

IMPACT OF GLOBAL WARMING ON FOOD SECURITY OF SOUTH EAST ASIA

Southeast Asia occupies a special position on the globe, as it is constituted of countries exhibiting huge variations in their fiscal situation. On one end are the affluent states like Singapore and Malaysia, where the concept of food insecurity is unimaginable, and the other end is weighed down by the impoverished states of Burma and Laos, where food insecurity is a norm. However, whether the states are prosperous or destitute, the weather does not discriminate between them, and mauls them all with its ravaging monsoon rains, mounting sea levels, devastating droughts and catastrophic cyclones.

This article is a description of the effects of global warming on the countries in Southeast Asia, with their resultant effects on the food security of the affected nations. For this purpose, first an introduction to the terms and technical words is made, followed by a brief profile of Southeast Asia. Further on, we discuss the effects of global warming in Southeast Asia with the disastrous effects on its food security.

DEFINITIONS

1. CLIMATE

According to the Intergovernmental Panel on Climate Change (IPCC), Climate is often defined as 'average weather'. Climate is usually described in terms of the mean and variability of temperature, precipitation and wind over a period of time, ranging from months to millions of years (the classical period is 30 years).

2. GREEN HOUSE EFFECT

Green House effect is the phenomenon whereby the earth's atmosphere traps solar radiation, and is mediated by the presence in the atmosphere of gases such as carbon dioxide, water vapor, and methane that allow incoming sunlight to pass through, but absorb the heat radiated back from the earth's surface.

3. GLOBAL WARMING

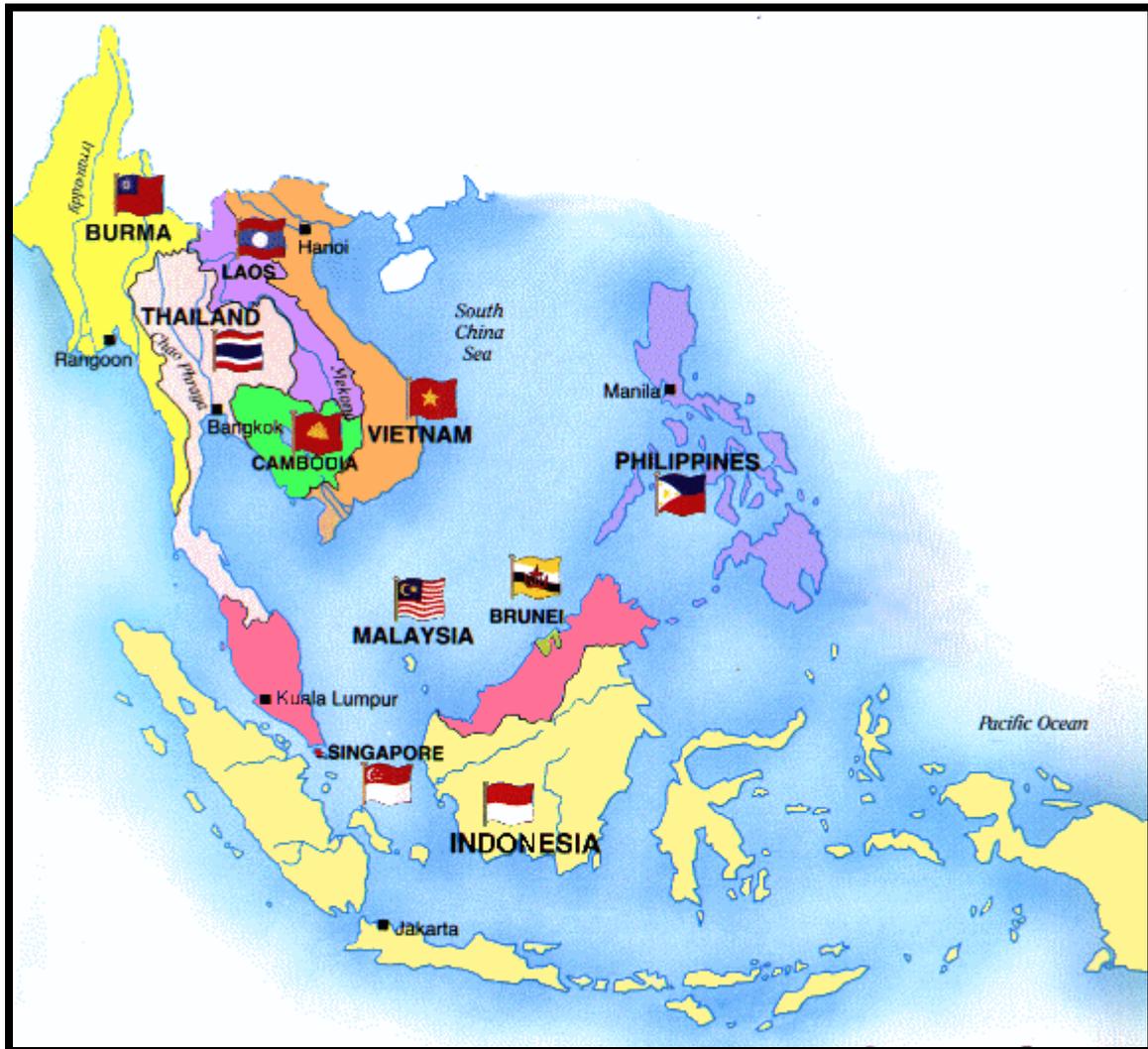
The human activities like burning of fossil fuels, excessive smoke discharges from factories and the depletion of forests have led to an increase in the concentration of the Greenhouse Gases(GHG's) in the earth's atmosphere, which are responsible for trapping excessive heat inside the environment and thus increasing the overall temperature of the earth, leading to the phenomenon of Global Warming.

4. FOOD SECURITY

Food security is achieved when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. there are four aspects of food security; Food availability, Sources of food supplies, Access to food and Quality dimension.

AN INTRODUCTION TO SOUTHEAST ASIA

Southeast Asia occupies a significant position on the globe, with the countries lying on the crossroads of the geological plates. This makes the states of Southeast Asia highly susceptible to weather changes, torrential rains and volcanic activity. There are vast variations in the land and climate; at some places boiling volcanic regions like the Malay archipelago are present, and other places like the Island of New Guinea are clustered with ice glaciers. The region comprises of about ten states, most of them being island groups, known as archipelago. The geographical distribution of these states is into two groups.



1. Mainland Southeast Asia

- Thailand
- Vietnam
- Burma

- Laos
- Cambodia
- Peninsular Malaysia

2. Maritime Southeast Asia

- Indonesia
- Philippines
- Brunei
- East Malaysia
- Singapore

A BRIEF INTRODUCTION TO THE STATES OF SOUTHEAST ASIA

1. THAILAND

Thailand is the world's 51st largest country with an area of 513,120 square kilometers, and the world's 20th most populous country with a population reaching 64 million people. It is located in the centre of mainland southeast Asia with a predominant monsoon weather.

2. VIETNAM

Vietnam occupies the eastern border of the mainland southeast Asia. Therefore it has a long coastline of 3444 km, making it very susceptible to tsunamis and cyclones. It is located between the latitudes 8° and 24°N and the longitudes 102° and 110°E with a total area of around 331,210 km², and boasts a heavy population of 87.8 million people, making it the world's 13th most populous country.

3. BURMA

Burma is a large country, occupying 676,578 km² of land, making it the 40th largest country in the world. It has a large population of around 60.28 million, making it the 24th most populous country of the world. The country lies sandwiched between the Tropic of Cancer and the Equator, so that it has a heavy rainfall, particularly in the coastal regions, which receive over 5000mm rain annually. It has a large coastline of 1930 km which makes it susceptible to the rising sea levels and cyclones associated with global warming.

4. LAOS

Laos is one of the most impoverished states of southeast Asia with a population of 6,288,037 million people. It is a non-coastal zone, bordering with Vietnam to the east, Burma and China to the northwest, Cambodia to the south and Thailand to the west. It lies between the latitudes 14° and 23°N°, and longitudes 100° and 108°E, with a distinct rainy season.

5. CAMBODIA

Cambodia is located at the southern border of the mainland southeast Asia, and therefore has along coastline of 443 km along the Gulf of Thailand. It has a total area of 181,035 square km, with a population of 14.8 million, making it the world's 68th most populous country. It lies between the latitudes 10° and 15°N, and longitudes 102° and 108°E and boasts a landscape that is mostly made of low lying plains. The country faces extreme monsoons, with recurrent flooding.

6. MALAYSIA

Malaysia is the only country in Southeast Asia which occupies both parts of it. Malaysia can be divided into two parts. The Peninsular Malaysia and east Malaysia, both parts separated from each other by the South China Sea. The total area of Malaysia is 392,847 square kilometers, with a predominant monsoon climate. The vicinity of the oceans leads to a great susceptibility to climatic disasters, like the rising sea levels, droughts, cyclones and tsunamis.

7. INDONESIA

Indonesia is the largest archipelago in the world, comprising of 17508 islands. It lies between latitudes 11°S and 6°N, and longitudes 95°E and 141°E. It is the world's fourth most populous country with a population of around 238 million people. Indonesia occupies a distinct location on the world map, lying on the edges of the Pacific, Australian and Eurasian tectonic plates. As a result, about 150 active volcanoes are present in Indonesia, accompanied by frequent earthquakes. The weather in Indonesia is usually tropical, with a predominant monsoon.

8. PHILIPPINES

The Philippines is also an archipelago, consisting of about 7107 islands, with a huge population of around 92 million, making it the world's 12th most populous country. It is bounded by the Sulu Sea, the Celebes Sea and the Philippine sea, and the locations renders it susceptible to cyclones and tsunamis. It is located on the Pacific ring of Fire, which causes the occurrence of frequent earthquakes. The climate is basically tropical, with heavy rainfall received in the monsoon seasons.

9. BRUNEI

Brunei is an affluent state, ranked the world's fifth richest nation by Forbes because of an abundance of petroleum and natural gas fields. It has two independent parts and a total land area of 5765 square km with a population of 401,890 people. Most of the land is covered by rain forests, and the climate is tropically equatorial.

10. SINGAPORE

Singapore is also one of the most affluent states of Southeast Asia, and is the fourth leading financial centre of the world. It is also an archipelago consisting of 63 islands, with a population of around 5 million. It has a tropical rainforest climate in which there is a uniform temperature throughout the year with abundant rainfall.

EFFECT OF GLOBAL WARMING ON CLIMATE OF SOUTHEAST ASIA

Southeast Asia is highly vulnerable to the changing climate. All the countries are surrounded by seas, rising levels of which are engulfing parts of the states. In addition, global warming is also known to trigger climatic changes like tsunamis, cyclones and floods which specifically target the coastal areas. In the past decade, exceptionally severe climatic disasters wrecked havoc on the Southeast Asian states, causing massive financial and life losses. In addition, the food supply of these countries was also hampered by the floods and droughts ravaging the entire region. A chart showing the major climatic catastrophes of the past decade in the Southeast Asian region is given below.

A TIMELINE OF THE MAJOR CLIMATIC DISASTERS IN SOUTHEAST ASIA IN THE PAST DECADE

DATES	EFFECTS	COUNTRY
1-8 August 2012	Typhoon Habagat hit the country, causing massive flooding, leaving 95 people dead and damages of at least ₱604.63 million	Philippines
22 December 2011	flooding with more than 1000 people missing	southern Philippines
26 September 2011	Typhoon Nesat causing damage of \$361 million	Philippines
16 January to 25 July 2011	worst flooding in 50 years of history with a loss of \$45.7 billion	Thailand
25 October 2010	Earthquake of 7.7 magnitude, leading to the formation of a mega tsunami, killing 435 people, and displacing 20,000	Sumatra, Indonesia
18 October 2010	Typhoon Megi hit the country with damages of \$255 million	Philippines
29 September 2009	Earthquake of 7.9 magnitude hit Sumatra, also affecting Singapore and Malaysia, triggering tsunamis, killing 1115 people	Sumatra, Indonesia
23 September 2009	Typhoon Ketsana hit Manila, adding to the damage of the continuous flooding from the pacific typhoons 2009, killing	Manila, Philippines

	465 people	
3 may 2008	Cyclone Nargis hit Burma, the worst natural disaster in history of Burma, with 138,366 fatalities and damage of \$10 billion	Burma
2 February–12 February 2007	Severe floods in Jakarta with damages of \$400 million	Jakarta, Indonesia
May- November 2006	About 18 cyclones from the 2006 Pacific cyclone season hit the country, causing flooding, evacuations and leaving thousands dead	Philippines
17 July 2006	Earthquake of 7.7 magnitude brought a 3 meter high tsunami, killing at least 668 people	Indonesia
26 December 2004	An earthquake of magnitude 9.1 struck the Indian ocean and brought the worst tsunami in the world's history, with 280,000 casualties in Indonesia	Indonesia

CLIMATE CHANGE VULNERABILITY MAP OF SOUTHEAST ASIA

The Climate Change Vulnerability Map of Southeast Asia is a mapping of the countries according to their susceptibility to climatic disasters, published in January 2009. The map shows that almost all of the Philippines, Indonesia, Cambodia, the Mekong River Delta in Vietnam and the Bangkok region of Thailand are highly susceptible to climatic disasters. The below given map shows all the countries in Southeast Asia with specific colors that shows their vulnerability to the climatic disasters. The regions depicted in red are the ones that are the most susceptible, e.g. Philippines, and the ones in yellow show that these regions are not vulnerable, like most of Malaysia.

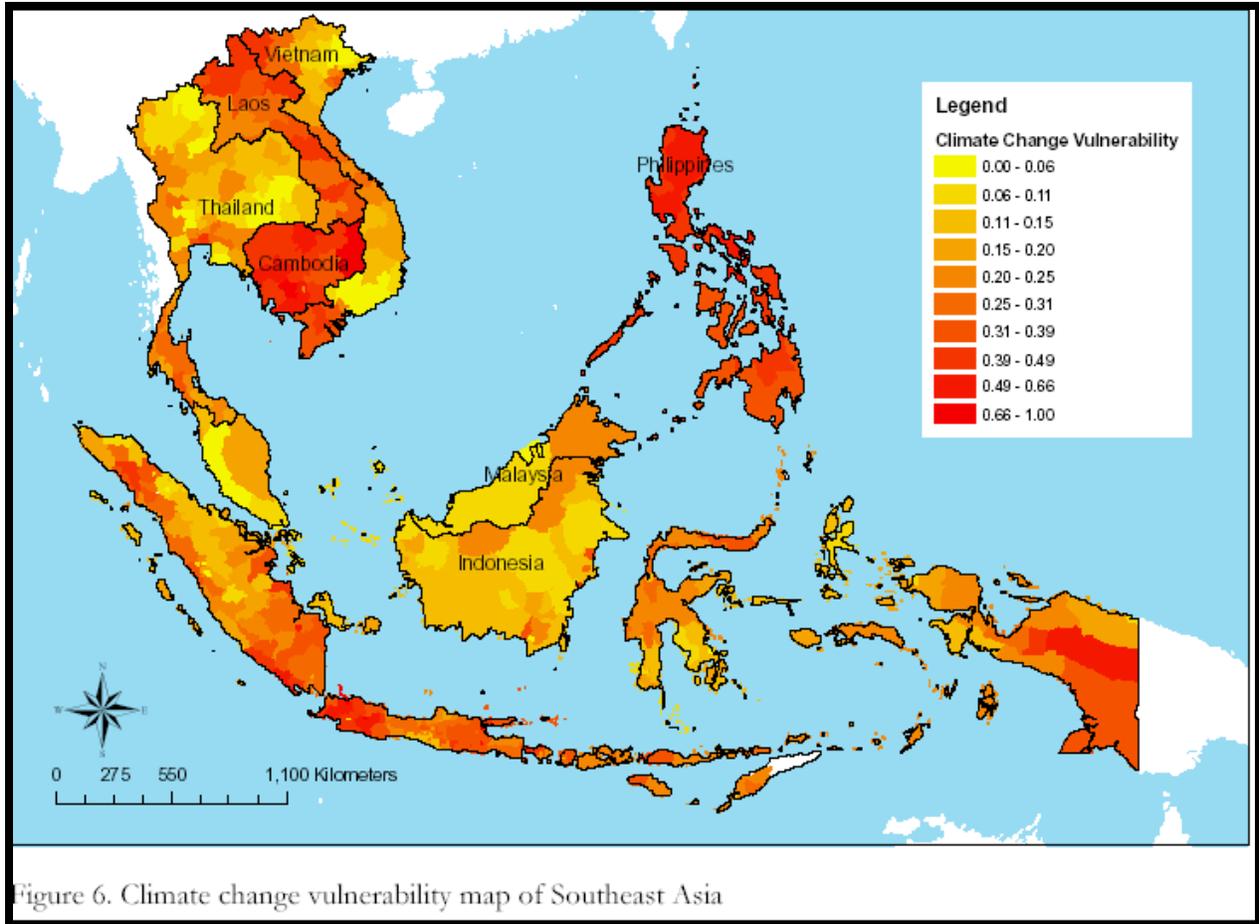


Figure 6. Climate change vulnerability map of Southeast Asia

Similarly, The chart given below shows the most vulnerable regions with the most probable climatic disasters liable to hit them.

COUNTRY	CLIMATIC CHANGE
Northwestern Vietnam	Droughts
Eastern coastal areas of Vietnam	Cyclones, droughts
Mekong region of Vietnam	Sea level rise
Bangkok and its surrounding area in Thailand	Sea level rise, floods
Southern regions of Thailand	Droughts, floods
The Philippines	Cyclones, landslides, floods, droughts
Sabah state in Malaysia	Droughts
Western and eastern area of Java Island,	Droughts, floods, landslides, sea level rise

FOOD INSECURITY IN SOUTHEAST ASIA DUE TO CLIMATIC DISASTERS

As explained above, the term 'food security' has four dimensions. These are the availability of food, the sources of food, the access to food and the quality of food. A decrease in any of the four dimensions causes a situation of 'food insecurity'. For example, people may have access to rice as a staple food, but a concurrent deficiency of fruits and vegetables affects the 'quality dimension' and thus leads to a deficiency of essential minerals and vitamins, ultimately resulting in malnutrition.

Southeast Asia exhibits a wide spectrum of countries regarding food security. The countries like Brunei and Singapore are one part of the spectrum, where the term 'food insecurity' is not imaginable because of the small population and rising economics. On the other hand, countries like Laos, Indonesia, Burma and Philippines exhibit the other dark side of the spectrum with hundreds of homes facing the situation of food insecurity, and where the concept of foodless days still exists.

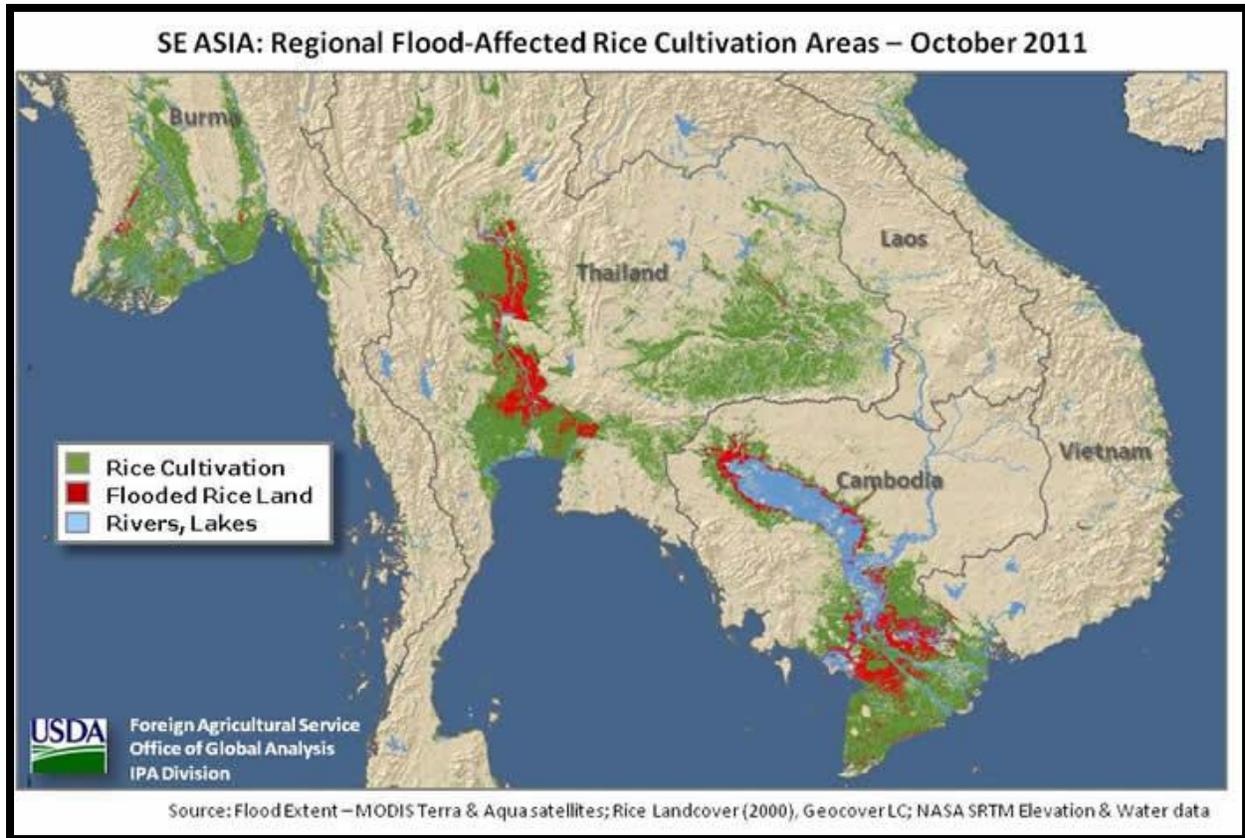
Southeast Asia has been naturally blessed with a rich soil and sufficient rainfall so that there is an enormous agricultural potential in these countries. However, in the recent times, global warming has resulted in a series of catastrophic climatic disasters like floods, cyclones, tsunamis and droughts, which have ravaged the region's agricultural capacity, slain millions of edible animal food reserves and destroyed the aquatic habitats so that the food supply of people has been cut short severely. As a result, a grave state of malnutrition exists in these countries, with widespread deficiencies of vitamins and minerals and rare states like protein calorie malnutrition frequently occurring in the population.

The climatic disasters have affected the food supply of the Southeast Asian nations in the manners given below.

1. DESTRUCTION OF EXISTING CROPS BY FLOODS AND CYCLONES

The frequency and intensity of floods and cyclones have increased in intensity over the last decade because of the process of global warming. As a result, these climatic disasters have swept away the standing crops, cutting down the major food supply of the people of these countries. In the year 2011 alone, the continuous spell of floods and cyclones caused immense damage to the agricultural field, destroying millions of hectares of farmland. The following statistics were encountered in the year 2011.

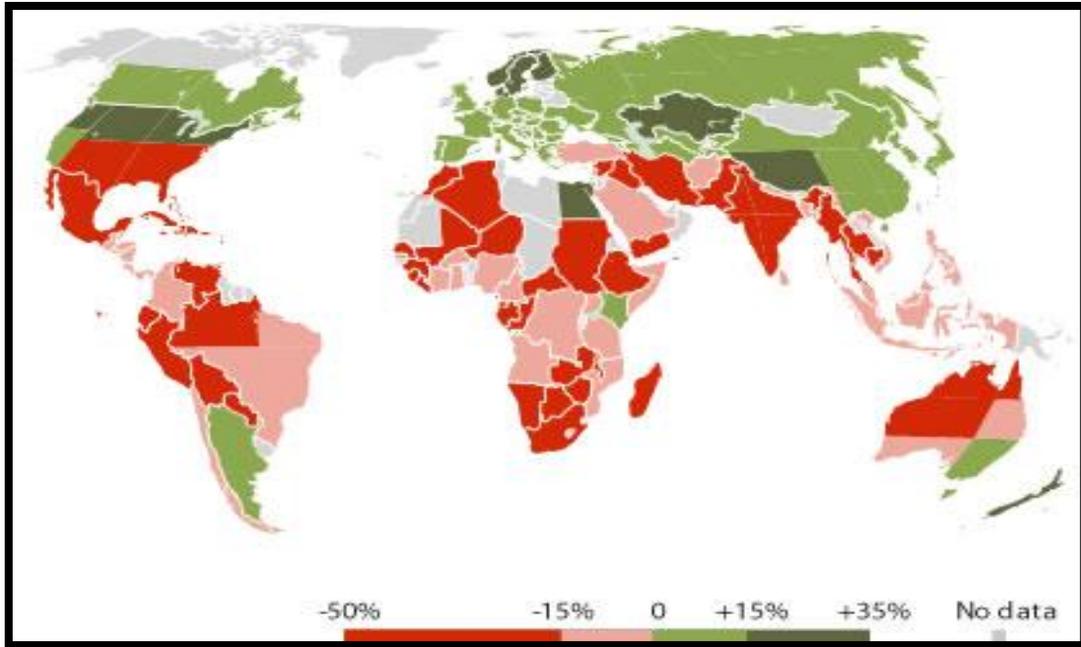
- a. Thousands of hectares of crops destroyed by the floods in Indonesia
- b. 269,000 hectares of farmland submerged in flood water in Thailand
- c. 10,000 hectares of crops damaged by the Philippines floods
- d. 99000 hectares of crops submerged in the flood water in Vietnam



In addition, the destructive Cyclone Nargis of 2008 swamped an estimated 783,000 hectares of agricultural land, leading to the destruction of one third of the rice crop in the Ayeyarwady (Irrawaddy) delta, the country's rice bowl and also swept away the rice seeds stored in the containers. The Pacific Cyclone Season and the 2005 tsunami also deprived the countries of the majority of their standing crops.

2. EFFECT OF THE RISING TEMPERATURES ON THE AGRICULTURAL PRODUCTIVITY

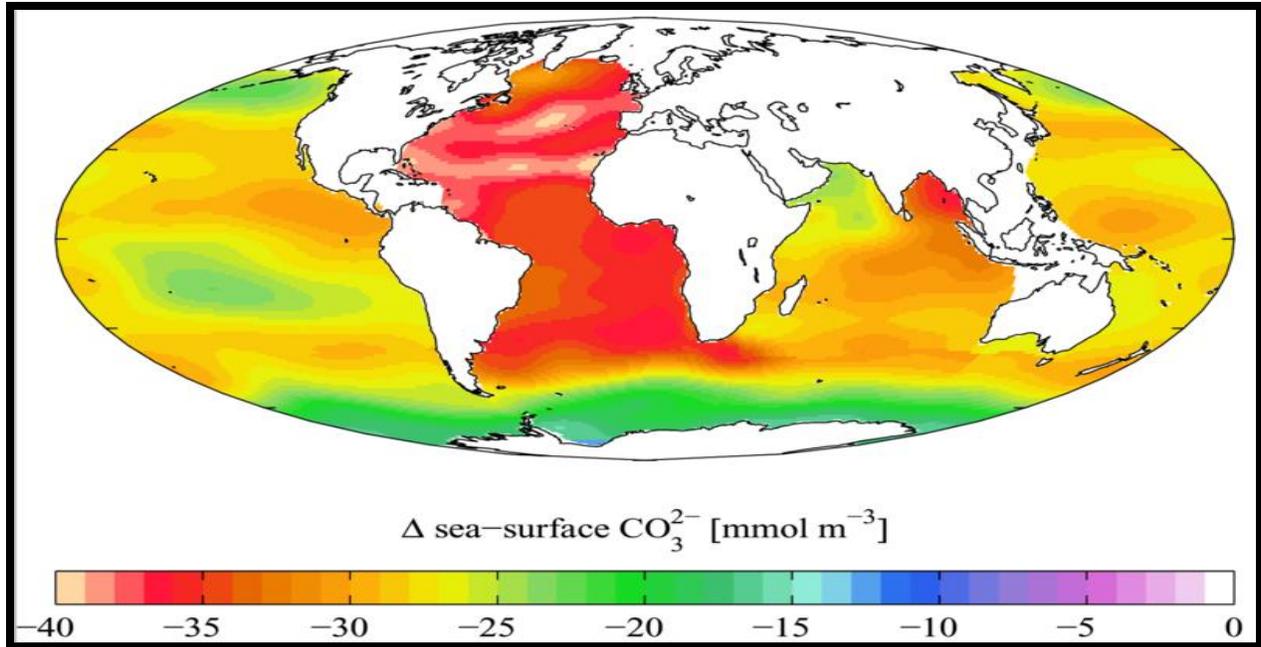
All plants can tolerate only a little increase in temperature before they wilt and die away. The rising temperatures of the world pose a threat to the plants as they are unable to flourish well in higher temperatures. The same can be said for most of the crops which are unable to put up with the increasing heat, especially Rice. The below given figure shows the decline in agricultural productivity in different parts of the world associated with the increasing temperatures, highly significant in Southeast Asia.



In 2004, it was reported by the International Rice Research Institute (IRRI) that the rice grain yield declines by 10% for each 1°C rise in temperature. Therefore, a decline in the agricultural yield has been reported in the last few years, reducing the already strained food supply of the people. It has been estimated that if the process of global warming continues unabated, the grain losses in Southeast Asia in 2080 will be as high as 18 to 22%.

3. RISING SEAWATER ACIDITY

The increased human emissions of carbon dioxide have not only affected the air that we breathe in. It has also resulted in an acidification of the oceans, leading to a decreased pH of the ocean waters and put the aquatic habitats in danger. The term 'ocean acidification' refers to an increase in the CO₂ concentration of the oceans, as about 30-40% of the carbon dioxide emitted in the atmosphere gets dissolved in the water, where it forms a chemical known as carbonic acid which splits to yield hydrogen ions, responsible for decreasing the pH of the water. It is estimated that during the last two centuries, the ocean water pH has decreased from 8.25 to 8.14, an increase in the acidity by almost 30%.



The figure given above shows the increase in the acidity of the world oceans in the last two centuries, and shows that a significant increase in acidity has occurred over the seas closest to the Southeast Asian regions. This increase in the acidity has led to a disturbance of the whole 'food chain' as the acidity causes decreased shell formation of the shelled organisms like oysters, clams sea urchins and shallow water corals. As a result, these organisms die early and quickly, leading to a decreased food supply for bigger fish, and ultimately for the humans.

The increase in sea water acidity has particularly affected the coral reef population of Southeast Asian seas, where 80% of the coral reefs are endangered. According to estimates, In Indonesia's Aceh province 80% of the corals have died. Similarly, In Malaysia during 2010, it was reported that all the coral reefs died because of bleaching.

4. DROUGHTS

The process of global warming affects the overall climate in such a manner that all weathers tend to get extreme. There is extreme rainfall, extreme summers and short spells of extreme colds. This has resulted in the setting of floods at one time, and droughts at others in different parts of the globe.

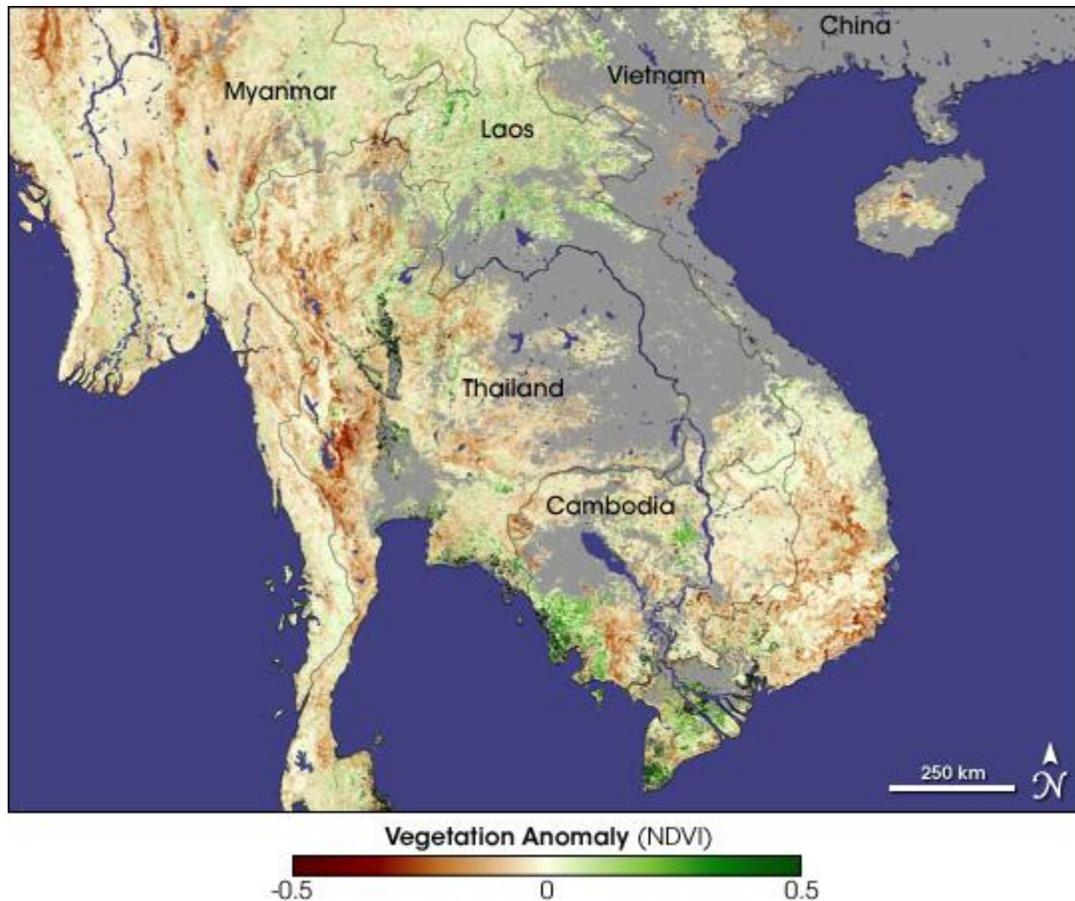
The southeast Asian region has also suffered the consequences of these weather extremes in the forms of droughts, badly hampering the food supply of people in this region. The major droughts in the Southeast Asian region during the last decade were encountered in 2005 and 2010. These are briefly described below.

a) Drought of 2004- 2005

In the year 2004, an early end to the wet season was encountered, as a result of which hundreds of water reservoirs in the Southeast Asian region experienced their lowest water levels in decades, and a severe drought affected Thailand, Cambodia, Vietnam and Laos. The drought affected almost all crops in these regions, particularly rice, coffee and sugar, and also reduced the drinking water resources of the people. The damages of the drought were as follows.

- i. Thailand was the most severely hit region, with 70 of its 76 provinces being hit by the drought with almost a million hectares of agricultural land being water deprived.
- ii. In Thailand, the rice crop was reduced by about 1 million tons, and the sugar crop dropped by 30%.
- iii. In Vietnam, eight Central Highlands provinces suffered their worst drought in 28 years, affecting about 1 million people and causing an estimated US\$80 million worth of crop losses. The coffee crop was hit hard and a 30% drop in the production was encountered.
- iv. In Cambodia which was already plagued by ongoing droughts for the past two years, the 2005 droughts inundated another 700,000 farmers because of water shortages.

The effect of the drought on the vegetation in the Southeast Asian region is depicted in the NASA photograph given below, in which most of the regions are drought affected, as shown in brown color.



b) Drought of 2009- 2010

There was an enormous decline in rainfall in Southeast Asia starting from November 2009, and continuing till the start of the monsoon season in May 2010. During that time, a severe drought condition prevailed over Myanmar, Thailand, Vietnam, Cambodia and Laos, with water levels in the Mekong River at their lowest in the past 50 years. The Mekong river flows through the above five countries and China, and a drought in this river affected more than 65 million people, and caused damages of billions of dollars. The major damages caused by the drought are given below.

- i. In Thailand, 19 provinces in the North and the Northeast, and 13 in the Central and East regions were declared as drought effected, with a decrease in the crop yields by about 1.4 million tons.
- ii. In Vietnam, the country's Mekong river Delta also known as the 'rice bowl' of the country was gravely affected by the drought, with about 620,000 hectares of farmland endangered by the water scarcity and salinity.
- iii. In Philippines, the rice crop was badly damaged, and a loss of 56,696 tons of rice crop was reported.

CONCLUSION

Thus it can be concluded that the Southeast Asian region faces a serious predicament because of the process of global warming. The increasing global warming has brought some of the most disastrous events of the world's history in Southeast Asia, ranging from the 2005 Indonesian tsunami to the 2006 Pacific cyclone season, the cyclone Nargis in Burma in 2008, and the massive flooding of Philippines almost every year. The droughts have exacerbated in intensity because of the rising temperatures, and thus the food security of the Southeast Asian people lies in a grave jeopardy if the process of global warming continues unabated.

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