INTRODUCTION TO THE RESEARCH PROBLEM

Environmental geography is the branch of geography that describes and explains the spatial aspects of interactions between human individuals or societies and their natural environment. Such interactions are normally expressed in the form of the impact of environment on man and/or human impact on the environment resulting in defacement of environment and debasement of society, sustainability of environment etc.

A large proportion of the population now lives in the cities and metropolitan areas. The environmental challenges caused by the rapid growth of cities manifest themselves within the city boundary as well. The urban expansion also destroys natural habitat in the city. Exposure to green spaces and the observation of green space provide well-being and psychological relief from urban stress.

Urban nature doesn’t occur as separate and discrete entities; there are great deals of interaction between the organisms such as trees, birds, insects and another biota that stay in the cities. The massive scale of urbanization in India is posing enormous challenges to the countries’ environment, ecology, society, and sustainability. So, it is very important to understand the importance of urban nature in the city and better protection, inclusive management and limited access to urban nature will be essential for urban sustainability.

In order to meet the social and sociological need of citizens satisfactorily, green spaces in the cities should be easily accessible and adequate to optimal management in quality and quantity. Green spaces need to be uniformly distributed throughout the city area. Urban green spaces play a role in improving the ability of town and cities. Therefore, the green infrastructure approach seeks to use or planning policy mechanisms to safeguard natural areas.

Green spaces exist in a great variety of shapes, structures, and types within the city or urban areas. The successful protection, creation, and development of the spaces are one of the key elements required to achieve sustainable urban development. A strategy is, in general, a policy for achieving a number of specific objectives. In the case of green spaces, strategies are required to address a variety of environmental, social and economic policies and sustainable development objectives. They must be able to effectively fulfill the objectives against other issues of urban development and planning in case of decision making and resource allocation. The purpose of green space strategy is therefore:

- To safeguard the future of green spaces
- To improve the quality of urban areas and its neighborhood
- To make the urban area more attractive
- To enhance wellbeing the local people and tourist.
Bandyopadhyay Chandralekha; International Journal of Advance Research and Development

Thus, well management policy leads towards the better use of green space potentials and health dissolve conflicts in advance. To be most effective and for the greatest efficiency to develop the bio- potentiality of the city, the strategy should be integrated into the planning system of the city.

Although a large number of studies have been carried out with respect to urban housing, migration, demography, planning; systematic studies on the green space management of the cities are relatively lacking. In the Indian scenario, characterized by a large-scale influx of rural population in urban areas, such studies are essential for preserving the ecology of the city. Therefore, the present study seeks to analyze and interpret the green space and the temporal changes of the same with respect to the city of Burdwan in the state of West Bengal in India.

2. REVIEW OF PREVIOUS LITERATURE

It has been stated earlier that studies on the green space of the urban areas are relatively fewer. Furthermore, the concepts of ‘bioperspectives’ and ‘bioprospecting’ are relative of recent origin. Therefore, it is needless to state that available literature on this aspect is not very common. In this section, some of the important studies are mentioned.

2.1 Literature related to urban green space

“Lee, A.C and Maheswaran, R (2010)” ‘The health benefits of urban green spaces’- This paper deals with the newly emerged concept of urban green space. Health benefits of green space is an integrated concept, through which is evidenced for physical and nonphysical health benefits of urban green space can be judged. This paper depicts certain concepts of public health in the urban domains, its benefits to society as well as physical and mental health and well-being of society all over the world using different case studies. It also discusses the causal relation between human and environment and accessibility of green space affects its used for physical activity, user determinants such as age, gender, ethnicity and perception of safety are also important. This paper provides a detailed outline relating to the concept of urban health and its management.

“University of Leeds, LEAF researches have produced a report summarizing. October 20, 2015”- “urban green space.” The report deals with urban green spaces in terms of domestic gardens, parks, and woodlands which provide a multitude of benefits to the human urban population, and a vital habitat for wildlife. By improving physical fitness and reducing depression, the presence of green spaces can enhance the health and wellbeing of the people living and working in cities. Green space also indirectly impacts our health by improving air quality and limiting the impact of heat waves by reducing urban temperatures. In addition to this, urban vegetation stores carbon, helping to mitigate climate change and reduce the likelihood of flooding by reducing the instantaneous surface runoff. For the present inquiry, this paper provides a detailed outline relating to the concept of urban green space and its management.

2.2 Literature related to urban biodiversity

“Biodiversity concepts and urban ecosystem” by Jean-Pierre L. Savarda et. al. (1999): This paper deals with the concepts of biodiversity in an urban context, its benefits to society, the association of biodiversity and urban ecosystems which has usually concerned the impact of urbanization on biodiversity. However, biodiversity concepts can easily be applied to the urban ecosystem itself. As more and more people live in cities, restoration, preservation, and enhancement of biodiversity in urban areas become important. Concepts related to biodiversity management such as scale, hierarchy, species identity, species values, and fragmentation, global approaches can be used to manage urban biodiversity.

“Benefits of restoring ecosystem services in urban areas” by Ploeg, S. (June 2015): This paper is an attempt wherein the cities are shown as a key nexus of the relationship between people and nature and are huge centers of demand for ecosystem services besides causing large-scale environmental impacts. Current projections of rapid expansion of urban areas present fundamental challenges and also opportunities to design more livable, healthy and resilient cities (e.g. adaptation to climate change effects). It deals with the benefits of ecosystem services in urban areas. It shows that investing in ecological infrastructure in cities, and the ecological restoration and rehabilitation of ecosystems such as rivers, lakes, and woodlands occurring in urban areas, may not only be ecologically and socially desirable but often, economically advantageous, even based on the most traditional economic approaches.

2.3 Literature related to urban open spaces

“Urban open space in the 21st century” by Thompson, C. (2002): This paper asks what should be demanded from urban open space in the 21st century. It explores the social and spatial implications of new lifestyles, values, attitudes to nature and sustainability, and the models for future city life and the patterns of urban open space that might accommodate these. One vital role that urban parks play is providing space for the expression of diversity, both personal and cultural. This raises issues of democratic provision for and access to public open space. It suggests, inter alia, that the role of the urban street as public space may need to be re-thought. The social and cultural values of open space include attitudes towards nature and the desire to contact with it; contemporary understandings of ecology offer new insights into ways to serve both human needs and the broader ecological framework of urban open space structures.

“The value of urban open space” by Koetse, M. and Brander, L. (2011): Meta-analyses of contingent valuation and hedonic pricing results”. Urban open space provides a number of valuable services to urban populations, including recreational opportunities, aesthetic enjoyment, environmental functions, and may also be associated with existence values. In separate meta-analyses of the contingent valuation (CV) and hedonic pricing (HP) literature, we examine which physical, socio-economic, and study characteristics determine the value of open space. The dependent variable in the CV meta-regression is defined as the value of open space per hectare per year in 2003 US$, and in the HP model as the percentage change in house price for a 10 m decrease in distance to open space.
2.4 Urban renewal

“Helen weighing (January 2014)- A review of recent studies on sustainable urban renewal”- Urban renewal and sustainable development are two popular issues in both policy agenda and academia. This paper presents a critical review of recent studies on sustainable urban renewal over the period 1990-2012. The review focuses on the planning sub-system and the social sub-system of urban renewal in terms of the evaluation of sustainability. The complexity of achieving sustainable urban renewal is emphasized and discussed. To better clarify the mechanism behind the urban renewal process and improve urban sustainability, recommendations of future research directions are also provided.

2.5 Literature related to ecosystem management in the urban area

“Lundberg, J. And Folke, C. (2005) Incorporating Green-area User Groups in Urban Ecosystem Management”- They have analyzed the role of urban green areas managed by local user groups in their potential for supporting biodiversity and ecosystem services in growing city-regions, with focus on allotment areas, domestic gardens, and golf courses. Using Stockholm, Sweden, as a case study for a city-region, they have compiled GIS data and its spatial characteristics and relate these data to GIS for protected areas and “green wedges” prioritized in biodiversity conservation. Results reveal that the three land uses cover 18% of the studied land area of Stockholm, which corresponds to more than twice the land set aside as protected areas.

“Tratalos (2007) urban form, Biodiversity potential, and ecosystem services”- This paper suggests that at any given density, there is substantial scope for maximizing ecological performance. The social status of residents was related to measures of tree cover. Housing type was significantly associated with some types of ecosystem service provision, indicating that the type of development may be important independent of its density. These findings have implications for understanding the distribution of ecosystem services and biodiversity across urban landscapes, and the management of development aimed at meeting UK government housing density targets.

2.6 Literature related to the regeneration of green space in an urban area

“Anna Chiesura (2004) the role of urban parks for the sustainable city”- This paper is an attempt wherein the main concern is to address the importance of urban nature for citizens’ well-being and for the sustainability of the city in which they inhabit. Some results of a survey conducted among visitors of an urban park in Amsterdam (The Netherlands) are presented and discussed. The issues investigated concern people’s motives for urban nature, the emotional dimension involved in the experience of nature and its importance for people’s general well-being. Results confirm that the experience of nature in an urban environment is a source of positive feelings and beneficial services, which, in turn, fulfill important immaterial and non-consuming human needs.

3. RESEARCH GAP

From the comprehensive study of the available literature in this field, the following are the important observations that could be made out:

- The concept of urban green space is a very new domain in the field of urban ecology. This is because most of the papers and articles are post-1995.
- Most of the studies in this sector have concentrated on defacto scenario. Systematic studies on temporal changes/characteristics of the urban green space are relatively lacking.
- All the studies are confined to the countries of Europe and North America, the so-called developed realm. However, it is pertinent to mention here that the Asian countries such as India, China, Bangladesh, Malaysia, etc. are the ones which face the greatest amount of population pressure and rural-urban migration. None of the studies focused on the so-called developing nations.

The present study, therefore, tries to look into the urban green spaces of the Burdwan Town in India, so as to analyze the status of the Asian domain. This research is expected to fill the existing research gap between the relatively well-documented European and North American cities on one hand and the Asian cities on the other.

![Table 1: Location and Identity to the study area](image)

<table>
<thead>
<tr>
<th>Location</th>
<th>23.2462168 N to 23.245192 N, 87.8312295 E to 87.898950E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Area (sq km.)</td>
<td>26.30</td>
</tr>
<tr>
<td>Forest Cover (sq km.)</td>
<td>0.1431</td>
</tr>
<tr>
<td>Total Population(Urban)</td>
<td>314265</td>
</tr>
<tr>
<td>Population Growth Rate</td>
<td>(+)10.04</td>
</tr>
<tr>
<td>Population Density (per sq.km)</td>
<td>11949</td>
</tr>
<tr>
<td>Total Household</td>
<td>71628</td>
</tr>
<tr>
<td>Household Density(per sq.km)</td>
<td>2723</td>
</tr>
<tr>
<td>Total Road Lengths</td>
<td>373.80 km</td>
</tr>
<tr>
<td>Total Road Density</td>
<td>14.21 km</td>
</tr>
</tbody>
</table>

In a present study Bardhaman Town occupying the central part of the Purba Bardhaman District, is the true representative of Rarh Bengal. The town is located between 23.1362168N, 23.145192 N, 87.5012295 East, 87.528950 East with the shape of an isosceles triangle. The total area coverage of the Town is 6885 sq.km. In a Bardhaman town, 32 Words are located here.
4. LOCATION MAP

5. OBJECTIVE OF THE STUDY

- To analyze existing land use/land cover pattern and high growth of the population of the study area
- To assess frequently changing landscape since the period of 1990
- To understand human interconnectedness with nature and animals
- To perceive the positive aspects of nature relatedness on urbanites in terms of mood, health, as well as the well-being of people
- To find out possible ways to regenerate green spaces as well as improving existing greeneries in the study area, if possible at all.

6. DATA BASE AND METHODOLOGY

For the accomplishment of the major objectives of this research, both primary, as well as secondary tabular data supplemented by high-resolution satellite imageries, will be used. The broad methodology may be divided into the following parts:

a. Changes in the demographic data: For this purpose, the Census of India data for the years 1971-2011 will be referred to. The population of different decades will be analyzed and the trends of change in population will be studied. Statistical Techniques such as Time Series and Moving Average Method will be applied. Also, the data for migration will be analyzed and correlated.
b. Landuse Landcover change: The satellite imageries of the 1960s to 2010s will be procured from the USGS as well as BHUVAN websites. Supervised image classification will be carried out in different image processing software like ERDAS for different years and the validation of the same will be done by Kappa Coefficient with respect to GPS derived GCPs. The change in the land use categories and their magnitude will be mapped and analyzed.

![Land Use Land Cover Classification of an Urban Area - A Case Study of East Burdwan Municipality](image1)

**Fig. 3: Landuse Landcover change**

![NDVI map in 2001](image2)

**Fig. 4: NDVI map in 2001**

![NDVI map in 2014](image3)

**Fig. 5: NDVI map in 2014**

Above the two NDVI map mainly showing the changes in vegetation coverage in the year 2001 & 2014. In 2001 vegetation coverage basically high than the year 2014. Because this time overpopulation and urbanization is not developed in this area, it is mainly developed in 2011. This time population is highly increasing day by day. So, basically cutting the trees is also increases and vegetation coverage is also decreasing day by day.

![NDWI MAP](image4)

**Fig. 6: NDWI MAP**

c. Vegetation Signatures: One of the most useful and popular techniques in digital image processing is the vegetation and water body signatures such as Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI) and Normalized Difference Built-up Index (NDBI). These indices can be computed from various algorithms in ERDAS software. It is a known fact that all these indices are interrelated. Therefore, the degree of relation will be ascertained by various Spatial Autocorrelation techniques (like Moran’s Index) in ArcGIS. This will help in identifying the actual green space changes and their impacts.

![NDVI map in 2001](image2)

**Fig. 4: NDVI map in 2001**

![NDVI map in 2014](image3)

**Fig. 5: NDVI map in 2014**
d. Changes in the land surface temperatures: One of the important and well-known effects of an increase in the build-up area is an increase in temperature. We know that green surfaces act as Carbon Sinks whereas, the concrete ones promote Global Warming. Therefore, an important component of this study will be to see the effects of construction on temperature. For this purpose, the thermal bands of different years will be analyzed in ERDAS to extract the Land Surface Temperature (LST). This information will be compared and correlated with vegetation indices.

e. Public perception of green space: No planning proposal will be successful without active participation by the stakeholders. Therefore, this study plans to incorporate public perception and awareness into the realm of environmental planning. For this purpose, all the sectors of society, directly or indirectly associated with the green space will be taken into consideration. This includes domestic households, street vendors, local tourists, etc. Semi-structured questionnaire surveys (attached in the last page) will be carried out and people will be interviewed and their experiences will be noted and documented.

f. Analysis and representation: Various statistical and cartographic techniques will be employed for analyzing and representing the obtained information. Statistical techniques such as the parametric (Karl Pearson’s Correlation Coefficient, Students’ t-test, ANOVA Test, Linear Regression, etc.) as well as the non-parametric statistics (Spearman’s Rank Correlation Coefficient, Mann-Whitney Test, Kruskal Wallis Test, etc.) will be applied. It is a known fact that any of the natural and anthropogenic phenomena is governed by a number of factors. Therefore, Multivariate statistical techniques such as Multivariate Regression, Principal Component Analysis, etc. will also be performed.

g. Synthesis: Finally, all the obtained information will be analyzed and synthesized in the form of a report/thesis. A suitable and sustainable Green Management Plan is expected to come out for Burdwan Town.
7. THE SIGNIFICANCE OF THE STUDY

It has been stated earlier that systematic studies on urban green space are relatively lacking in the Indian scenario. Besides the fact that India is characterized by high population growth and massive rural-urban migration, lack of awareness about green spaces and their utilities is also responsible for the fact that urban green spaces in India have not been studied properly. This study, if complete, will be the first of its kind with respect to the urban areas of India and possibly Asia. Furthermore, the fact that the temporal changes in the urban green space will also be looked into, the future modeling and simulation may also be carried out. This will help us to postulate a suitable and sustainable green space management plan for the city of Burdwan in India. This may be of help to the government officials, environmental planners, Non-Governmental Organizations (NGOs), etc.

8. RESULT AND DISCUSSION

At the initial stage while the topic was selected by the active advice of supervisor, it was really appeared a difficult task to carry out the investigation as the basic motto related to the topic “Bio-perspective and Bio-prospecting”-is related to the psychological consideration of the urbanites. But later on the topic was enlightened with the Bio-environmental status of the study area, the role of the municipal organization to increase green spaces and bio-diversity and peoples’ outlook about bio-perspective and bio-prospection. Thus the four main chapters were taken into analysis in the tune of history of evolution of Burdwan town, Existing bio-perspective of the town as well as rich heritage of the past, motto of municipal authority for increasing ecological regime and people perception about Bio-perspective and Bio-prospecting with those cream chapters, now at the end stage of this enquiry it is necessary to synthesize the analysis by essential observation, major finding and concluding remarks.

It is utmost true that with the ramp out urban and peri-urban development in the study area the bio-prospective of the study area is smashed and the Municipal Authority has a role for such a development of bio-prospective from another angle, with the urban restructuring epically including of inner-city road (NH-2 Within city) The large size mature trees are cutting the last one year. No, satisfactory as well as the systematic plan has been taken to comprehensively the ruthless Destruction of trees with the consequent demolish on of birds, insects squirrel etc. The peri-urban area, on the other hand, is experiencing a rapid conversion of land use from agriculture to housing. As a result, the ecological food print is gradually exporting under stress. This was a slow process. But for the last 15-20 years, large scale residential enclave is a readily built-up area in the form of satellite towns, at the cost of agricultural field and peri-urban rural villages. Such a drastic reduction of the ecological footprint is an alarming behavior to comprehension to gradually changes, but it would be sustainable planning is sufficient green and water bodies are kept within it.

Thus the future of bio-prospecting of this urban unit is too poor to mention, but the only consolation is the restricted area occupied by the university authority, where neither common people nor municipal authority can after the ecocentric environment into a built-up environment.

8.1 Major Findings

Burdwan is being crowded basically agrarian population of the surrounding region. So, new urbanized have a soft mind for eco-preservation and bio-prospecting which can be fruitful if proper initiatives are taken by the university. The major findings of the inquiry are as follows:

- Burdwan town has a rich historical heritage especially in the context of biotic signature, as the Royal sites are steel marked with parks, playgrounds, water bodies, forest.
- Most of the elderly people enrolled in the morning walker associated has a soft comer for bio-preservation, which is hot strong for the younger generation.
- Very few people are found as a wild lover but they are highly devoted to the protection of street dogs, caring for cats, birds etc.
- Pet lovers irrespective of age, sex, caste, and religion are highly devoted to their pets but not for wild animals
- Garden owner of workers in the park and genders are endowed with biocentrism. They can devote their life to wildlife and biota.
- The municipal authority is almost reluctant for enhancing urban green and biodiversity. They are more interested to develop cosmetic environmental beauty of the urban area.
- Peri-urban area is losing its bio-potentials due to rapid as well as rampant development of the residential area. Therefore, the exponentials of the urban periphery and drastically reducing at an alarming rate.
- Last but not least; huge paleo-channels are there within the town. But those are rapidly encroached by the slum dwellers or poor urbanites. If the Municipal Authority protects it and renovates it, it would be a big step to bioprospecting in the future.

8.2 Concluding remarks

Such a topic can be highlighted from different perspectives horizons and corners. But for the time limitations, the topic has been represented in the light of existing bio-prospective, historical basis and bioprospecting in near future. The possible sites for bio-prospecting have not been demarcated due to lack of time to visit the whole area. The challenges in relation to bio-rejuvenation of paleochannels and vested land have not been enquired which is left for further inquiry.

9. REFERENCES


