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PERSPECTIVE OPEN ACCESS

Rural Settlement Expansion and its Effect on Food Security in Salanpur, West Bengal, India

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Abstract

The settlement may be viewed as the manifestation of delicate human-nature interaction and cultural impression of humanity in the landscape system. With the progress of civilisation, the perception of use of natural resources and cultural development become ever-changing phenomena that causes the changes in the rural settlement all over the world. Salanpur C.D. Block of Paschim Bardhhaman district has registered an unusual settlement arrangement and spatio-temporal changes. Using satellite imageries and competent GIS technologies it is observed that an unplanned growth of rural settlement has developed in this part of West Bengal. This paper examines the spatio-temporal dynamics of the rural settlement over ten years (2008-2018), employing PR index, and SI index. In doing so, it, analyses the dynamic change of rural settlement at Gram Panchayat Level and its relation with overall land-use in the study area. This paper also envisages how the rural settlement expansion affects the various dimension of food security in Salanpur C. D. Block.

Along with this, the Spearman Rank-order Correlation Coefficient (rho=p) is also applied to comprehend the effect of the rural settlement expansion on regional food security. Growth of rural settlement towards productive agricultural land, unequal access to food, insufficiency in clean water, sanitation, and health care facility are also indicators of increasing threat to the long run food security of the people in the study area. The result shows a positive correlation between the rural settlement expansion index (SI) and food insecurity Index (FISI), it indicating that if the rural settlements expand, it would enhance the risk of food insecurity of the area. Development and growth are the buzz of the modern era, but the dark side of it is that destruction of agricultural lands would be ultimately responsible for food insecurity and uneven economic growth. The findings suggest that lopsided and unplanned growth of settlements is pose threats on food security of the study area. Therefore, sound planning is required to come out of these potential threats for the sake of the inhabitants.

Keywords: Rural Settlement, Expansion, Salanpur, Food Security, PR Index, SI Index, FISI, West Bengal, India

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Introduction

The key purpose of this research is to examine the impact of the expansion of settlement on food security. It is well established that the settlement is often regarded as the manifestation of delicate human-nature interaction and cultural imprint of humanity in the landscape system. With the progress of society, the perception of the use of natural possessions and aesthetic improvement become a continually changing phenomenon that causes to the alterations of the rural settlement all over the world. "Since the early days of human civilisation, the settlement has been one of the main foot prints of humanity on the Earth's terrestrial ecosystems" (Bar-Massada, et al., 2014: 429). Settlements seem to be the foremost dynamic human component over the earth's surface. It needs serious geographical investigations and scientific explorations (Sarkar, 2010). In India, a very modest number of literatures has been inscribed on rural settlement systems in contrast with the sizeable number of literature appearing on the urban systems. The literature that exists is mainly devoted to the historical and temporal evolution of individual rural villages and their spatial forms and types, but the rural settlement expansion patterns and their spatiotemporal dynamics are rarely reflected. Ascertaining the past and present settlement aspects is very much important to elucidate the future trend of settlement pattern. This research studies the spatiotemporal dynamics of a rural settlement over ten years (2008-2018) and its relation with overall land-use in the Salanpur, West Bengal.

Changes in the system of land use can often, however, lead to very unfavourable secondary effects on the fragile natural environment (Dhinwa, et al., 1992).These effects become worldwide vital through their accumulation effects and its impact on food security, caused by the transformation of agrarian land into rural and urban built-up area due to the population explosion. The rapid rural residential development is threatening food security and local ecological safety (Xie and others2005). A secure regional food system is a system that allows the region to meet the nutritional and dietary needs of its population without compromising the region's future ability to continue to do so. It incorporates three aspects of sustainability: ecologic or environmental sustainability, economic viability, and social equity (Beil, et al., 2014). Commonly, the most used definition of food security is the definition extracted from the 1996 World Food Summit:

> Food security, at the individual, household, national, regional and global levels[is achieved 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 an active and healthy life .

"Nutrition insecurity is sometimes used interchangeably with food insecurity" (Jones, et al.,2013: 482). The Food and Agricultural Organisation (FAO) of the United Nations defines nutrition security as "A situation that exists when secure access to an appropriately nutritious diet plus a hygienic setting, adequate health services and care, so as to make sure a healthy and active life for all household members".

Haphazard and unplanned growth of rural settlement not only influence the food security through the conversion of agricultural land into non-agricultural use and its effect on physical and economic access to available food product but it also challenges the equal and secure access to proper sanitary environment, quality water, and sufficient health services and care to safeguard the overall dimension of food security. FAO identifies four dimension of food security-food availability (that is production and imports of food), food access (social and economic access to food), food utilisation (safe and nutritious food can be utilised) and food stability (all people at all times). Land use planning can play a key role in protecting farmland and thereby safeguard the food supply (Beil, et al., 2014).The next section reviews the relevant literature that underpins the research.

Review of Literature

Ever since India's independence, the planners realised the need to attain self-sufficiency in food grains as one of the critical goals of planning (Datt & Sundharam, 2002). The agricultural development policies have aimed at reducing hunger, food insecurity, malnourishment, and poverty (Acharya, 2009). The concept of food security has evolved, developed, multiplied and diversified since the first World Food Conference of 1974. However maintaining food security at the national and household levels continues to be a major concern for India, both for the welfare of the people as well as for political stability (Kumar et al., 2012). Realising the importance of food security, since its inception, the Journal Space and Culture, India has published a number of articles on this topic (Bezbaruah, 2013; Siddique & Mukherjee, 2017 and also Bulkhairova et al., 2019; Zhupley et al., 2018). Amongst these articles, the first was on the National Food Security Act, 2013 (also known as the Right to Food Act) by (Bezbaruah, 2013). It was passed by the Government of India into a piece of legislation on 12 September 2013. This Act aims at providing subsidised food grains to (Bezbaruah, 2013) approximately two-thirds of India's 1.3 billion. Bezbaruah (2013) makes a detailed analysis of the mechanisms of implementation of this Act. The beneficiaries of the Public Distribution System (PDS), who live in below the poverty line (BPL) are mainly the beneficiaries of this Act. The beneficiaries of this Act qualifies for 5 kilograms (11 lb) per person per month of cereals —for instances— rice at ₹3 (4.2¢ US) per kg; wheat at ₹2 (2.8¢ US) per kg and coarse grains (millet) at ₹1 (1.4¢ US) per kg. In addition, the children, lactating and expecting mothers are entitled to free cereals on a daily basis under schemes like Mid-Day meal and despite these magnanimous provisions, the implementation of this act continues to be highly uneven (Acharya, 2009; Bezbaruah, 2013; Kumar, 2012; Ritchie et al., 2018; Sarkar and Shekhar, 2017; Siddique and Mukherjee, 2017).However, one has to note that achieving food security continues to be a major and burning issue in other countries too (Bulkhairova et al., 2019; Chen, 2007; Verburg et al., 2000; Zhupley et al., 2018).

Within the context of India, with an aim to identify the food insecure states, M.S. Swaminathan Research Foundation (MSSRF) and WFP (World Food Programme), jointly prepared and distributed the following atlases: Food Insecurity Atlas of Rural India (April, 2001), Food Insecurity Atlas of Urban India (October, 2002), Atlas of the Sustainability of Food Security in India (February, 2004), State of Food Insecurity in Rural India (2008) and State of Food Insecurity in Urban India (2010). The purposes of these atlases were to understand the types and the extent of food insecurity in terms of food availability and affordability via physical access to food, levels of food consumption, and medium of PDS of the different states of India, and accordingly Figure action plans to accomplish food security.

Scholars from India have undertaken research to examine the performance, challenges and underlying policies in food security in terms of its three main pillars- availability, accessibility and absorption (Gahukar, 2011; Kumar et al., 2012; Singh, 2014). These scholars analysed the regulations for land tenure and land rights, low crop productivity, biological constraints for production and quality of grains, unavailability of farm inputs and labour, socio-economic-political-cultural constraints to sustainable food production. Based on their analysis, these scholars suggested several strategies for crop production and food distribution and emphasis the need for a second green revolution. However, Siddque & Mukherjee (2018) argue that rapid, haphazard urbanisation; infrastructural development and associated loss of agricultural land are the major cause of food insecurity. Along with several factors, income inequality among the different subgroups and consequent poverty were the leading causes of food insecurity in India (Karmakar & Sarkar, 2013). Linked to these factors, in their research in rural West Bengal, Sarkar & Sekhar (2017) examined and unfolded that the education of head of the household, caste, source of income, MPCE (Monthly per Capita Expenditure) status,

availability of livestock were significantly associated with household food security. In a similar context, Md. Ismail &Md. Mustaquim (2013) examined the relationship between food security and occupational structure among the various workers and described that households with their members not being permanently employed have higher chance of becoming a victims of food insecurity.

Historically, the most essential instrument of food security initiated by the Government of India has been the PDS (Public Distribution System). The PDS acted as a price support programme for the consumer during the period of food shortage of the 1960's (Datt & Sundharam, 2002). But the PDS as a system proved to be far from satisfactory in many respects (Report on the State of Food Insecurity in Urban India, 2010). Hence, in 1997, the Government of India introduced targeted policy shift (TPDS) to improve the functioning of the PDS (Report on the State of Food Insecurity in Urban India, 2010). Similarly, ICDS (Integrated Child Development Programme) programme in 1975's, Mid-Day-Meal programme in 1997 is Government of India's initiative for the prevention of chronic energy deficiency (Datt & Sundharam, 2002). Article forty-seven of the Constitution of India states that, -"the State shall regard raising the extent of nutrition and standard of living of its people and enhancement in publically health among its primary duties. Progress was monitored through the national surveys- NFHS (National Family Health Service), NNMB (National Nutrition Monitoring Bureau)" (Ramachandra, 2018: 14).

The above-reviewed literature on food security in India mainly devoted to depicting overall food scenario and formulating strategies for crop production and distribution. These literatures are mostly linked to income inequality, poverty, household status, livelihood pattern in addition to role of haphazard urban growth, infrastructural development and associated loss of cultivated land and its effect on food security. However, little is known about the impact due to increased dynamics of rural settlement systems on food security. In the light of this argument, the key purpose of this research is to examine the status of food (in) security linked to rural settlement expansion at Salanpur of Paschim Barddhaman District, West Bengal. Hence, the central aim of this research is to evaluate the effect of rural settlement expansion on food insecurity. To accomplish this objective, the research would quantify rural residential land percentage and expansion index between 2008 and 2018 at Gram Panchayat (GP) level. The following section outlines the methods deployed.

Methods and Materials

The vector data of settlement area and Land use-Land cover were obtained from LANDSAT 5 TM (acquired in 2008/4/12) and LANDSAT 8 OLI (acquired in 2018/3/07) images by supervision classification using maximum likelihood method. The outcome is then synchronised with the Google Earth image of the study area and field survey.

Spatio-temporal dynamic change of rural settlement is analysed by employing the Rural Residential Land Percentage to examine the spatial distribution of rural settlement. The rural residential development index was applied to study the spatial variance of rural residential development (Tian, 2007), expressed as follows:

$$PR = RL/TL \times 100 \quad (1)$$

Where, PR is a rural residential land percentage of a G.P., RL is a rural residential land area of a G.P. (sq.km), TL is the total land area of a G.P. (sq.km).

$$SI = \blacktriangle RLij/TL \times 100 \quad (2)$$

Where, SI is the rural residential development index of a G.P. from period i to j and ▲RLij is the rural residential development from period i to j.

To obtain the objectives of evaluation of food insecurity status to determine which G.P. is maximum and least vulnerable to insecurity a Food Insecurity Index (FISI) is constructed. The categories of food insecurity are divided according to FAO recognised dimension and the indicators are chosen on the basis of applicability and availability of data. The categories and indicators are described in Table 1.

Indicators are normalised on the basis of the following formula:

$$X = [x - \min(x)]/[\max(x) - \min(x)] \quad (3)$$

After normalising the data, scores are assigned, on an ordinal scale for each G.P. –the scale ranges from 0-10. 0 indicates the most favorable condition and 10 indicate the most adverse situation. After aggregating the score, highest scoring G.P. means more susceptible to food insecurity.

After dividing the entire block into high, medium and low settlement expansion zone, (Table: 2)150 structured questionnaire surveys (50 samples from each 3 G.P. that is Rupnarayanpur, Basudebpur-Jemari, and Dendua) were conducted using random sampling method to understand the vulnerability of local people to food insecurity.

Simple percentage method and Spearman Rank-order Correlation Coefficient (rho=p) method has also been applied to understand the relationship between rural settlement extension and food insecurity. The study area is described in the following section.

The Study Area

Salanpur is the western-most land of Paschim Bardhhaman district, sharing the state boundary with Jharkhand (Figure 1). It is surrounded by Dhanbad district of Jharkhand on the west, Jamtara district of Jharkhand on the north, Barabani C.D. Block of Paschim Bardhhaman district on the east, and Asansol Municipal Corporation on the south. Salanpur C.D. block encompasses a total area of 135.05 sq.km (Census of India, 2011).

It has one Panchayat Samity, eleven Gram Panchayats, 75 mouzas, 69 inhabited villages and two urban units (Salanpur Block Development Office). The shape of this block resembles a triangle (Hagget Shape Index=0.49).

It is an undulating hilly tract, covered with laterite soil zone between river Barakar in the west and river Ajay in the north. This block, also comprises an extended part of Chotonagpur plateau.

River Barakar enters West Bengal near Ghatkul mouza of Salanpur, and Ajay River near Simjhuri of Chittaranjan. The highest elevated land of this block, as well as the district, is Hadla hill (approximately, 220 metres), where Maithan reservoir is constructed (Chattopadhya, 2000). Hadla hill and its surrounded area are covered with thick forest (covering 1755 hectares of land), and the abundance of coal mine zone in this area also proved that this region was once covered with dense forest.

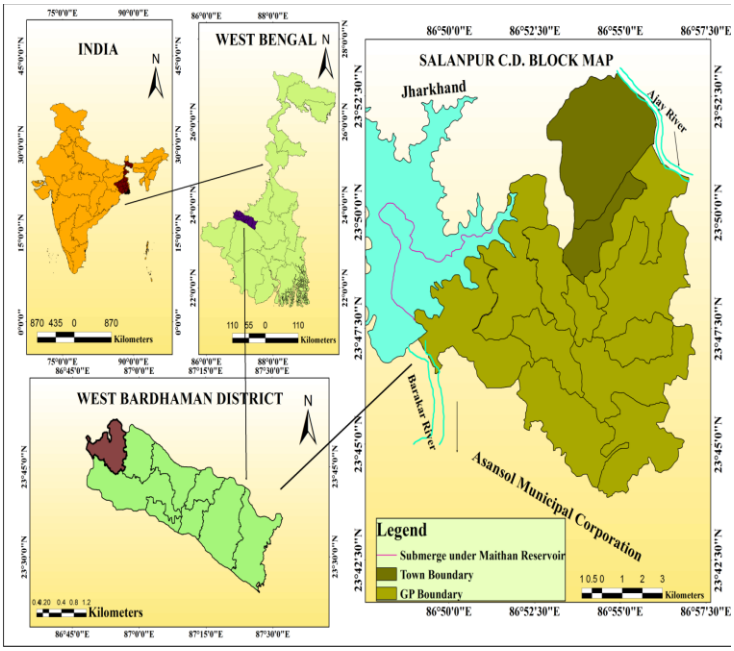

Figure 1: Location of the Study Area
Source: Computed by the Authors

Table 1: Categories and Indicators of Food Insecurity Index

Categories	Indicators	Data Sources
Food Availability (sufficient food is available, production and imports)	Average Crop (Aman rice) production per G.P.	District Statistical Handbook Bardhhaman(2015)
	Average Animal product (fish) production per G.P.	District Statistical Handbook Bardhhaman(2015)
	No of PDS shop per 1000 population	District Census Handbook Bardhhaman(2011)
	No of Mandis per 1000 population.	District Census Handbook Bardhhaman(2011)
	No of Weekly Hut per 1000 population.	District Census Handbook Bardhhaman(2011)
	No of ICDS centre per 1000 population.	District Census Handbook Bardhhaman(2011)
	No of Anganwadi centre per 1000 population.	District Census Handbook Bardhhaman(2011)
Food Access(Economic and social access to food)	Road Length per 5 sq.km	Google earth image(2018)
	Work participation rate (%)	District Census Handbook Bardhhaman(2011)
	Distance to nearest town(KM)	Calculated in ARC GIS software.
Food Utilisation(Safe and nutrias food can be utilised)	No of primary health sub centre per 1000 population	District Census Handbook Bardhhaman(2011)
	Distance to nearest primary health centre(KM)	Calculated in ARC GIS software.
	Availability of tap water per village	District Census Handbook Bardhhaman(2011)
	Availability of tube well water per village	District Census Handbook Bardhhaman(2011)
	Availability of community toilet including bath per village	District Census Handbook Bardhhaman(2011)
	Availability of community bio-gas for reproductive use/per village.	District Census Handbook Bardhhaman(2011)

Sources: Compiled by the Authors

Results and Discussion

Spatio-Temporal Dynamics of Rural Settlement (2008-2018)

According to the Census of India, in Salanpur 62.16% of the total population are distributed in 69 administrative villages. The research applied the aforementioned methods to examine the spatio-temporaldynamics rural settlement of the study area.

Table 2: Percentage of Rural Residential Land Area and Settlement Expansion Index			
Gaon Panchayats	2008	2018	2008-2018
	Percentage of Rural Residential Land Area (PR)	Percentage of Rural Residential Land Area (PR)	Settlement Expansion Index(SI) in %
Achhra	0.72	15.91	380.75
Alladi	5.14	17.50	92.93
Basudebpur-Jemari	3.45	22.85	292.47
Dendua	5.73	14.79	39.52
Ethora	2.82	11.17	87.49
Jitpur-uttarrampur	2.20	11.26	93.97
Kallya	1.60	11.66	80.74
Phulberya	4.34	15.07	99.72
Rupnarayanpur	5.33	35.58	538.44
Salanpur	6.45	18.53	101.60
Shyamdi	4.44	16.96	263.06
Sources: LANDSAT 5 TM (2008/4/12) and LANDSAT 8 OLI (2018/3/07) & Authors.			

It is clear from Table 2 and Figure 2 that the maximum rural residential areas are distributed unevenly across the region. Highest residential area are concentrated in Rupnarayanpur G.P., as it is located in a low lying area and it is the administrative, commercial, transportation nodal centre of Salanpur. Basudebpur-Jemari, Alladi, Shyamdi, Achhra, Phulberya show medium concentration of rural residential area. These are the areas, which comprises few physical and man-made features such as Muktaichandi Hill (180 metre) covering Shyamdi and Phulberya G.P. plus the mining-induced dumping site of Basudebpur-Jemari G.P. However, these are the areas that comprises larger rural residential zone. This is because of the presence of mining activities in Mohanpur, Jemari, Basudebpur addition to improved agricultural practice and better transport facilities. As is evident, the rural settlement of the Dendua G.P. is sparsest as 11.91% area is covered by dense forest, plus the presence of the Hadla Hill (220 metres). Besides, 45.53% of the area is submerged under Maithan reservoir. Similarly, in the Ethora G.P. too, 78.44% is devoted to agricultural activity and hence sparse settlement. Jitpur-Uttarrampur and Kallya G.P.s too illustrate meagre settlement as these two GPs have remained backward in terms of agricultural development and socio-economic facilities. It can be argued that in general, a regional difference of rural settlement has been influenced more by socio-economic development rather than the topography in Salanpur.

In between 2008-2018, rural residential land area expanded dramatically. Rupnarayanpur G.P. recorded the highest expansion intensity, followed by Achchra, Basudebpur- Jemari G.P. and Shyamdi (Figure 3).

Lowest expansion intensity is being recorded in Dendua G.P. as this area is a physically and ecologically most sensitive zone of Salanpur, for human exploitation. Because, the maximum area of this G.P. is covered by dense forest, water body (Maithan reservoir) and hilly tracks. The rural residential land area is expanded in different rate and destructed the productive agricultural land. Settlement expansion and its associated demand of land for infrastructural development is the main cause for land abuse and soil quality degradation. It can be argued that, these constitute a serious threat on future food security of Salanpur.

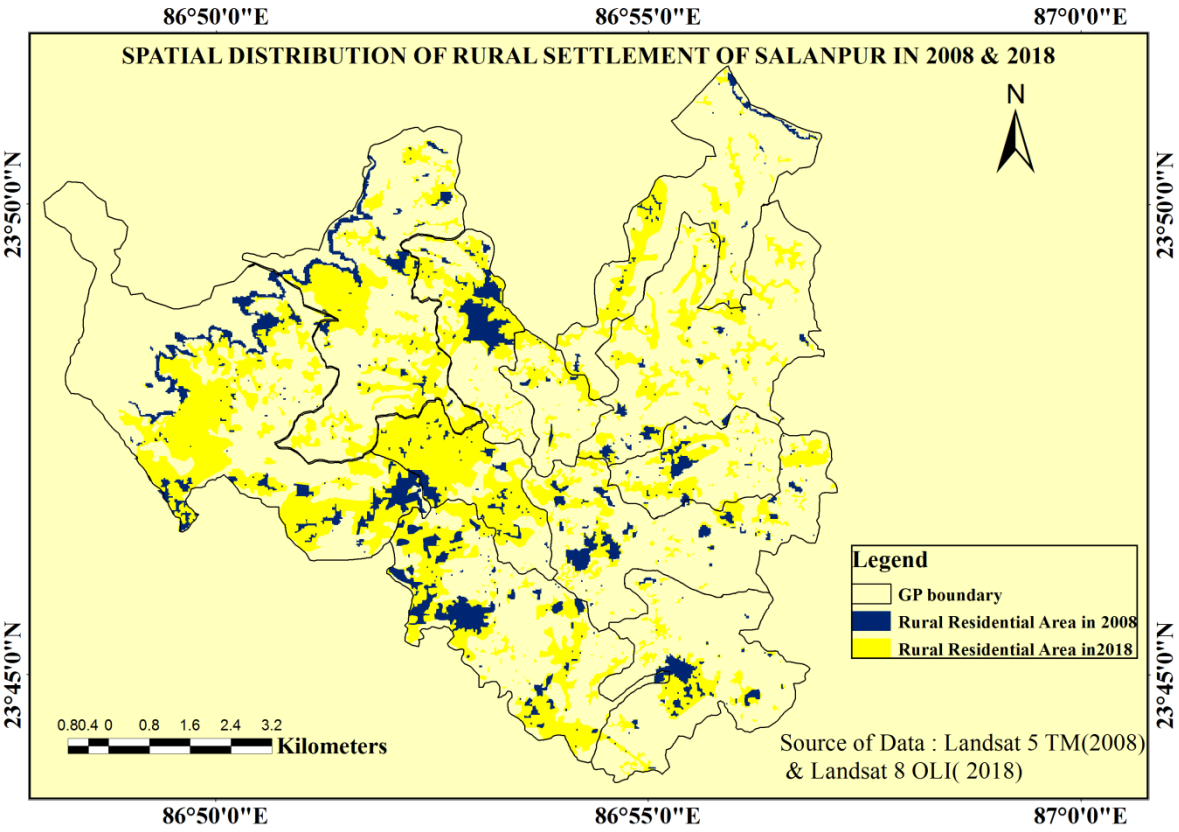

Figure 2

Sources: LANDSAT 5 TM (2008/4/12) and LANDSAT 8 OLI (2018/3/07) & Authors.

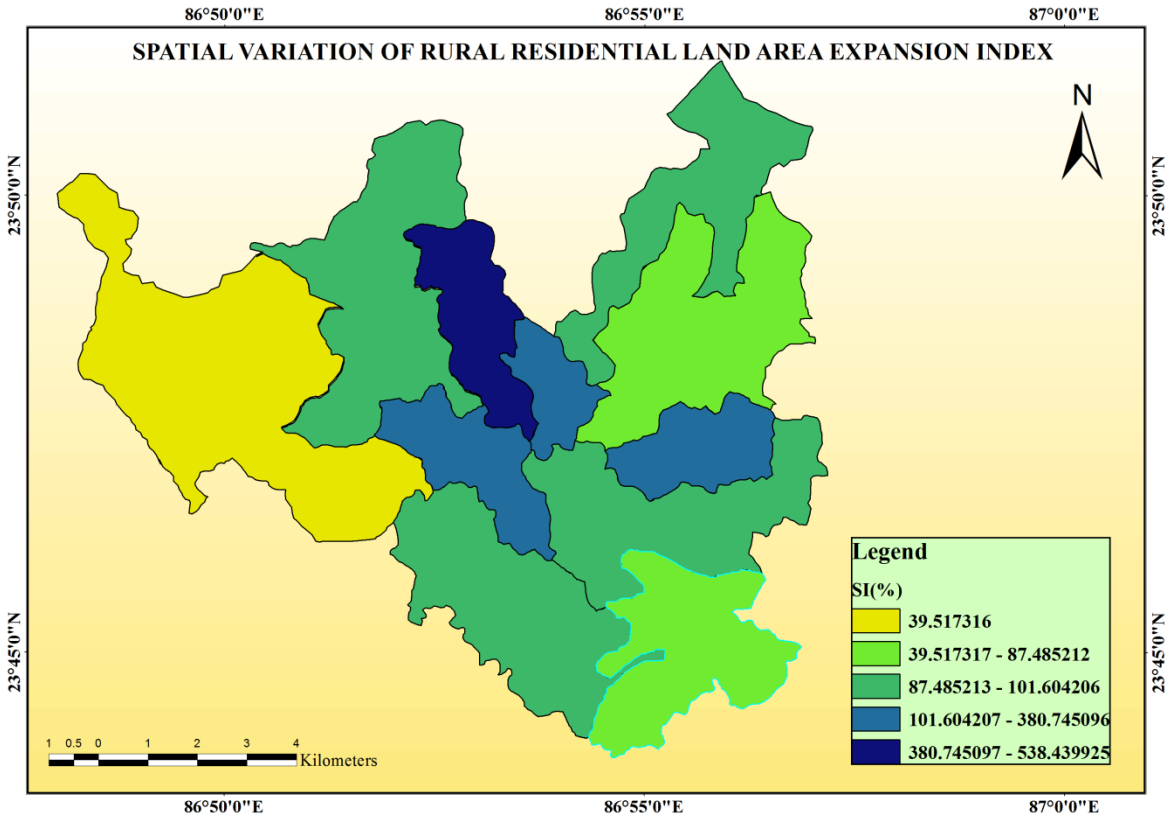

Figure 3

Sources: LANDSAT 5 TM (2008/4/12) and LANDSAT 8 OLI (2018/3/07) & Authors.

Landuse/Landcover(LULC) Change in Between 2008 & 2018 and its Effect on Food Security

The LULC study showed that rural settlement increased and agricultural land decreased at different levels of 11 G.P. during the past 10 years (Figure 4). According to the Census of India, Net Sown area of Salanpur decreased from 72.91 sq.km to 70.45 sq.km in between 2001-2011.The concept of a regional food system introduces the idea of locality- that a significant portion of the food eaten by the residents of a region should come from within or nearby that region (Beil et al., 2014). Table 3 demosntrates that all the GPs of Salanpur, the cultivated land area (cropland) are gradually shrinking indicating the study area would face problems with sufficient food production. Alongside water bodies and forestlands are also decreasing and the proportions of vacant land are increasing, which in turn are having a negative impact on the rural residents as they depend on fishery ponds, nala, jorh and forest wood for their daily lives.

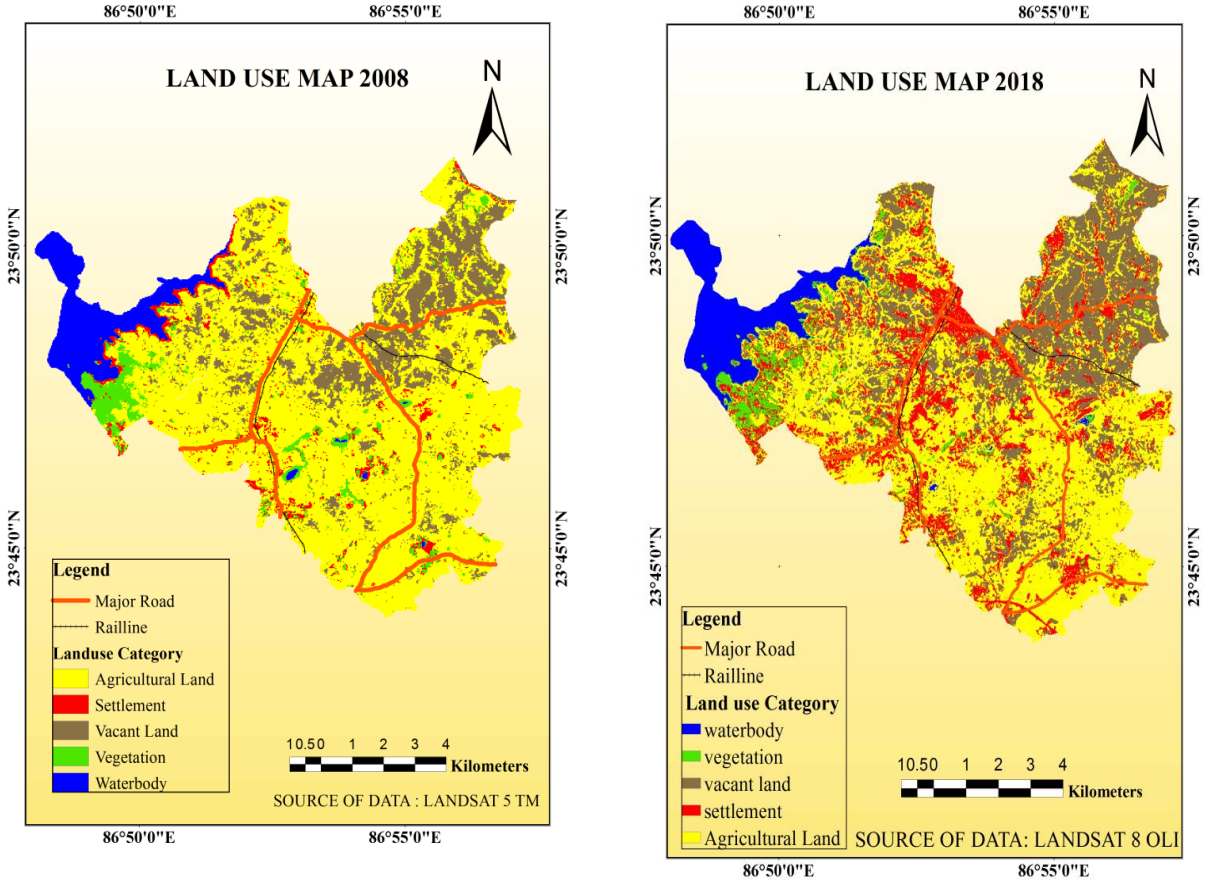

Figure 4: Landuse/Landcover Map, 2008 & 2018
Source: Computed by the Authors.

In between 2008-2018, the maximum settlement enhancements are found at Rupnarayanpur G.P. (30.25%) and this G.P. also recorded maximum decline of agricultural land followed by Basudebpur-Jemari G.P. and Achchra G.P. It is therefore arguable that the intrusion of built-up area replacing agricultural land, destruction of natural water bodies and forest area have declined the food production, which fails to match with the increasing population pressure. This in turn has created a huge gap on demand-supply ratio of food products. It is apparent from Figure 4 and Table 3 that due to expansion of rural settlement in the study area, there has been pressure on the limited agricultural land. To meet the demand of the growing population, artificial manures and chemicals are applied in the agricultural fields, which in turn have negatively influenced not only on the quality of agro-products but also on

the groundwater and the surrounding environment (see, Mandal and Sanyal, 2019).

Table 3: Landuse/Landcover Change Dynamics.

Gaon Panchayats	Change Dynamics in between 2008-2018(values in %)				
	Vacant land	Vegetation Cover	Water body	Agricultural Land	Settlement
Achhra	4.08	-4.95	-0.02	-16.34	15.19
Alladi	14.34	2.85	0.73	-30.54	12.36
Basudebpur-jemari	3.23	-3.97	-0.04	-19.91	19.4
Dendua	3.39	-0.12	0.01	-12.33	9.06
Ethora	3.73	-2.75	0.04	-9.09	8.35
Jitpur-uttarRampur	18.89	-2.28	-1.49	-24.72	9.06
Kallya	18.34	-0.78	-1.6	-26.92	10.06
Phulberya	10.4	-2.58	-0.84	-17.32	10.73
Rupnarayanpur	13.56	-3.31	-2.38	-31.72	30.25
Salanpur	8.36	-5.46	-0.33	-15.29	12.08
Shyamdi	16.42	-0.63	-1.39	-28.98	12.52

Sources: LANDSAT 5 TM (2008/4/12) and LANDSAT 8 OLI (2018/3/07) & Authors

Causes of Agricultural Land Loss

Changing economic opportunities (linked to other social, political, infrastructural changes), Government decisions on settlement schemes and development projects, infrastructural development, conversion and fragmentation of rangelands, agricultural intensification, urban-led demands for conversion and recreational land uses, changing way of life, rearrangement of local factors by the global force, is the main driving forces of land-use land-cover change (Lambin et al., 2001).

Changing land use policies, demographic changes, and advance economic development paved the way for the increase of living space per capita, transportation of land per capita are the critical factors of arable land loss (Tan et al., 2005). In Salanpur, the main drivers of conversion of the agricultural land into the built-up area are a person changing perception on economic opportunities. People are not interested in agrarian activities as it is not profitable for them; it is evidenced by the growing non-agricultural land area (Figure 5). Residents who possess land possession are more interested in selling their land because agriculture needs intensive labour, but returns lower output. The water crisis is also the main reason for the reduction of agricultural practice. People are more attracted to participate in secondary and tertiary activities. According to field survey, 60% of the people who possess land are interested in selling their land because of severe water scarcity required for their agricultural fields. 40% of the respondents are engaged in mining activities, factories, shops to sustain their livelihood as these professions are more lucrative than agriculture.

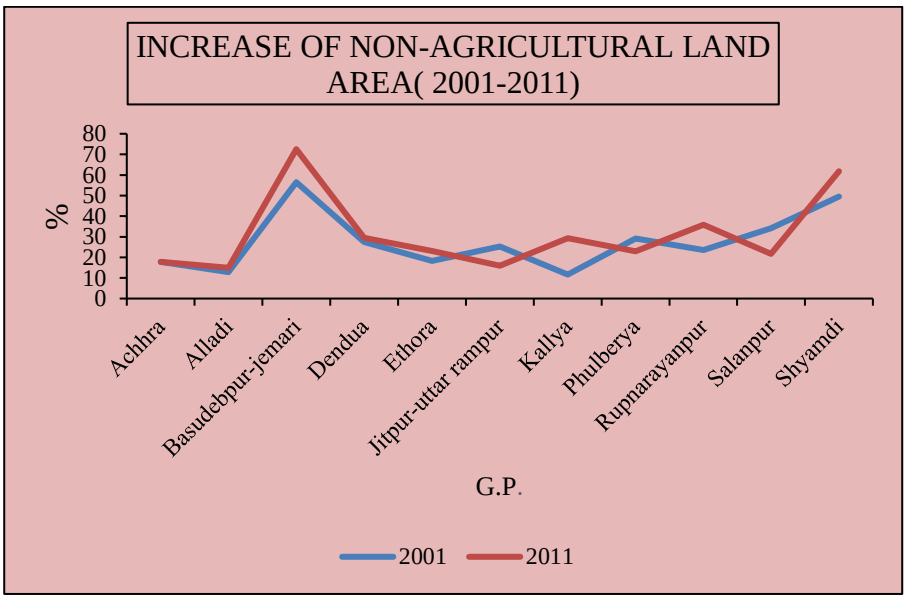

Figure: 5 Statistical Representation of Non-Agricultural Land Area
Sources: District Census Handbook Bardhhaman, 2001 & 2011

Status of Food Security in Relation with Rural Settlement Expansion

The aim of this segment is to estimate the status of food security and to provide a discussion on the interrelationship between rural settlement expansion and each facet of food security, that is, food availability, food access, food utilisation, and food stability.

Figure 6 displays the multidimensional character of food insecurity zones of Salanpur based on food security dimension and selective indicators (Table 1). Total G.P. wise ranking ranges from a minimum 51.00 (favourable situation) points to a maximum score of 106.50 (adverse situation) points. Basudebpur-Jemari G.P. (106.5 points) and Salanpur G.P. (101.5 points) are more susceptible to regional food insecurity vulnerability. Alladi G.P. (92 points), Jitpur-uttarrampur G.P. (89 points), and Ethora G.P. (86 points) are moderately susceptible to food insecurity. Remaining G.Ps like Rupnarayanpur (79), Shyamdi (72.5), Achchra (77.5), Dendua (67.50) and Kallya (51) are less vulnerable in terms of regional food security.

Spearman Correlation co-efficient technique is utilised to measure the magnitude and direction of the linear relationship between rural settlement expansion intensity (SI) and Food Insecurity Index (FISI).

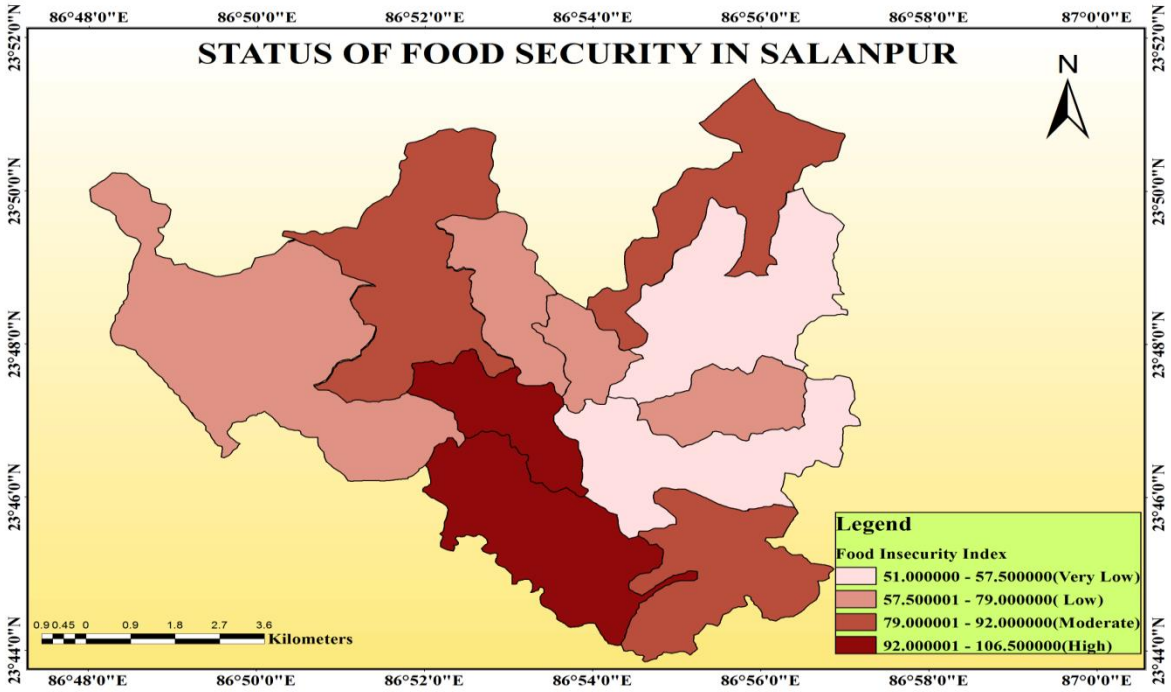

Figure 6
Calculations are based on Food Insecurity Index (FISI).
Source: Computed by the Authors

Table 4: Calculation Table for Spearman Correlation Co-efficient.

G.P.	(SI)	Rank	(FISI)	Rank	D	D^2
Achhra	380.75	10	77.5	5	5	25
Alladi	92.93	4	92	9	5	25
Basudebpur-Jemari	292.47	9	106.5	11	2	4
Dendua	39.52	1	67.5	3	2	4
Ethora	87.49	3	86	7	4	16
Jitpur-uttarrampur	93.97	5	89	8	3	9
Kallya	80.74	2	51	1	1	2
Phulberya	99.72	6	57.5	2	4	16
Rupnarayanpur	538.44	11	79	6	5	25
Salanpur	101.60	7	101.5	10	3	9
Shyamdi	263.06	8	72.5	4	4	16
Sources:						

Spearman Rank-order Correlation Coefficient (rho=p) =

$$1- 6\sum D^2/N\ (N^2-1) = 0.31 \quad (4)$$

Where,

P=rho, Spearman's rank-order correlation coefficient.

D= difference between paired ranks (in each case).

N= number of pairs of ranks. (Mohanty & Misra, 2016)

The results demonstrate that there is a positive relationship (rho=0.31) between rural settlement expansion and food insecurity, which

means as the rural settlement expands the risk to food insecurity also increased.

Food Availability

Rural settlement expansion constitutes a challenge to food availability in the rural areas in terms of food production and supply processes. *Aman* rice is the major crop of Salanpur, and its production and yield rate has decreased in between 2008-2015 (Table 5).

Table 5: Statistical Table for Area, Production and Yield of Major Crops

	Aman			Wheat			Mustard		
	Area(hect)	Prod(thousand MT)	yield(kg/hect)	Area(hect)	Prod(thousand MT)	yield(kg/hect)	Area(hect)	Prod(thousand MT)	yield(kg/hect)
2008	5102	13.63	2672	0	0	0	0	0	0
2015	330	0.747	2263	20	0.047	2363	1	0.001	590

Sources: District Statistical Handbook of Burdwan (2008, 2015).

On the other hand, wheat and mustard production were started in a small amount. This crop diversification is a good indication for this area but but rice is the main staple food for the rural poor. Decreasing production of *Aman* rice raises an elementary doubt as to whether the wheat and mustard production are playing a role in the decrease of *Aman* production. So, the tendencies of the rural people for procurement of food products have gradually transformed from own farm production to purchased foods. According to the field survey, for cereals and vegetables, only 13% households depend on their own firm production and the remaining households mainly rely on ration, and purchased the products from the local markets, shops and vendors.

Nonetheless, in the rural areas, as mentioned above, the PDS also play a crucial role in the food supply system, by making the food grains available at subsidised rates to the rural poor living BPL (Bezbaruah, 2013). A large proportion of rural people depend on ration shop for rice, wheat, and sugar. "In West Bengal PDS, families whose annual income is ₹42000 or less are entitled to receive all the benefits given to BPL families. Rice at ₹ 2 per kg and flour at ₹5 per 750 gm. are available at ration shops. After the announcement of "food for all" in 2011 by the West Bengal Government, the budgetary allocation on food supply increased by the Food & Supplies Department. As a result, the overall food supply scenario has improved hugely and grain storage capacity increased almost 21 times"[1]. Its mean more products are available at all fair price shops, but during the field survey, it was revealed by the local people that only rice and wheat are available in ration commonly, but the other PDS listed products like sugar, edible oil, and pulses are rarely distributed via this system. So, the residents avail this product from outside shops at a high price. Availability of food product is not sufficient for a secure food system; quality of food is also a significant concern nowadays. According to the primary survey, 45% of the households reported that rice and wheat found in the fair price shops are of low quality, but they depend on these ration products because they cannot afford to buy products at high prices from elsewhere.

[1] Food Security Made Possible by the Mamata Banerjee Government. 2015, West Bengal, Available at http://www.aitcofficial.org/aitc/food-security

Food Access

Apart from food availability, food access is also a significant concern to maintain rural food security. As stated above, due to the continuously growing build-up areas, the amount of agricultural land have been shrinking and the simultaneous deacrease of agricultural production, the residents of the study area relying more on purchased foods. Price and quality of grains, vegetables, and fruits are indirectly related to the rural road infrastructure and distance to the nearest big town where the food product is available at a low price in the wholesale market. Local grocery and street shopper, vendors purchase foodstuff from the wholesale market and sell them in their own shops. So, as a general rule, the price of the economic goods in the villages of the study area are determinnned by the quality of the roads, mode of transportation and the distance from the study area to the nearest wholesale market. "In addition to physical food access, financial access plays an important role in food security" (Szabo, 2015: 31). According to the primary survey, 52% of the people are engaged as an unorganised employee in factory, mines and shops, 13% of the residents are agriculturalist, 5% are salaried government employee, and the remaining 18% of the people are self-employed. Unsurprisingly, this occupational structure depicts that ability to purchase is not the same for all people.

Food Utilisation

Food utilisation is one of the important elements of food security. "It is defined as the ability of the human body to ingest and metabolise food through proper diet, clean and safe water, adequate sanitation facility, improved access to health care facilities to reach a state of nutritional well-being where all physiological needs are met"[2]. If the growth of rural settlement is not properly balanced by improved sanitation, environment, quality water access, and health care facility, then it becomes a major concern to attain secured nutrition and health. According to the field survey, 32% of the households fails to have the toilet facilities within the premises of the house. This observation bear resonance to the research findings of Koner (2018) where she demonstrates the crisis faced by women and girls due to the lack of adequate sanitation facilities in Darjeeling town, West Bengal.

Nonetheless the research findings are in contrast to the claims of Swachh Bharat Mission, [3]which claims to have built in 92267516 toilets since 2nd October 2014. Although, Swachh Bharat Mission website claims that 99.76% households in West Bengal now have access to toilet facilities and 95.48% villages of West Bengal have been made open defacation free, yet the study area reveals lack of access to toilets. The scenario of water access is quite good, that is, almost all the households of the study area have access to either tap or tube well water, but the research findings reported mismanagement. In terms of health care facilities, people lack consciousness. 42% of the people do not go to the health centre for food poison-related diseases. The majority of the people of the study area consume inadequate and low-quality food; not only the grains distributed by the PDS system but also consume poor quality street food = exposing them to health risk. This finding is similar to the findings of Mensah, Yeboah-Manu, Owusu-Darko, &Ablordey, 2002 (cited in Szabo, 2015).

Food Stability

Expansion of settlement means increasing the pressure of population in addition to the concurrent demand for food products. "This will put additional pressure on rural infrastructure, transport, technologies and food distribution outlets" (Matuschke, 2009: 6). A long-term food stability of an area is directly interrelated with food availability, food access, and food utilisation. Due to the decline of agricultural production lower food availability tends to be lower. The findings of the study further reveals that lesser availability of food would definitely

[2]Philippine Food Security Information System. Retrieved 21 November 2018 from http://philfsis.psa.gov.ph/index.php/id/1#&panel1-1

[3]Swachh Bharat Mission (*Gramin*).Retrieved 23 February 2019 from, http://sbm.gov.in/sbmdashboard/Default.aspx

increase the food price, which in turn would be a threat to the economic access of food especially for the rural poor.

Conclusion

The main objective of this paper is to identify rural settlement dynamics, detect land use land cover change and its effect on regional food security. It is found that within a span 10 years from 2008 to 2018, the study area witnessed a remarkable expansion of rural settlement. Subsequently, the overall land use pattern has changed and the amount of agricultural land has declined. Loss of agricultural land, immense population pressure, and an increase of non-agricultural land, mismanagement in providing clean water, sanitation, and health care facilities would pose a serious threat to food security in the study area.

So, this research recommends that the Food Security Act of 2013 needs to be implemented rigorously with quality food grains not only in the study area but also in all the areas where there are significant population living BPL so that poor can access affordable food grains to lead a dignified life

Some of the measures to accomplish food security in the study area are:

- To ensure appropriate irrigation system throughout the area to tackle the water crisis in agriculture.
- Increase the production of the high-calorie content crop like pulses.
- Ensure proper land use planning to make a balance between agricultural and non-agricultural land.
- Ensuring proper availability of clean & safe water, sanitation and primary health care.

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