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Synthetic Rhino Horns as a Conservation Method

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species have one horn, while others have two. [1] Three of those five rhino species are considered facing a high threat of extinction in the wild; the subspecies of the Northern White Rhino is now only populated by two female rhinoceroses, the last male died in sanctuary in March of 2018. Thus, the fate of the Northern White Rhino rests in potential In Vitro Fertilization (IVF), technology that has yet to have been proven to work or utilized, and for this reason they are often classified as extinct in the wild.[2]

Wildlife crime, specifically poaching, is the biggest threat to global rhino populations. As National Geographic photographer Ami Vitale w

witnessing the extinction of a species that had survived for millions of years but could not

[3] Humans have caused the drastic decline in global rhino populations, dominantly through poaching, but habitat destruction and pollution have also contributed to the

potency in men, and in others horns serve as indications of a very high social status, wealth, and importance. Around 2008, a rumor circulated tha

cancer, and after this demand for it grew exponentially in Vietnam.[5] Rhino horns are illegally supplied through sophisticated transnational organized crime networks, commonly referred to as [6] Poaching of rhinos has steadily and quickly increased since 2008; for the last five years, rhinos have been poached at a rate of 3 per day.

Rhino preservation has become a pressing issue in the conservation field, due to their decreasing populations , a term that signifies that rhinos hold, and have held for fifty million years, important roles in a wide range of ecosystems, and the survival and wellbeing of other animal, plant, and insect species depend on rhinoceroses. When rhinos are protected, so are these many other species and thus global biodiversity as well. (2009) investigation of the one horned rhino in Nepal, found that under current rhino poaching prevention strategies, the population is going to continue to be at large risk, most likely reaching extinction.[7] Thus calling for some sort of adaption to rhino conservation methods.

Synthetic rhino horns, or fake-manufactured rhino horns are a potential conservation method that could be utilized to decrease poaching and therefore save rhino populations. In this thesis a theoretical discussion of various economic theories and models will be utilized to explore the possibility of synthetic rhino horns as a conservation method aimed at potentially deterring poaching of wild rhinos for their horns. The goal of these synthetic rhino horns should

[5] Actman, Jani. (2015) Can Fake Rhino Horn Stop the Poaching of a Species at Risk?
[6] Save the Rhino. (2016) IUCN Reports Deepening Rhino Poaching Crisis in Africa
[7] Poudyal, M., Rothley, K., and Knowler, D. (2009) Ecological and Economic Analysis of Poaching of the Greater One-horned Rhinoceros (Rhinoceros Unicornis) in Nepal

be to cause uncertainty in the minds of buyers and so create a type of Market for Lemons, as in Akerlof (1970).

Literature Review

Conservation of endangered species is a well explored subject, many academic articles and proposals exist on wildlife preservation. Yet, there is barely any existing literature on synthetic rhino horns. This is because they have not yet been utilized as conservation method. The delay on production is due to the existence of dissent surrounding the positive effect of synthetic rhino horns on wild rhino populations. Organizations such as Save the Rhino

same warming-ability as real fur does. So, the people switching from real fur to faux fur will not be located those regions, for example northern Russians will not substitute real fur for faux fur. Additionally, the authors consider other environmental impacts of synthetic and real fur, such as the resources it takes for minks to be fed and sustained in order to kill them and obtain their fur. Considering this, real fur is found to be much more environmentally harmful than fake, synthetic, or faux fur. They find that because of market demands, the fashion industry will continue to have both real fur and faux-fur products, not necessarily decreasing the amount of real fur used, or animals killed in the production of real fur. Additionally, organizations such as People for the Ethical Treatment of Animals (PETA) that raise awareness around animal abuse, encourage consumers to favor faux-fur if they are inclined to decrease animal abuse.[10] Finally, they find that status will continue to drive the demand for real fur, regardless of the coldness or need for warmth and the known animal abuse.

An issue that conservation surrounding the fur industry faces, despite tactical attempts such as faux fur, is the poorly regulated fur trade. For example, in 2000, the United Kingdom banned fur farms from existing through a national probation, followed by some other European countries.[11] Yet, the UK continues to be a factor in the over 1 billion rabbits and 50 million other animals (foxes, seals, mink, raccoons, and dogs) killed for their pelt to be used in fur. Much of this fur is imported from China and other countries that have poor regulation of the fur trade, and fur that is not faux is commonly labeled as faux.[12] In this sense, faux fur has not been successful in diminishing the animal slaughter that goes in to producing fur, and the rate that they are being killed at is not expected to slow.

[10] Muthu, S. S. (2017). Textiles and Clothing Sustainability: Sustainable Fashion and Consumption.
[11] Fur Free Alliance. Fur bans.
[12] Last Chance for Animals. Fur Trade Facts.

Other proposed conservation methods for endangered species include the privatization of wildlife, and the legalization of wildlife trade where it has been previously banned. The term

reproduction. The advantage of this conservation tactic is that the private owner of the wildlife receives a positive economic return, and therefore has incentive to conserve the wildlife. [13] A prominent example of this in the United States is cattle, because of the profits gained from beef and milk, cattle ranchers have incentive to sustain the population of cows; it is very unlikely that cows will go extinct for this reason. However, rhinoceroses are not as easily domesticated, they are more aggressive and reproduce more slowly than other domesticated animals, making this an

Animals that are illegally killed by trophy hunters have begun to be auctioned off as an attempt to regulate the market for trophy kills. For example, there has recently been public backlash against the selling of a rare white lion as a trophy kill. [14] Tactics like this, and the one employed by the Alberta National Park in auctioning off big horn sheep to hunters, are meant to regulate the market and control the amount animals being killed, monitoring population rate.[15] This conservation method generates income for the group regulating the market, and in the case of Alberta, is utilized to fund wildlife research that otherwise would not exists. Legalization and

market regulation and stockpile collection would have to be done using captive breeding programs (CBPs) for rhinos. For rhinoceroses this would require spatial and costly terrain, and their aggressiveness would once again inhibit feasible domestication and stockpile collection of their horns.[16] Furthermore, current rhino populations are much lower than other wildlife populations, and they reproduce at a slower rate. Other regulated wildlife industries, like crocodile skin, were established in existing well-regulated industries, enabling them to be monitored and carried out proficiently. Meanwhile rhino horns are currently used in an unprocessed form mainly in China and Vietnam, which are known for weak control of their drug industries, specifically.[17] Suggesting that market regulation would not be an effective conservation method .

Conservation and rhino poaching prevention methods require improvement, and without it there is a grim future for global rhino populations. As shown by the global, continued decrease of rhinoceros populations, along with

National Park, rhino conservation methods have not been successful in saving the populations. However, poaching is a complex problem, influenced by many different factors such as the price of rhino horn on the international market, local socioeconomic factors, and the population dynamics of the species. Therefore, few studies have attempted to address this complexity.[18] The case of the greater One-Horned rhinoceros in Nepal was a study attempting this, and Poudyal et al. concluded that current rhino conservation is not going to be effective in saving the population.

long-run control, antipoaching policies should be directed at

[16] Collins, A., Fraser, G., Snowball, J. (2016) Issues and Concerns in Developing Regulated Markets for Endangered Species Products: The Case of Rhinoceros Horns.
[17] Prins, H., Okita-Ouma, B. (2013) Rhino Poaching: Unique Challenges.
[18] Poudyal, M., Rothley, K., and Knowler, D. (2009) Ecological and Economic Analysis of Poaching of the Greater One-horned Rhinoceros (Rhinoceros Unicornis) in Nepal

increasing the opportunity costs of poaching by creating better alternative economic opportunities, and at antipoaching enforcement [19] Other studies have been done examining the impact of specific conservation methods on rhino populations. Berger and Cunningham found that the practice of dehorning rhinoceroses in order to decrease the incentive for poachers is unlikely to be an effective prevention strategy in areas with dangerous predators (such as poachers), and conclude that their study highlights the importance of experiential conservation/prevention strategies in protecting rhinoceroses.[20] Rabinowitz studied vulnerable populations of Sumatran rhinos in Borneo, and concluded that the long-term conservation practice of capturing and breeding Sumatran rhinoceroses has ultimately failed in salvaging rhino populations.[21] Rhino populations are dependent on new, innovative conservation tactics to ensure

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The Market for Lemons, adverse selection, and uncertainty in the consumers has been examined in other fields, and by Akerlof himself in the used-car industry. However, like the market for wild rhino horns, there are other markets that humanitarian or philanthropic groups and advocates wish not to exist. The market for drugs is an example where uncertainty could also play a role in reducing or collapsing the market for benevolent reasons: less abuse, overdoses, and other harm caused by drugs. In the Economics of Illegal Drug Markets, the authors question how this market has not collapsed because of the inability to know the purity of illegal drugs

the unenforceability, means the drug market is always on the brink of collapse

inferior, superior, and perfect substitutes to wild rhino horns by consumers, with the synthetic rhino horn production being monopolistic and then perfectly competitive. His main finding is that the market structure and the suitability of the synthetic rhino horn are what determine if there is a decrease in poaching of rhinos, and what the magnitude of that decrease would be.

Practical Implications of Synthetic Rhino Horns

A bioengineering company based in the United States, Pembient, began exploring the potential of synthetic rhino horns back in 2015. The company is f

world new ideas need to disrupt the markets for wildlife goods in order to save endangered populations. Pembient wants to begin larger production of fake, bio-fabricated rhino horns by injecting rhino genetic code into yeast adding rhino DNA, and then 3-D printing horns using this substance.[23] Originally, Pembient released plans of these synthetic horns being marketed as a powder, and several companies were interested in combining it with items like beer and skin cream to be sold to Southeast Asian consumers. However, this received a very high amount of backlash from conservationists because it would be that will reach an entirely new audience , stated.[24]

From here, Pembient shifted its plans back towards producing rhino horn products in the durable goods market, and jewelry. Pembient has created prototypes of these items and is hoping to get them out into the market by 2022.[25] However, the company plans to market these synthetic horns, or products derived from them, as artificial rhino horns, and at a

[23] Pembient. (2019). Conservation.
[24] Actman, Jani. (2015). Can Fake Rhino Horn Stop the Poaching of a Species at Risk?
[25] Peters, Adele. (2018). Synthetic Rhino Horns are supposed to disrupt poaching. Will they work?

and the development of legitimate sales for profit may lend credibility to the unproven claims of rhino horn

worldwide.[29] Professor Chen agrees that introducing an alternative artificial product would risk increasing the demand for horns in general, thus increasing the economic incentive of poaching, and exacerbating the . He also identifies how there are more than one way to flood the market with these products, and how conservation groups tend to clump the different strategies related to synthetic rhino horns together and reject them all.[30]

Introducing synthetics into the market that pass as real rhino horn because they are chemically and biologically identical, or close enough to identical to real rhino horns, and have some sort of negative consequence is the path Chen suggests pursuing. The negative consequence could be that ingesting the synthetic rhino horn triggers some sort of stomach ache, or simply could be that a consumer spent $60,000 per kilogram on a rhino horn product that is fake, and thus does not have the rarity or reputation of the raw material that they desired. The potential of these chemically convincing rhino horns now seems to lie in the development of synthetics made from horsehair. [31] Horsehair has become the best option in creating a confusingly similar synthetic horn, because rhinoceroses and horses share a common ancestor, likening their DNA structures. Additionally, , is the

competitive market, we know that the long run efficient outcome is for all goods that are supplied, lemons and suitable, being sold. The price of the good, and the consumer value, and resulting consumer surplus from purchasing a rhino horn, either synthetic or real, is what determines the quantity of each good being sold.[36] A market with full information for buyers and consumers would not result in a complete reduction of authentic rhino horns being produced through poaching, in the way a market with asymmetrical information would.

Asymmetrical information occurs when traders on one side of the market know the status of a good, as a lemon or suitable good, and the traders on the other side of the market do not.[37] The problem presented in this market is because traders who have the detailed information, (suppliers) may benefit from concealing or misrepresenting the goods. Buyers cannot distinguish between the two types of goods, and in this case the two types are synthetic and real rhino horns. Thus, there is only one price and one market for the good, rhino horns. The buyers decision to purchase a horn now incorporates an uncertainty of the quality of the good. Furthermore, individuals in this market know that with the probability q it is a suitable good, and with probably $1 \quad q$ it is a lemon, and by assumption q is the proportion of real rhino horns produced, and $1 \quad q$ is the proportion of synthetic rhino horns produced.[38] Overtime, the proportion of rhino horns being produced, q, will be decreasing due to the continuous decline of their population, but also hopefully because of successful anti-poaching measures. Contrastingly, if Dr. Vollath and colleagues and are able to successfully produce an indistinguishable synthetic rhino horn, production of lemons could be increasing overtime. Thus, the probability of receiving a lemon,

[36] Ibid.
[37] Ibid.
[38]

1 q, while paying full price for a rhino horn, would be increasing. This uncertainty introduced to the market, would taint the market

and most likely be magnified by the extremely high prices of products derived from rhino horn. Resulting in the market for rhino horns collapsing, as no consumers will want to buy a rhino horn as it becomes increasingly likely that is a lemon, which they are unable identify for themselves.

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bimetallic system of currency, as an analogy for how the lemons would drive the suitable goods out of the market.[39]

An indistinguishable synthetic rhino horn being produced enables the possibility of

ing realistically applied to the case of rhino horns. Thus, presenting an opportunity for the market for rhino horns to collapse, removing the economic incentive for poachers, and saving global rhino populations from their most imminent threat. Professor Chen explores the implications of synthetic rhino horns, in *The Economics of Synthetic Rhino Horns,* concluding that the market structure and substitutability of the synthetic rhino horns determine its effectiveness in reducing the poaching of rhinos.

Expansions of Synthetic Rhino Horns

synthetic rhino horns is also applicable to the various developments of the potential conservation method thus far. He finds that synthetic rhino horn producers would benefit the most by promoting their products as superior substitutes to real rhino horns. This marketing strategy portrays the synthetic horns as distinguished from the real ones, and superior to them for reasons such as environmental friendliness or the lack of

[39] Ibid.

contamination of the bio-fabricated products compared to the contaminated horn of a wild animal.[40]

as profit maximizers in the way Pembient has planned for. Rather, the firms are more likely to be not-for-profit entities solely aimed at saving rhino populations if synthetic rhino horns are ever to be implemented and supported by the conservation community. Synthetic rhino horns like that of prototypes being accepted by the conservation community, utilized exclusively with the altruistic motive of reducing poaching, and specifically as a method to reduce demand for real rhino horns is the most likely avenue for this potential conservation method. For profit maximizing companies the objective function is maximizing revenue and minimizing costs. But there is no absolute consensus on not-for-profit entities , but rather they prioritize the benevolent motives involved in the founding of their company.[42] And in this case, the primary altruistic motive would be to save an endangered species by decreasing consumption of rhino horn and therefore poaching.

Professor Chen explores the possibility of synthetic rhino horns being considered inferior, perfect, and superior substitutes for wild rhino horns. However, it is more realistic to assume that synthetic rhino horns will be perceived as inferior substitutes to wild rhino horns by consumers. This assumption is crucial to the collapse of the market for authentic rhino horns when flooded with lemons. If the synthetic rhino horns are identical, or too costly or confusing, to distinguish from the real wild rhino horns, but not considered to be lesser in some way, then the market will not collapse and the synthetic horns could have negative effects on rhino populations. However it is realistic to assume that the synthetic rhino horns would not be considered superior or perfect substitutes for authentic ones because highly valuable is rooted in the perception of rhinoceroses as mystical beasts who have roamed the earth for 50 million years. There is a certain masculinity that is involved with removing and owning the horn

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of a beast, similar to the virility conceived from hunting a lion or other exotic animals that a synthetic horn cannot provide. Furthermore, because synthetic rhino horns do not have any proven medicinal or scientific value, the belief that they cure various diseases or health disorders lies in the understanding that rhino horns have some sort of curability because of their mythical aspect or powers. However, western media and understanding heavily overestimates the consumption of rhino horns in Southeast Asia for medicinal purposes. A study of consumer reasoning for purchasing a rhino horn showed that it now serves as more of a positional good than any else. Exploring this when pursuing the production of synthetics is important in evaluating the success of them as a conservation method.

Rhino Horns as a Positional Good

A media content analysis between Chinese and western newspapers from 2000 to 2014 was utilized to examine the difference between perceptions of wild rhino horn consumption in Southeast Asia.[43] Western media alleged consumption of rhino horn in China to be overwhelmingly due to its perceived medicinal value. Reporting that 84% of rhino horn acquisition and consumption was due to the belief that is has scientific powers, such as curing cancer, blood disorders, or hangovers. Furthermore, the west has disproportionality alleged rhino horn consumption to be related

The newspaper analysis points out the arts and antiques market as an underestimated driver of the demand for rhino horns in China. In Chinese media, rhino horn consumption was reported to be driven by investment and collectible value 75% of the time, by artistic value 40%, of the time, and by medicinal value only 29% of the time. Additionally, their study showed a

number of rhinoceroses being poached in South Africa, which has the largest rhino population in the world. Revealing the collectible and artistic value of rhino horns to be crucial in the conservation conversation. Rhino horns are utilized as a fine art craving material to make cups, bowls, hairpins, rings, and many other functional or ornamental items.[44]

define what it means for members of a society to be wealthy, determined by whether they can attain them or not, and conspicuous consumption is the spending of money in order to attain utility by publicly displaying

nuance that message with some rhino is good, some of its bad, some its legal, some of it is illegal, you lose people and lose the clarity of the message. [48] However, this logic more applies to the synthetic rhino horns that would be marketed as artificial, and legal, like Pembient s prototypes. Meanwhile, an identical, inferior substitute would not have messaging of being superior, or good, for contamination or environmental reasons, and rather would be more of a fear or distrust for consumers when buying a horn. Additionally, flooding the market for altruistic, rather than profit-based objectives, could potentially be done through groups such as Save the Rhino, which, depending on how the market is infiltrated, could allow for regulation issues to be avoided.

Conclusion

Despite concerns surrounding the current development of synthetic rhino horns from profit-based bio-tech companies, if implemented in the correct way, synthetic rhino horns could be an extremely effective conservation method. New ideas and strategies are necessary, and further exploration of this one seems to be becoming more important as rhino populations continue to decline at very alarming rates. An indistinguishable, identical, synthetic rhino horn that would serve as a lemon in the market for horns would cause the market to collapse and eliminate ood. However, further information such as the realistic possibility of flooding the market with these synthetics and doing so in a way to avoid regulatory issues, is required before the conservation community is likely to get on board. Gambling with conservation methods for a species with very low numbers is dangerous, so the horns would need to be implemented in an extremely cautious and constructive manner. Yet,

[48] Actman, Jani. (2015) Can Fake Rhino Horn Stop the Poaching of a Species at Risk?

doing nothing to improve the current status and trend of rhino populations means we are likely to see this species go extinct. This

synthetic rhino horns and their practical implications has lead to the conclusion that this conservation strategy should be considered further in light of the impending rhinoceros crisis.

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