An Assessment of the Extent of Projected Global Famine Resulting From Limited, Regional Nuclear War

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Abstract

The recent study by Robock et al on the climatic consequences of regional nuclear war shows that even a "limited" nuclear conflict, involving as few as 100 Hiroshima-sized bombs, would have global implications with significant cooling of the earth's surface and decreased precipitation in many parts of the world. A conflict of this magnitude could arise between emerging nuclear powers such as India and Pakistan. Past episodes of abrupt global cooling, due to volcanic activity, caused major crop failures and famine; the predicted climate effects of a regional nuclear war would be expected to cause similar shortfalls in agricultural production. In addition large quantities of food might need to be destroyed and significant areas of crop land might need to be taken out of production because of radioactive contamination. Even a modest, sudden decline in agricultural production could trigger significant increases in the prices for basic foods and hoarding on a global scale, both of which would make food inaccessible to poor people in much of the world. While it is not possible to estimate the precise extent of the global famine that would follow a regional nuclear war, it seems reasonable to postulate a total global death toll in the range of one billion from starvation alone. Famine on this scale would also lead to major epidemics of infectious diseases, and would create immense potential for war and civil conflict.

It has been clear for some time, that a large scale nuclear war involving a substantial portion of the nuclear arsenals of the United States and Russia would have devastating consequences far beyond these two countries and would constitute a truly global catastrophe.

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The recent study by Robock et al on the climatic consequences of regional nuclear war shows clearly that even a "limited" nuclear conflict, involving as few as 100 Hiroshima-sized bombs, would also have global implications with significant effects on weather patterns throughout the world. Debris injected into the atmosphere from the explosions and resulting fires would produce an average surface cooling of -1.25ºC that would last for several years.[1] Even 10 years out, there would be a persistent average surface cooling of -0.5ºC. Perhaps more important than the average cooling, there would be decreases in the growing season (frost free days), of 10 to 20 days in many of the most important grain producing areas throughout the world. This decrease might "completely eliminate crops that

have insufficient time to reach maturity."[2] There would also be major alterations in patterns of precipitation, with a 10% reduction in global rainfall, and large reductions in the Asian summer monsoon.

A conflict of this magnitude would not necessarily involve the nuclear super powers. It could arise between emerging nuclear powers such as India and Pakistan. This paper attempts to examine the potential effect on human health of these sudden climate changes.

The most important direct effect of these changes in temperature and precipitation would be a decrease in global food production. While there are no accurate estimates of the shortfall in food production available at this time, there is historical experience from previous cooling episodes which suggests the impact on food supplies would be very large.

Climate and Famine: The Historical Record

In 1816 North America and Europe experienced "The year without a summer", following the 1815 eruption of the Indonesian volcano Tambora, the largest volcanic eruption in recorded history.[3] The average global deviation in temperature was -0.7ºC, and there was significant shortening of the growing season. In the northeastern United States and eastern Canada, which were particularly hard hit, temperatures were actually above average during the early part of the year, and even during the summer months there were a number of periods with average or above average temperatures. But four severe cold waves, June 6-11, July 9-11, and August 21 and August 30, brought killing frosts as far south as the Mid Atlantic States, and in New England and Quebec there was even significant snow fall in June.[4] These periods of frost caused extensive damage to crops, particularly to the most important crop, corn (maize), much of which was destroyed. The resulting shortages led to the extensive slaughter of livestock which could not be fed, and to a doubling in grain prices throughout the area.

In the New World, where population density was still quite low, there was relatively little hunger, except in some isolated rural communities. In the more densely populated countries of western and northern Europe the effects were far more severe with the widespread crop failures leading to outright famine. As described in a letter published in an Albany, New York newspaper that year, "From the Baltic to Breslau the greater part of the land sewn with winter wheat has been obliged to be ploughed up, and of the corn that remains standing scarcely one third part of a crop is to be expected."[5] Famine was reported in Ireland, the German states, Switzerland and France, and again a doubling of prices for grain occurred. In Europe a much greater disaster was averted only because of the very strong harvest in 1815 which left grain stocks high at the outset of the famine, and another strong harvest in the summer 1817. As it was, "In the spring of 1817 pallid, half starved people were wandering the fields, hunting for, and grubbing up, overlooked and rotting potatoes of the last year's crop."[6] Crop failures and famine were also reported in India.[7]

The worst of the cooling caused by the Tambora eruption lasted for only one year. A less well documented, but more prolonged episode of cooling took place between 536 and 545.[8] This event may also have been precipitated by a large volcanic eruption in Indonesia, this time in the Sunda Strait between Java and Sumatra. The historical record from this period is quite fragmentary, but references to extensive crop failure and severe famine are found in documents from Byzantium, China, Korea and Japan, and the archeological record suggests a devastating drought in South America and the western United States.[9]

During both of these prior events, crop failures were due primarily to cooling and lower precipitation; several other factors might affect the size of available food stocks in the event of a regional nuclear war. If the soot injected into the atmosphere in a nuclear war caused significant ozone depletion, that could cause a further major decline in actual food production.[10] Furthermore food that was grown might be diverted to industrial use. Today ethanol production is already using significant quantities of grain that would otherwise be available as food or livestock feed.[11] In the event that a regional nuclear war involved petroleum producing countries, or disrupted shipping from petroleum producing countries, there might be increased diversion of grain to ethanol production to try to make up for this shortfall. Finally, if a regional war resulted in significant radioactive contamination of one or more major food producing countries, large quantities of food might need to be destroyed and significant areas of crop land might need to be taken out of production.

Current Demographic Conditions

At this point in time, we are ill prepared to deal with a major fall in world food supply. As of mid August of this year, global grain stocks were approximately 322 million tons with annual consumption at 2,098 million tons.[12] Expressed as days of consumption world grain stocks are therefore approximately 56 days, lower than at any point in the last 50 years, and dramatically lower than the 100 to 120 days of consumption available in the 1980's and 1990's.[13] These stocks would not provide any significant reserve in the event of a sharp decline in global production.

At our current baseline there are already millions of people suffering chronic malnutrition. While there is considerable academic debate about the exact scope of global malnutrition, and even about the best way to define malnutrition,[14] The average adult needs somewhere between 1800 and 2000 calories per day, depend-

ing on his or her stature, to meet basic metabolic requirements and sustain a minimal level of physical activity. Requirements for children are dependent on age and size. There are more than 800 million people in the world whose daily caloric intake falls below these minimum requirements. Each year some five million children in this group starve to death. A small further decline in available food would put this entire group at risk.

Given these conditions, even a modest, sudden decline in agricultural production could trigger massive famine. At the time of the great Bengal famine of 1943, during which three million people died, food production was only 5% less than it had been on average over the preceding five years, and it was actually 13% higher than it had been in 1941 when there was not a famine.[15] But in 1943, after the Japanese occupation of Burma, which had historically exported grain to Bengal, the decline in food production was coupled with panic hoarding and the price of rice rose nearly five fold, making food unaffordable to large numbers of people. These two factors, hoarding and the severe increase in rice prices, caused an effective inaccessibility of food far more severe than the actual shortfall in production.

In the event of a major global cooling episode with widespread crop failures, a similar scenario would unfold on a global scale. Whatever the initial shortfall in agricultural production, and it might be much higher than the modest 5% drop that triggered the Bengal famine, there would be widespread panic, particularly if there were a general understanding that crops would continue to fail for a number of years. In 1972, the price of both wheat and rice doubled simply in response to a tightening of world food stocks to just under 60 days of consumption.[16] In this setting we would expect to see much greater rises in grain prices worldwide. These price increases would put a crippling burden on whole countries which import large portions of their food supply and would make food unaffordable for hundreds of millions of individuals who are already malnourished precisely because of their inability to afford adequate food even at current world prices.

In addition we would probably see hoarding on a global scale. In September 2002, Canada, faced with a sharp decline in wheat production because of drought conditions, suspended wheat exports for a year. The next year the European Union took similar action, as did Russia. And in August 2004 Vietnam indicated it would not export rice until the following spring.[17] In the event of a regional nuclear war, the grain exporting states would be faced with major crop losses and the prospect of bad harvests for the next several years. It is probable that they would take similar action, and refuse to export whatever grain surplus they might have, retaining it instead as a domestic reserve.

This year global grain consumption is about 2,098 million tons, of which 220 million tons, or 11% is imported.[18] Many countries which currently do not have major problems with widespread malnutrition are nonetheless dependent on imported food. For example, North Africa, home to more than 150 million people, with average caloric consumption well above the minimal level, imports 45% of its food.[19] A number of other countries in the Middle East, Malaysia, South Korea, Japan and Taiwan are also dependent on imports for 50% or more of their grain consumption.[20] The wealthier of these countries might initially be able to obtain some grain on the international market by bidding up the price, but as the extent of the global crop failures became clear, grain producing countries would tighten their export bans, and the hundreds of millions of people dependent on grain imports would also face starvation.

Famine Deaths and Synergistic Effects

Somewhat paradoxically, the ongoing effects of global warming might make the world more vulnerable in the event of a sudden cooling event. For example, in Africa, “Increasingly variable growing season conditions are disrupting subsistence agricultural production leading to famine.”[21] Populations already weakened by the negative effects on food production of global warming would be less able to withstand a sudden further decline in accessible food.

It is of course impossible to estimate with accuracy the full extent of the global famine that would follow a regional nuclear war. But it seems reasonable to conclude that few of the 800 million people who are already malnourished would survive if their already substandard intake decreased by even 10% for a whole year. If the crop failures and resulting food shortages persisted for several years their fate would be sealed. Additional hundreds of millions whose current intake is marginal, or who live in countries dependent on food imports would also be at risk, particularly if the famine persisted. Thus, in the event of a protracted global cooling, triggered by a limited, regional nuclear war, it seems reasonable to fear that the total global death toll could exceed one billion from starvation alone.

Two other issues need to be considered as well. First, there is a very high likelihood that famine on this scale would lead to major epidemics of infectious diseases. The prolonged cooling and resultant famine in 536-545 was accompanied by a major outbreak of plague which developed over the next half century into a global pandemic.[22] The famine of 1816 triggered an epidemic of typhus in Ireland that spread to much of Europe[23] and the famine conditions in India that year led to a an outbreak of cholera that has been implicated in the first global cholera pandemic.[24] The well studied Great Bengal Famine of 1943 was associated with major local epidemics of cholera, malaria, smallpox, and dysentery.[25]

Despite the advances in medical technology of the

last half century, a global famine on the scale anticipated would provide the ideal breeding ground for epidemics involving any or all of these illness. In particular the vast megacities of the developing world, crowded, and often lacking adequate sanitation in the best of times, would almost certainly see major outbreaks of infectious diseases; and illnesses, like plague, which have not been prevalent in recent years might again become major health threats.

Finally we need to consider the immense potential for war and civil conflict that would be created by famine on this scale. Within nations where famine is widespread there would almost certainly be food riots, and competition for limited food resources might well exacerbate ethnic and regional animosities. Among nations, armed conflict seems highly likely as states dependent on imports adopt whatever means are at their disposal in an attempt to maintain access to food supplies.

It is impossible to estimate the additional global death toll from disease and further warfare that this "limited regional" nuclear war might cause, but given the world wide scope of the climate effects the dead from these causes might well number in the hundreds of millions.

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