

China:

A Potential Model for Sustainable Development

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Despite what Donald Trump, forty-fifth president of the United States, preaches, climate change is indeed not a hoax perpetrated by the Chinese. In fact, China faces severe and debilitating impacts from this serious dilemma. Although China did not invent the concept of climate change, the country plays a hefty role in this current issue today. As stresses from the transition from a developing to a developed nation continue to mount, China is at a breaking point with the potential to either act as a climate model or as a climate failure for the rest of the world.

In 2006, China surpassed the United States as the world's largest producer of greenhouse gas emissions. The process of China's rise as the main emitter occurred over just a few decades. In 1970, China's total greenhouse gas emissions were 1,873,971.675 kilotons (kt) of carbon dioxide (CO₂) equivalent. These emissions steadily rose throughout the late 20th century and leveled off between 1995 and 2001 around 5,000,000 kt of CO₂ equivalent. The substantial spike in China's growth rate of emissions reflects how the nation became a global power in trade during the 21st century. By 2012, total emissions grew to 12,454,710.605 kt of CO₂ equivalent.¹ China's total emissions increased by nearly seven times in just four decades. In addition, China's CO₂ emissions in metric tons per capita have displayed a similar trend over the past few decades. China's per capita emissions

¹ World Bank Group, "Total Greenhouse Gas Emissions (kt of CO₂ equivalent)," *WorldBank*, (2016). <http://data.worldbank.org/indicator/EN.ATM.GHGT.KT.CE?locations=CN>.

hit a low point of .574 metric tons/capita in 1967. The same steady rise is seen throughout the late twentieth century, with stabilization around 2.7 metric tons/capita in the late 1990s. Again, the 21st century exhibits the same drastic rise in per capita emissions, with 7.551 metric tons/capita in 2013.² Globalization and world trade is the primary reason why China has become such a threat to the global environment. Increases in demand for China's cheap products drives the continuation of manufacturing and thus fossil fuel usage. One third of China's total carbon pollution is associated with the export of cheap clothes, electronics, etc. consumed in developed areas like Europe and the United States.³

Similarly, deforestation due to globalization plays a role in China's greenhouse gas emissions. In 2000, the Natural Forest Conservation Program was implemented nationwide in China. This program has a significant role in carbon sequestration today. China's forest cover increased by over 46,000 square miles from 2000 to 2010. China aims to increase total forest cover by 154,440 square miles by 2020. However, as China regrows its own forests to offset its carbon emissions, timber imports rise and result in deforestation elsewhere. Some of the carbon sequestration occurring in China can be offset by the deforestation the country causes in places like Southeast Asia and Africa. This negation of carbon sequestration has not been calculated, but China's work is clearly counterproductive to some extent. The atmosphere is a global example of the commons; sequestering and emitting carbon at similar rates has no net effect on the atmosphere. China attempts to develop in a sustainable manner but still faces the temptation of being a global power in trade. There is such a high demand for products made with wood around the globe which forces China to import timber despite efforts to reduce deforestation.⁴

The 2015 United Nations climate summit in Paris brought about

2 World Bank Group, "CO2 emissions (metric tons per capita)," *WorldBank*, (2016). <http://data.worldbank.org/indicator/EN.ATM.CO2E.PC?locations=CN>.

3 Phil McKenna, "China's Success Regrowing its Forests has a Flip Side: Deforestation Elsewhere," *Inside Climate News*, March 23, 2016. <https://insideclimatenews.org/news/22032016/china-success-regrowing-its-forests-has-flip-side-deforestation-carbon-emissions>.

4 Ibid.

an unprecedented level of global consensus about the need to address climate change. Limiting the growth of greenhouse gas emissions serves as the main takeaway from this summit. China committed to halt the growth of its emissions by 2030. The trajectory of emissions shows a current increase in total emissions with a peak coming by 2025, if not sooner. A main driver of this goal to peak in the next decade is China's thirteenth Five-year plan. This plan contains three main objectives for the country: a twenty-three percent reduction in water consumption, a fifteen percent reduction in energy consumption, and an eighteen percent reduction in CO₂ emissions by 2020.⁵ China proves that it can act as a role model for the rest of the globe during such turmoil and climate-induced stress. If the world's largest emitter can make lofty goals for inhibiting its emissions, then so can other countries. China's positive position in global negotiations demonstrates its ability to act as a model for other nations and influence other countries to adopt policy changes as well.⁶

However, for all the wealth China gains from its participation in global trade, the country also receives substantial environmental harm.⁷ Most of the planet accepts the notion that conventional economic progress directly correlates to environmental damage. One immediate impact of climate change already occurring in China is a drastic change in air quality. Morbidity and mortality have both risen due to increased air temperatures and air pollution. This threat to clean air is one of the most widely known impacts of climate change in China because unlike many other effects, it is blatantly visible to everyone around the globe. Pictures of Chinese citizens wearing masks as they roam the clouded streets of Beijing resonate with viewers all over the internet. In the last fifty years, there has also been an increase in both the frequency and intensity of extreme heat events in eastern China.⁸ Heatwave mortality possesses unequal effects on different demographics. Individuals with

5 Shilu Tong et al., "Climate Change, Food, Water, and Population Health in China," *Bulletin of the World Health Organization* 94, no. 10 (2016): 759-765. doi:10.2471/BLT.15.167031.

6 Ibid.

7 Joyeeta Gupta, "Growth, the Environment, and Development in the Anthropocene," *Current History* 114, no. 775 (2015): 311-15.

8 Tong, et al., 760.

cardiovascular or respiratory diseases, the elderly, and women are put at a higher risk with the increases in heatwave mortality. Also, employees get paid subsidies for working on extremely hot days. As temperatures continue to rise with global warming, labor costs could skyrocket which would end up as a huge economic cost for China.⁹

Other extreme weather patterns include severe droughts and flooding, which threaten China's food security. China will witness substantial alterations in their food supply and security as the effects of climate change continue to mount. Therefore, global climate change also affects social stability and human nutrition. This is not a problem of the future; China is already experiencing these threats to food security and human safety. Between 2012 and 2014, over two billion people in China had "hidden hunger," which refers to micronutrient insufficiency. Additionally, China already imports grains to meet the country's food necessities.¹⁰ Economic gains from trade mean nothing if citizens of the country are unable to obtain proper nutrients in their diets. China possesses twenty-two percent of the entire world's human population, but only seven percent of the world's arable land. The disproportionality between population and farmland proves detrimental to the Chinese people. There is a high level of vulnerability if climate change were to affect the little arable land they already have. Also, per capita cereal production could decrease by eighteen percent by the 2040s in comparison to levels in 2000. Perhaps the most disheartening impact China faces is the fact that the downfall of its many great dynasties in the past resulted from similar conditions they are facing today. Climatic conditions in history created food shortages which led to social disruption and the end of dynasties. China could witness similar social uproar if food shortages persist.¹¹

Likewise, agricultural rice output serves as one of the most vulnerable components of Chinese society to climate change. The largest rice-producer in China is the rural Hunan province. In 2013, this province alone produced twelve-point-six percent of China's total

9 Tong, et al., 762.

10 Ibid, 759.

11 Ibid, 760-61.

rice production.¹² The Crop Environment Resource Synthesis-Rice (CERES-Rice) 4.5 model is used under representative concentration pathways (RCPs) 4.5 and 8.5 to predict how varying levels of climate change will influence rice production. The RCP4.5 reflects a climate scenario with lower radiative forcing levels ($W\ m^{-2}$) and RCP8.5 reflects higher radiative forcing levels. These two different scenarios were utilized because they represent medium and extreme climate scenarios, which enables us to see perhaps an ideal vs. a worst-case possibility.¹³ This study on how climate change will impact rice cultivation in the Hunan province showed that ensemble-average maturity durations of most rice cultivars will decrease by 1.5-11.4 days under RCP4.5 and .9-17.5 days under RCP8.5. Also, the magnitude of changes in flowering duration and maturity duration increase under both RCP scenarios. Rice yields decrease under both RCPs. The decline in yields is predicted to be mild during the 2020s with intensification decades later in the 2080s.¹⁴

Additionally, the CERES-rice model study proposed two adaptation models for China regarding effects on its rice yields. Switching rice cultivars and altering planting dates prove effective in mitigating the effects of climate change on rice yields. Some plants grow better when planted early while some grow better when planted later in the season. These two ideas for adapting to the changing climate provide farmers and policy-makers with information on how to develop effective and sustainable agriculture in the Hunan province.¹⁵

Fortunately, China shows many signs of resiliency in the wake of climate change. Although China has become the largest source of total emissions on the planet, most of the public is “willing to pay” for energy-efficient technology and eco-friendly products. Different households from all thirty-one provinces of mainland China were surveyed, for a total of 4,169 respondents. Of all respondents, eighty-five percent indicated that they would be willing to pay at least ten percent more

12 Yamei Li et al., “Simulating Climate Change Impacts and Adaptive Measures for Rice Cultivation in Hunan Province, China,” *Journal of Applied Meteorology & Climatology* 55, no. 6 (2016): 1359-1376. doi:10.1175/JAMC-D-15-0213.1

13 Ibid, 1362

14 Ibid, 1367-68.

15 Ibid, 1369.

than the market price for environmentally friendly products, hence the label “willing to pay.”¹⁶ Support from the Chinese people provides a beacon of hope because a unified country is more able to enact change. Public awareness of climate change and its damaging effects proves that the trajectory of emissions has the potential to decrease. The public is very respondent and willing to make alterations to their lifestyles for the betterment of both the local and global communities. Also, education plays a big factor in the willingness to pay which shows that awareness of climate change is one of the most important aspects in altering consumers’ current habits.¹⁷ Acknowledgement of climate change allows citizens to play their role and push for more sustainable technology and products.

Another indicator of resiliency for China is the fact that it is not yet a completely developed country. As developing countries like China continue to develop, they have the potential to alter their current habits and their emissions trajectories. Triangular trade-offs depict how several aspects of society are interconnected as a country considers sustainable development as a guideline. These models connect economic, ecological, and social elements which shows that there must be a balance between all three aspects of society for development to occur in a sustainable manner.¹⁸

On the other hand, China possesses several vulnerabilities to the impacts of climate change. Water supply is unsteady for the country considering many regions lie in transition zones where climate change already influences the security of water resources.¹⁹ Public health is also at stake for a complex combination of reasons. The future distribution of malaria vectors coupled with future changes in land use, urbanization, and the changing climate will all result in a large increase in the size of the population exposed to malaria vectors by the 2030s.²⁰ Since there are numerous factors influencing the amount of the population exposed to malaria vectors, the country finds itself more vulnerable and in need

16 Yamei Li et al., “Willingness to Pay for Climate Change Mitigation: Evidence from China,” *Energy Journal* 37 (2016): 179-194. doi:10.5547/01956574.37.S11.yli.

17 Ibid, 180.

18 Gupta, 313.

19 Tong, et al.

20 Ibid, 762.

of a solution. Also, there is a North/South divide in China which results in an unequal distribution of responsibility for tackling climate change. Southerners believe that the North has not yet shown the ability to stray from growing emissions, which has put much of the burden on them to develop low-carbon lifestyles.²¹

In recent years, China has made several pursuits to reduce emissions while pushing for sustainable development. In June 2015, China committed to reduce greenhouse gas emissions per unit of gross domestic product by sixty to sixty-five percent (compared to 2005 levels) by 2030. Along with this, China aims to increase the reliance on renewable energy sources that fit in with their ideal of “low-carbon life.”²² Unlike the United States with legislators that negate all efforts made by President Obama to combat climate change, the Chinese government is unitary and dictatorial. This governing system means that policies can be implemented rather quickly since they do not require approval from a legislative branch.²³

Also, China recognizes that there are other problems besides just CO₂, which is why policymakers work to reduce other source of greenhouse gas emissions. China emits large amounts of non-CO₂ greenhouse gases such as methane, nitrous oxide, and hydrofluorocarbons (HFCs). Although less abundant in the atmosphere, these gases are more potent and trap more heat than CO₂ which reveals a hidden dilemma for society. While CO₂ is typically demonized for being the most abundant greenhouse gas, it is nowhere near the worst for the environment. In 2012, these non-CO₂ gases comprised one-fifth of the country’s total emissions. China has taken several steps to decrease these emissions since the country aims to be an environmentally sustainable model of development. First off, reduction targets for coal bed methane and HFCs are supported by financial subsidies and tax policies. Other efforts to reduce non-CO₂ emissions include the 2015 Circular Economy Promotion Plan. The plan aims to increase waste recycling and reuse, which in turn reduces methane emissions. Additionally, the 2012 Cleaner Production Promotion Law focuses on reducing waste, implementing better resource utilization, and overall cleaner production processes. As previously

21 Gupta, 314-15.

22 Ibid, 314.

23 Ibid, 315.

mentioned, the thirteenth Five-year plan explicitly states the need to control non-CO₂ greenhouse gas emissions considering they also pose a serious threat the global environment.²⁴

Furthermore, the specifics of China's abatement actions are promising for a bright future for the country. China aims to reduce methane emissions from coal mining and rice fields. Methane constitutes half of China's non-CO₂ emissions, which shows the need to specifically control emissions of this gas. Also, methane can trap 28 times as much heat as CO₂ on a per metric ton basis. This increased heat-trapping ability demonstrates the dire need for China to control emissions other than CO₂. China's post-2020 national climate action plan, also known as its Intended Nationally Determined Contributions (INDC), commits to the vast reduction of methane emissions. Along with methane emissions are goals to reduce HFC emissions from industry practices. Financial subsidies in 2015 were designed to stimulate reductions in HFC-23, which is the most potent out of all HFCs. This alone could cut HFC emissions by up to ninety percent by 2030, which is a large deal for the country's climate action plan. In addition, nitrous oxide emissions are also being targeted. China desires to reduce nitrous oxide emissions from fertilizers because they possess the highest levels of any country in the world and account for one-third of the world's total nitrous oxide emissions. Working with bio-inhibitors that slow the release of nitrous oxide from the fertilizers could bring about a ten percent reduction in total emissions alone.²⁵

In conclusion, China faces a lot to lose with the effects of climate change. Food and water security, air quality, and public health are all at stake. As the world's largest greenhouse gas emitter, China recognizes its role to play in the fight against climate change. China plans to both mitigate their emissions and adapt to the inevitable effects of climate change in the years to come. By imposing goals and guidelines and participating in global agreements, China demonstrates that they are making sustainable development into reality. While the conspiracy theorists continue to declare global warming a Chinese hoax, China

24 Katherine Ross et al., "Beyond CO₂: China can Curb its Other Greenhouse Gas Emissions by Nearly 30% by 2030," *World Resources Institute*, (2016), <http://www.wri.org/blog/2016/06/beyond-co2-china-can-curb-its-other-greenhouse-gas-emissions-nearly-30-2030>.

25 Ibid.

proves they are on the path towards becoming the most powerful global force in alleviating climate change.