

THE IMPACTS OF CLIMATE CHANGE AND DISASTERS ON FOOD CROP YIELDS AND SOME MEASURES TO COPE WITH THEM FOR FOOD SECURITY AND SUSTAINABLE DEVELOPMENT ON AGRICULTURE IN VIETNAM

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ABSTRACT

Climate change and climate variability, typhoons, floods, droughts and other climate elements related to natural disasters have a direct influence on the quantity and quality of agricultural productions access, on new technology in agricultural and food production, such as modern irrigation schemes, soil un-conservation and management techniques and erosion control. These should in any case be accompanied by knowledge of information about weather and climate and other related environmental factors to make full of technological advances. Therefore environmental monitoring of climate and agroclimate on the region of Monsoon Tropical Climate with many disasters of South East Asia in general, and particular in Vietnam, are important problem for National, Regional food security. Hence this report have been studied the following problems: (1) Real situation of food security in Vietnam: It is shown that food assess on the poverty. Poverty is widespread in Vietnam but has been significantly reduced during the 1990s, largely as a result of the rapid economic growth; Stability of food supply and assess of rice and other food crops in Vietnam is seasonal. Food prices rise in the months leading up to Tet (New Year by Moon Calendar) and in the between- harvest period of March-May, and fall during the main rice harvest in September-November. (2) The impacts of climate change and disaster here shows the impact of climate change and disasters (typhoon, flood and drought duration ENSO events , ...) on food crop yields such as rice in Winter- Spring and Summer crop season, maize, soy-bean... and then directly influence on Agriculture and Food security in Vietnam; (3) Study the law of distribution of typhoon, flood, and drought in Vietnam; (4) The some measures to cope with climate change and climate disasters for serving agriculture and food security in Vietnam as followings: Agrometeorological adaptation strategies to cope with climate variability and climate change ; Rational exploiting of climate and agroclimatic information; The changing cropping pattern and crop varieties to avoid other damage of climate disasters; Some proposal the agrometeorological action for agriculture and food security in Vietnam. The report is useful for policy analysis decision-makers and practice for sustainable development on agriculture and food security in Vietnam and some other developing countries as well.

1. INTRODUCTION

Climate change and variability, typhoon, floods, droughts and other climate elements related to natural disasters have direct influences on the quantity and quality of agricultural production process access. On new technology in agricultural and food production, such as modern irrigation schemes, soil un-conservation and management techniques and erosion control there should in any case be accompanied by knowledge of information about weather and climate and other related environmental factors to make full of technological advances. Therefore, environmental monitoring of climate and agro-climate on the region of monsoon tropical climate with many disasters of South East Asia in general and particular in Vietnam is important problem for National and Regional food security. Hence these reports have been studied the following problems:

1.1 Real situation of food security in Vietnam

Food security status: Latest FAO estimates show that percentage of the population who are undernourished has fallen from 32% in 1979-1981 to 27% in 1990-1992. This put Vietnam well on track to meet the Millennium Development Goals (MDGs) target of 13-14% of the population undernourished by 2015.

Food consumption: Food intake is the most immediate factor in determining nutritional and health status. The average daily per capita dietary energy supply increased from 2,363 calories in 1997 to 2,533 calories in 2001.

Economic conditions: After high economic growth in the mid-1990's, economic growth slowed in 1998 and in 1999 following the regional economic crisis. Growth picked up in 2000 in this continued into 2001, when GDP grew by 6-8%.

Food availability: Vietnam' agricultural sector has grown dramatically during 15 years of renovation, leading to rapid growth in food production. Food production in Vietnam increased by 3-5% per/year in the late 1990's, but the growth fell back to 2-4% in 2000 before falling slightly in 2001.

Food access: The key factor limiting people's ability to access food is poverty. Poverty is widespread in Vietnam, but has been significantly reduced during the 1990s, largely as result of the rapid economic growth. The % of population below the international poverty line decreased from 58% to 37% between 1993 and 1998. The percentage below the food poverty line (that is, those unable to purchase the basic food items) fell from 25% to 15% over the same period.

Stability of food supply and access: The supply of rice and other food crops in Vietnam is seasonal. Food prices rise in the months leading up to Tet and in the between harvest period of march-May, and fall during the main rice harvest in September- November.

The other factors affecting food security (except climate and disaster): Other key food indicators, Vietnam such as: Population below growth, School net enrolment rate-primary, Access to clean water (% of rural population), Access to electricity (% of rural population), Rural population as % of total.

1.2 The impact of climate change on food crop yields

The climate change in Vietnam: In brief: Frequency and intensiveness of the natural disasters such as typhoon, heavy rain, floods, high temperature, and draught are increasing in many regions of the country. Annual average temperature increases about 0.10°C per decade. In summer months, temperature increases about 0.1- 0.3°C per decade. Long term variation and trend of temperature in January, July and annual over last 35 years are increased about 0.2-1.0 °C. Trend and variation of absolute minimum temperature increased 0.4 (North central region) – 2.0 °C in Northwest Heavy rain happen more frequently and Seasonal rainfall amount decreases in July and August and increases in September, October and November. The trend of change of rainfall is not clear some stations are increased, some other stations are decreased.

Typhoon visit in Vietnam: In every year typhoons visit Vietnam step by step in the North and then to the South, nowadays typhoon visit Vietnam intensively more than in the past some decades and visit more the South Central region of Vietnam. Typhoons are moving southward and typhoon season is shifting to the later months of the year. Big floods more happen in the mid and south of Vietnam. Adverse drought happens every year in the most regions of the country.

The impact of climate change: For this study we have calculated correlation coefficients between winter-spring rice, summer rice, maize, ground nut, soybean yields with climate elements in growing period. In order to calculate food crop yields before harvest time we use equation 1:

$$Y_{t+1} = Y_t + \Delta Y \quad (1)$$

Where are: Y_{t+1} - Calculate crop yield in this year

Y_t - Crop yield in the year before

ΔY - Difference food crop yield can find in different equations by climate elements

1.3 Agriculture losses by disasters

Agriculture losses by typhoon and floods in Vietnam: Vietnam is known as remaining mountainous. Three-quarters of the country suffers from flash flooding over 70% of the population of Vietnam is affected by water disasters. We have provided some conservative estimates on the damage caused by flood and typhoons in Vietnam from 1971 up to now.

Affect of El-nino and Lanina: According to recent scientific studies from 1951 to 1998 there were 13 elnino years, 11 lanina years and 24 non ENSO years see the following:

El-nino years: 1951, 1953, 1957, 1963, 1965, 1969, 1972, 1976, 1982, 1987, 1991, 1994, 1997 .

Lanina years : 1954, 1955, 1956, 1964, 1970, 1971, 1973, 1975, 1988, 1995, 1998.

Agricultural losses by drought: In Vietnam, drought usually appear in the dry season. But on the other hand the rainfall distribution is also affected by terrain conditions, there are the rainfalls of 3000 - 4000 mm/ year such as in some places of the North mountain, Central region, central highland region, but some other regions have the annual rainfall only 750 - 800 mm/ year - such as in Phanthiet, Phanrang of South Central Region. In Vietnam sometimes droughts also appear in the rainy season, because of it's extreme climate event (ENSO plomena). From 1980 to 1999 the Vietnam in general in Mekong river delta in particular faced to dangerous drought in Winter- spring season of 1989, 1991, 1993, and 1998. In summer - autumn season the constant drought happened from 1981 to 1998. In summer season drought happened in the years 1981, 1983, 1984, 1985, 1987, 1992, 1994, 1998. In the drought year the drought area in every crop was 4000ha - 230000ha and area have been lost from 1000ha to 390000ha. In the drought of 1998 damaged 32000ha of winter - spring and summer - autumn crop area.

Average damages in ENSO years 1982, 1987, 1991, 1994, and 1997(Elnino years) and 1988, 1995, 1998 (Lanina years) are US\$ 134 million/year, Regarding to damage in paddy crops are drawn: Average annual damage in ENSO years is 325943 ha/year; Damage in Elnino years is much bigger than in Lanina years (Elnino : 407537 ha/year, in Lanina : 113972 ha/year).

2. THE SOME MEASURES TO COPE CLIMATE CHANGE AND DISASTERS FOR FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

2.1 Some adaptation strategies for sustainable development on agriculture and food security.

2.1.1 Short term adaptation

- Insurance: in agriculture to cope with weather variation,
- Crop and livestock diversification. Changing crop types requires sufficient knowledge on the part of the farmer.
- Changes in intensity of production.
- Improved nutrient and pest control management.
- Changes in tillage practices and farm systems
- Temporary migration.

2.1.2 Long term adaptation

- Development of new technologies and modernization
- Changing crop mix.
- Improving water management
- Permanent migration of labor

2.1.3 Both short and long-term strategies

- Investment and accumulation of capital
- Reform of pricing schemes development of open markets and other reforms.
- Adaptation of new technologies
- Promotion of trade This is likely to enhance economic adaptations under climate
- Extension services
- Diversification if income earning and employment opportunities
- Dissemination of climate data
- Institutional planning and implementation

2.2 Adequate crop pattern to cope with natural disasters

The designing sustainable cropping pattern in agriculture production especially for rice crop with the climatic disaster aims to following demands.

Effective avoid and mitigating damage caused by disaster. Having proposal options for agricultural production,(especially for rice) that are adaptable to disasters of all kinds in order to keep national food security. In redesigning cropping pattern, ceating divesification of crop and agricultural goods in different ecological regions there are crop weather calendar for rice in different seasons. Cereal crop (such as maize, sweet potatoes, cassava...) are planted instead on the land where sowing 2-3 rice crop per year is not effective. To have crop weather calendar for this plant, we have used the day of accumulative rainfall about the 75mm before rainfall season with probability 80%.

Rotation crops were designed as following:

Winter – Spring rice + cereal crop (maize, sweet potatoes) + Summer rice

In land feed rain in high land rotation crops were:

Summer rice + cereal crop (maize, sweet potatoes) + Autumn.

Winter – spring cereal crop (maize, sweet potatoes) + Summer rice.

2.3 Application of climate and ENSO forecasts for Agriculture in Vietnam

At present, the technology and data in Vietnam are inadequate for the preparation of effective long-range forecasts. Even though El Nino and La Nina have affected Vietnam, they appear not to have received the attention they merit. For example, in 1997 and 1998, information and documents from international media on the effects of El Nino were assembled and comparisons made with actual data for previous El Nino periods. However, it was not possible to incorporate such material usefully into the long-range forecast.

So far, no systematic effort has been made in Vietnam to capitalize on the different weather patterns associated with ENSO when preparing long-range or seasonal forecasts. They should be part of the standard forecast practices and procedures. Some of the ways in the potential of ENSO forecasts could usefully be taken into account in the design and preparation of long-range forecasts would be through research into:

- (1) Rainfall behavior in Central Vietnam;
- (2) Typhoon behavior in Central and southern Vietnam;
- (3) Influence of temperature on rice production in Northern Vietnam during the Winter-spring season; and
- (4) Water management for rice production in Central Vietnam during the winter- spring season.

There are doubtless many other features requiring study that would promote improvements in the availability and usefulness of long-range and seasonal forecasts in association with ENSO events. For example Agrometeorological Research Centre in Vietnam have proposed cropping patterns as part studies the potential application of ENSO forecasts for agriculture.

2.4 The changing crop calendar in winter - spring, summer rice such as

- ***In El Nino years***
 - The change of crop season in winter spring rice in year with El Nino.
 - Use some necessary measures in rice production
- ***In La Nina years in the North Vietnam should pay attention to***
 - Having measure for preventing chilling for seeding.
 - Using late maturity and chilling tolerant varieties.
 - Having priority to early and leading crops in designing rice cropping pattern in delta region.
- ***The change crop rotation pattern for every regions***
 - In the North region:
 - + Winter - spring rice + Summer rice + winter dry land crop
 - In the central coastal region.
 - + Winter - spring rice + Summer-Autumn rice + autumn-winter dry land crop
 - In the southern delta region.
 - + Winter - spring rice + spring-Autumn rice + autumn-summer rice or:
 - + Winter - spring rice + spring-summer dry land crops + autumn-summer rice.
 - Strengthen capability of climate forecast and warning system agro meteorological Services, early warning and forecasting economic losses by climate disasters;
 - Scheme of cooperation among multi agencies for collecting, analyzing and forecasting for food crop yields on TV.

3. CONCLUSION

From the study of the impacts of climate change and disasters on foods crop yields and some measures to cope with them for food security and sustainable development on agriculture in Vietnam could be concluded as following.

The effect of climate change, variability, and disasters on agriculture is not similar in difference agro-ecological region of Vietnam. For serving on food security and sustainable development on agriculture to cope with climate change and disasters, we have to change the cropping calendar, cropping pattern, cropping rotation for every agro-ecological regions. At present and near future we should use climate index and ENSO index in early Agrometeorological Monitoring and Forecasting food crop yield especially for rice, for conserving with food security in Vietnam. For region with soil moistures is unsustainable have to keep water in the soil is first response, another is choosing new varieties of crop, which can adapt to drought. Building a good irrigating system such as in the red river delta and Mekong river delta. Building more reservoirs of all kind in the midland and highland region.

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