

# U.S.-China Economic and Security Review Commission

Staff Research Report



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## China's Interests in U.S. Agriculture: Augmenting Food Security through Investment Abroad

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## Introduction

China faces growing demands on its agricultural production that it seeks to address through policy, technology, and economic activities. In 2021, China imported a record amount of corn at 28.35 million metric tons (mmt), 152 percent more than in 2020 and more than 10 percent of China’s Ministry of Agriculture and Rural Affairs (MARA) estimate for the country’s total corn consumption (see Tables 1 and 2).<sup>1</sup> The China Academy of Social Sciences’ 2020 Rural Development Institute report claimed “there is likely to be a grain shortfall of about 130 mmt, including about 25 mmt of staple food grain” by the end of 2025.\*<sup>2</sup>

Diminishing arable land, shifting demographics, and natural disasters compound these trends and present food security challenges to China’s leaders. In response, China has introduced domestic policies to promote food security and lessen food waste, both of which have been a priority of General Secretary of the Chinese Communist Party (CCP) Xi Jinping since he assumed power. Under his rule, the government has also established policies to expand domestic farmland and harness innovations in agricultural technologies, such as genetically modified (GM) seed lines, all in an effort to bolster food security.

The Chinese government’s domestic efforts, however, are not enough to solve China’s problems. Recognizing its challenges, China has also gone abroad to address its needs through investments and acquisitions of farmland, animal husbandry, agricultural equipment, and intellectual property (IP), particularly of GM seeds. The United States is a global leader in all of these fields, making it a prime trading partner and often a target of China’s efforts to strengthen its agriculture sector and food security, sometimes through illicit means.

These efforts present several risks to U.S. economic and national security. For example, Chinese companies’ acquisition of hog herds in the United States may save China money and enhance its domestic capacity; however, this could also reduce China’s need for U.S.-sourced production and redistributes the environmental effects of hog waste to U.S. communities. If further consolidations and Chinese investments in U.S. agricultural assets take place, China may have undue leverage over U.S. supply chains. China’s access to U.S. agricultural IP may also erode U.S. competitiveness in agriculture technology that supports food production. Additionally, China’s illicit acquisitions of GM seeds provides a jumpstart to China’s own development of such seeds, deprives U.S. companies of revenue, and offers an opportunity to discover vulnerabilities in U.S. crops.

This report reviews China’s food security challenges and how these vulnerabilities drive interests in U.S.-China agricultural relations. Specifically, it evaluates the motivations behind China’s agricultural investments, including challenges to food production and relevant CCP efforts to reduce import reliance, conserve farmland, and modernize agricultural technologies. It then examines the main areas of Chinese investment in the United States, including land, livestock, grains, and relevant infrastructure, like agricultural equipment and technology. Finally, the report presents considerations for lawmakers regarding further Chinese integration in the U.S. agriculture sector.

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\* The report also predicts that China’s grain output will be around 636 million metric tons by 2025. This would be a decline in production according to China’s National Bureau of Statistics, which reports that grain output has exceeded 650 million tons for seven consecutive years. Ministry of Agriculture and Rural Affairs of the People’s Republic of China, “Grain Acreage among Key Issues for Rural Areas,” *China Daily*, January 16, 2022.  
[http://webcache.googleusercontent.com/search?q=cache:V5JXZahwpn8J:english.moa.gov.cn/news\\_522/202201/t20220116\\_300779.html+&cd=2&hl=en&ct=clnk&gl=us](http://webcache.googleusercontent.com/search?q=cache:V5JXZahwpn8J:english.moa.gov.cn/news_522/202201/t20220116_300779.html+&cd=2&hl=en&ct=clnk&gl=us).

**Table 1: Top Ten U.S. Agricultural Exports to China, 2016 and 2021**  
(US\$ millions)

Top Ten Exports (2016)		Top Ten Exports (2021)	
Soybeans	\$ 14,202.62	Soybeans	\$ 14,102.15
Grain Sorghum	\$ 1,031.34	Corn	\$ 5,099.47
Residues of Starch Manufacture	\$ 471.30	Grain Sorghum	\$ 1,863.43
Rutabagas, Hay, Clover	\$ 429.75	Beef	\$ 1,299.96
Pork	\$ 329.81	Poultry & Edible Offal	\$ 896.16
Ethyl Alcohol	\$ 313.48	Pork	\$ 890.39
Edible Offal (internal organs), Bovine, Swine, etc.	\$ 245.19	Nuts	\$ 867.39
Wheat & Meslin	\$ 211.51	Wheat & Meslin	\$ 802.54
Animal Guts, Bladders, Stomachs, & Parts	\$ 176.30	Edible Offal Bovine, Swine, etc.	\$ 657.93
Whey & Milk Products	\$ 169.24	Rutabagas, Hay, Clover	\$ 640.20

Source: U.S. Census Bureau, *USA Trade Online*, March 2022. <https://usatrade.census.gov/>.

**Table 2: Top Ten U.S. Agricultural Imports from China, 2016 and 2021**  
(US\$ millions)

Top Ten Imports (2016)		Top Ten Imports (2021)	
Prepared/Preserved Fruit, Nuts	\$ 556.40	Prepared/Preserved Fruit, Nuts	\$ 402.22
Fruit, Nuts, Vegetable Juices	\$ 325.85	Food Preparations	\$ 361.32
Vegetable Saps & Extracts	\$ 246.84	Vegetable Saps & Extracts	\$ 314.85
Preparations Used in Animal Feeding	\$ 210.96	Preparations Used in Animal Feeding	\$ 274.34
Dried Vegetables	\$ 177.86	Vegetables, Not Frozen	\$ 161.94
Onions, Shallots, Garlic, Leeks	\$ 147.21	Fruit, Nuts, Vegetable Juices	\$ 145.46
Vegetables, Not Frozen	\$ 146.10	Animal Products, Dead Animals, Inedible	\$ 126.73
Sugar	\$ 137.49	Dried Vegetables	\$ 106.17
Animal Guts, Bladders, Stomachs, & Parts	\$ 136.54	Pasta, Prepared or Not	\$ 104.02
Food Preparations	\$ 136.36	Sauces & Prep, Mixed Condiments	\$ 102.81

Source: U.S. Census Bureau, *USA Trade Online*, March 2022. <https://usatrade.census.gov/>.

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# Challenges Facing China's Food Security

## Lack of Arable Land

Although the United States and China have roughly the same amount of land mass, China's arable land is shrinking. China possesses only 7 to 9 percent of the world's arable land, but it houses nearly 20 percent of the global population.<sup>3</sup> As of 2018, China has 294 million acres (1.79 billion mu) of arable land and a population of 1.4 billion (2020).<sup>\* 4</sup> The United States has more than 375 million acres (2.27 billion mu) of arable land and a population of 329.5 million.<sup>† 5</sup>

Throughout the last decade, rapid urbanization and industrial growth have encroached onto farmland, displaced agricultural workers, and reduced land that communities are dependent on for agricultural work. In addition, soil and water pollution challenges are further threatening the availability of arable land. Rapid urban growth has significantly polluted the country's farmland, destroying crops and raising concerns about food safety.<sup>6</sup> China's pesticide and fertilizer use has also contributed to its extreme water and soil pollution. China's Ministry of Ecology and Environment (MEE) reported in 2018 that 15.5 percent of groundwater was considered unsuitable for any use.<sup>7</sup> Similarly, the Ministry of Land and Resources<sup>‡</sup> and the Ministry of Environmental Protection<sup>§</sup> published a report in 2014 that determined that 19.4 percent of China's agricultural land, or about 64 million acres, had contaminated soil.<sup>8</sup> The Chinese government has taken some steps to respond to extensive soil contamination, for instance by forbidding farming on plots of farmland to allow time for it to be rehabilitated.<sup>9</sup> According to Reuters, China's State Council "aims to make around 93 percent of its contaminated farmland fit for crops by the end of 2025," but Chinese researchers are open about the challenges of soil and groundwater rehabilitation.<sup>10</sup> After China's 2021 rural work conference, Xu Xiaoqing, a researcher at the State Council's Development Research Center, assessed that managing and restoring China's soil and groundwater is unlikely to be accomplished in the short term and will require sustained efforts.<sup>11</sup> China's 14th Five-Year Plan also says it will curb "nonagricultural" uses of arable land and increase concentrated farmland by 177 million acres (1.08 billion mu) in an effort to preserve its limited supply of land.<sup>12</sup>

China's policymakers face the challenge of balancing industrialization with preserving and growing the agricultural economy. China's leaders intended to protect land from urbanization and subsequent pollution challenges, so they established a clear "red line" of 296.5 million acres (1.80 billion mu) as a minimum to be preserved as arable land in order to achieve the goal of 95 percent self-sufficiency in grain production.<sup>\*\* 13</sup> Reporting from the UN Food and Agricultural Organization suggests the red line was crossed in 2010.<sup>††</sup> China's Ministry of Natural Resources (MNR) claims China has more arable land and the red line has not been crossed, but notably reports a more drastic decline in arable land since 2009.<sup>14</sup> Its Third National Land Survey<sup>‡‡</sup> indicates China's arable land declined 5.6 percent from 334.4 million acres (2.03 billion mu) in 2009 to 314 million acres

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\* Chinese sources generally list land in mu, but measurements are given in acres throughout this paper for consistency. In discussions regarding Chinese land, mu will also be listed for reference.

† One mu (亩) is equal to 0.165 acres, or 1 acre is equal to 6.07 mu.

‡ The Ministry of Land and Resources was folded into the Ministry of Natural Resources in March 2018.

§ The Ministry of Environmental Protection was folded into the Ministry of Ecology and Environment in March 2018.

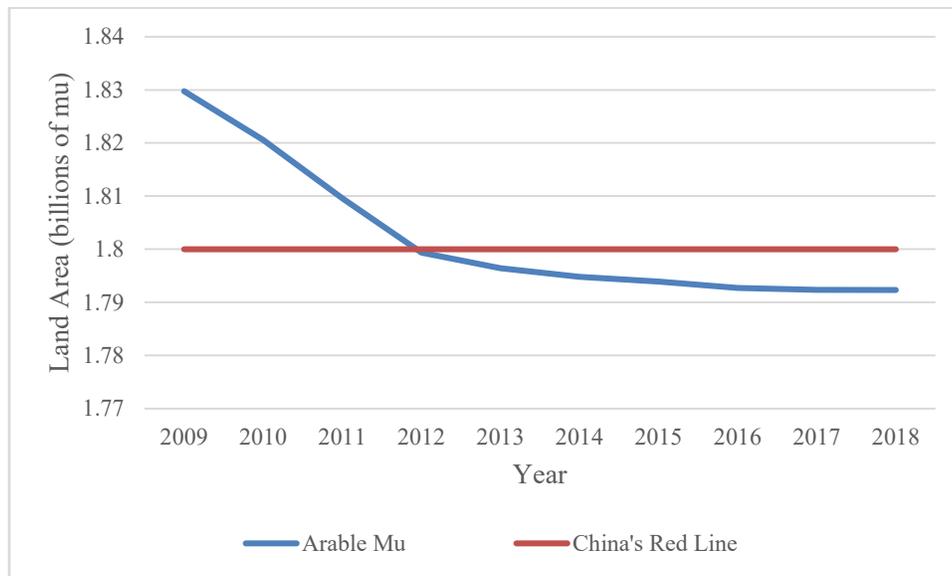
\*\* China's government distinguishes arable or cultivated land (耕地) from "garden land," which includes tea plantations and orchards, as well as "forests," which are other types of agricultural land. Gao Wen, "How to Understand the Loss of 113 Million Mu in Cultivated Land between the Second and Third National Survey" (如何看待“三调”比“二调”少了1.13亿亩耕地), *Farmer's Daily*. Translation. August 27, 2021. [http://webcache.googleusercontent.com/search?q=cache:fa0Az5Zg2i8J:www.moa.gov.cn/ztl/gdzlbyjys/mtbd\\_28775/mtbd/202108/t20210827\\_6375079.htm](http://webcache.googleusercontent.com/search?q=cache:fa0Az5Zg2i8J:www.moa.gov.cn/ztl/gdzlbyjys/mtbd_28775/mtbd/202108/t20210827_6375079.htm).

†† According to World Bank data, China's arable land shrank by 2.45 percent from 2009 to 2018, decreasing from 299.8 million acres (1.82 billion mu) to 294.8 million acres (1.79 billion mu).

‡‡ The survey has been conducted every decade by MNR or its predecessor. The most recent survey was launched in September 2018 and collected data through the end of 2019. It was released in August 2021. Yang Wangli, "Survey: Nation Getting Greener over Past Decade," *China Daily*, August 27, 2021. [www.gov.cn/policies/latest\\_releases/2017/10/16/content\\_281475909460245.htm](http://www.gov.cn/policies/latest_releases/2017/10/16/content_281475909460245.htm).

(1.91 billion mu) in 2019.\*<sup>15</sup> Regardless of whether or not the red line was actually crossed, if China’s industrial development and subsequent pollution are not controlled, the amount of arable land China does have is not sustainable or sufficient for meeting its food production goals.

**Figure 1: China’s Arable Land Declines below Red Line (World Bank/Food and Agriculture Organization), 2009–2018**



Source: World Bank, Food and Agriculture Organization, “Arable Land – China,” 2018.  
<https://data.worldbank.org/indicator/AG.LND.ARBL.ZS?end=2018&locations=CN&start=2000&view=chart>.

## Shifting Migration and Consumption Demands Strain Domestic Capacity

Declining birthrates and increased migration to the cities, particularly among young adults, are straining farms across China. Similar to the United States, Chinese families with small-scale farms struggle to pass down their way of life to the next generation as more working-age individuals travel to the larger cities hoping to find higher-paid jobs or pursue education.<sup>16</sup> China’s 14th Five-Year Plan articulates its goals for moving more rural residents into cities.<sup>17</sup> This rural to urban migration moves workers off of the farms and into manufacturing jobs in the cities.<sup>†</sup> This creates a labor shortage among an already aging farmer population. The *New York Times* tells the story of Zheng Nanda, a farmer in Shanhui, China, whose children moved to city centers or chose a different line of work. The article explains, “As young people leave for the cities, more small farmers like Mr. Zheng are leasing their land for others to work.”<sup>18</sup> In 2021, 64.72 percent of China’s population lived in urban areas, compared to just 37.09 percent in 2001.<sup>19</sup> This puts China on track to reach, or possibly exceed, its 14th Five-Year Plan goal of 65 percent urbanization by 2025. In that same Five-Year Plan, the CCP said it would delineate and implement urban development boundaries and ecological barriers to protect its land and water sources.<sup>20</sup> While China has clear objectives for increasing urban migration, it is challenged with also creating policies to mitigate the effects of migration on rural communities. In an effort to address the pressures on farmers and meet its development goals, the Chinese government provides various agricultural insurance plans and subsidies for farmers.<sup>21</sup>

As populations have grown in the cities, so has Chinese household wealth, driving demand for more protein and higher-quality cuts of meat: China’s growth in animal protein consumption has almost tripled in the last 40

\* MNR Deputy Minister Wang Guanghua claims that much of the reduction in arable land between 2009 and 2019 can be explained by agricultural land being converted to forest or garden land used for tea plantations or orchards. Gao Wen, “How to Understand the Loss of 113 Million Mu in Cultivated Land between the Second and Third National Survey” (如何看待“三调”比“二调”少了1.13亿亩耕地), *Farmer’s Daily*, August 27, 2021. Translation. [http://wecache.googleusercontent.com/search?q=cache:fa0Az5Zg2i8J:www.moa.gov.cn/ztl/gdzlbyhys/mtbd\\_28775/mtbd/202108/t20210827\\_6375079.htm](http://wecache.googleusercontent.com/search?q=cache:fa0Az5Zg2i8J:www.moa.gov.cn/ztl/gdzlbyhys/mtbd_28775/mtbd/202108/t20210827_6375079.htm).

<sup>†</sup> For more on China’s urbanization, see “April 2021 Trade Bulletin,” U.S.-China Economic and Security Review Commission, April 30, 2021. <https://www.uscc.gov/trade-bulletins/april-2021-trade-bulletin>.

years.<sup>22</sup> On March 6, 2022, at a Two Sessions meeting, an annual gathering of China's two main political bodies, General Secretary Xi acknowledged China's changing diet. Using the term "big food concept," General Secretary Xi spoke about the country's new food demands reflecting China's economic and social growth.<sup>23</sup>

The Organization for Economic Cooperation and Development (OECD) estimates that by 2029 China's total meat consumption will reach about 54 kilograms (kg) per capita. This is up from around 45 kg per capita in 2009, and compared to 64 kg per capita in OECD countries, which has remained relatively consistent over the last decade.<sup>24</sup> Pork accounts for the majority of growth in China's meat consumption, and the demand for protein is growing quicker than Chinese farmers are able to produce.<sup>25</sup>

China's growing pork industry also requires greater levels of grain imports to feed hog herds. Given these demands, CoBank, a major lender to the U.S. agricultural sector, confirmed that through May 2021, China was closest to meeting its purchase commitments made in the January 2020 Phase One Trade Agreement in U.S. grain imports.<sup>26</sup> According to Chad P. Bown, Reginald Jones Senior Fellow at the Peterson Institute of Economics, China purchased 83 percent of the agricultural commodities agreed to under the Phase One commitment between January 2020 to November 2021.<sup>27</sup> The trend can be attributed to stable pork production in China, higher slaughter rates, and poor grain supplies from Brazil.<sup>28</sup> In 2021, China imported more than 30 mmt of corn, used mainly for feed, from the United States, a substantial increase from the less than 5 mmt of corn in 2019.<sup>29</sup>

## Livestock Diseases, Pests, Pollution, and Natural Disasters

Livestock diseases, pests, and extreme weather conditions exacerbate China's land scarcity, rapidly growing food demand, and diminished production capacity. These recurring challenges increasingly impact global agriculture markets, including in the United States.

- **African swine fever (ASF)** is a highly contagious virus that is deadly for domestic and wild hogs but does not affect humans. Hogs first tested positive in Liaoning Province in August 2018, and by April 2019 the virus had spread to all of China's provinces.\* The majority of China's pig farms are considered small or medium-sized farms and often struggle to afford adequate waste management systems and maintain sanitary conditions.† Consequently, after one pig becomes sick, the virus often quickly spreads to the rest of the herd, destroying the farms in its wake.<sup>30</sup> In 2018, China's National Bureau of Statistics reported a stock of 428 million hogs, hundreds of millions of which died or required culling during the ASF outbreak.<sup>31</sup> The timing of this challenge further compounded the economic burdens brought on by the novel coronavirus (COVID-19) shutdowns and pandemic response. China produced only 36 mmt of pig meat in 2020 compared to 54 mmt in 2018.<sup>32</sup> The ASF outbreak also highlights the importance of China as an export market for the United States. As China's hog supply decreased, domestic pork prices rose to new highs.<sup>33</sup> By early 2020, pork prices in China reached more than \$3.50 per pound compared to about \$1.50 per pound in mid-2018.<sup>34</sup> The economic effects associated with the outbreak and subsequent control measures have affected farmers in both China and the United States.‡ With fewer hog herds to feed and rising bilateral political tensions, China's demand for U.S. corn and soybeans substantially dropped. Beginning July 2018, U.S. farmers also faced Chinese tariffs on corn and soybean exports, compounding the pricing problem.<sup>35</sup> As a result, U.S. soybean exports dropped below a 20 percent market share in 2018 compared to 37 percent the previous three years.§<sup>36</sup> Pork deficits caused by ASF, however, drove up U.S. pork exports to China. In 2020, pork exports reached 3.7 mmt, more than double 2018 exports to China.<sup>37</sup> The average retail value of pork in the United States also rose by 4.84

\* For an assessment of the impact of ASF in 2019, see Sean O'Connor, "China's African Swine Flu Outbreak: Implications for U.S. Food Safety and Trade," *U.S.-China Economic and Security Review Commission*, May 15, 2019. <https://www.uscc.gov/sites/default/files/Research/China%27s%20African%20Swine%20Flu%20Outbreak.pdf>.

† China's government considers a small or medium-sized farm to be less than about 16 acres (100 mu). Huang Zongzhi, "Are Family Farms the Development Path Forward for China's Agriculture?" (家庭农场 是中国农业的发展出路吗?) *Open Times* (开放时代) 2014. [www.opentimes.cn/Abstract/1947.htmls](http://www.opentimes.cn/Abstract/1947.htmls).

‡ Not only is there an immediate financial loss from culling but also a longer-term impact on reproductive capacity from losing breeding pigs.

§ As noted above, corn exports to China rebounded from their low 2018 and 2019 levels following the conclusion of the Phase One Trade Agreement in January 2020.

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percent from \$3.84 per pound to \$4.03 per pound between 2019 and 2020.<sup>38</sup> These market disruptions put pressure on the Chinese government to stabilize the country's pork supply, the main protein of choice for China's modern middle class.

- **Fall Army Worm (FAW)** devastated China's southwestern provinces beginning in 2019.<sup>39</sup> FAW is an invasive pest that feeds on 80 different crop species, including corn, and has affected crops in more than 100 countries, including the United States.<sup>40</sup> The outbreak spread to 26 provinces in 2019 and infested an estimated 2.8 million acres of land.<sup>41</sup> In 2020, it spread into China's northeast provinces, home to its corn belt. In February 2020, MARA responded by issuing a 2020 Plan for Fall Armyworm Prevention ahead of the spring planting season, but it estimated that 16.6 million acres would be affected, a large increase from the 2.7 million acres affected the prior year.<sup>42</sup> China continued to work to minimize the impact of the FAW outbreak. FAW in China—combined with recovery in the hog sector and the Phase One Trade Agreement—created a favorable climate for U.S. corn exports. In 2020, exports of U.S. corn (primarily used in animal feed) to China reached \$1.2 billion compared to just \$56 million in 2019.<sup>43</sup>
- **Water and soil pollution**, as noted above, has damaged 19.4 percent of China's arable land and created additional challenges for China's agricultural production goals, including food safety, grain output, and difficulties with regulatory enforcement.<sup>44</sup> Rapid urbanization and poor environmental regulations have exacerbated existing burdens on China's farms, including water shortages. China's water and soil have been polluted by toxic human, agricultural, and industrial waste resulting from economic development in the last several decades. In 2021, a research team at Tsinghua University released a study that found 100 million people in China accessed water with unsafe levels of toxic chemicals.<sup>45</sup> In 2013, China's 2nd National Water Resource Survey found that 60 percent of groundwater was polluted, often by heavy metals, and as noted above, a 2018 government study found 15.5 percent of groundwater was unsuitable for any use.<sup>46</sup> Furthermore, the 2013 survey reported that each year heavy metal pollution destroyed about 10 mmt of grain and contaminated an additional 12 mmt.<sup>47</sup> Mining and industrial sewage has also affected China's rice fields, causing serious food safety concerns. China's government has made efforts to curb water pollution, but it often struggles with enforcement.
- **Flooding** across China over the last several years has had a notable impact on food production, including crop yields and pork output. As the country responded to the COVID-19 pandemic in June and July 2020, historic rainfall ripped through Wuhan and other parts of China.<sup>48</sup> The floods destroyed crops and delayed production by damaging roads and farms and displacing people. The summer floods affected approximately 63 million people and more than 14 million acres of cropland.<sup>49</sup> More flooding took place in August after heavy rains in Sichuan and Shandong. Damage to farmland and transportation infrastructure, compounded by setbacks from ASF, fostered a surge in imports, particularly for pork, wheat, and corn.<sup>50</sup> Throughout 2021, China again experienced severe flooding, this time primarily in Henan and Shanxi provinces. The July 2021 floods in Henan were the worst the province had seen in decades.<sup>51</sup> The floods displaced hundreds of thousands of residents and had devastating effects on local farmland.<sup>52</sup> Despite the natural disasters of the last few years, China's National Bureau of Statistics (NBS) reports positive growth in key sectors.\* For instance, in 2021 China's grain output rose to 682.9 million tons, compared to 650 million tons in 2020.<sup>53</sup>

## China's Policies Seek to Build Self-Sufficiency

China's government sees two main options for addressing land scarcity concerns, relative to food security, without becoming more reliant on other countries' producers. It can either purchase land abroad where it will have captive production or work to improve its domestic land. Both options have become integral to China's strategy as the population has grown and new domestic production challenges have arisen. There is, however, tension between China's desire to build self-sufficiency in agriculture and the reality of its domestic resources that drives it to

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\* Foreign analysts, economists, and investors maintain skepticism about the reliability of China's official reported economic data. China's economic data are highly politicized and help to support a curated narrative of national success.

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attractive investments abroad. Each force is pulled tighter by General Secretary Xi's desire to maintain China's food security.

Although the CCP expresses confidence in its processes for maintaining food security, General Secretary Xi's consistent emphasis in public speeches on minimizing food waste suggests there is enduring fear over food deficiencies. Shortly after coming into power in 2013, Xi Jinping established the "operation empty plate" initiative as an anti-food-waste campaign.<sup>54</sup> The issue received renewed focus in General Secretary Xi's August 2020 speech following the summer floods that so badly destroyed crops. General Secretary Xi emphasized China's progress in grain production, but he explained that the nation was still in a state of balancing its demand for grain and grain supply and called for people to be vigilant and avoid waste.<sup>55</sup>

While publicly, General Secretary Xi calls for agricultural frugality and self-sufficiency, China's investments in foreign farms, mills, and other agricultural assets diversify its supply chain and provide a level of insurance should its domestic ecosystem face challenges like the ones discussed above. China is wary of overreliance on any foreign source but is expected to continue investing in attractive aspects of the U.S. agricultural economy, like the pork industry, in tandem with its efforts to improve its domestic production.

**Reduce Import Reliance:** Amid the deficit of these critical products in China and rising prices, MARA announced policies in March 2021 to reduce the amount of soy and corn used in animal feed.<sup>56</sup> China relies heavily on corn and soy imports from countries like the United States and Brazil, which supply more than 80 percent of global soybean exports.<sup>57</sup> About 60 percent of global soybean exports go to China.<sup>58</sup> The deficits were compounded by logistics challenges resulting from China's response to COVID-19, including port closures.\* In 2019, 86.4 percent of China's corn imports came from Ukraine, meaning Russia's invasion of Ukraine may prolong the challenges to China's food security even as the effects of the COVID-19 pandemic subside.†<sup>59</sup> At a Politburo Standing Committee meeting in December 2021, General Secretary Xi added an emphasis on food security, saying that "the food of the Chinese people must be made by and remain in the hands of the Chinese. Everyone needs to take responsibility for food security."<sup>60</sup> Then, at the December 2021 Central Rural Work Conference in Beijing, General Secretary Xi further stressed the importance of food security by saying that the Chinese people's "rice bowl must be firmly held in their hands at all times."<sup>61</sup> He also called for efforts to increase soybean and oilseed production.<sup>62</sup> In February 2022, CCP mouthpiece *People's Daily* reported that General Secretary Xi identified quality seeds as one of the primary solutions to ensuring stable grain output, calling on the Chinese people to "develop China's seed industry, pay close attention to cultivating excellent varieties with independent intellectual property rights, and ensure food security from the source."<sup>63</sup>

**Improve Domestic Farmland:** China's State Council and MARA have announced numerous efforts to improve and conserve China's farmland, including a January 2021 statement by Agriculture and Rural Affairs Minister Tang Renjian that China would improve and conserve China's domestic farmland by almost 25 percent in 2021.<sup>64</sup> The government plans to upgrade 16.5 million acres (100 million mu)—more than 3 million acres (20 million mu) above the 2020 target—to high standard or well-facilitated farmland able to withstand droughts and floods while producing high and stable yields.‡<sup>65</sup> A 2022 government report reiterates calls for improving land, indicating that it has yet to reach its goals.<sup>66</sup> Looking to address food security concerns, MARA has said that it plans to use large-scale mechanical farming to improve productivity and crop yields on the nation's farms.<sup>67</sup> MARA also plans to upgrade irrigation systems to conserve water and improve the systems' effectiveness.<sup>68</sup> China's 14th Five-Year-Plan to Advance Agricultural and Rural Modernization (2021–2025) includes plans to upgrade its arable land through improving saline and alkali soils in northern China and acidified soils in southern China. The plan also calls for greater pollution control by reducing farmers' use of chemical fertilizers and pesticides. In less polluted areas, the State Council wants to implement rehabilitation measures. By contrast, heavily polluted land will be converted into forests and grassland or adjusted to accommodate nonedible

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\* For more on China's port closures, see U.S.-China Economic and Security Review Commission, "September 2021 Trade Bulletin," September 14, 2021.

† For more on China's actions toward Russia following Russia's invasion of Ukraine, see the U.S.-China Economic and Security Review Commission, "China's Position on Russia's Invasion of Ukraine," May 11, 2022.

‡ New articles have pointed out that this amount of land is roughly equal to the size of the Republic of Ireland. William Zheng, "China Aims to Upgrade Farmland the Size of the Republic of Ireland. Here's Why," *South China Morning Post*, December 18, 2020. <https://www.scmp.com/news/china/politics/article/3114483/china-aims-upgrade-farmland-size-republic-ireland-heres-why>.

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agricultural commodities.<sup>69</sup> In February 2022, China released its No. 1 central document for rural vitalization. The document includes plans to promote black soil protection and conduct the third national census on soil conditions, which will occur more than 40 years after the last one. The census will examine soil quality to improve soil protection and utilization efforts.<sup>70</sup>

**Advance Agritech Innovation:** China hopes industrial farming approaches will increase agricultural productivity as the rural population declines. However, the transition is disruptive for local agricultural economies composed of small-scale farms, requiring them to purchase expensive equipment and transform practices they have been implementing for generations. One study found farmers' intentions to use machines were limited by the financial burden of purchasing and maintaining the equipment. Instead, many smaller farms in China still rely on low-tech tractors. The *South China Morning Post* points out, "These low-tech tractors will be unable to work the kind of larger-scale plots that the government wants to create."<sup>71</sup> China's agricultural machinery industry also struggles to produce the high-end machinery needed to create the kind of large-scale agricultural ecosystem the government envisions. As Luo Xiwen, an academician of the Chinese Academy of Engineering explains, "In terms of typical agricultural machinery such as tractors and harvesters, there is a gap of more than 30 years between us and foreign countries."<sup>72</sup> The CCP has particularly emphasized investments in high-tech innovations that will advance China's agricultural capabilities. China's 2015 blueprint to gain dominance in high-tech industries, Made in China 2025, focuses on driving innovation in ten specific sectors, including agricultural equipment.<sup>73</sup> The policy directs the state to advance its production of agricultural technology and equipment like high-end tractors and harvesters.<sup>74</sup> By 2025, Beijing wants 95 percent of Chinese market demand for agricultural equipment to be met by domestic manufacturing.<sup>75</sup> More specifically, it aims to meet 60 percent of its demand for large tractors above 200 horsepower and harvesters. While China's output of smaller tractors has decreased in recent years, its medium and large-sized tractor output has increased. China produced 40,000 large tractors in both 2018 and 2019 and imported more than 10,000 agricultural machines.<sup>76</sup> In 2021, China produced 51,000 large-sized tractors, a 27.5 percent increase from the previous two years.<sup>77</sup> This appears to have impacted China's purchase of U.S. tractors and could impact third-country buyers in the U.S. export market. In 2013, U.S. agricultural equipment sent to China totaled nearly \$27 million.<sup>78</sup> In 2015, the year the Made in China 2025 policy was introduced, exports were at about \$16 million and have since dropped to around \$9 million in 2021.<sup>79</sup>

This policy shift has implications for U.S. trade with China, which is a large market for U.S. agricultural equipment companies. China's expansion of agricultural equipment production comes at the same time as its implementation of tariffs on foreign imports, which has produced a notable decline in agricultural machinery exported to China and impacted U.S. agricultural equipment businesses like John Deere.

Where it once saw itself as far behind the United States and others in agricultural technology and equipment, China is now catching up. The United States remains the frontrunner in agricultural innovations, but MARA claims China is now among the world's leaders in agricultural technology and science.<sup>80</sup> MARA's director for science and technology development, Yang Xiongian, spoke at a China Academy of Agricultural Sciences (CAAS) forum in November 2021, saying, "China is self-sufficient in 70 percent of key livestock and poultry varieties" and has a more than 71 percent mechanization rate of crop cultivation and harvesting.<sup>81</sup> MARA also released a five-year plan for agricultural mechanization in December 2021 that calls for securing "total power of agricultural machinery nationwide."<sup>82</sup> The plan includes farmland development, smart information technology, and agronomic systems as areas in need of agricultural mechanization.<sup>83</sup> Despite its anxieties about food security and efforts to grow domestic capacity, China still finds value in investing in U.S. agriculture. It recognizes that in many areas of the ecosystem, the United States has something China does not, whether that is infrastructure, land mass, IP, or an already built out supply chain. By accessing these areas through capital, or in some cases theft, China gains useful intelligence for achieving agricultural self-sufficiency.

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## How U.S. Agriculture Assets Assist China

The Chinese government's concerns about food security inform its interests in an array of U.S. agricultural assets. Investment targets include land, livestock, seeds, and supporting infrastructure, like grain elevators.\* In owning these assets in both the United States and within China, Chinese agricultural producers diversify supply and mitigate risks from events like natural disasters. Consolidating some of its production lines within the United States, for instance with pork, also helps expedite the production process from farm to table. Additionally, shifting its more environmentally taxing agricultural practices to the United States appeals to China, as it faces global and domestic criticism for its environmental record. While these assets primarily remain in the United States, perhaps the most valuable and easily transferrable property are seeds. As China's government attempts to foster development of a domestic seed industry, Chinese nationals have smuggled seeds out of the United States to China to be replicated, which is discussed in more detail later in this paper. There are not clear estimates on the scale of commercial losses due to agricultural IP theft, but losing these seeds to China is certainly costly for the United States. For example, creating a single hybrid seed, the typical subject of theft, requires breeding two inbred seed lines. Each inbred seed can cost up to \$30 million to \$40 million in lab costs, field work, and trial and error, not to mention the time spent completing this work.<sup>84</sup> Though it is illegal to import GM seeds, China allows imports of GM crops, used mainly for animal feed, and has active research into GM seeds.<sup>†</sup><sup>85</sup> China's government has encouraged further development of the country's domestic seed industry, however, including GM seeds. China's 14<sup>th</sup> Five-Year Plan calls for developing new agricultural varieties, accelerating the commercialization and industrial application of biological breeding, and fostering "leading enterprises in the seed industry with international competitiveness."<sup>86</sup>

### Agribusinesses

#### Fufeng Group in North Dakota

One case of Chinese agribusiness investment is in a relatively small plot of land in North Dakota that local officials argue will have a large return on investment. In November 2021, Grand Forks announced that Fufeng Group of Shandong, China, had selected the municipality as the location for its new wet corn mill, a potential driver of revenue for local or regional corn farmers depending on where the company decides to buy its corn.<sup>‡</sup><sup>87</sup> The Chinese company, known for its MSG production within China, purchased 370 acres in Grand Forks' agribusiness park.<sup>88</sup> While not a state-owned enterprise, Fufeng Group has ties to the Chinese government. Li Xuechun, Fufeng's chairman, previously participated in Shandong's 12<sup>th</sup> People's Congress and has received praise for being the "Model Laborer" for his business achievements.<sup>89</sup>

The mill will be located about 12 miles from the Grand Forks Air Force Base, which houses some of the United States' top intelligence, surveillance, and reconnaissance capabilities. The location of the land close to the base is particularly convenient for monitoring air traffic flows in and out of the base, among other security-related concerns.<sup>90</sup> Under the Foreign Investment Risk Review Modernization Act of 2018 (FIRRMA), the land's proximity to a military installation may qualify the transaction for a review by the Committee on Foreign Investment in the United States (CFIUS). There have been no public reports indicating whether CFIUS did or did not review Fufeng's purchase in Grand Forks.

Fufeng Group considered a number of locations before choosing to settle in Grand Forks. Some local corn cooperatives are concerned about where Fufeng may choose to buy their corn and are wary of industry

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\* Grain elevators are facilities for storing grains in bulk that use a conveyor or elevator to lift grain into a silo. They are typically located near railroads, highways, or waterways to make transporting the grain easier. George Carney, "Grain Elevators," *Encyclopedia of the Great Plains*, 2011. <http://plainshumanities.unl.edu/encyclopedia/doc/egp.arc.026>.

† Breeding GM crop varieties and manufacturing GM seeds is also prohibited by the Chinese government. The Chinese populace harbors skepticism regarding the safety of GM products.

‡ Wet corn mills use water to process and break down corn kernels to separate the parts for various uses, such as corn starch, corn oil, sweetener, and gluten meal. Daniel O'Brien and Mike Woolverton, "Recent Trends in U.S. Wet and Dry Corn Milling Production," *Agricultural Marketing Resource Center*, February 2009. <https://www.agmrc.org/renewable-energy/renewable-energy-climate-change-report/renewable-energy-climate-change-report/february-2009-newsletter/recent-trends-in-us-wet-and-dry-corn-milling-production>.

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consolidation, particularly when it corners off a critical market to a foreign company with ties to the CCP.<sup>91</sup> The U.S. agriculture industry has already witnessed this kind of consolidation following Smithfield Foods' acquisition by a Chinese company, which is discussed below. Evaluating lessons learned by the United States from the Smithfield case can provide insight into what vulnerabilities may exist in other foreign acquisitions of U.S. agribusinesses and agricultural land.

### **WH Group (万州国际) and Smithfield Foods**

Smithfield Foods, Inc. is the largest pork producer in the United States. It was founded in 1936 in Smithfield, Virginia, but acquired in 2013 by Shuanghui International Holdings Limited, a subsidiary of the Chinese company WH Group (formerly Shuanghui Group). With backing from the Chinese government, the acquisition marked China's largest purchase of a U.S. asset to date at \$4.7 billion, or \$7.1 billion, including debt.<sup>92</sup> State-owned Bank of China provided the \$4 billion loan for WH Group to make the purchase.<sup>93</sup> CFIUS conducted a review of the acquisition and approved the proposal in September 2013, despite concerns raised by some lawmakers.<sup>94</sup> The company gained more than 146,000 acres in the acquisition, which are mostly concentrated in North Carolina, Missouri, Utah, Virginia, Colorado, and Oklahoma.<sup>95</sup> These states host Smithfield's hog farms, processing plants, and feed mills, among other things.<sup>96</sup>

Shuanghui was founded in 1958 by a municipal government in Henan Province.<sup>97</sup> WH Group's longtime chairman, Wan Long, joined the plant ten years later and was general manager by 1984. Wan Long grew the company from a small and struggling single processing plant into China's largest food processor by 2006.<sup>98</sup> As Usha Haley noted in her testimony before the Senate Committee on Agriculture, Nutrition, and Forestry in 2013, Wan Long spent more than 15 years as a member of China's National People's Congress.<sup>99</sup> Wan Long's links to the CCP provided him the support Shuanghui needed to acquire Smithfield. The Chinese government stood to benefit from Smithfield's established reputation globally and record on food safety, both areas where Shuanghui struggled. Additionally, the U.S. company's advanced hog genetics and valuable technology were an undeniable draw for China, which was looking to diversify its agricultural supply chain and increase the yield of its herds. WH Group was also seeking out ractopamine-free pork, which Smithfield was able to provide. Ractopamine is a feed supplement often used by producers to promote leaner hogs. China has long banned pork imports using ractopamine production due to concerns about its health effects on pigs and humans.<sup>100</sup>

Since 2012, China's investment in Smithfield has continued to prove its worth. Pork prices have been particularly volatile over the last five years as China's hog herds battled disease and the COVID-19 outbreak disrupted domestic and global supply chains. Despite these challenges, Smithfield supplied China with record amounts of pork in 2020 as its own hog farms were still recovering from the ASF outbreak, many facilities had closed due to the pandemic, and pork prices remained high.<sup>101</sup> China is incentivized to do what it can to guard against volatility in its own food supply. Investing in a major foreign pork operation like Smithfield allows China to hedge against uncertainty in its domestic pork production. Short-term challenges, like higher shipping costs, are not likely to impact China's long-term strategy of diversifying its food supply chain.

More recently, WH Group has encountered challenges in its leadership. In June 2021, the conglomerate announced it was ending the employment of its executive director, Wan Honjian, the son of Chairman Wan Long, who was the company's expected successor. Wan's eldest son was fired due to "aggressive behaviors against the company's properties."<sup>102</sup> Shortly after, in August 2021, it was announced that Wan Long would also be stepping down from his role as chairman and chief executive officer of WH Group. WH Group's stock price dropped by 17 percent on the Hong Kong stock exchange following allegations from Wan Honjian that his father had evaded taxes and mismanaged the company's finances for years.<sup>103</sup>

### **Other Investments**

While not as substantial as the Fufeng or Smithfield deals, there are examples of smaller Chinese investments in U.S. agribusinesses, including COFCO's 2017 partnership with GROWMARK, a U.S. grain logistics company. COFCO is a Chinese state-owned food processing company headquartered in Beijing. Its deal with GROWMARK gave it joint ownership and operation of the latter's Mississippi barge, truck, and rail terminal in

Illinois.<sup>104</sup> This strategic partnership gives the Chinese company access to key areas for exporting grain in the United States. In 2015, China's New Hope Liuhe also invested \$127 million in Lansing Trade Group, a grain trading company.<sup>105</sup> New Hope Liuhe is primarily engaged in animal feed manufacturing and meat processing.<sup>106</sup> Its alliance with Lansing gave it 20 percent ownership in the company and access to a number of the company's grain elevators.<sup>107</sup>

### Chinese-Owned Agricultural Land in the United States

While Chinese entities held slightly less than 1 percent of all foreign-held acres in the United States in 2020, the volume of their holdings increased dramatically over the preceding decade.\*<sup>108</sup> According to U.S. Department of Agriculture (USDA) Agricultural Foreign Investment Disclosure (AFIDA) reports, Chinese investors' holdings of U.S. agricultural land surged from 13,720 acres in 2010 to 352,140 acres in 2020 (for more on AFIDA, see Appendix).<sup>109</sup> This jump owes chiefly to Shuanghui's 2013 purchase of Smithfield Foods. As of 2019, 76 percent of U.S. agricultural land owned by Chinese entities belonged to Smithfield Foods.<sup>110</sup> Smithfield, like other foreign-owned companies, is required to report to USDA when it purchases agricultural land. Reporting does not require much detail regarding a company's ownership structure or intentions behind the investment. Lack of transparency related to foreign investors self-reporting purchases of U.S. land makes it difficult to gauge their specific interests.

It is also interesting to note the types of land Chinese investors are purchasing. According to AFIDA reports, Chinese buyers largely invest in what USDA categorizes as "other land."<sup>111</sup> While some of the Chinese-held land is considered cropland, and an even smaller amount pasture land, a significant amount of the acreage owned is labeled "other land." USDA defines this type of land as having unclassified uses like swamps, marshes, or bare rock. This may include scenic wetlands or property with water sources running through it.<sup>112</sup> In 2013, the year Shuanghui acquired 146,000 U.S. acres in the Smithfield acquisition, USDA reported that Chinese-owned acreage totaled 192,928, 78 percent of which was labeled "other land."<sup>113</sup> Chinese investors reported just 31 thousand acres as cropland that same year.<sup>114</sup> It is not clear why Chinese investors hold so much other land. Notably, they are distinct from most other foreign holders of U.S. agricultural land in owning far more "other land" and far less cropland or pasture land. In 2013, German investors owned more than 547,000 acres of cropland and more than 52,000 acres of other land.<sup>115</sup> Italians owned more than 911,000 acres of cropland in 2013 and more than 63,000 acres of other land.<sup>116</sup> "Other land" is not intended for growing crops or for livestock grazing.

The categorization of other land, particularly Chinese Investments of this type, poses a transparency issue for U.S. regulators. The possibility remains that land usage could change after a foreign buyer's purchase is cleared and the investor has completed the initial reporting requirements. USDA requires foreign buyers to report on any changes to land use, but the lack of enforcement makes this an area ripe for neglect.

Each state has its own foreign-ownership laws in place for land, and some ban it outright, making just a few exceptions. In Iowa, for example, a nonresident alien, foreign business, or foreign government cannot purchase land in the state; the law does not apply to acquisitions prior to 1980. Exceptions to this rule include land acquired for research or experimental use or for testing, developing, or producing seeds.<sup>117</sup> In Arkansas, any foreign party can acquire interest in agricultural land, but it must register with the county clerk where the land is located within 60 days.<sup>118</sup>

## Building Out the Supply Chain: Livestock, Grain, and Supporting Infrastructure

China's rapid economic growth and large population make it a major consumer of food products. For example, in 2020 China's soybean imports accounted for 85 percent of its domestic consumption.<sup>119</sup> As China's demand for food continues to swell, the country is looking to the United States as a source for increasing its livestock supply and to boost production. While China has made great strides in animal husbandry, it continues its efforts to evolve the quality of its livestock. Ronald Lemenager, professor and cochair of the Beef Center at Purdue

\* While this is slim in comparison to Canadian or Dutch ownership, there has been a steady increase in Chinese-held land over the last decade. U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2020*, 2021. [https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/EPAS/PDF/2020\\_afida\\_annual\\_report.pdf](https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdafiles/EPAS/PDF/2020_afida_annual_report.pdf).

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University, observes, “When you have a nation’s diet changing as rapidly as China’s, the most efficient way to build up production is to improve your animal genetics. We have the genetics they want.”<sup>120</sup> China has purchased millions of U.S. animals as breeding stock, saving itself decades of time and resources on the advanced agricultural research that goes into improving animal health and nutritional quality.<sup>121</sup> Each year, China produces and consumes more than 50 percent of the pork supply worldwide and continues to seek ways to secure its supply chain and boost production.<sup>122</sup>

Following its acquisition of Smithfield, China has acquired additional links in the global food supply chain through its ownership of the U.S.-based company. WH Group was founded as a state-run meatpacking plant in China.<sup>123</sup> Just three years after it was acquired by WH Group, Smithfield bought Clougherty Packing from Hormel Foods Corp. The deal cost them \$145 million, and in return they acquired two processing facilities in California and three farms in Wyoming, California, and Arizona.<sup>124</sup> The acquisitions continued in 2017 with Smithfield’s purchase of Kansas City Sausage Co. LLC, a joint venture formed in 2013 between KC Sausage and sister company Pine Ridge Farms.<sup>125</sup>

Since its acquisition of Smithfield, WH Group has reorganized operations to cut out many of Smithfield’s U.S. suppliers and service providers. CHS, the largest farmer-owned grain cooperative in the United States, saw its contract end with Smithfield in 2014, the year after the acquisition.<sup>126</sup> Then, in 2015 Smithfield ended its contract with MaxYield Cooperative in Algona, Iowa. The company had supplied a Smithfield feed mill for 20 years.<sup>127</sup> In the fall of 2016, Smithfield purchased grain elevators in Harpster and Morral, Ohio.<sup>128</sup> This allows the company to ship grain directly from Ohio to North Carolina where it has its feedlots for the hogs.<sup>129</sup> Owning grain elevators allows WH Group to cut out the middle men or grain handlers. Animal feed makes up more than half of Smithfield’s costs, so buying directly from farmers and using its own grain elevators to transport the feed lowers costs and allows the company to be less reliant on commercial grain processors. While acquisitions of this kind are not unique to Smithfield, concerns regarding its consolidations stem from its foreign ownership and links to the Chinese government.

## Risks of Chinese Acquisition of U.S. Agriculture Assets

### Impact on Local Communities

Chinese companies, particularly Smithfield, have expanded their hog farms instead of just processing the meat. The livestock is either exported to China for breeding or the company seeks out hog farms for purchase in the United States.<sup>130</sup> Chinese buyers were particularly attracted to Smithfield because of its U.S.-based hog herds, which allows its Chinese parent company, WH Group, to consolidate its production line—saving time and money—and to offshore some of the environmental impacts of hog farming. Feeding the herds in the United States is cheaper, the farms are more expansive, and the environmental concerns do not impact China’s land.<sup>131</sup> As noted above, China is the top importer of U.S. corn and soybeans and relies heavily upon the United States as well as other countries to feed both its U.S.-based and home-grown hog herds. In 2021, the United States sent 30 million tons of corn to China, up from 9 million tons in 2017.<sup>132</sup> In the United States, Smithfield, for example, feeds 16 million hogs annually, which take around 150 million bushels of wheat, sorghum, corn, and soybeans.<sup>133</sup> The company also imports feed from Brazil, Argentina, and Europe.<sup>134</sup> By offshoring its hog herds to the United States, China is less reliant on feed grain imports since Smithfield can transport feed grain directly from U.S. sellers to its U.S.-based hog farms. U.S.-based hog farms allow China to augment its domestic pork production at a scale and speed not possible at home. WH Group’s acquisition of more than 400 Smithfield-owned hog farms and an additional 2,000 independent farms gave it access to a well-established and integrated system in the United States where it could increase its access to quality pork while creating a buffer against U.S. tariffs on feed grain exports necessary for feeding China’s domestic hogs.<sup>135</sup> According to Smithfield’s 2016 report, the last year for which there is a publicly available report, its sales to international customers accounted for approximately 20 percent of its net sales.<sup>136</sup>

Additionally, raising hogs is an environmentally impactful practice, as hog waste fills acres of open-air lagoons or pits that have been found to emit toxic chemicals.<sup>137</sup> Farmers aware of how quickly disease can wipe out their

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herds rely heavily on antibiotics, insecticides, and vaccines to protect against health problems.<sup>138</sup> These toxins have also been found to seep into local water supplies, causing residents to become sick with various ailments.<sup>139</sup> Hog farms—including those owned by Smithfield—in eastern North Carolina and the surrounding towns have been notably impacted by the effects of pork production. A study from 2018 found that North Carolinians who reside near clusters of industrial swine operations have a higher rate of sepsis, kidney disease, tuberculosis, and infant mortality, among other conditions.<sup>140</sup> Other studies have also found that children who go to school near hog farms more frequently experience asthma or wheezing.<sup>141</sup> Recognizing its challenges with soil and water pollution, China stands to benefit from keeping its hog farms abroad, not to mention avoiding the health impacts these farms can have on surrounding communities. After years of a poor environmental record and subsequent lawsuits, Smithfield invested \$15 million into researching alternative waste management systems. This investment led to a 2013 report, released the same year WH Group acquired Smithfield, which identified a more environmentally sound system for managing hog waste. Smithfield ultimately chose to forgo this option, citing the cost as not economically feasible. Despite using different biogas digesters at its Chinese-based farms, WH Group still uses open-air lagoons at its U.S. Smithfield farms, which are subject to less stringent regulations than Chinese farms.<sup>142</sup>

## Hungry for U.S. IP

### Economic Competitiveness

China's efforts to gain access to data on U.S. genetically modified (GM) grains present serious concerns for U.S. economic competitiveness as Chinese firms illicitly acquire U.S. IP. China relies heavily on grain imports from the United States to feed its growing livestock inventory. Because season-to-season grain yields can be volatile and grain sales have small profit margins, advanced seed lines are an invaluable commodity.<sup>143</sup> Genetically engineered seeds promise new opportunities for mitigating risk of drought, pests, and diseases. Improved seed stock can also minimize the amount of land required for planting. Innovation in seed development has generated billions of dollars in revenue for U.S. companies, like Monsanto. In 2020, the U.S. exported \$1.62 billion worth of seeds, primarily vegetables, corn, soybeans, and grasses.<sup>144</sup> The United States exported \$173.91 million of seeds to China in 2021, which is about 15 percent of its total exports.<sup>\*</sup><sup>145</sup> China's government recognizes that increasing crop yields means improving seed quality and advancing domestic innovations in synthetic biology. In March 2021, MARA announced that over the next three years it plans to conduct a survey of seed and animal genetic resources. As the Chinese state publication *Global Times* reports, the survey is "the first concrete step in a broad effort to break through the bottleneck of foreign-controlled resources and ensure China's food security."<sup>146</sup>

Chinese scientists have in certain cases chosen to simply steal U.S. agriculture IP and technology rather than try to research and develop them themselves.<sup>147</sup> Acquiring U.S. trade secrets through agricultural espionage has become a convenient way for China to improve its agricultural output and become more competitive in global markets. China's GM crop research, including seed breeding, is still underdeveloped relative to the United States, which is the largest exporter of GM crops. The growing GM crop industry in China would greatly benefit from access to protected U.S. seed lines that take many years and resources to develop. Agricultural IP theft could enable Chinese agribusinesses to undercut U.S. competitors on international seed markets. For instance, in January 2022, the U.S. Department of Justice announced that Xiang Haitao, a Chinese national, had pleaded guilty to economic espionage conspiracy.<sup>148</sup> In April 2022, he was sentenced to 29 months in prison, three years of supervised release, and a \$150,000 fine.<sup>149</sup> Xiang resided in Chesterfield, Missouri, where he worked at agricultural biotechnology company Monsanto and its subsidiary The Climate Corporation as an imaging scientist from 2008 to 2017. Assistant Attorney General Matthew Olsen explained that "despite Xiang's agreements to protect Monsanto's IP and repeated training on his obligations to do so, Xiang has now admitted that he stole a valuable algorithm from Monsanto, transferred it to a memory card and attempted to take it to the People's Republic of China for the benefit of Chinese government."<sup>150</sup> Monsanto and The Climate Corporation developed online farming software to help farmers collect, store, and visualize field data to improve their production efficiency. Powering the software is the stolen algorithm referred to as the Nutrient Optimizer. This algorithm is

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<sup>\*</sup> In 2021, the United States exported \$231.12 million of seeds to Mexico, or 20.3 percent of total exports globally, and \$191.71 million to Canada, 16.8 percent of the total.

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a particularly valuable piece of the company's IP, which would help accelerate technological advancements for the Chinese government and affiliated corporations.<sup>151</sup>

Law enforcement has also discovered larger-scale schemes to steal critical IP. Robert Mo, a Chinese scientist who came to the United States as a graduate student, was convicted of stealing GM seeds from Iowan cornfields to send back to China in 2016.<sup>152</sup> At the time, he worked for Dabeinong (DBN) Technology Group, a company manufacturing and distributing feed products.<sup>153</sup> DBN is closely integrated with the Chinese government as its top leadership has also held key positions at the China Academy of Agricultural Sciences (CAAS), which falls under MARA's jurisdiction.<sup>154</sup> After several years with the company, Mo's boss suggested he "help find a shortcut" to ease China's food security concerns.<sup>155</sup> He sent Mo to Iowa, where he collected thousands of seed samples from Monsanto and Pioneer test fields and subsequently shipped them to China where they could be studied and made into a new hybrid seed for Beijing's use.<sup>156</sup> He was eventually caught in 2011 when someone spotted him with two colleagues leaving a corn field.<sup>157</sup>

### **Military Applications**

Agricultural genetic technologies present unique dual-use potential that may attract further economic espionage. While China's main interest in obtaining GM seeds from the United States is in improving its crop yields, the potential weaponization of agricultural IP is possible.<sup>158</sup> Using the genetic code data it has obtained on U.S. crops, China can strengthen its agricultural output by replicating years of U.S. research on its own farms, or it can take a more nefarious route. As one Chinese expert from the Chinese Academy of Sciences notes, "An important feature of genetically modified technology is that reverse engineering it is very easy to accomplish."<sup>159</sup> Similar to hacking a computer code, Beijing could easily hack the code or DNA of U.S. GM seeds and conduct biowarfare by creating some type of blight that could destroy U.S. crops.<sup>160</sup> For example, biotechnology experts have recognized that fungal spores "could be used as biological warfare agents to target staple crops."<sup>161</sup> Scientists develop GM seeds to be resistant to naturally occurring diseases, but a GM blight could do grave damage to crops grown in the United States. One vulnerability of GM seeds is their limited genetic variation.<sup>162</sup> Consequently, a virus or fungus engineered to kill a GM plant could wipe out an entire crop with no genetic variation to mitigate the losses. In a natural crop, a variety of DNA traits in the field could mitigate some losses and ensure some of the plants survive the viral or fungal infection. Following the 2001 terrorist attacks in the United States, China's government began expressing concerns about bioterrorism and focusing more on biosecurity and biosafety measures. As noted earlier, the Chinese government has reservations regarding the import of GM animals and plants from the West, but it has increasingly acknowledged the strategic advantages genetically modified organisms (GMOs) may present. Defensive applications of synthetic biology may also be a motivation behind China's desire to access advanced U.S. seed lines or other agricultural IP. Perhaps indicating sentiment among Chinese scientists, Jiang Gaoming, a researcher and professor at the Chinese Academy of Sciences, wrote an article on U.S. biodefense efforts, exhorting other Chinese scientists to channel their research toward China's biological defense, commenting, "Friends, GMO experts, your wisdom should be aimed at the enemy, not your own."<sup>163</sup>

## **Considerations for Congress**

China has built an extensive toolkit for addressing its domestic concerns regarding food security as well as its larger goals of achieving global leadership in agricultural innovation and production. Below are areas of consideration that may present opportunities or concerns for Congress:

- *Information on Chinese ownership of U.S. agricultural land lacks transparency and remains limited.* USDA reporting requirements for foreign ownership of U.S. land lack rules and transparency related to ownership, use, and change in use. The lack of enforcement mechanisms in place regarding false reporting or no reporting at all also raises concerns. It is unclear to what extent USDA conducts field assessments or tracks changes in land use or ownership after the initial paperwork is filed. Chinese firms may easily circumvent current reporting requirements under the Agricultural Foreign Investment

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\* Jiang Gaoming's column was published in 2018 on Ai Sixiang, an online academic discussion forum.

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Disclosure Act and could repurpose the purchased land with little concern of repercussions from USDA due to the lack of enforcement measures in place. Without the proper collection of land data, it will be increasingly difficult for the U.S. government to monitor and consider any potential risks to national security.

- *Chinese theft of U.S. agricultural IP threatens U.S. competitive advantage in crop development and agriculture technology innovation.* The United States government, private sector businesses, and academia invest enormous amounts of time and resources into researching and developing the science that goes into these innovations. Continued theft of valuable U.S. IP will continue to disadvantage homegrown innovation necessary for the United States to stay competitive in the agriculture sector.
- *The potential weaponization of GMOs, like GM seeds, also poses a threat to U.S. economic and food security, which could be at risk if GM seed code is used to create a bioweapon.* There are currently few open source documents on cooperation between the intelligence community and USDA. As the agriculture sector continues to experience consolidations, CFIUS reviews of key agricultural mergers and acquisitions are likely to continue. USDA may provide critical information regarding trends in China's agriculture sector that could prove useful for CFIUS reviews. The extent of USDA and other related agency involvement in CFIUS actions may need clarification. Additionally, USDA may benefit from classified briefings as relevant government agencies see fit.
- *The CCP may have undue leverage over U.S. supply chains if further consolidations and Chinese purchases of U.S. agribusinesses take place.* As seen with the Smithfield case, large agribusinesses have the resources to streamline their production lines by purchasing links or companies along the chain. This may create economic distortions in the U.S. agriculture market should China have more leverage over U.S. suppliers, resulting in more closed market or intracompany trade transactions.
- *Foreign-owned land near military installations may require additional monitoring.* As more Chinese investors purchase land, including for agricultural use, CFIUS has an opportunity to safeguard vital military assets. Current U.S. law says that a purchase, lease, or concession by or to a foreign person of real estate located in proximity to sensitive government facilities could be subject to review by CFIUS. The committee has a right to refuse the transaction being considered, but it rarely conducts oversight post hoc. In some cases, threat environments may evolve and create new risks to U.S. defense infrastructures. Periodic reviews, as would be required with a security clearance, for example, could help alleviate national security concerns.

## Appendix

U.S. law requires foreign investors to report their purchases of U.S. agricultural land to USDA. Each year, USDA's Farm Service Agency (FSA) publishes a report on foreign holdings of U.S. agricultural land. This report is required under AFIDA, which then President Jimmy Carter signed into law in 1978, and it is based on data provided by farmers registered with USDA that participate in agency programs.\*<sup>164</sup> The *2020 AFIDA Annual Report* notes that 2.9 percent of all privately held agricultural land in the United States is under foreign ownership. The report also shows an increase of more than 2.4 million foreign-owned acres in the United States from 2019 to 2020.<sup>165</sup>

Currently, Canadian investors own the largest amount of reported foreign-held land in the United States, which accounts for 32 percent of total foreign-owned agricultural land. Investors from four other countries make up another 31 percent, including the Netherlands, Italy, the United Kingdom, and Germany. The other 36 percent of foreign-held land is owned by various countries, including China.<sup>166</sup> FSA's *2020 AFIDA Annual Report* has just 352,140 acres listed under Chinese ownership, which is less than 1 percent of the overall foreign-held acres.<sup>167</sup>

While foreign investment stretches across the country, Texas and Maine have the largest percentage of foreign-owned land in the country, mainly from Canadian investments. Texas along with Oklahoma and Colorado saw a significant increase in foreign-held land, mostly cropland, in 2020.<sup>168</sup>

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\* About 75 to 80 percent of U.S. farms are registered with USDA.

**Appendix Table 1: Comparison of World Bank/FAO and MNR Findings on China’s Arable Land, 2009 and 2018/2019**

Source	2009	2018 (World Bank/FAO) 2019 (Third National Land Survey)
World Bank/FAO	299.8 million acres (1.82 billion mu)	294.8 million acres (1.79 billion mu)
Third National Land Survey	334.4 million acres (2.03 billion mu)	314.6 million acres (1.91 billion mu)

Source: World Bank and UN Food and Agriculture Organization, “Arable Land – China,” 2018; *Xinhua*, “The Third National Land Survey Data Was Released 第三次全国国土调查主要数据成果发布,” August 26, 2021. Translation.

## Endnotes

- <sup>1</sup> *Reuters*, “China’s Corn Imports Soar to New Record in 2021” January 18, 2022. <https://www.reuters.com/markets/asia/chinas-grain-pork-sugar-imports-december-2022-01-18/>.
- <sup>2</sup> Orange Wang, “China Food Security: Country Faces ‘Grain Supply Gap of 130 Million Tonnes by 2025 as Rural Workforce Dwindles,” *South China Morning Post*, August 18, 2020. <https://www.scmp.com/economy/china-economy/article/3097781/china-food-security-country-faces-grain-supply-gap-130>.
- <sup>3</sup> Aiqi Chen et al., “A Study on the Arable Land Demand for Food Security in China,” *Multidisciplinary Digital Publishing Institute*, 2019. <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKewjQtPaxk4r2AhUxUt8KHf4yDE0QFnoECAQQAQ&url=https%3A%2F%2Fwww.mdpi.com%2F2071-1050%2F11%2F17%2F4769%2Fpdf&usq=AOvVaw2SqQzcD2y-u-GVAgXUZRRJJ>; State Council of the People’s Republic of China, “Chinese Team to Turn 6.7m Hectares of Saline-Alkali Land into Rice Paddies,” *CGTN*, January 17, 2021. [http://webcache.googleusercontent.com/search?q=cache:6BikkJ-nQwJ:english.www.gov.cn/news/topnews/202101/17/content\\_WS6003aa18c6d0f72576943f53.html](http://webcache.googleusercontent.com/search?q=cache:6BikkJ-nQwJ:english.www.gov.cn/news/topnews/202101/17/content_WS6003aa18c6d0f72576943f53.html).
- <sup>4</sup> World Bank, “Arable Land – China,” 2018. <https://data.worldbank.org/indicator/AG.LND.ARBL.HA?locations=CN>; John Carter, Sidney Leng, and Orange Wang, “China Population: Census Confirms Increase to 1.412 Billion in 2020, but Births Fall Again,” *South China Morning Post*, May 11, 2021. <https://www.scmp.com/economy/china-economy/article/3132980/china-population-latest-census-confirms-increase-1412-billion>.
- <sup>5</sup> U.S. Census Bureau, *QuickFacts*, United States, 2020. <https://www.census.gov/quickfacts/fact/table/US/PST045221>.
- <sup>6</sup> Danielle Wiener-Bronner, “Nearly One-Fifth of China’s Arable Land Is Polluted,” *Atlantic*, April 18, 2014. <https://www.theatlantic.com/international/archive/2014/04/one-fifth-of-chinas-farmland-is-polluted/360873/>.
- <sup>7</sup> China Power Team, “How Does Water Security Affect China’s Development?” *China Power*, Center for Strategic and International Studies, February 25, 2020. <https://chinapower.csis.org/china-water-security/>.
- <sup>8</sup> Danielle Wiener-Bronner, “Nearly One-Fifth of China’s Arable Land Is Polluted,” *Atlantic*, April 18, 2014. <https://www.theatlantic.com/international/archive/2014/04/one-fifth-of-chinas-farmland-is-polluted/360873/>; Lily Kuo, “China Just Revealed a Major State Secret: Nearly 20% of Its Farmland Is Polluted,” *Quartz*, April 18, 2014. <https://qz.com/200602/china-just-revealed-a-major-state-secret-nearly-20-of-its-farmland-is-polluted/>.
- <sup>9</sup> Alexandra Baych, “Agricultural and Rural Modernization Plan Reiterates Prior Pledges,” *U.S. Department of Agriculture, Foreign Agricultural Services*, March 2, 2022. [https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20and%20Rural%20Modernization%20Plan%20Reiterates%20Prior%20Pledges\\_Beijing\\_China%20-%20People%27s%20Republic%20of\\_CH2022-0023](https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20and%20Rural%20Modernization%20Plan%20Reiterates%20Prior%20Pledges_Beijing_China%20-%20People%27s%20Republic%20of_CH2022-0023).
- <sup>10</sup> *Reuters*, “China Has ‘Long Way to Go’ to Meet Ecological Goals – State Council,” November 7, 2021. <https://www.reuters.com/business/environment/china-has-long-way-go-meet-ecological-goals-state-council-2021-11-07/>; *Xinhua*, “Third National Land Survey Main Data Results Released,” (第三次全国国土调查主要数据成果发布), August 26, 2021. Translation. [http://webcache.googleusercontent.com/search?q=cache:SqZwa2dTlrIJ:www.gov.cn/xinwen/2021-08/26/content\\_5633497.htm](http://webcache.googleusercontent.com/search?q=cache:SqZwa2dTlrIJ:www.gov.cn/xinwen/2021-08/26/content_5633497.htm); China Ministry of Land and Resources, China National Statistics Bureau, Office of the State Council Leading Small Group on the Second National Survey, *Announcement Important Results of the Second National Survey* (关于第二次全国土地调查主要数据成果的公报), December 30, 2013. Translation. [http://webcache.googleusercontent.com/search?q=cache:YIMDp0x8UXEJ:www.mnr.gov.cn/zl/hd/dqr/48dqr/zygq/201312/t20131230\\_2060666.html](http://webcache.googleusercontent.com/search?q=cache:YIMDp0x8UXEJ:www.mnr.gov.cn/zl/hd/dqr/48dqr/zygq/201312/t20131230_2060666.html).
- <sup>11</sup> Xu Xiaoping, “Ensure National Food Security and Vigorously Implement the Rural Revitalization Strategy – Learn from the Spirit of the Central Rural Work Conference,” (确保国家粮食安全 大力实施乡村振兴战略——学习中央农村工作会议精神), 宣讲家网,

- February 23, 2021. Translation.  
[http://webcache.googleusercontent.com/search?q=cache:yHc73FA6ZHgJ:www.71.cn/2021/0223/1118726\\_3.shtml](http://webcache.googleusercontent.com/search?q=cache:yHc73FA6ZHgJ:www.71.cn/2021/0223/1118726_3.shtml).
- <sup>12</sup> Center for Security and Emerging Technology, “Translation: 14<sup>th</sup> Five-Year Plan,” May 12, 2021, 55.  
[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwi8sdX4ztr2AhWnd98KHaTWCdEQFnoEC\\_AQQAQ&url=https%3A%2F%2Ffcset.georgetown.edu%2Fwp-content%2Fuploads%2F0284\\_14th\\_Five\\_Year\\_Plan\\_EN.pdf&usg=AOvVaw2oRHNmkbmE3wl1D7OI8rxS](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwi8sdX4ztr2AhWnd98KHaTWCdEQFnoEC_AQQAQ&url=https%3A%2F%2Ffcset.georgetown.edu%2Fwp-content%2Fuploads%2F0284_14th_Five_Year_Plan_EN.pdf&usg=AOvVaw2oRHNmkbmE3wl1D7OI8rxS).
- <sup>13</sup> Zhan Yan, “China Seeks a Balance between Food Security and Urbanization,” *Embassy of the People’s Republic of China in the United States of America*.  
<https://webcache.googleusercontent.com/search?q=cache:sWgOXrheCwCJ:https://www.mfa.gov.cn/ce/ceus/eng/zt/t516240.htm+&cd=3&hl=en&ct=clnk&gl=us>.
- <sup>14</sup> Gao Wen, “How to Understand the Loss of 113 Million Mu in Cultivated Land between the Second and Third National Survey” (如何看待“三调”比“二调”少了1.13亿亩耕地), *Farmer’s Daily*, August 27, 2021. Translation.  
[http://webcache.googleusercontent.com/search?q=cache:fa0Az5Zg2i8J:www.moa.gov.cn/ztzl/gdzlbhyjs/mtbd\\_28775/mtbd/202108/t20210827\\_6375079.htm](http://webcache.googleusercontent.com/search?q=cache:fa0Az5Zg2i8J:www.moa.gov.cn/ztzl/gdzlbhyjs/mtbd_28775/mtbd/202108/t20210827_6375079.htm).
- <sup>15</sup> David Stanway, “China’s Total Arable Land Shrinks Nearly 6% from 2009-2019 – Survey,” *Reuters*, August 27, 2021.  
<https://www.reuters.com/world/china/chinas-total-arable-land-shrinks-nearly-6-2009-2019-survey-2021-08-27/>; Xinhua, “Third National Land Survey Main Data Results Released,” (第三次全国国土调查主要数据成果发布), August 26, 2021.  
[http://webcache.googleusercontent.com/search?q=cache:SqZwa2dTrIJ:www.gov.cn/xinwen/2021-08/26/content\\_5633497.htm+&cd=1&hl=en&ct=clnk&gl=us](http://webcache.googleusercontent.com/search?q=cache:SqZwa2dTrIJ:www.gov.cn/xinwen/2021-08/26/content_5633497.htm+&cd=1&hl=en&ct=clnk&gl=us); China Ministry of Land and Resources, China National Statistics Bureau, Office of the State Council Leading Small Group on the Second National Survey, *Announcement Important Results of the Second National Survey* (关于第二次全国土地调查主要数据成果的公报), December 30, 2013. Translation.  
[http://webcache.googleusercontent.com/search?q=cache:YIMDp0x8UXEJ:www.mnr.gov.cn/zt/hd/dqr/48dqr/zygq/201312/t20131230\\_2060666.html+&cd=1&hl=en&ct=clnk&gl=us&client=safari](http://webcache.googleusercontent.com/search?q=cache:YIMDp0x8UXEJ:www.mnr.gov.cn/zt/hd/dqr/48dqr/zygq/201312/t20131230_2060666.html+&cd=1&hl=en&ct=clnk&gl=us&client=safari).
- <sup>16</sup> Senqi Ma, “No, a Three-Child Policy Alone Will Not Save China from an Impending Demographic Crisis,” *Center for Strategic and International Studies*, August 2, 2021. <https://www.csis.org/blogs/new-perspectives-asia/no-three-child-policy-alone-will-not-save-china-impending-demographic>.
- <sup>17</sup> Center for Security and Emerging Technology, “Translation: 14<sup>th</sup> Five-Year Plan,” May 12, 2021.  
[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwi8sdX4ztr2AhWnd98KHaTWCdEQFnoEC\\_AQQAQ&url=https%3A%2F%2Ffcset.georgetown.edu%2Fwp-content%2Fuploads%2F0284\\_14th\\_Five\\_Year\\_Plan\\_EN.pdf&usg=AOvVaw2oRHNmkbmE3wl1D7OI8rxS](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwi8sdX4ztr2AhWnd98KHaTWCdEQFnoEC_AQQAQ&url=https%3A%2F%2Ffcset.georgetown.edu%2Fwp-content%2Fuploads%2F0284_14th_Five_Year_Plan_EN.pdf&usg=AOvVaw2oRHNmkbmE3wl1D7OI8rxS).
- <sup>18</sup> Michael Schuman, “China’s Small Farms Are Fading. The World May Benefit,” *New York Times*, October 5, 2018.  
<https://www.nytimes.com/2018/10/05/business/china-small-farms-urbanization.html>.
- <sup>19</sup> Xinhua, “China’s Urbanization Rate Hits 64.72 Pct in 2021,” February 22, 2022.  
[http://www.xinhuanet.com/english/20220222/21fdca83b71648b09082bb1cabf5b616/c.html#:~:text=22%20\(Xinhua\)%20%2D%2D%20China's%20urbanization,National%20Development%20and%20Reform%20Commission;WorldBank,“UrbanPopulation–China,Germany,UnitedStates,UnitedKingdom,Japan,”UnitedNationsPopulationDivision,2021.https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?end=2020&locations=CN-DE-US-GB-JP&start=1990](http://www.xinhuanet.com/english/20220222/21fdca83b71648b09082bb1cabf5b616/c.html#:~:text=22%20(Xinhua)%20%2D%2D%20China's%20urbanization,National%20Development%20and%20Reform%20Commission;WorldBank,“UrbanPopulation–China,Germany,UnitedStates,UnitedKingdom,Japan,”UnitedNationsPopulationDivision,2021.https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?end=2020&locations=CN-DE-US-GB-JP&start=1990).
- <sup>20</sup> Center for Security and Emerging Technology, “Translation: 14<sup>th</sup> Five-Year Plan,” May 12, 2021.  
[https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwi8sdX4ztr2AhWnd98KHaTWCdEQFnoEC\\_AQQAQ&url=https%3A%2F%2Ffcset.georgetown.edu%2Fwp-content%2Fuploads%2F0284\\_14th\\_Five\\_Year\\_Plan\\_EN.pdf&usg=AOvVaw2oRHNmkbmE3wl1D7OI8rxS](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwi8sdX4ztr2AhWnd98KHaTWCdEQFnoEC_AQQAQ&url=https%3A%2F%2Ffcset.georgetown.edu%2Fwp-content%2Fuploads%2F0284_14th_Five_Year_Plan_EN.pdf&usg=AOvVaw2oRHNmkbmE3wl1D7OI8rxS).
- <sup>21</sup> Kaixing Huang, Wenshou Yan, and Jikun Huang, “Agricultural Subsidies Retard Urbanization in China,” *Australian Journal of Agricultural and Resource Economics* (2020): 1–20.  
<https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwja1P2SmNr3AhWpmHIEHRvMATYQFnoECAoAQ&url=https%3A%2F%2Fwww.ccap.pku.edu.cn%2Fdocs%2F2020-09%2F20200910175007942116.pdf&usg=AOvVaw3-ek51PZ2HJ2ZkAJkSLAXX>.
- <sup>22</sup> Aryn Baker, “China’s New 5-Year Plan Is a Blueprint for the Future of Meat,” *Time*, January 27, 2022.  
<https://time.com/6143109/china-future-of-cultivated-meat/>.
- <sup>23</sup> *People’s Daily*, “Putting ‘Grain Storage in Land and Technology’ in Place (Discussion with the General Secretary),” (把“藏粮于地、藏粮于技”真正落实到位(我和总书记面对面)), March 7, 2022. [http://paper.people.com.cn/rmrb/html/2022-03/07/mw.D110000renmrb\\_20220307\\_2-02.htm](http://paper.people.com.cn/rmrb/html/2022-03/07/mw.D110000renmrb_20220307_2-02.htm).
- <sup>24</sup> *Organization for Economic Cooperation and Development*, “OECD-FAO Agricultural Outlook 2013-2022,” 2021.  
[https://www.oecd.org/berlin/OECD-FAO%20Highlights\\_FINAL\\_with\\_Covers%20\(3\).pdf](https://www.oecd.org/berlin/OECD-FAO%20Highlights_FINAL_with_Covers%20(3).pdf).
- <sup>25</sup> *Reuters*, “From the U.S., a Future Supply of Livestock for China,” *New York Times*, April 20, 2012.  
<https://www.nytimes.com/2012/04/21/business/global/china-buys-future-supply-of-livestock-from-the-us.html#:~:text=Last%20year%2C%20Chinese%20companies%20bought,the%20U.S.%20Department%20of%20Agriculture>.
- <sup>26</sup> CoBank, “China Changes Buying Tactics as U.S. Grain Run Enters Volatile Stage,” June 30, 2021.  
<https://www.cobank.com/corporate/news/2021/china-changes-buying-tactics-as-u.s.-grain-run-enters-volatile-stage>.
- <sup>27</sup> Chad Bown, “U.S.-China Phase One Tracker: China’s Purchases of U.S. Goods,” *Peterson Institute for International Economics*, July 26, 2021. <https://www.piie.com/research/piie-charts/us-china-phase-one-tracker-chinas-purchases-us-goods>.

- <sup>28</sup> CoBank, “China Changes Buying Tactics as U.S. Grain Run Enters Volatile Stage, Strong Demand Will Continue, but China Shifts to Opportunistic Buying When Prices Soften,” June 30, 2021. <https://www.cobank.com/corporate/news/2021/china-changes-buying-tactics-as-u.s.-grain-run-enters-volatile-stage>.
- <sup>29</sup> Chase McGrath, “Grain and Feed Update,” *United States Department of Agriculture, Foreign Agricultural Service*, September 30, 2021. [https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Grain%20and%20Feed%20Update\\_Beijing\\_China%20-%20People%27s%20Republic%20of\\_09-27-2021](https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Grain%20and%20Feed%20Update_Beijing_China%20-%20People%27s%20Republic%20of_09-27-2021).
- <sup>30</sup> Shijing You et al., “African Swine Fever Outbreaks in China Led to Gross Domestic Product and Economic Losses,” *Nature Food*, September 27, 2021. <https://www.nature.com/articles/s43016-021-00362-1#citeas>.
- <sup>31</sup> CEIC, “Hog Stock,” *National Bureau of Statistics*, 2018.
- <sup>32</sup> Mildred Haley and Fred Gale, “African Swine Fever Shrinks Pork Production in China, Swells Demand for Imported Pork,” *U.S. Department of Agriculture Economic Research Service*, February 3, 2020. <https://www.ers.usda.gov/amber-waves/2020/february/african-swine-fever-shrinks-pork-production-in-china-swells-demand-for-imported-pork/>.
- <sup>33</sup> Abraham Inouye, “China: China’s 2020 Agricultural Policy Document Stays the Course,” *U.S. Department of Agriculture, Foreign Agricultural Service*, April 9, 2020.
- <sup>34</sup> Grady McGregor, “China Is Getting Its Pig Epidemic under Control, but It’s Not Out of the Woods Yet,” *Fortune*, July 3, 2021. <https://fortune.com/2021/07/03/african-swine-fever-epidemic-china-pig-recovery/>.
- <sup>35</sup> Grady McGregor, “China Is Getting Its Pig Epidemic under Control, but It’s Not Out of the Woods Yet,” *Fortune*, July 3, 2021. <https://fortune.com/2021/07/03/african-swine-fever-epidemic-china-pig-recovery/>.
- <sup>36</sup> U.S. Department of Agriculture, *International Agricultural Trade Report*, June 2021. <https://www.fas.usda.gov/sites/default/files/2021-07/SosybeanIATR-Final.pdf>.
- <sup>37</sup> Mildred and Fred Gale, “African Swine Fever Shrinks Pork Production in China, Swells Demand for Imported Pork,” *U.S. Department of Agriculture, Economic Research Service*, February 3, 2020. <https://www.ers.usda.gov/amber-waves/2020/february/african-swine-fever-shrinks-pork-production-in-china-swells-demand-for-imported-pork/>.
- <sup>38</sup> U.S. Department of Agriculture, *Historical Monthly Price Spread Data for Beef, Pork, Broilers*, February 25, 2022. <https://www.ers.usda.gov/webdocs/DataFiles/52160/history.xls?v=8877.8>.
- <sup>39</sup> Hallie Gu and Tom Daly, “China’s Northeast Cornbelt Likely to Be Hit by Fall Armyworm in 2020: Government Report,” *Reuters*, December 26, 2019. <https://www.reuters.com/article/us-crops-armyworm-china/chinas-northeast-cornbelt-likely-to-be-hit-by-fall-armyworm-in-2020-government-report-idUSKBN1YU0DB>.
- <sup>40</sup> Genevieve Croft, “Fall Armyworm: USDA Research Lends a Hand in International Pest Outbreak,” *U.S. Department of Agriculture*, August 2, 2021. <https://www.usda.gov/media/blog/2018/02/26/fall-armyworm-usda-research-lends-hand-international-pest-outbreak>;
- Bayer Global, “Combating an Invasive Pest Exacerbated by Climate Change,” April 12, 2022. <https://www.bayer.com/en/news-stories/fall-armyworm-combatting-another-invasive-pest-amidst-the-pandemic>.
- <sup>41</sup> Hallie Gu and Tom Daly, “China’s Northeast Cornbelt Likely to Be Hit by Fall Armyworm in 2020: Government Report,” *Reuters*, December 26, 2019. <https://www.reuters.com/article/us-crops-armyworm-china/chinas-northeast-cornbelt-likely-to-be-hit-by-fall-armyworm-in-2020-government-report-idUSKBN1YU0DB>.
- <sup>42</sup> U.S. Department of Agriculture, Foreign Agricultural Service, Office of Agricultural Affairs, Beijing, China: *MARA FAW Prevention Plan Braces for Widespread Pest Impact in 2020-21 Crops*, March 23, 2020. <https://www.fas.usda.gov/data/china-mara-faw-prevention-plan-braces-widespread-pest-impact-2020-21-crops>.
- <sup>43</sup> U.S. Department of Agriculture, *Corn 2002 Export Highlights*, 2021. <https://www.fas.usda.gov/corn-2020-export-highlights>.
- <sup>44</sup> Lily Kuo, “China Just Revealed a Major State Secret: Nearly 20% of Its Farmland Is Polluted,” *Quartz*, April 18, 2014. <https://qz.com/200602/china-just-revealed-a-major-state-secret-nearly-20-of-its-farmland-is-polluted/>.
- <sup>45</sup> Echo Xie, “Nearly 100 Million Chinese Supplied Drinking Water with ‘Unsafe’ Levels of Toxic Chemicals,” *South China Morning Post*, January 16, 2021. <https://www.scmp.com/news/china/politics/article/3117969/nearly-100-million-chinese-people-supplied-drinking-water>.
- <sup>46</sup> Xiao Nan Zhang et al., “Water Quality, Agriculture, and Food Safety in China: Current Situation, Trends, Interdependencies, and Management,” *Journal of Integrative Agriculture* 14:11 (2015). [https://doi.org/10.1016/S2095-3119\(15\)61128-5](https://doi.org/10.1016/S2095-3119(15)61128-5); China Power Team “How Does Water Security Affect China’s Development?” *China Power, Center for Strategic and International Studies*, February 25, 2020. <https://chinapower.csis.org/china-water-security/>.
- <sup>47</sup> Nadya Ivanova, “Toxic Water: Across Much of China, Huge Harvests Irrigated with Industrial and Agricultural Runoff,” *Circle of Blue*, January 18, 2013. <https://www.circleofblue.org/2013/world/toxic-water-across-much-of-china-huge-harvests-irrigated-with-industrial-and-agricultural-runoff/>.
- <sup>48</sup> Phoebe Zhang, “Covid-19 and Now Floods: Wuhan, First Epicenter of the Pandemic, Braces Again,” *South China Morning Post*, July 10, 2020. <https://www.scmp.com/news/china/society/article/3092627/covid-19-and-now-floods-wuhan-first-epicentre-pandemic-braces>.
- <sup>49</sup> X. He, D. Hayes, and W. Zhang, “The Impact of Flooding on China’s Agricultural Production and Food Security in 2020,” *Agricultural Policy Review (Fall 2020)*, Center for Agricultural and Rural Development, Iowa State University. [https://www.card.iastate.edu/ag\\_policy\\_review/article/?a=115](https://www.card.iastate.edu/ag_policy_review/article/?a=115).
- <sup>50</sup> X. He, D. Hayes, and W. Zhang, “The Impact of Flooding on China’s Agricultural Production and Food Security in 2020,” *Agricultural Policy Review (Fall 2020)*, Center for Agricultural and Rural Development, Iowa State University. [https://www.card.iastate.edu/ag\\_policy\\_review/article/?a=115](https://www.card.iastate.edu/ag_policy_review/article/?a=115).

- <sup>51</sup> Erika Na, “Chinese Farmers in Henan Still Dealing with Aftermath of Country’s Worst Floods in Decades,” *South China Morning Post*, November 4, 2021. <https://www.scmp.com/video/china/3154800/chinese-farmers-henan-still-dealing-aftermath-country-s-worst-floods-decades>.
- <sup>52</sup> Pei Lin Wu and Rebecca Tan, “Death Toll in China Floods Climbs to at Least 33 as Rains Spread and More Cities Call for Help,” *Washington Post*, July 22, 2021. <https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwj0sqU14n2AhWWjYkEHYx3A6wQFnoECAQQAQ&url=https%3A%2F%2Fwww.washingtonpost.com%2Fworld%2F2021%2F07%2F22%2Fchina-floods-henan-rains%2F&usg=AOvVaw2dE2O344F4OWfoL6YO75v0>.
- <sup>53</sup> Luna Sun, “China’s Grain Output Hits New High in 2021 as Food Security Drive Begins to Pay Off,” *South China Morning Post*, December 6, 2021. <https://www.scmp.com/economy/china-economy/article/3158632/chinas-grain-output-hits-new-high-2021-food-security-drive>; People’s Republic of China National Bureau of Statistics, *Grain Output, 2018–2021*. [stats.gov.cn](http://stats.gov.cn).
- <sup>54</sup> *China Daily*, “Word of the Day – ‘empty plate’ campaign,” (每日一词 | 光盘行动 ‘empty plate’ campaign), August 13, 2020. Translation. <https://webcache.googleusercontent.com/search?q=cache:mCl3yZOReosJ:https://cn.chinadaily.com.cn/a/202008/13/WS5f348d64a310a859d09dd83e.html>.
- <sup>55</sup> *Xinhua*, “Why There Is Still a Need for Crisis Awareness with Successive Years of Bumper Harvests” (粮食生产连年丰收 为何还强调要有危机意识), August 13, 2020. Translation; *Xinhua*, “Xi Jinping Has Made Important Instructions to Emphasize Resolutely Stopping Wasteful Food and Beverage Behavior, and Effectively Cultivating the Habit of Saving, and Creating an Atmosphere of Shame in Waste in the Whole Society,” (习近平作出重要指示强调 坚决制止餐饮浪费行为切实培养节约习惯 在全社会营造浪费可耻节约为荣的氛围), August 11, 2020. [http://webcache.googleusercontent.com/search?q=cache:knvB1ZymxzMJ:www.xinhuanet.com/politics/leaders/2020-08/11/c\\_1126353394.htm+&cd=2&hl=en&ct=clnk&gl=us](http://webcache.googleusercontent.com/search?q=cache:knvB1ZymxzMJ:www.xinhuanet.com/politics/leaders/2020-08/11/c_1126353394.htm+&cd=2&hl=en&ct=clnk&gl=us).
- <sup>56</sup> Hallie Gu and Dominique Patton, “China Seeks to Cut Corn, Soybean Content in Animal Feed – Sources,” *Reuters*, March 18, 2021. <https://www.reuters.com/article/china-grains-feed-idAFLN2LG0DJ>.
- <sup>57</sup> Fred Gale et al., “Interdependence of China, United States, and Brazil in Soybean Trade,” *U.S. Department of Agriculture*, June 2019. <https://www.ers.usda.gov/webdocs/outlooks/93390/ocs-19f-01.pdf?v=647.6>.
- <sup>58</sup> Fred Gale et al., “Interdependence of China, United States, and Brazil in Soybean Trade,” *U.S. Department of Agriculture*, June 2019. <https://www.ers.usda.gov/webdocs/outlooks/93390/ocs-19f-01.pdf?v=647.6>.
- <sup>59</sup> United Nations, “UN COMTRADE database.” <https://comtrade.un.org/data/>.
- <sup>60</sup> Phoebe Zhang, “China’s Xi Jinping Puts Focus Back on Food Security,” *South China Morning Post*, December 26, 2021. <https://www.scmp.com/news/china/politics/article/3161100/chinas-xi-jinping-puts-focus-back-food-security>
- <sup>61</sup> *Global Times*, “Xi Stresses Food Security at Key Central Rural Work Conference,” December 26, 2021. [https://webcache.googleusercontent.com/search?q=cache:jLiPGtIIK\\_8J:https://www.globaltimes.cn/page/202112/1243427.shtml+&cd=2&hl=en&ct=clnk&gl=us](https://webcache.googleusercontent.com/search?q=cache:jLiPGtIIK_8J:https://www.globaltimes.cn/page/202112/1243427.shtml+&cd=2&hl=en&ct=clnk&gl=us).
- <sup>62</sup> *Global Times*, “Xi Stresses Food Security at Key Central Rural Work Conference,” December 26, 2021. <https://www.globaltimes.cn/page/202112/1243427.shtml>.
- <sup>63</sup> *People’s Daily*, “The Rice Bowl Mainly Holds Chinese Grain (The General Secretary’s Concern for Food Security),” (“饭碗主要装中国粮” (总书记牵挂的粮食安全), February 18, 2022. [http://paper.people.com.cn/rmrb/html/2022-02/18/nw.D110000renmrb\\_20220218\\_1-01.htm](http://paper.people.com.cn/rmrb/html/2022-02/18/nw.D110000renmrb_20220218_1-01.htm).
- <sup>64</sup> *Xinhua*, “China to Promote Crop Production, Farmland Protection in 2021,” January 3, 2021. [https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjmaTdiOf1AhWpg3IEHcwVCbcQFnoECAgAQ&url=http%3A%2F%2Fwww.xinhuanet.com%2Fenglish%2F2021-01%2F03%2F2c\\_139637211.htm&usg=AOvVaw2IK0HnlPKkFRx2nTOqriCa](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjmaTdiOf1AhWpg3IEHcwVCbcQFnoECAgAQ&url=http%3A%2F%2Fwww.xinhuanet.com%2Fenglish%2F2021-01%2F03%2F2c_139637211.htm&usg=AOvVaw2IK0HnlPKkFRx2nTOqriCa); *Xinhua*, “China Taking Measures to Ensure Grain Security: Minister,” January 3, 2021. [http://www.xinhuanet.com/english/2021-01/03/c\\_139638458.htm](http://www.xinhuanet.com/english/2021-01/03/c_139638458.htm).
- <sup>65</sup> *Xinhua*, “China to Promote Crop Production, Farmland Protection in 2021,” January 3, 2021. [https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjmaTdiOf1AhWpg3IEHcwVCbcQFnoECAgAQ&url=http%3A%2F%2Fwww.xinhuanet.com%2Fenglish%2F2021-01%2F03%2F2c\\_139637211.htm&usg=AOvVaw2IK0HnlPKkFRx2nTOqriCa](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjmaTdiOf1AhWpg3IEHcwVCbcQFnoECAgAQ&url=http%3A%2F%2Fwww.xinhuanet.com%2Fenglish%2F2021-01%2F03%2F2c_139637211.htm&usg=AOvVaw2IK0HnlPKkFRx2nTOqriCa); *Xinhua*, “China Taking Measures to Ensure Grain Security: Minister,” January 3, 2021. [http://www.xinhuanet.com/english/2021-01/03/c\\_139638458.htm](http://www.xinhuanet.com/english/2021-01/03/c_139638458.htm).
- <sup>66</sup> Li Yuxin, “China Expands 3.6 Million Hectares of Forest in 2021,” *Ecns*, March 21, 2022. <http://www.ecns.cn/video/2022-03-21/detail-ihawuesq7010376.shtml>.
- <sup>67</sup> China’s Ministry of Agriculture and Rural Affairs, *China Unveils Five-Year Plan for Agricultural Mechanization*, January 6, 2022. [http://english.moa.gov.cn/news\\_522/202201/t20220111\\_300773.html](http://english.moa.gov.cn/news_522/202201/t20220111_300773.html).
- <sup>68</sup> William Zheng, “China Aims to Upgrade Farmland the Size of the Republic of Ireland. Here’s Why,” *South China Morning Post*, December 18, 2020. <https://www.scmp.com/news/china/politics/article/3114483/china-aims-upgrade-farmland-size-republic-ireland-heres-why>.
- <sup>69</sup> Alexandra Baych, “Agricultural and Rural Modernization Plan Reiterates Prior Pledges,” *U.S. Department of Agriculture, Foreign Agricultural Services*, March 2, 2022. [https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20and%20Rural%20Modernization%20Plan%20Reiterates%20Prior%20Pledges\\_Beijing\\_China%20-%20People%27s%20Republic%20of\\_CH2022-0023](https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Agricultural%20and%20Rural%20Modernization%20Plan%20Reiterates%20Prior%20Pledges_Beijing_China%20-%20People%27s%20Republic%20of_CH2022-0023).
- <sup>70</sup> *Global Times*, “China to Start Third Nationwide Soil Census, Build 6.67 m Hectares High Quality Cropland: Govt Work Report,” March 5, 2022.

- <https://webcache.googleusercontent.com/search?q=cache:BQSKxS9P65kJ:https://www.globaltimes.cn/page/202203/1254004.shtml+&cd=1&hl=en&ct=clnk&gl=us&client=firefox-b-1-d>.
- <sup>71</sup> Mark Godfrey, “China Encouraging the Wrong Kind of Farm Mechanization with Its Generous Subsidies,” *South China Morning Post*, June 28, 2015. <https://www.scmp.com/comment/insight-opinion/article/1826730/china-encouraging-wrong-kind-farm-mechanisation-its-generous>.
- <sup>72</sup> Zhang Ye, “Major Agricultural Powers Encounter ‘Agricultural Machinery Trouble:’ China’s Tractor Industry is 30 Years behind Foreign Countries,” (农业大国遭遇“农机之困”：拖拉机和国外有 30 年以上差距), *Science and Technology Daily*, August 31, 2020. [https://www.thepaper.cn/newsDetail\\_forward\\_8961222](https://www.thepaper.cn/newsDetail_forward_8961222).
- <sup>73</sup> Institute for Security and Development Policy, “Made in China 2025, Backgrounder,” June 2018. <https://isd.dp.eu/content/uploads/2018/06/Made-in-China-Backgrounder.pdf>.
- <sup>74</sup> State Council People’s Republic of China, *Made in China 2025*, May 19, 2015. [http://english.www.gov.cn/policies/latest\\_releases/2015/05/19/content\\_281475110703534.htm](http://english.www.gov.cn/policies/latest_releases/2015/05/19/content_281475110703534.htm); U.S. Chamber of Commerce, “Made in China 2025: Global Ambitions Built on Local Protections,” 2017. [http://dusselpeters.com/CECHIMEX/20190327\\_Made\\_in\\_China\\_2020-2025.pdf](http://dusselpeters.com/CECHIMEX/20190327_Made_in_China_2020-2025.pdf).
- <sup>75</sup> U.S. Chamber of Commerce, “Made in China 2025: Global Ambitions Built on Local Protections,” 2017. [http://dusselpeters.com/CECHIMEX/20190327\\_Made\\_in\\_China\\_2020-2025.pdf](http://dusselpeters.com/CECHIMEX/20190327_Made_in_China_2020-2025.pdf). Alice Tse and Julianna Wu, “Why ‘Made in China 2025’ triggered the wrath of President Trump,” *South China Morning Post*, September 11, 2018. <https://multimedia.scmp.com/news/china/article/made-in-china-2025/index.html>.
- <sup>76</sup> Research and Markets, “Global and China Agricultural Machinery Industry Report, 2020-2026,” April 2020. [https://www.researchandmarkets.com/reports/5021668/global-and-china-agricultural-machinery-industry?utm\\_source=dynamic&utm\\_medium=BW&utm\\_code=71186m&utm\\_campaign=1407232+-+Global+and+China+Agricultural+Machinery+Market+\(2020+to+2026\)+-+Featuring+John+Deere%2c+CNH+Industrial+%26+AGCO+Among+Others&utm\\_exec=jamu273bwd](https://www.researchandmarkets.com/reports/5021668/global-and-china-agricultural-machinery-industry?utm_source=dynamic&utm_medium=BW&utm_code=71186m&utm_campaign=1407232+-+Global+and+China+Agricultural+Machinery+Market+(2020+to+2026)+-+Featuring+John+Deere%2c+CNH+Industrial+%26+AGCO+Among+Others&utm_exec=jamu273bwd).
- <sup>77</sup> Zhou Xiaosong, “The Current State of the Market Supply and Regional Distribution Situation for China’s Tractor Industry in 2021 – Are Medium and Small Size Tractors Still Mainstream?” (2021 年中国拖拉机行业市场供给现状及区域分布情况 中小型拖拉机仍是主流), *Qian Zhan*, September 2, 2021. Translation. <https://webcache.googleusercontent.com/search?q=cache:3msuxbO441kJ:https://www.qianzhan.com/analyst/detail/220/210902-dbef5b37.html>.
- <sup>78</sup> USA Trade Online, “U.S. Import and Export Merchandise Trade Statistics,” 2022. <https://usatrade.census.gov/data/Perspective60/Dim/dimension.aspx>.
- <sup>79</sup> USA Trade Online, “U.S. Import and Export Merchandise Trade Statistics,” 2022. <https://usatrade.census.gov/data/Perspective60/Dim/dimension.aspx>.
- <sup>80</sup> Zhao Yimeng, “Nation among Leaders in Agricultural Technology,” *China Daily*, November 20, 2021. <https://www.chinadaily.com.cn/a/202111/20/WS61984940a310cdd39bc76766.html>.
- <sup>81</sup> Zhao Yimeng, “Nation among Leaders in Agricultural Technology,” *China Daily*, November 20, 2021. <https://www.chinadaily.com.cn/a/202111/20/WS61984940a310cdd39bc76766.html>.
- <sup>82</sup> Ministry of Agriculture and Rural Affairs People’s Republic of China, *China Unveils Five-Year Plan for Agricultural Mechanization*, January 6, 2022. [http://webcache.googleusercontent.com/search?q=cache:j2CufKsBBaUJ:english.moa.gov.cn/news\\_522/202201/t20220111\\_300773.html+&cd=1&hl=en&ct=clnk&gl=us](http://webcache.googleusercontent.com/search?q=cache:j2CufKsBBaUJ:english.moa.gov.cn/news_522/202201/t20220111_300773.html+&cd=1&hl=en&ct=clnk&gl=us).
- <sup>83</sup> Ministry of Agriculture and Rural Affairs People’s Republic of China, *China Unveils Five-Year Plan for Agricultural Mechanization*, January 6, 2022. [http://webcache.googleusercontent.com/search?q=cache:j2CufKsBBaUJ:english.moa.gov.cn/news\\_522/202201/t20220111\\_300773.html+&cd=1&hl=en&ct=clnk&gl=us](http://webcache.googleusercontent.com/search?q=cache:j2CufKsBBaUJ:english.moa.gov.cn/news_522/202201/t20220111_300773.html+&cd=1&hl=en&ct=clnk&gl=us).
- <sup>84</sup> Del Quentin Wilber, “The Saga of the Chinese Spies and the Stolen Corn Seeds: Will It Discourage Economic Espionage?” *Los Angeles Times*, October 31, 2016. <https://www.latimes.com/nation/la-na-seeds-economic-espionage-20161031-story.html>.
- <sup>85</sup> SciDev.Net, “China Shifting GM Policy to Grow More Corn, Soybean,” *Phys.org*, January 18, 2022. <https://phys.org/news/2022-01-china-shifting-gm-policy-corn.html>.
- <sup>86</sup> People’s Government of Fujian Province, *Outline of the 14<sup>th</sup> Five-Year Plan (2021-2025) for National Economic and Social Development and Vision 2035 of the People’s Republic of China*, August 9, 2021.
- <sup>87</sup> Mimi Mackilligan, “China’s Fufeng Group Plans to Build Its First US Plant in North Dakota’s Grand Forks,” *China Matters for America Matters for China*, January 31, 2022. <https://asiamattersforamerica.org/articles/chinas-fufeng-group-plans-to-build-its-first-us-plant-in-north-dakotas-grand-forks>.
- <sup>88</sup> City of Grand Forks, “Fufeng Group Ltd. Selects Grand Forks as U.S. Manufacturing Site,” November 6, 2021. <https://www.grandforksgov.com/Home/Components/News/News/6760/550>.
- <sup>89</sup> Fufeng Group Limited, “Proposed General Mandates to Issue and Repurchase Shares Re-Election of Directors and Notice of Annual General Meeting,” April 10, 2019. <http://webcache.googleusercontent.com/search?q=cache:E8flCNKz2hEJ:en.fufeng-group.cn/Upload/File/20190409121234.pdf+&cd=7&hl=en&ct=clnk&gl=us>.
- <sup>90</sup> Tom Tucker, “U.S. Security Expert on Proposed Chinese-Owned Processing Plan in Grand Forks,” *WZFG The Flag Radio Interview*, February 21, 2022. <https://www.am1100theflag.com/news/local-news/43781-us-security-expert-on-proposed-chinese-owned->

- processing-plant-in-grand-forks*; Fortis Analysis, “Belt and Road Comes to the Heartland,” *Human Terrain*, January 10, 2022. <https://fortisanalysis.substack.com/p/belt-and-road-comes-to-the-heartland?s=r>.
- <sup>91</sup> Ingrid Harbo, “Corn Growers, Co-op Managers Weigh Fufeng Effect on Local Farmer-Owned Cooperatives,” *Grand Forks Herald*, February 5, 2022. <https://www.grandforksherald.com/business/corn-growers-co-op-managers-weigh-fufeng-effect-on-local-farmer-owned-cooperatives>.
- <sup>92</sup> American Enterprise Institute, “Chinese Investments in the United States,” 2022. <https://www.aei.org/china-tracker-home/>.
- <sup>93</sup> *PBS NewsHour*, “Who’s behind the Chinese Takeover of World’s Biggest Pork Producer?” September 12, 2014. <https://www.pbs.org/newshour/show/whos-behind-chinese-takeover-worlds-biggest-pork-producer>.
- <sup>94</sup> *Reuters*, “U.S. Clears Smithfield’s Acquisition by China’s Shuanghui,” September 6, 2013. <https://www.reuters.com/article/us-usa-china-smithfield/u-s-clears-smithfields-acquisition-by-chinas-shuanghui-idUSBRE98513120130907>.
- <sup>95</sup> Noah Wicks, “Despite Holding Little US Land, China Remains Focus of Foreign Ownership Discussion,” *AgriPulse*, December 1, 2021. <https://www.agri-pulse.com/articles/16846-despite-holding-little-us-land-china-remains-focus-of-foreign-farmland-ownership-discussion>.
- <sup>96</sup> Smithfield, “Operations,” 2021. <https://www.smithfieldfoods.com/about-us/Operations>.
- <sup>97</sup> WH Group, “Our Company History.” <http://www.wh-group.com/en/about/milestones.php>.
- <sup>98</sup> Zhang Lu, “Henan Meat Processor Shuanghui Up for Sale,” *China Daily*, March 4, 2006. [http://www.chinadaily.com.cn/english/doc/2006-03/04/content\\_526484.htm](http://www.chinadaily.com.cn/english/doc/2006-03/04/content_526484.htm).
- <sup>99</sup> Usha Haley, written testimony before the Senate Committee on Agriculture, Nutrition, and Forestry, *Hearing on Smithfield and Beyond*. July 10, 2013. [https://www.agriculture.senate.gov/hearings/smithfield-and-beyond\\_examining-foreign-purchases-of-american-food-companies](https://www.agriculture.senate.gov/hearings/smithfield-and-beyond_examining-foreign-purchases-of-american-food-companies).
- <sup>100</sup> *Reuters*, “China Rejects Pork Imports from U.S., Canada,” September 17, 2007. <https://www.reuters.com/article/us-china-safety-pork/china-rejects-pork-imports-from-u-s-canada-idUSPEK4981120070917>.
- <sup>101</sup> Michael Corkery and David Yaffe-Bellany, “As Meat Plants Stayed Open to Feed Americans, Exports to China Surged,” *New York Times*, June 16, 2020. <https://www.nytimes.com/2020/06/16/business/meat-industry-china-pork.html>.
- <sup>102</sup> Eric Ng, “Chinese Pork Giant WH Group Fires Chairman’s Son from Board over Aggressive Behavior,” *South China Morning Post*, June 18, 2021. <https://www.scmp.com/business/china-business/article/3137735/chinese-pork-giant-wh-group-fires-chairmans-son-board-over>.
- <sup>103</sup> Grady McGregor, “The Father-Son Beef that Is Rattling the World’s Largest Pork Processor,” *Fortune*, August 25, 2021. <https://fortune.com/2021/08/25/wh-group-smithfield-foods-china-pork-family-feud/>.
- <sup>104</sup> Holly Demaree-Saddler, “COFCO Creates Grain Partnership with GROWMARK,” *World-Grain*, August 22, 2017. <https://www.world-grain.com/articles/8573-cofco-creates-grain-partnership-with-growmark>.
- <sup>105</sup> *Reuters*, “Lansing Trade Group Says Sells 20 Percent Stake to New Hope Liuhe Co.,” December 8, 2015. <https://www.reuters.com/article/us-new-hope-liuhe-lansing-trade-group/lansing-trade-group-says-sells-20-percent-stake-to-new-hope-liuhe-co-idUSKBN0TR2EA20151208>.
- <sup>106</sup> U.S. Securities and Exchange Commission, *Lansing Trade Group Announces the Sale of Equity to New Hope Liuhe Investment, Inc.*, December 4, 2015. <https://www.sec.gov/Archives/edgar/data/821026/000082102615000058/ex-991lansingtradegrouppre.htm>.
- <sup>107</sup> *Reuters*, “Lansing Trade Group Says Sells 20 Percent Stake to New Hope Liuhe Co.,” December 8, 2015. <https://www.reuters.com/article/us-new-hope-liuhe-lansing-trade-group/lansing-trade-group-says-sells-20-percent-stake-to-new-hope-liuhe-co-idUSKBN0TR2EA20151208>.
- <sup>108</sup> U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2020*, 2021. [https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020\\_afida\\_annual\\_report.pdf](https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020_afida_annual_report.pdf).
- <sup>109</sup> U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2010*, 2011. [https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/afida\\_thru\\_12312010.pdf](https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/afida_thru_12312010.pdf); U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2020*, 2021. [https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020\\_afida\\_annual\\_report.pdf](https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020_afida_annual_report.pdf).
- <sup>110</sup> Noah Wicks, “Despite Holding Little US Land, China Remains Focus of Foreign Ownership Discussion,” *AgriPulse*, December 1, 2021. <https://www.agri-pulse.com/articles/16846-despite-holding-little-us-land-china-remains-focus-of-foreign-farmland-ownership-discussion>.
- <sup>111</sup> U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2020*, 2021. [https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020\\_afida\\_annual\\_report.pdf](https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020_afida_annual_report.pdf).
- <sup>112</sup> U.S. Department of Agriculture, Economic Research Service, *Major Land Uses*, 2021. <https://www.ers.usda.gov/data-products/major-land-uses/>.
- <sup>113</sup> U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2013*, 2013. <https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/afida2013report.pdf>.
- <sup>114</sup> U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2013*, 2013. <https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/afida2013report.pdf>.
- <sup>115</sup> U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2013*, 2013. <https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/afida2013report.pdf>.
- <sup>116</sup> U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2013*, 2013. <https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/afida2013report.pdf>.

- <sup>117</sup> Erin McKinstry, “Regulation on Foreign Ownership of Agricultural Land: A State-by-State Breakdown,” *Midwest Center for Investigative Reporting*, June 2, 2017. <https://investigatamidwest.org/2017/06/22/regulation-on-foreign-ownership-of-agricultural-land-a-state-by-state-breakdown/>.
- <sup>118</sup> Erin McKinstry, “Regulation on Foreign Ownership of Agricultural Land: A State-by-State Breakdown,” *Midwest Center for Investigative Reporting*, June 2, 2017. <https://investigatamidwest.org/2017/06/22/regulation-on-foreign-ownership-of-agricultural-land-a-state-by-state-breakdown/>.
- <sup>119</sup> Orange Wang and Ji Siqi, “China’s Soybean Production to Increase 40 Percent by 2025 amid Food-Security Alarms,” *South China Morning Post*, January 14, 2022. [https://www.scmp.com/economy/china-economy/article/3163281/chinas-soybean-production-increase-40-cent-2025-amid-food?module=perpetual\\_scroll\\_0&pgtype=article&campaign=3163281](https://www.scmp.com/economy/china-economy/article/3163281/chinas-soybean-production-increase-40-cent-2025-amid-food?module=perpetual_scroll_0&pgtype=article&campaign=3163281).
- <sup>120</sup> Reuters, “From the U.S., a Future Supply of Livestock for China,” *New York Times*, April 20, 2012. <https://www.nytimes.com/2012/04/21/business/global/china-buys-future-supply-of-livestock-from-the-us.html#:~:text=Last%20year%2C%20Chinese%20companies%20bought,the%20U.S.%20Department%20of%20Agriculture>.
- <sup>121</sup> Reuters, “From the U.S., a Future Supply of Livestock for China,” *New York Times*, April 20, 2012. <https://www.nytimes.com/2012/04/21/business/global/china-buys-future-supply-of-livestock-from-the-us.html>.
- <sup>122</sup> Renub Research, “Global Pork Market Forecast by Production, Consumption, Import, Export, Company,” May 2020. [https://www.researchandmarkets.com/reports/5024113/global-pork-market-forecast-by-production?utm\\_source=dynamic&utm\\_medium=GNOM&utm\\_code=4v7jgg&utm\\_campaign=1388086+-+Global+Pork+Market+Forecast+\(2018+to+2026\)+-+By+Production%2c+Consumption%2c+Import%2c+Export+%26+Company&utm\\_exec=jamu273gnomd](https://www.researchandmarkets.com/reports/5024113/global-pork-market-forecast-by-production?utm_source=dynamic&utm_medium=GNOM&utm_code=4v7jgg&utm_campaign=1388086+-+Global+Pork+Market+Forecast+(2018+to+2026)+-+By+Production%2c+Consumption%2c+Import%2c+Export+%26+Company&utm_exec=jamu273gnomd).
- <sup>123</sup> Patrick Woodall, written testimony for U.S.-China Economic and Security Review Commission, *Hearing on Chinese Investment in the United States: Impacts and Issues for Policymakers*, January 26, 2017.
- <sup>124</sup> *National Hog Farmer*, “Smithfield Foods Completes Acquisition of Clougherty Packing LLC,” January 4, 2017. <https://www.nationalhogfarmer.com/business/smithfield-foods-completes-acquisition-clougherty-packing-llc>; *Food Business News*, “Smithfield Foods Finalizes Acquisition of Clougherty Packing from Hormel Foods,” January 4, 2017. <https://www.foodbusinessnews.net/articles/8710-smithfield-foods-finalizes-acquisition-of-clougherty-packing-from-hormel-foods>.
- <sup>125</sup> *GlobeNewswire*, “Smithfield Foods Acquires Kansas City Sausage Company,” August 14, 2017. <https://www.globenewswire.com/news-release/2017/08/14/1084450/0/en/Smithfield-Foods-Acquires-Kansas-City-Sausage-Company.html>. Erica Shaffer, “Smithfield Acquires KC Sausage Co.,” *Meat+Poultry*, August 15, 2017. <https://www.meatpoultry.com/articles/16903-smithfield-acquires-kc-sausage-co>.
- <sup>126</sup> Michael Hirtzer, “Pork Giant Smithfield Skips Middlemen in Grain Supply Chain,” *Reuters*, December 30, 2016. <https://www.reuters.com/article/us-smithfield-foods-grains-analysis/pork-giant-smithfield-skips-middlemen-in-grain-supply-chain-idUSKBN14J0FA>.
- <sup>127</sup> Michael Hirtzer, “Pork Giant Smithfield Skips Middlemen in Grain Supply Chain,” *Reuters*, December 30, 2016. <https://www.reuters.com/article/us-smithfield-foods-grains-analysis/pork-giant-smithfield-skips-middlemen-in-grain-supply-chain-idUSKBN14J0FA>.
- <sup>128</sup> Leah Douglas, “China’s Smithfield Consolidates Supply Chain with Grain Elevator Acquisitions,” *Food and Power*, March 16, 2017. <https://www.foodandpower.net/latest/2017/03/16/chinas-smithfield-consolidates-supply-chain-with-grain-elevator-acquisitions%E2%80%8B>.
- <sup>129</sup> Michael Hirtzer, “Pork Giant Smithfield Skips Middlemen in Grain Supply Chain,” *Reuters*, December 30, 2016. <https://www.reuters.com/article/us-smithfield-foods-grains-analysis/pork-giant-smithfield-skips-middlemen-in-grain-supply-chain-idUSKBN14J0FA>.
- <sup>130</sup> *Associated Press*, “NC Hog Farmers Worry about Smithfield Food Buyout,” *Journal Now*, October 6, 2013. [https://journalnow.com/business/n-c-hog-farmers-worry-about-smithfield-foods-buyout/article\\_32dfccc4-2ee9-11e3-b9a6-0019bb30f31a.html](https://journalnow.com/business/n-c-hog-farmers-worry-about-smithfield-foods-buyout/article_32dfccc4-2ee9-11e3-b9a6-0019bb30f31a.html).
- <sup>131</sup> Lily Kuo, “The World Eats Cheap Bacon at the Expense of North Carolina’s Rural Poor,” *Quartz*, July 14, 2015. <https://qz.com/433750/the-world-eats-cheap-bacon-at-the-expense-of-north-carolinas-rural-poor/>.
- <sup>132</sup> USA Trade Online, “U.S. Import and Export Merchandise Trade Statistics,” 2022. <https://usatrade.census.gov/data/Perspective60/Dim/dimension.aspx>.
- <sup>133</sup> Michael Hirtzer, “Pork Giant Smithfield Skips Middlemen in Grain Supply Chain,” *Reuters*, December 30, 2016. <https://www.reuters.com/article/us-smithfield-foods-grains-analysis/pork-giant-smithfield-skips-middlemen-in-grain-supply-chain-idUSKBN14J0FA>.
- <sup>134</sup> Michael Hirtzer, “Pork Giant Smithfield Skips Middlemen in Grain Supply Chain,” *Reuters*, December 30, 2016. <https://www.reuters.com/article/us-smithfield-foods-grains-analysis/pork-giant-smithfield-skips-middlemen-in-grain-supply-chain-idUSKBN14J0FA>.
- <sup>135</sup> Larry Pope, testimony before the U.S. Senate Committee on Agriculture, Nutrition, and Forestry, *Hearing on Smithfield and Beyond: Examining Foreign Purchases of American Food Companies*, July 10, 2013. [https://www.agriculture.senate.gov/imo/media/doc/Testimony\\_Pope.pdf](https://www.agriculture.senate.gov/imo/media/doc/Testimony_Pope.pdf).
- <sup>136</sup> U.S. Securities and Exchange Commission, *Form 10-K – Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934*, March 29, 2016. <https://www.sec.gov/Archives/edgar/data/91388/000009138816000064/a201510k.htm>.
- <sup>137</sup> Oliver Milman, “Underreporting of Toxic Waste at Hog Farms Prompts Inquiry,” *Guardian*, June 6, 2018, <https://www.theguardian.com/us-news/2018/jun/06/north-carolina-hog-farms-toxins-waste-reporting-inquiry>.

- <sup>138</sup> Doug Bock Clark, “Why Is China Treating North Carolina Like the Developing World,” *Rolling Stone*, March 19, 2018. <https://www.rollingstone.com/politics/politics-news/why-is-china-treating-north-carolina-like-the-developing-world-122892/>.
- <sup>139</sup> Doug Bock Clark, “Why Is China Treating North Carolina Like the Developing World,” *Rolling Stone*, March 19, 2018. <https://www.rollingstone.com/politics/politics-news/why-is-china-treating-north-carolina-like-the-developing-world-122892/>.
- <sup>140</sup> Julia Kravchenko et al., “Mortality and Health Outcomes in North Carolina Communities Located in Close Proximity to Hog Concentrated Animal Feeding Operations,” *North Carolina Medical Journal*, September 2018. <https://www.ncmedicaljournal.com/content/79/5/278>.
- <sup>141</sup> Maria Mirabelli et al., “Asthma Symptoms Among Adolescents Who Attend Public Schools that Are Located near Confined Swine Feeding Operations,” *American Academy of Pediatrics*, July 2006. <https://publications.aap.org/pediatrics/article-abstract/118/1/e66/69575/Asthma-Symptoms-Among-Adolescents-Who-Attend?redirectedFrom=fulltext>.
- <sup>142</sup> Charles Bethea, “Could Smithfield Foods Have Prevented the ‘Rivers of Hog Waste’ in North Carolina after Florence?” *New Yorker*, September 30, 2018. <https://www.newyorker.com/news/news-desk/could-smithfield-foods-have-prevented-the-rivers-of-hog-waste-in-north-carolina-after-florence>; Doug Bock Clark, “Why Is China Treating North Carolina Like the Developing World?” *Rolling Stone*, March 19, 2018. <https://www.rollingstone.com/politics/politics-news/why-is-china-treating-north-carolina-like-the-developing-world-122892/>.
- <sup>143</sup> Robert Farley, “Robert Mo, Wen Ho Lee, and Non-Military Chinese Intellectual Property Theft,” *Diplomat*, July 7, 2020. <https://thediplomat.com/2020/07/robert-mo-wen-ho-lee-and-non-military-chinese-intellectual-property-theft/>.
- <sup>145</sup> USA Trade Online, “U.S. Import and Export Merchandise Trade Statistics,” 2022. <https://usatrade.census.gov/data/Perspective60/Dim/dimension.aspx>.
- <sup>146</sup> Tao Mingyang, “China Aims to Finish Seed Survey in 3 Years, a Move to Break Foreign Control,” *Global Times*, March 24, 2021. <https://www.globaltimes.cn/page/202103/1219360.shtml>.
- <sup>147</sup> Mara Hvistendahl, “The Scientist and the Spy: A True Story of China, the FBI, and Industrial Espionage,” Riverhead Books, 2020.
- <sup>148</sup> U.S. Department of Justice, “Press Release: Chinese National Pleads Guilty to Economic Espionage Conspiracy,” January 6, 2022. <https://www.justice.gov/opa/pr/chinese-national-pleads-guilty-economic-espionage-conspiracy>.
- <sup>149</sup> U.S. Department of Justice, “Press Release: Chinese National Sentenced for Economic Espionage Conspiracy,” April 7, 2022. <https://www.justice.gov/opa/pr/chinese-national-sentenced-economic-espionage-conspiracy>.
- <sup>150</sup> U.S. Department of Justice, “Press Release: Chinese National Pleads Guilty to Economic Espionage Conspiracy,” January 6, 2022. <https://www.justice.gov/opa/pr/chinese-national-pleads-guilty-economic-espionage-conspiracy>.
- <sup>151</sup> U.S. Department of Justice, “Press Release: Chinese National Pleads Guilty to Economic Espionage Conspiracy,” January 6, 2022. <https://www.justice.gov/opa/pr/chinese-national-pleads-guilty-economic-espionage-conspiracy>.
- <sup>152</sup> Dina Temple-Raston, “The Chinese Spy in the Iowa Corn Field,” *Washington Post*, March 6, 2020. [https://www.washingtonpost.com/outlook/the-chinese-spy-in-the-iowa-corn-field/2020/03/05/b3c2f110-4d03-11ea-9b5c-eac5b16dafaa\\_story.html](https://www.washingtonpost.com/outlook/the-chinese-spy-in-the-iowa-corn-field/2020/03/05/b3c2f110-4d03-11ea-9b5c-eac5b16dafaa_story.html).
- <sup>153</sup> David Martin, “Unraveling the Great Chinese Corn Seed Spy Ring,” *Al Jazeera America*, October 6, 2014. <http://america.aljazeera.com/watch/shows/america-tonight/articles/2014/10/6/unraveling-the-greatchinesecornseedspyring.html>.
- <sup>154</sup> ZhongGuangCun Science Park, “Shao Genhuo,” December 31, 2011. [http://webcache.googleusercontent.com/search?q=cache:Hme6d9koONcJ:www.chinadaily.com.cn/m/beijing/zhongguancun/2011-12/31/content\\_17148963.htm+&cd=2&hl=en&ct=clnk&gl=us&client=firefox-b-1-d](http://webcache.googleusercontent.com/search?q=cache:Hme6d9koONcJ:www.chinadaily.com.cn/m/beijing/zhongguancun/2011-12/31/content_17148963.htm+&cd=2&hl=en&ct=clnk&gl=us&client=firefox-b-1-d).
- <sup>155</sup> Dina Temple-Raston, “The Chinese Spy in the Iowa Corn Field,” *Washington Post*, March 6, 2020. [https://www.washingtonpost.com/outlook/the-chinese-spy-in-the-iowa-corn-field/2020/03/05/b3c2f110-4d03-11ea-9b5c-eac5b16dafaa\\_story.html](https://www.washingtonpost.com/outlook/the-chinese-spy-in-the-iowa-corn-field/2020/03/05/b3c2f110-4d03-11ea-9b5c-eac5b16dafaa_story.html).
- <sup>156</sup> Robert Farley, “Robert Mo, Wen Ho Lee, and Non-Military Chinese Intellectual Property Theft,” *Diplomat*, July 7, 2020. <https://thediplomat.com/2020/07/robert-mo-wen-ho-lee-and-non-military-chinese-intellectual-property-theft/>.
- <sup>157</sup> Robert Farley, “Robert Mo, Wen Ho Lee, and Non-Military Chinese Intellectual Property Theft,” *Diplomat*, July 7, 2020. <https://thediplomat.com/2020/07/robert-mo-wen-ho-lee-and-non-military-chinese-intellectual-property-theft/>.
- <sup>158</sup> Jerry Warner et al., “Analysis of the Threat of Genetically Modified Organisms for Biological Warfare,” *Center for Technology and National Security Policy, National Defense University*, May 2011. <https://ndupress.ndu.edu/Portals/68/Documents/DefenseTechnologyPapers/DTP-082.pdf?ver=2017-06-22-143029-967>.
- <sup>159</sup> *Chinese Science Journal*, “Experts from the Chinese Academy of Sciences Comment on the ‘Conspiracy Theory:’ It is the Imagination of the Layman that it is Technically Not True,” (中科院专家评转基因“阴谋论”：技术上不成立是外行人臆想), January 23, 2017. <https://tech.sina.cn/d/qy/2017-01-23/detail-afxzuswq3301796.d.html>.
- <sup>160</sup> Katherine Charlet, “The New Killer Pathogens: Countering the Coming Bioweapons Threat,” *Carnegie Endowment for International Peace*, April 17, 2018. <https://carnegieendowment.org/2018/04/17/new-killer-pathogens-countering-coming-bioweapons-threat-pub-76009>.
- <sup>161</sup> David Clark and Nanette Pazdernik, “Biotechnology, Apply the Genetic Revolution,” *Elsevier* (2015): 687–719. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7150198/>.
- <sup>162</sup> Heather Landry, “Challenging Evolution: How GMOs Can Influence Genetic Diversity,” *Harvard University*, August 10, 2015. <https://sitn.hms.harvard.edu/flash/2015/challenging-evolution-how-gmos-can-influence-genetic-diversity/#:~:text=A%20major%20concern%20of%20genetically,between%20individuals%20of%20a%20species..>

- 
- <sup>163</sup> Jiang Gaoming, “Are Biological Weapons an Exaggeration?” (转基因生物武器是耸人听闻吗?), *Aisixiang*, January 12, 2018. <https://www.aisixiang.com/data/107796.html>.
- <sup>164</sup> Cornell Law School, “Electronic Code of Federal Regulations, Title 7 – Agriculture, Subtitle B.” <https://www.law.cornell.edu/cfr/text/7/781.2>.
- <sup>165</sup> U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2020, 2021*. [https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020\\_afida\\_annual\\_report.pdf](https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020_afida_annual_report.pdf).
- <sup>166</sup> U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2020, 2021*. [https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020\\_afida\\_annual\\_report.pdf](https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020_afida_annual_report.pdf).
- <sup>167</sup> U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2020, 2021*. [https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020\\_afida\\_annual\\_report.pdf](https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020_afida_annual_report.pdf).
- <sup>168</sup> U.S. Department of Agriculture Farm Service Agency, *Foreign Holdings of U.S. Agricultural Land through December 31, 2020, 2021*. [https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020\\_afida\\_annual\\_report.pdf](https://www.fsa.usda.gov/Assets/USDA-FSA-Public/usdfiles/EPAS/PDF/2020_afida_annual_report.pdf).