NUCLEAR FAMINE: A BILLION PEOPLE AT RISK

Global Impacts of Limited Nuclear War on Agriculture,
Food Supplies, and Human Nutrition

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Executive Summary

Over the last several years, a number of studies have shown that a limited, regional nuclear war between India and Pakistan would cause significant climate disruption worldwide. Two studies published this year examine the impact on agricultural output that would result from this climate disruption.

In the US, corn production would decline by an average of 10% for an entire decade, with the most severe decline, about 20% in year 5. There would be a similar decline in soybean production, with, again, the most severe loss, about 20%, in year 5.

A second study found a significant decline in Chinese middle season rice production. During the first 4 years, rice production would decline by an average of 21%; over the next 6 years the decline would average 10%.

The decline in available food would be exacerbated by increases in food prices which would make food inaccessible to hundreds of millions of the world's poorest. Even if agricultural markets continued to function normally, 215 million people would be added to the rolls of the malnourished over the course of a decade.

However, markets would not function normally. Significant, sustained agricultural shortfalls over an extended period would almost certainly lead to panic and hoarding on an international scale as food exporting nations suspended exports in order to assure adequate food supplies for their own populations. This turmoil in the agricultural markets would further reduce accessible food.

The 925 million people in the world who are chronically malnourished have a baseline consumption of 1,750 calories or less per day. Even a 10% decline in their food consumption would put this entire group at risk. In addition, the anticipated suspension of exports from grain growing countries would threaten the food supplies of several hundred million additional people who have adequate nutrition today, but who live in countries that are highly dependent on food imports.

The number of people threatened by nuclear-war induced famine would be well over one billion.

These studies demonstrate the need for additional research and underscore the urgent need to move with all possible speed to the negotiation of a nuclear weapons convention that will eliminate the danger of nuclear war.

Background


UN PHOTO/ ALBERT GONZALEZ FARRAN

In the 1980s, a number of scientific studies demonstrated that a large scale nuclear war between the United States and the Soviet Union would cause "Nuclear Winter", a profound worldwide climate disruption with significant decreases in precipitation and average surface temperature.

A US National Academy of Sciences study on the medical consequences of nuclear war concluded that, in the aftermath of such a war, "the primary mechanisms for human fatalities would likely not be from blast effects, not from thermal radiation burns, and not from ionizing radiation, but, rather, from mass starvation."[1] While the direct mortality attributed to a "large-scale nuclear war" was estimated at several hundred million people, the subsequent food and health crisis was expected to result in "the loss of one to four billion lives."

In 2007, a study by Robock et al demonstrated that even a very "limited" regional nuclear war, involving only 100 Hiroshima-sized bombs, or less than 0.5% of the world's nuclear arsenal, would also produce global climate disruption, although the impact on temperature and precipitation would be less profound.[2] At that time, there were no data on the effect that the predicted climate disruption would have on agricultural production. The historical experience following cooling events caused by volcanic eruptions, most notably the Tambora eruption in 1815, suggested that there might be a very significant impact on food production and human nutrition.

A 2007 report by the International Physicians for the Prevention of Nuclear War and its US affiliate, Physicians for Social Responsibility, suggested that up to one billion people might starve if a limited nuclear war led to even a 10% decline in their food consumption.[3]

This report is an initial attempt to quantify the impact of a limited nuclear war on agricultural production and the subsequent effects on global food prices and food supply, and on human nutrition.

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1 Harwell, M., and C. Harwell. 1986. Nuclear Famine: The Indirect Effects of Nuclear War. In, Solomon, F. and R. Marston (Eds.). *The Medical Implications of Nuclear War*. Washington, D.C.: National Academy Press. 117-135.

2 Robock, A., L. Oman, G. Stenchikov, O. Toon, C. Bardeen and R. Turco, 2007, Climatic consequences of regional nuclear conflicts. *Atm. Chem. Phys.,* 7: 2003-12.

3 Helfand, I. 2007. *An Assessment of the Extent of Projected Global Famine Resulting from Limited, Regional Nuclear War.* Paper presented to the Royal Society of Medicine, London, UK, October 2007.

Climate disruption from a "limited" regional nuclear war

UN PHOTO / ESKINDER DEBEBE

A 2007 study by Toon et al[4] considered the consequences of a possible nuclear war between India and Pakistan and showed that such a conflict would loft up to 6.6 Tg (6.6 teragrams or 6.6 million metric tons) of black carbon aerosol particles into the upper troposphere. Robock et al then calculated the effect that this injection of soot would have on global climate assuming a war in South Asia occurring in mid May.

Their study used a state of the art general circulation climate model, ModelE from the NASA Goddard Institute for Space Studies, and employed a conservative figure of only 5 Tg of black carbon particles. They found that, "A global average surface cooling of -1.25°C persists for years, and after a decade the cooling is still -0.50°C. The temperature changes are largest over land. A cooling of several degrees occurs over large areas of North America and Eurasia, including most of the grain-growing regions." In addition the study found significant declines in global precipitation with marked decreases in rainfall in the most important temperate grain growing regions of North America and Eurasia, and a large reduction in the Asian summer monsoon.[5]

4 Toon, Owen B., Richard P. Turco, Alan Robock, Charles Bardeen, Luke Oman, and Georgiy L. Stenchikov, 2007: Atmospheric effects and societal consequences of regional scale nuclear conflicts and acts of individual nuclear terrorism. *Atm. Chem. Phys.,* 7, 1973-2002.

5 Robock, Alan, Luke Oman, Georgiy L. Stenchikov, Owen B. Toon, Charles Bardeen, and Richard P. Turco, 2007: Climatic consequences of regional nuclear conflicts. *Atm. Chem. Phys.,* 7, 2003-2012.

Two studies conducted in 2011 examined how these climate alterations would affect agricultural output.

Ozdogan et al[6] examined the impact on corn and soybean production in the US Corn Belt where more than 70% of US grain is produced. Localized climate data were generated for four separate sites in the Corn Belt, one each in Indiana, Illinois, Iowa, and Missouri (Figure 1). The study used a comprehensive terrestrial ecosystem model, the Agro-Integrated Biosphere Simulator (Agro-IBIS), to calculate the change in predicted yield for corn and soybeans at each of these sites for the 10 years following a limited nuclear war in South Asia. The calculated change in crop yield was based on the decline in precipitation, solar radiation, growing season length, and average monthly temperature predicted in Robock's study.

The calculations in this initial study are probably conservative, as the study did not consider two other environmental factors which would be expected to produce a further significant decline in yield. It did not factor in the increase in UV light secondary to ozone depletion, and, perhaps more importantly, it did not consider daily temperature extremes which may lead to complete crop failure. The observed weather following the Tambora eruption suggests that these daily extremes may be the largest determinant of total crop losses. The average global deviation in temperature in 1816 was only -0.7°C, but there was significant shortening of the growing season.

In the northeastern United States and eastern Canada, which were particularly hard hit, temper-

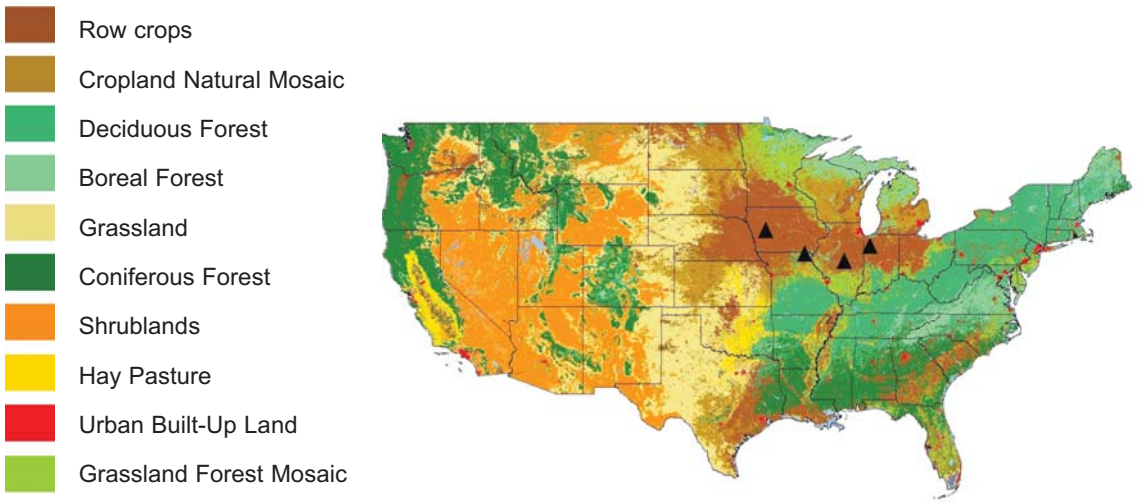


Figure 1. Localized climate data were generated for four sites in the US Corn Belt. From left to right, Iowa, Missouri, Illinois, and Indiana. [Figure 1 from Ozdogan et al.[6]]

6 Ozdogan, Mutlu, Alan Robock, and Christopher Kucharik, 2012: Impacts of Nuclear Conflict in South Asia on Crop Production in the Midwestern United States. Submitted to *Climatic Change*.

atures 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.[7] These periods of frost caused extensive damage to crops. A similar pattern in Northern Europe caused crop losses in the range of 75%[8] and the last multi-country famine in European history.

In addition, the study did not consider several other factors which might limit food production. Modern agriculture is very dependent on gasoline to power tractors and irrigation pumps and to transport produce to market, and on other petroleum products used in the manufacture of fertilizer and pesticides. A major conflict in South Asia would be very likely to affect petroleum supplies and prices which would have an additional negative impact on agricultural output. Further, given the intense demand for petroleum products, some of the grain produced might be diverted to ethanol production to try to offset the shortfall in petroleum.

Despite this conservative bias, the study showed very significant declines in both corn and soybean production. Averaged over 10 years, corn production would decline by 10% at all four sites (Figure 2). But there would be a great deal of

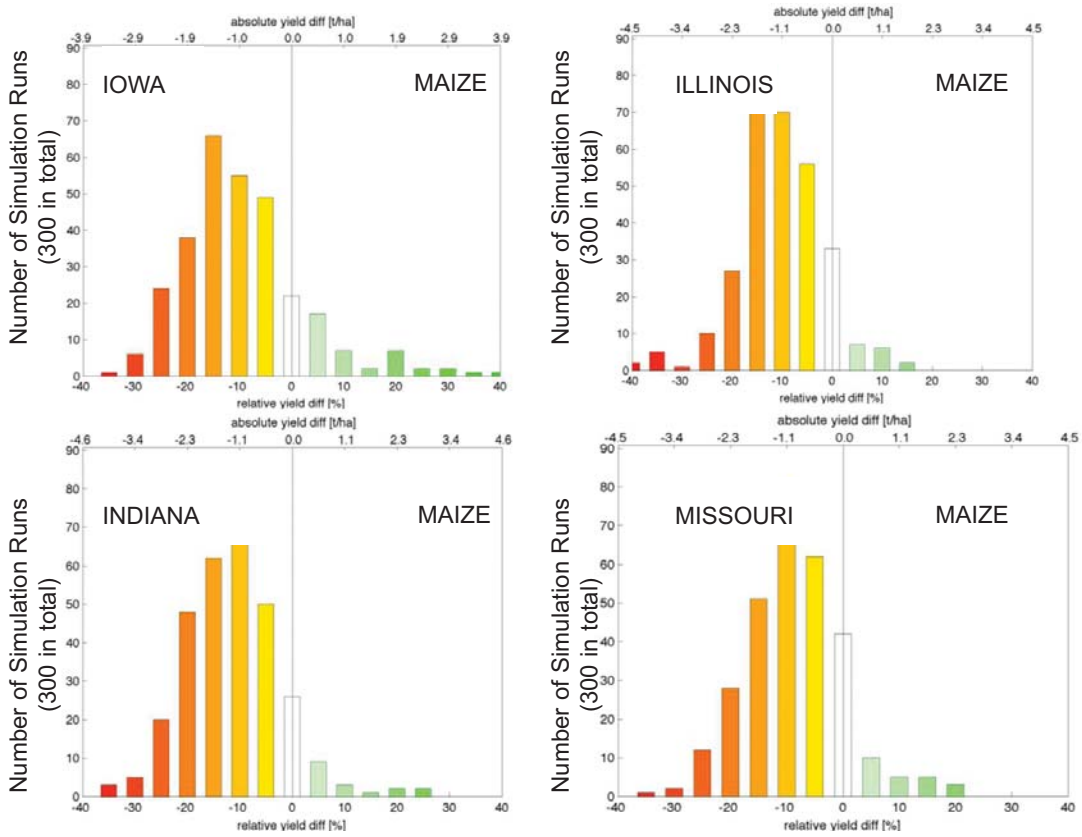


Figure 2. Declines in US corn (maize) production. To generate an estimate of the probable change in crop yield, computer simulations were run to obtain 300 different baseline crop yield levels using random selection of actual annual climate data over the past 30 years. The x axis shows the percent change in crop yield from the estimated baseline; the y axis shows the number of simulations that yielded a change of that size. [Figure 7 from Ozdogan et al.[6]]

7 Stommel H, Stommel E. 1979. The year without a summer. *Scientific American*. 240:176-186

8 Post, J. 1983. Climatic change and subsistence crises. *Journal of Interdisciplinary History*. 14:153-160.

variation from year to year, and losses would be most severe in year 5, averaging more than 20% (Figure 3). For soybeans there would be a similar decline averaged over 10 years (Figure 4 on pg 7). Here, too, the losses would be most severe in year 5, again averaging more than 20%.

In a separate study, Xia and Robock[9] examined the decline in Chinese middle season rice production in response to this 5 Tg event. This study used a different model, the Decision Support System for Agrotechnology Transfer model 4.02 (DSSAT). It is a dynamic biophysical crop model and simulates plant growth on a per hectare basis, maintaining balances for water, carbon and nitrogen. The required inputs include the plant environment (weather and soil), cultivar genotypes and agricultural management practices. The outputs from this model are potential yields, which are usually higher than actual yields. Perturbed climate data in 24 provinces in China were generated using predictions of climate change from Robock et al. and observations in China from 198 weather stations from 1978 to 2008 (China Meteorological Data Sharing Service System). The simulated change in middle season rice yield in China was due to the predicted decline in average monthly precipitation, solar radiation and temperature.


UN PHOTO / MARTINE PERRET

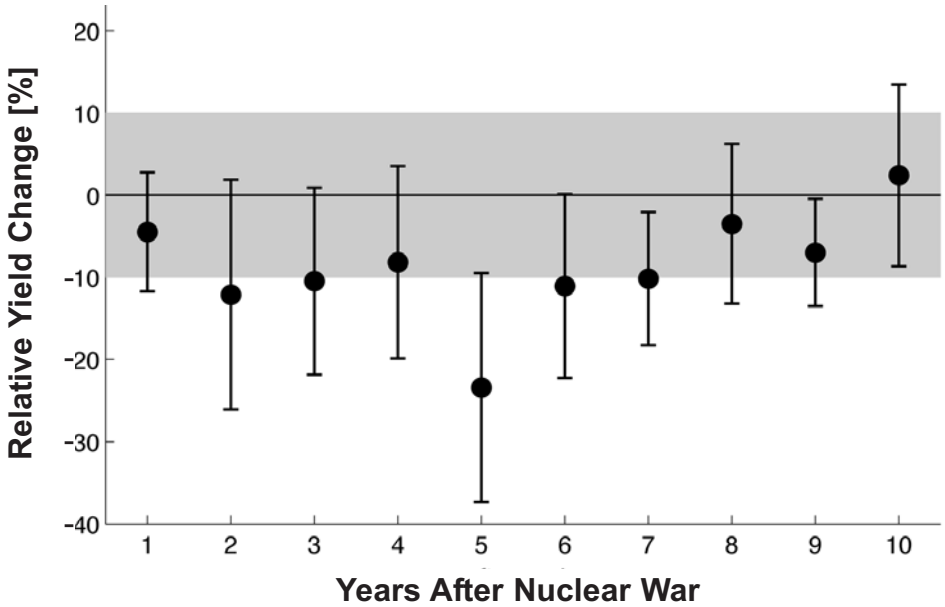


Figure 3. Reduction of maize production over time, with whiskers showing one standard deviation for each year after the nuclear war. The gray area shows ±1 standard deviation from the control runs, illustrating the effect of interannual weather variations. [Figure courtesy of M. Ozdogan.]

9 Xia, Lili, and Alan Robock, 2012: Impacts of Nuclear Conflict in South Asia on Rice Production in Mainland China. *Climatic Change* (accepted for publication April 16, 2012).

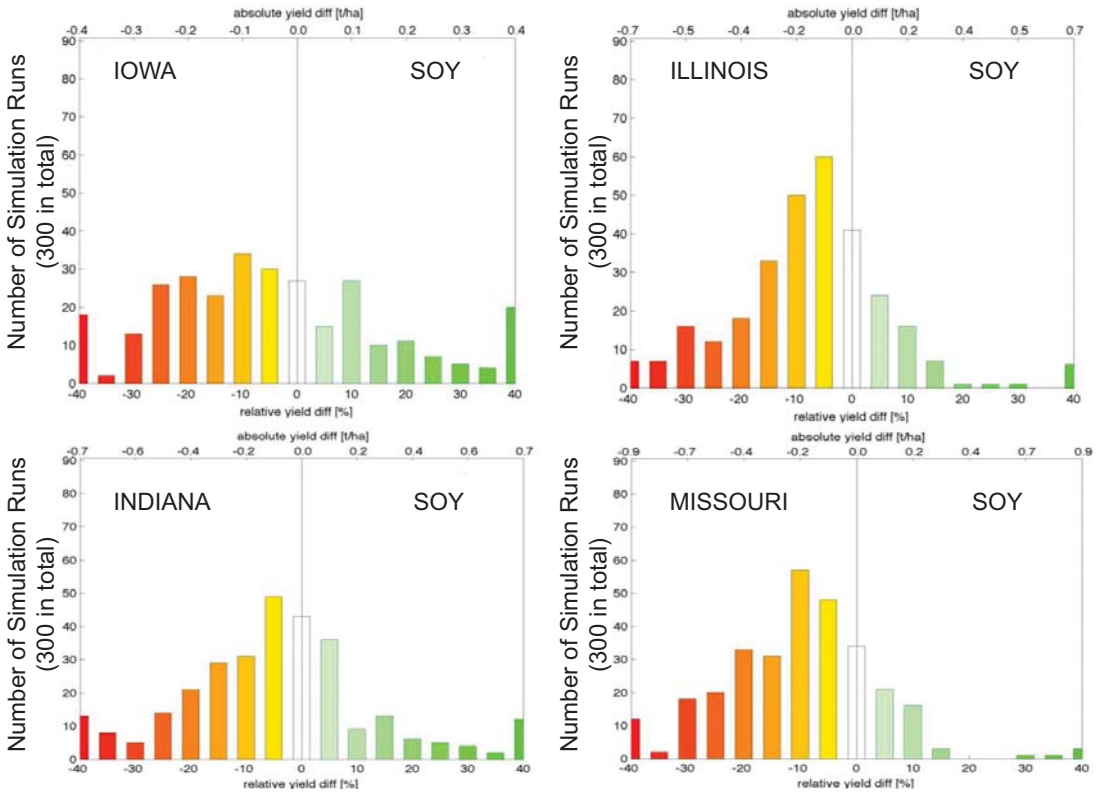


Figure 4. Declines in US soy production. The graphs were generated using the same methodology as in Figure 2 on pg 5. [Figure 8 from Ozdogan et al.[6]]

This study also did not consider the effect of UV light increases or daily temperature extremes, or the possible decline in available fertilizer, pesticide and gasoline. Again, despite this conservative bias, the study showed a significant decline in Chinese middle season rice production. Averaged over 10 years, the decline would be about 15% (Figure 5 on pg 8). During the first 4 years, rice production would decline by an average of 21%; over the next 6 years the decline would average 10% (Figure 6 on pg 8).

The impact on rice production was found to vary widely by province (Figure 7 on pg 9). In some areas in the South and East of China, production would actually rise. For example, in Hainan rice yield would increase by 5 to 15% per year. In other areas to the North and West the decline would be much more severe than the national average. In Heilongjian province, home to 36 million people, there would be a complete failure of the rice crop in year 1 following the war. Rice production would remain 60 to 70% below baseline for most of the rest of the following decade (Figure 8 on pg 9).

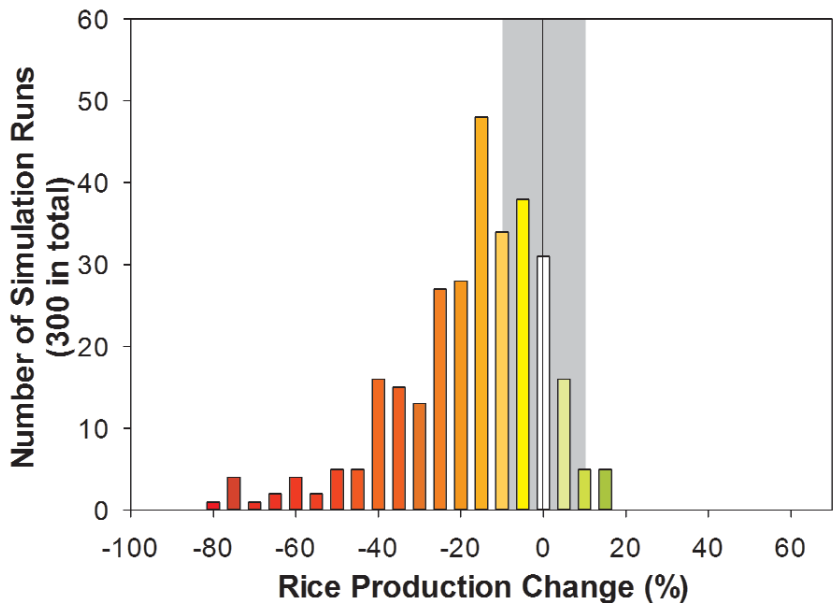


Figure 5. Distribution of rice production change (%): The gray area shows ±1 standard deviation from the control runs, illustrating the effect of interannual weather variations. [Figure 2(b) from Xia and Robock.[9]]

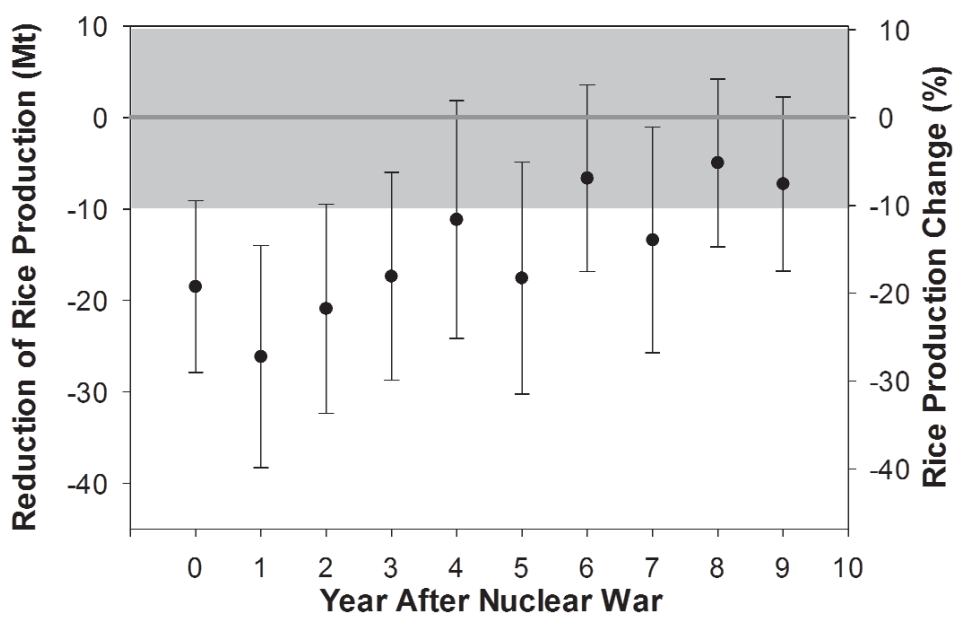


Figure 6. Reduction of rice production with whiskers showing one standard deviation for each year after the nuclear war. The gray area shows ±1 standard deviation from the control runs, illustrating the effect of interannual weather variations. [Figure 2(a) from Xia and Robock.[9]]

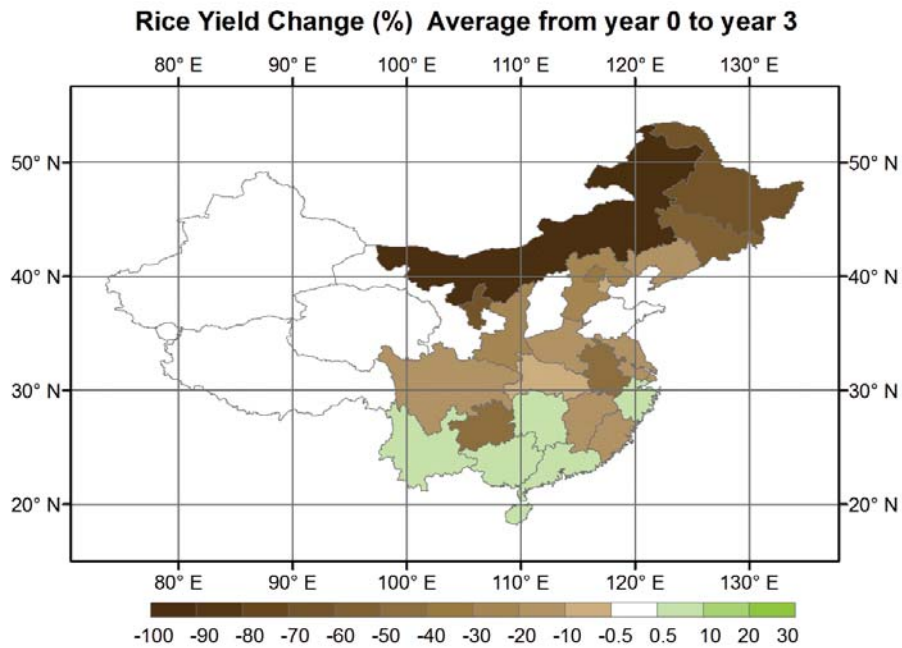


Figure 7. Map of rice yield reduction (%) for the first 4 years after regional nuclear conflict. Brown indicates negative change, and green indicates positive change. White regions are provinces for which we did not conduct model simulations. [Redrawn from Figure 5 of Xia and Robock.[9]]

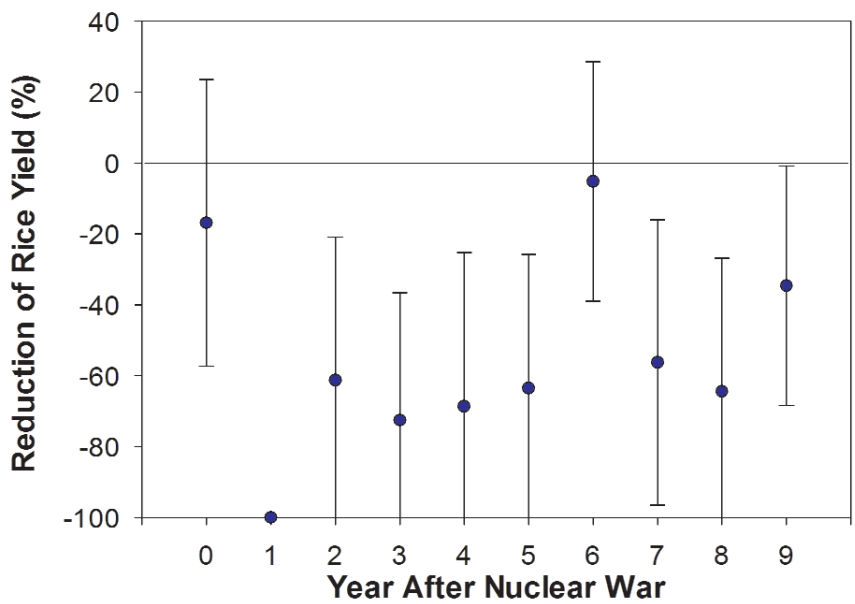


Figure 8. Reduction of rice yield over time in Heilongjiang Province, with whiskers showing one standard deviation for each year after the nuclear war. [Redrawn from Figure 6 of Xia and Robock.[9]]

The impact on human nutrition and health

UN PHOTO / STUART PRICE

The world is particularly vulnerable at this time to a major decline in food production. In March 2012, the UN Food and Agriculture Organization estimated that grain stocks were 518 million metric tons, 22% of the annual consumption of 2,319 million metric tons.[10] Expressed as days of consumption, this reserve would last for 80 days. The US Department of Agriculture estimates were somewhat lower at 467 million metric tons of grain stocks, a mere 19% of their estimated annual consumption, of 2,299 million metric tons.[11] Expressed as days of consumption, this reserve would last for only 68 days.

Furthermore, the UN Food and Agriculture Organization estimated in 2010 that there are 925 million people in the world who already suffer from malnutrition.[12]

Given this precarious situation, even small further declines in food production could have major consequences.

The large and protracted declines in agricultural output predicted by Ozdogan and Xia are unprecedented in modern times, and the full extent of their impact on human nutrition are difficult to predict.

Normally a decline in agricultural production affects food consumption by raising the cost of food; the decline in "accessible" food, the amount of food that people can afford to buy, is much greater than the decline in "available" food, the actual agricultural output. The impact of rising food prices is, of course, felt disproportionately by people who are already malnourished precisely because they cannot, at baseline prices, afford to buy enough food.

A 2011 study by Webb et al[13], drawing on the data generated by Ozdogan, attempted to estimate the effect that the shortfall in agricultural output following a limited nuclear war would have on the price of food, and therefore on its accessibility. Using a global economy-wide model, the Global Trade Analysis Project (GTAP), the study examined the effects on food prices, and the numbers of people who are malnourished. In order to simulate the shock's effect on cereal and soybean prices, the study assumed that all crops produced globally suffer yield declines to the same extent that Ozdogan predicts for maize and soybeans in the US corn belt.

The study found that the rise in food prices associated with the average yearly decline in food production would cause an additional 40 million

10 www.fao.org/worldfoodsituation/wfs-home/csdb/en/

11 www.usda.gov/oce/commodity/wasde/latest.pdf

12 www.fao.org/publications/sofi/en/

13 ippnw.org/pdf/projected-impacts-webb.pdf

Somalia Suffers from Worst Drought in Century

A woman holding her malnourished baby queues for food at the Badbado camp for Internally Displaced Persons. Famine has been declared in two regions of southern Somalia. In 2011, UN Secretary General Ban Ki-moon indicated that 3.7 million people across the country—that's nearly half of the Somali population—were in crisis and in urgent need of assistance.

UN PHOTO / STUART PRICE

people to become malnourished, and that the largest annual decline in food production in year 5 would cause 67 million to enter the ranks of the malnourished. The cumulative effect over 10 years would cause a total of 215 million people to become malnourished.

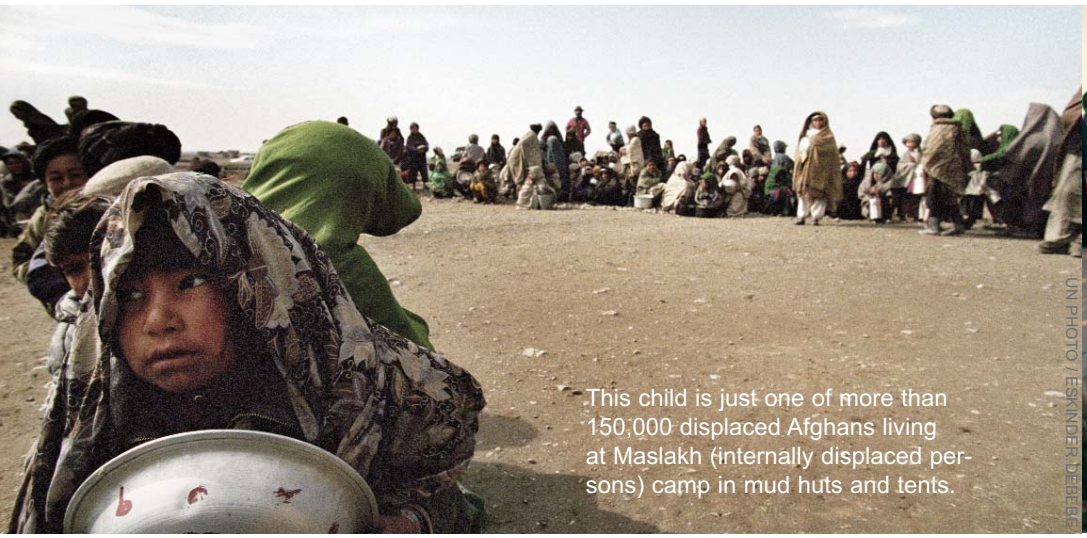
The study concluded that a one year 20% decline in crop yield would cause crop prices to rise 19.7%. But this rise would be very unevenly distributed across the globe. In East Asia the rise would be 21.4% and in South Asia 31.6%. The relationship between crop yield and food prices is not linear: a further decline in yield would lead to a much larger increase in prices. While the current crop studies do not predict a decline of 40%, should that occur, it would cause global crop prices to rise an average of 98.7%. Again the price rise would be very uneven. In South Asia as a whole prices would rise 140.6%, and in India 159.6%.

It is hard to calculate with certainty the effect of these price rises on caloric intake, but the study argues that, "There is a broad consensus in the literature that this parameter [the percentage change in caloric intake given a one percent increase in the price of food] is approximately -0.5." So a one year decline in crop yield of 20% worldwide would lead to a a 19.7% rise in prices and a 10% decline in caloric intake. The much larger increases in food prices in some areas that are predicted in the study would therefore be expected to have a profound effect on the number of calories that people are able to consume.

A number of factors suggest that the accessible food for those who are already malnourished would decline even more dramatically than these numbers suggest. The GTAP model looks only at market behavior and assumes that markets behave "normally." In fact, experience suggests that, in the aftermath of nuclear war, markets would not behave normally. As the authors explain, "Markets react…with commodity speculation, hoarding (withholding of products from the market), or by seeking to capture market share through private non-open market deals (a loss of transaction transparency), each of which contributed to higher price volatility and market uncertainty" in recent years. For example, in March 2008, global wheat prices leaped 25% in a single day; in the following month the price of rice rose 50% in just two weeks.[14] These transient jumps in price were prompted by events far less significant than a nuclear war.

At the time of the great Bengal famine of 1943,

14 Webb, P. 2010. Medium to Long-Run Implications of High Food Prices for Global Nutrition. *Journal of Nutrition.* 140 (1): 140S-47S.



This child is just one of more than 150,000 displaced Afghans living at Maslakh (internally displaced persons) camp in mud huts and tents.

UN PHOTO / ESKINDER DEBEBE

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. 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 increased nearly five fold, making food unaffordable to large numbers of people.[15] 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.

We would have to expect panic on a far greater scale following a nuclear war, even if it were a "limited" regional war, especially as it became clear that there would be significant, sustained agricultural shortfalls over an extended period.

It is probable that there would be hoarding on an international scale as food exporting nations suspended exports in order to assure adequate food supplies for their own populations. In the last decade there have been a number of examples of nations banning grain exports. 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.[16] India banned rice exports in November 2007 which, followed by export rice restrictions in Vietnam, Egypt, and China in January 2008, contributed to historic increases in world rice prices. In 2010, Russia, responding to the severe drought conditions that year, again suspended grain exports.[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. It is also probable that there would be widespread speculation on agricultural markets.

Given these potential disturbances in normal market conditions, it is possible that the increases in food prices could be much larger than predicted by the Global Trade Analysis Project (GTAP) model used in the Webb et al study.

Even if we do not take into account the way that

15 Sen, A. *Poverty and famines*. Oxford: Oxford University Press. 1981.

16 Brown, LR. *Outgrowing the Earth*. New York: WW Norton & Co. 2004.

17 Khrennikov, I. Medvedev orders review of Russian grain export ban at harvest end. 2010. www.businessweek.com/news/2010-10-04/medvedev-orders-review-of-russia-grain-export-ban-at-harvest-end.html

Refugees from Libya queue for food at the Tunisia Transit Camp.

UN PHOTO / OCHA/ DAVID OHANA

rising food prices exacerbate the effects of a fall in food production, the declines in available food predicted by Ozdogan and Xia would be devastating.

For the 925 million people who are currently malnourished, the majority of their caloric intake is derived from grain. For example, in Bangladesh the figure is about 78%. We cannot know with certainty that a 10-20% decline in grain production would translate directly into a 10-20% decline in grain consumption for all 925 million. Some of the malnourished are subsistence farmers who live in areas where grain production might not decline. But we do know that the chronically malnourished cannot survive a significant, sustained further decline in their caloric intake. With a baseline consumption of 1,750 calories per day, even a 10% decline would lead to an additional deficit of 175 calories per day. While many of the malnourished might survive the first year, it is realistic to fear that they would not survive if these conditions persisted for a decade.

Even if minimal, life-sustaining, levels of calories could be provided for all of the malnourished, the decline in quality of nutrition would cause significant health effects. As Webb et al point out in their study:

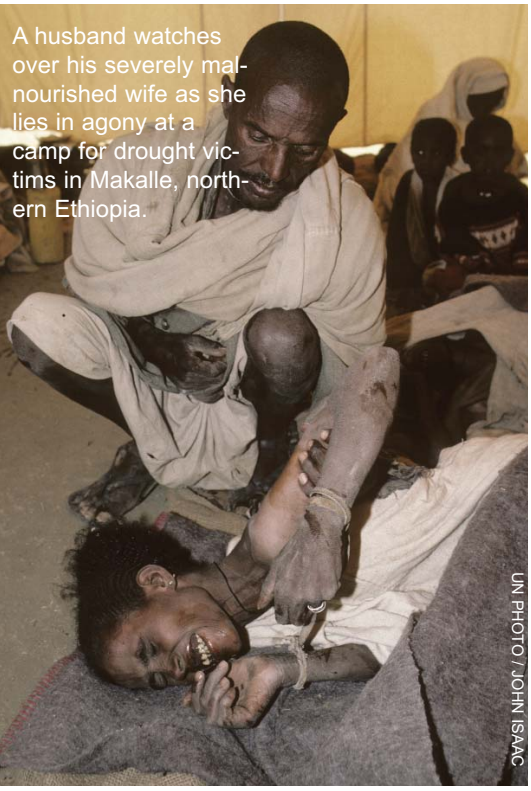
"As food prices rise people spend relatively more on staples and less on 'quality' foods (which tend to be micronutrient rich, including meat, eggs, vegetables, etc.)…

"The specific impacts of reduced diet quality as well as quantity include a rise in wasting among children under 5, maternal undernutrition (low body mass index) which can also cause irreversible damage to the fetus and a rise in rates of low birth weights, and outbreaks of micronutrient deficiency diseases that may be killers in their own right.

"Based on such experiences, one can assume that any large food price increases attendant on a nuclear shock would result in similar shifts in household consumption globally (not only in South Asia) away from nutrient-rich, higher cost foods towards core staples (with a view to buffering at least a minimum energy intake). There are insufficient data to allow for the more complex modeling required to estimate resulting nutrition outcomes in terms of increased micronutrient deficiencies, maternal nutritional compromise or low birth weight. However, it is clear that the human impacts would be huge—with impaired growth and development of children, increased morbidity (due to failing immune functions caused by malnutrition), and a rise in excess mortality."[18]

18 Webb et al, op. cit. 2011. www.ippnw.org/pdf/projected-impacts-webb.pdf

The agricultural disruption caused by a limited nuclear war would also pose a threat to the several hundred million people who enjoy adequate nutrition at this time, but who live in countries that are dependent on food imports. The nations of North Africa, home to more than 150 million people, import more than 45% of their food.[19] Malaysia, South Korea, Japan and Taiwan, as well as a number of countries in the Middle East, import 50% or more of their grain.[20] The anticipated suspension of exports from grain growing countries might cause severe effects on nutrition in all of these countries. The wealthier among them might initially be able to obtain grain by bidding up the price on international markets, but as the extent and duration of the crop losses became clear, exporting countries would probably tighten their bans on exports threatening the food supplies of all these importing countries.


A husband watches over his severely malnourished wife as she lies in agony at a camp for drought victims in Makalle, northern Ethiopia.

UN PHOTO / JOHN ISAAC

Combined with the 925 million people who are currently malnourished, the populations of these food importing countries place the number of people potentially threatened by famine at well over one billion.

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 AD was accompanied by a major outbreak of plague which developed over the next half century into a global pandemic.[21] The famine of 1816 triggered an epidemic of typhus in Ireland that spread to much of Europe[22] and the famine conditions in India that year led to an outbreak of cholera that has been implicated in the first global cholera pandemic.[23] The well studied Great Bengal Famine of 1943 was associated with major local epidemics of cholera, malaria, smallpox, and dysentery.[24]

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 illnesses. 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 would be a very real possibility as states dependent on imports attempted 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 worldwide scope of the climate effects, the dead from these causes might well number in the hundreds of millions.

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19 www.ers.usda.gov/publications/gfa16/GFA16CountryTablesNAfrca.xls.

20 www.iucn.org/themes/wani/eatlas/html/gm19.html.

21 Keys, D. *Catastrophe*. London: Century. 1999.

22 Stommel, H. *Volcano weather: The story of 1816, the year without a winter.* Newport, Rhode Island: Seven Seas Press. 1983.

23 Stommel, H, Stommel, E. op. cit.

24 Sen. op. cit.

According to the World Food Programme, the number of undernourished people worldwide is just under 1 billion - equivalent to the population of North America and Europe combined.

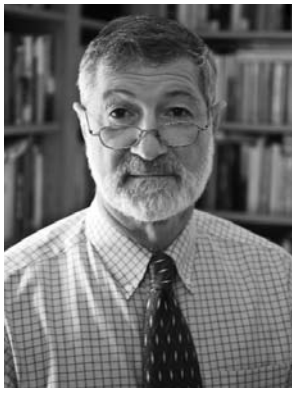
Conclusions and recommendations

The newly generated data on the decline in agricultural production that would follow a limited, regional nuclear war in South Asia support the concern that more than one billion people would be in danger of starvation. Epidemic disease and further conflict spawned by such a famine would put additional hundreds of millions at risk. These findings support the following recommendations:

1) There is an urgent need for further study to confirm the declines in corn and rice production predicted by Ozdogan and Xia, and to examine the effect on other key crops, such as wheat, and in other important food producing countries.

2) There is a need to explore in more detail the subsequent effects that these shortfalls would have on human nutrition including both the extent of the decline in caloric intake that would result from these crop losses and the extent of micronutrient deficiencies that would, in turn, result from this decline in caloric intake.

3) The need for further study notwithstanding, the preliminary data in these studies raises a giant red flag about the threat to humanity posed by the nuclear arms race in South Asia and by the larger and more dangerous nuclear arsenals possessed by the other nuclear weapons states. There is an urgent need to reduce the reliance on nuclear weapons by all nuclear weapons states, and to move with all possible speed to the negotiation of a nuclear weapons convention that will ban these weapons completely.



About the author

Ira Helfand, a physician from Northampton, Massachusetts, has been writing and speaking about the medical consequences of nuclear war on behalf of IPPNW and its US affiliate, Physicians for Social Responsibility, since the 1980s. For the past five years, he has been working with climate scientists Alan Robock, O. B. Toon, and others to help document the health and environmental disaster that would ensue from a range of possible nuclear wars.

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International Physicians for the Prevention of Nuclear War (IPPNW) is a federation of national medical organizations in 63 countries, representing doctors, medical students, other health workers, and concerned citizens who share the common goal of creating a more peaceful and secure world freed from the threat of nuclear annihilation. IPPNW received the 1985 Nobel Peace Prize.

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Founded in 1961, **Physicians for Social Responsibility** (PSR) is a non-profit organization that is the medical and public health voice for policies to prevent nuclear war and proliferation and to slow, stop and reverse global warming and toxic degradation of the environment.

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