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Impact of climate change on agriculture, livestock and living environment in the Southeastern Part of Bangladesh

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Abstract: Bangladesh is one of a disaster prone countriy in the world. About 80% of coastal lands in Bangladesh are annually flooded during the rainy season. It is anticipated that Climate Change through the rise of sea level, will intensify flooding and inundation in the coastal areas of the country. Many geophysical, biological and social systems become imbalanced and are at risk because of climate change. Climate change is a main challenge for agricultural productivity which is anticipated and influenced to affect crop and livestock production by extreme events like drought, floods and storms. It will change the types and frequencies of various crops and livestock, availability of irrigation water supplies and the severity of soil erosion. Climate change risks can be distinguished into two classes. Sudden arrival risks emerge quickly such as flooding or hurricanes and the chronic risks are very slow events that are noticeable by society such as drought or sea level rise. Because of this climate change, social threat focuses on those demographic and socioeconomic factors that increase the impacts of hazard events on local populations (Tierney et al. 2001; Heinz Center 2002). Within the above backdrop, this paper intends to focus the impacts of climate change on agriculture, livestock and living environment of the people in the southeastern part of Bangladesh spesially Jessore, Satkhira, Khulna Mongla Bagerhat and Sundarban.

Key words: Climate Change, agriculture, livestock, living environment Southeast Bangladesh

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Introduction

Climate change and variation impacts every sector of human lives. Its risk is getting worse day by day which faces the certain species and people in danger. Many geophysical, biological and social systems become imbalance and are at risk because of climate change. Climate change is the main challenge for agricultural productivity which is anticipated and influenced to affect crop and livestock production by severe extreme events like drought, floods and storms. It also changes the types and frequencies of various crop and livestock, availability of irrigation water supplies and the severity of soil erosion. To realize and understand the literature; some key points need to define. The concept of risk merges the level of impacts with the possibility of its incidence and confines its doubt in original processes of climate change exposure, sensitivity and adaptation. In addition, risks of negative consequences like increased droughts and the melting of ice caps in Greenland and Antarctica balance any potential positives, such as longer growing seasons in countries such as Canada and Russia. In other instances a natural event such as drought also is a driving force behind population displacements, which create a complex humanitarian crisis results where material assistance to those in need is often compromised by the civil conflict (NRC 2007).

In case of climate change we can distinguish risks into two classes. Sudden arrival risks emerge quickly such as flooding or hurricanes and the chronic risks are very slow events that are noticeable by society such as drought or sea level rise. Because of this climate change, Social threat focuses on those demographic and socioeconomic factors that increase the impacts of hazard events on local populations (Tierney et al. 2001; Heinz Center 2002). Within the climate change community, flexibility is used along with adaptation to measure how society responds to this threat source (see Cutter et al. 2008 for an overview).

The purpose of this literature review is to mention the risks and impacts of climate change on society especially on agriculture. The review has four sections: 1) Impact of climate change and Agriculture 2) Crop response to climate change 3) Livestock response to climate change 4) Economic importance of climate change on agricultural supply and 5) Conclusion.

Impact of climate change and Agriculture

Agriculture is very dependent on climate. The present climate change of the world has both opportunity and risk (Wall, E, Marzall, K., (2006). The opportunity is to expand the growing season and grow higher value crops against the risk of increased frequency of extreme events which may damage crops and or infrastructure, impacts on the environment in global markets. Plant systems and crop yields are influenced by many environmental factors, such as moisture and temperature with other factors in determining yields (Waggoner 1983). Because of climate change is to cut across a host of environmental factors, most quantitative estimates of climate change effects on crop yields are derived from such crop simulation models (Rosenzweig and Parry 1994). The temperature increases have both positive and negative effects on crop yields which are determined by the balance between these negative and positive direct effects on plant growth and development and by indirect effects that can effect production. This indirect effect has been ignored in the assessment of climate change effects. Indirect effects may arise from changes in the incidence and distribution of pests and pathogens (Sutherst et al. 1995), increased rates of soil erosion and degradation due to rising temperatures (Adams 1986).

Study on the agricultural sector in Canada began before most other sectors were analyzed. Much of the theoretical understanding of the principles for investigating adaptation from a socio-economic perspective resulted from the work of Barry Smit and his colleagues at the University of Guelph (e.g. Belliveau et al, 2006; Bryant, 2008; Bryant et al, 2000; Dolan et al, 2001;; Smit and Wandel, 2006; Wall and Marzall, 2006; Wall and Smit, 2005; among other works). The pattern of research has continued with subsequent studies by others (e.g. Rousseau et al, 2007). Agriculture in many climatically-suitable regions is limited by soil conditions and competing demands for suitable land (e.g. Ramsey, 1993; Sigursveinsson, 1985). But Potential for development of new crops, or expansion of present efforts (e.g. Debnath, 2009), may exist.

Response of crops to climate change

Agriculture is a diverse system that covers a wide range of species and production systems across the world. Climate change provokes changes in crops species. But Crop species differ in their basic temperature range for life cycle development. There is a base temperature for vegetative development, at which growth originates, and an optimal temperature, at which the plant develops as fast as possible. Increasing temperature generally hastens chain of a crop through its life cycle phases, up to a species-dependent optimal temperature. Beyond this optimal temperature, development slows.

The effects of climate change on agricultural yields vary by region and by crop. For example, Rosenzweig and Iglesias (1994) note that for a 4°C warming yields in mid and high latitude countries increase, but yields in low latitude countries decline. Other studies (IPCC 1996) and Smith et al. (1996) note that crop impacts in lower latitude tend to be more negative than crop impacts in higher latitudes, particularly with respect to wheat and maize yields. Rice yields are less variable than wheat and maize yield impacts. The few researches assess that the impact of climate change on agriculture revealed reduction in yields and increase variability in crop production. (Liverman et al. 1991, Sala & Paruelo 1994)

Increasing of temperature may be the prime causes of the shortened of the duration of reproductive phase and life cycle of maize, resulting in decreased grain yield (Badu-Apraku et al. 1983). Reproductive development in soybean has basic temperatures that are somewhat lower than those of maize. Grain of wheat and other small grains shorten dramatically with rising temperature (Sofield et al. 1974, 1977; Chowdhury and Wardlaw 1978; Goudrian and Unsworth 1990). This temperature effect is a major reason for the lower wheat yield potential in the Midwest than in northern Europe, even with the water limitation removed. The temperature has been well studied in case of the response of rice (Baker and Allen 1993a, 1993b; Baker et al. 1995; Horie et al. 1996). Leaf-appearance rate of rice increases with temperature from a base of 8ºC, until reaching 36-40ºC. However, the optimal temperatures for grain formation and yield of rice is lower (25ºC) (Baker et al. 1995). Cotton is considered to have adapted to high-temperature environments. With this view, reproductive processes of cotton have been shown to be adversely affected by elevated temperature (Reddy et al. 2000). Tomato is an important vegetable crop known to suffer heat stress in mid-summer the base and optimal temperature is 7º and 22ºC for rate of leaf appearance, rate of truss appearance, and rate of progress to an thesis (Adams et al. 2001). Crop yield response to temperature and CO2 for maize, soybean, wheat, rice, sorghum, cotton, peanut, and dry bean was collected from the scientific literature. In general, the optimum temperature for reproductive growth and development is lower than that for vegetative growth. Furthermore, these crops are characterized by an upper failure-point temperature at which pollination and grain-set processes fail.

For most frequent, temperate fruit and nut crops, winter temperatures play a significant role in productivity. However, reductions in yield with increasing temperature in field conditions may not be due to temperature alone, as high temperatures are often associated with lack of rainfall in many climates. The changes in temperature do not produce linear responses with increasing temperature because the biological response to temperature is nonlinear, therefore, as the temperature increases these effects will be larger. The interactions of temperature and water deficits negatively affect crop yield.

Response of livestock to climate change

The climate change has also impacts on livestock, which may be affected by 2 ways: the quality and amount of forage from grasslands may be affected and due to higher temperature there may be direct effects on livestock. For instance, warmer summer temperatures are estimated to have a suppressing effect on livestock appetite, which leads to lower weigh gain (Adams et al. 1998). He also observe that under a 5°C increase in temperature, livestock yields in the U.S.A. fell by 10% for cow/calf and dairy operations in Appalachia. Climate change tended to have adverse impacts on livestock production through both declining forage quality and increased ambient temperature. There is evidence that livestock systems are adaptable to climate change than crop systems because they are better able to adapt to extreme events (IPCC 1996). However, higher temperatures will very reduce livestock production during the summer season, but these losses will very likely be partially offset by warmer temperatures during the winter season.

Climate changes also impacts on the economic capability of livestock production systems worldwide. Surrounding environmental conditions directly affect mechanisms and rates of heat gain or loss by all animals (NRC 1981). In the central U.S. in 1992, 1995, 1997, 1999, 2005, and 2006, some feedlots (intensive cattle feeding operations) lost in excess of 100 head each during severe heat episodes (Hahn and Mader 1997; Hahn et al. 2001). The winter of 1996-97 also caused hardship for cattle producers because of greater than normal snowfall and wind velocity, with some feedlots reporting losses in excess of 1,000 head. During that winter, up to 50 percent of the newborn calves were lost, and more than 100,000 head of cattle died in the Northern Plains of the United States.

The risk potential associated with livestock production systems due to global warming can be characterized by levels of vulnerability, as influenced by animal performance and environmental parameters (Hahn 1995). On the other hand, the potential impacts of climatic change on overall performance of domestic animals can be determined using defined relationships between climatic conditions and voluntary feed intake, climatologically data, and GCM output. (Mader et al.2006). Domestic livestock can cope with or adapt to gradual changes in environmental conditions; however, rapid changes in environmental conditions to extreme conditions radically reduce productivity and are potentially life threatening.

Another area of concern is the influence of climate change on diseases and parasites that affect domestic animals. Incidences of disease, such as bovine respiratory disease, are known to be increasing (Duff and Gaylean 2007). However, causes for this increase can be attributed to a number of non-environmentally related factors. As for parasites, similar insect migration and over-wintering scenarios observed in cropping systems may be found for some parasites that affect livestock.

Economic impacts of climate change on agricultural

Human beings adapt the new agricultural systems because of economic and physical conditions. These adoptions are natural. Price and other changes in market and international as well as intra-national trade can be adapted. The new agricultural system adapts climate changes which are well documented (Kaiser et al. 1993, Easterling 1996). The steady pattern of growth in global yields over the past 50 years suggests that crop yields will be higher in the future with or without climate change.

Changes in agricultural supply result from the combination of changes in yields and changes in crop acreage. Changes in crop yields are the result of climate change. Food costs and the capacity of food are directly affected by changes in commodity supply and result price changes. Crops reduce in supply and will raise the price, which reduce consumption levels and badly affect consumer welfare. The impacts of climate change are also affected by changes in market signals which is described by Adams et al. (1995). Darwin et al. (1995) also mention the importance of farm level behavior in order to change in supply.

Actually, the effect of climate change on prices depends on net increase and decrease in supply. For many agricultural commodities, prices are influenced by changes in global food supplies. These price change are due to an increase and decrease in crop production. For example, Darwin et al. (1995) mentioned decrease in global wheat and other grain prices because of increase production. However, the changes in prices will lead to changes in the economic system of agricultural producers and consumers.

Conclusion

The world economy greatly depends on climate conditions. Agriculture, animal, forestry, fishing and tourism are relied also on the climate. But agricultural sector is facing and passing serious threats globally like soil degradation and the pollution of water resources, the changing in planting dates, alternative cultivars or crops, irrigation practices, land allocations to crop production and other uses. Over the last few years, extreme weather events have increased and affected on economical losses for the world. In the last few decades, the average yearly temperature of the world has proved a slight tendency to increase.

Climate change is one of the biggest challenges for humanity faces in present day. But it is clear that no country can face it alone. The above discussion includes the consequence of climate change on agricultural sector directly and indirectly. For instance, increases in temperature directly affect animal death and the accessibility of food and grain price increases due to droughts, indirectly. As a result, climate change is to reduce the food supply and leading to high prices of food on which people depend for daily lives. The most affected people are farmers who produce food, for this reason sometimes consumers may also adapt alternative low priced products as a result of the effects of climate change. Climate change affects the productivity and collective demand for factors of production. It also affects the welfare of economic groups differently. To prevent ourselves from this great thereat we should be made as soon as possible to ensure that everyone involved acts and adapts in the best possible way.

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