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Sunda Clouded Leopard Conservation; Understanding the Mitigation Efforts of the Threats in Kalimantan, Sabah, and Sarawak

Introduction

Top or apex predators are being studied all over the world due to the importance of the role they play in many ecosystems. Most of these predators do not have a predator of their own, other than humans. Top predators control populations of herbivores that, if populations were allowed to explode, can affect the ecosystem around them by degrading the landscape and vegetation through overgrazing (Ripple et al., 2001). For example, humans had hunted and pushed the wolf population out of Yellowstone which caused the ungulate population to rise dramatically (Smith et al., 2003). With the increase in the ungulate population, elk specifically, the population increased its food intact which then caused vegetation of Yellowstone to decrease (Ripple et al., 2001). This caused a cascading effect which resulted in degradation and erosion along riverbanks throughout the park (Ripple et al., 2001). Thirty-one wolves were reintroduced to Yellowstone between 1995 and 1996, and seven years after, they had repopulated most of the National Park which resulted in the reduction of the elk population thus allowing for the return of vegetation (Smith et al., 2003). This success story demonstrates the influence top predators have on the ecosystem. With this said, most apex predators are classified as "vulnerable" or "endangered" on the IUCN Red List (Sanderson et al., 2008). The International Union for Conservation of Nature, or the IUCN, is responsible for providing the knowledge and tools to everyone to allow for economic growth, development, and conservation to work together in an environmentally friendly manner (IUCN, 2008). The "Red List" provides basic information on the species and a "status" of the animal, which ranges from "Least Concern" to "Extinct" (IUCN,

2008). The listing of "vulnerable" or "endangered" often begins the call for conservation of the area in which the animal lives or is a result of multiple studies. Apex predators are often listed as "vulnerable" or "endangered" due to multiple reasons. For example, the decrease in viable habitat that supports adequate prey numbers due to the ever-growing human population is one of the main reasons (Ripple et al., 2014). These animals have a high demand for food paired with low densities and low reproduction rates which drives them into conflict with humans (Ripple et al., 2014).

Many of the larger wild cat species, such as jaguars, tigers, and leopards, often hunt livestock which has become an easy prey source (Ripple et al., 2014). Because of their increased ranges and overlap with human populations larger cat species are frequently studied (Ripple et al., 2014). This overlap with humans is a problem for all large animals. It is one of the reasons for the decrease in the wolf population in Yellowstone (Smith et al., 2003). Because of their large ranges, conservationists often argue for the conservation of these larger cats because conservation of these cat species umbrellas the other species within these areas (Sergio et al., 2006). Top predators such as these are difficult to argue conservation for due to the multitude of problems that occur when there is conflict with humans.

Smaller wild cats do not kill humans or larger livestock which decreases human / animal conflict. Many times, during conservation arguments smaller wild cats are often under the umbrella of these larger cats because their ranges overlap. On top of this, many of them are rare, secretive, difficult to find, and hardly studied. Although their impact on the human population can be minimal, it is still important to understand their impacts on ecosystems and develop conservation projects to protect them since they do play an important role in our ecosystem as a member of a higher trophic level. Borneo is home to five smaller wild cats such as the marbled

cat, the leopard cat, the flat headed cat, the bay cat, and the clouded leopard. None of these cats are under the umbrella of the conservation of the larger, more charismatic cats around the world. Clouded leopards are the top felid predator on the island of Borneo. These wild cats of Borneo have also not been well-researched which makes it difficult to create programs, projects, and laws that protect these animals. Due to the secretive lifestyle of all the cats of Borneo, their influence on prey populations and ecosystem services have not been studied. In Borneo, the largest wild cat is the Sunda clouded leopard (*Neofelis diardi*). This cat is believed to be the top predator on this island due to its size (Rabinowitz et al., 1987). Its influence is most likely to be

Clouded leopards have gained the interest of many scientists and conservationists of the world with the discovery of the two species of clouded leopard in 2006 (Buckley-Beason et al., 2006; Kitchener et al., 2006). Many papers have been written about their existence, but there is still a lack of knowledge about their ecology, hunting patterns, and most importantly, their abundance and distribution on the island of Borneo. At the moment, I am unable to conduct such research myself, so I will begin by analyzing conservation efforts. Doing so will allow for an estimation of the effectiveness of the conservation in place. Understanding the rules and regulations the protect clouded leopards will help determine if conservation efforts could be effective or if these efforts in Borneo must be increased. It is important to understand the conservation in place and threats towards the survival of the Sunda clouded leopard due to the tropic level these animals function in. As stated before, its influence is most likely to be similar to that of the larger cat species (Rabinowitz et al., 1987) which increases the level of importance in its conservation. Focusing on the three major areas that make up Borneo, Kalimantan, Sabah,

and Sarawak, encompasses conservation regulations that have the greatest effect on the Sunda clouded leopard.

Clouded Leopard Ecology and Conservation

In 2006, two studies determined that there are two species of clouded leopard instead of four subspecies; three around mainland of Southeast Asia and Taiwan and the fourth in Borneo and Sumatra (Buckley-Beason et al., 2006; Kitchener et al., 2006). The Neofelis nebulosa was determined to be the mainland clouded leopard and the Neofelis diardi was declared to be the Borneo and Sumatra clouded leopard, or Sunda clouded leopard (Buckley-Beason et al., 2006; Kitchener et al., 2006). N. diardi diverged from N. nebulosa around 1.4 million years ago which is also around the same time that Borneo became an island (Buckley-Beason et al., 2006). We have extremely limited knowledge of the animal, but they range from southeastern Himalayas, southern China, and Taiwan, to Peninsular Malaysia, Sumatra, and Borneo (Chiang, 2007) and spend most of their time at altitudes less than 2000 meters (Chiang et al., 2015). It is known that the clouded leopards live in low density populations, approximately 1 in 100 km² with ranges from 22.9–45.1 km² (Grassman et al., 2005). The clouded leopard is shaped and behaves similarly to both large and small wild cats (Guggisberg 1975, Gao 1987, Rabinowitz et al. 1987). Clouded leopards are a smaller cat species, weighing 25-51 lbs (Chiang, 2007). Its feeding habitats are primarily unknown since it is a secretive, nocturnal, and arboreal cat (Chiang, 2007). Most likely, the clouded leopard feeds primarily on prey that is less than half its body weight, but it is possible the cat could get larger prey (Chiang et al., 2015). The Sunda clouded leopard most likely focuses on prey such as macaques, rodents, deer (Chiang et al., 2015), and possibly birds, boar, and bearded pig (Azlan et al., 2006).

The clouded leopard, before the division of species, was already classified as "vulnerable" under the IUCN Red List (Sanderson et al., 2008) and are under Appendix I of CITES. Although the IUCN does not have the authority to direct conservation of a species, it has compiled background on most animals to allow for an unbiased, factual conversation that can help develop conservation projects (IUCN, 2008). CITES, or the Convention on International Trade in Endangered Species of Wild Fauna and Flora, is an agreement amongst governments on an international scale that restricts and regulates the trade of endangered and threatened species and ensures their survival will not be affected. The trade of clouded leopards has been regulated since 1975 when they were placed under Appendix I of CITES which says the trade of these animals is only "permitted only in exceptional circumstances" (D'Cruze and Macdonald, 2015). This includes any and all trade of captive animals and specimens which are primarily being transported to zoos and museums around the world (D'Cruze and Macdonald, 2015). Over a 38year period, 316 clouded leopard trade reports were given to CITES where the animal was legally traded live, but illegally traded primarily in skins (D'Cruze and Macdonald, 2015). Anthropogenic interferences with the already small population on the island of Borneo could be detrimental to the new species. Due to many problems created by humans, conservation for both of the species must be increased in order to protect the clouded leopard from becoming extinct.

Conservation of Wildlife

Indonesia

Indonesian law that focuses on the conservation and protection of the flora and fauna of Indonesia is called the "Act of the Republic of Indonesia No. 5" (Republic of Indonesia, 1990). This act was created in 1990 and focuses on the "living resources" of Indonesia (Republic of Indonesia, 1990). This law outlines how to sustainably use and harvest flora and fauna and the ecosystems surrounding them while putting an emphasis on the welfare of future generation (Republic of Indonesia, 1990). While this law is an outline of what is to be done and refers to other laws regarding the enforcement of this act, it is very broad and lacks detail about how to preserve plants, animals, and their ecosystems. It focuses on the idea of keeping wild ecosystems natural. For rare and endangered species, including the Sunda clouded leopard, this law discusses what not to do such as take or harvest any of these plants or animals alive or dead, but humans are allowed to kill them if it puts the human at risk (Republic of Indonesia, 1990). This statement is important for all of Borneo because there are animals that could kill humans. With many humans of Borneo living in close proximity to wildlife, protecting themselves is extremely important. However, someone is able to say they are protecting themselves, but in reality, they hunted the animal for meat. There is a lack of clarity in the laws surrounding logging, hunting, and the wildlife trade (Rangarajan, 2016). This could be due to corruption of government or the belief that the laws are effective in mitigating these threats towards biodiversity (Rangarajan, 2016).

Sarawak and Sabah

Both Sarawak and Sabah are both part of Malaysia, so many of their rules and regulations are similar, but each have their own state government which ends up creating differences in how laws are implemented and enforced. A Master Plan for Wildlife was put in place for all of Malaysia in 1996 that strictly bans the trade of wildlife and their parts (Stoner et al., 2007). In the Master Plan for Wildlife, access to protected areas is strictly controlled, a ban on firearms in these areas was implemented, harvesting protected tree species is controlled, alternative meat sources are given for logging companies, and conservation education was increased (Bennett and Gumal, 1997). This plan is the establishment of the Wildlife Protection Ordinance and the National Parks Ordinance that are part of the Malaysian Wildlife Law. Even with these restrictions in place, forests are still falling and wildlife habitat is still being degraded (Bennett and Gumal, 1997). Many animals are only able to live in primary forests, but it has been discovered that Sunda clouded leopards have been found in secondary forests and oil palm plantations as well (Azlan et al., 2006). Much of Sarawak is becoming oil palm plantations due to the high demand as well as the high demand for timber (Straumann, 2014). Oil palm plantations are not truly a viable habitat for any animal, including the other cats of Borneo, but the Sunda clouded leopard has been found hunting in these areas (Azlan et al., 2006). Unfortunately, oil palm is only good for hunting on the ground for the Sunda clouded leopard most likely due to how short the plants are and the lack of arboreal hiding and resting areas (Azlan et al., 2006). With this said, Sarawak's government has created a goal to plant 100,000 trees around the state in order to have more logging areas, but this could also help the wildlife of Sarawak as the forest is their home (Stuebing, 2005). Although this plan is not outlined well and does not describe the types of trees (Stuebing, 2005), increasing the number of trees could create viable habitat for Sunda clouded leopards as well as other forest dependent wildlife.

Sabah created a Biodiversity Council and the Sabah Biodiversity Center in 2000 in order to focus on the conservation of biodiversity (State of Sabah, 2000). These two creations allowed Sabah to have a section that would help influence and focus the government on conservation and conservation research (State of Sabah, 2000). The council would focus on making sure all laws and regulations correlate with the the Wildlife Ordinance and the National Parks Ordinance that are in place throughout Malaysia (State of Sabah, 2000). The council also approves access licenses to parts of Sabah that are natural or conservation areas (State of Sabah, 2000). The center is able to provide the government and other institutions with information about the biodiversity of Sabah, such as statistics or problems that must be tackled in order to protect biodiversity (State of Sabah, 2000). Sabah also has the Wildlife Conservation Enactment of 1997 which focuses on opening wildlife sanctuaries to the public (Minister of Tourism and Environmental Development, 1998). Licensing of wildlife guides is an important part of this enactment to ensure the safety of the wildlife of Sabah (Minister of Tourism and Environmental Development, 1998). It also discusses the requirements for hunting and fishing in these areas (Minister of Tourism and Environmental Development, 1998).

Threats and Mitigating Efforts

In many places such as Indonesia and Malaysia, management of protected areas is poor which, once this was realized, people began to use the forests to their own digression (Gaveau et al., 2013). This mismanagement and lack of management throughout these major parts of Borneo has created many problems to the wildlife and biodiversity, including the Sunda clouded leopard. It has been found in many areas where people are going into the forest to log or to collect for the wildlife trade, people hunt for subsidence (Rangarajan, 2016; Danker, pers. com. 6.8.2018; Biddle, pers. com. 5.30.2018). Many of these hunters have a preference for a specific species, starting with small mammals, such as primates, ungulates, and carnivores (Rangarajan, 2016). This correlates with the Sunda clouded leopard's prey species. This correlation should be taken into consideration for hunting laws and regulations in areas where people are illegally logging, hunting, and collecting. Focusing on the three major threats to the Sunda clouded leopard, logging, hunting, and the illegal wildlife trade, allows for focused mitigation efforts to be analyzed.

Logging

Three quarters of Southeast Asia's forests and nearly 50% of its biodiversity will be gone by 2100 if something is not done to prevent such occurrence (Sodhi et al., 2004). Logging and deforestation as well as habitat destruction are occurring around the world due to the increasing human population (Sodhi et al., 2004). Habitat destruction is the primary reason for many of the world's species to be classified as endangered. Fragmentation of habitat caused by habitat destruction can cause inbreeding due to the lack of access to mates with different genetic information (Chiang, 2007). This limitation in genetic variation is known to be detrimental to already small or struggling populations (Chiang, 2007). Logging has become one of the leading factors of habitat destruction and fragmentation.

Commercial logging and the demand for Asian timber has increased drastically since 1950 (Sodhi et al., 2004). Borneo is home to a species of tree, dipterocarp trees, that is in high demand for domestic use (Sodhi et al., 2004). During logging, even selective logging, the canopy is altered dramatically which increases the temperature of the forest below (Sodhi et al., 2004). Naturally, trees fall leaving open light spaces in the canopy, but when the trees are removed completely, the temperature increases dramatically. Seedlings and saplings at the logging sites are either non-existent or very low due to the destruction of the forest floor from the machines used for logging as well as this temperature increase (Sodhi et al., 2004). Without seedlings and saplings, forests cease to continuously grow and replenish themselves. This decreases biodiversity which, in the end, decreases the ecosystem services these areas provide human populations. Without this new growth, the forest will eventually die, leaving animals without shelter, food, and water. The Sunda clouded leopard, like the mainland clouded leopard, is primarily arboreal and relies on the trees for resting and hunting purposes (Chiang, 2007). Without trees, the Sunda clouded leopard has no place for resting and is forced to change its hunting tactics. Logging is not only destructive to arboreal lifestyle of the Sunda clouded leopard, but also to future generations of this animal and future generations of humans.

Some of the biggest drivers of deforestation are corruption of government bodies and poverty of the people in the areas surrounding forests (Sodhi et al., 2004). As seen in *Money Logging*, corruption can cause massive issues for the environment (Straumann, 2014). The greed for money from a commanding figure in government can lead to the destruction of all habitat

within the boundaries if not checked (Straumann, 2014). Through research in coastal Sarawak, it was discovered that much of the land that has been taken over by the government from communities and turned into national parks were logged or communities were given oil palm plants in exchange for the land and logged as well (Danker, pers. com. 6.9.2018). The corruption of the Sarawak government is not the only drive of extensive logging in Borneo. Living in poverty drives people to seek work and pay. Logging companies are willing to pay people to cut down the trees on their land in order to harvest the best timber (Danker, pers. com. 6.9.2018; WWF, pers. com. 5.21.2018).

Logging - Mitigation Efforts Kalimantan

In all of Indonesia, 33.5 million ha are set aside as 'protected forest' and 20.5 million ha are 'conservation forests' which are both protected areas which do not allow logging (Wardojo and Masripatin, 2002). Protection forests focus on protecting basic life necessities such as water while conservation forests conserve biodiversity (Wardojo and Masripatin, 2002). With this, like many places in Borneo, including Indonesian Borneo or Kalimantan, converting natural forest to plantations is typically prohibited, but in many areas, this is ignored (Gaveau et al., 2013). In order to log, companies are required to legally obtain a permit that allows them to log selectively in order to keep natural canopy cover (Gaveau et al., 2013). In Kalimantan, these areas are called "natural forest timber concessions," but in the 90s, due to loss in revenue, they were renamed "industrial plantation concessions" (Gaveau et al., 2013). With this change, these areas are now able to be converted to oil palm plantations which requires the forest to be logged. This, in the end, drives both the oil palm industry and the timber industry forward by allowing for this increase in supply (Gaveau et al., 2013). In 2010, Norway proceeded to commit to US\$1 billion worth of programs that focused on deforestation and emission reduction in Indonesia

(Dharmasaputra and Wahyudi 2014). This program called REDD+ was implemented in three phases of which the first phase focused on creating a plan and measuring what has already been done in Indonesia (Dharmasaputra and Wahyudi 2014). The second phase focused on implementing a plan that focused on law enforcement and policy development which was to happen from 2011 to 2013 (Dharmasaputra and Wahyudi 2014). Phase three focused back onto assessment and verification of the implementation of the REDD+ program (Dharmasaputra and Wahyudi 2014). Since Indonesia is still a developing country and corruption has been present in the government system for many years, it is believed that corruption will overtake these practices due to Norway paying forward instead of paying for a result (Dharmasaputra and Wahyudi 2014). This program that was implemented under the agreement with Norway was extremely limited and unfortunately did not allow for success throughout the entirety of Indonesia (Dharmasaputra and Wahyudi 2014). With the focus only on natural forests, any forest classified as 'secondary' or 'degraded' was not included (Dharmasaputra and Wahyudi 2014). On top of this classification problem, many borders and boundaries are not solid lines which again creates problems for this program (Dharmasaputra and Wahyudi 2014).

Sabah and Sarawak

The Forest Enactment of 1968 and the Forests Rules of 1969 are the two primary laws that outline logging in Sabah (Australian and Malaysian Gov., 2015). Sabah, back in 2002, had about 60% forest cover of some sort, which include natural, primary forest, secondary forest, and degraded forests (ECD, 2002). Legal logging in Sabah is focused primarily in the Commercial Forest Reserves that are required to to be harvested sustainably and the State-land Forests that are more focused on agriculture (ECD, 2002). The Forest Department approves a 100-year plan that a private Forest Management Unit creates before applying and receiving a license to log in Sabah's forests (ECD, 2002). There are strict rules and regulations that outline steps before,

during, and after logging has commenced in order to be more sustainable and to do less damage on the surrounding the environment (ECD, 2002). These steps focus specifically on the environmental impacts logging has on the environment and the human settlements in the surrounding areas (ECD, 2002). Much of the illegal processes surrounding logging in Sabah occur during the steps after the logging is finished (ECD, 2002). Burning vegetation occurs more often then not in these logging areas and has become the greatest problem Sabah has had to deal with surrounding logging (ECD, 2002). Sabah has a Timber Legality Assessment System that was evaluated and revised in 2013 (European Commission, 2013). This system is in place to make sure that Sabah's regulations are sustainable and healthy for both the people of Sarawak and the timber industry (European Commission, 2013). The version before this one lacked environmental regulations at are required to be approved through this system (European Commission, 2013).

Sarawak is known for the corruption in the government that has allowed the timber industry to take over and log drastic amounts of timber with Sarawak's borders (Straumann, 2014). Logging in Sarawak is managed by the Forest Department Sarawak and the Sarawak Forestry Corporation (Australian and Malaysian Gov., 2015). The Forest Ordinance of 2015 is the most recent outline of rules and regulations that surround logging and timber production in Sarawak (Laws of Sarawak, 2015). There are, similar to Sabah, outlines and regulations of the processes, permits, and licenses required in order to harvest timber within Sarawak's borders (Australian and Malaysian Gov., 2015). With this said, excessive and illegal timber harvesting has been happening within Sarawak for years and is due to the corruption within the government (Straumann, 2014). With the government promoting excessive and illegal logging, enforcement is nonexistent in Sarawak (Straumann, 2014; Danker, pers. com. 6.9.2018).

Hunting

The Iban people who live throughout Borneo have been known to have patches of sacred forest within their ancestral lands (Wadley and Colfer, 2004). Both the sacred and non-sacred parts of these ancestral forest lands provide important products that they have used for generations (Wadley and Colfer, 2004). These services include hunted meat of mammals and birds that are one of their primary sources of protein (Wadley and Colfer, 2004). Many of the Iban people have practiced sustainable hunting since they were children because this is how they were taught to keep the populations alive for future generations (Wadley and Colfer, 2004; Danker, pers. com. 6.9.2018). As the human population and densities increase, natural forest cover has decreased drastically and bush meat hunting pressures have increased dramatically in response, especially in Southeast Asia (Sodhi et al., 2004). With logging and the creation of roads, more areas of the forest have become easily accessible which has allowed for easier access to good hunting grounds (Sodhi et al., 2004). Hunting has been part of the culture of Borneo and the only meat source for many, many generations (Struebig et al., 2007). Although hunting for bush meat is an important food source for many, without proper management and the increase of human densities, this food source could disappear for both humans and the Sunda clouded leopard. Hunting, if not managed, can lead to a decrease in populations which could further translate to an extinction. Since the Sunda clouded leopard is a carnivore, its life depends on a steady supply of meat such as macaques, rodents, deer and possibly birds, boar, and bearded pig (Azlan et al., 2006). Which prey species the Sunda clouded leopard focuses on is unknown, but it is possible that this animal is an opportunistic hunter (Azlan et al., 2006). Protecting the primary prey source for the Sunda clouded leopard is important for their survival, but since it has yet to be discovered, proper management of all the possible prey sources would be able to sustain the cat population.

<u>Hunting - Mitigation Efforts</u> *Kalimantan*

The conservation areas mentioned before in Indonesia are broken up into three different areas (Wardojo and Masripatin, 2002). These areas are sanctuary reserves, nature conservation areas, and hunting areas (Wardojo and Masripatin, 2002). Protection forests also include hunting areas specifically for unprotected fauna (Wardojo and Masripatin, 2002). These two areas allow for the protection of wildlife, including the Sunda clouded leopard as well as the multiple possible prey sources. The hunting of endangered or rare species is illegal under "Act of the Republic of Indonesia No. 5," but this act does not include hunting laws of non-endangered species (Republic of Indonesia, 1990). This shift towards markets has moved many people away from hunting, but it is still much cheaper to go hunt than pay for the meat (Luskin et al., 2013). Poverty lessens the ability to buy meat, so hunting, for many who are living in poverty or who do not wish to spend the money, continue to hunt (Luskin et al., 2013). This is one of the main problems Kalimantan has, but on top of this, there are enforcement issue as well (Wardojo and Masripatin, 2002). The laws above regulate the trade and hunting of rare and endangered species, but struggles to outline hunting regulations in general (Rangarajan, 2016).

Sabah and Sarawak

Sabah has the Wildlife Conservation Enactment of 1997 which is the basic outline to their hunting and fishing laws in wildlife sanctuaries (Minister of Tourism and Environmental Development, 1998). These areas are a very small section of Sabah, so even with intensive restrictions here, wildlife is still at risk. Similar to the United States, in these areas everyone with a license, unless the license says otherwise, must register their catch (Minister of Tourism and Environmental Development, 1998). Unfortunately, this enactment does not mention the difference between hunting protected or unprotected animals or repercussions for going against the law (Minister of Tourism and Environmental Development, 1998). Protected animals are not allowed to be hunted and will result in a minimum sentence of six months with a maximum sentence of five years (Rajamani et al., 2006), but for animals that are not protected, hunting laws and poaching consequences seem to be nonexistent. This is an extremely old law and must be updated since these areas are important to both the Sunda clouded leopard and its prey. Protected areas and wildlife sanctuaries should be areas with high enforcement rates that protect the animals from being hunting and traded as well.

Hunting animals is tradition in Sarawak and is actually seen as a very normal way to acquire meat products (Danker, pers. com. 6.9.2018; WWF, pers. com. 5.21.2018; Biddle, pers. com. 5.30.2018). Indigenous people continue to hunt for subsidence, but many other people also hunt because it tastes better or costs less (Biddle, pers. com. 5.30.2018; and Robinson et al., 1999). The enforcement for the buying, selling, and hunting of wild meat used to be minimal, but around 2005, markets along the Indonesian border were not openly selling bush meat (Jensen and Das, 2008). This could be to an increase of enforcement or the development of a small culture shift. Being able to buy farmed meat demonstrates the amount of money that is being earned since farmed meat typically costs more (Jensen and Das, 2008).

Wildlife Trade

In China, where much of illegal felid trade is conducted, there has recently been a shift away from primarily traditional towards luxury use of cat products (Nijman and Shepherd, 2015). These products are typically tiger products, but, due to the decline in the tiger population, increase of conservation efforts, and increase in demand, it is believed that other felids could be replacing the supply (Nijman and Shepherd, 2015). The demand of wild cat parts has most likely increased due to the rise in China's standard of living (Nijman, 2010). Skins are used for decorative purposes due to their beautiful clouded patterns and are seen as an object that demonstrates the wealth of the owner (D'Cruze and Macdonald, 2015). Skins are more often found than any other item in the illegal wildlife trade (D'Cruze and Macdonald, 2015). This could be due to the easy display of the skins whereas bones and teeth are harder to identify (D'Cruze and Macdonald, 2015). However, even with this knowledge, there is very little known about the poaching and illegal trading of the clouded leopard (Nijman and Shepherd, 2015). In one study, which asked clouded leopard experts on the illegal trade, determined that traded clouded leopards were destined for China through India and Nepal borders (D'Cruze and Macdonald, 2015). During this time period, there was no division of clouded leopard subspecies, so it is unknown how much of each species were traded. With this said, there were five illegal trade records in Sarawak and Sabah from 1975 to 2013 (D'Cruze and Macdonald, 2015). In another study, surveys determined 482 clouded leopards, primarily heads, skulls, and skins, were found in shops around Mong La and Tachilek, Myanmar (Nijman and Shepherd, 2015). They were the second most abundant illegal cat trade found in this area, next to the leopard cat, which is a common wild cat (Nijman and Shepherd, 2015). In many of these markets, there were double the number of clouded leopard parts than tiger parts (Nijman and Shepherd, 2015). With this said, reports mentioned above is most likely to be lesser than the actual number of specimens in the wildlife trade market.

On top of the dead specimens, there has been an increase of wildlife tourism and demand of these animals in the pet trade (D'Cruze and Macdonald, 2015). Since CITES makes it very difficult to trade live animals, it is very possible there has been an increase in illegal trade (D'Cruze and Macdonald, 2015). This puts greater pressures on the already rare species, as live animals that have been found or confiscated are most likely taken from the wild (Biddle, pers. com. 5.30.2018). Captive breeding of these animals has had limited success and maintaining the standards of their needs is difficult, so it is primarily believed that many clouded leopards involved in these trades are being sourced from the wild (D'Cruze and Macdonald, 2015). Since the separation between the mainland clouded leopard and the Sunda clouded leopard, it is possible that more animals have come from Borneo, but mistaken or labeled as the mainland species. Tracking illegal trade of these animals can be difficult because people keep these animals and specimens hidden in transport due to the large cash reward (D'Cruze and Macdonald, 2015). Both the mainland clouded leopard and the Sunda clouded leopard are at risk of this trade, but to what extent for each species is primarily unknown. Indonesia, Malaysia and Vietnam are believed to be the leaders in wildlife exportation, so it is possible that their laws and regulations are not being implemented strongly enough or at all (Rangarajan, 2016).

Wildlife Trade - Mitigation Efforts Kalimantan

Trading and collection of wildlife is illegal in Indonesia without a license from the Directorate General of Forest Protection and Nature Conservation (Rangarajan, 2016). For non-CITES wildlife, trade is regulated through an annual quota which can be set by the province through a request after humane studies have been conducted to gather an approximate number of the wild populations (Rangarajan, 2016). With these laws in place, there are still people who collect and trade wildlife without a license and do not report back what they have collected (Rangarajan, 2016). Because of this problem, much of the wildlife trade from Kalimantan and the rest of Indonesia is not being monitored or regulated. On top of the unregulated and unreported collection, the non-detriment studies are not typically conducted and do not have a set time when they are supposed to be conducted (Rangarajan, 2016). A problem specifically for the Sunda clouded leopard is the fact that these studies, when they are conducted, do not take into consideration the changes in classification (Rangarajan, 2016). Even though the Sunda clouded leopard is now its own species, the species will still be counted along with the mainland clouded

leopard species. This means the population might look greater in the study conducted than in reality due to this split.

Sabah and Sarawak

The laws Malaysia has created surrounding wildlife are lacking because they are not current or enforced. It has been over 20 years since there has been any amendments made to these laws, and it seems as if they have not been acknowledged since the time they were created. Although wildlife and ecosystems themselves might not change in this amount of time, human impacts and perspectives could shift. With this lack of knowledge than can now be made aware of in these coastal areas, Sarawak could be able to use this information and increase education. As with any rules and regulations, they are only followed if enforcement is readily seen. During my research in Sarawak, I discovered that enforcement, at least in these areas and knowledge of the people I spoke to, is practically nonexistent. Sarawak has the Wildlife Protection Ordinance which seems to be the only regulation surrounding any and all wildlife trade other than CITES. This is minimal regulations for wildlife trade and, again, enforcement is also minimal, nonexistent, or not brought forward to the public eye (Biddle, pers. com. 5.30.2018; Danker, pers. com. 6.9.2018).

Again, in Sabah, under the Wildlife Conservation Enactment of 1997, protected animals are not allowed to be hunted and will result in a minimum sentence of six months with a maximum sentence of five years (Rajamani et al., 2006). Sabah also follows CITES wildlife trade regulations. There are certifications required under the Wildlife Conservation Enactment of 1997 to trade and/or own wildlife that is accompanied by an inspection for the welfare of the animal (Minister of Tourism and Environmental Development, 1998). There are multiple permits for different stages of animal trade and possession, but if these are not followed, then the illegal wildlife trade can continue and change wild populations drastically (Minister of Tourism and Environmental Development, 1998). These laws, however, are not effective if enforcement is not brought to the public eye and if people are not educated on the wildlife trade.

Leopard cats are a commonly traded wild cat (Nijman, 2010) and, from research gathered, it is possible that people of Sarawak and Sabah could mistake the clouded leopard for a leopard cat along the coast at least (Biddle, pers. com. 5.30.2018; Danker, pers. com. 6.8.2018; Drivers pres. com. 5.19.2018 – 6.6.2018; Abigail Noon, pers. com. 5.26.2018; SBC Guide pers. com, 5.21.2018). Few people who were spoken with in the coastal areas of Sarawak new the difference between the Sunda clouded leopard and the leopard cat (Danker, pers. com. 6.9.2018; Mulu Tour Guide, pers. com. 6.7.2018; Drivers pers. com. 5.19.2018 – 6.8.2018). Although, this could be a regional occurrence, it is still possible that the people of Borneo who do not live alongside these animals get them confused. Education plans for all of Borneo should be implemented in order to spread this knowledge. Also, giving the people of Kalimantan, Sabah, and Sarawak an animal that they can be proud to call their own could encourage many to save these animals and their forests. Even with this change, enforcement that is brought forward to the public eye to make an example of what will happen is extremely important because it will start the chain of stricter enforcement.

Sarawak Research

I had set out to understand the attitudes of the people of Sarawak towards the secretive animal, the clouded leopard and its conservation as well as to determine the effectiveness of conservation efforts and mitigation of threats. I asked multiple questions such as the following:

- Are there programs in place to spread awareness of the two-separate species of clouded leopard, one being endemic to Borneo and Sumatra?
- Are there any programs set up by the government to mitigate these threats? In your opinion, do you believe these programs are being implemented properly and effectively?

- Are you about to name all 5 Borneo wild cats without looking them up? What are the names you know them by? Could you tell me what you know about clouded leopards specifically?
- What value do you see in presence of clouded leopards? Why? Why do you or why do you not have strong feelings towards clouded leopards?

• In your opinion, what are the biggest threats toward the clouded leopards of Sarawak? After the first day of our time in Sarawak, I quickly discovered that many people did not even know what a clouded leopard was, let alone the fact that Borneo was home to the Sunda clouded leopard. After further describing the animal or showing a picture, many people still did not recognize the clouded leopard or had mistaken it for a leopard cat, a much more common cat in the surrounding area. Many people could not answer my questions at all because of this mistake or lack of knowledge and fewer saw value in such a secretive animal. Through a conservation, I discovered that many people, especially those in Kuching, were primarily focused on money making careers (Abigail Noon, pers. com. 5.26.2018).

Being only in coastal Sarawak, I feel like I was missing the perspective of the people who lived within the same areas as clouded leopards. Attitudes towards animals can vary due to the interactions people have with the animal. For many people in the United States, tigers are beautiful, strong animals that we respect, but our exposure to them is through zoos or online videos. Videos of cute baby tigers and other baby animals are the most exposure many people get to animals, so the world spread spatial distribution of attitudes towards tigers depends on how interactions have occurred as well as how much. Most people in the United States have not lived with the fear of a tiger possibly hunting their livestock or their livelihood. However, many people living in Nepal have completely different attitudes towards them because of their proximity to tigers and tiger attacks (Carter, et al., 2014). Understanding the spatial distributions of attitudes towards tigers in Nepal is important to wildlife conservation because behaviors typically stem from attitudes (Carter, et al., 2014). In a 2014 study in Nepal's Chitwan National Park on the spatial distribution of attitudes towards tigers, it was found that there is a significant difference over a small study area with only 500 people in the study (Carter, et al., 2014). The attitudes towards the tigers were typically based on what people had heard from the community they lived in as well as the number attacks they heard about (Carter, et al., 2014). Although the Sunda clouded leopard does not leave as large of an impact on lives of people in Borneo and Sumatra as tigers do in other areas around the world, the attitudes towards them are most likely extremely spatially dependent.

Conclusion

Through conservation, humans can have the ability to save many of the species that are being threatened by habitat destruction and illegal wildlife trade as well as the excessive hunting of prey species. All these problems with mitigation efforts in Borneo are extremely complex and will take many years to resolve. With this said, Sarawak, Sabah, and Kalimantan all have outlined goals or laws that could work well in protecting the Sunda clouded leopard and the biodiversity of Borneo if law enforcement efforts were to be increased dramatically. In theory, Sabah and Sarawak have well outlined laws surrounding wildlife trade and hunting, but unfortunately, there are many problems with enforcement in Sarawak specifically. The demand for timber and the easy access the government in Sarawak has to gazette, de-gazette, and gazette again national parks and other areas in order to extract timber is much of the reason why habitat destruction is a massive issue in Sarawak. Logging in Kalimantan is not well managed on top of the corruption in the government. Sarawak and Kalimantan seem to have the same problems for mitigating the threats towards their biodiversity and the Sunda clouded leopard. Hunting is part of the lifestyle of Sarawak. Much of the wildlife is seen as a food source for the people in this area. This is not a bad thing, but without proper management, hunting can destroy wild animal

populations that are major prey sources for the Sunda clouded leopard. The threat of hunting toward the Sunda clouded leopard populations will not be changed by law enforcement alone, but a change in culture must also occur for this threat to diminish. Buying and selling meat in markets must be seen as a normal before this threat can be minimized. There must also be a culture before the wildlife trade threat diminishes. The demand from China for both live and dead wild cats has increased due to the increase in quality of life in the populations of China. Medicinal uses for wild cat products are still believed to work well and cure a number of illnesses such as aches and pains (Gratwicke et al., 2008). The lack of regulation and persecution surrounding wildlife trade, illegal or not, in all three areas discussed above makes them an easy target for the wildlife trade.

Overall, the laws and regulations that the majority of Borneo has in place are not being enforced strongly enough to truly protect the Sunda clouded leopard or its prey species. The three major areas that make up Borneo, Sarawak, Sabah, and Kalimantan, all lack the enforcement required to be effective for sustainable harvesting. This apex predator of Borneo, the Sunda clouded leopard, is under a great threat with the drastic loss of habitat and the continuation of poorly managed hunting and wildlife trade. The lack of studies on this species and its prey species continues to allow this species to be almost completely unknown. Conservationists must focus on the beginning. Understanding what and where the Sunda clouded leopard hunts along with discovering the population distribution and abundance are the first steps in saving this species from extinction.

Bibliography

- Australian and Malaysian Government. (2015). "Country specific guideline for Malaysia (Sarawak)." http://www.agriculture.gov.au/SiteCollectionDocuments/forestry/australiasforest-policies/illegal-logging/malaysia-sarawak.pdf
- Azlan, J. M. and Dionysius S. K. Sharma. (2006). "The Diversity and Activity Patterns of Wild Felids in a Secondary Forest in Peninsular Malaysia." *Oryx* 40(1):36-41 <u>http://ezproxy.ups.edu/login?url=https://search-proquest-</u> <u>com.ezproxy.ups.edu:2443/docview/222241826?accountid=1627</u>.
- Bennett, Elizabeth L., and Melvin T. Gumal. (1997). The Interrelationships of Commercial Logging, Hunting, and Wildlife in Sarawak: Recommendations for Forest Management.
- Buckley-Beason, V.A., Johnson, W.E., Nash, W.G.; Stanyon, R., Menninger, J.C., Driscoll, C.A., Howard, J., Bush, M., Page, J.E., Roelke, M.E., Stone, G., Martelli, P.P., Wen, C., Ling, L., Duraisingam, R.K., Lam, P.V., and O'Brien, S.J. (2006). "Molecular evidence for species-level distinctions in clouded leopards." Current Biology. 16 (23): 2371–2376. doi:10.1016/j.cub.2006.08.066
- Carter, Neil H., Shawn J. Riley, Ashton Shortridge, Binoj K. Shrestha, Jianguo Liu. (2014). "Spatial Assessment of Attitudes Toward Tigers in Nepal." AMBIO, 43:125–137. DOI 10.1007/s13280-013-0421-7
- Chiang, Po-Jen. (2007). Ecology and conservation of Formosan clouded leopard, its prey, and other sympatric carnivores in southern Taiwan.
- Chiang, P.-J., Pei, K. J.-C., Vaughan, M. R., Li, C.-F., Chen, M.-T., Liu, J.-N., and Lin, C.-Y. (2015). "Is the clouded leopard Neofelis nebulosa extinct in Taiwan, and could it be reintroduced? An assessment of prey and habitat." Oryx, 49(2), 261–269. <u>https://doi.org/10.1017/S003060531300063X</u>
- D'Cruze, Neil and David W. Macdonald. (2015). Clouded in mystery: the global trade in clouded leopards. *Biodiversity and Conservation* 24 (14) pp 3505–3526
- Dharmasaputra, Metta, and Ade Wahyudi. (2014). "The Impact of Payment-for-Performance Finance on the Political Economy of Deforestation in Indonesia." CDG Background Paper, Center for Global Development, Washington D.C. <u>https://www.cgdev.org/sites/default/files/CGD-Climate-Forest-Series-9-Dhamasaputra-Wahyudi-Indonesia.pdf</u>
- Environmental Conservation Department (ECD), Sabah, Malaysia. (2002). "Environmental Impact Assessment (EIA) Guidelines for logging and forest clearance activities, Sabah, Malaysia." <u>https://www.elaw.org/system/files/Malaysia%20Sarawak%20forest%20EIA%20guidelin</u> es.pdf

- European Commission. (2013). "Evaluation and revision of the Sabah TLAS standard and audit checklists." <u>file:///Users/Moflaherty/Downloads/evaluation_and_revision_of_the_sabah_tlas_standar_d_and_audit_checklists_31oct13_final.pdf</u>
- Gao, Y. T. 1987. Fauna Sinica, Mammalia, Vol. 8: Carnivora. Science Press, Beijing, China.
- Gaveau, David L A., Sheil, Douglas, Husnayaen; Salim, Mohammad A, and Arjasakusuma, Sanjiwana. (2016). "Rapid conversions and avoided deforestation: examining four decades of industrial plantation expansion in Borneo" Scientific Reports (Nature Publisher Group) 6. DOI:10.1038/srep32017
- Grassman, Lon I., Michael E. Tewes, Nova J. Silvy, Kitti Kreetiyutanont. (2005). "Ecology of Three Sympatric Felids in a Mixed Evergreen Forest in North-Central Thailand." *Journal* of Mammalogy, 86(1); 29–38, <u>https://doi.org/10.1644/1545-1542(2005)086<0029:EOTSFI>2.0.CO;2</u>
- Gratwicke, Brian, Judy Mills, Adam Dutton, Grace Gabriel, Barney Long, John Seidensticker, Belinda Wright, Wang You, and Li Zhang. (2006). "Attitudes Toward Consumption and Conservation of Tigers in China." https://doi.org/10.1371/journal.pone.0002544

Guggisberg, C. A. W. 1975. Wild cats of the world. 1st edition. Taplinger Pub. Co., New York.

- IUCN. (2008). "Neofelis diardi." IUCN Red List. http://www.iucnredlist.org/details/136603/0.
- Jensen, Karen A. and Indraneil Das. (2008). "Cultural Exploitation of Freshwater Turtles in Sarawak, Malaysian Borneo." *Chelonian Conservation and Biology*7(2):281-285 <u>http://ezproxy.ups.edu/login?url=https://search-proquest-</u> <u>com.ezproxy.ups.edu:2443/docview/208666433?accountid=1627</u>
- Kitchener, A.C., Beaumont, M.A., and Richardson, D. (2006). "Geographical variation in the clouded leopard, Neofelis nebulosa, reveals two species." Current Biology. 16 (23): 2377–2383. doi:10.1016/j.cub.2006.10.066
- Laws of Sarawak. (2015). "FORESTS ORDINANCE, 2015." http://lawnet.sarawak.gov.my/lawnet_file/Ordinance/ORD_Watermark.pdf
- Nijman, V. (2010). An overview of international wildlife trade from Southeast Asia. Biodiversity Conservation. 19: 1101. <u>https://doi.org/10.1007/s10531-009-9758-4</u>
- Nijman, Vincent and Chris R. Shepherd. (2015). "Trade in tigers and other wild cats in Mong La and Tachilek, Myanmar – A tale of two border towns." 182, 1-7 <u>https://doi.org/10.1016/j.biocon.2014.10.031</u>

Minister of Tourism and Environmental Development. (1998). "WILDLIFE CONSERVATION

ENACTMENT 1997 (Enactment No. 6 of 1997)." https://www.sabahlaw.com/Wildliferegulation.htm

- Rabinowitz, A., P. Andau, and P. P. K. Chai. (1987). "The clouded leopard in Malaysian Borneo." Oryx 21(2):107 – 111. DOI: 10.1017/S0030605300026648
- Rajamani, Leela, Annabel S. Cabanban and Abdul R. Ridzwan. (2006). "Indigenous use and Trade of Dugong (Dugong Dugon) in Sabah, Malaysia." *Ambio*35(5):266-8 http://ezproxy.ups.edu/login?url=https://search-proquestcom.ezproxy.ups.edu:2443/docview/207672998?accountid=1627
- Rangarajan, Rohini. (2016). "Understanding the Motivations for Illegal Hunting: Creating Typologies of Hunters in Southeast Asia." Order No. 10310837, National University of Singapore. http://ezproxy.ups.edu/login?url=https://search-proquestcom.ezproxy.ups.edu:2443/docview/1876856829?accountid=1627.
- Republic of Indonesia. (1990). "Act of the Republic of Indonesia No. 5 Concerning Conservation of Living Resources and their Ecosystems." Ministry of Forestry of the Republic of Indonesia. <u>http://extwprlegs1.fao.org/docs/pdf/ins3867.pdf</u>
- Ripple, William J., Eric J. Larsen, Roy A. Renkin, Douglas W. Smith. (2001). Trophic cascades among wolves, elk and aspen on Yellowstone National Park's northern range. *Biological Conservation* 102 pp 227–234.
- Ripple, W. J., James A. Estes, Robert L. Beschta, Christopher C. Wilmers, Euan G. Ritchie, Mark Hebblewhite, Joel Berger, Bodil Elmhagen, Mike Letnic, Michael P. Nelson, Oswald J. Schmitz, Douglas W. Smith, Arian D. Wallach, and Aaron J. Wirsing. (2014). Science 343, 1241484. DOI: 10.1126/science.1241484
- Robinson, John C., Kent H. Redford and Elizabeth L. Bennett. (1999). "Wildlife Harvest in Logged Tropical Forests." *Science* 284(5414):595-596. <u>http://ezproxy.ups.edu/login?url=https://search-proquest-</u> <u>com.ezproxy.ups.edu:2443/docview/213562862?accountid=1627</u>
- Ross, J., A. J. Hearn, P. J. Johnson, and D W. Macdonald. "Activity patterns and temporal avoidance by prey in response to Sunda clouded leopard predation risk" *Journal of Zoology* 290(2), 96-106. ttp://ezproxy.ups.edu/login?url=https://search-proquestcom.ezproxy.ups.edu:2443/docview/1406173976?accountid=1627
- Sanderson, J., Khan, J.A., Grassman, L. Mallon, D.P. (2008). *Neofelis nebulosa*. IUCN Red List of Threatened Species (accessed 05.05.18).
- Sergio, F., I. Newton, L. Marchesi, and P. Pedrini. (2006)." Ecologically justified charisma: preservation of top predators delivers biodiversity conservation." Journal of Applied Ecology 43:1049–1055

- Smith, Douglas W., Rolf O. Peterson, and Douglas B. Houston. (2003). Yellowstone After Wolves. *BioScience*, Volume 53, Issue 4, 1, Pages 330–340, <u>https://doi.org/10.1641/0006-3568(2003)053[0330:YAW]2.0.CO;2</u>
- Sodhi, Navjot S., Lian Pin Koh, Barry W. Brook, and Peter K.L. Ng. (2004). "Southeast Asian biodiversity: an impending disaster." TRENDS in Ecology and Evolution Vol.19 No.12. doi:10.1016/j.tree.2004.09.006
- Stuebing, Robert B. (2005). "Wildlife conservation in the planted forests of Sarawak: Blind Ambition?" Wallace in Sarawak– 150 Years Later. An International Conference on Biogeography and Biodiversity. 2005. A. A. Tuen and I. Das (Eds). pp: 134–142.
- Straumann, Lukas. (2014). "Money logging: on the trail of the Asian timber mafia." Bergli Books, Basel, Switzerland.
- Struebig, M. J., Harrison, M. E., Cheyne, S. M., & Limin, S. H. (2007). Intensive hunting of large flying foxes *Pteropus vampyrus natunae* in central Kalimantan, Indonesian Borneo. *Oryx*, 41(3), 390-393. doi:http://dx.doi.org/10.1017/S0030605307000310
- Wadley, Reed L., and Carol J. Pierce Colfer. (2004). "Sacred Forest, Hunting, and Conservation in West Kalimantan, Indonesia." *Human Ecology*, 32(3) <u>https://link.springer.com/content/pdf/10.1023/B:HUEC.0000028084.30742.d0.pdf</u>

Wardojo, Wahjudi, and Nur Masripatin (2002). "Trends in Indonesian Forest Policy." Policy Trend Report: 11-21 https://pdfs.semanticscholar.org/2476/e43a3e5dab1ee62ce15d915ca33a84c542c3.pdf