**Impact of CO2-Caused Climate Changes on Food Production This section looks at the implications of the previous chapters for the planet’s food supply. Extreme Weather (in general) John Podestra, who was** President Clinton’s final chief of staff and later became co-chair of President Obama’s transition team, wrote in 2010: “ Food shortages resulting from severe crop losses will occur more frequently and take longer to recover from as more people become vulnerable to extreme weather events”6 In 2011, Oxfam published a report entitled “Extreme Weather Endangers Food Security: 2010-11: A Grim Foretaste of Future Suffering and Hunger?”Romm judged this report, according to which extreme weather had pushed millions of people into hunger, the “climate story of the year,” Oxfam’s report, Romm said, “shows how several extreme weather events have contributed to food insecurity at global, regional and local levels since 2010.”7 In 2012, George Monbiot entitled a story, “If Extreme Weather becomes the Norm, Starvation Awaits.” In 2013, Peter Kendall, president of Britain’s National Farmers Union, said that extreme weather is the biggest threat to farming’s ability to feed the country. “A gentle increase in temperature is fine,” said Kendall, “but extreme weather events completely stuffs farming.”8 In 2014, Bloomberg published an article headed “Extreme Weather Wreaking Havoc on Food as Farmers Suffer,” which began: Too much rain in northern China damaged crops in May, three years after too little rain turned the world’s second-biggest corn producer into a net importer of the grains. . . . U.K. farmers couldn’t plant in muddy fields after the second-wettest year on record in 2012 dented the nation’s wheat production.9 Heat a 2009 article in Science noted: “Although much attention is focused on threats of increased droughts in subtropical agriculture, the potential impacts of seasonal average temperature changes in both the tropics and sub-tropics. . . . are often over-looked”10 Lead author David Battisti said, “The stress on global food production from temperatures alone is going to be huge.” Because temporary heat waves have already greatly reduced crops (the European heat wave of 2003 caused crops to decline as much as 36 percent), a world in which the average temperatures are as high as today’s hottest summers “will surely challenge the global population’s ability to produce adequate food in the future.”11 The years following the Battisti article almost seem designed to prove its truth: The year 2010 brought the historic Russian heat wave, in which 17 percent of Russia’s total crop, including 30 percent of its wheat crop, was lost – a loss that led Russia to end grain exports for a year.12 In 2011, Lester Brown reported: “Crop ecologists have found that each one-degree Celsius rise in temperature above the optimum can reduce grain harvests by 10 percent.”13 In 2013, the World Bank warned that in sub-Saharan Africa, the combination of increasing heat and drought will make it impossible for the staple crop, maize, to thrive in 40 percent of the current farmland, and that the heat will kill or at least degrade swaths of the savanna where livestock graze. Also, researchers at Kansas State University concluded that the addition of another degree Celsius will lead to a 21 percent decrease in the wheat harvests of that state.14 In early 2014, the heat wave was so extreme in Brazil that, in conjunction with the long-lasting drought, it scorched the grazing fields, leading the price of Brazil’s beef – which is primarily grass fed – to go to the highest level ever. 15 Increasing temperature can also affect food supply by making waters too warm for both ocean and freshwater seafood. For example, a 2013 study of California’s native fish projected that the continuation of business as usual would lead to the extinction of 82 percent of its 121 freshwater species. In 2014, Maine’s shrimp season was cancelled after the rising water temperature in the Gulf of Maine had become too warm for the tiny organisms on which shrimp feed, and in California, salmon were dying because the water was too warm, so millions of young Chinook salmon were shipped to the ocean by truck. 16 Drought As pointed out in Chapter 3, Romm in 2011 wrote: “Drought is the most pressing problem caused by climate change. . . . Feeding some 9 billion people by mid-century in the face of a rapidly worsening climate may well be the greatest challenge the human race has ever faced.” That same year, Oxfam reported, East Africa had a drought that contributed to “over 13 million people being published into crisis.” Oxfam also reported that, due to a serious drought in Afghanistan, people were facing food shortages, because up to 80 percent of their rain-fed wheat crops had been destroyed by the lack of rain.17 In 2012, a University of Leeds-led report warned that severe droughts in Asia are likely to bring food crises imminently – within 10 to 15 years. The crisis will originate, it says, in China, India, Pakistan, and Turkey as they are major producers of wheat and maize. One of the co-authors said: “Our works surprised us when we saw that the threat to food security was so imminent; the increased risk of severe droughts is only 10 years away from China and India.”18 In 2014, just as heat and drought devastated Brazil’s beef cattle, this combination did the same for the corn crop of Argentina, the world’s third largest supplier.19 According to a 2012 UN statement quoted in Chapter 3: “Drought ranks as the single most common cause of severe food shortages in developing countries. Drought caused more deaths during the last century than any other natural disaster.” That same year, the US drought led the Department of Agriculture to issue its most extensive disaster declaration ever, one that included almost one-third of the counties in the United States, covering 26 states.20 Storms The expected increase in frequency and severity of the two types of storms that are most destructive of agriculture – hurricanes and extreme rain with flooding – will have a major impact on food production, if the past is any guide. Extreme Rain with Flooding: Ban Ki-Moon called the Pakistani deluge of 2010 (see Chapter 4) “the worst disaster” he had ever seen. It destroyed crops estimated to be worth over two billion dollars, reported Time magazine, which added: “Some 17 million acres of agricultural land have been submerged, and more than 100,000 animals have perished.” This destruction was catastrophic, because “[a]bout a quarter of Pakistan’s economy and nearly a half of its workforce depend on agriculture.”21 Between August and October 2011, reported Oxfam, heavy monsoons “inundated large areas of productive rice lands in South East Asia – including Thailand, Cambodia, Vietnam, Laos, Myanmar, and the Philippines.” These floods were devastating to the year’s rice fields; in Thailand, which is the world’s largest exporter of rice, these rains “caused that nation’s most expensive natural disaster in history.”22 Hurricanes: A summary of the damage by Hurricane Mitch in 1998 said: At least 70 percent of [Honduras’] crops destroyed. . . . Beans, sugar, and banana crops [of Nicaragua] devastated. . . . As much as 80% of [El Salvador’s] maize crop lost. Coffee plantations and sugar cane crop severely affected. In 2009, Cyclone Nargis in Myanmar (Burma) “killed three-fourths of the livestock [in the delta it struck] and salted a million acres of rice paddies with its seawater surges.” In 2012, Hurricane Isaac caused an estimated $100 million worth of crop damages in Louisiana, and Hurricane Sandy “ravaged parts of the Caribbean, sparking fears of food shortages where food insecurity was already a concern.” And in Haiti “up to 70% of crops – such as corn, avocado, bananas and plantains – were obliterated.”23 Sea-Level Rise Three countries whose food supplies along the coastlines are especially threatened are Bangladesh, Vietnam, and Egypt. Bangladesh: According to the IPCC, “Bangladesh is slated to lose the largest amount of cultivated land globally due to rising sea levels. A one-meter rise in sea level would inundate 20 percent of the country’s landmass,” because much of the country’s crop-growing land is only slightly above sea level. Long before the land is inundated, moreover, seepage can make it too salty to grow food. “The once fertile land of this whole southwestern region has now turned into a huge saline swamp where no vegetation grows,” said one farmer. “We cannot grow rice or any vegetables. Coconut palms and banana grows are dying. The coconut water that used to be so sweet and refreshing even a decade ago has now become bitter.” A Union of Concerned Scientists report said: “By mid-century, more than 3 million people stand to be directly affected by sea-level rise. . . . Bangladesh could lose nearly 25 percent of its 1989 land area by around 2100.”24 People cannot respond to moving to higher land, because Bangladesh has 142 million people locked in a very small space: Being about the size of the state of New York, its population is almost half that of the USA. According to an article by two German scholars: “There are no free areas left in Bangladesh; its neighbor India is already very concerned about the past and present illegal immigration of Bangladeshi.”25 Vietnam: Orrin Pilkey and Rob Young wrote: “[I]n many parts of Asia the rice crop will be decimated by rising sea level. . . . [A] three-foot sea level rise will eliminate half of the rice production of Vietnam” (one of the world’s leading producers of rice). Much of Vietnam’s rice fields could be destroyed because, due to its very long coastline, “74% of the population lives in low-lying areas such as coastal plains or river deltas that are threatened by sea level rise.” As a result, “Vietnam could face the most devastating consequences of global sea level rise.”26 The chief problem is that the Mekong Delta, which is Vietnam’s “rice bowl,” is becoming salty. According to a 2011 story in the Guardian: “The vast, humid expanse of the delta is home to more than 17 million people, who have relied for generations on its thousands of river arteries. But rising sea water caused by global warming is now increasing the salt content of the river water and threatening the livelihoods of millions of poor farmers and fisherman**.” This salinity especially affects rise production. If the world keeps emitting large quantitites of CO2, a 2009 report noted, the sea level will keep rising and salt** water could submerge almost a third of the delta.27 Egypt: Illustrating the fact that sea-level rise does not threaten only the food supply of Asian countries, Egypt is experiencing the same problems as Bangladesh and Vietnam. According to the UN Human Settlements Program, a rise of almost 20 inches (50 centimeters), which is expected at about 2040, will “force[e] two million people in Egypt’s north coast and delta region to abandon their homes.” Besides forcing these people to move, the rising sea-level cuts into Egypt’s capacity to feed to its growing population: [F]armers throughout the delta are losing crops to the rising water table as the salty seawater contaminates the groundwater and makes the soil infertile. This is particularly worrying because nearly half of Egypt’s agriculture – including such crops as wheat, rice, corn and cotton – takes place in the delta region.28 Water Shortage “Of all the environmental trends that are shrinking the world’s food supplies,” said Lester Brown, “the most immediate is water shortages. In a world where 70 percent of all water use is for irrigation, this is no small matter.” But various sources of water have been fading.29 Glaciers: As we saw in Chapter 6, global warming is causing the melting of South America’s “frozen water towers,” the “water towers of Europe,” “Africa’s Alps,” and the “Third Pole glaciers.” At some point, the continents will have trouble producing the food needed by their populations. Snowpack: “Being an essential source of agricultural irrigation for billions of people,” snowpack is providing less water each decade. While he was the Secretary of Energy, Steven Chu said that the continuation of present policies will lead to the disappearance of the Sierra snowpack, which provides most of California’s water. This is a scenario, he said, “where there’s no more agriculture in California.” This is serious, given the fact that California’s Central Valley “yields a third of all the produce grown in the United States.”30 Ground Water: Equally serious is the depletion of ground water. “Aquifer depletion now,” said Lester Brown in his 2013 article on peak water, “threatens harvest in China, India, and the United States,” which “together supply half of the world’s grain harvest.” With regard to China, “the water table under the North China Plain, an area that produces over half of the country’s wheat and a third of its corn, is falling fast.” With regard to India, “The country’s farmers have drilled 21 million irrigation wells, with the result that water tables are falling in almost every state.”31 The first country “to publicly reveal how aquifer depletion will shrink its grain harvest,” Brown added, was Saudi Arabia: In the 1970s, the Saudis “developed a heavily subsidized irrigated agriculture based on pumping water from a fossil aquifer over a half-mile below the surface. In early 2008, with the aquifer largely depleted, the Saudis announced that they will phase out wheat production by 2016.” As a result, Saudi Arabia will start “importing roughly 14 million metric tons of wheat, rice, corn, and barley.”32 Given Saudi Arabia’s relatively small population, this development will not cause a shock too large for world markets to absorb. But what will happen if China or India do the same?