

CLIMATE CHANGE

Causes, Impacts and Possible Responses
in Asian Agriculture



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Climate Change: Causes, Impacts and Possible Responses in Asian Agriculture

Our unsustainable way of life is causing a crisis in our environment at a global scale. Climate change is threatening the future of our planet. The crisis is largely our own doing, and we also have the means to solve it, if we are willing to act on it. Farmers, fishers, and indigenous peoples, who live close to nature for their survival, are the most vulnerable to the effects of climate change. But they also have a special role to play in addressing climate change. What they need for survival – sustainable and ecological friendly practices – are also what are needed to heal our planet.

What is climate change?

Climate change is the change in climate directly or indirectly attributed to human activities which alter the composition of global atmosphere in addition to natural variability in climate over a comparable period of time. It is also often referred to as Global Warming.

The average temperature of the earth's surface has risen by 0.74° C since the late 1800s. It is expected to increase by another 1.8° C to 4° C by the year 2100 - a rapid and profound change - should the necessary action not be taken. Even if the minimum predicted increase takes place, it will be larger than any century-long trend in the last 10,000 years. (UNFCCC, Feeling the Heat: 2008)

The manifestations of climate change include: (1) global warming - melting of polar caps and glaciers; (2) extreme weather conditions - prolonged droughts, strong cyclones, hurricanes, etc.; and (3) changes in weather and rainfall patterns. (Daño: 2008)

What are the causes of climate change?

The scientific community has agreed that climate change exists and 90% of scientists agree that much of it is caused by human activities. They say that the effects that we are experiencing are the result of greenhouse gases (GHG) emitted 30 years ago.

Greenhouse gases include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and other gases generated during industrial processes -- the burning of ever-greater quantities of oil, gasoline, and coal, the cutting of forests, and the practice of certain farming methods. Such gases occur naturally - they are critical for life on earth, they keep some of the sun's warmth from reflecting back into space, and without them the world would be a cold and barren place. But in augmented and increasing quantities, they are pushing the global temperature to artificially high levels and altering the climate. Eleven of the last 12 years are the warmest on record, and 1998 was the warmest year. (UNFCCC, Feeling the Heat: 2008)

The three main causes of increase in greenhouse gas emissions are fossil fuels, land use, and agriculture.

Energy- and chemical-intensive farming has led to increased levels of greenhouse gas emissions, primarily as a result of the overuse of fertilizers, land clearance, soil degradation, and intensive animal farming. The total global contribution of agriculture to climate change, including deforestation for farmland and other land use changes, is estimated to be between 17- 32% of all human-induced greenhouse gas emissions. Fertilizer overuse is responsible for the highest single share of agriculture's greenhouse gas emissions. Excess fertilizer results in the emission of nitrous oxide (N₂O), which is some 300 times more potent than carbon dioxide in changing the climate. (Greenpeace: 2008)

These chemical fertilizers and pesticides are produced using fossil fuels too. Crops and various agricultural and food products are being transported at local and international markets using vehicles and ships that use fossil fuels. And as societies become modernized and westernized, agricultural lands are converted to industrial and commercial uses such as factories, office buildings and shopping malls, which use fossil fuels for energy. Furthermore, less agricultural lands means less lands for food production, which can lead to food insecurity.

What are the main effects of climate change?

While many people may only have a vague understanding of the science of climate change, most of us are familiar with its manifestations. Extreme weather, including droughts, heavy rains, heat waves, and stronger typhoons, has occurred more often. Glaciers and ice caps have melted and contributed to the rise in sea levels. Changes in physical processes and biological species or communities have led to migration or disappearance of certain plants and animals.

It is projected that in the next 100 years, the earth's temperature will continue to rise more than it has since the 1900's. Extreme weather events will continue to strike more often. Sea levels will keep on rising. More severe storms and floods will threaten crowded coastlines. Potential crop yields in most tropical and subtropical regions will decrease and cause disruptions in food supply worldwide. Salt water intrusion from rising sea levels will reduce the quality and quantity of freshwater supplies. Most of the world's endangered species will disappear. Dangerous diseases such as malaria will spread to more areas. (UNFCCC, *Feeling the Heat: 2008*)

With these, there will be serious threats to global food security and food sufficiency, consequent loss of cultures and traditions, posing a most serious threat to human survival.

What are the effects of climate change on agriculture?

In agriculture, climate change will have effects on (1) growth of plants, microorganisms; (2) higher temperature in agriculture and agricultural systems/practices; (3) water availability; (4) climate variability; (5) soil fertility and erosion; (6) pests and diseases; and, (7) sea level rise. The effects of climate change will be exacerbated by problems of environment, population, and poverty. Due to environmental damage, nature will be more vulnerable to changes in climate.

Effects on plant growth

Some plants like wheat, rice and soybeans are most sensitive to increased CO₂ in the atmosphere, while other plants like sugarcane, corn & sorghum respond less to increased CO₂ in the air. There are unknown effects on plant physiology, but are only based on controlled experiments. There are also unknown effects on soil microorganisms.

Effects of higher temperature

Higher temperature will alter cropping patterns across regions and altitudes. Agriculture may expand in higher altitude areas, but with much less yield due to less fertile soil. There will also be adverse effect on plant growth and productivity by higher temperatures.

Water availability

Moisture stress due to changes in rainfall and evaporation pattern is harmful to plant growth. There will be increased demand for irrigation, thus greater competition for water resources. Already, agriculture consumes up to 77% of freshwater use in Southeast Asia. There will also be demand for higher investments in irrigation infrastructures. And intensified evaporation will increase salt accumulation in the soil.

Climate variability

Extreme weather conditions disrupt crop production. Increases in temperature are detrimental to plant growth, esp. in rice, which is planted in regions with maximum temperature limits for rice growing. Prolonged droughts also reduce water supply.

Soil fertility and erosion

Warmer conditions will speed up natural decomposition of organic matters and will increase the rates of other soil processes that affect fertility. No comprehensive study has been done yet on impacts of climate change on soil microbial growth. Loss of soil fertility will result to greater use of synthetic fertilizers with adverse impacts on soil and water quality. Warmer conditions may result to the increase in continual cycling of plant nutrients in the soil-plant-atmosphere system, thus increasing greenhouse gas emissions (CO₂ and N₂O). Nitrogen fixation in soil may also increase coupled with limited moisture, resulting to drier soil that may suppress root growth, thus, making plant susceptible to wind erosion.

Pests and diseases

Favorable conditions for insect pests in warmer climates will arise, as longer growing seasons will enable insects to complete more reproductive cycles. Altered wind patterns may change the spread of wind-borne pests and agents of crop disease. More pest and disease infestation may result to greater use of pesticides.

Sea-level rise

There will be a rise in sea level due to thermal expansion of sea water and partial melting of land-based glaciers and sea-ice. According to the IPCC, sea level rise may range from 0.1 to 0.5 meters by the middle of the next century. This presents huge threats to agriculture in low-lying coastal areas and most island-states.

(Daño: 2008)

Who are/will be affected?

Climate change will affect all of humanity, but the poor countries/people are most vulnerable and will be affected the most. Ironically, poor countries/people have the least contribution to climate change. They have low greenhouse gas emissions per capita and low historical carbon footprints (a measure of the impact human activities have on the environment in terms of the amount of greenhouse gases produced, measured in units of carbon dioxide). (Daño: 2008)

The world's vast human population, much of it poor, is more vulnerable to climate stress. Indeed, climate change will have a disproportionate impact on the poor in the developing countries. As the UNFCCC puts it succinctly, Global warming almost certainly will be unfair. The industrialized countries of North America and Western Europe, along with a few other states, are responsible for the vast bulk of past and current greenhouse-gas emissions. These emissions are a debt unwittingly incurred for the high standards of living enjoyed by a minority of the world's population. Yet those to suffer most from climate change will be in the developing world. They have fewer resources for coping with storms, with floods, with droughts, with disease outbreaks, and with disruptions to food and water supplies. They are eager for economic development themselves, but may find that this already difficult process has become more difficult because of climate change. The poorer nations of the world have done almost nothing to cause global warming yet are most exposed to its effects. (UNFCCC, *Feeling the Heat*: 2008)

Women are the most affected by climate change because they often have fewer means to adapt and prepare for extreme weather conditions and disasters. Women living in poverty are the most threatened by the dangers that stem from global warming. They are also key actors in ensuring their communities' ability to cope with and adapt to climate change. When we approach climate change from the perspective of women, we see the ways that women are made vulnerable to

threats associated with climate change, and that women's skills and leadership are crucial for people's survival and recovery. Therefore, defending the full range of women's human rights within the context of addressing climate change is essential both to protecting women themselves and to cultivating their capacity for leadership—on which so many lives depend. (MADRE: 2008)

How small scale farmers will be affected by climate change, particular areas that will be affected, and how they will be affected:

Ka Rene Peñas, PAKISAMA, Philippines:

In the province of Bukidnon in Southern Philippines, the effect of climate change has been observed. In the 1980's to the 1990's, the 1st cropping of corn was from April to May. Then, the 2nd cropping was from August to September. However, in 2000, the planting season changed. Planting was now being done in the last week of May or the 1st week of June, and then we are no longer sure if we will have a 2nd cropping season.

The rainy season is also now shorter. Notably, Bukidnon province now experiences drought, which has not happened in the past.

The changes in climate patterns also affect farmers who traditionally plant at certain times. If drought happens at that time, it will be very hard for us. One example of a crop that will be severely affected by drought is coconut. Its seeds are becoming smaller, thus leading to a decrease in production.

Huang, Tsung-Chi, TDFA, Taiwan:

Climate change has impact on imported grass from Australia that is used as feeds for milking cows. As price of feeds increase, farmers are able to buy less and less grass. This then leads to decrease in milk production of the cows.

Vu Le Y Voan, VNFU, Vietnam:

The river deltas and coastal areas in Asia will be among the worst affected regions. Vietnam is one of the countries worst hit by climate change. About one

third of the population and one sixth of the land area will be affected.

Climate change is taking away or reducing farmers' assets and resources. Houses, cattle, and working facilities are destroyed after every strong storm, flood, or typhoon.

In 2007, Vietnam experienced strong storms from May/June to December in the North, in the central coastal region, and in the South. In 2006, Vietnam had a loss of USD 1.2 billion because of typhoons. There were heavy droughts which lasted for a long time in North West mountainous areas, Central highlands and Southern provinces (Ninh Thuan and Binh Thuan, where nearly 2 million people depend on the land affected by drought). Floods often happen in the North and Central provinces (from Nghe An to Quang Nam, Quang Ngai). The rise in sea level (ranging from 10 to 85 cm between 2007 and 2100) will cause loss of coastal land, and will lead to decrease in agriculture productivity. It will cause food insecurity and pose enormous risks to Vietnam. In 2007, Vietnam's rice production accounted for 43% of the gross revenue of agriculture products. In 2008, the yield of rice may be reduced because of the previous long cold period (nearly 40 days). When climate is changed so much, and temperature is too high or too low, it can decrease the rice yields. In February 2008, the provinces in North Vietnam experienced damaging cold, which led to a loss of 400 billion VND (1 USD=15,900 VND). 5,000 cattle died, 146,150 hectares of young rice/seedlings died, and 15,000 hectares of crops such as maize, peanut, and soybean were spoiled.

Oun Sophal, FNN, Cambodia:

There will be an increase in expenses to treat diseases. Productivity will decrease, in terms of quantity and quality. Farmers will as a result, have less food on our tables.

Khun Prawit Panchareon, SORKORPOR, Thailand:

In Thailand, the impact of climate change has been discussed for some time, but farmers do not discuss

much about it. We have very little understanding of it. But we can see the changes. We saw that drought and diseases are more serious. In the past 20 years, there occurred heavy rainfall, twice in the South, once in the North, destroying the soil and affecting communities and farms. Beside heavy rainfall, long drought also happened many times in the past 20 years. In the past 10 years, we had a long drought in the Southern part of Thailand. Rubber trees died because of lack of water. The drought also had some effects on the river. Twenty years ago we could not walk through it, but now, we can do so. Underground water, which can be used year-round before, is now finished as early as March instead of May. Rubber plantation farmers lost a lot of products. In many areas, farmers are now competing for water for their fruit trees, which did not usually happen in Thailand before.

Muhammad Nuruddin, API, Indonesia:

In the 1970's to the 1990's the first cropping in Indonesia was from October to January, the second cropping in February to May, then May to August is for planting corn or soybeans. Now, the season calendar changed between the West and the East. In the West, there is good irrigation; in the East, there is dry land. The first cropping is now from January to March, the second cropping from March to June, and from June to October, the farmers cannot plant anymore.

Park, Eui Kyu, KAFF, Korea:

Pig farmers are affected when price of feeds increase or when supply decline due to changes in weather condition.

(Taken from the Proceedings of AFA's Consultation on Climate Change, Cheonan, South Korea, February 29-March 2, 2008)

What is being and can be done?

Global warming is a modern problem - complicated, involving the entire world, tangled up with

difficult issues such as poverty, economic development and population growth. Dealing with it will not be easy. Ignoring it will be worse. (UNFCCC, *Feeling the Heat*: 2008)

Despite dire predictions of climate change impacts, there are measures that we can take, as nations, as communities, as individuals, to slow the rate of global warming and help the world cope with the climate shifts that occur. We must reduce emissions by using oil and coal more efficiently, switching to renewable forms of energy, and developing new industrial and transport technologies. We must expand forests, which help remove carbon dioxide from the atmosphere. We must change lifestyles and government policies and regulations to promote more efficient use of energy and reduce global warming. We must promote coping mechanisms to reduce the inevitable consequences of global warming. (UNFCCC, *Feeling the Heat*: 2008)

There is a need to shift to organic agriculture, defined by the FAO as a holistic production management system that avoids the use of synthetic fertilizers and pesticides, and genetically modified organisms, minimizes pollution of air, soil and water, and optimises the health and productivity of plants, animals and people. Organic agriculture relies on fossil fuel independent, locally available resources that incur minimal agro-ecological stresses and are cost effective. FAO calls it a neo-traditional food system which combines modern science and indigenous knowledge. (ISIS: 2007)

Over a decade ago, most countries joined an international treaty - the United Nations Framework Convention on Climate Change - to begin to consider what can be done to reduce global warming and to cope with whatever temperature increases are inevitable. More recently, a number of nations approved an addition to the treaty, called the Kyoto Protocol, which has more powerful (and legally binding) measures. The Protocol's first commitment period began in 2008 and ends in 2012. A strong multilateral framework needs to

Initiatives and proposals to help members cope with and/or counter the effects of climate change:

Ka Vic Fabe, PAKISAMA, Philippines:

Farmers do intercropping of corn and cassava, because the 2nd cropping of corn is no longer successful. Cassava is harvested after 10 months.

Huang, Shun-Fa, TWADA, Taiwan:

TWADA gives technical training to members on how to adapt production, despite extreme climate change. Members with experience share their knowledge with other members.

Vu Le Y Voan, VNFU, Vietnam:

We call on our government to provide immediate support in terms of food and inputs for production after natural disasters. Government should create adaptation strategies to minimize the losses of farmers and the agriculture sector and develop sustainable agriculture using environment friendly technologies (organic farming, IPM, GAP). Farmers will adjust cropping calendars (When to plant, what to plant, where to plant). For example, adjusting calendar for short season crops. Improve irrigation-drainage water systems, especially in rice fields. Increase research on developing new crop varieties considering climate change conditions.

Oun Sophal, FNN, Cambodia:

FNN will make members more aware of the impacts of climate change. It will convene members to replant trees, establish disaster zones, and improve the cook-stove to save trees from being used as firewood. It will promote ecological agriculture. It is implementing a project on linking small farmers to market to sell their organic products. It will organize training workshops for farmer representatives on climate change. It will encourage members to cope with climate change through funds and other support.

Khun Prawit Panchareon, SORKORPOR, Thailand:

SorKorPor is involved in planting trees for debt. Planting more trees will help lessen the impact of climate change and help pay the farmers' debt.

(Taken from the Proceedings of AFA's Consultation on Climate Change, Cheonan, South Korea, February 29-March 2, 2008)

What are our calls to governments, both at international and national levels?

We call on inter-government bodies to

a. Ensure that initiatives on climate change adaptation and mitigation are beneficial for developing and least developed countries and that proposals for climate change financing are opened up to wider ownership and engagement from all stakeholders, including small-scale men and women farmers, fishers, and indigenous peoples.

We call on regional and multilateral institutions such as ASEAN, FAO, IFAD, ADB and WB to

a. Support rural communities in adaptation and mitigation actions to ensure that available and future funding mechanisms for climate change actions will support farmers' efforts in adaptation and mitigation such as (i) the Adaptation Fund under the Kyoto Protocol, (ii) various multilateral and bilateral programs, and (iii) World Bank's new funding facilities on climate change.

We call on our national governments to

a. Reduce the risks of climate change among poor small scale men and women farmers, fishers and indigenous peoples.

-Develop community-based disaster management programs. Establish early warning systems with strong information dissemination mechanisms especially for the vulnerable groups.

-Support researches that help small scale farmers and fishers to cope up with the effects of climate change --

crops to plant, seed variety to use using sustainable, ecologically friendly approaches. Support their on-ground experimentation on these matters. Ensure effective and efficient agricultural extension work, in efforts to disseminate research findings.

-Formulate national climate change strategies and programs, especially those that closely relate to agriculture, in consultation with small men and women farmers.

-Allocate adequate financial resources, technical support, etc. for climate change adaptation and mitigation measures in agriculture such as awareness-raising among rural communities on climate change and its impacts, mobilizing communities in adaptation measures and actions.

b. Reverse the trend of climate change by mainstreaming sustainable, ecological, organic agriculture and use of renewable energies.

-Recognize the role of small scale farmers, fishers and indigenous peoples as custodians of the natural resource base. Establish and effectively implement policies that give them access and control over these natural resources, such as land, waters, seas and seeds.

-Promote agriculture and fisheries that effectively lift the rural people, both men and women, from poverty, utilize local wisdom and appropriate, environment-friendly technologies, get fair prices from fair markets, and preserve the agricultural heritage of rural communities against devastating impacts of corporate-led agriculture and fisheries.

-Mainstream sustainable, organic agriculture through massive extension and promotion. Support for soil conservation and incentives for sustainable production practices should be given to small scale men and women farmers, fishers and indigenous peoples.

-Formulate standards for sustainable and fair production and marketing, such that farmers and traders are encouraged to produce and sell only products that are produced in a safe and sustainable manner and that give fair returns to small producers.

-Develop an energy policy that promotes the increasing use of reusable sources of energy including solar, water, and wind energy as well as bio-fuels. However, the development of renewable sources, especially bio-fuel energy, should consider the balance between meeting the needs on energy and food security of the people, especially that of small men and women farmers, fishers and indigenous peoples. As much as possible, encourage and assist community-based farmers' groups to manage the production, marketing and trading of bio-fuels, primarily for their own locality's energy needs.

What are our calls to our fellow small producers?

We call on each small man and woman rural producer to support and practice various forms and technologies of sustainable, eco-friendly, organic agriculture. AFA is committed to the promotion of sustainable, organic agriculture and makes efforts to spread its practice among its members. Together with other advocates of organic agriculture, sustainable rural development, equity-led trade and agrarian reform, renewable energies, and simple lifestyle, we will join hands in making the earth not only a cooler planet, but one which is more just, fair and caring for small scale men and women farmers, fishers and indigenous peoples.

We encourage small men and women farmers, both as individuals and as organizations at the national and international levels, to

a. Engage their governments to ensure that grants and loans for climate change mitigation, adaptation and prevention benefit and go to their communities. For example, in September 2008, leading industrialized nations pledged more than US\$6.1 billion to the Climate Investment Funds, a pair of international investment instruments designed to provide interim, scaled-up funding to help developing countries in their efforts to mitigate increases in greenhouse gas (GHG) emissions and adapt to climate change. Formally approved on July 1 by the World Bank Board of Executive Directors, the first proposals to benefit from funding under the CIF are expected to be announced early in

2009. The funds, to be disbursed as grants, highly concessional loans, and/or risk mitigation instruments, will be administered through the multilateral development banks and the World Bank Group.

Also, two trust funds are being created under the Climate Investment Funds. The Clean Technology Fund will invest in projects and programs in developing countries that contribute to the demonstration, deployment, and transfer of low-carbon technologies. The projects or programs must have a significant potential for long-term greenhouse gas savings. The second fund, the Strategic Climate Fund, will be broader and more flexible in scope. It will serve as an overarching fund for various programs to test innovative approaches to climate change. The first program under this fund is a pilot aimed at increasing climate resilience in developing countries. A Forest Investment Program and a Scaling-Up Renewable Energy Program are also expected to be created in the coming months. (World Bank: 2008)

What are the most recent and most popular climate adaptation and mitigation measures for agriculture?

Climate change adaptation techniques include: (1) development of adaptive seed varieties, such as drought-resistant, flood-tolerant or later-maturing crop varieties through conventional breeding using traditional and local adaptive varieties; (2) switching crop varieties or crop types; (3) adjusting the timing of crop management or farm operation; (4) conservation of soil moisture through no-tillage systems, etc.; (5) increasing irrigation efficiency; (6) shifts in regional production centers; (7) adjustment of capital, land and labor allocation (shifting of labor and investments to non-agriculture activities); (8) market and trade adjustments; and, (9) relocation to other areas, resulting in the phenomenon of climate refugees.

Organic agriculture needs to be promoted for climate change adaptation and mitigation. Organic agriculture (1) does not depend on chemical inputs; (2) uses lo-

cally available materials; (3) depends on natural biomass; (4) uses appropriate and accessible technologies; (5) minimizes water dependence through approaches like SRI (systematic rice intensification); (6) relies on locally-adapted traditional and local crop (and animal) varieties; (7) creates a diversity of crop species in the farm which serve as carbon sink; and (8 helps reduce food miles) through local marketing of organic products. (Daño: 2008)

Conclusion

Climate change is one of the most serious threats that the world faces today. Scientists predict catastrophic impacts in the years to come if it is not abated. Already, its effects are being felt worldwide. Agriculture, especially in developing countries, is most vulnerable. Small farmers are the most threatened. The biggest contributors to climate change are industries and big agricultural companies. Countries have signed on to the UNFCCC and to the Kyoto protocol to curb greenhouse gas emissions.

We believe that sustainable, organic/ecological friendly agriculture which is owned, controlled and managed by small scale men and women farmers, fishers and indigenous people, and supported by government policies and programs, is a key to a significant reduction of greenhouse gases. Much more needs to be done. Farmers have a special role to play. For what they need to survive as small producers living close to nature are what the world also needs to survive – agricultural practices and a lifestyle that are sustainable and ecologically sound.



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