**Dedicated to my beloved parents**

***Late Sri. Sankar Lal Saha***

**&**

***Smt. Sampa Saha***

**Who have given their everything for my study**

# .....DECLARATION

I declare that the thesis entitled **"A Geospatial Analysis of Urban Growth in Siliguri Planning Area, West Bengal"** has been prepared by me under the guidance of Dr. Ranjan Roy, Professor of Department of Geography and Applied Geography, University of North Bengal. No part of this thesis has formed the basis for the award of any degree or fellowship previously.

Arjun Saha. 14.08.2023

(Arjun Saha)

Department of Geography and Applied Geography
University of North Bengal
Raja Rammohunpur
Siliguri, Dist. Darjeeling
PIN: 734013
Date:

# CERTIFICATE


**DEPARTMENT OF GEOGRAPHY & APPLIED GEOGRAPHY**
**UNIVERSITY OF NORTH BENGAL**
ACCREDITED BY NAAC WITH GRADE B++
RAJA RAMMOHUNPUR, P.O. NORTH BENGAL UNIVERSITY, DIST. DARJEELING, WEST BENGAL, PIN - 734013
Ph. No. +91-0353-2776342, FAX +91-0353-2699001, URL: www.nbu.ac.in


This is to certify that Arjun Saha has prepared the thesis entitled **"A Geospatial Analysis of Urban Growth in Siliguri Planning Area, West Bengal"** for the award of Ph.D degree in Geography and Applied Geography of University of North Bengal under my guidance. He has carried out the research work at the Department of Geography and Applied Geography, University of North Bengal and the thesis has been prepared based on the extensive literature study for collecting secondary data and field study for primary data, information and ground verification.

14.8.2023

(Dr. Ranjan Roy)

Prof. (Dr.) Ranjan Roy
Professor
Dept. of Geography
&
Applied Geography
University of North Bengal

Professor
Department of Geography and Applied Geography
University of North Bengal
Raja Rammohunpur
Siliguri, Dist. Darjeeling
PIN: 734013
Date:

# PLAGIARISM REPORT

Ouriginal

## Document Information

| | |
|---|---|
| **Analyzed document** | Arjun Saha_Geography and Applied Geography pdf (D172701973) |
| **Submitted** | 8/10/2023 8:24:00 AM |
| **Submitted by** | University of North Bengal |
| **Submitter email** | nbuplg@nbu.ac.in |
| **Similarity** | 0% |
| **Analysis address** | nbuplg.nbu@analysis.urkund.com |

## Sources included in the report

## Entire Document

A Geospatial Analysis of Urban Growth in Siliguri Planning Area, West Bengal A Thesis Submitted to University of North Bengal, Darjeeling For the Award of Doctor of Philosophy Submitted by Arjun Saha Registration No. Ph.D/Geog. (1315)/495/R-2021 Under the Supervision of Prof. (Dr.) Ranjan Roy Department of Geography and Applied Geography University of North Bengal Raja Rammohunpur, Darjeeling August, 2023

7 CHAPTER – 1 INTRODUCTION SECTION – A 1.1 Introduction Urban geography is a branch of geography that examines the history of urban centers, how they have changed over time, how they have changed morphologically, how they serve their communities, and many other facets of urban life. Analysis of urban expansion is a key component of urban geography. According to Bhatta et al. (2010) and Clark (1982), urban growth is the alteration of both spatial characteristics and demographic structures, as well as the growing significance of towns and cities for the concentration of people. It can be summed up as an expansion of the category of urbanized land that has features added by urban extension (Viana et al., 2019). On the basis of the emergence of new built-up features over time, Wilson et al. (2003) divided urban growth into three categories: infill, expansion, and outlying growth. According to Wilson et al. (2003), infill growth is defined as the conversion of non-built- up or empty land into a built-up region that is encircled by at least 40% of previously existing built-up land. Edge expansion is the term used to describe the conversion of non- built-up land into built which grows from the boundary to the outer part of present built-up land and is encircled by not more than 40% of existing built-up land. Outlying urban growth is characterized by the conversion of non-built-up areas into built up which are developed at a greater distance from the existing major built-up developed area (Wilson et al., 2003; Sun et al., 2013). Outlying growth is further divided into three categories: isolated growth, which is a small emerging built-up area some distance from the present built-up area; linear branch, which refers to the growth of new roads corridors, and concurrent development of some settlements along it; and clustered growth, which is a compact, large built-up evolution away from the present built-up area (Wilson et al., 2003). The term "leapfrog development" also applies to this clustered growth (Harvey & Clark, 1965). Due to population expansion, particularly in metropolitan areas, the world has seen dramatic changes in both the natural world and anthropology in the twenty-first century (Foley et al., 2005). Only 13% of the world's population lived in cities in 1900; by 2018,

14.8.2023.

Prof. (Dr.) Ranjan
Profe
Dept. of Geogra
&
Applied Geogra
University of North E

# .....ACKNOWLEDGEMENT

"No one who achieves success does so without acknowledging the help of others. The wise and confident acknowledge this help with gratitude"

..... Alfred North Whitehead

I would like to express my deepest gratitude to all of them whose constant support and love had helped me to complete this long journey.

Firstly, I would like to thank and feel myself indebted to my supervisor Dr. Ranjan Roy, Professor, Department of Geography & Applied Geography, University of North Bengal for his constant love and support during different ups and downs in this journey and I thank to God that I have got opportunity to work under him. It would not be possible for me to complete this work without his expertise knowledge and valuable feedbacks in different times.

I would like to thank my teachers of the department of Geography & Applied Geography for generously providing their knowledge and expertise for the betterment of this work. I am extremely grateful to Prof. (Dr.) Deepak Kumar Mandal, Head, Department of Geography & Applied Geography, Prof. (Dr.) Subir Sarkar (Retd.), Prof. (Dr.) Sushma Rohatgi (Retd.), Dr. Suman Sao (Retd.), Dr. Indira Lepcha (nee) Lama, Dr. Arindam Basak, Dr. Snehashis Saha, Dr. Rupak Kumar Paul, Dr. Indrajit Roy Chowdhury, Dr. Riti Moktan, Late Dr. Suryapada Paul.

I would like to express my heartfelt gratitude towards the Vice Chancellor, Registrar, Dean, Faculty of Sciences, Librarian, Mr. Amit Kumar Dey, and Mr. Vivekananda Roy, Office Staff, Registrar branch, all the staffs of Geography & Applied Geography department for allowing me and helped me to complete this work.

I am extremely grateful to my teachers Dr. Nazrul Islam, Head, Department of Geography, Coochbehar Panchanan Barma University, Dr. Bappa Sarkar, Head, Department of Geography, Dinhata College, for their inspiring words and support for doing this work.

I am very much thankful to my co-scholars, Dr. Biswajit Das, Assistant Professor, Department of Geography, Manipur Central University, Mr. Tapan Debnath, Mr. Krishna Barman, Mr. Indrajit Poddar, Mr. Dipankar Das, SACT, Siliguri College, Ms. Sangita Karmakar, Dr. Bhupen Barman, Assistant Professor, Tufanganj Mahavidyalaya, Dr.

Punama Sen, Mr. Goutam Mandal, Assistant Teacher, Jawhar Navodaya Vidyalaya, Mr. Tuhin Dey Roy, SACT, Siliguri Mahila College, Mr. Debanjan Basak, Mr. Golap Hossain, Mr. Rajib Mitra, Mr. Kunal Chakraborty, Mr. Bhupesh Roy Pradhan, Mr. Amit Sarkar, Mr. Paritosh Das for their support during the research work.

It would not be possible for me without the support and sacrifice of my parents and my each family member. I am very much thankful and indebted to Late Mr. Sankar Lal Saha (Father), Smt. Sampa Saha (Mother), Late Mr. Haran Ch. Saha (Uncle), Smt. Beauty Saha (Aunty), Elder Sisters Smt. Mandira Saha and Smt. Taniya Saha, Brother-in-laws Mr. Sambhu Ray and Mr. Sandipan Saha, elder brother Mr. Tanmay Saha, Mr. Amit Saha, Sister-in-law Smt. Poulami Saha, beloved niece and nephew Srijita Ray and Himaghna Saha, two sweet aunties Kanan Saha and Rita Saha for their love and support during my study.

I take the opportunity to express my gratitude to various authors, publishers, organizations and institutions for allowing me to access their papers, journals, articles, scientific data, remote sensing data, reports in connection with my research work.

Date: 14.08.2023.

Place: University of North Bengal.
Siliguri.

Arjun Saha.
(Arjun Saha)

# .....PREFACE

Urban growth is a universal phenomenon and it has taken place in all the places and countries and it will goes on. In developing world like India, this growth in maximum cases does not follow the rules and regulations and for this, different negative impacts on environment take place. This same thing has happened in the city Siliguri and its adjoining areas which mainly bear the influx of populations after the independence, simultaneous partition and excessive migration from East Bengal. For this, Siliguri and its adjoining areas known as Siliguri Planning Area has been chosen to identify the growth of urban built-up and different issues due to it.

The whole work has been divided into seven chapters. First chapter mainly deals with the conceptual framework of the work, history of the study area, different objectives and hypotheses that have been framed, overall socio-economic, physical characteristics of this area. Second chapter deals with the land use and land cover changes and transformation that had taken place in this area from 1992 to 2021. Third chapter is about the urban growth of this region. This chapter mainly tried to find out the pattern of urban growth, its speed and trends of development over this region from 1992 to 2021. Fourth chapter stated about the identification of different types of suitable lands in patches for the new built-up development which will helpful for the people to select their actual residential plots. Fifth chapter deals with the infrastructural development in last twenty years in this region and to relate the population growth with this, which will stimulate the growth of impervious surfaces. Sixth chapter is for the analysis of different negative impacts that is facing this region due to the unplanned urban growth and huge burden of population. Impacts on river water, local climate, and on vegetation density had been analyzed to justify the urban growth and negative impacts on environment. Last chapter tried to put some suggestions for better and scientific and sustainably suitable to reduce the problem of unplanned urban growth as well as for a healthy urban growth in this region.

# .....LIST OF TABLES

# .....LIST OF FIGURES

## .....LIST OF PHOTO PLATES



## .....LIST OF APPENDICES