

Climate Change Impacts on Food Security, a Brief Comparative Case Study of Bangladesh, India, Nepal and Pakistan

Medani P Bhandari*

Professor and Deputy Program Director of Sustainability Studies, Akamai University, Hawaii, USA and Professor of the Department of Finance and Entrepreneurship, Sumy State University, Ukraine

***Corresponding Author:** Medani P Bhandari, Professor and Deputy Program Director of Sustainability Studies, Akamai University, Hawaii, USA and Professor of the Department of Finance and Entrepreneurship, Sumy State University, Ukraine.

Received: June 09, 2018; **Published:** July 25, 2018

Abstract

This brief editorial piece intends evaluate how climate change has direct impact on the agricultural development and broader economic growth in South Asia-Bangladesh, India, Nepal and Pakistan. Paper is just a statement of the problem and outlines the need and direction of research agendas for future research.

Keywords: *Climate Change; Food Security*

Introduction

In South Asia-Bangladesh, India, Nepal and Pakistan encounter similar climate induced changes though they differ in their socio-political, economic and cultural conditions. The majority of the people of this region still live on subsistence farming, for example, 73% population in Bangladesh lives on subsistence farming, 71% in India, 83% in Nepal, and 64% in Pakistan [1]. Table 1 shows the total area, farm area, areas under various crop production, and total population as of 2008. Based on these statistics, arithmetic and physiological population densities have been calculated. The physiological population densities (farming population per unit

of agricultural land) suggest that these countries belong to the threat zone in terms of climate change impact on agriculture. It has been obvious that any unfavorable climatic conditions mean poor agricultural growth which will have serious ramification on the countries' economies. Poverty induces poverty; because of the rudimentary technologies used in agriculture, more manpower is needed for farming thus encouraging couples to increase family manpower to invest on farming, which might lead to overpopulation. Nepal's condition is the most vulnerable due to her over dependence on monsoon climate [2]. The high physiological population density of Nepal indicates maximum vulnerability to food security, if any unprecedented climatic variation occurs.

Country	Land area (sq. km)	Arable land (hectares)	Population in million as of 2008	Arithmetic population density	Physiological population density	Arable land (hectares per person)	Permanent cropland (% of land area)	Cereal production (metric tons)	Food production index (1999-2001 = 100)	Cereal yield (kg per hectare)
Bangladesh	143,998	8.61 E + 06	152.2	1057	655	4.94E-02	6.15E+00	4.91E+07	1.36E+02	3.97E+03
India	3,287,576	1.56E+08	1158.00	352	618	1.39E-01	3.76E+00	2.67E+08	1.23E+02	2.65E+03
Nepal	147,179	1.81E+06	28.00	185	879	8.18E-02	8.23E-01	8.07E+06	1.26E+02	2.36E+03
Pakistan	796,098	1.67E+07	174.00	218	753	1.22E-01	1.11E+00	3.55E+07	1.28E+02	2.65E+03

Table 1: The Conditions of DFID/ESRC's Focused South Asian Countries.

Data source: World Bank Data (2011).

The peripheral status of Nepal and the over dependence of increasing population on limited subsistence practices have created various vicious cycles. The nation has already faced food security problems and will experience even greater challenges due to convergence of multiple factors. On the demand side, population will increase from estimated 28.8 million today to nearly 36.2 million by 2025 [3]. Already, agricultural production and food security have been hampered due to increasing land degradation, lack of location-specific technology, and inadequate infrastructure for agricultural development [4,5]. In addition to poor technological responses to agriculture, the ongoing political instability has not only threatened the subsistence farming economies [6] but also it has forced many agricultural workers to migrate abroad hoping for remittances [7]. Food market has been very instable due to the decrease in farm production [8,9]. Intertwined effects of these factors have posed significant challenges to farm communities [4]. In some areas farm produces such as apples, peaches, and vegetables are decayed on the fields due to unprecedented bands (shutdown) of transportation [10]. Many patients have died unexpectedly due to the shutdown of transportation services. Poor government responses to increasing insecurity have created difficult lives [11]. Coupled to these problems, climate changes and associated variability have threatened agricultural production. To improve our understanding of the great uncertainty of agricultural production coupled with the large potential impacts of increased population mobility, it has been essential to increase our understanding of the relationship between climate variability and change and human behaviors such as migration [12-14].

Though much research has focused on forced migration due to political uncertainties, little is known regarding the indirect impacts of climate on human migration leaving aside the farming practices. To address the deficiency, there is need to investigate the impact of climatic vulnerability on the food security of people. "Vulnerability to climate change refers to the propensity of human and ecological systems to suffer harm and their ability to respond to stresses imposed as a result of climate change effects. The vulnerability of a society is influenced by its development path, physical exposures, the distribution of resources, prior stresses and social and government institutions... Adaptation to climate change takes place through adjustments to reduce vulnerability or enhance resilience in response to observed or expected changes in climate and associated extreme weather events" [15]. Nepali people have managed to adapt in different circumstances, for example, despite the fact that the winter drought of 2008/2009 had almost decimated the winter crops throughout the country [16] people of Nepal have survived by diversifying their farming activities, such as planting fruit trees or focusing more on animal husbandry [17]. In the

same year, despite a strong harvest of summer crops, net harvest resulted in a negative production balance of 132,914 MT of cereal (-2.5%) for all of Nepal [18-20]. With ever increasing population, even a slight decrease in annual food production becomes a matter of great concern for food security. Because of these vulnerabilities, people might not have enough food even to purchase as Amartya Sen puts food security toward the demand side [21-24]. Definitely, in a subsistence farming, a shortage of food leads to environmental degradation that threatens food security (Baro and Deubal, 2006).

Increasing food insecurity leads to the deterioration of ecological services, which in turn creates further food shortages [17]. According to the FAO [25], in 2008-09, there was a total of 132,916 metric tons food grain deficit in Nepal that impacted 16% of 28 million populations across the country. Mountains and hill regions face such vulnerabilities more frequently than the Tarai region [26]. Districts located in the western regions are the most vulnerable. Disaster, mostly natural ones, are the major causes of instability in food production in which substantial land area, crops, livestock and human losses incur every year [2]. Drought and landslide have impacted on the production of paddy, maize and millet. In 2008/09, the total cropped area affected by natural disasters was 93,700 hectares in which paddy area was 92,000 hectares [4].

Food security and climate change

Food security has been understood in different forms, and very often, it has been defined narrowly to mean food self-sufficiency, but it is much more than this. The FAO defines food security as a state "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for active and healthy life." This definition encompasses several dimensions of food security. First, it implies both physical and economic access to sufficient food. Second, it means that such access should encompass all people irrespective of their economic and social backgrounds. Third, it implies such access at all times in a year, and in times of unusual events such as that prompted by social unrest and climatic factors. Fourth, it implies that food has to be safe, nutritious and conducive to a healthy life. Of the several dimensions of food security, in the case of Nepal, net productivity of grains has the most direct effect on food security.

Understanding the potential impact of climate change on food security in Nepal is critical for two reasons. First, the existing system of food production in the country is highly climate sensitive because of its low level of capital and technology. Second, agriculture is the main source of livelihood for the 88% of the total population in Nepal, where 80% of over 15 years population is engaged

in agriculture (NG/ADB, 1995). Nearly 2/3rd of the rural household income is derived from agricultural activities, and 8 out of 10 people working in the agriculture sector are self-employed farmers. This is the only source of cash income for 90% poor people [26]. The consequences of an adverse climate change could therefore significantly affect food security of the country and the well-being of the Nepalese people [27]. Any decrease in food production will further reduce the food intake in this one of the poorest calorie intake countries of the world. Similar to the global trends, evidence of climate change, such as general warming, receding snowline, prolonged drought, and unpredictable rainfall patterns, have been well documented across the country [28] BBC Nepali news often presents discussions on the issues of changing farming practices and phenological patterns in the hills of Nepal where temperature is increasing from 0.06 to 0.120C/year in recent decades, with sig-

nificant warming in the higher elevations of the Hills and Mountain. In the high-altitude region of Nepal, there are also reports of the loss of arable land due to drying of irrigation canals fed by melting snow but no longer replenishment with receding snowline. A recent assessment of the change in average temperature and precipitation in Nepal using over a dozen general circulation models (GCMs) projected a significant change in rainfall and consistent increase in temperatures for 2030, 2050, and 2100 [29]. Characterized by low levels of capital and technology, Nepal's existing system of food production is highly climate sensitive and is considerably more vulnerable to climate change [27].

Future direction/ Research need

There is a need of extensive research, which can identify how the subsistent farmers of South Asian [30] and other developing

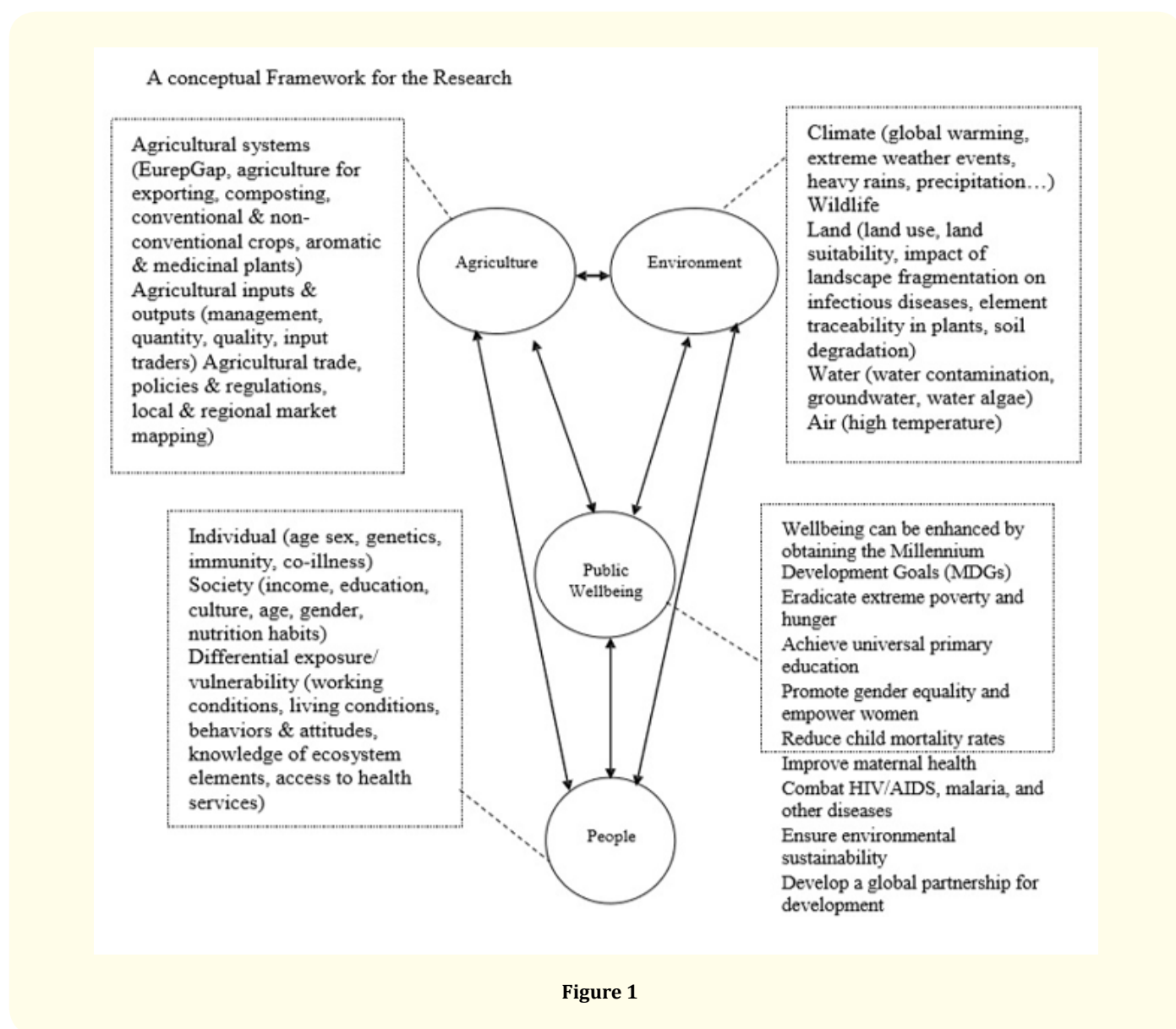


Figure 1

countries are coping with climatic variations and what adaptation and mitigation practices they have been utilizing, and what tools and technology are available; what the policy directives are to mitigate these problems in sustaining the rural livelihoods. The climate events will definitely affect agricultural farming at the local scale ($\sim 10^2$ - 15^2 sq. km), meso-scale ($\sim 10^4$ sq. km), and the national scale $\sim 10^6$ sq. km). These changes impact on the ecosystem services that support growing human population. In order to mitigate these problems, there is research need:

1. To explore the knowhow of the food production patterns and propose alternatives to increase the productivity of healthy food even at the time of climatic variations;
2. Develop a model and replicate it, if applicable, to other areas;
3. To explore how subsistence farmers are responding to climate change and other socioeconomic factors to maintain their livelihoods in a sustainable manner;
4. To investigate whether the issues of equity especially the well-being of disadvantage groups are addressed by policy instruments.
5. To explore how the people are contributing to the sustainable management of natural resources and biodiversity at the time of climate variation.

Conclusion

In sum, it is a known fact that agriculture field has been facing the climate change induced problem directly and have adverse impact. The developing world whose major economy is based on agriculture; have witnessing severe climatic variation since last decades or so. There is an assumption that farmers' livelihood depends on incomes based on the size of farmlands, number of cattle, economically active population in the family, highest level of education a family member has, involvement of a family members in various types of jobs including remittance practices, distances of settlements to nearby markets, existing forest resources in the vicinities of households, types of house, and dependency ratios [30-32]. However, there are no such research, which validates such assumption. There are knowledge gaps in the interrelationships of climatic factors and vulnerability to increase understanding of how the various geospatial technologies help to link between science and conscience facing the development planners, resource managers and environmental scientists working to resolve local, regional and national ecosystem services that are representatives of other South Asian countries mainly hit by climatic variability. Researchers need to explore more on these issues in their future research.

Acknowledgements

I would like to thank to Ms. Prajita Bhandari for her insightful thoughts and comments on the paper, without her support this research was impossible. Special thanks to Manaslu; Prameya and Kelsey who read this paper several times, provided their feedbacks and edited the language. I would also like to thank my childhood best friend Mr. Rajan Adhikari and his family for their help and supports throughout in our trajectory. Thanks to all readers as well.

Bibliography

1. World Bank Data. "Multi scale data portal, World Bank, Washington, DC (2011).
2. Bhandari and Medani P. "Green Web-II: Standards and Perspectives from the IUCN". Program and Policy Development in Environment Conservation Domain: A Comparative Study of India, Pakistan, Nepal, and Bangladesh, River Publishers Series in Chemical, Environmental, and Energy Engineering, River Publishers (2018).
3. Population Bureau. "Agriculture Statistics of Nepal". Central Bureau of Statistics Kathmandu, Nepal (2010).
4. Pyakuryal PN and B R Upreti. "(eds). Land Agriculture and Agrarian Transformation". Consortium for Land Research and Policy Dialogue (COLARP) (2010).
5. Shrestha NR and K Bhattarai. "Historical Dictionary of Nepal". The Scarecrow Press, Inc (2003).
6. Upreti BR., *et al.* "The Remake of a State: Post- Conflict Challenges and State Building in Nepal". South Asia Regional Coordination Office of the Swiss National center of Competence in Research (NCCR North-South) and Human and Nature Resources Studies Centre, Kathmandu University, Nepal (2010).
7. Ghimire A and BR Upreti. "The forgotten forces: Role of migrants in post-conflict Nepal". In Upreti, B. R., S. R. Sharma, K. N. Pyakuryal, and S. Ghale (2010) (eds) The Remake of a State: Post- Conflict Challenges and State Building in Nepal. South Asia Regional Coordination Office of the Swiss National center of Competence in Research (NCCR North-South) and Human and Nature Resources Studies Centre, Kathmandu University, Nepal (2010).
8. Pyakuryal B., *et al.* "Trade liberalization and food security in Nepal". *Food Policy* 35.1 (2010): 20-31.

9. Thapa Y B. "Political economy of conflict and agrarian change in Nepal". In Pyakuryal, P. N. and B. R. Upreti. "(eds) Land Agriculture and Agrarian Transformation". Consortium for Land Research and Policy Dialogue (COLARP) (2010).
10. Adhikari Jagannath. "Food Crisis in Karnali: A Historical and Politico-economic Perspective". Kathmandu, Nepal: Martin Chautari (2008).
11. BBC Nepali News daily.
12. Axinn WG and D Ghimire. "Social Organization, Population, and Land Use". *University of Michigan: Population Studies Center* (2007).
13. Brown O. "Migration and Climate Change". Geneva, Switzerland: International Organization for Migration (2008).
14. Carr DL. "Population and deforestation: why rural migration matters". *Progress in Human Geography* 33.3 (2009): 355-378.
15. Adger WN., *et al.* "Assessment of adaptation practices, options, constraints and capacity". In *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, eds. M. L. Parry *et al.* Cambridge, UK: Cambridge University Press (2007): 469-506.
16. Food and Agriculture Organization (FAO). "Food insecurity and vulnerability in Nepal: Profiles of seven vulnerable groups". (Agricultural and Development Economics Division, the Food and Agriculture Organization of the United Nations ESA Working Paper No. 04-10) (2004).
17. Bhattarai K. "Land ownership and the use of forest in Nepal". VDM Publishing House Ltd (2010).
18. CBS. "Statistical Year Book. Central Bureau of Statistics, Government of Nepal, Kathmandu, Nepal (2010).
19. CBS. "Nepal Living Standards Survey Report, vol. I. Kathmandu, Nepal: Central Bureau of Statistics" (1996a).
20. CBS. "Nepal Living Standards Survey Report, vol. II. Kathmandu, Nepal: Central Bureau of Statistics (1996b).
21. Coates J., *et al.* "Comparison of a qualitative and quantitative approach to developing a household food insecurity scale for Bangladesh". *Journal of Nutrition* 136.5 (2006): 1420S-1430S.
22. Webb PJ., *et al.* "Measuring household food insecurity: Why it's so important and yet so difficult to do". *Journal of Nutrition* 136.5 (2006):1404S-1408S.
23. Webb P. "Medium- to Long-Run Implications of High Food Prices for Global Nutrition". *The Journal of Nutrition* 140.1 (2010):143S-147S.
24. Feleke S., *et al.* "Determinants of food security in Southern Ethiopia at the household level". *Agricultural Economics* 33.3 (2005): 351-363.
25. WFP and FAO. "Food and Agricultural Markets in Nepal". Final Report, Katmandu (2007).
26. Ghale Y. "Right to food and food security in the changing context Pyakuryal, P. N. and B. R. Upreti (2010) (eds)". Land Agriculture and Agrarian Transformation. Consortium for Land Research and Policy Dialogue (COLARP) (2010).
27. Chhetri NB. "Understanding the Process of Agricultural Adaptation to Climate Change: Analysis of Climate-Induced Innovation in Rice Based Cropping System of Nepal". Laxenburg, Austria: International Institute for Applied Systems Analysis (2008).
28. MoE. Ministry of Population and Environment. Government of Nepal (2018).
29. Aggarwal PK. "Global climate change and Indian agriculture: impacts, adaptation and mitigation". *Indian Journal of Agricultural Sciences* 78.11 (2008): 911-919.
30. Bhandari Medani P. "The climate change induced problems in South Asia, a case study of Bangladesh, India, Nepal, and Pakistan". *Advanced Agricultural and Environmental Science* 1.1 (2018a): 52-54.
31. Bhandari and Medani P. "Climate change science: a historical outline". *Advanced Agricultural and Environmental Science* 1 (2018b).
32. The Consultative Group on International Agricultural Research-CGIAR. CRP7 Proposal: Climate Change, Agriculture and Food Security (CCAFS), Lead Center: International Center for Tropical Agriculture (CIAT), Headquarters, Cali, Colombia (2011).

Volume 2 Issue 8 August 2018

© All rights are reserved by Medani P Bhandari.