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Enhancing China's Dwindling Bee Population One Buzz at a Time

Buzz, Buzz, Buz, Bu, B... Do you hear that? Nothing. That's the sound of the dwindling bee population in China. The *Apis mellifera*, commonly referred to as honey bees, are perhaps the most intensely studied insect. Their importance to the agricultural industry has driven the need for scientific research. As a result, important and interesting information has been discovered. Bees may be the hardest working creatures on this planet, and because of their hard work, we owe many thanks to this amazing, yet commonly underappreciated insect. It's been said that the honey bee is the greatest and most important pollinator. In fact, the value of honey bees alone as pollinators in the United States is estimated at about \$15 billion annually with them doing almost 80% of all crop pollination, in fruits, nuts, berries, and many other various crops. Without them, farmers and consumers could potentially be at a great loss. A large colony makes it easy for bees to communicate the direction and distance of a food source. Pollination is the transfer of pollen grains between the male germ cell of a plant (anther) and the female reproductive system (stigma) in seed plants. Without pollination, plants would not produce a crop. Honey Bees are vital in procuring pollination and sustaining life. We as Americans have also seen a great decline of the honey bee population in the past few years. Many agencies and independent activists are working diligently in the efforts to save the diminishing population of honey bees. Although our population is declining, we still have an abundance of bees to sustain a majority of our pollinated crops. We also have the technology and education to further increase the population. But further research shows that other countries are also facing this decline of the honey bee population. The one country that stands out the most to me is China. The statistics are startling! This has propelled me to dig even deeper into my research on how to save the honey bee population around the world: specifically, China.

Located in Southeast Asia along the Pacific Ocean, China is one of the largest countries in the world. It is a communist country, which means it is governed by an appointed leader. The current Leader of China is, Xi Jinping. As of 2016, China had a population of over 1.37 billion people with a continuum of steady increase each passing year. In all countries of the world, family is the epicenter of life. This also rings true in Chinese culture. A typical family size consists of 3.81 people per household. This number has dropped from previous years being 4.81 in 1973. In the 1950's, China's population started to exceed the food supply. As a result, the government created an "Only Child Policy" in 1979. This meant that a couple could only have one child. This was only supposed to be a short-term law. In 2015 this law was amended so that only certain couples that fit into strict criteria could have two children. As time went on, the policy became more lenient and now allows all citizens to have two children. This policy was only implemented to ensure that the country's population would not exceed the food supply as well as natural resources.

Let's take a closer look at the lifestyle of a typical Chinese family. Education in China is held in high regard. Most families have access to local healthcare. The average wage of a Chinese worker depends on the education level obtained as well as the type of career. A typical family diet consists of four main food groups containing, grains, fruits, vegetables, and meat. They do not consume a lot of dairy products, so they substitute it with soy and tofu. Chinese culture heavily relies on vegetables and fruits, which can be found in fresh food markets, which is the typical shopping destination of the average family. There is a water scarcity problem within China, along with water contamination and pollution. Millions are living without proper water sanitation, leading to many health issues amongst the population.

Being a very diverse country, population and growth impacts living circumstances. This is true in all

countries around the world, but it remains true to the Chinese way of life, with China having a large and flourishing geographical landscape. Throughout the history of China, people have come up with many diverse and creative housing styles to fit in with different regions and climates. About 57% of China's population lives in urban dwellings, where as 43% of the population lives in the rural landscape of this lush country. Let's take a closer look at these statistics and break them down individually.

First let's talk about urban living. More people in China are migrating to the city in search of better paying employment. Some of these employment opportunities include marketing and advertising, journalism, finance, engineering, sales, and consulting. China has become a diverse job market, thus the growth and population in urban areas. The urban population has increased 30-50 million people annually since 1985.

Those left living in the rural areas of China, have many advantages and disadvantages. Let's focus on the disadvantage of rural living first. There is lack of immediate health care like in the urban areas. Also, fresh food markets are not easily accessible for food consumption for the family. Schooling is harder to obtain compared to urban areas, and prices may be higher for schooling because of the lack of nearby educational centers. Because of the lack of sanitation stations for water, there is a higher level of water pollution in the rural areas. Some advantages are more land ownership and availability of farm ground for ag production.

China is a large agricultural country and has a vast amount of natural resources to perpetuate the agricultural industry. The agricultural industry employs over 300 million farmers. Over 56% of China's land is cultivated for farming. The climate and geography of China makes it easy to grow sunflower seeds and rice; which is their number one export. Along with these crops, China also is a large producer of fruit trees, such as apple and pear trees. All of these crops need pollinated. Having 1.37 billion people in its population makes it important to produce the highest yields possible, not only to feed its country, but also for agricultural exports to sustain its economy.

At the beginning of this paper, I very briefly touched on the subject of honey bees and their job as pollinators within our country and agriculture. Digging deeper into China's agricultural background, has led me to the shocking findings that China's honey bee population is rapidly declining, along with a growth in pollination issues within China's agricultural system. There are 3 main reasons why the honey bee population is on the rapid decline: habitat destruction/food shortage, disease, and the most harmful being pesticides. The natural habitats that honey bees have relied on for centuries are depleting, with the growth of urban areas. Loss of habitat, meaning trees and flowers, are being destroyed to gain commercial development. Humans, without knowingly doing so, have spread parasites that have caused tremendous harm to the bee population. The number one parasite is the invasive Varroa mite, which originated in Asia. Pesticides are the number one cause of Colony Collapse Disorder (CCD). According to EPA.gov, "Colony Collapse Disorder is the phenomenon that occurs when the majority of worker bees in a colony disappear and leave behind a queen, plenty of food, and a few nurse bees to care for the remaining immature bees and queen," therefore; the queen and the immature bees are left to die off because there is no one to care for them, resulting in colony collapse. Neonicotinoid pesticides are commonly found in agricultural areas. A pesticide protects the plant from harmful insects that consume the plant, causing plant death and low yields. The pesticides kill the honey bee that is just trying to pollinate the plant. The pesticide slowly kills the honey bee from the inside out, by slowing and potentially stopping the respiratory system. There are no rules and regulations on pesticide use in china. Therefore the farmers continuously use the pesticides for crops, unsure of what its doing to the population of honey bees.

At this point in time, the rate of honey bees will continue to decline, if proper action is not taken immediately to ensure their future in agriculture. This topic affects both rural and urban areas of China. The entire topic is all concerning to health, food supply, and the agricultural industry.

In recent years, because of the decline in naturally occurring pollination by the honey bee, Chinese

farmers have been forced to painstakingly apply pollen to all their crops by hand. This is a time consuming, tedious job. Carrying pots of pollen, as well as homemade pollen dusters made from feathers, the Chinese farmers must go around their farms and brush pollen on each flower. They shake the male pollen into a jar. Then the farmer must get the pollen onto the stigma, which is the female part of the flower for proper reproduction. This is hard for the farmer to get precise, but is a natural process done by honey bees. Not only is this a time-consuming process, it is also a human danger factor, due to having to climb to the tallest peak of each fruit or nut tree. This job is often done by young, inexperienced children resulting in falls, injury, and sometimes death. With the lack of technology used in this process in China, there tends to be a lower yield for the crop and is not an efficient way to pollinate. As the 3rd largest country in the world, there are many people to feed and exports to ship, and hand pollinating each plant does not produce a high enough yield to fulfill the task.

The lack of efficient pollination affects both rural and urban areas. It also affects people of both genders, all ages throughout life, as well as the rich and the poor. In rural areas, the farmers that are producing these crops are not being paid according to the time devoted to pollination. And, with not producing maximum yields, the farmers aren't producing a maximum profit. Also, because they are in rural areas and using hand pollination that sometimes results in injury, it is imperative that they have access to immediate health care, which is hard to come by in that type of rural setting.

In the urban areas of China, the lack of efficient pollination status differs greatly from the rural setting. Some of the major concerns are not having enough food in the urban markets and not having fresh food, which is a staple in the Chinese culture. There is also a lack of urban bee colonies that pollinate environmental surroundings, such as flowers and or trees, which produce clean oxygen for the population to breathe.

A few good questions to stop and ponder at this point in the essay are: Does China have any type of legislature to protect the honey bee? Do the people of China understand what is happening with the loss of the honey bee? Is there proper education and study of the honey bee? How do we correct the rapid decline of natural pollinators? Upon my research, I have found there is no easy answer to these questions, but I feel called to begin the process of introducing this devastating topic to the masses of China.

I feel this calling because I feel a strong attachment to these intriguing creatures and the amazing abilities that they possess. I have spent countless hours working with my own hives. I truly understand their effect on the world through agriculture; including their job as pollinators, honey producers, and servitudes toward our country.

While there is a regulatory committee known as the Ministry of Agriculture, they are only concerned about the yield and care of the crops of honey and royal jelly that comes from the honey bees. They do not regulate independent farmers and their ability and care of their hives for pollination purposes. Yet there are many countries around the world that are trying to maintain and preserve this population of bees for pollination purposes by the use of technology, conservation measures, independent advocates, as well as the average everyday citizen maintaining their own hives. As an example, the United States has created many laws as well as conservation parks in urban and rural settings in the effort to maintain the population. Many independent advocates as well as big name Hollywood actors have taken an interest in the preservation of honey bees. Morgan Freeman, who is known for his distinct voice in Hollywood and award-winning characters on the silver screen, is now beginning a new chapter in his life, by turning a 124-acre Mississippi ranch into a wild flower sanctuary for honey bees to live and flourish.

Upon careful consideration and further research, I have contemplated a few solutions to further China's diminishing honey bee population and pollination issues. These plans include up to date technology, conservation and education, along with a plan to curb the use of harmful pesticide in china's agricultural industry.

The first solution in using advanced technology to perpetuate China's pollination issues. This first solution is ironically called a "Drone Drone." A drone is a male bee in the hive that pollinates plants up to three miles away from the hive. Another definition of a drone is a remote controlled pilotless aircraft. The usage of drones has increased dramatically over the past few years in the United States, along with many other countries. A simple method would be for China to replace the human dusting method with an unmanned drone. This drone would efficiently place pollen onto plant stigma's to properly pollinate the plant, leading to a much higher crop yield. It also eliminates the high-risk factor to the humans performing the pollination process. According to Eijiro Miyako, a chemist at Japan's National Institute of Advanced Industrial Science and Technology (AIST), you can simply take an ionic gel that is just sticky enough to pick up pollen grains from a given source. He realized that simply adding the gel to a smooth surfaced drone was not going to work. Therefore, he attached horse hair that mimicked fine bee fur. The bee like fur, or horse hair, provided the perfect material to pick up and transfer pollen grains. The pollen grains held to the horse hair due to electrostatic forces. This is similar to rubbing a balloon against your hair causing it to stand up and attach to the balloon. Miyako said in a press release. "We believe that robotic pollinators could be trained to learn pollination paths using global positioning systems and artificial intelligence." (www.zdnet.com). This drone was produced on a low budget. The drone was purchased for \$100; they acquired horse hair and the ionic gel. This first attempt was done on a very large lily. This plan is not yet fool proof but has the potential to become a great resource for the Chinese agricultural industry. This low budget attempt could be done by the everyday farmer for only \$100, while also realizing this is not 100% effective at this time as it does not possess the natural pollination accuracy of a honey bee. This use of technology could also be quite overwhelming for farmers noting that they are not use to working or being around such advanced equipment. They would have to take several classes and or lessons to perfect this pollination process. This by no means solves China's pollination issues, but it is certainly a step in the right direction to incorporate technology into saving Chinese agriculture.

The second and more reasonable solution in utilizing conservation and education to guide and correct the diminishing bee population for pollination purposes. I plan on collaborating with the Chinese farmers, to assemble bee kits that will add to their already existing hives. These would enhance what they already have at their disposal. These kits would include one deep hive body unassembled, ten unassembled wooden frames, ten black plastic foundations, one reversible bottom board, and nails for assembly, hive tool, stainless steel smoker, beginning beekeeping book, leather gloves, and veil and helmet. These are all of the basic beginning needs when starting a hive. I would also plan on sending Caucasian bees. I have picked this breed of bee because they are gentle and not as aggressive like many other breeds. They also thrive in all climates not just warm humid weather. Caucasian bees also show some resistance to [European Foul Brood](#) and are not overly inclined to swarm. This project could be sponsored by China's National Bee Keeping Association, in collaboration with the help of the American Bee Keeping Association. This could be easier said than done. There is no guarantee that China's Bee Keeping Association will want to collaborate with the US. On a smaller scale, Chinese farmers or the everyday citizen can enhance the bee population by building small Mason jar bee hives, by using only a few everyday items around the common home. These items are: wood to build a box, as well as frames, mason jars, and screws to assemble the hive. This is an easier and more cost-effective way to sustain the honey bee population. Along with building the honey bee population and sustaining pollination, these bees would also produce honey, giving their keepers a natural food source as well as a small profit if sold. Honey has been studied for many years and is thought to have trace enzymes, minerals, vitamins, amino acids, antibacterial, antifungal, and antioxidant properties. This would give the farmers a more natural, healthy food source, as well, as a healing product. Honey makes excellent cough medicine and can be used to treat wounds. The rural farmers live further away from immediate healthcare; this would be a great option for their medical needs. Throughout the years, as I have worked with my bees, I realize the utmost importance of their existence. I feel called to help not only my fellow American bee keepers, but also to reach out internationally to share my experience on the importance of the honey bee for pollination purposes. I believe that some bee keepers get so caught up in the production and fiscal aspect of bee

keeping; such as the honey and royal jelly, that they lose track of what is really important to sustaining our agricultural industry.

My third and final proposal also utilizes conservation as well as education. I plan to create one or multiple honey bee conservation parks in China. A conservation park is an enclosed area protected for conservation purposes. This would provide a safe environment as well as a diverse food source for the honey bees. This conservation park would contain many species of flowers and plants to better generate pollination amongst the honey bees. This land of conservation could possibly be attained by applying for a land grant through the Chinese government. If not through the government, then by possible land grant or lease by local farmers. That lease could possibly be funded by the local bee keeping associations. Along with conservation parks, I would like to utilize education by offering classes to local Chinese farmers to enhance their knowledge on pollination as well as how to maintain a healthy honey bee hive. I would also explain the risk of heavy pesticide use and how that affects the population of bees. There also needs to be more education amongst ag producers about this concerning topic. This would be on a volunteer basis by individual honey bee farmers. This would not only solve the pollination problem, it would create a better understanding amongst the human population of China on the importance of the honey bee and how it affects their country greatly.

B, Bu, Buz, Buzz, Buzzz...Do you hear that? That is the sound of China's honey bee population flourishing. Once the honey bee population begins to grow and soar again, pollination will hopefully no longer be an issue facing China's land. After the population begins to rise again you will find that China's economy will also begin to rise resulting in higher yields to export, human health, and an overall more sustainable society. After all the problems being explained and possible solutions to those problems given, it is my hope that you consider this a desperate call to action for this issue that China is facing. Bees are nature's pollinators, and they play a vital role in sustaining countries various crops. These small creatures might be the most undervalued yet hardest working animals in the agricultural industry. We as humans should owe them a large apology for underestimating them, as well as a big thank you for everything that they do for us. It's not too late to save this amazing creature. Today we have the ability to not only better enhance China's agricultural industry, we have the chance to save a species from extinction. Thus, eliminating pollination issues throughout China. I believe that this issue should be at the utmost importance of today's agricultural world, saving one buzz at a time.

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