides of each war would use rhinoceros horn to fund their specific efforts (Emslie, 2020). Increased poaching within the 1990's and then again between 2003-2005 have ultimately led to the extinction of the white rhinoceros in the Democratic

Republic of the Congo and the assumed extinction of the white rhinoceros in South Sudan as neither country has found any evidence of these populations within their borders since 2007 (Emslie, 2020).

Both the elephant and the rhinoceros are known as keystone species within their environments, specifically as mega-herbivores that help shape their ecosystems, thus making the loss of the elephant or rhinoceros detrimental to their habitats' ability to sustain other species (Wiltshire & Macdonald, 2022). They are also both known as ecosystem engineers, meaning they significantly influence their environment by creating, modifying, and maintaining given habitats. For example, the elephant is one of the main consumers of woody vegetation (Hiscox, 2020). This ultimately facilitates a fast and shallow nutrient cycle, allowing for higher productivity and diversity of both plant and animal species than would be seen otherwise (Hiscox, 2020). Elephants are also major sources of seed dispersal within different ecosystems as they will ingest the seeds in one area and then release them in another (Hiscox, 2020). With the decreasing elephant populations, several plant species have either gone extinct or have decreased in population size due to the inability to spread their seeds and create offspring, as they had adapted to dispersal by the elephant population (Hiscox, 2020). The large size of elephants also can lead to the destruction of trees and removal of branches, which creates habitats for smaller species such as lizards or bugs (Hiscox, 2020). Finally, elephants can create large paths and trails within forests and grasslands that allow for passage by other species, giving the smaller species access to new resources and the ability to travel between habitats (Hiscox, 2020).

The rhinoceros is of similar importance to the elephant, as it partakes in many of the same activities. Specifically, the rhinoceros is a major geo-former, meaning they fundamentally reshape the land around them over time (Wiltshire & Macdonald, 2022). This is completed

through the act of wallowing, as rolling around in mud works to create natural waterholes and helps to keep existing waterholes open (Wiltshire & Macdonald, 2022). Along with this, the rhinoceros helps to spread nutrients and provide the basis of complex food chains by essentially consuming a large amount of vegetation that then helps the rhinoceros to deposit more than 20 kg of dung per day (Wiltshire & Macdonald, 2022). This depositing of the dung both fertilizes the soil and provides habitats to several bugs whose eggs are then used as nutrients for small carnivores and omnivores (Wiltshire & Macdonald, 2022). Finally, the rhinoceros modifies vegetation by establishing and maintaining short grass lawns (Wiltshire & Macdonald, 2022). Not only does this create a suitable habitat for short annual grass species that often cannot survive in wooded or long-grass ecosystems, but it also creates a safe space for many different herbivorous species to feed without the fear of not being able to see their predators (Wiltshire & Macdonald, 2022).

Even with the extreme importance of the elephant and rhinoceros within their own habitats, poaching and habitat loss have taken a toll on their overall population numbers. The attitude towards these species, although positive in many areas, can also be negative and malicious, as the large body size of both species is often destructive in nature. The differences in these views have led to conflict between African citizens (who have to deal with these species every day) and their governments (who work to protect these species). However, the overall behavioral ecology of both elephants and rhinoceroses proves their importance to their surrounding environments and shows how influential both species are. Thus, it is important to protect the two species and work to create a harmony between the African people and the animals living among them.

Chapter Two: A Crash Course in the Complex Relationship Between Humans and Animals That Are Ten Times Their Size

The complex relationship between humans and elephants has lasted for centuries. Many cultures see elephants as a symbol of strength and have even named several plants and animals after them due to their shape, size, and strength (including elephant garlic and elephant pepper, and elephant sharks and elephant seals) (Easa, 2019). Even dating back to paleolithic times there has been an element of human involvement with elephants (Barkai, 2016). For instance, the Neanderthals used elephants as a source of sustenance, with a large part of the elephant body supplying the main portion of the Neanderthal diet (Barkai, 2016). Neanderthals utilized elephant bone as a tool to build their homes, and, like humans today, Neanderthals used mammoth and elephant ivory to create symbolic imagery items such as figurines and statuettes (Barkai, 2016). However, there was also a more complicated element to this relationship. While the Neanderthals saw the elephant as a food source, they also respected elephants as a "sister species," resembling humans in physical, social, behavioral, and perceptional aspects, illustrated in the sharing of their habitats and both the dependence on and resemblance of human society to the elephant social groups (Barkai, 2016).

Furthermore, in many Asian cultures and religions, the elephant is central to specific teachings and myths. Take, for example, the legend of Queen Maya's Dream in the Buddhist religion. After being childless for many years, Queen Maya had a dream of a white elephant with a lotus on its head entering her womb, and soon after this dream, she gave birth to Siddhartha, who grew up to become Buddha (Easa, 2019). From this, the elephant (especially the white elephant), became a symbol of both power and fertility to those practicing the Buddhist religion (Easa, 2019). However, in opposition to this, the Siamese rulers (modern day Thailand) would

often gift a white elephant to those they found bothersome, as it was an admired animal that was also hard to take care of and often impossible to sell or give away, leading to coining of the white elephant gift exchange as a "white elephant" because friends will often exchange comical or useless gifts as a joke (Bullen, 2011). More comparably to Buddhism, the elephant is also loved by those who practice Hinduism, as many of their beloved gods are depicted with elephants at their sides (Easa, 2019). Lakshmi, the Hindu goddess of wealth and beauty, is typically pictured flanked by two elephants who honor her by pouring water over her head with their trunks (Easa, 2019). Ganesha, another beloved Hindu deity, has an elephant head instead of a human head (Easa, 2019; Figure 11).

Figure 11. Carving of Ganesha, the Hindu god of prosperity and wisdom, on the external wall of South Indian temple in Kerala, India (Britannica, 2024).

Many African religions considered elephants to be sacred animals that symbolized spiritual purity, wisdom, and power (Hajarashali, 2023). For these religions, followers often used elephant symbolism during rituals, as the people within these indigenous communities believed elephants had divine qualities and were ancestral spirits that linked the living with their ancestors (Hajarashali, 2023). Due to the elephant's large stature, the elephant has inspired many African artists for sculptures, paintings, intricate carvings, and even jewelry, with the elephant often pictured as the central theme (Hajarashani, 2023). For many African cultures, similarly to the African religions, the elephant was a symbol of strength, fertility, and communal harmony, and was thus portrayed through elaborate dances and performances during traditional festivals and ceremonies to not only celebrate the relationship between human and elephant, but to emphasize and encourage good relationships between a culture's people (Hajarashali, 2023).

Elephants have also historically served as both tools and weapons in wars. In the areas of ancient Greece, Rome, Northern Africa, and India, the elephant's immense amount of strength was used to carry heavy materials in and out of war zones while also transporting both supplies and people to different war areas (Easa, 2019; Cartwright, 2016). While in battle, elephants wore heavy armor and were often depicted as crushing the enemy underneath their feet, with their size and stature being used as a physical and psychological weapon (Easa, 2019). In many historical images and descriptions of the war between King Porus and Alexander the Great along the Indus River, elephants fill the fleet of King Porus and were battle-trained and prepared to fight against the Macedonian army (Easa, 2019) Hannibal, a Carthaginian general, brought elephants on his

journey across the Alps to attack Rome (O'bryhim, 1991). The elephants crossed treacherous mountain ranges and worked as both a transportation device and weapon (O'bryhim, 1991).

When it comes to the rhinoceros, a similar relationship with humans has existed throughout history. While what is known of this history does not extend as far back as the history between humans and elephants, it is still necessary to understand the complex relationship that exists today. Much of this relationship is first evident in southern Africa's indigenous farming communities, with the first representatives of these communities arriving south of the Zambezi River about 1,800 years ago (Boeyens & Van der Ryst, 2014). Like the elephant, the rhinoceros was valued for its strength, with many of its behavioral attributes used as a comparison to the chiefs of these early African societies (Boeyens & Van der Ryst, 2014). For example, the dangerous behavior, unpredictability, power, and solitary lives of the black rhinoceros were shared by many of the leaders of the ancient city of Mapungubwe and Great Zimbabwe (Boeyens & Van der Ryst, 2014).

Along with the symbol of leadership, the aggression of the black rhinoceros was used as a metaphor for the ferociousness of early fighting rituals between distinguished members of the Shona tribes, which determined the most valiant and accomplished societal members (Boeyens & Van der Ryst, 2014). The white rhinoceros, being slightly less intense in behavior, was also a symbol of leadership, with African chiefs valuing its more sociable and territorial behavioral aspects instead of its aggression (Boeyens & Van der Ryst, 2014). Newly appointed chiefs were also expected to perform a rhinoceros dance (similar to the stamping act of a rhinoceros) once officially appointed and brought into their specific royal courts. Chiefs could also use this performance as a rain-dance, as the chiefs were considered responsible for the wellbeing of their

people and the fertility of their lands and were expected to utilize their rhinoceros-like power to keep their people and crops safe from harm (Boeyens & Van der Ryst, 2014).

In other African communities, the rhinoceros was considered a rain-animal, or an animal that would be captured, killed, and sacrificed to bring rain. This belief ultimately led to the use of rhinoceros bone in rainmaking rituals, as many of these communities would relate the rhinoceros's bone to the power of past leaders and would use the bone to call on this power to bring rain to their farming areas (Boeyens & Van der Ryst, 2014). Specifically, the more docile white rhinoceros' bone would be used when a softer rain was needed, while the more aggressive and ill-tempered black rhinoceros' bone would be used when a harder rain or thunderstorm was needed (Boeyens & Van der Ryst, 2014). Many African farming communities also associated the stomping out of fires by black rhinoceroses as a metaphor for the cooling of heat. This association led to the use of black rhinoceros' leg and foot bone in rain rituals to alleviate droughts, as those were the body parts most directly associated with the action of stomping out the fires and were thought to be a good symbol for the cooling of the heat brought on by a drought (Boeyens & Van der Ryst, 2014).

The use of rhinoceros' bone in rain rituals was not the only way these African communities would use the rhinoceros' body. It is important to note that these communities did not consider the rhinoceros to be a totem, which is an animal that is venerated by a given community and is not killed unless absolutely necessary (Boeyens & Van der Ryst, 2014). Species with totem status differed across African communities and included other large animals like the elephant, hippopotamus, lion, eland, and buffalo (Boeyens & Van der Ryst, 2014). Thus, with the use of the rhinoceros' bone in the rain rituals and as a symbol of chief status, the rhinoceros was, while still being considered an important animal, not held as highly as other

African species. Although the presence of the rhinoceros was valued and the rhinoceros had many symbols throughout African culture, it was never declared a totem and could thus be killed and either eaten or utilized in other ways (Boeyens & Van der Ryst, 2014).

Rhinoceros meat was used to feed families and often the breast meat of the rhinoceros would be given to the chief as a gift (Boeyens & Van der Ryst, 2014). Along with the use in rain rituals, rhinoceros' bone, horn, and skin made up many fashion ornaments and weapons in these African areas (Boeyens & Van der Ryst, 2014). In fact, many southern African cultures had rhinoceros horn clubs that were reserved strictly for the use of the chief of that given tribe as a symbol of both leadership and power, with the epithet “rhinoceros' horn” serving as an honorific title for the chief (Boeyens & Van der Ryst, 2014; Figure 12). Many chiefs and successful military generals would use the front horn of a rhinoceros as both a weapon and symbol of their own success, with the cutting action of the horn also symbolizing the final authority of the chief (Boeyens & Van der Ryst, 2014). Finally, it was also common to present a cut-off rhinoceros head when a defiant leader or subject chief came into power, and the people of the tribe wanted to convey the message that their subordination would not be tolerated (Boeyens & Van der Ryst, 2014).

Figure 12. Rhinoceros horn club (British Antique Dealers Association, 2024).

Communities within both Africa and Asia had direct relationships with the elephant and rhinoceros, but outside of Africa, and specifically in Europe, elephants and rhinoceroses were an exotic luxury (Cartwright, 2016). Although initial expenses went towards acquiring elephants from both Asia and Africa, mainly for warfare purposes, most costs were wasted on the training of both the elephant and its rider, making the use of elephants for warfare in the Mediterranean countries extremely difficult and ultimately pointless (Cartwright, 2016). The inability to use elephants in war led to the use of these animals in other less aggressive and more public ways (Cartwright, 2016). Over time, Mediterranean countries began to use elephants, rhinoceroses, and other wild animals in more peace-time activities, such as spectacles in Roman arenas, circuses for the public, and even parades (Cartwright, 2016; Hughes, 2003). Many elephants were also gifted to neighboring states by the Roman Empire to protect and improve diplomatic relations (Cartwright, 2016).

In many Greco-Roman cultures, sacred groves, or temples for the gods, included a multitude of wild animals (Hughes, 2003). Due to this inclusion, the religious and civil ceremonies of the time would often feature the sacrifice of wild animals (acquired from other nations) as a gift to the respective god (Hughes, 2003). Outside of godly usage, many rulers or affluent individuals would set aside a bit of land surrounded by a wall known as a "paradise" (Hughes, 2003). This paradise would house many non-native plant and animal species that the ruler would use for recreational activities, such as hunting or fishing, with the exotic animals being the main target (Hughes, 2003). As mentioned previously, many exotic animals including the elephant and rhinoceros, were used in Roman arena shows (also known as circuses) and were essentially hunted and killed to show the brute strength of the hunter in the arena and provide entertainment for those watching in the seats above (Hughes, 2003).

Although the relationship between humans and both elephants and rhinoceros was one of respect and admiration, there has been a shift in the perceptions of these two species by many African people. As discussed in the previous chapter, the main threats to both the elephant and rhinoceros are poaching and habitat loss (Gobush et al., 2021; Gobush et al., 2022; Emslie, 2020), both of which are driven primarily by humans. As the human population has grown, more space is required to provide shelter for humans, leading to more development and urban areas. The elephant and rhinoceros unfortunately utilize the same open grasslands and bushy habitats that are perfect land to develop and support a new and growing human community. Along with this, the poaching of both the elephant and rhinoceros to sell their tusks and horns has become a huge source of personal profit, especially in times of civil unrest (Campbell-Staton et al., 2021; Emslie, 2020). To raise money for themselves or for whatever organization they support, poachers illegally hunt these two species and leave them for dead (Campbell-Staton et al., 2021).

In contrast to earlier civilizations, not all the elephant or rhinoceros will be used, with many carcasses left to decompose or be eaten by other carnivorous species.

In non-elephant and rhinoceros range countries, the relationship between them and humans is a little different. These areas do not have native wild elephants or rhinoceroses roaming around and people must visit zoos to witness the strength, power, and wonder of these species. In many of these areas, such as here in the United States, the main pests people must worry about entering their backyard are wasps, snakes, or coyotes, all of which could not tear down a house even if they tried. While these, and other native species, can cause damage, none of it is to the same scale as the elephant or rhinoceros. Due to this, for human populations that do not interact with the elephant or rhinoceros directly, the elephant and rhinoceros are generally known as majestic creatures whose lives should be protected. The people outside of African countries simply see the declining population numbers and do not always understand why these declines are happening.

This difference in perception between people in range versus non-range countries and the lack of information in the latter, has ultimately led to a stark contrast between the emotions expressed by those directly interacting with these two species and those that do not. While the human-animal relationship was once positive and respectful, certain negative emotions like fear, frustration, and general lack of knowledge have added tension to the current relationship between humans and elephants. In 2022, researchers analyzed the use of the social media app Twitter to determine the attitudes surrounding conversations about elephant conservation (Hammond, Dickman, & Biggs, 2022). The researchers examined the exact conversations about elephant conservation and the specific benefits and threats that these conversations could possibly cause (Hammond, Dickman, & Biggs, 2022). They also investigated the willingness of individuals to

repost, donate, or share specific posts or links that would increase the amount of revenue and support going into elephant conservation (Hammond, Dickman, & Biggs, 2022). Of the 3749 relevant tweets from January 2019 to December 2019, 23% discussed concerns for elephant welfare and 19% covered general conservation messages (including general talk of population decline, general conservation news that did not specify any threats to elephants, and elephant facts) (Hammond, Dickman, & Biggs, 2022). One of the most shocking statistics, however, is that 72% of the tweets came from non-elephant range countries and only 14% of the tweets came from African elephant range countries (Hammond, Dickman, & Biggs, 2022). This statistic alone is extremely concerning, as it limits discussion of the real threats to elephants. For example, habitat loss, one of the main reasons for elephant population decline, was discussed in <1% of tweets (Hammond, Dickman, & Biggs, 2022). Along with this, most of the tweets from African elephant range countries discussed issues like human-elephant conflict, poaching, and the promotion of elephant tourism, while most of the tweets from non-elephant range countries pushed issues of elephant welfare and trophy hunting, keeping the real problems between elephants and humans from being heard (Hammond, Dickman, & Biggs, 2022). Based off these tweets alone, there is an observable difference between the concerns of populations that directly interact with elephants and those that do not. Moving forward, it is vital for policymakers and government officials to listen to those directly affected by elephants first, and the public opinion second.

Take, for example, a study completed in Zimbabwe in 2014. In the areas surrounding Nyatana Game Park, researchers surveyed citizens to determine how they felt about the elephant populations in the game park (Taruvinga & Mushunje, 2014). Overall, there was an extremely negative attitude towards the elephants in this area. The communities were extremely concerned

about the crop damage and injury to livestock that would occur because of the elephant populations; they felt as if they were more likely to lose crops and livestock with the elephants around (Taruvinga & Mushunje, 2014). Along with this, they expressed their concerns over the limited amount of revenue that came from the elephant population along with the improper distribution of that revenue to the people in the surrounding communities, as most of the money generated went straight to Safari Operators and Councils (Taruvinga & Mushunje, 2014). There was also an extremely negative response to the elephants regarding social stability within these communities (Taruvinga & Mushunje, 2014). Many of the African citizens felt that elephants caused extreme social instability due to fear of wild animals and were often worried that the elephants would cause harm or death to the people in the areas surrounding the park (Taruvinga & Mushunje, 2014).

When it comes to rhinoceros poaching, community attitudes in specific African countries and villages have had a major effect on conservation work. In a case study of the Hlane Royal National Park in Eswatini, researchers discovered that the individuals living in this community were more likely to help poachers in exchange for money from the poachers themselves or for a portion of the earnings they would receive instead of supporting and encouraging the conservation of native species (Mamba et al., 2020). Of the total respondents, 20% claimed that they would be willing to aid a poacher to gain some sort of monetary benefit (Mamba et al., 2020). However, some of these citizens were willing to give up information about poachers they had been in contact with or with poachers that had been trying to get in contact with them (Mamba et al., 2020). Many of the older participants of the study (aged over 30), had extremely bitter reactions towards the existence of the Hlane Royal National Park, feeling that they were excluded from the park and were restricted from using and enjoying the natural resources that the

park could provide (Mamba et al., 2020). Yet, even with these sentiments, 56% of respondents felt extremely passionate about wildlife in their area, and a total of 88% of respondents felt as though the prevention of rhinoceros poaching is of paramount importance (Mamba et al., 2020). While the results often yielded contrasting responses, this study helps show the many different aspects that can play into the success or failure of wildlife conservation, with most of it being based on the feelings and moral compasses of the human population.

In another study, researchers surveyed South Africa's private sector to discover the attitudes of rhinoceros owners towards the horn trade. In this case, rhinoceros' owners are private ranch owners that house and protect rhinoceros individuals on their land. Overall, most rhinoceros' owners who responded to the study had a serious lack of trust in national and provincial environmental departments, with 51.8% of respondents feeling that involvement by the Department of Environmental Affairs would definitely increase the risk of poaching as a whole and 25.9% of respondents feeling it would probably increase the risk of poaching as a whole (Rubino & Pienaar, 2020). Along with this, the rhinoceroses' owners must spend an extreme amount of money on rhinoceros' ownership, with 273,600 USD per month spent on security costs and 220,400 USD spent on management total across the 33 rhinoceros owners surveyed (Rubino & Pienaar, 2020). Individually, each owner spends an average of 8,290 USD on security and 6,680 USD on management per month (Rubino & Pienaar, 2020). These expenditures include salaries, accommodation, and equipment for guards for the security costs, and feed, dehorning, insurance, management plan/consulting, and permit costs for the management costs (Rubino & Pienaar, 2020). Finally, due to these costs, the rhinoceros' owners were in strong agreement with legalizing the global rhinoceros horn trade (with 81.9% of respondents in favor of the legalization) as it would help accommodate the costs of owning a

rhinoceros while also limiting the dangers that can come with it (Rubino & Pienaar, 2020). The rhinoceros' owners felt that it would be acceptable for the legalization of the rhinoceros horn trade to lead to intensive rhinoceros farming (62.6% of respondents strongly agreed with this), and that there should be a minimum land size requirement for participation in the horn trade market to incentivize habitat conservation (36.3% of respondents agreed with this notion and 42.7% strongly agreed) (Rubino & Pienaar, 2020).

Along with polling African residents, it is important to examine the overall emotions people have towards specific animal species from all areas of the world and their willingness to work for their restoration. A big reason the human population is often so unwilling to support or get behind the idea of saving a specific species is due to the fear that is associated with them (Notaro et al., 2022). Certain preferences due to the "cuteness" or "fluffiness" of an animal have caused serious differences in the amount of effort or revenue placed into the conservation of scarier species, such as large predatory carnivores, leaving the scarier animals neglected (Notaro et al., 2022). For example, increased media coverage over the dangers presented by large carnivores, like bears or wolves, has increased the levels of fear generated when seeing these animals (Notaro et al., 2022). To test the hypothesized increase in fear based off species type and species portrayal, researchers showed participants images of wolves, lynxes, and salamanders (Figures 13-15). The lynx and salamander only had one treatment group for each species while the wolf had two: one fear treatment featuring a picture of a snarling wolf and one assurance treatment featuring a picture of a calm wolf. The researchers then measured the levels of fear participants associated with these animals by rating their fear levels on a scale of 0-6, with 0 representing no fear at all and 6 representing lots of fear (Notaro et al., 2022). Not only is the fear reported much higher for wolves than for salamanders and lynxes, the fear-treated wolf

group had higher fear values (ranging from 4-6) than the assurance-treated wolf group (who had lower fear values ranging from 0-3, with a 0 score in excess of 40% of the time) (Notaro et al., 2022).

Figures 13-15. A gray wolf (top left), a lynx (top right), and a salamander (bottom) as described in Notaro et al. (2022) (Peiker, 2000; About Animals, 2024; San Diego Zoo, 2024).

From these results, the respondents were then asked to rate their willingness to pay (WTP) for the conservation of these species based off the population size of the species. The respondents had an increasing WTP for population sizes up to 50 specimens in size, and a decreasing WTP for any population size over 50 specimens for all the species in question (Notaro et al., 2022). When it came to the assured versus fear treated wolf groups, the WTP for the fear treated group was significantly lower than the WTP for the assured treatment group (Notaro et al., 2022). These results demonstrate the effect that human emotions can have on the willingness to support the survival of a given species. As the negative connotations and fear

surrounding a species increases, the less likely a group of people is to want to help that species grow.

For several centuries, many cultures have held both the elephant and rhinoceros in high regard. However, as time has gone on, both species have become pests and annoyances to the cultures that held them so highly. A relationship that was once built on respect has now crumbled at the hands of indifference and anger. As the conservation of these two species moves forward, it is vital that the differing conservation efforts take the feelings of African citizens within elephant and rhinoceros range countries into account. Restoring the respectful relationship that these cultures once had with both the elephant and rhinoceros by decreasing the fear and frustrations felt by the African citizens towards these animals needs to become a top priority. The support of the citizens of Africa towards the conservation of these animals should be expected and guaranteed. With the forward movement of the conservation of these species, what African citizens both want and need must be considered to remedy the negative feelings many of them have towards both elephants and rhinoceroses. To limit the amount of poaching and unnecessary killing of these animals, the relationship with the people that interact with them daily must become positive and endearing. Seeing how important human feeling is to conservation efforts means that human feeling must have a place in the discussion of what can be done to save these two species going forwards.

Chapter Three: A Crash Course in Conservation Techniques

Overall, conservation is defined as the act of preserving Earth's natural resources for current and future generations, where natural resources include air, minerals, plants, soil, water, and wildlife (National Geographic Society, 2022). It is an area of study that, similar to poaching and habitat loss, can be affected by human intervention. There are many kinds of conservation tactics, all of which vary based on the species being protected, their habitat, the resources available to conservationists, and the home range of the species. For example, conservation techniques will look different in the United States, which does not have any native elephant or rhinoceros' species, than it would in Africa, where many native elephants and rhinoceroses roam. Within non-elephant and rhinoceros range countries, one is more likely to see the creation of zoos and aquariums, or artificial habitats for species that are on the decline or whose habitats are being destroyed by human development. In elephant and rhinoceros range countries, one is more likely to witness ecotourism, specific natural park or reserve patrolling techniques, and trophy hunting to support the animals and people living in similar areas.

This difference in conservation techniques is evident in the introduction of zoos to many countries that are outside those within the elephant and rhinoceros' geographic range (Figure 16). Zoological facilities are collection-based institutions which (like aquariums, botanical gardens, and natural history museums) house different species from all over the world to showcase the biodiversity and wildlife that reside in the different areas across the globe (Miller et al., 2004). Many, if not all zoos, have conservation mission statements that demonstrate their desire to aid in the conservation of the non-native species that they house, with the elevation of conservation science and conservation education as their main goal (Miller et al., 2004). In fact, certain zoos and wildlife facilities within the United States (currently only 10% of these facilities) have an

Association of Zoos and Aquariums accreditation (Association of Zoos & Aquariums). With this accreditation, the zoo in question is recognized as a leading figure in animal welfare and care, along with being a significant influencer in the fight for wildlife conservation (Association of Zoos & Aquariums). The AZA accredited zoos not only invite and educate their visitors, but they also donate more than $230 million USD to field conservation alone (Association of Zoos & Aquariums).

For many urban areas that are disconnected from many sources of nature, zoos stimulate curiosity about wildlife, offer educational opportunities about nature, and even improve the chance of winning support for nature preservation by exposing people to the wonders of life they may not see every day (Miller et al., 2004). In fact, of just 136 zoos in the United States, there are at least 134 million visitors a year, demonstrating the large number of people that zoos can educate (Patrick et al., 2007). This value jumps up to 600 million when looking at the number of people visiting zoos worldwide, and when it comes to the number of annual visits to both zoos and aquariums across North America, the value is 186 million, depicting an extreme interest in the information that zoos have to offer (Gusset & Dick, 2011).

Figure 16. One of the greater one-horned rhinoceroses' that inhabits Denver Zoo (9news, 2019).

While these numbers show that zoos are leaders in education, it is important to note the ways in which zoos also lead in conservation efforts (Patrick et al., 2007). In a 2008 study, researchers contacted twelve national and regional zoo and aquarium associations to discover the number of visitors each year and the amount of money the associations spend on differing conservation efforts (both zoo-based and not) (Gusset & Dick, 2011). Researchers discovered that U.S. zoos spent $350 million USD on conservation in the year 2008 (Gusset & Dick, 2011). This number, while extremely large, is also predicted to be an underestimate, as five of the associations did not include their expenditures in their responses to this study (Gusset & Dick, 2011). In relation to major international conservation organizations, the World Zoo and Aquarium Communities came in third for overall conservation expenditures, beaten only by The Nature Conservancy and the World Wildlife Fund Global Network (Gusset & Dick, 2011). These numbers alone depict the large impact that zoos have on the conservation world, and how zoos both educate and encourage individuals to get involved in saving wild species, even if the individuals do not see that species every day or interact with that species' given habitat.

Along with zoos, many conservationists outside Africa suggest artificial habitat creation to have specific areas protected for the animals to roam and survive that are still similar to the habitats the animals would inhabit in the wild. Artificial habitat creation can range anywhere from the re-creation of the original ecosystem to the construction of an entirely new, alternative ecosystem and is meant to be a human-made substitute for natural habitat structures (Pratt, 2004). Certain benefits of artificial habitat creation include limiting habitat loss caused by illegal rock collectors, limiting predator efficiency and providing more environment for prey to hide or

survive, and restoring different environments where a habitat may have been destroyed, such as land where agricultural development occurred (Watchorn et al., 2022). The main risks of artificial habitat creation include a poorly made artificial habitat that causes organisms to settle for a poor environment, reducing their fitness, and the exploitation of the habitat by invasive species (Watchorn et al., 2022). There is also the risk of the desired species not inhabiting the new habitat, or the new habitat not being able to support the desired species for a long period of time (Pratt, 1994). However, the benefits of artificial habitats outweigh the risks, and suggest that the creation of artificial habitats can be very beneficial for animal populations that have become endangered or placed in harm's way due to human factors such as urbanization, agriculture, or infrastructure building (Watchorn et al., 2022).

In fact, artificial habitats are extremely successful in many marine and terrestrial communities. Over 50% of coastal habitat has been replaced by human infrastructure in many parts of Europe, the United States, and Australia (Dugan et al., 2011). To help preserve marine life, artificial habitat structures were incorporated into existing seawalls and other infrastructure to enhance the availability of complex microhabitats (Figure 17). This ultimately increased the abundance and diversity of invertebrates and fish species in modified intertidal environments (Chapman & Underwood, 2011). The creation of artificial habitats that mimic habitats created naturally by other animals in terrestrial environments has seriously increased the survival rates of a multitude of animals (Watchorn et al., 2022). In France, 86% of artificial burrows that mimicked rabbit burrows were occupied by different lizard species, and in the Swiss Alps, artificial nest boxes that mimicked tree hollows that were excavated by woodpeckers led to a sixfold increase in the population size of the Eurasian hoopoe *(Upupa epops)* (Arlettaz et al., 2010; Grillet et al., 2010). Although the lizard and the hoopoe are much smaller than the

elephant and rhinoceros, the study, research, and testing of these small species to determine if the artificial habitats would be beneficial to them is a wonderful example of a conservation tactic that could be used and executed for larger animals in the future.

Figure 17. An example of an artificial reef created from old shipwreck material (Marine Sanctuary, 2020).

While artificial habitats are used mainly for species that already reside in or have resided in an area, it could also be beneficial to use artificial habitats to save certain exotic species. It would take a significant amount of time and planning, but should the African continent no longer support the populations of elephants and rhinoceroses present, artificial habitat creation would allow for an African ecosystem to be created outside of Africa. Should poaching or habitat loss completely overtake the current elephant and rhinoceros' populations, perhaps they could be moved to a different country, where the artificial habitat would allow them to survive and thrive in a given area, without the limits of a zoological facility. Although this would be an extremely drastic measure, should the relationship become too tense between the elephant and rhinoceros'

species and the citizens within the African communities surrounding them, the species could be moved to another location. However, this should only be considered a last-ditch effort, with the main focus of current elephant and rhinoceros conservation techniques being to save the species and its natural habitat while encouraging a positive relationship between the species and the African people.

Within elephant and rhinoceros range countries, many conservationists have used ecotourism as their main conservation tactic. Ecotourism is defined as a commercial activity that generates economic returns to support and achieve a conservation objective (Black & Cobbinah, 2018). Most of these enterprises include individual leisure and holiday travel, which in turn includes visiting national parks and conservation areas, with the tourists staying at resorts in these areas or travelling into these areas for recreational activities, such as tours and safaris (Buckley, 2008). Many tour operators have also aided in conservation efforts by sponsoring transportation and accommodation along with providing land and infrastructure to conservation organizations, while also running tours for conservation organizations with cash contributions from the price of participation or from direct contributions made by the tour operator or tour participants (Buckley, 2008; Figure 18).

Figure 18. Guests watching a leopard from the safari car on an African safari (African Budget Safaris, 2024).

Many of the park and reserve areas used for tourism activities within Africa include both community and private landholdings, public forests and rangelands, and national parks (Buckley, 2008). With the location of the tourist areas, many resorts, hotels, and safari companies hire local African citizens to work as employees and guides (Akama et al., 2011). However, not many individuals benefit from these jobs. In Kenya, only 2-5% of the safari tourism receipts made it down to the African citizens working in the low paying service jobs, such as a souvenir shop worker or agricultural produce employee (Akama et al., 2011). Despite these economic concerns, many citizens within the communities bordering the protected areas that are used for conservation tourism feel that the creation of the protected area was justified, and that the use of that land for conservation has had a positive effect, as it limits the dependence of the citizens on the resources provided by the area that could only be obtained illegally (i.e. illegal logging) (Black & Cobbinah, 2018). This immediate effect on the lives of the African citizens within these communities must be taken into consideration when developing plans for using tourism as a conservation technique. To encourage saving specific African species and the continual efforts of conservation in the species' home range, the African people sharing the land with these species must be saved and supported as well.

A wonderful example of the balance between ecotourism and African culture is evident in the creation of the Sarara Luxury Tented Camp in Kenya (Figure 19). Placed in the heart of the Namunyak Wildlife Conservancy, the Sarara Camp is a safari ecolodge company that was originally created by Kenyans and is now fully managed and owned by the seminomadic Samburu tribe that is native to the area (Trimble, 2021). To establish this community-based

conservation model, the Samburu people have complete control over the land, and now regard themselves as the protectors of the wildlife that inhabit it (Trimble, 2021). The tourism to the area helps fund the community's living, and the community works to protect the animals that the tourists wish to see. In fact, the Sarara Camp is partnered with the Reteti Elephant Sanctuary, the first community-owned and managed elephant orphanage in Africa (Trimble, 2021). Not only does this sanctuary further encourage the involvement of the Samburu people, but it also provides another means for tourism and income by allowing tourists to visit and works towards elephant conservation by rescuing and rehabilitating orphaned elephants until they can be re-released back into the wild (Trimble, 2021).

Figure 19. The Sarara House, a two-bedroom house in the Sarara Camp (Sarara, 2024).

To further elaborate on the effects of tourism on the African continent, the COVID-19 pandemic had an interesting effect on the animal populations and overall vulnerability of species in Africa, along with the levels of tourism within Africa, which ultimately affected the livelihoods of the African citizens in areas dependent on tourism. As of 2018, nature-based

tourism had contributed $29.3 billion USD in gross domestic product across the African continent and supported 1.5 million jobs in South Africa alone (Barker & Rodway-Dyer, 2023). However, the pandemic necessitated many restrictions on communities globally, limiting the amount of travel that could take place both within and between countries, and thus limiting the amount of revenue generated by things like nature-based tourism. Roth (2020) discovered that this lack of travel was ultimately bad for the species of Africa as the increased restrictions on human activity led to a decrease in the restrictions on poaching. For example, researchers discovered an increase in human intrusions and disturbances (such as poaching) of South African biodiversity within protected areas and biomes during the first portions of the South African lockdown procedure (Ehlers Smith et al., 2023). Most of these human disturbances stemmed from the loss of jobs and economic instability that came from the 81% drop in international arrivals to Africa from 2019 to 2021, demonstrating the effect of the lack of tourism on the African communities (Barker & Rodway-Dyer, 2023).

However, in contrast to Roth's (2020) study, the researchers within South Africa determined that the pandemic was beneficial for African animals as it allowed them to roam their environments freely without risk of human involvement or interaction (Ehlers Smith et al., 2023). Yet when it came to conservation, the lack of tourism caused a serious economic decline in the area, thus limiting the budget for conservation and the amount of conservation work completed in 2020 (Ehlers Smith et al., 2023). Along with this, the immense decline in tourism led to a decrease in job availability, that ultimately pushed African citizens within communities surrounding protected areas to poaching in an effort to support their families (Barker & Rodway-Dyer, 2023). The ability of these African citizens to survive directly affected the conservation efforts within the protected areas.

The patrolling efforts of parks, reservations, and protected areas can influence conservation and poaching as well. A large portion of the failures of conservation in Africa have to do with the inability of its park rangers to properly recognize and report incidents of poaching. In many African nations, park rangers patrol specific environmental areas with the goal of detecting and apprehending any poaching efforts (Hilborn et al., 2006; Dobson et al., 2019; Figure 20). However, several factors can lead to the inability of park rangers to properly report poaching incidences. These include GPS equipment failure or satellite failure, inability to use the equipment correctly, forgetting to record observations, lack of supervision in the field, and even collusion with poachers (Moreto et al., 2014). Some rangers even avoid certain areas of the park while patrolling because they are either working with the poachers or are more concerned about other areas that are known to be poaching hot spots, leading to increased poaching patterns in the areas they avoid (Kuiper et al., 2020).

Figure 20. Park rangers patrolling in Kruger National Park (Africa Geographic, 2021).

In an experimental study that attempted to recreate some of the patrolling tendencies of different national parks or wildlife reserves within Africa, researchers found that one of the biggest problems with poaching is that there is no current and effective way to detect it (Van Doormaal et al., 2022). The study took place in Olifants West Nature Reserve in Limpopo Province, South Africa, and it is important to note that this reserve already had patrolling techniques in place (Van Doormaal et al., 2022). Prior to the study, park management would assign a team of 2-3 rangers to patrol grid cells of 1.02 x 1.1 km. The teams searched the grids for about two hours early in the mornings and received a small financial reward along with their base salary for any illegal activity they found (Van Doormaal et al., 2022). To test the effectiveness of this patrol style, the researchers placed 166 imitation snares randomly throughout the park and did not notify the rangers that a study would be taking place to limit any bias or skewing of the data (Van Doormaal et al., 2022). At the end of a 3.5-month period, only 39 of the 166 imitations snares (23%) were detected by rangers and, at the completion of the study (200 days) the probability of an imitation snare going undetected was 77% (Van Doormaal et al., 2022). These results aided the conclusion that most of the African countries involved in elephant and rhinoceros' conservation have a significant number of holes in their patrolling techniques, allowing poachers to easily sneak into these wildlife areas and hunt the specific animals they are searching for (Van Doormaal et al., 2022).

However, this study also provides a significant number of solutions for these countries in the way they patrol these specific areas and in the work that can be done to stop poaching (Van Doormaal et al., 2022). In the second half of the study, another group of volunteers and researchers from a local NGO conducted systematic searches of areas similar to where rangers would patrol (Van Doormaal et al., 2022). The systematic searches included walking along

parallel lines (i.e., transects) and in a quadrant pattern for 2.5 hours, both of which are more effective than the random inspection of specific grids (Chung & Burdick, 2007; Delaney & Leung, 2010). These searches are very productive when it comes to finding targets that are small or blend in with their background, which is often true of many poaching techniques (Cacho et al., 2007; Delaney & Leung, 2010). For the systematic searches, 45% of imitation snares were found by the parallel line technique and 42% of imitation snares were found by the quadrant search technique (Van Doormaal et al., 2022). Both systematic search patterns were significantly more effective than the baseline search technique that was already in place by the current rangers, ultimately depicting the importance of systematic patrolling techniques in catching poaching (Van Doormaal et al., 2022). This study is thus an example of how the effectiveness of human search efforts can directly affect the livelihood of both the elephant and rhinoceros, as the ability of these park rangers to locate and apprehend the snares is vital to the elephants' and rhinoceros' survival. It is important to provide funds for different conservation organizations that can both improve poaching tracking/reporting equipment and provide enough incentive to keep park rangers from wanting to work with the poachers. The more likely conservation is to benefit the African citizens living with the elephant and rhinoceros, the more willing these citizens will be to partake in conservation actions and the more successful the conservation efforts will be.

When it comes to rhinoceros' conservation, there are similar threats to those of the African elephants. Chanyundura et al. (2021) examined these threats and provided specific ways to combat them on the international, regional, national, and local level. On the international level, education and awareness campaigns should increase so those outside of elephant and rhinoceros range countries can understand the full extent of issues surrounding the conservation of these two species (Chanyandura et al., 2021). On the regional level, there should be regional

corporations created that can partner with law enforcement to elevate crime detection and tracking, while also creating transboundary conservation efforts (Chanyandura et al., 2021). At the national level, the researchers encourage strengthened habitat protection and management initiatives, strategic dehorning programs, re-introduction programs, and innovative systems and surveillance equipment for real-time poaching monitoring (Chanyandura et al., 2021). Finally, at the local level, environmental education and awareness campaigns should be put into place, along with local community involvement and participation, and enhancing the livelihoods of local communities (Chanyandura et al., 2021). Furthermore, local law enforcement should create anonymous tip programs where local citizens can provide information on instances of poaching that they are aware of without having to face any negative consequences (Codron et al., 2007; Mogomatski & Madigele, 2017). The repeated compare and contrast between problem and solution helps show that there are many ways certain conservation problems can be solved as long as people take the time to process through them (Chanyandura et al., 2021). However, the researchers also show that local communities' involvement is vital to the success of conservation strategies.

Relating back to chapter two, one of the conservation tactics that concerns both non-elephant or rhinoceros range countries and elephant and rhinoceros range countries is trophy hunting (Hammond, Dickman, & Biggs, 2022). Essentially, trophy hunting is when an individual pays a certain amount of money to hunt specific species, typically selecting for individuals with exceptional physical attributes (such as horns, tusks, or large body size) (Lindsey et al., 2007). This tactic is seen as beneficial and productive to the citizens within the elephant and rhinoceros range countries as it provides job opportunities and income to the African citizens surrounding national parks or protected areas (Figures 21-22). Many of the minimum 18,500 (yearly) clients

of trophy hunting are wealthy European and Americans that are led on hunting trips by professional hunting guides that are usually citizens from the African communities surrounding the game area (Lindsey et al., 2007). The hunting operators' market and sell the hunts to clients at international hunting conventions, lease or own hunting areas and safari camps, and employ a staff consisting of professional hunters, trackers, drivers, skinners, and camp staff that are citizens from the surrounding areas (Lindsey et al., 2007). Not only does trophy hunting provide a multitude of job opportunities for the local African community, trophy hunting also creates a very large revenue of about 201 million USD annually, all of which comes from the 23 sub-Saharan African countries where trophy hunting is allowed (Lindsey et al., 2007). The high cost of trophy hunting per person creates a high revenue from a lower amount of people, limiting the environmental impact of trophy hunting, while also generating revenue for conservation in areas that may not be suited for tourism (such as countries experiencing political instability) (Lindsey et al., 2007).

Figures 21-22. Trophy hunters posed next to their elephant and rhinoceros prizes (Action for Elephants UK, 2024; Fight for Rhinos, 2024).

Take, for example, the cost of hunting an elephant in South Africa under the African Hunt Lodge company. For an unexportable elephant trophy hunt in Zimbabwe (meaning the meat, skin, skull, and tusks go back to the locals) the client would be expected to pay $22,000 USD along with daily fees that reach $345 USD per hunter per day (*Elephant hunts*). An exportable elephant hunt under this company (of up to 40-60 pounds) would increase the cost to $35,000 USD with the same daily fees (*Elephant hunts*). As for the hunting of a South African white rhinoceros, the daily fees are the same as the elephant hunt, but the hunt price can reach upwards of $110,000 USD depending on the size of the horn of the rhinoceros (*Rhinoceros Hunt*). The African Hunt Lodge company also offers white rhinoceros Green Hunts for $10,500 USD, where participants can aid veterinary staff in tranquilizing a rhinoceros (*Rhinoceros Hunt*). The participant gets to tranquilize the animal and take pictures while the veterinary staff gathers vitals and samples for the Rhino Registry before the animal is released back into the wild (*Rhinoceros Hunt*).

In many African countries, game management areas (GMAs) are semi protected areas that create a buffer between national parks and areas open to full development (Lewis & Alpert,

1997). The GMAs border many of the national parks in Africa and are where some human settlement and hunting is allowed, thus creating the locations used for trophy hunting (Lewis & Alpert, 1997). The money generated from trophy hunting often goes back to the community around the area and is used for both community development and for paying trophy hunting company employees, with many scouts earning 1.3 times the average Zambian income (Lewis & Alpert, 1997). The money comes from two main sources: hunting rights fees from hunting companies for leases to run hunts and license and permit fees from the hunting clients for each hunt and animal (Lewis & Alpert, 1997). In the 1994 season alone, trophy hunting companies made a total of 3.1 million USD, with 30% of that revenue going to the Wildlife Conservation Revolving Fund and 0.9 million USD going to the Administrative Management Design for Game Management Areas (ADMADE) (Lewis & Alpert, 1997).

Of the money made by the ADMADE, units spent almost half of the total amount on staff costs and training, paying many of the local citizens who acted as guides and paying to train more citizens to become guides (Lewis & Alpert, 1997). ADMADE also used their portion of the revenue from trophy hunting to improve local facilities for education and health and to seed local enterprise (Lewis & Alpert, 1997). Common ADMADE-funded projects include classrooms, houses for teachers, clinics, and village shops (Lewis & Alpert, 1997). Other development budgets have also provided emergency community assistance in times of disaster (Lewis & Alpert, 1997). Although trophy hunting does not initially seem like a good conservation tactic, as the killing of animals does not seem like the best way to save them, it is often extremely controlled, with guides accompanying the hunters, and is also a good way to bring in large sums of money to conservation while also limiting the number of animals that are affected (Lewis & Alpert, 1997). Trophy hunting is one of the more positive conservation tactics for those directly

involved with both elephants and rhinoceroses and should be considered a beneficial tactic going forwards.

It is important to note the effect that the African citizens within the elephant and rhinoceros range countries can have on their success of these various conservation tactics. While the different conservation techniques mentioned in this chapter can all be successful, policy makers and conservation organizations must listen to those who are directly involved with the animals they are trying to save moving forward. The opinions of those outside of elephant and rhinoceros range countries, while still influential in helping educate and raise funds, should not be placed on a higher pedestal than those within the elephant and rhinoceros range countries when deciding what conservation tactics to pursue. Conservation can look very different based on where it is taking place, so the thoughts, feelings, and ideas of those with a direct relationship to the species that are being affected must be considered to encourage as much human support as possible. The more beneficial a conservation tactic is to the public, the more likely they are to participate in and participate well in that specific tactic.

Chapter Four: A Crash Course in Why Any of This Matters

While the support and encouragement of conservation by the local African communities that interact with elephant and rhinoceroses is vital to their survival, there are also several efforts that can be taken outside of the elephant and rhinoceros range countries to provide support for the differing conservation efforts. Although the direct involvement of non-elephant and rhinoceros range countries should be limited when it comes to the decision of which conservation tactics to use, the support of these countries can and should aid African countries in the conservation process. Whether through monetary donations, equipment donations, government legislation, or education programs, the value of non-elephant and rhinoceros range countries is still substantial, and it is still important for them to contribute to elephant and rhinoceros' conservation. However, the involvement of these countries should only come after the discussion of conservation policy and organization of conservation efforts directly with the African citizens and local/state/provincial groups of the areas affected. The involvement of non-elephant and rhinoceros range countries may look different than it does now but would still aid in ensuring the future of the elephant and rhinoceros' species. Ultimately, the perspectives and attitudes of the local African citizens should be the main foundation of elephant and rhinoceros conservation plans, with non-elephant and rhinoceros range countries contributing through financing, education, and legislation.

For example, when it comes to deciding the conservation tactic that should take place within an area, conservation organizations should listen to the opinions of the African people within that area and should not let the voices of non-elephant and rhinoceros range countries influence their decision. As demonstrated by Hammon, Dickman, and Biggs (2022) who studied the differences in conversations on Twitter about elephant conservation, if non-elephant range

countries were making the decisions for elephant range countries, trophy hunting would be completely out of the question, even though many African citizens see it as a viable technique for elephant conservation. However, once the decision has been made, conservation organizations can look to non-elephant and rhinoceros range countries as an example of how to run the conservation program and fund the conservation program. As an example, The Nature Conservancy, the World Wildlife Fund, Wildlife Conservation Society, National Geographic, and the International Union for the Conservation of Nature are all strong leads to follow when it comes to funding and using different conservation techniques.

This process can become complicated though, as many conservation organizations have a serious cost reporting issue (White et al., 2022). Current cost-reporting tendencies indicate a lack in funding according to conservation priority and extreme geographic variance in funding across conservation programs (Restani & Marzluff, 2002; Balmford et al., 2003). In fact, of the estimated 722-967 billion USD required for effective global biodiversity protection, only 124-143 billion USD is received (Deutz et al., 2020). Across 1,989 studies strictly from the year 1987, only 13.3% provided specific numeric costs of the conservation action and only 8.8% provided total costs of the conservation technique (White et al., 2022). Without knowing how much to spend or how much money is required, it can be hard to not only determine what conservation tactic to use but also whether or not the conservation tactic is even worth it.

Even with this uncertainty, the inclusion of costs in conservation assessments can improve the amount of biodiversity returns that can come from a given budget (Murdoch et al., 2007). Essentially, knowing how much money is required for a given conservation tactic can help determine its effectiveness. When the conservation tactic requires less money but can still produce an increase in biodiversity, it is considered cost-effective. Without proper cost-reporting,

conservationists are not able to accurately determine efficiency gains from different conservation techniques (White et al., 2022). However, in more recent years cost-reporting regarding invasive species control, habitat and natural process restoration, and enterprise projects (payments for ecosystem services and alternative livelihood projects) has increased and become more consistent (White et al., 2022). The increase in reporting allows conservationists to determine which techniques work best at a lower cost so they can pursue them in different areas. However, the inconsistency and doubt that comes with cost-reporting elsewhere can often lead to misconceptions and misinformation about different conservation methods. If the public does not know the benefits of different conservation techniques, they are less likely to support them.

When conservation organizations receive accurate cost reports and are aware of the supplies necessary to complete a given conservation tactic, they are then able to spread the correct information about that given tactic and advocate for its support. This support is where the populations of non-elephant and rhinoceros range countries comes into play. Many of the conservation organizations mentioned previously (e.g. World Wildlife Fund, National Geographic, etc.) have designated places where non-elephant and rhinoceros range countries citizens can make a donation to the organization, which then supports other smaller conservation organizations or funds the larger organization's conservation efforts. The World Wildlife Fund specifically allows its website visitors the choice of making monthly or one-time donations that can benefit specific species (World Wildlife Fund, n.d.). Along with these options, the size of the donation can also determine the size of the thank you gift that the World Wildlife Fund will send back to the donator (World Wildlife Fund, n.d.). Gifts include tote bags, reusable straws, a fleece blanket, and stuffed animals (World Wildlife Fund, n.d.).

Along with larger conservation organizations, many designated Association of Zoo and Aquarium zoos accept donations that they then use to fund specific conservation projects. For example, the Fort Worth Zoo has spent $9.8 million USD towards education, conservation, and animal care of amphibians, birds, bonobos, elephants, lizards, big cats, bongos, crocodilians, iguanas, rhinoceroses, and turtles and tortoises (Fort Worth Zoo, n.d.; Figure 23). Of that money, the total amount has been spread across conservation projects in more than 30 countries around the world, including Zambia, Puerto Rico, Honduras, Jamaica, Turks and Caicos, and many others (Fort Worth Zoo, n.d.). The Fort Worth Zoo also works on the national and statewide level, allocating money wherever it is best used.

Figure 23. The elephant habitat at the Fort Worth Zoo in Fort Worth, Texas (fxtx, 2023).

Similar to the Fort Worth Zoo, Denver Zoo also has a large impact on the conservation world. Since 1996, Denver Zoo has participated in over 600 conservation projects that span 62 countries and six continents (Denver Zoo, 2024). Specifically, Denver Zoo donates more than $2 million USD a year to field conservation efforts in Colorado, Latin America, and Asia (Denver

Zoo, 2024). Denver Zoo has a holistic and adaptive approach to wildlife conservation, meaning it prioritizes landscapes and species with significant conservation needs in areas where the zoo can make the most impact. For example, Denver Zoo has been working in Mongolia for 20 plus years, Peru since 2008, Vietnam since 2011, and Colorado since 2010 (Denver Zoo, 2024; Figure 24). Although Denver Zoo only began their direct involvement in Colorado conservation in 2010, they are partnered with organizations such as Denver Mountain Parks, who have been doing conservation work in the state for decades (Denver Zoo, 2024). Denver Zoo also partners with SANCCOB in Cape Town, South Africa to rescue, rehabilitate, and release African penguins (Denver Zoo, 2024). On the Denver Zoo website, at the bottom of their conservation page, visitors can donate money to the zoo to fund these conservation efforts and support their local animal care (Denver Zoo, 2024).

Figure 24. Denver Zoo conservationist holding a Titicaca Water Frog near Lake Junin in Peru (Denver Zoo, 2024).

While the donations made by non-elephant and rhinoceros range countries can go directly to conservation organizations that then use the donations to fund conservation techniques, there

are many other uses for the money that is dedicated to conservation. Many people both within and outside elephant and rhinoceros range countries do not truly understand the importance of the elephant and rhinoceros' species. For conservation to continue, it is vital that all people (but especially the African citizens who interact with the elephant and rhinoceros every day) have the proper information about the two species. Education programs can become a tool that not only helps the animals but helps the people in affected communities. Educating African citizens on the importance of elephants and rhinoceroses to their ecosystems can help shift their perspective of these animals as pests. The idea of these animals as keystone species must be pushed within the African communities so the people can understand the true majesty, beauty, and importance of the elephant and rhinoceros. The more passionate people become about the animals themselves, the more likely they are to want to save them.

For example, many global organizations, such as the United Nations Childrens Fund (or UNICEF), have been working to improve the overall education system on the African continent. Many African children are either out of school or not receiving the proper literacy and numeracy skills necessary for success in the modern world (UNICEF, n.d.). Organizations like UNICEF work to change this by setting up education programs and building schools in low-income areas that may not have them (UNICEF, n.d.). They also provide educators and curriculum for the schools to follow, with the main goal being that the children gain a basic understanding of reading, writing, and math (UNICEF, n.d.). Moving forward, it will be important to include courses regarding conservation and animal welfare to inspire proper relationships between the upcoming African citizens and their wildlife counterparts. By utilizing current education programs in this way, the next generation of African citizens could become more tolerant of the elephant and rhinoceros, and their conservation efforts.

On a more continental level, the African Union also works to increase education levels and educational opportunities for African citizens. Specifically, the African Union works to develop harmony between education policies and programs across the continent, spearhead the revitalization of education systems, and develop and manage continental education management information systems linked on the regional and national levels to bring information to local and international users (African Union, 2020). The African Union has even established the Pan African University, which is a suborganization dedicated to developing institutions of excellence in science, technology, innovation, social sciences, and governance across Africa to increase higher education across the continent (African Union, 2020). With education programs like these already beginning, including the importance of African wildlife species in the course systems would be an easy step to take. Teaching the growing African citizens the importance of the wildlife around them, will make them more likely to appreciate and have a positive attitude towards the species. And, for the non-elephant and rhinoceros range countries, organizations like UNICEF and the African Union take donations and appreciate employees and volunteers, giving the out-of-range countries a way to contribute to the education programs without being directly involved.

Along with educating African people on the importance of the animals comes the importance of educating them about conservation as well. These people will want to be involved in what happens on their land and have every right to know what is going on around them. Therefore, it is vital for future conservation efforts to discuss their conservation tactics with the local people, so that they may understand and support them. As the general information around the conservation tactic increases, participation in the conservation tactic will increase as well. For example, the PACE (Pan African Conservation Education) system is an education system

created by Tusk and Siren Conservation Education that is utilized by teachers, farmers, park rangers, and community development workers across Africa (PACE, 2023; Figure 25). PACE hosts virtual field visits and webinars for all users to learn about topics like living with wildlife, water, soil, forests and trees, and more (PACE, 2023). PACE has reached more than 1000 schools and 2400 communities, with 200,000 people using the system (PACE, 2023). There are also 11,000 people in Africa currently using PACE to inform practical actions regarding the topics they can learn about (PACE, 2023). So, once the citizens have access to tools, systems, and equipment that allow them to get involved it is then important to educate them on the proper use of the tools, equipment, systems, patrolling techniques, and dangers that can come with specific conservation methods. The more the locals understand the goal of the conservation tactic and how to use the equipment and strategies it will take to reach that goal, the more likely they are to use the conservation tactic, and the more likely conservation is to succeed.

Figure 25. The Pan African Conservation Education system logo (PACE, 2023).

On this same note, educating people outside of elephant and rhinoceros range countries is necessary as well. While this education is still extremely important, it must look slightly different than the education programs presented to those within the elephant and rhinoceros range countries. For the non-elephant and rhinoceros range areas, it is vital to show which conservation tactics are actually working and which ones are not. The voices of the African citizens directly involved with these animals should be at the forefront with their testimonials and opinions shared

directly to the audience. By providing information on what the African citizens find most effective and least intrusive on their lifestyles, the right types of conservation can be pushed and supported by those not residing in the elephant and rhinoceros range areas. As seen in Hammon, Dickman, & Biggs' (2022) work, there is a stark contrast between the conversations about conservation occurring in elephant range countries compared to non-elephant range countries. The work of these specific education programs should be to get those conversations on the same page. Take Denver Zoo for example. They do constant work with organizations in the areas that are directly affected by certain conservation efforts. With more partnerships like the one with SANCCOB, zoos would still be able to partake in conservation outside of their own country while allowing the organization in the affected area to choose how to use the money. Denver Zoo would then be tasked with raising awareness about the partnership to educate its visitors on the conservation tactics being used so that the visitors would be more likely to donate. With a general agreement between the two differing populations, the African citizens are more likely to willingly partake in conservation tactics, thus increasing their success, and the non-elephant and rhinoceros range countries citizens are more likely to support and push for conservation tactics that the African citizens would also want and involve themselves in.

Along with education programs, non-elephant and rhinoceros range countries can push for legislation that supports the funding of conservation organizations locally, nationally, and internationally. Take, for example, the United States' END Act of 2016. END stands for Eliminate, Neutralize, and Disrupt Wildlife Trafficking. This Act was put into place in 2016 and requires the Secretary of State to submit to Congress a full report that lists Focus Countries or Countries of Concern (US Department of State, 2021). A Focus Country is a major source, transit point, or consumer of wildlife trafficking products or their derivatives, and a Country of

Concern is a Focus Country whose government has actively engaged in or knowingly profited from the trafficking of endangered or threatened species (US Department of State, 2021).

Once the identification of these countries is complete, the bill then directs the Presidential Task Force on Wildlife Trafficking to collaborate with the national wildlife service of a country of concern to analyze the threats to wildlife in that country. They then work with the wildlife service to prepare a strategic plan with recommendations for addressing wildlife crime; coordinating efforts to implement strategic plans among federal agencies and non-federal partners; and coordinating with stakeholders qualified to provide assistance regarding anti-poaching activities, law enforcement efforts, and strategies to reduce illicit trade and reduce consumer demand for illegally traded wildlife and wildlife products (Coons, n.d.). Ultimately, the act allowed the United States to identify countries where wildlife trafficking was a problem and step in as necessary. This act led to the improvement of many conservation organizations within elephant and rhinoceros range countries, such as Canines for Conservation, which is an African conservation organization that trains and utilizes dogs to sniff out instances, supplies, or products within illegal wildlife trafficking attempts. By actively voting for and supporting this legislation, people in a non-elephant and rhinoceros range country are able to help elephant and rhinoceros range countries while still allowing them to choose exactly which course of action they would like to take.

Finally, it is important to remember that humans have been the ultimate cause of the elephant and rhinoceros populations' decline. The selfishness of the human population and the desperate need for growth and power has led to the killing of millions of elephants and rhinoceroses, along with the destruction of a majority of their habitats. The human population must work to undo the harm that they have done to these populations so that the elephant and

rhinoceros can continue to survive, thrive, and carry an entire ecosystem on their backs. Since the development of the human population has ultimately caused the decline of these animal populations worldwide, it is vital that human's step in to reverse some of the damage, or the world will become a dreadful and lifeless place, lacking in wonder, majesty, and beauty. However, the ways in which this conservation is achieved must have the African citizens at the forefront. Moving forward, it will be vital for those who interact with a given species daily to determine what types of conservation are put into practice. Their voices are the most important because they are the ones most directly affected. The roles of non-elephant and rhinoceros range countries must shift from being the drivers of conservation to being the funders and the supporters, so that elephant and rhinoceros' conservation can have the highest chance at success.

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