

## **An Overview of problems due to rapid urbanisation in Panihati Municipal Area: an approach through Geospatial process and Weighted Score Technique**

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### **Abstract:**

**Background:** Urbanisation has turned out to be one of the major symbols of development. In India, urbanisation gained momentum since Independence. Proportion of population living in the urban areas of India has undergone significant rise from 11.4% in 1901 to 31.16% in 2011. Although urbanisation brings about large-scale economic transformation providing people with innumerable services and amenities, it also imparts a significant effect on the physical environment and on the life of the city dwellers. Urbanisation at an accelerated pace not only brings about degradation of vegetation health and amount and triggers the event of urban heat island but also it increases the intensity of problems faced by urban dwellers in their daily life. Panihati Municipal Area is also not an exception. An attempt has been made in this paper to analyse the effect of urbanisation on the vegetation health and urban heat island scenario of Panihati Municipal Area and also make a detailed study of the urban problems faced by the people of Panihati Municipality in their daily lives.

**Materials and Methods:** In order to accomplish the task, the researchers have generated primary data by conducting a field survey. Secondary data was collected from the Municipal Office and census website. Satellite images were downloaded from USGS Earth Explorer. ERDAS Imagine 2014 and ArcGIS 10.3 software were used for the preparation of NDVI and Land Surface Temperature maps. Charts were prepared using MS Excel. Major problems faced by the local people of the study area were analysed by adopting the Weighted Score Technique of Aristidis K Nicolopoulous.

**Results:** The study revealed that urbanisation is bringing about a degradation in the health and areal coverage of vegetation and it is also triggering the urban heat island effect which can be seen from the high range of temperature of the study area. Besides, out of all the problems, waterlogging turned out to be the most important problem of the study area which needs an immediate solution.

**Conclusion:** Since development is the utmost need, urbanisation cannot be stopped. However, strategies and planning should be done in such a way that urbanisation takes place without hampering the environment. Besides, the municipality must take immediate steps to solve the problems faced by the inhabitants at the earliest.

**Key words:** Urbanisation, Vegetation Health, Urban Heat Island, Urban problems.

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### **I. INTRODUCTION**

Urbanisation is one of the major indicators of development. India has been witnessing incident of rapid urbanisation since a long time. According to the census of 1901, about 11.4% of total population resided in the urban areas which have increased to become 31.16% in 2011. World Bank reports suggested that the proportion of proportion of population living in the urban areas in 2019 has become almost 34.47%. Large scale increase of population and increasing trend of rural-urban migration has been the primary reason. However, urbanisation is also bringing about degradation of the physical environment through degradation of vegetation health and areal coverage. It is also bringing about significant alteration on the temperature condition by aggravating the urban heat island phenomenon. Besides, urbanisation has also increased the intensity of problems in the daily life of its residents. Panihati Municipality is one such area which has undergone rapid urbanisation since last few years and has laid significant impact on the physical environment and life of the people. The main objectives of the study are:

1. To analyse the effect of urbanisation on the vegetation of the study area.
2. To study the effect of urbanisation on the heat island scenario of the study area.
3. To analyse the problems currently faced by the residents of the study area.

4. To make suitable recommendation and suggestions for the solution of the problems.

## II. MATERIALS AND METHODS

**Study Design:** A field visit was conducted and residents in different parts of the municipality were surveyed for the identification of the problems faced by them.

**Study Location:** Panihati Municipality has the latitudinal extension of 22°40'26"N to 22°43'10"N and longitudinal extension of 88°21'55"E to 88°25'13"E. It is the largest municipality in North 24 Parganas. At present, the municipality has 35 wards. It is flanked by Khardah Municipality in the north, Kamarhati Municipality in the south, Bilkanda panchayat in the west and River Hugli in the east.

**Study Duration:** From March 2019 to August 2019.

**Sample size:** 250 persons.

**Sample size calculation:** The total population from which the sample was collected was considered to be the total population of 377351 residing in 35 wards of Panihati Municipality. All the respondents surveyed were more than 21 years of age. Out of these 250 respondents, 125 respondents were old residents staying in the Panihati Municipal area for more than 5 years while the remaining 125 respondents were new residents inhabiting in the area for less than 5 years.

**Subjects & selection method:** The study population were the residents of different wards of Panihati Municipality.

**Procedure methodology:** For the accomplishment of the task, geospatial technique and weighted score technique of Aristidis K Nicolopoulous were adopted. Landsat 5 TM and Landsat 7 ETM+ satellite images were downloaded from USGS Earth Explorer for the years of 1999 and 2018 respectively. Landuse maps, Normalized Difference Vegetation Index (NDVI) maps and Land Surface Temperature (LST) maps were prepared from those satellite images using ERDAS Imagine 2014 and ArcGIS 10.3 software to understand the trend of urbanisation, scenario of vegetation health and trend of range of temperature between 1999 and 2018 respectively. A total of 250 persons out of which 125 respondents were old residents staying in the Panihati Municipal area for more than 5 years while the remaining 125 respondents were new residents inhabiting in the area for less than 5 years were surveyed for the identification of the major problems faced by them in their daily lives. Weightage was given according to the number of respondents responding to a specific problem. Now, the weightage and the number of respondents were multiplied to compute the weighted score (Goswami and Sen, 2020). Graphs were prepared using MS Excel. Finally, the maps and graphs were interpreted to arrive at the necessary results.

**Statistical Analysis:** Weighted score approach of Aristidis K Nicolopoulous was adopted for understanding the degree of problems. Each problem was given weightage on the basis of number of respondents responding to a specific problem (Goswami and Sen, 2020). Higher the value of weighted score, the greater the intensity of the problem becomes (Goswami and Sen, 2020).

## III. RESULTS

### A brief idea about the study area:

Panihati Municipality is one of the major urban administrative unit at the local level. It was established 1<sup>st</sup> April, 1900 covering the areas like Sukchar, Panihati, Agarpara, Ghola, Natagarh, Sodepur and some adjacent mouzas. It covers a total area of about 19.43 sqkm. Panihati Municipality has the latitudinal extension of 22°40'26"N to 22°43'10"N and longitudinal extension of 88°21'55"E to 88°25'13"E (Figure 1). It is the largest municipality in North 24 Parganas. At present, the municipality has 35 wards. It is located at a distance of about 9 km from the district headquarter of Barasat and 16 km from Kolkata. It is flanked by Khardah Municipality in the north, Kamarhati Municipality in the south, Bilkanda panchayat in the west and River Hugli in the east. According to 2011 census, the total population of the municipality is 377351.

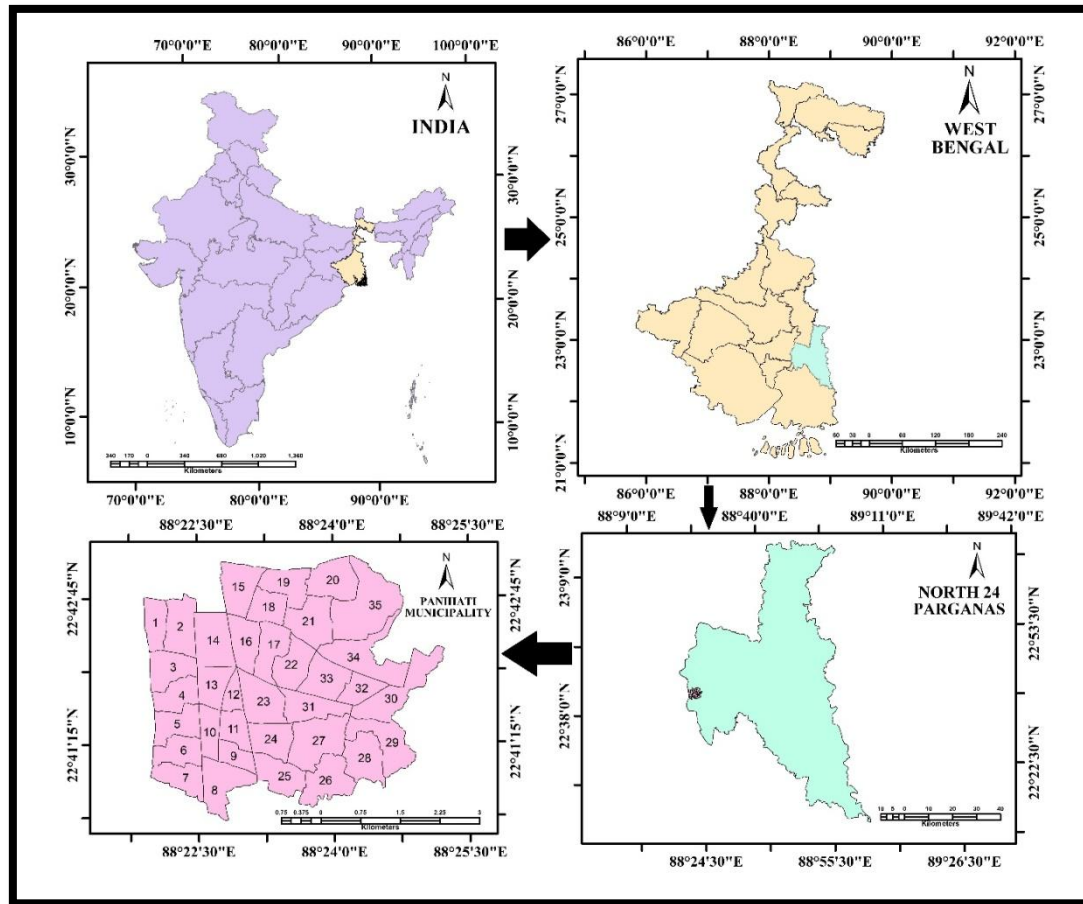


Figure 1: Location Map of the Study Area

**Analysis of Demographic aspect of the Panihati Municipal Area:**

An analysis of demographic scenario of Panihati Municipality has been performed using census data of 1991, 2001 and 2011. The study reveals that according to census 1991, the total population of Panihati Municipality (comprising of 30 wards) was 275990. According to census 2001, the total population of the Municipality (comprising of 35 wards) increased to become 348438. Thus, the population growth rate of 1991-2001 was 26.25%. According to census of 2011, the population of the study area (comprising of 35 wards) further increased to become 377351. Thus, the population growth rate of 2001-2011 period turned out to be 8.3%. However, the population growth has registered a meteoric rise of 36.7% in two decades time (1991-2011). According to 1991 census, the population density of the study area was 14204 persons per square kilometre which in 2001 increased to become 17932 persons per square kilometre and in 2011, it further increased to become 19421 persons per square kilometre. Hence, it is seen that in the above mentioned census years, the population density of the study area remained much above the national average value (271 persons per square kilometre in 1991, 325 persons per square kilometre in 2001 and 382 persons per square kilometre in 2011).

**Analysis of Land use change of Panihati Municipality to understand trend of urbanisation between 1999 and 2018:**

- **Landuse scenario of Panihati Municipal Area in 1999-** The landuse map of Panihati Municipal area in 1999 reveals the fact that out of total land area of about 1978 hectares, about 268.29 hectares is dominated by water bodies; about 1335.69 hectares is dominated by built up areas: about 290.07 hectares is dominated by light vegetation and about 84.42 hectares is dominated by dense vegetation (Figure 2.1).
- **Landuse scenario of Panihati Municipal Area in 2018-** The landuse map of Panihati Municipal area in 2018 reveals the fact that out of total land area of about 1978 hectares, about 198.99 hectares is dominated by water bodies; about 1430.64 hectares is dominated by built up areas: about 218.79 hectares is dominated by light vegetation and about 130.05 hectares is dominated by dense vegetation (Figure 2.2).

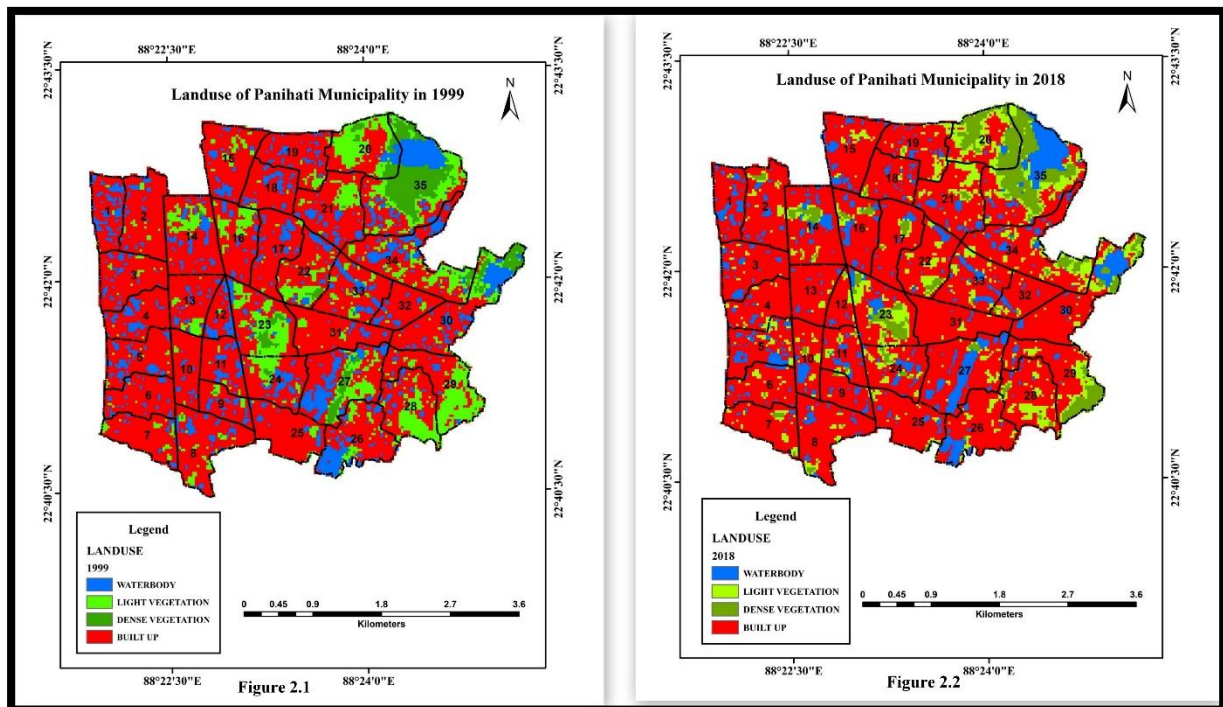
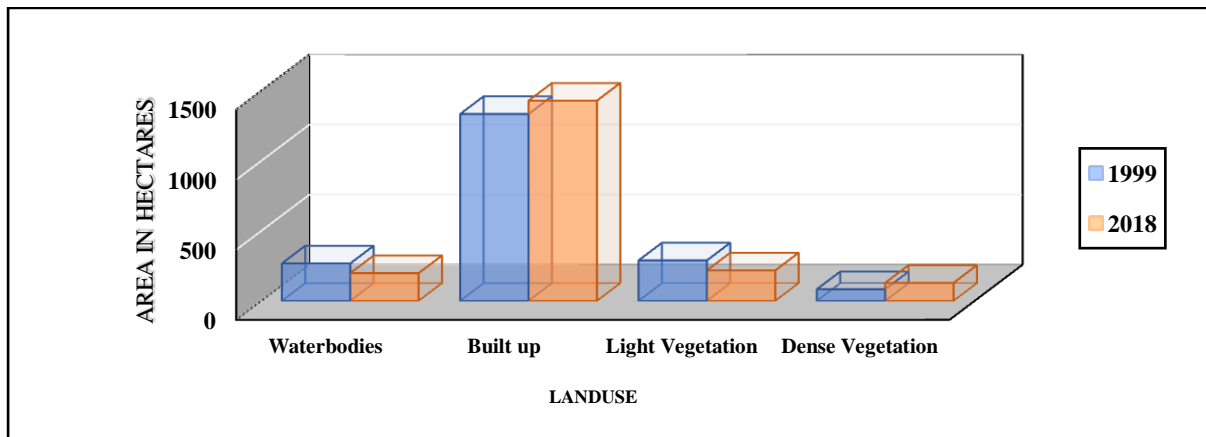


Figure 2: Land-use scenario of Panihati Municipality in 1999 and 2018

#### Temporal analysis of change in land-use of Panihati Municipality between 1999 and 2018:

The temporal analysis of landuse of Panihati Municipality between 1999 and 2018 reveal significant changes in landuse and landcover between the two periods. Area under waterbody has experienced a decline from 268.29 hectares in 1999 that accounted for about 13.56% of total area to 198.99 hectares in 2018 that accounted for about 10.06% of the total area (Figure 3). Such decline is attributed to large scale filling up of waterbodies and ponds for construction of buildings and flats. The area under built up area experienced a rise from 1335.69 hectares in 1999 accounting for about 67.53% of total area to 1430.64 hectares in 2018 accounting for about 72.33% of total area (Figure 3). Such increase in built up coverage is due to large scale concretization and constructional activities that has been going on within the municipal area and it clearly indicates the event of rapid urbanisation. However, vegetation of the study area has revealed an interesting fact. Area under light vegetation cover has declined from 290.07 hectares in 1999 accounting for about 14.66% of total area to 218.79 hectares in 2018 accounting for about 11.06% of total area (Figure 3). However, an exceptional case has been noted in case of dense vegetation and it has revealed a paradoxical situation. Area under dense vegetation cover has increased from 84.42 hectares in 1999 accounting for about 4.27% of total area to 130.05 hectares in 2018 accounting for about 6.57% of total area (Figure 3). Such positive change in dense vegetation cover is due to afforestation programmes that have been undertaken by several Government funded NGOs. An NGO named Mira Kundu Smriti Samiti has started undertaking afforestation programmes since 2004. Another reason is that many areas that were under light vegetation cover were left undisturbed or unutilised for which more growth of vegetation has converted the areas under light vegetation into deep vegetation cover. But if the total area under vegetation cover is taken into account (Area under light vegetation cover+ Area under deep vegetation cover), then it has faced a decline due to largescale conversion of vegetation lands into built up areas. In 1999, about 374.49 hectares was under the cover of vegetation accounting for about 18.94% of total area and it declined to 348.84 hectares in 2018 accounting for about 17.63% of total area.



**Figure 3:** Change in landuse and landcover of Panihati Municipality in 1999 and 2018.

Hence, from the above discussions it can be stated that Panihati Municipality has experienced rapid urbanisation between 1999 and 2018 which can be seen from increase in built up area between 1999 and 2018 (Figure 3). Such change in percentage can also be understood from table number 1 and table number 2.

**Table 1:** Change in percentage of Landuse and Landcover of Panihati Municipality in 1999 and 2018

LANDUSE AND LANDCOVER	AREA PERCENT IN 1999	AREA PERCENT IN 2018	CHANGE IN %
Waterbody	13.56%	10.06%	-3.5%
Built Up	67.53%	72.33%	4.8%
Light Vegetation	14.66%	11.06%	-3.6%
Dense Vegetation	4.27%	6.57%	2.3%

**Table 2:** Change in percentage of area in Vegetation Cover in Panihati Municipality in 1999 and 2018

LANDUSE AND LANDCOVER	AREA PERCENT IN 1999	AREA PERCENT IN 2018	CHANGE IN %
Vegetation Cover	18.94%	17.63%	-1.3%

**Impact of rapid urbanisation on vegetation health and scenario of urban heat island of Panihati Municipality:**

Urbanisation of Panihati Municipality has introduced two major environmental problems namely decline in vegetation health and vegetation cover of the study area and have also aggravated the phenomenon of Urban Heat Island.

**1. Impact of rapid urbanisation on vegetation status of the Study area-** Rapid urbanisation of Panihati Municipal area has laid considerable impact on the status of vegetation. The study area has experienced not only decline in the areal coverage in vegetation but also a significant decline in the vegetation health has been noticed. In 1999, about 374.49 hectares was under the cover of vegetation and it declined to 348.84 hectares in 2018. Such decline can be attributed to large scale conversion of vegetation and fields into built up areas and also for construction of skyscrapers which would give shelter to maximum population of the area in a limited space. Secondly, the vegetation health has also experienced a decline in vegetation health which has been computed by using Normalised Difference Vegetation Index (NDVI) using Landsat satellite images for the years 1999 and 2018. NDVI values are used to estimate the status of vegetation health and it ranges from -1 to +1 (Chatterjee,2020). Vegetation with NDVI values ranging from 0.3 to 0.6 are considered to be stressed vegetation while vegetation with NDVI values greater than 0.6 are considered to be healthy vegetation (Bhatta, 2020). It is seen that the maximum value of NDVI in 1999 was 0.611511 and it has declined to 0.602649 in 2018. Based on scale, vegetation may be considered as healthy as in both the years maximum NDVI values remained above 0.6. However, its health has started declining and unplanned urban development can be considered as one of the major reasons for its decline. (Figure 4).

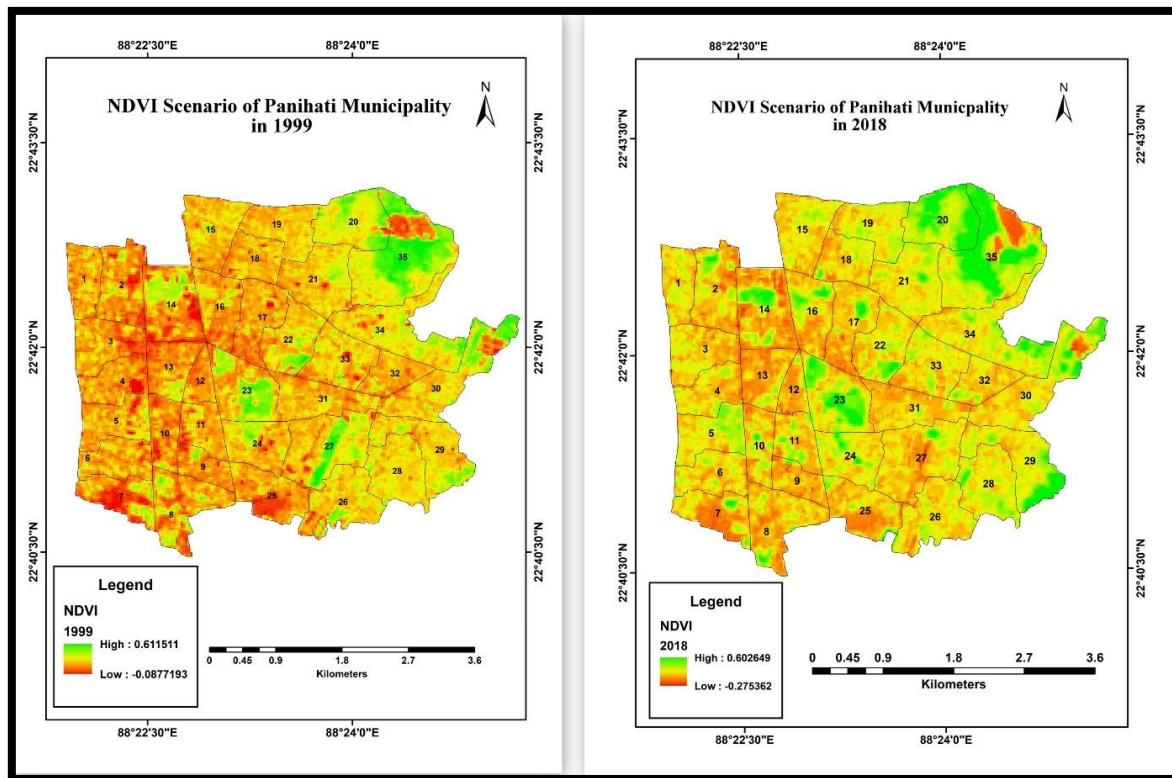


Figure 4: Change in vegetation area of Panihati Municipality in 1999 and 2018.

2. **Increase in Urban Heat Island Effect-** Urban Heat Island is a direct consequence of increasing trend of urbanisation of any area. Buildings, concretised roads and cemented walls of urban areas trap more heat than their rural counterparts. As a result, the temperature of the urban area becomes higher than the surrounding rural areas and the event is known as urban heat island (Roy and Basak, 2020). Increasing phenomena may also bring about changes in the range of temperature. Through the analysis of range of temperature data for the month of March within the time span of 38 years (1981 to 2019) in three different locations of Panihati Municipality, it has been found that the ideal range of temperature for the month of March should have been 16.1°C. However, increasing event of urban heat island owing to rapid urbanisation have raised the range of temperature from 17°C in 1999 to 18°C in 2018 (Figure 5). Not only the range of temperature exhibits a rising trend between 1999 and 2018, but also it shows that in both the years, the range of temperature remained above the ideal value of range of temperature i.e., 16.1°C. Such behaviour of the range of temperature is owing to increase in the event of urban heat island due to rapid urbanisation of the Panihati Municipal Area. Concretization of roads with bitumen and cement and construction of flats and apartments in the study area is trapping a huge amount of heat which is aggravating the phenomena of urban heat island which in turn has led to a rise in the temperature range of the study area. Another reason responsible for increase in the event of urban heat island is decline in vegetation cover. Since vegetation helps in the regulation of temperature, destruction of vegetation cover of the study area has brought about significant alterations in the temperature range of the study area.

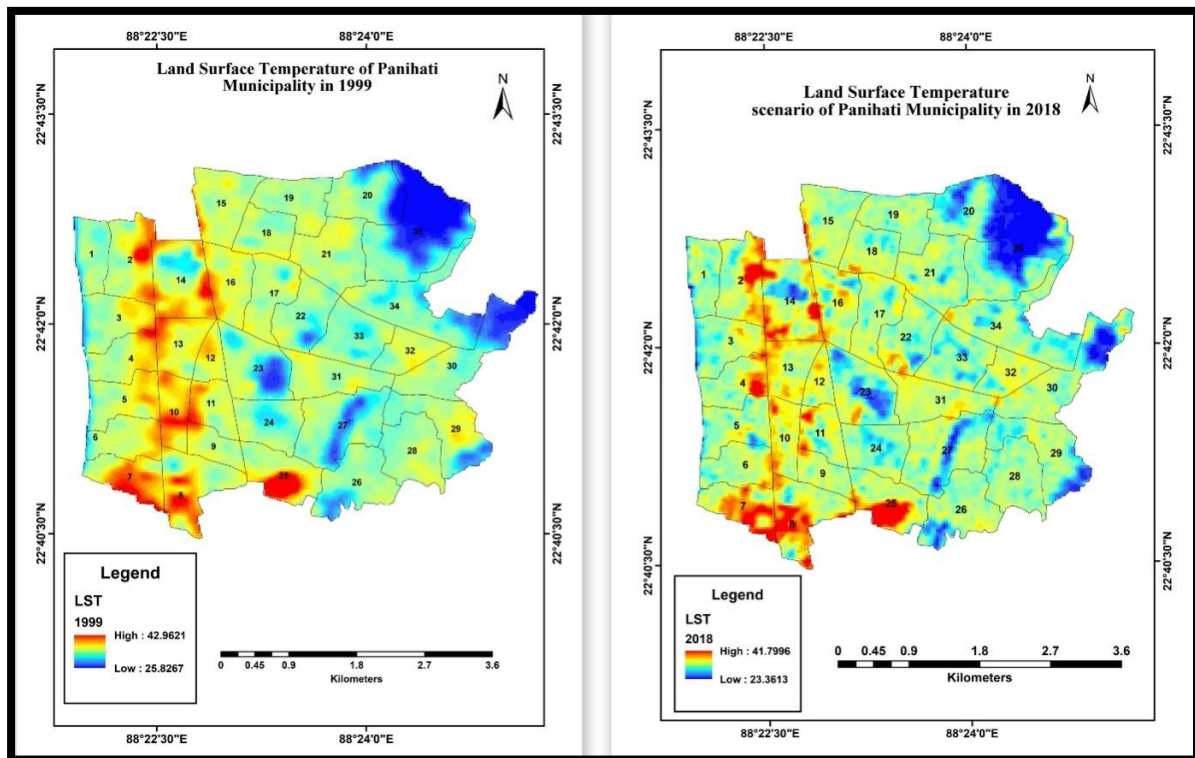


Figure 5: Land Surface Temperature scenario of Panihati Municipality between 1999 and 2018.

**Analysis of problems of the people of Panihati Municipal Area using Weighted Score Technique:**

Rapid urbanisation has also triggered many problems in the daily life of the people who reside in different wards of the Panihati Municipality. The municipality have failed to keep pace with the degree of urbanisation of the study area and as a result, it has failed to provide its people with all the basic needs and requirements which are needed to maintain a good standard of living.

1. **Problem of Waterlogging-** Waterlogging is the most serious problem for the people of the Panihati Municipal area. The problem becomes more severe even during the rainy season. Places like Ghola Bazar, Ghloa post office, Natagarh, Parthapur, Anandanagar, H.B. Town and Sajirhat experience this problem to a large extent (Figure 6). The main reason for this problem is that firstly, all these places are low lying areas and secondly the drainage system of the area is very poor. High drains as well as small drains remain clogged throughout the year and are not cleared regularly. The local residents of the area opine that during monsoon season, when heavy rainfall takes place, the roads get waterlogged within a very few moments of time. Dirty water of the drains often enters the courtyard of their houses. Roads remain waterlogged for 5-6 days in continuation. Fowl smells are emitted and the dirty water becomes the breeding ground of the mosquitos. Sometimes dirty water often enters the pipes that supply them drinking water through minor leakages and thus water gets contaminated. Auto and toto drivers who provide transport facilities to huge number of passengers are of the opinion that they have to face great problem in driving their vehicles during rainy season when the Sodepur-Barasat Road gets waterlogged. They have to drive their vehicles slowly for which there is traffic congestion and the passengers get late and often have to miss their trains from Sodepur station. School and college students are of the opinion that due to excessive waterlogging; they often get late to reach their schools and colleges. Many students opined that they do not attend schools and colleges when heavy rainfall takes place owing to the hardship, they had to face to reach their educational institutions on time. Auto and toto drivers opined that dirty water often enters the engine of the vehicle and damages them for which the auto and the toto drivers have to bear huge expenses. The auto drivers who provide their auto services from Sodepur to Madhyamgram Chowmatha often have to suspend their service due to this problem since they fear that accumulated rainwater may damage their vehicles. Passengers who travel to Madhyamgram from Sodepur Station says that they have to often reserve autos to go to Madhyamgram from Sodepur Station and the auto drivers also charge a very high price. The problem of waterlogging also has raised the problem of traffic congestion which creates a lot of problem for the people. Many accidents also take place on the Sodepur-Barasat Road due to the problem of waterlogging. Considering the above-mentioned situation, this problem has been assigned the highest weighted score of 192.50 (Figure 8).



**Figure 6:** Waterlogged street of Panihati Municipality (Source: Primary Survey)

2. **Waste Disposal Problem-** This is another serious problem which the people of the study area are facing. Rapid urbanisation of the study area and its population growth have aggravated the problem. The municipality have failed to undertake everyday cleaning of garbage vats. Bins for dumping garbage are not available everywhere. Since the garbage vats are not cleared regularly, they emit foul smell that disturbs the local environment as well as also create discomfort for the people. The problem becomes even worse during rainy season when the issue of waterlogging gets added. Dirty water along with garbage from overflowed garbage vats often enters the house and cause problems. Besides, stray dogs often make the local environment dirty by spreading plastic bags, food plates and wastes all over the area. Since vats are not cleared regularly, garbage often comes down on the road and thus makes the road narrow which in turn increases the problem of traffic congestion (Figure 7). This problem turns out to be the second most important problem and has been given a weighted score of 140.4 (Figure 8).



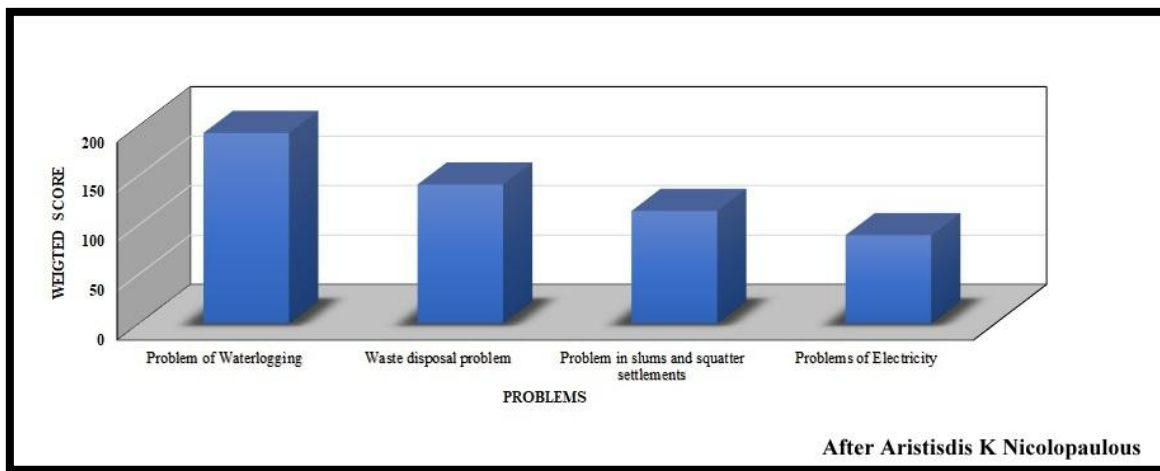
**Figure 7:** Waste disposal problem of Panihati Municipal Area (Source: Primary Survey)

3. **Problem of slum dwellers-** Problem of slum dwellers is another important problem of Panihati Municipality. There are 82 slums in the entire municipal area. A considerable portion of the population living in slums are migrants who have come from other parts of the state for employment. Some of these slums are even squatter settlements. People do not have proper accessibility of clean drainage and sanitation facilities. In many



places, people have confiscated Government plots and have started dwelling under a very degraded and dilapidated environment. Issues like malnutrition, child labour, drug addiction, alcoholism and poverty are part and parcel of their daily lives. Owing to poverty, a considerable part of children does not go to schools and are engaged in different jobs. As a result, increased incidences of child labour are seen. Most of the dwellers of the slums are rickshaw pullers, mansions or run small businesses. Thus, they do not have sufficient income to send their kids to school. A considerable number of children especially female children have left their school and are presently engaged in jobs like working as household maids. This has triggered the problem of school dropouts and gender disparity. Each house does not have tap water services which is provided by the municipality. Some slums have a very few numbers of taps. Dwellers also opined that they do not get municipality water service at night time. Municipality provide water services four times a day- 6 am in the morning, 11 am, 4 pm in the evening and 9 pm at night. In some slums, inhabitants opined that they are deprived of the water facility given at 9 pm at night. This turns out to be a serious problem for them during summer season when they need more water for drinking and performing domestic works. Dwellers of the slum also stated that they do not get adequate amount of rice and wheat from ration shops. Slum people get 1 kg of rice per head and 1 kg of wheat per head. Most of the houses do not have electric connection and often have to perform hooking to get connection of electric lines. Some people often burn kerosene or dry leaves to light their houses as well as for cooking because they do not provision of gas connection. Since all these problems have highly affected the general wellbeing of the dwellers, this problem has been assigned a weighted score of 113.75 (Figure 8).

**4. Problems in Electricity-** Disruption of electric supply is also one of the problems that the people of the study area face. People are of the opinion that the problem becomes severe when there is power cut during the hot and sultry summer months. People also stated that the electric supply is disconnected even if there is light breeze during the summer. People being surveyed opined that the electric supply remained disconnected after the outbreak of the 'Amphan' cyclone which had caused a havoc in the study area in May 2020. Students and many young IT workers of the study area opined that power cut has turned out to be a serious trouble for them during the pandemic since the students were doing online classes and the IT workers were working from home. They had to suffer as they could not charge their mobile phones and laptops and also there was disturbance in internet connectivity. In spite of the fact, people say that they do not face extreme problems owing to power cut since they have inverter connections at their homes. Considering this, the problem of electricity has been assigned the weighted score of 89.125(Figure 8).



**Figure 8:** Analysis of problems of Panihati Municipality using Weighted Score Technique

#### IV. DISCUSSIONS

##### Suggestions and recommendations:

There is no doubt of the fact that Panihati Municipality has undergone rapid urbanisation. Although it has brought about large-scale development, however it also has triggered several problems. It has affected the physical as well as socio-economic life of the people. Solution to such problems can be brought about by taking into account the following the suggestions.

1. The municipality must take steps to install taps all over the municipality especially in the slum areas. Availability of tap water at 9 pm must be ensured.
2. The problem of waterlogging needs an immediate solution that can be brought about by regular cleaning up of the high drains which are clogged with mud and have exceeded their carrying capacity. It is only

through proper and regular cleaning and dredging that the carrying capacity of the drains can be increased and then only rainwater will not remain stagnant and will be easily flow through the drains.

3. The municipality must take measures so that there is regular collection of wastes and garbage from homes. Periodic cleaning of vats by the side of the road has to be undertaken. Waste dumping bins should be provided at each and every ward of the municipality.

4. It is only the municipality who can drive the attention of the Government for the improvement of the living conditions of the slum dwellers. Although different schemes initiated by the West Bengal Government have driven a considerable portion of the child population to schools, mass awareness programmes have to be undertaken so that poor and illiterate parents may come to know the value of education in the life of their children and for such successful campaigns the local councillor, the municipality, the NGO's as well as the State Government must coordinate with each other. Strict legal action has to be taken against those parents who force their children to get themselves engaged in hazardous jobs to supplement their family income or give their daughters marriage at early ages. Rehabilitation programmes can be organised on a regular basis by the municipality for the people who are addicted to drugs or are drunkards with the goal that they leave their bad habit and get back in the social mainstream.

5. The municipality along with NGO's must accelerate the pace of afforestation. Local school and college students must come forward and take active participation in such programmes. It is only through afforestation that the vegetation area can be increased; vegetation health condition can be improved and regulation of temperature within the study area will be possible to control urban heat island effect. Afforestation programmes already initiated by different NGO's along with municipality is really praiseworthy. One such NGO named Mira Kundu Smriti Samiti has already initiated afforestation programme since 2004. However, such programmes must be conducted at an accelerating rate.

## V. CONCLUSION:

There is no doubt of the fact that urbanisation is a precursor of development (Roy, 2020). However, along with urbanisation the issues of environment must be taken care of. Urbanisation should be done in such a way that it brings about development of the people and at the same time do not damage the environment. The Panihati Municipality must adopt a balanced approach and take necessary steps to eradicate the problems of its inhabitants and also keep a close watch on the environment. If all these steps are taken properly, then only a balanced event of urbanisation will take place that will ensure a wholesome development of the study area.

## REFERENCES

- [1]. Bhatta, B. (2011): *"Remote Sensing and GIS"*, 2<sup>nd</sup> Edition, Oxford University Press, New Delhi.
- [2]. Chatterjee S. (2020): *"Spatio-temporal Analysis of Vegetation Health in Siliguri Municipal Corporation Area: A Case study through NDVI on LANDSAT Imageries"*, Sustainable Urbanisation in East India: Present Trends and Future Concerns (ed. Kundu, P.K), Levant Books, Kolkata, pp. 358-371.
- [3]. Goswami, A and Sen, S. (2020): *"Appraisal of Causes of Child Trafficking in North 24 Parganas and Nadia districts: An Approach through Weighted Score Analysis"*, Child Trafficking: A Social Evil and Challenges (ed. Karmakar, M), Wizcraft Publications and Distribution, Solapur, pp. 86-97.
- [4]. Roy, T.D and Basak, A. (2020): *"The Emergence of Urban Heat Island through Remote Sensing Approach: A Case Study of Greater Siliguri, West Bengal, India"*, Sustainable Urbanisation in East India: Present Trends and Future Concerns (ed. Kundu, P.K), Levant Books, Kolkata, pp. 349-357.
- [5]. Roy, S. (2020): *"Urban encroachment and its impact on indigenous agricultural practice: An overview of the Apatani Tribe, Arunachal Pradesh"*, Sustainable Urbanisation in East India: Present Trends and Future Concerns (ed. Kundu, P.K), Levant Books, Kolkata, pp. 282-297.

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