Agricultural Production Typology in Bangladesh[1]

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ABSTRACT

This paper reports the changing pattern of crop typology in the changing socio-economic and climatic context of Bangladesh. Crop typology is viewed as a new paradigm concept connotes 'futurity',' 'holistic view', 'synoptic', 'productivity', 'sustainability', 'optimization', 'priority to the poor' and 'efficiency and effectiveness of resource uses' required for the farmer to make their long term strategic and short term farming action plan. The empirical process covers analyses of last ten years socio-economic and climatic condition, characterization and clustering hydro-climatic zones, defining the determinant of crop types as rice, fisheries and livestock, then describes the changing pattern and dominant types of crop production to describe the crop typology and policy implication for Bangladesh. The empirical results revealed that crop production in Bangladesh is affected by the natural hazards and there is variability in socio-economic and climatic parameters. The results of changing pattern of crop, fisheries and livestock type reveal that livestock was the first dominant production type in eastern hill, north-west, north-east and south-west region and fisheries was the first dominant crop in south-central region during 2003-2005. On the contrary, rice and fisheries has become the dominant crops in all the regions during 2009-2011. Moreover, Aus-Aman-Boro was dominant crop types in 2003-2005 which significantly changed as Aus- Aman - Vegetables during 2009-2011.

Keywords: Crop typology, hydro-climatic region, construction, determinants and description of crop typology and policy action

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1. INTRODUCTION

Agriculture is the single most important sector of the economy in Bangladesh. It is the major source of livelihood in the rural areas, where three-fourth of the population lives. Approximately two-thirds of the labor force is employed in agriculture. Although its share in the GDP is predictably declining, agriculture contributes approximately one-fifth of the GDP. The performance of this sector affects the overall economic growth. With irrigation covering only around 45 percent of the potentially irrigated area, agriculture is still weather dependent and has grown slower than was earlier expected, particularly because of the predominantly small farmer holdings in Bangladesh. However, Bangladesh is endowed with a favorable climate and soil conditions for the production of a variety of crops all the year round. The rich genetic estate, the richness in ecosystem diversity, and the vast untapped human resources who can learn and adopt new skills have been the major points of comparative advantage in Bangladesh. Thus, there are ample opportunities for crop.

Crop farming practices are largely influenced by hydro-climatic variability in almost all part in The 64 districts of Bangladesh are clustered into eight hydrological regions: Northwest (NW), North Central (NC), Northeast (NE), Southeast (SE), South Central (SC), Southwest (SW), Eastern Hills (EH) and Rivers and Estuaries (RE). Within each of these regions there are significant sub-regions, defined by parameters including agro-climatic zone, land form, river salinity and degree of urbanization. Farmers are growing crops, but they are facing some problems such as salinity, drought, flood and flash flood which differ from region to region. Crops are often damaged by natural calamities such as tidal surge, hailstorm, fog, cold wave etc. On the other hand they don’t have knowledge on modern varieties use, technologies, quality seeds and saplings and post harvest technologies. For various types of crop production, the

consideration of sustainability, productivity, efficiency, effectiveness, zoning, timing are the important component to adopt farming decisions in order to meet the food demand of the country.

The article aims at building a typology to identify typical agricultural, fisheries a livestock farms in Bangladesh by identifying determinants causing particular typologies. The study of crop typology helps to produce optimal crop production in the changing environment and rapid population growth, which basically allows farmers to produce crops effectively and efficiently. The study also helps the policy planners to make appropriate policy planning for adopting an environmental-friendly crop production process. Finally, formulation of appropriate policy plan and environment-friendly practice will support to grow more crops, which will help to meet the food demand for the present and future generations of the country.

Hydro-climatic variability in Bangladesh

Crop production in Bangladesh basically depends on the three hydro-climatic conditions, which are (i) climatic, (ii) physiographic and (iii) hydrological. Considering the importance of these three conditions, National Water Management Plan of Bangladesh has divided the whole Bangladesh into eight distinct hydro-climatic regions, which are considered regional clustering for development of crop typology. The description of the regions are stated in below:

South West Region: The basic characteristics of this region, it is saline prone, rich mangrove forest, dry season, a large number of coastal embankments, drainage congestion, flood and

cyclone prone. The extremes of the zones to the north are somewhat tempered. Rainfall is between 1500 mm-1800 mm. Mean summer temperature is below 35^0C.

North East Region: This region is characterized by mean maximum temperature is rarely above 32^0C but mean is 10^0C and below. Average humidity is even more than in south eastern zone. The cloudiest part of Bangladesh. There are haor region, flood, river erosion, drainage congestion, hill irrigation is required for crop production.

North Central: The basic characteristic of this region bulk water supplies and pollution, waste management for due to Dhaka city. Flooding and drainage problems, draught in the western fringes, especially the Hill Barind. There areMadhupur Tract and low lying areas. In this region moderate rainfall, being above 1500 mm. River erosion of old Brahmaputra right bank.

North-West: The basic characteristics of this region is flooding and drainage problem. Drought in the western fringess, especially the High Barind. This zone is similar to the northern part of the northern region. The rainfall is lower which causes atmospherically drier.

South Central: Siltation and drainage congestion, cyclone, flood, charlands and low lying areas. The rainfall is abundant, being above 1,900 mm. The range of temperature is, as can be expected, much less than to the west, but somewhat more than in south-eastern zone.

South East: Major area covers under cyclone prone, salinity, flooding, coastal embankments and hilly areas. The temperature goes over a mean of 32^0C and below a mean of 13^0C. Rainfall is heavy, usually over 2540 mm. The winter season is much severe than other region.

Eastern Hill: Small scale irrigation, cyclone prone, salinity, hilly areas. Temperature is relatively lower than other region. Humidity is much higher than other regions.

2. METHODOLOGY

This study has followed a comprehensive and well-organized approach and methodology, which is shown in the following schematic diagram:

Construction of Crop Typology:

Data was collection for constructing crop typology from secondary sources mostly from: Soil Resource Development Institute (SRDI), Bangladesh Agricultural Research Council (BARC), Bangladesh Rice Research Institute (BRRI), Bangladesh Agricultural Research Institute (BARI), Bangladesh Agricultural Development Council (BADC), Bangladesh Bureau of Statistics (BBS), Agricultural Sample Survey of Bangladesh, Fisheries Resources Survey System (FRSS), Department of Fisheries (DoF), Centre for Environmental and Geographic Information Services (CEGIS).

The collected data have been analyzed for the crop typology construction. The crop typology has been constructed following the steps (i) Calculation of total value of production (TVP) for the entire Bangladesh. It included five crop types namely rice (Aus rice, Aman rice and Boro rice), fisheries and livestock. District-wise data on quantities and prices of these crop types have been used in calculating the TVP; (ii) Trend analysis from period 2003-05 to 2009-11. For this, first of all, relative importance of the five crop types as percentage of the TVP has been calculated for 2003-05 and 2009-11. Then these have been compared to show trends in their relative importance. GIS maps have been prepared to visualize these trends; (iii) Dominant crop share determination. Which crop type out of rice, fisheries and livestock holds the major share has been determined for all the 64 districts of Bangladesh; (iv) Correlation analysis. It has been done

hydrological region-wise to find out the degree of association of one crop type with another; after the construction of crop typology, the determinants behind it have been identified.

Clustering of Crop Types: Culture practices are largely influenced by hydrological characteristics. The 64 districts of Bangladesh are clustered into seven hydrological regions: Northwest (NW), North Central (NC), Northeast (NE), Southeast (SE), South Central (SC), Southwest (SW), Eastern Hills (EH) and Rivers and Estuaries (RE). The district-wise crop values under each of the hydrological zones were normalized using the following formula:

$$x_{ij} = \frac{X_{ij} - \underset{i}{Min}\{X_{ij}\}}{\underset{i}{Max}\{X_{ij}\} - \underset{i}{Min}\{X_{ij}\}} \quad \text{.................................. (1)}$$

Where, Xij = Production amount, Max (Xij) = Maximum Production, Min (Xij) = Minimum Production. Correlation analyses of one crop type on another were done on the normalized values for each of the seven hydrological regions for 2003-05 and 2009-11.

Calculating the Value of Crop Types: The values of Crops, Fisheries and Livestock are all expressed in monetary values e.g. in million BDT (Bangladeshi Taka) at 2005 and 2011 current prices respectively. This was done by multiplying respective year's crop production in metric ton with respective year prices per m.ton. The values of crop production were obtained directly from Bangladesh Bureau of Statistics (BBS) publications. The values of fisheries production were similarly obtained by multiplying annual fish production of major species in metric tons with respective year prices of major fish species. The fish species considered include carp, cathead, snake head, shrimps and others. The value of livestock production was obtained by multiplying the number of different types of livestock like buffalo and cattle, goats and sheep and poultry (fowl and duck) with respective average unit prices. Annualized value was calculated by dividing

total value with average lives of these animals. The values of crops, fisheries and livestock sectors thus obtained were cross-checked with the respective sector's output in million BDT and found to be more or less similar. The three rice crops are assumed to constitute about 75% of all crops (rice and non-rice) while fisheries and livestock sectors cover their respective sectors in entirety, which is shown in the Table 1

Crop Typology Determinants: The shared value of different crop types and their culture practices within sub-regions are defined by parameters including agro-climatic zone, land form, river salinity and degree of urbanization. The regulating factors behind the particular crop types (rice, fisheries and livestock) were determined through literature review. Moreover, correlation and multivariate exploratory (principal component analysis) analysis have been used for determining inter-relationships among crop types.

3. RESULTS AND DISCUSSION

Observed changed in Dominance of Crop Types: To find the observed dominance in crop types, region-wise share of the dominant crop types (highest and second highest shares) were calculated for 2003-05 and 2009-11 and the changes were analyzed.

Share of rice: District-wise analysis showed that the share of rice production (three types together) to total have marked a decrease in 2009-11 compared to 2003-05 for the districts of Khulna, Barisal, Barguna, Jhalokathi,Bagerhat, Patuakhali, Bagerhat, Rangamati, Banderban, and Khagrachari. In all other districts, the share of rice production increased in 2009-11. The reasons for such decrease are (i) increase in salinity in the southern belt (ii) the vulnerability of climate change manifested through erratic rainfall pattern etc. (Figure 2)

Share of fisheries: District-wise analysis presented indicated that share of fisheries production (capture and culture) to total have marked a decrease in 2009-11 compared to 2003-05 for the districts of Barisal, Bramhanbaria, Cox's Bazar, Dhaka,Dinajpur,Khulna,Jhenaidah, Kishureganj, Narayanganj, Netrokona, Pabna, Rangamati, Sunamganj, Sylhet, Thakurgaon etc. In all other districts the share of fisheries production has increased in 2009-11. The main reasons for such decrease are shrinking in water bodies due to crop cultivation, urbanization and industrialization, roads and embankments etc.

Share of livestock: District-wise analysis of share of livestock production (cattle and buffalo, goats and sheep, fowl and ducks) to total have marked a decrease in 2009-11 compared to 2003-05 for all the districts. The reasons for such decline are (i) decrease in grazing land, absence of adequate breeding of drought resistant livestock by breeding organization, lack of government focus on livestock etc.

Region wise correlation among culture types:

Correlation analyses (marked with asterisks in the table 3) are done on the normalized values for each of the seven hydrological regions for 2003-05 and 2009-11. Correlation values for different hydrological regions are revealed (shown in the following Table-3). In drought prone North Western region (i) Aman and Aus, (ii) Aman and Boro and (III) Aus and Boro compete with each other for limited water and therefore these are found to be negatively correlated. In the drought prone area, farmers are giving emphasis on both livestock and fish culture/ capture and therefore these are found to be positively correlated. However, in wetland and flood prone North Central and South eastern region, fish culture competes with Aman/ Boro depending on the

topography and soil conditions. Therefore these are found to be negatively correlated. The coastal areas are emphasized by fisheries and livestock and thus, are positively correlated.

Description of the Typology

The crop production varies from one hydrological region to another. Principal crop production has been analyzed by Principal Component analysis using STATISTICA software package. Principal production components have been extracted according to Varimax Normalized Factor Loading. It has also been found that there were significant changes in rice (Kharif-I, Kharif-II and Rabi), fisheries (capture and culture), livestock (Cattle/Buffalo, Goat/Sheep and Fowl/Duck) between the average year of 2003-2005 and 2009-2011. The significant relationships among the productions of rice, fish and livestock also vary from one region to another and from the average year of 2003-2005 to 2009-2011.

In the case of North Central Hydrological region, culture fisheries, Kharif-I (Aus) and Kharif-II (Aman) rice were the principal production components for the average year of 2003-2005 showing significant correlation with principal production-1 axis by 0.94, 0.92 and 0.96 respectively (Figure 4). On the other hand, Kharif-I rice and fowl/duck were the principal production components for the average year of 2009-2011 showing significant correlation with principal production-1 axis by 0.83 and 0.82. In addition, fish production from culture fisheries has been the second principal production component for the average year of 2009-2011 (showing significant correlation with principal production-2 axis by 0.86). Moreover, rice and fish production has been increased over the livestock production in that region. On the other hand, the fisheries dominated districts namely Dhaka and Gazipur in 2003-2005 was dominated by rice production in 2009-2011 because of reducing low land area.

In the case of North East Hydrological region, Kharif-I and Kharif-II and Rabi rice were the principal production components for the average year of 2003-2005 and 2009-2011 showing significant correlation with principal production-1 axis by 0.97, 0.93 and 0.97 for 2003-2005 and 0.97, 0.83 and 0.91 for 2009-2011 respectively (Figure 4). Moreover, Cattle/Buffalo and fish production from capture and culture fisheries were the second principal productions for the average year of 2003-2005 (0.96, 0.84 and 0.88 to principal production-2 axis) and for the year of 2009-2011 Cattle/Buffalo attained the second principal production showing significantly correlated to principal production-2 axis by 0.91. It is concluded that in North East region there was no significant change in production between the average year of 2003-2005 and 2009-2011.

In North West Hydrological region, Kharif-I and Kharif-II rice was the principal production component for the average year of 2003-2005 showing significant correlation with principal production-1 axis by 0.88 and 0.92 respectively (Figure 4). Moreover, Rabi rice has been the second principal production component for the average year of 2003-2005 and of 2009-2011 (significantly correlated with principal production-2 axis by 0.97 and 0.93). And Kharif-I and Kharif-II rice was the second principal production component for the average year of 2009-2011.

Moreover, the rice and fisheries production has been increased over the livestock production from 2003-2005 to 2009-2011 average years, because of more HYVs introduce and management practices are improving. Moreover, fisheries production has been increased more than the rice production covering maximum districts in that region.

In the case of South Central Hydrological region, the production of capture and culture fisheries, Cow and Buffalo, Kharif-I, Kharif-II and Rabi rice were the principal production components for the average year of 2003-2005 (significantly correlated with principal production-1 axis by 0.84,

0.96, 0.78, 0.92, 0.95 and 0.90 respectively) shown in the Figure 4. On the other hand, Kharif-I rice was single the principal production component for the average year of 2009-2011 showing significant correlation with principal production-1 axis by 0.92. Moreover, Kharif-II and Rabi rice production showed the second principal production component for 2009-2011 by 0.97 and 0.96 to principal production-2 axis respectively. Moreover, major change has been occurred in livestock production being decreased dominancy from three districts in 2003-2005 to zero districts in 2009-2011 which were dominated by fisheries. However, there was no change in rice production between these average years.

In the case of South East Hydrological region, Kharif-II and Rabi rice production were the principal production components for the average year of 2003-2005 showing significant correlation with principal production-1 axis by 0.85 and 0.96 respectively (Figure 4). On the other hand, Kharif-I rice production was the single principal production component for the average year of 2009-2011 (significantly correlated with principal production-1 axis by 0.9). Moreover, fish production from capture fisheries has been the second principal production component for the average year of 2009-2011 (showing significant correlation with principal production-2 axis by 0.98). It is concluded that although there was no major change in dominancy, but the dominant rice production in Noakhali district has been interchanged with fish production dominant in Comilla district between the average year of 2003-2005 and 2009-2011. No dominancy in livestock production has been found in this region in both the average year.

In South West Hydrological region, livestock productions (Cow&Buffalo, Goat&Sheep and Fowl&Duck) were the principal production components for the average year of 2003-2005 and of 2009-2011 showing significant correlation with principal production-1 axis by 0.96, 0.91 and 0.90 for 2003-2005 as well as 0.96, 0.86 and 0.91 for 2009-2011 respectively (Figure 4).

Moreover, culture fish production has been second principal production component for the average year of 2009-2011 (showing significant correlation with principal production-2 axis by 0.89). It is concluded that in this region livestock production showed highly negative relationship with the rice production in Rabi season in the average year of 2003-2005. However, highly positive relationship has been found in between the rice production in Kharif-I season and Rabi season. Moreover, there are no significant relationships found among the commodities in 2009-2011.

In Eastern Hill region, capture fisheries, Cattle/Buffalo, Fowl & Duck, Kharif-I, Kharif-II and Rabi rice production were the principal production components for the average year of 2003-2005 and 2009-2011 (significantly correlated with principal production-1 axis by 0.95, 0.94, 0.93, 0.99, 0.99 and 0.98 for 2003-2005 and 0.96, 0.92, 0.84, 0.94, 0.98 and 0.98 for 2009-2011 respectively) shown in Figure 7.7. On the other hand, Goat & Sheep production was the principal production component for only the average year of 2003-2005 (significantly correlated with principal production-1 axis by 0.85). Moreover, fish production from culture fisheries has been only the second principal production component for the average year of 2003-2005 (showing significant correlation with principal production-2 axis by 0.98). These conclude that both the dominancy of rice and fish production has been increased over the livestock production in that region. Moreover, in the average year of 2003-2005 highly positive relationship exist in between the fish production from culture fisheries and livestock production as well as between the rice production in Kharif-I season and in Kharif-II season. However, negative relationship exists between the livestock production and rice production in Rabi season. The changes in relationship has been found in the average year of 2009-2011 where highly positive relationships occur in

between the fish production from capture fisheries and rice production in Kharif-II and Rabi season.

4. POLICY RECOMMENDATIONS

For fostering agricultural development based on the present findings, following recommended policy should be implemented by relevant ministries and organizations: Breeding and upgrading of drought, saline and flood tolerant rice and livestock varieties; Increasing efficiency of irrigation systems like use of piped irrigation, practicing alternate wet and dry (AWD) irrigation; Developing suitable institutional architecture for interface with country's agricultural extension agencies (for example DAE and developing capacities of their extension agents with regard to improving crop productivity; Providing extension services to farmers so that they can translate these into do-able actions; Promoting integrated farming (such as poultry, livestock and fisheries along with rice) that have higher net earnings than non-integrated farming (e.g., farms with rice production only). This would require release of drought tolerant livestock, poultry and fisheries; Promoting growth of more non- rice crops or fisheries and livestock in some districts instead of rice mono-culture for sake of both sustained productivity of soil as well as insurance against risk; Encouraging simultaneous growing of drought / saline/ etc. resistant livestock and drought / saline/ etc resistant rice in some districts where there is positive correlation among these variables; Facilitating supplementary irrigation, rain-water harvesting and Alternate Wet and Dry (AWD) technologies for increasing irrigation efficiency in the face of projected shortage of ground-water in some of the zones; Carrying out detailed study on water recharges and discharges in major hydrological zones of Bangladesh for proper planning on use of ground versus surface water for irrigation in customized weather forecasts model; Promoting non-rice crops in areas of limited groundwater recharge to augment water availability; Supporting

establishment of localized weather sub-stations with the objective of supplying related weather data for crop typology; Capacity enhancement of Meteorological organization for timely generation and supply of relevant weather information to farmers, livestock herders and fishers.

- Improving Crop, Fisheries and Livestock Productivity
    - Breeding and upgrading of drought, saline and flood tolerant rice and livestock varieties.
    - Increasing efficiency of irrigation systems like use of piped irrigation, practicing alternate wet and dry (AWD) irrigation.
    - Developing suitable institutional architecture for interface with country's agricultural extension agencies (for example DAE and developing capacities of their extension agents with regard to improving crop productivity..
    - Providing extension services to farmers so that they can translate these into do-able actions.
    - Promoting integrated farming (such as poultry, livestock and fisheries along with rice) that have higher net earnings than non-integrated farming (e.g., farms with rice production only). This would require release of drought tolerant livestock, poultry and fisheries.
- Achieving Crop Diversification

- Promoting growth of more non- rice crops or fisheries and livestock in some districts instead of rice mono-culture for sake of both sustained productivity of soil as well as insurance against risk

- Encouraging simultaneous growing of drought / saline/ etc. resistant livestock and drought / saline/ etc resistant rice in some districts where there is positive correlation among these variables.

- Facilitating supplementary irrigation, rain-water harvesting and Alternate Wet and Dry (AWD) technologies for increasing irrigation efficiency in the face of projected shortage of ground-water in some of the zones.

- Increasing Water Availability

  - Carrying out detailed study on water recharges and discharges in major hydrological zones of Bangladesh for proper planning on use of ground versus surface water for irrigation in customized weather forecasts model

  - Promoting non-rice crops in areas of limited groundwater recharge to augment water availability.

  - Supporting establishment of localized weather sub-stations with the objective of supplying related weather data for crop typology

- Providing Early Warning

  - Capacity enhancement of Meteorological organization for timely generation and supply of relevant weather information to farmers, livestock herders and fishers

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Table 1: Sectoral coverage of Rice-Fisheries-Livestock

Crop type	Culture Type	Sectoral Coverage (%)
Rice	Aus (Kharif I)	75
	Aman (Kharif II)	
	Boro (Rabi)	
Fisheries	Capture	100
	Culture	
Livestock	Cattle and Buffalo	100
	Goats and Sheep	
	Poultry (Fowl) and Duck	

Table 1: Dominant crop types in different hydrological regions

Hydro-climatic Region	2003-2005			2009-2011		
Eastern Hill	Livestock	Livestock and Rice	Fisheries	Rice and Fisheries	Rice	Livestock
North West	Livestock	Fisheries	Rice	Fisheries	Livestock	Rice
North East	Livestock and Fisheries	Fisheries	Rice	Fisheries	Livestock	Rice
North Central	Fisheries	Livestock and Fisheries	Rice	Rice and Fisheries	Livestock	Rice
South East	Fisheries	Livestock	Rice	Fisheries	Livestock	Livestock and Rice
South Central	Livestock, Rice and Fisheries	Fisheries	Rice	Fisheries	Livestock	Rice
South West	Livestock	Fisheries	Rice	Fisheries	Livestock	Rice

Table-3: Correlation values among the crop typology determinants for 2009-2011

Sl No.	Typology determinants	EH		NE		NW		NC		SE		SW		SC	
		+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve	+ve	-ve
1.	Fish Culture-Aman	0.85	0.68	-	-	-	-	-	-	-	0.79	-	-	-	-
2.	Fish Capture-Aman	0.83	0.68	-		-	-	-	-	-	-	-	-	-	-
3.	Fish Capture-Livestock	-	-	-	-	0.91	-	-	-	-	-	-	-	-	-
4.	Capture-Culture	-	-	-	-	0.81	-	-	-	0.89	-	0.71	-	-	-
5.	Aus-Boro	-	-	-	0.81	-	0.81	-	-	-	-		-	-	-
6.	Fish Culture-Livestock	-	-	0.93	-	-	-	-	-	0.87	-	-	-	0.66	-
	Fish Capture-Livestock	-	-	0.89	-	-	-	-	-	-	-	0.73	-	0.88	
7.	Aman-Fish	-	-	-	-	-	-	-	-	-	-	-	-	-	0.65
8.	Boro-Fish	-	-	-	-	-	-	-	-	-	-	-	-	-	0.67
9.	Aus-Fish Capture	-	-	-	-	-	-	-	-	-	-	-	0.71	-	-
10.	Aus-Fish Culture	-	-	-	-	-	-	-	-	-	-	-	0.48	-	-

Figure 1: Hydrological Regions of Bangladesh.

Figure 2: Schematic Diagram of Approach and Methodology

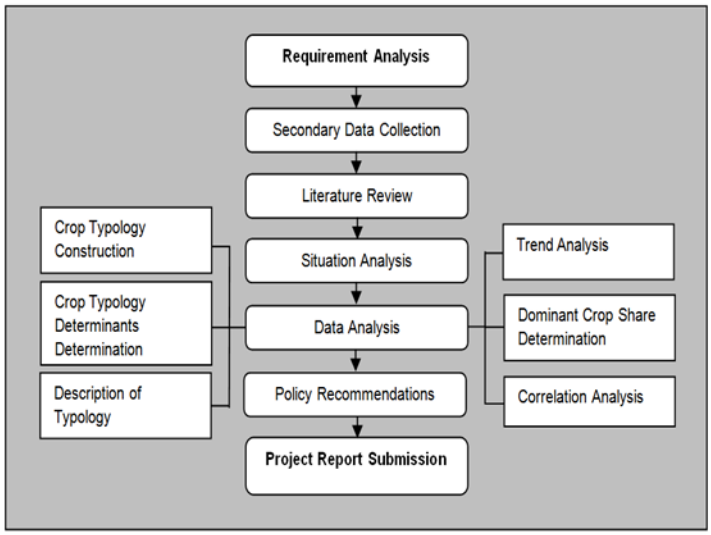


Figure 3: Dominant crop types in Bangladesh for 2003-05 and 2009-11

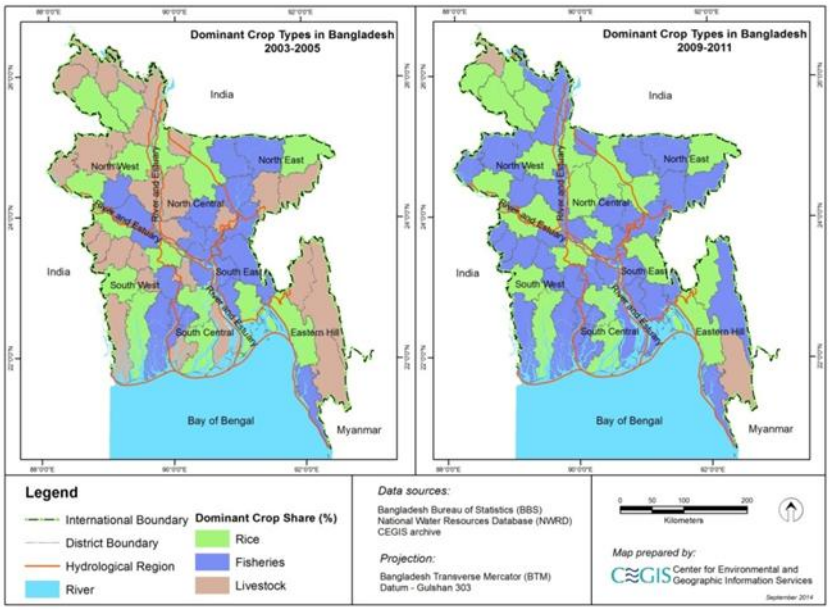
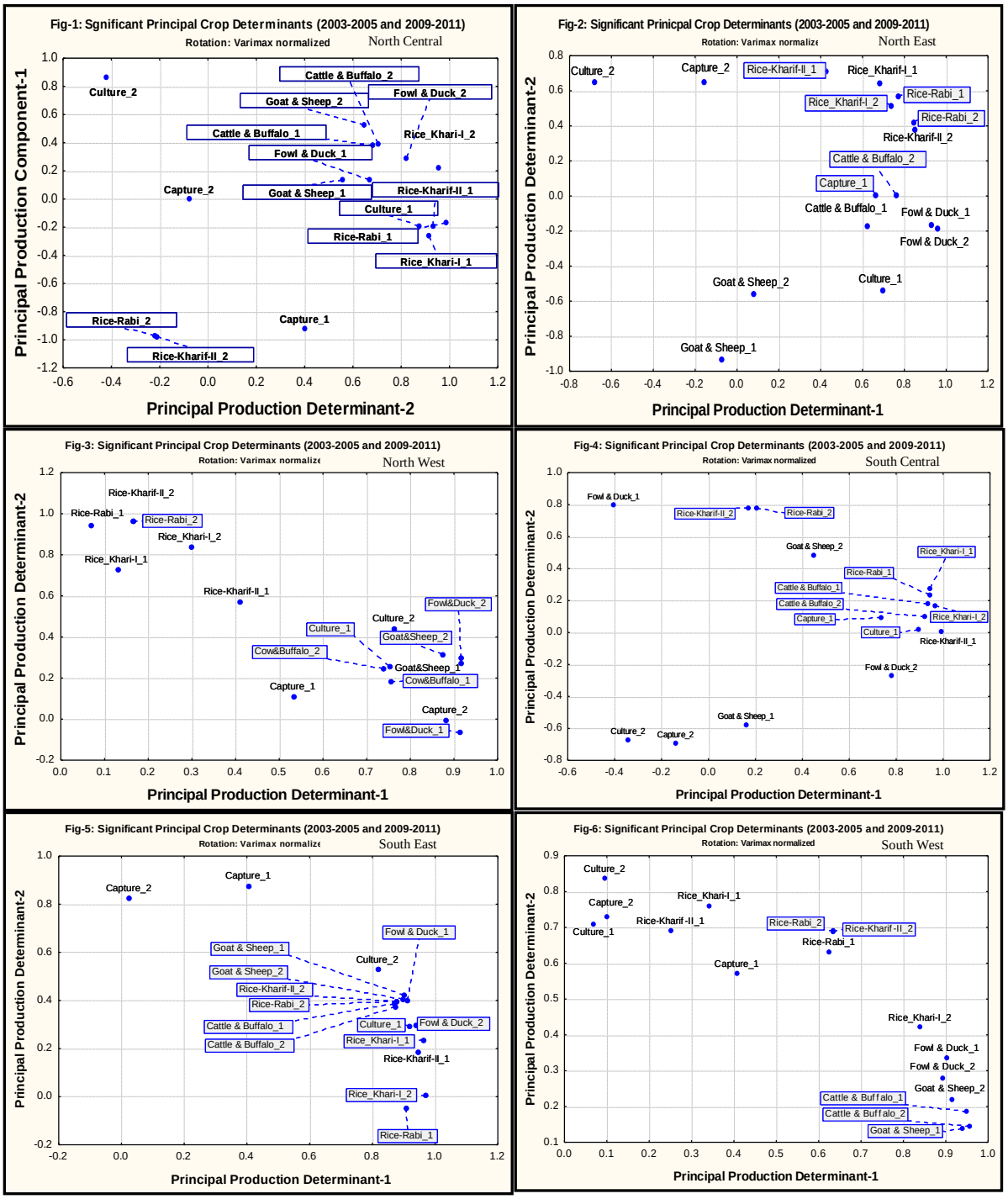


Figure 4: Significant Principal Crop Determinants for the average year of 2003-2005 (1) and 2009-2011 (2) in seven hydrological regions in Bangladesh



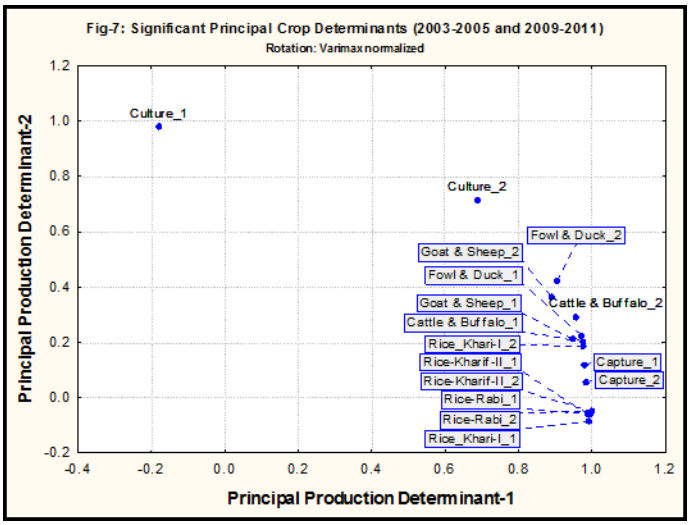


Fig-7: Significant Principal Crop Determinants (2003-2005 and 2009-2011)
Rotation: Varimax normalized
Principal Production Determinant-2
Principal Production Determinant-1
1.2
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.2
0.0
0.2
0.4
0.6
0.8
1.0
1.2
Culture_1
Culture_2
Fowl & Duck_2
Goat & Sheep_2
Fowl & Duck_1
Cattle & Buffalo_2
Goat & Sheep_1
Cattle & Buffalo_1
Rice_Khari-I_2
Rice-Kharif-II_1
Capture_1
Rice-Kharif-II_2
Capture_2
Rice-Rabi_1
Rice-Rabi_2
Rice_Khari-I_1