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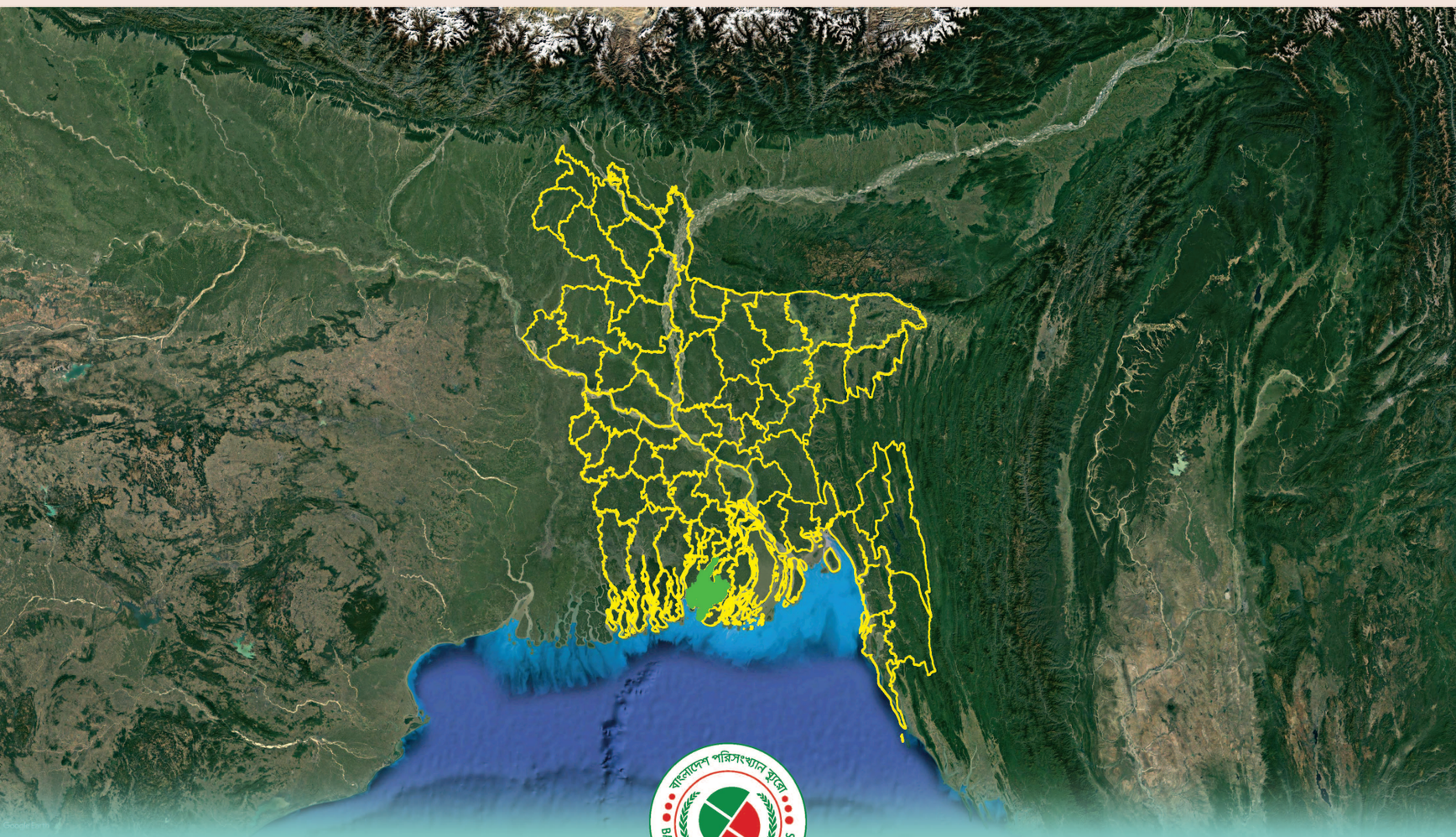
GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

DISASTER PRONE AREA ATLAS BANGLADESH

BARGUNA ZILA



BANGLADESH BUREAU OF STATISTICS (BBS)
STATISTICS AND INFORMATICS DIVISION (SID)
MINISTRY OF PLANNING

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BANGLADESH BUREAU OF STATISTICS (BBS)
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Foreword

Bangladesh Bureau of Statistics (BBS), the National Statistical Organization (NSO), is responsible for collecting, compiling and disseminating of statistics on population, demography, and economics as well as on other social indicators to measure the trends of the country's growth and development. Conducting Population and Housing Census is one of the core activities of BBS. Beside this, BBS conduct lots of Inter-censual survey and generate lots of analytical reports for the users which are mainly used for planning and policymaking at the national and sub-national levels. These reports are widely used for poverty alleviation interventions and initiatives for the improvement of the people's quality of life.

Bangladesh has taken a holistic approach towards disaster management, where emphasis has been given for working together with all stakeholders to build strategic, scientific and implementation partnerships with all relevant government departments and agencies, other key non-government players including NGOs, academic and technical institutions, the private sector and development partners. The role of Government is mainly to ensure that risk reduction and comprehensive disaster management programmes are in place. Given emphasis on that, BBS took an initiative to produce disaster prone area atlas for 17 coastal districts of the country. These atlases will focus on the existing situation of hazards, risk and disaster proneness of the districts and at the same time it will help to visualize the vulnerability through map and statistics. The disaster prone atlas of Barguna District is one of the output of such initiative.

Let me take privilege to thank UNFPA for providing financial and technical support to Stat4Dev Project of BBS under which this Atlas is prepared. I would like to thank the working group comprising relevant experts from Government of Bangladesh, Research Organizations and International Organizations for their technical backstopping in preparing the maps and the Atlas. I also would like to express my sincere thanks to the Director General of BBS, Project Director, GIS and his team for their sincere efforts in successful completion of this tremendous job. Thanks are also due to the distinguished members of the technical committee and report review committee for their valuable guidance in finalizing of the Atlas.

Dhaka: June, 2018

Saurendra Nath Chakrabhartty

Director General
Bangladesh Bureau of Statistics (BBS)
Statistics and Informatics Division (SID)
Ministry of Planning
Government of the People's Republic of Bangladesh

Preface

Bangladesh Bureau of statistics (BBS) already has been entered into a new era through the enactment of the Statistical Act 2013. As per this Act BBS is mandated as the standalone agency for generating official statistics. The law has empowered BBS to provide guidance to other agencies for producing official statistics and also to authenticate statistics generated by them. According to Statistical Act 2013, BBS has prepared the National Strategy for Development of Statistics (NSDS) aimed at capacity building of the nationwide use of statistics as well as Environment, Climate Change and Disaster related quality statistics. Following that mandate, previously BBS published small area atlas for 64 districts and now, BBS is going to prepare the disaster prone area atlas for 17 coastal districts of the country for the first time. The disaster prone area atlas of Bangladesh is a tool to enhance decision-making to reduce the economic and social impacts of natural hazards in the country. It is intended to provide a wide range administrators policy makers with appropriate risk information in order to strengthen the capacity of the country to develop strategic risk reduction & management strategies. It provides an excellent tool in identifying, showcasing and disseminating important information needed to make timely and sound technical decisions to enhance the development process. The atlas serves as a catalyst for the holistic approach of building resilient communities. The disaster prone area atlas of Barguna District is one of the outcome our disaster prone area mapping exercise.

I am grateful to UNFPA for their technical and financial assistance and to the representatives of universities, research organizations for their valuable guidance in preparing the Atlas and in conducting the field verification .My earnest thanks to Md. Zahidul Hoque Sardar, Project Director, A.S.M. Quamruzzaman, Deputy Director, Md. Maksud Hossain, Deputy Director and other colleagues of Stat4Dev Project of BBS for their relentless effort in preparing the disaster prone area atlas and for bringing out this atlas. The members of the editorial committee deserve special thanks for their input in the technical improvement of the atlas.

I am sure this atlas will be useful to the planners, administrators, researchers, policy makers and development partners to meet their demand for map of the country. Any constructive suggestions for further improvement of the report will be appreciated.

Dhaka: June, 2018

Md. Amir Hossain

Representative
UNFP Bangladesh

Message

I am glad to know the Bangladesh Bureau of Statistics (BBS), under the Statistics and Informatics Division (SID) of the Ministry of Planning of the Government of Bangladesh, has taken the initiative of publishing the Disaster-Prone Area ATLAS prepared by the UNFPA-supported project with BBS. An ATLAS is a handy tool to identify and reveal the exact location and geophysical and socio-economic characteristics of a geographical area. I believe this Disaster-Prone ATLAS will give a clear understanding of spatial and temporal occurrences of natural calamities and will be beneficial in mitigation strategies and preparedness plans, allocation of resources for a response, and will provide the decision support system in disaster management.

UNFPA assists the national efforts at building and sustaining capacities for knowledge management and data/ statistics systems, for integrating population dynamics into national planning and monitoring systems. It commits UNFPA Bangladesh to strengthen national capacity for the production and use of age, sex and location disaggregated population data, in line with the Sustainable Development Goals (SDGs) and International Conference on Population and Development (ICPD) beyond 2014. The 2030 Agenda for Sustainable Development, adopted in 2015, has placed the highest priority on ensuring that "no one is left behind", calling on national statistical systems to disaggregate national indicators and monitor and redress inequalities as a matter of human rights. This aspiration places a high demand on national data ecosystems, and on data disaggregation by age, sex and location in particular.

Climate change is one of the greatest challenges facing humanity today. Due to its geographical location, geological and climatic conditions, Bangladesh is one of the most disaster-prone countries in the world. UNFPA is working with the Governments and other development partners to understand population dynamics better, how they affect the changing climate and how people can become resilience in the face of these changes. This disaster-prone area ATLAS has visualized through maps and statistics of the existing situation of hazard and the risk of Barguna district.

I would like to express my sincere appreciation to the Director General of BBS, Project Director, and his team for their sincere efforts in successful completion of this tedious job.

Dhaka: June, 2018

Ms. Asa Torkelsson

Project Director
Stat4Dev Project
Bangladesh Bureau of Statistics (BBS)
Statistics and Informatics Division (SID)
Ministry of Planning

Acknowledgement

I am delighted to acknowledge the active role of officials concerned in undertaking the exercise for preparation of Disaster Prone Area Atlas. It is worth-mentioning that the staff members of BBS have professionally and successfully completed the Atlas by overcoming all the challenges.

I would like to express my humble gratitude and thanks to Saurendra Nath Chakrabhartty, Secretary, Statistics and Informatics Division (SID), Md. Amir Hossain, Director General, Bangladesh Bureau of Statistics, Ms Mahmuda Akhter, Additional Secretary (Development), Statistics and Informatics Division (SID), for their valuable suggestions, patient guidance, and all-out support for completion of the disaster prone area atlas.

Thanks to UNFPA Bangladesh for their generous support to BBS for conducting National Population Census and other outputs, like preparing disaster prone area maps, using census data for the very meaningful use by different government and non-government agencies.

Particularly I am grateful to ASM Quamruzzaman, Deputy Director, Md. Maksud Hossain, Deputy Director, Md. Firoz Ahmed Sardar, Statistical Officer and other Stat4Dev project's officials who were the active members of this Atlas team.

I have the pleasure to express my deepest gratitude to Mr. Mehedi Iqbal, Consultant and Assistant Professor, Department of Geography and Environment, Jahangirnagar University, who gave his full effort in preparing this Atlas. My great appreciation is due to the members of the project management team of stat4Dev project for their relentless efforts in this exercise.

I am deeply indebted to various stakeholders and agencies concerned who always provided their valuable suggestions and comments for successful completion of the Atlas and data collection from field.

Hope, users and readers will continue to forward their suggestion and comments for further improvement of those documents.

Dhaka: June, 2018

Md. Zahidul Hoque Sardar

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Chapter 1

Introduction

1.1 Background

Bangladesh is broadly distinguished as one of the world's countries most susceptible to climate change and one of the most vulnerable countries of the world in terms of natural and anthropogenic hazards. As per World Risk Report 2015 Bangladesh has been identified as the sixth most natural disaster-prone country among 173 countries in the world. The geography and climate have made the country vulnerable to different meteorological, hydrological and geological hazards. Natural hazards are a direct result of increased rainfall in the monsoon season, rising sea levels from climate change, and tropical cyclones. The occurrences of natural disasters in the nation are expected to increase as a result of climate change. Each disaster brings about devastating effects on the nation's agriculture, water supply, food resources, health and shelter. It is predicted that the effects of climate change, in the future, will generate more than 20 million climate refugees. Bangladesh is among the countries most predisposed to extensive flooding, tornados and destructive cyclones. Additionally, the water in Bangladesh is frequently contaminated with arsenic due to flooding and the high arsenic contents in the soil. It is estimated that nearly 77 million people in Bangladesh are exposed to toxic arsenic from drinking water.

Bangladesh Bureau of statistics (BBS) already has been entered into a new era through the enactment of the Statistical Act 2013. As per Act BBS is mandated as the standalone agency for generating official statistics. The law has empowered BBS to provide guidance to other agencies for producing official statistics and also to authenticate statistics generated by them. According to Statistical Act 2013, BBS has prepared the National Strategy for Development of Statistics (NSDS) aimed at capacity building of the nationwide use of statistics as well as Environment, Climate Change and Disaster related quality statistics.

1.2 Objectives

As a consequence of the above NSDS, BBS is going to prepared 17 coastal district disaster prone area atlas based on field verification and updating GIS map with other related information. Each disaster prone area atlas will represent single district and existing situation of hazard, risk and will visualized through map and statistics.

1.3 Scope of the work

Geographically, the survey covered the entire district for the selected 17 coastal district area. To identify the disaster-prone areas, a list of mauzas/mahallahs with the dominating type of disaster, which were collected from the field survey, was generated for 17 districts. The risk analysis was done at the extent of both the national and local levels. It will focus on main disaster namely flood, salinity, storm surge, excess rainfall, cyclone, thunderstorm and windstorm.

1.4 About the national disaster atlas

The main deliverable of the project is the district specific disaster prone area atlas. The atlas contains general information about demographic and climatic characteristics of specific district. It describes the main elements at risk and the hazard

profile of the local level based on settlements. The information were collected from the local level community and compiled to construct the maps. It contains an analysis of the risk and vulnerability of the district. The disaster prone area atlas of Bangladesh is a tool to enhance decision-making to reduce the economic and social impacts of natural hazards in the country. It is intended to provide a wide range of decision makers and policy makers with appropriate risk information in order to strengthen the capacity of the country to develop strategic risk management strategies. It provides an excellent tool in identifying, showcasing and disseminating important information needed to make timely and sound technical decisions to enhance the development process. The atlas serves as a catalyst for the holistic approach of building resilient communities.

1.5 Expected benefits to the nation

At the end of this Atlas, a lot of information on disaster and risks will be available and is able to define the disaster profile of specific district of Bangladesh. Such disaster risk profile will help to better coordinate all disaster management related initiatives in a proactive manner at national and local levels, leading to the reduction of disaster risk for all Bangladeshis citizens.

1.6 Key stakeholders

The National Disaster Atlas is intended to benefit a range of stakeholders and potential users. Mainly, the key decision/policy-makers will be able to ensure policy making and decisions are based on robust risk information. The atlas will benefit donors and development partners by informing their respective project formulation and design and risk-proofing development interventions. It will also ensure a risk informed planning by Planners in the government institutions, non-government organizations and the private sector. In addition, the academe is one of the expected beneficiary and user of the atlas specifically as basis or reference for further researches and academic papers. Moreover, the private sector will also benefit from the atlas as its findings could guide them in disaster risk proofing their investments. The humanitarian actors could also utilize the atlas as guide in identifying hazard-safe areas where humanitarian interventions are placed and implemented. The Districts and the local communities will by and large be the main beneficiaries and users of the atlas.

As herein listed, these stakeholders were grouped into ministries, governmental institutions, regional organizations, and international organizations (including UN Agencies and NGOs). Some of the other stakeholders, particularly the regional organizations, participated in the project by providing data required in the assessment including thematic inputs in the use of software, and modeling, including the development of the methodology and analysis. In particular, the UNFPA, aside from providing funding support to the project, have extensively provided technical guidance and assistance to the risk assessment process through its in-house disaster risk assessment expertise.

1.7 Key concepts and definitions

Disaster.

Disaster means any such incidents mentioned below created by nature or human or created due to climate change and its massiveness and devastation cause such damage to cattle, birds and fisheries including life, livelihood, normal life, resources, assets of community and the environment of the damaged area or create such level of hassle to that community whose own resources, capability and efficiency is not sufficient to deal this and relief and any kind of assistance is needed to deal that situation, such as: (a) Cyclone, northwester, tornado, sea high tides, abnormal tides, earthquake, tsunami, excessive rains, shortfall of rains, flood, erosion of river, erosion of coastal area, drought, excessive salinity, excessive pollution of arsenic, building slide, landslide, hill slide, gushing water from hills, hailstorm, heat wave, cold wave, long term water logging etc.; (b) Explosion, fire, capsize of vessel, massive train and road accident, chemical and nuclear radiation, pilferage of oil or gas, or any mass destruction incident; (c) Disease causing pandemic, such as pandemic influenza, bird flue, anthrax, diarrhea, cholera, etc.; (d) Harmful microorganism, poisonous materials and infection of life active object including infection by bio based or biological infectious object; (e) Ineffectiveness or damage of essential service or disaster protection infrastructure; and (f) Any unnatural incident or a misfortune causing massive life loss and damage (Disaster Management Act 2012).

Disaster risk

The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time. The definition of disaster risk reflects the concept of disasters as the outcome of continuously present conditions of risk. Disaster risk comprises different types of potential losses, which are often difficult to quantify. Nevertheless, with knowledge of the prevailing hazards and the patterns of population and socio-economic development, disaster risks can be assessed and mapped, in broad terms at least.

Disaster risk reduction

Disaster Risk Reduction (DRR) is development and application of policies and practices that minimizes risks to vulnerabilities and disasters, applies to managing and /or responding to current disaster risks.

Early warning system

It is a major element of disaster risk reduction. It prevents loss of life and reduces the economic and material impact of disasters. To be effective, early warning systems need to actively involve the communities at risk, facilitate public education and awareness of risks, effectively disseminate alerts and warnings and ensure there is constant state of preparedness (Ibid).

Exposure

People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses. Measures of exposure can include the number of people or types of assets in an area. These can be combined with the specific vulnerability of the exposed elements to any particular hazard to estimate the quantitative risks associated with that hazard in the area of interest.

Hazard

A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. There are hazards of natural origin and related environmental and technical hazard and risks. Such hazards arise from a variety of geological, meteorological, hydrological, oceanic, biological and technical sources, sometimes acting in combination. In technical settings, hazards are described quantitatively by the likely frequency of occurrence of different intensities for different areas, as determined from historical data or scientific analysis.

Natural hazard

Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. Natural hazards are a sub-set of all hazards. The term is used to describe actual hazard events as well as the latent hazard conditions that may give rise to future events. Natural hazard events can be characterized by their magnitude or intensity, speed of onset, duration, and area of extent. For example, earthquakes have short durations and usually affect a relatively small region, whereas droughts are slow to develop and fade away and often affect large regions. In some cases hazards may be coupled, as in the flood caused by a hurricane or the tsunami that is created by an earthquake.

Resilience

The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. The resilience of a community in respect to potential hazard events is determined by the degree to which the community has the necessary resources and is capable of organizing itself both prior to and during times of need.

Return period

A return period, also known as a recurrence interval or repeat interval, is an estimate of the likelihood of an event to occur. It is a statistical measurement typically based on historical data denoting the average recurrence interval over an

extended period of time. The theoretical period is the inverse of the probability that the event will be exceeded in any other year. For example, a 25 year flood has a 1/25 = 0.25 or 25% chance of being exceeded in any one year. Despite the connotations of the name "return period", it does not mean that a 25 year flood will happen regularly every 25 years or only once in 25 years (Wikipedia, 2015).

Risk

Risk means hazards, factors of dangers and possible harmful situation created due to internal process of the environment or assembling and capability. (Disaster Management Act, 2012)

Risk analysis

The process to comprehend the nature of risk and to determine the level of risk (ISO 31010).

Risk assessment

A methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend. Risk assessments (and associated risk mapping) include: a review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios. This series of activities is sometimes known as a risk analysis process.

Vulnerability

Vulnerability means any such existing socio-economic, geographical and environmental condition of any community, which may make expected capability of the community vulnerable, weak, unskill and limited to adapt with affect of natural or human created hazard or any adverse reaction.

Natural Disaster

A natural disaster is a major adverse event resulting from natural processes of the Earth; examples include cyclones, drought, floods, erosion, volcanic eruptions, earthquakes, tsunamis, and other geologic processes. A natural disaster can cause loss of life or property loss and damages, and typically leaves some economic loss and damages, the severity of which depends on the affected population's resilience, or ability to recover. Following is the description of some of the natural disasters (with their code number) in Bangladesh.

Drought

Bangladesh faces unpredictable drought hazard in the dry monsoon due to inadequate and uneven rainfall. It varies from place to place, however, and the north-western region/ districts of Bangladesh suffers most from the drought almost regularly in two-year cycle. It is unusual dryness of soil, resulting in crop failure and shortage of water for other uses, caused by significantly lower rainfall than average over a prolonged period. Hot dry winds, shortage of water, high temperatures and consequent evaporation of moisture from the ground can contribute to conditions of drought. This may have initiated the process of desertification in those districts where the affected areas maintain high temperatures, non-availability of surface water due to drying out of water sources, crops die out and there is a crisis of fodder as well. For people who are directly dependent on rainwater, drought is a big problem.

Flood

Flood is one of the major natural disasters in Bangladesh. In general the normal inundation of flood-free areas by water caused by excessive rain and spillage from the over flown riverbanks is called flood. Floods bring about immense havoc to the lives of the people. Flooding is a natural phenomenon in Bangladesh and occurs on an annual basis. The rivers are huge by global standards, and can inundate over 30% of the land mass at a time. Bangladesh is prone to serious and chronic flooding. Even in an average year, 18% of the landmass is inundated and previous floods have affected 75% of the country (as in 1988). 75% of the country is below 10m above sea level and 80% is classified as floodplain as Bangladesh is principally the delta region of South Asia's great rivers. Bangladesh floods on a regular basis, recent notable and catastrophic floods have occurred in 1988, 2004, 2007 and 2010. Floods cause erosion of chars (islands) by flooding rivers, cause landlessness amongst Bangladesh's poor; environmental refugees, loss of property, lives, epidemic, other water borne diseases, lack of drinking water, loss of agricultural land and crops, communication disruption are some of the major effects of this natural disaster.

Water Logging

Bangladesh's high vulnerability to frequently occurring natural disaster is known worldwide, a lesser-known new phenomenon - water logging - has been disrupting livelihoods of people during the past two decades. The phenomenon involves deterioration of drainage condition in a number of southern coastal rivers leading to temporary to permanent inundation of floodplains along those rivers, causing enormous difficulties towards maintaining livelihoods and disrupting land-based productive system including agricultural crops. The problem has become severe in the southwestern parts of Bangladesh, especially along the Kapataksma river system covering parts of Jessore, Khulna and Satkhira districts. Water logging is also becoming an issue in central southern Noakhali district, where gradual chocking of the Noakhali rivulet (i.e., khal) has given rise to temporary water logging every year.

Cyclone

A large-scale closed circulation system in the atmosphere with low barometric pressure and strong winds that rotate counter clockwise in the northern hemisphere and clockwise in the southern hemisphere. The system is referred to as a cyclone in the Indian Ocean and South Pacific, hurricane in the western Atlantic and eastern Pacific and typhoon in the western Pacific. Cyclones are the most devastating of the natural disasters. Generally, the disasters faced by the coastal areas are related to tides, river flows and weather conditions leading to cyclonic winds. A major hazard that occurs in the coastal areas is mostly due to weather conditions associated with depressions of varying severity. The hazards due to cyclones are associated with elements such as depressions, cyclone surges, effect of wind speed, hazard areas, etc. High winds cause rough conditions and high waves during the time of depression over the sea and cause damage and loss throughout the land they pass over. In Bangladesh, the main cause of damage and loss is the severe cyclonic storm with Hurricane intensity. In Bangladesh, most of the cyclones occur during the pre-monsoon (April/ May/ early-June) and post-monsoon (late-September/ October/ November) period. The pre-monsoon period is the sowing or broadcasting season for Aus rice and the post monsoon season is the harvesting season for Aman rice in the coastal areas. Hence, the impact of cyclones is severe in terms of economic loss, as well as loss of lives and property.

Tornado

The two transitional periods between southwest and northeast monsoons over the Indian sub-continent are characterized by local severe storms. The transitional periods are usually referred to as pre-monsoon (March-May), and post-monsoon (October-November). It is the pre-monsoon period when most of the abnormal rainfall or drought conditions frequently occur in different parts of Bangladesh. Also there are severe local seasonal storms, popularly known as nor'westers (Kalbaishakhi). Severe nor ‘westers are generally associated with tornadoes. Tornadoes are embedded within a mother thundercloud, and moves along the direction of the squall of the mother storm. The frequency of devastating nor' westers usually reaches the maximum in April, while a few occur in May, and the minimum in March. Nor' westers and tornadoes are more frequent in the afternoon.

Storm/Tidal Surge

Storms are caused by atmospheric disturbance involving perturbations of the prevailing pressure and wind fields, on scales ranging from tornadoes (1 km across) to extra-tropical cyclones (2000-3000 km across). This causes a rise in sea level that result in the inundation of areas along coastlines. The movement of ocean and sea currents, winds and major storms causes these phenomena.

Thunderstorm

A thunderstorm, also known as an electrical storm, a lightning storm, or a thundershower, is a type of storm characterized by the presence of lightning and its acoustic effect on the Earth's atmosphere known as thunder. Thunderstorms occur

in association with a type of cloud known as a cumulonimbus. They are usually accompanied by strong winds, heavy rain and sometimes hail, or, in contrast, no precipitation at all. Thunderstorms result from the rapid upward movement of warm, moist air. They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that can reach heights of over 20 km (12.45 miles). As the rising air reaches its dew point, water droplets and ice form and begin to fall through the clouds towards the Earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of cold air and moisture that spreads out at the Earth's surface, causing the strong winds commonly associated with thunderstorms, and occasionally fog.

River/Coastal Erosion

A combination of natural processes, including weathering, dissolution, abrasion, corrosion, and transportation, by which material is worn away from the earth's surface. The energy in a river causes erosion. The bed and banks can be eroded making it wider, deeper and longer. River erosion and submerging of the coastal lands are the natural phenomenon being one of the main natural disasters. River and coastal erosion causes much more destruction to the socioeconomic mechanism than any other natural disasters. Loss of life may not happen due to erosion but it makes people undone. It causes a massive financial loss and damages. The immense pressure of the downwards tide, current force and twirl, waves and tides, storm, tidal surges, lack of trees on the riverbank causes erosion to the coastal islands every year. The collision between downwards current of fresh water and uprising sea level creates strong twirling that cause erosion to the coast. Moreover, due to combined sudden flood, heavy rain, and downwards freshwaters causes collision to the riverbank and cause erosion to the riverbanks and coastal areas. Deforestation and lack of plantation in the riverbanks and coastal areas also complement to riverbank and coastal erosion.

Landslide

Landslides are a complex-disaster phenomenon that can be caused by earthquakes, volcanic eruptions, heavy rainfall (typhoons, hurricanes), sustained rainfall, heavy snowmelt, unregulated anthropogenic developments, mining, and others. In Bangladesh, landslides are mostly triggered by heavy rainfall. However, underlying causes of landslide include deforestation, hill cutting, unregulated development work, etc. Moreover, poverty and landlessness force poor people to live in the risky hill-slopes. However, recently landslide has emerged as a major hazard, particularly after the Chittagong Landslide 2007. Due to heavy rainfall during 10 -11 June 2007, landslides and collapsed walls caused widespread damages in six areas of Chittagong city and in different Upazilas of the District.

Salinity

Saline water intrusion is mostly seasonal in Bangladesh; in winter months the saline front begins to penetrate inland, and the affected areas rise sharply from 10 percent in the monsoon to over 40 percent in the dry season. Coastal districts such as Satkhira, Khulna, Bagerhat, Barguna, Patuakhali, Barisal are the victims of salinity intrusion. Agricultural production,

fisheries, livestock, and mangrove forests are affected by higher salinity in the dry season. It is observed that dry flow trend has declined as a result of which sea flow (saline water) is traveling far inside the country resulting in contamination both in surface and ground water. The population of pure freshwater fish species decline and species that are more tolerant survive and dominate changing the composition of the ecosystem and affecting the livelihoods of the people dependent of the freshwater resources.

Hailstorm

Hailstorm is a very curious geographical and climatic phenomenon. A hailstorm is named such, because during the storm, hail or balls of ice fall in huge quantities on the Earth. It is nothing but irregular lumps or balls of ice. The specialty of a hailstorm is that both hail, i.e. balls of ice, and rainwater fall during the storm, at the same time. The hailstorms are not exactly storms, but are a side effect of a much bigger storm, the thunderstorm. In fact, this phenomenon originates from thunderclouds that are known as Cumulonimbus clouds. When the existing temperature of a mass of air currents falls down rapidly over decreasing altitude, it results in a hailstorm. The hailstones are formed due to the process of freezing and grow over time. They are carried by the updrafts or the air currents moving in the upward direction, until they become large for these currents to continue carrying them. Hailstones must have at least 3/4 inch of diameter to become severe, and cause a substantial amount of damage and loss to life and property. Being a nature's phenomenon and a type of natural disaster, hailstorms are unavoidable. The impact of hailstones can cause widespread damage and loss to vulnerable plant, agricultural crops, infrastructure and equipment that is stored outside. Hailstones have the potential to destroy animals and human life upon impact if strong enough.

1.8 Data and Map source

The development of a comprehensive disaster risk profile requires foremost a good understanding of the general context and background of the country. Accordingly, many country data has been gathered. These data were organized in a dataset and converted into GIS formats. The data includes administrative entities, population, infrastructure, buildings and settlement, livelihood, health, education, elevation and topography and land use countrywide. It is important to note that the data availability constitutes a main challenge and constraint for the preparation of this atlas. The subsequent page demonstrates a table detailing data collected from different institutions, governmental, international organization and UN Agencies.

Table 1.1: Database Inventory

S/N	Type of data	Format	Content	Source
1	DEM	Point-based GIS shapefiles	Digital elevation model of 10 meter	BWDB
2	Topographic Maps	Image	Images covering the specific area produced in 2010	SoB
3	Land Cover Map	GIS Shapefiles	Land use land cover information	MoL

4	Education facilities location	GPS locations	Specific locations and other related informations	GPS survey
5	Health facilities location	GPS locations	Specific locations and other related informations	GPS survey
6	Administrative boundary	GIS Shapefiles	Admin boundary with Geocode	BBS
7	River Network	GIS Shapefiles	Detail river network with name	BWDW
8	Meteorological data	Spreadsheet	Daily Temperature, Rainfall, Humidity with station location's latitude and longitude	BMD
9	Demographic data	Spreadsheet	mauza specific Various demographic related data	BBS
10	Soil salinity	Point based GIS shapefiles	Salinity measurement for specific location of the study area	BARC
11	Disaster information	Spreadsheets	Various disaster and damage related information	Field survey

Chapter 2

Methodological Framework for Hazard and Risk Assessment

2.1 Understanding country situation and baseline data compilation

The risk assessment process was an extensive inventory and compilation of existing data and information related to hazards and elements at risk. It involves an understanding of the country's disaster risk management framework, practices and institutional set-up. It entails collection of baseline data of the country such as administrative boundaries, infrastructure, socioeconomic data (e.g. demographics, poverty index, employment, agriculture, etc.), spatial data (e.g. Digital Elevation Model, geology, soil, land cover, land use, road network, etc.) and meteorological data (e.g. rainfall, temperature, etc.). This process also include collection of historical disaster events and the damage and losses they caused. The collected data are compiled and structured in different datasets according to its nature, format and contents. Subsequently, the datasets are integrated in the Geographical Information System (GIS) platform and processed into maps and spatial formats. Some of the baseline data are presented in figures and tables. These maps, figures and tables are presented in chapter 3.

2.2 List of Disaster and disaster calendar

Each district has different hazards and occurred in different time. To identify the different hazards in particular district one questionnaire survey was conducted to collect the data from field and compiled together. Afterwards, a disaster table was created according to the local level perception and information. The table shows the disaster calendar for the Barguna district.

Upazila Name	Disaster Name	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Rank
Amtali	Tornado													1
	Cyclone													2
	Drought													3
	River Corrosion													4
	Flood													5
	Bore													6
Bamna	Flood													1
	Tornado													2
	Cyclone													3
	River Corrosion													4
	Bore													5
Barguna Sadar	Flood													1
	River Corrosion													2
	Lightning													3
	Tornado													4
	Cyclone													5
	Bore													6

Upazila Name	Disaster Name	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Rank
Betagi	Flood													1
	Bore													2
	Tornado													3
	Heavy Fog													4
	Cyclone													5
	River Corrosion													6
	Drought													7
	Lightning													8
	Hail													9
Patharghata	Cyclone													1
	Bore													2
	Flood													3
	Heavy Fog													4
	Drought													5
	Lightning													6
	River Corrosion													7
	Tornado													8
	Hail													9
Taltali	Bore													2
	Cyclone													1
	Flood													3
	River Erosion													5
	Tornado													4

2.3 Hazard assessment and mapping

Hazard assessment and mapping is the first step of the risk assessment process. It involves characterizing the hazards in terms of its spatial distribution, frequency and intensity. It covers six major hazards that are prevalent in Barguna District namely, cyclone, thunderstorm, coastal flood, salinity, Tidal Surge and Tornado. Specific hazard intensity maps are produced per hazard. The hazard maps identify the hazard-prone settlement areas, describe the physical characteristics of the hazards and characterize the hazards in terms of magnitude, frequency, duration, extent, intensity and probability.

2.4 Exposure assessment

Identifying and assessing the elements at risk is the next step in the risk assessment process. Exposure assessment is an intermediate stage of risk assessment, which links the hazard assessment with the targeted elements under consideration for the risk assessment (ADPC, 2013). The elements at risks in this study, also labelled as sectors of activity, are population,

building, critical facilities such as health and education facilities, infrastructure (e.g. roads) and agriculture (Table 2.1). Exposure will be quantified and expressed as the number of population (or human lives) and the value of properties and assets that can potentially be affected by a specific hazard.

Table 2.1 : Elements considered in the assessment per hazard

Type	Population	Settlement	Crop	Infrastructure	Transport
Flood	X	x	x	x	x
Thunderstorm	X	X	X	X	
Cyclone	X	X	X	X	X
Salinity	X		X		
Tidal surge	X	X	X	X	X
Tornado	X	X	X	X	X

The exposure assessment is aimed at creating a national database of elements at risks. It qualifies the elements located in hazard-prone areas. The goal is to develop a comprehensive profile of elements at risk and analysis of their exposure to various natural hazards. The analysis is carried out based on available data.

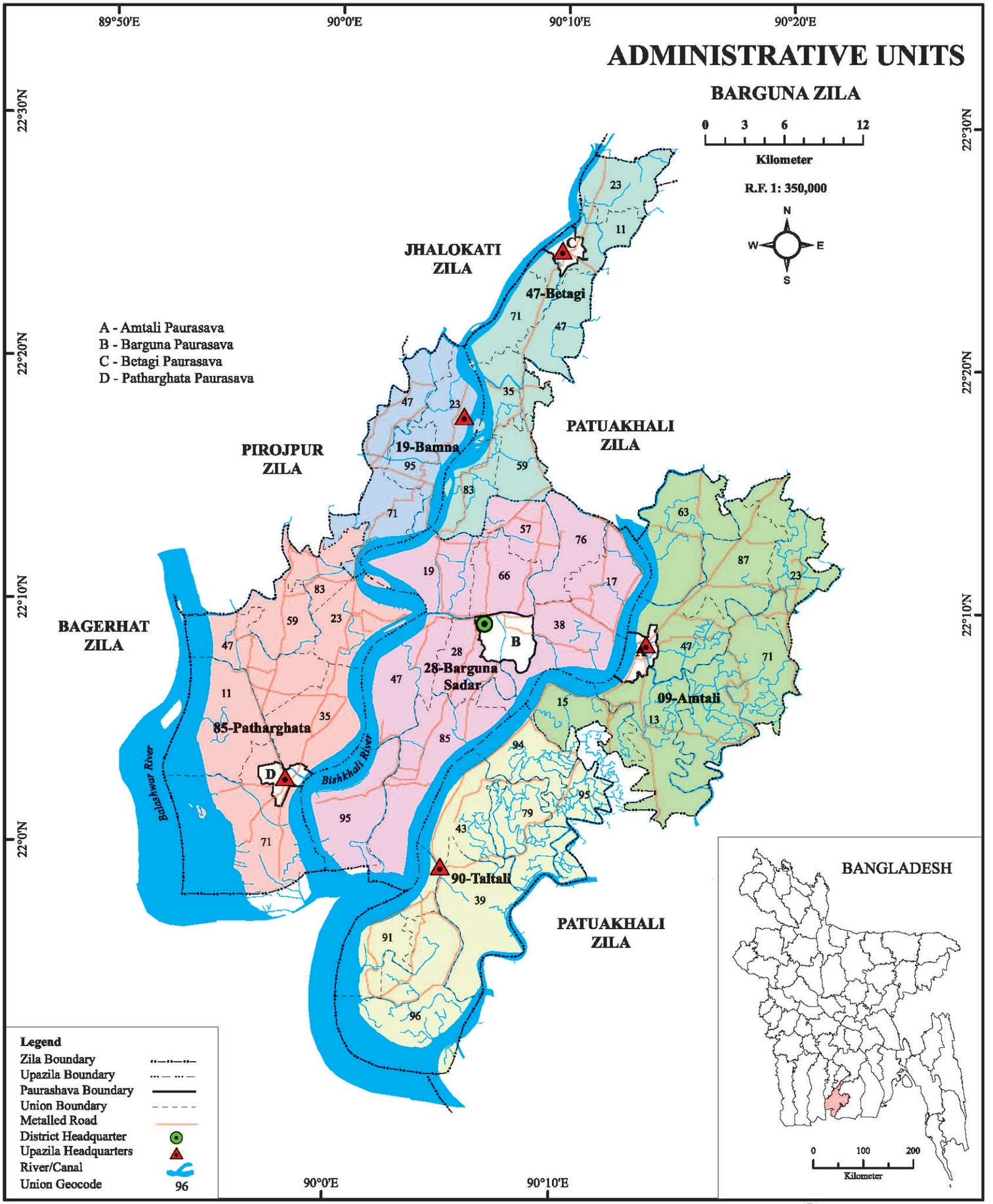
Chapter 3

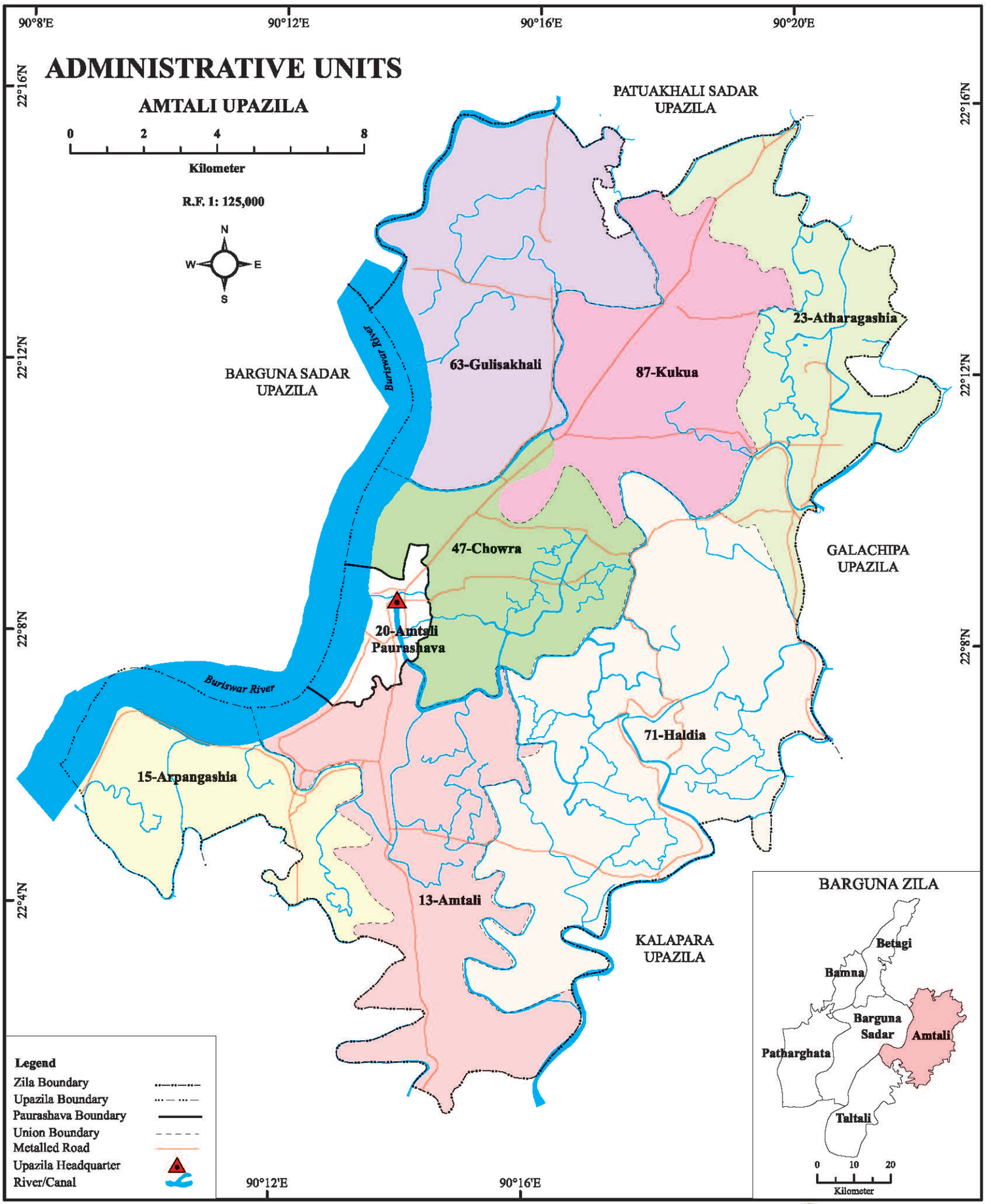
Basic Data and Base Maps of Barguna District

3.1 Geography and administrative division

Barguna region is comprised of four major districts of Jhalkathi, Barisal, Pirojpur and Patuakhali. In the east, it borders the Patuakhali district. On the south, Barguna is bounded by the Patuakhali district, and the Bay of Bengal. On the western side, it borders Pirojpur and Bagerhat districts The Barguna District has a total area of 1831.31 km^2. It was established as a district in 1984. The region has certain geographical variations. It has forest on one side and swamp land on the other side. The region is a rich reservoir of fishes. It has fishing centres, dried fish villages, river way communication system and newly emerged landmasses. It is surrounded by rivers and rivulets. Important rivers of Barguna district include the Paira River, Bishkhali River, khakdon river and the Baleshwar RiverBarguna. The region also has Rakahing villages. The major economic activities of the region are agriculture, fishing, fish business and fish farming. Muslims, Hindus, Buddhists, Christians and Rakhaing live in the region peacefully for years. The major agricultural products of the region include paddy and vegetables. The zila consists of 6 upazilas, 42 unions, 257 mauzas, village 563, 4 paurashavas, 36 wards and 50 mahallas. The upazilas are Amtoli, Bamna, Barguna Sadar, Betagi, Patharghata and Taltali.

Geography and Administrative Division


ADMINISTRATIVE UNITS
BARGUNA ZILA
0 3 6 12
Kilometer
R.F. 1: 350,000
N
W E
S
89°50'E
90°0'E
90°10'E
90°20'E
22°30'N
22°20'N
22°10'N
22°0'N
A - Amtali Paurasava
B - Barguna Paurasava
C - Betagi Paurasava
D - Patharghata Paurasava
JHALOKATI ZILA
PIROJPUR ZILA
PATUAKHALI ZILA
BAGERHAT ZILA
PATUAKHALI ZILA
47-Betagi
19-Bamna
28-Barguna Sadar
09-Amtali
85-Patharghata
90-Taltali
Bishkhali River
Baleshwar River
BANGLADESH
0 100 200
Kilometer
Legend
Zila Boundary
Upazila Boundary
Paurashava Boundary
Union Boundary
Metalled Road
District Headquarter
Upazila Headquarters
River/Canal
Union Geocode
96



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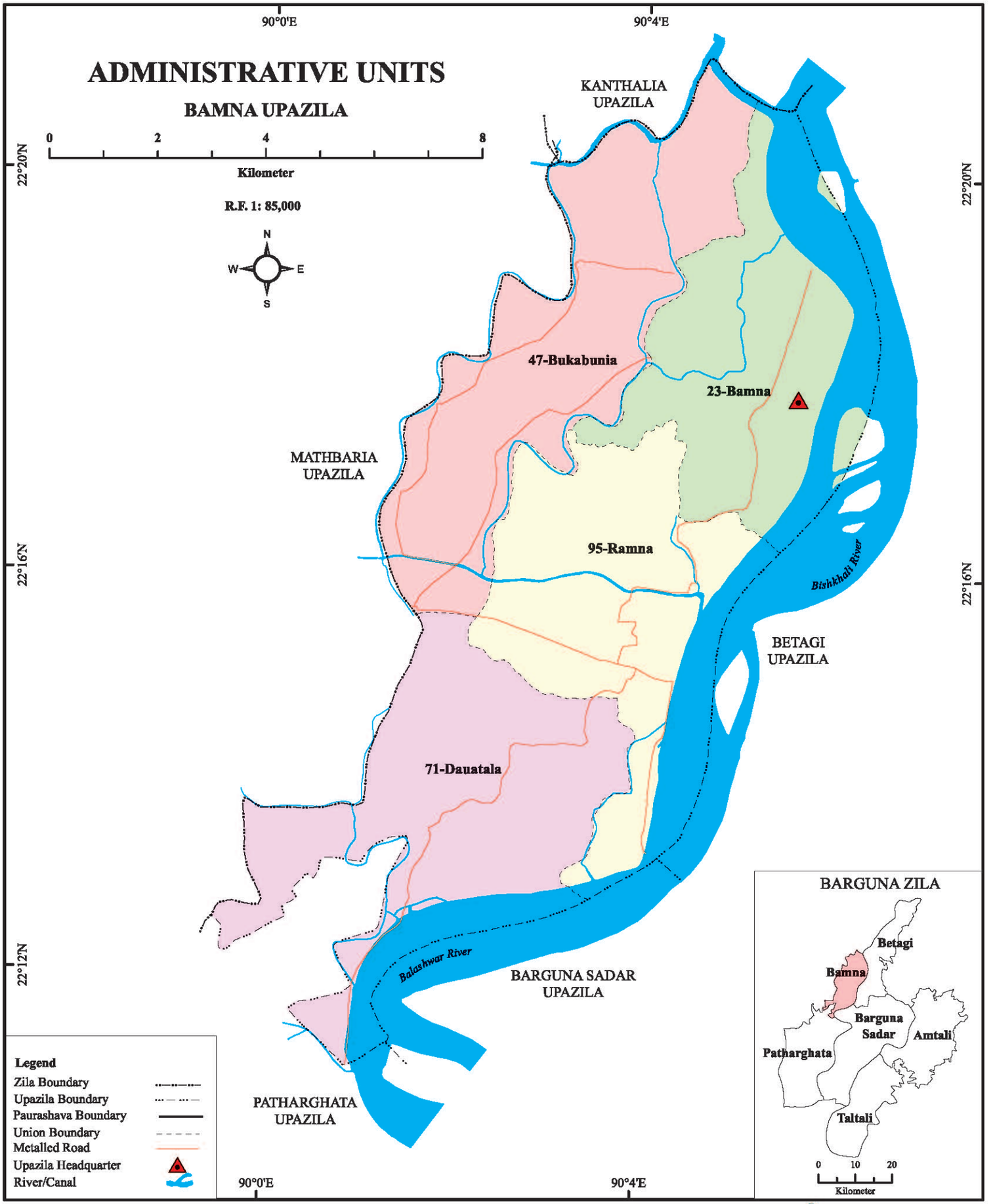

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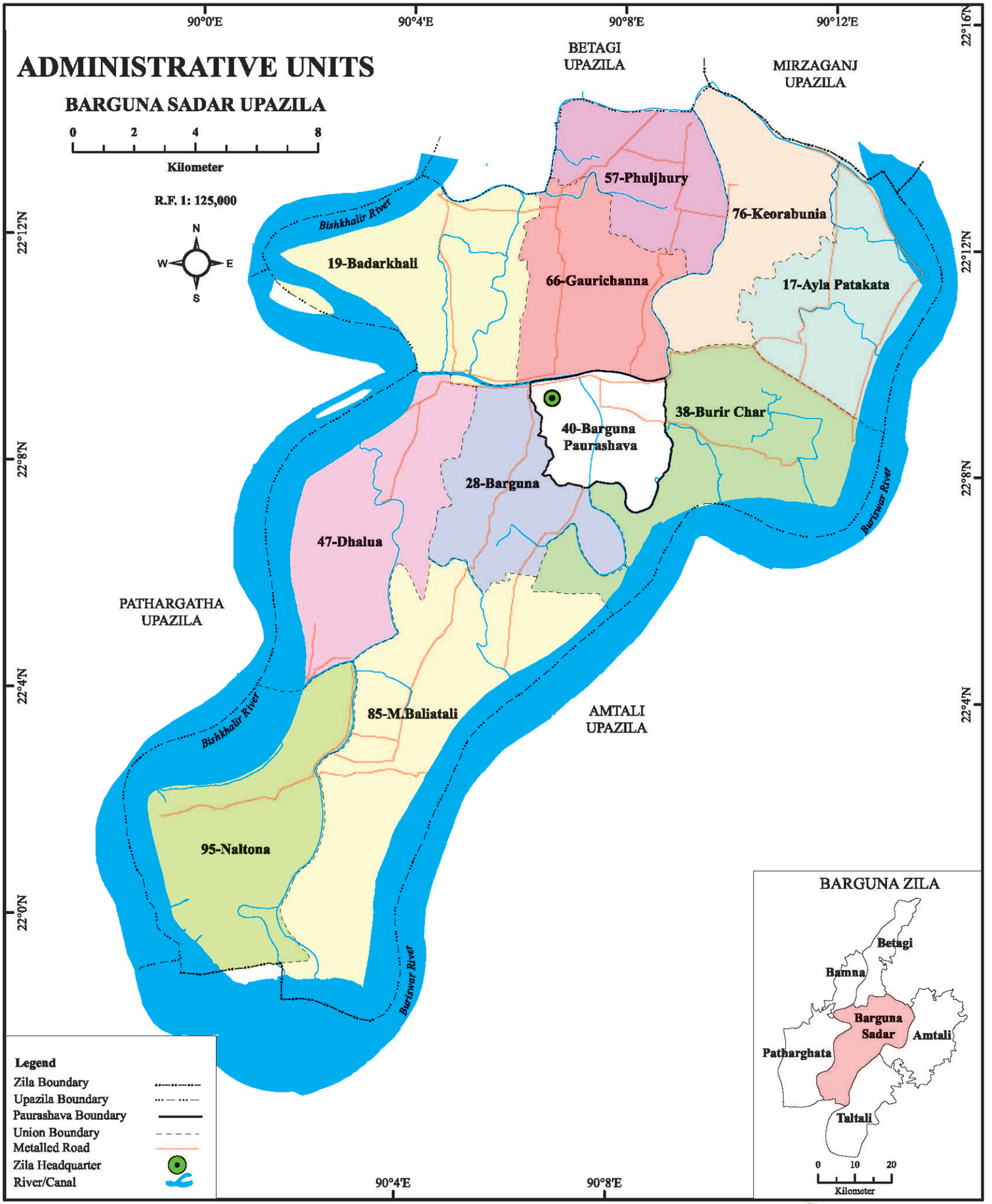

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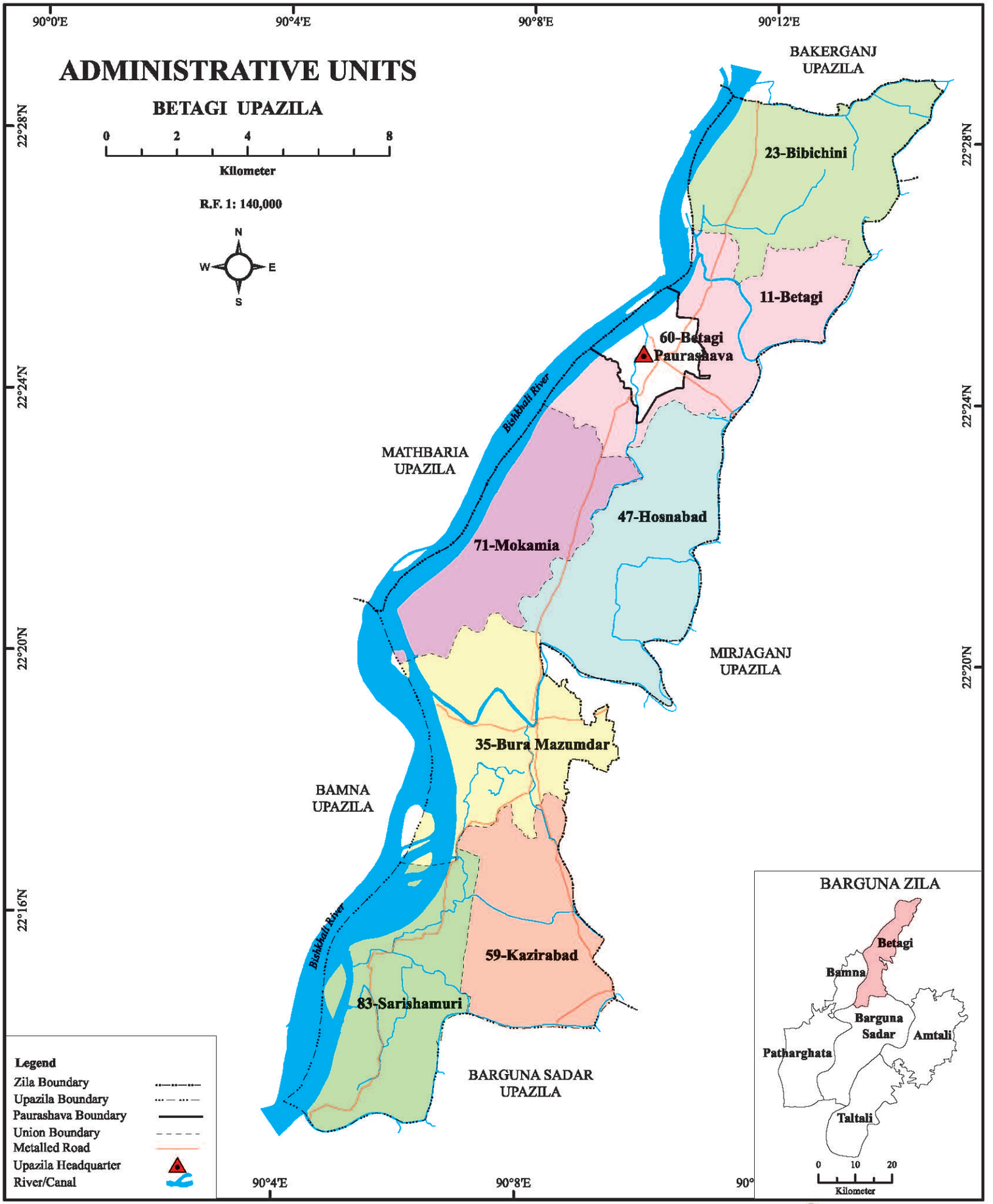

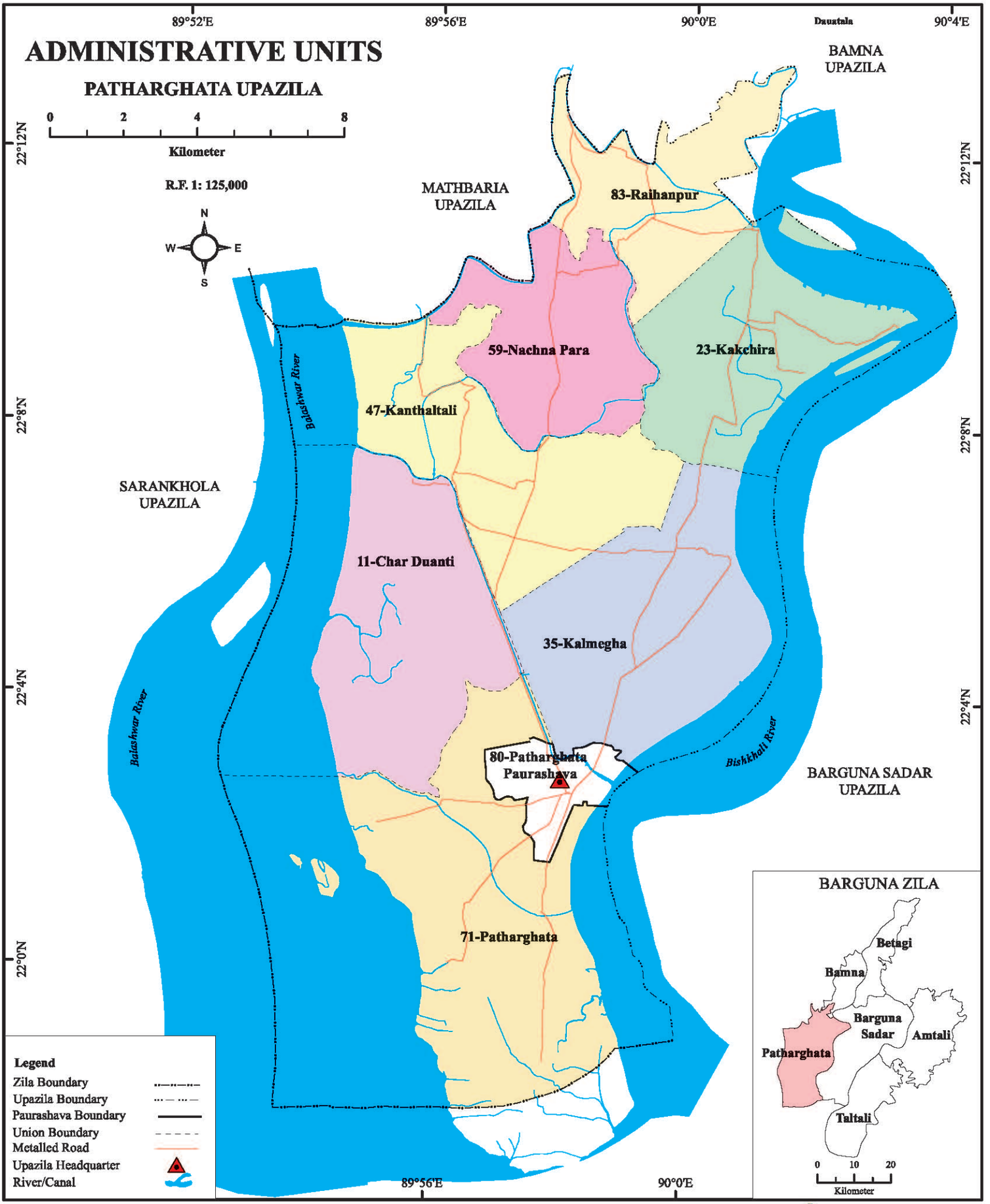

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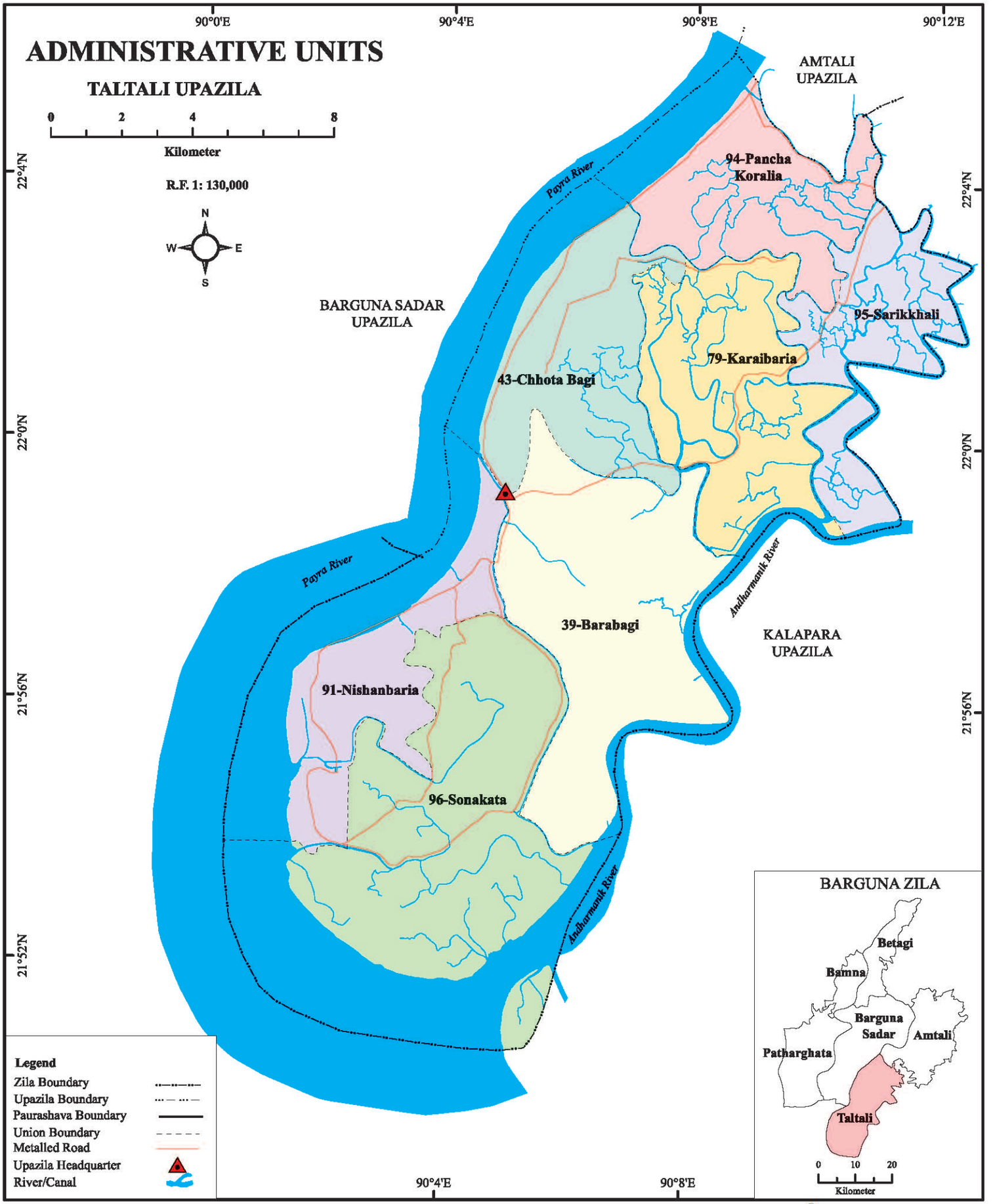


3.2 Population

The total population of the zila enumerated in 2011 Census is 8,92,781 of which 76,927 (13.69%) is urban population and the remaining 815,854 (86.31%) is rural population. The population contributes 0.62 percentage of the total national population, which was 0.69 percentage in the previous census year (2001). On the other hand, the population consist of 11.9% of urban male population and 88.1% is rural male population of the total male of the district. In addition, 11.2% is urban and 88.8% is rural female population of the total district female population.

Table 3.1: Population status of the Barguna District in 2011 and 2001 compare to the National status.

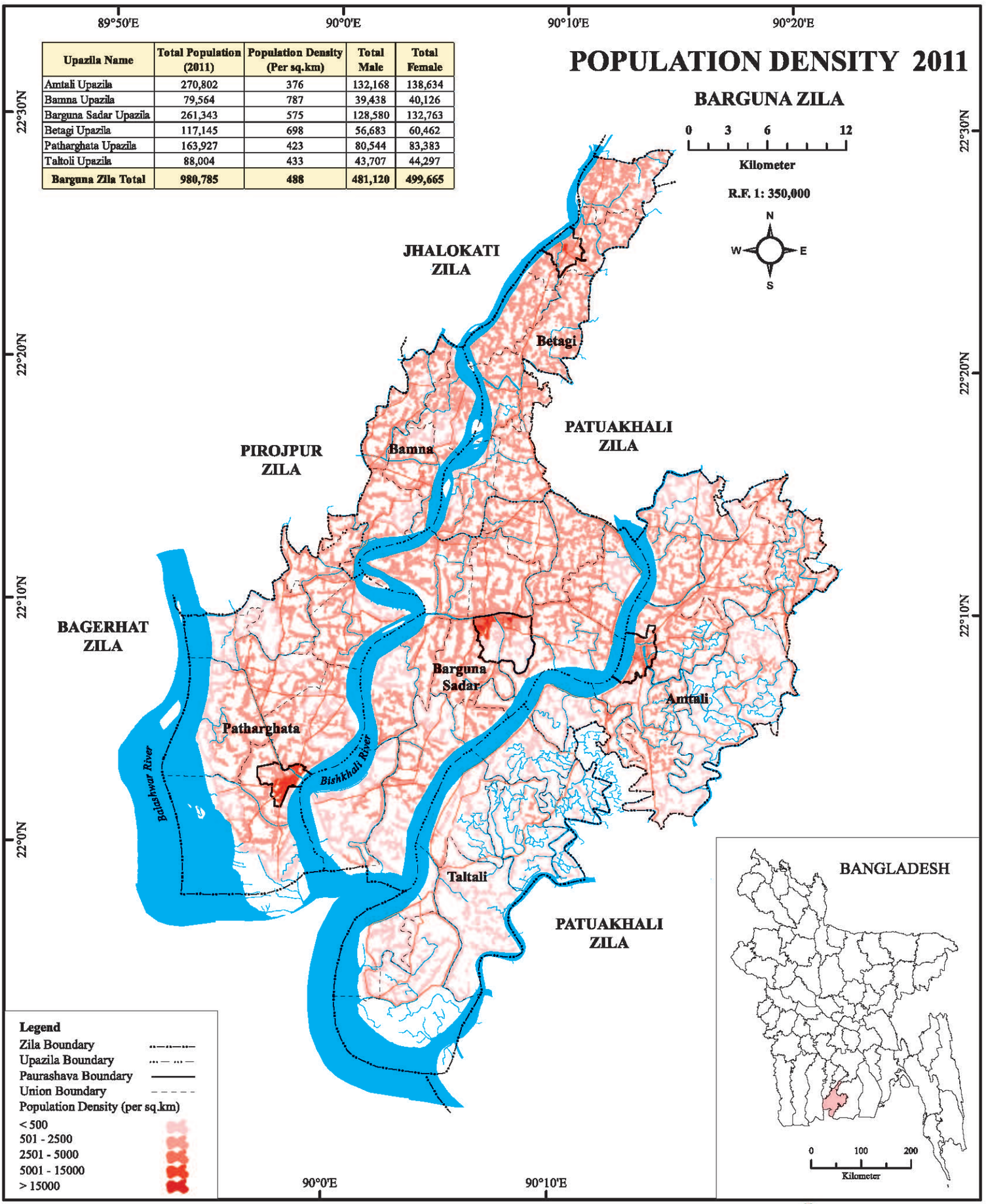
Type	**2011**		**2001**		**% of National Total**	
	Counts	%	**Counts**	%	**2011**	**2001**
Zila	8,92781	100	848142	100	0.62	0.69
Urban	76,927	13.69	73081	8.62	0.31	0.31
Rural	815,854	86.31	775061	91.38	0.71	0.80

Population
Demography

POPULATION DENSITY 2011

BARGUNA ZILA

Upazila Name	Total Population (2011)	Population Density (Per sq.km)	Total Male	Total Female
Amtali Upazila	270,802	376	132,168	138,634
Bamna Upazila	79,564	787	39,438	40,126
Barguna Sadar Upazila	261,343	575	128,580	132,763
Betagi Upazila	117,145	698	56,683	60,462
Patharghata Upazila	163,927	423	80,544	83,383
Taltoli Upazila	88,004	433	43,707	44,297
Barguna Zila Total	**980,785**	**488**	**481,120**	**499,665**



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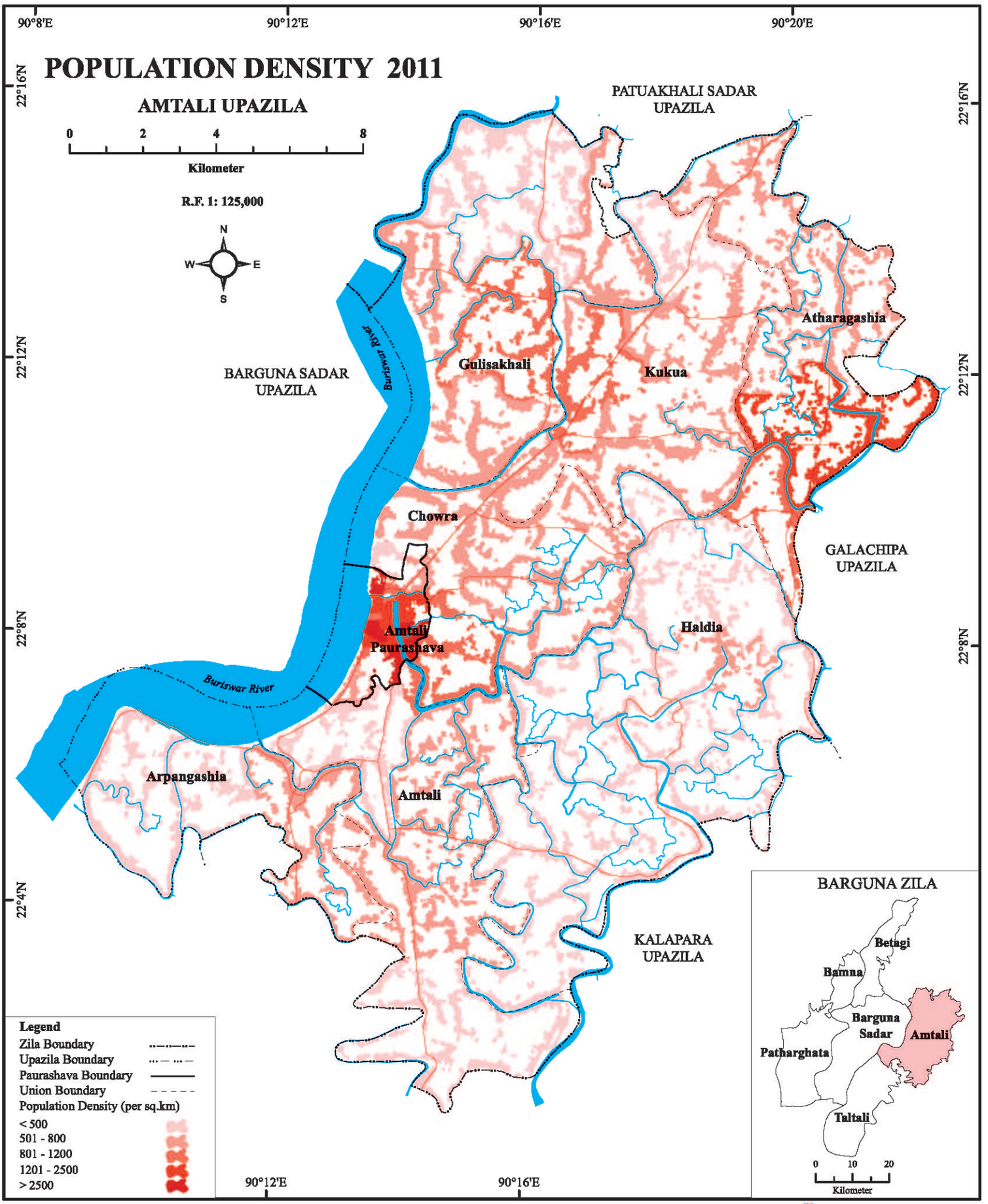

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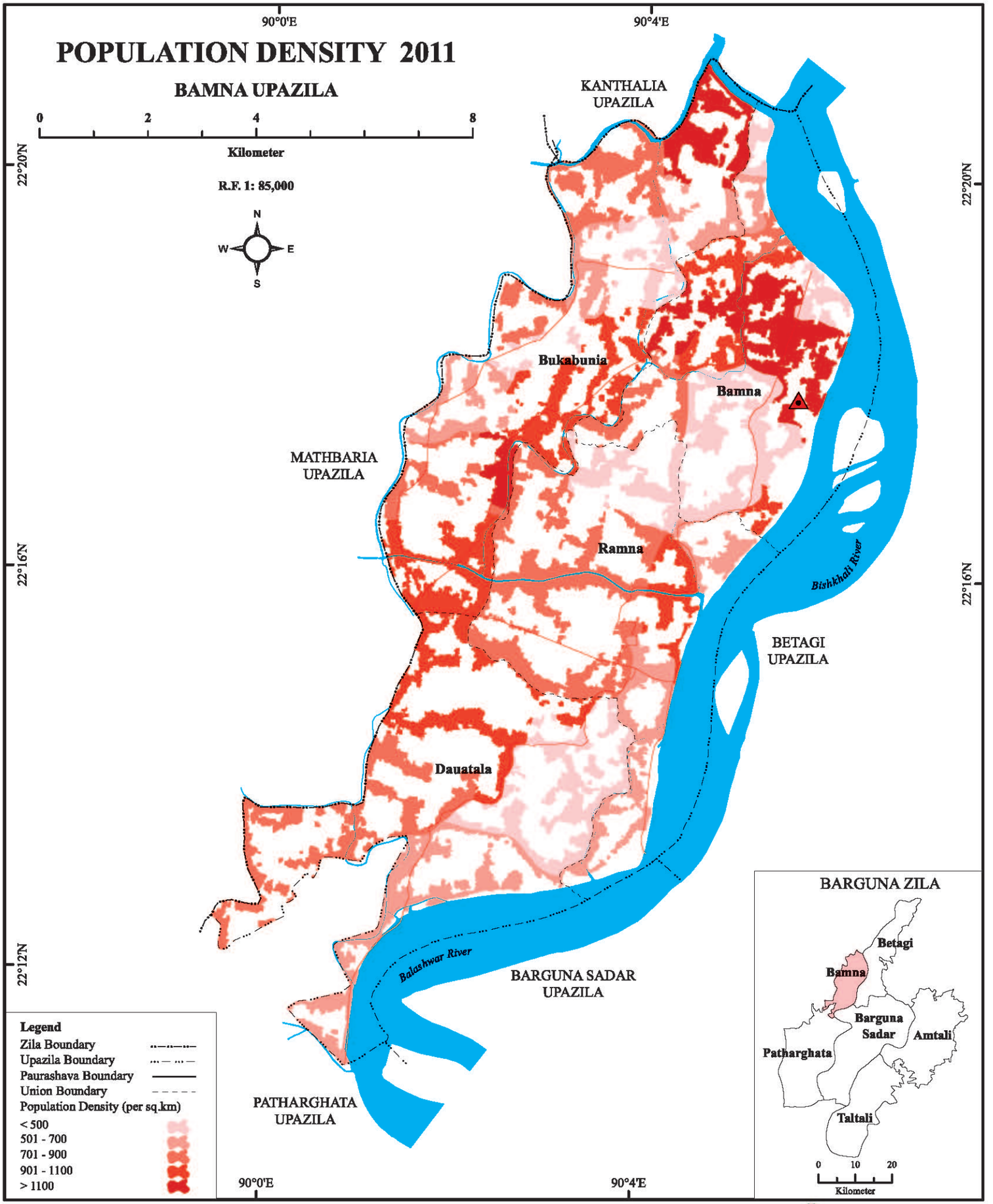
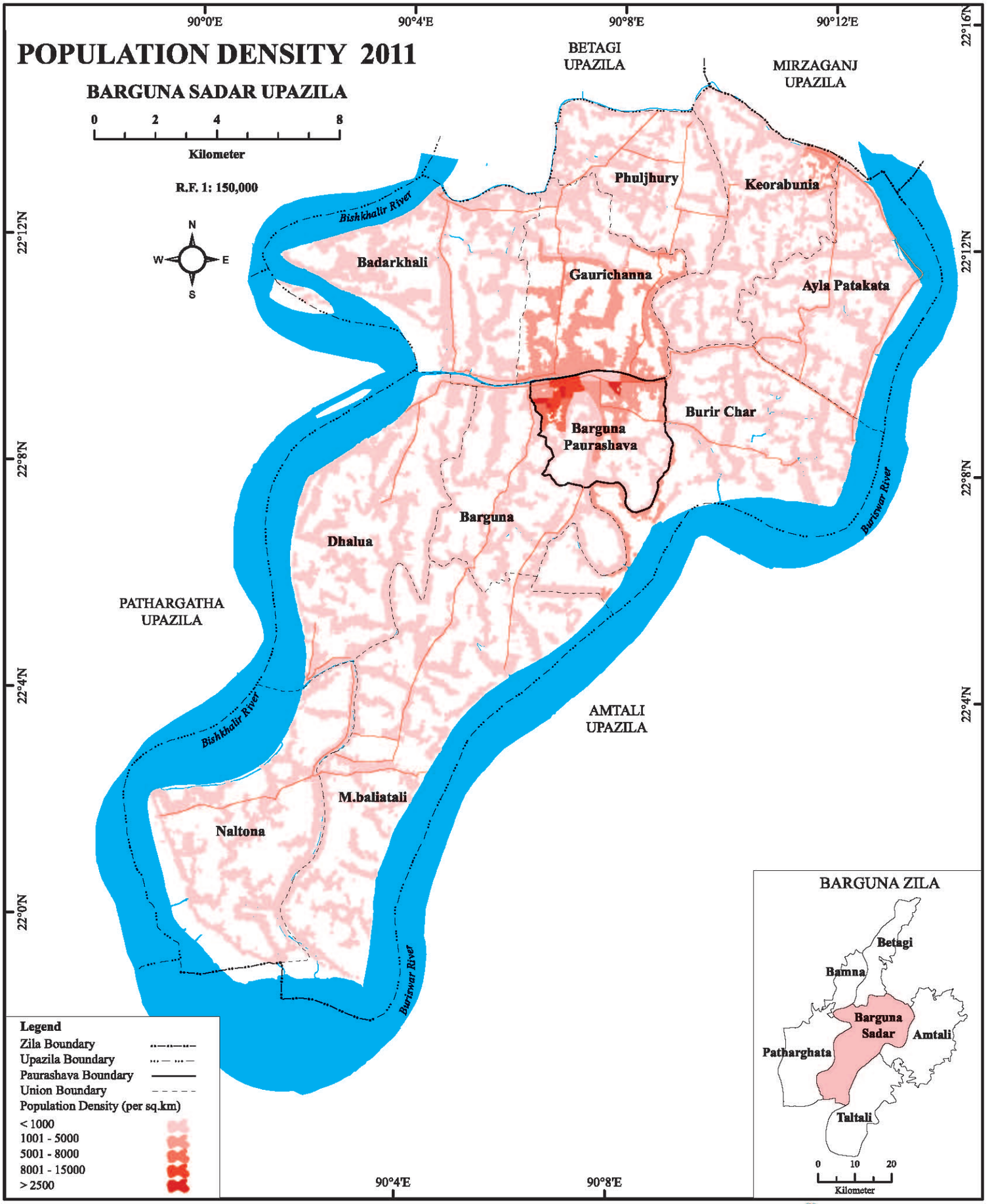

POPULATION DENSITY 2011
BAMNA UPAZILA
0 2 4 8
Kilometer
R.F. 1: 85,000
N
W E
S
90°0'E
90°4'E
22°20'N
22°16'N
22°12'N
KANTHALIA UPAZILA
Bukabunia
Bamna
MATHBARIA UPAZILA
Ramna
Bishkhali River
BETAGI UPAZILA
Dauatala
Balashwar River
BARGUNA SADAR UPAZILA
PATHARGHATA UPAZILA
Legend
Zila Boundary
Upazila Boundary
Paurashava Boundary
Union Boundary
Population Density (per sq.km)
< 500
501 - 700
701 - 900
901 - 1100
> 1100
BARGUNA ZILA
Betagi
Bamna
Barguna Sadar
Amtali
Patharghata
Taltali
0 10 20
Kilometer



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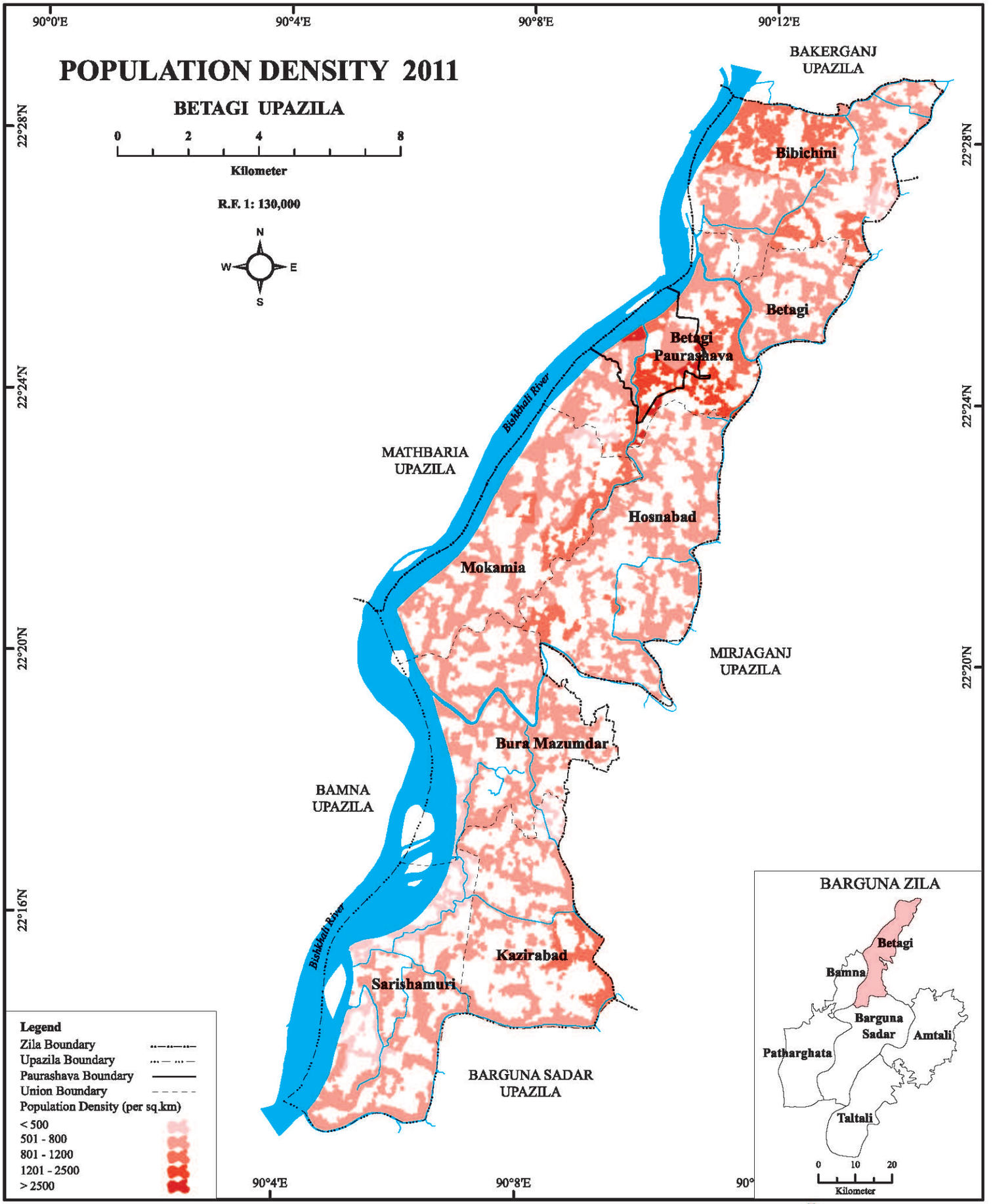
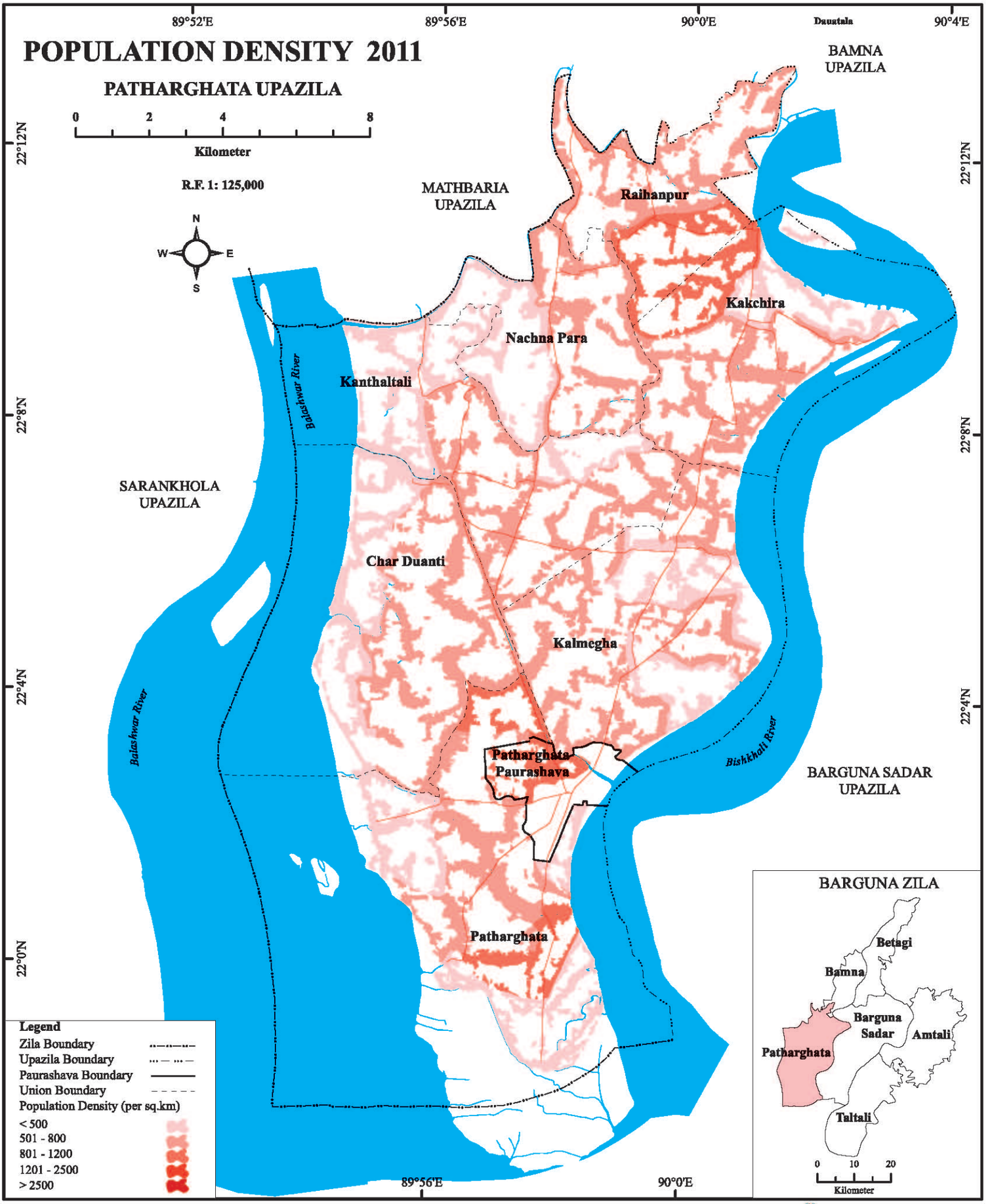

POPULATION DENSITY 2011
BETAGI UPAZILA
0 2 4 8
Kilometer
R.F. 1: 130,000
N
W
E
S
90°0'E
90°4'E
90°8'E
90°12'E
22°28'N
22°24'N
22°20'N
22°16'N
BAKERGANJ UPAZILA
Bibichini
Betagi
Betagi Paurashava
Bishkhali River
MATHBARIA UPAZILA
Hosnabad
Mokamia
MIRJAGANJ UPAZILA
Bura Mazumdar
BAMNA UPAZILA
Kazirabad
Sarishamuri
BARGUNA SADAR UPAZILA
Legend
Zila Boundary
Upazila Boundary
Paurashava Boundary
Union Boundary
Population Density (per sq.km)
< 500
501 - 800
801 - 1200
1201 - 2500
> 2500
BARGUNA ZILA
Betagi
Bamna
Barguna Sadar
Amtali
Patharghata
Taltali
0 10 20
Kilometer



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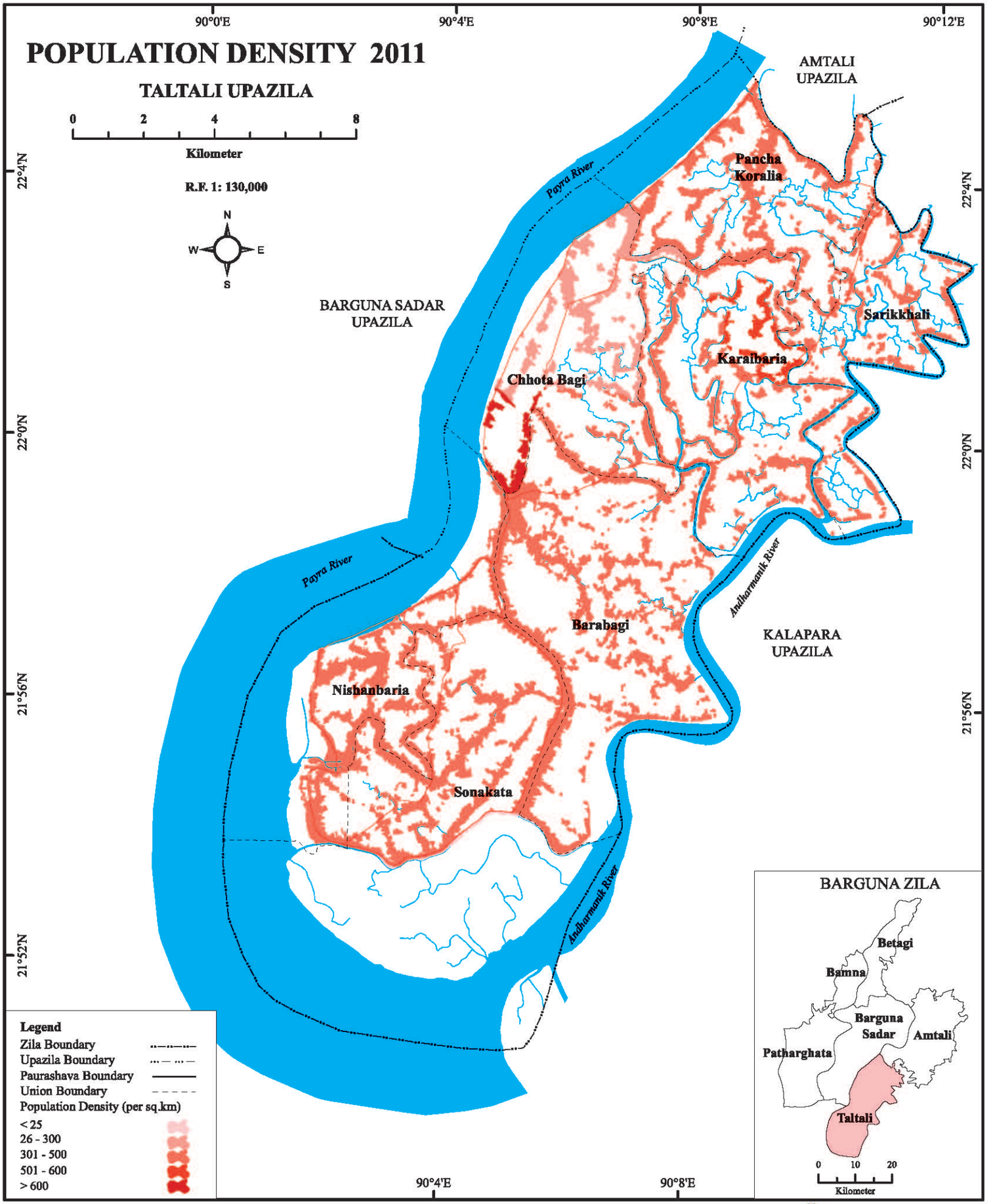

POPULATION DENSITY 2011
TALTALI UPAZILA
0 2 4 8
Kilometer
R.F. 1: 130,000
N
W
E
S
90°0'E
90°4'E
90°8'E
90°12'E
22°4'N
22°0'N
21°56'N
21°52'N
AMTALI UPAZILA
BARGUNA SADAR UPAZILA
KALAPARA UPAZILA
Pancha Koralia
Sarikkhali
Karaibaria
Chhota Bagi
Barabagi
Nishanbaria
Sonakata
Payra River
Andharmanik River
Legend
Zila Boundary
Upazila Boundary
Paurashava Boundary
Union Boundary
Population Density (per sq.km)
< 25
26 - 300
301 - 500
501 - 600
> 600
BARGUNA ZILA
Betagi
Bamna
Barguna Sadar
Amtali
Patharghata
Taltali
0 10 20
Kilometer

3.3 Households

The total household of Barguna Zila as enumerated in Population and Housing Census- 2011 is 215842 of which 24782 (11.48%) are in urban area and 191060 (88.52%) are in rural area. The type of household shows that there are 214863 (99.55%) general (dwelling), 148 (0.07%) institutional and 831 (0.38%) other households in the zila. It is observed that the increase of general household during the decade 2001-2011 are 21.63% in the zila, 37.32% in urban area and 19.89% in rural area. General household by residence is furnished in table HT01 for the last five consecutive censuses.

Table 3.2: General Household by Residence, 1974 - 2011

Residence	2011		2001		1991		1981		1974	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Zila	214863	100.00	176,648	100.00	145,211	100.00	115,476	100.00	109,897	100.00
Urban	24299	11.31	17,695	10.02	11,881	8.18	8,240	7.14	2,123	1.93
Rural	190564	88.69	158,953	89.98	133,330	91.82	107,236	92.86	107,774	98.07

Table 3.3: Percentage change over the year of 1974 to 2011

	2001-2011	1991-2001	1981-1991	1974-1981
Zila	21.63	21.65	25.75	5.08
Urban	37.32	48.94	44.19	286.49
Rural	19.89	18.77	24.80	0.50

It is observed in the above table that the general households have been increasing since 1974 in urban area and since 1981 in rural area. A slight decreasing trend is seen in the percentage contribution of rural area since 1974. The increasing trend for urban households reflects the pattern of migration from rural to urban area. The upward trend of urban general households over the decades registers a record of 286.49% during 1974-1981 suggesting a very rapid urbanization in Barguna Zila. The urbanization, though exhibits a downward slide 44.19% over the decade 1981-1991 but it has gone up

to 48.94% in the decade 1991-2001 and again a down ward slope of 37.32% during 2001- 2011 decade. The rural general household recorded the highest 24.80% expansion during 1981-1991 as compared to next increases of 18.77% in 1991-2001 and 19.89% in 2001-2011.

Table 3.4: Average Household (HH) size in comparism with Barisal division and Bangladesh.

Average HH Size	Bangladesh	Barisal Division	Barguna Zila	
			2011	2001
Total	4.44	4.45	4.12	4.72
Urban	4.36	4.39	4.11	4.66
Other Urban	4.42	4.49	4.10	4.63
Rural	4.46	4.45	4.12	4.73

3.4 Topography and climate

The Barguna district, the southern part of Bangladesh, is situated in between the district of Patuakhali and Khulna. The land is flat and full of rivers, estuarine creeks, having regular low and high tides. It sets on the Ganges tidal flood plain and therefore, the land type is medium to high. The main rivers in Barguna district are khakdon and the Baleshwar. The Bay of Bengal starts from the southern boundary of this district. The district is highly susceptible to storms and tidal flooding (DPHE, 2015).

Barguna has a tropical climate. During most months of the year, there is significant rainfall in Barguna. There is only a short dry season. The climate here is classified as Am by the Köppen-Geiger system. The average annual temperature in Barguna is 26.0 °C. About 2516 mm of precipitation falls annually. The driest month is December, with 10 mm of rainfall. Most precipitation falls in July, with an average of 571 mm. The warmest month of the year is May, with an average temperature of 29.9 °C. In January, the average temperature is 19.5 °C. It is the lowest average temperature of the whole year. The difference in precipitation between the driest month and the wettest month is 561 mm. The average temperatures vary during the year by 10.4 °C.

Table 3.5: Distribution of Average temperature and rainfall of the Barguna Zila.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. Temperature (°C)	19.5	22.2	26.4	28.6	29.9	28.7	28	28.1	28.3	27.7	24.2	20.3
Min. Temperature (°C)	13.3	16.2	20.9	24.2	25.6	25.9	25.7	25.8	25.6	24.2	19.4	14.5
Max. Temperature (°C)	25.8	28.2	31.9	33	34.3	31.5	30.4	30.5	31.1	31.2	29	26.2
Precipitation / Rainfall (mm)	12	24	44	87	214	502	571	480	332	194	46	10

3.5 Land cover/ Land use

Barguna District is a riverine area with 21 % of the total district area. Only 5% area is covered with forest and rest of the area is land. Among all the Upazilas, Amtali Upazila is larger by land area and Bamna is smaller. There are no forest area in Bamna and Betagi Upazila.

Table 3.6 : Land area distribution to different upazilas of Barguna district (in sq km)

Upazila	Total area	%	Land area	%	Reserve forest	%	River area	%
Amtali	720.75	39.36	539.3	40.42	51.64	53.139	129.81	32.47
Bamna	101.05	5.52	92.47	6.93	0	0.000	8.58	2.15
Barguna Sadar	454.38	24.81	311.67	23.36	8.26	8.500	134.45	33.63
Betagi	167.75	9.16	156.81	11.75	0	0.000	10.94	2.74
Patharghata	387.36	21.15	234.11	17.54	37.29	38.372	115.96	29.01
Total	**1831.31**	**100.00**	**1334.39**	**100.00**	**97.18**	**100.000**	**399.74**	**100.00**

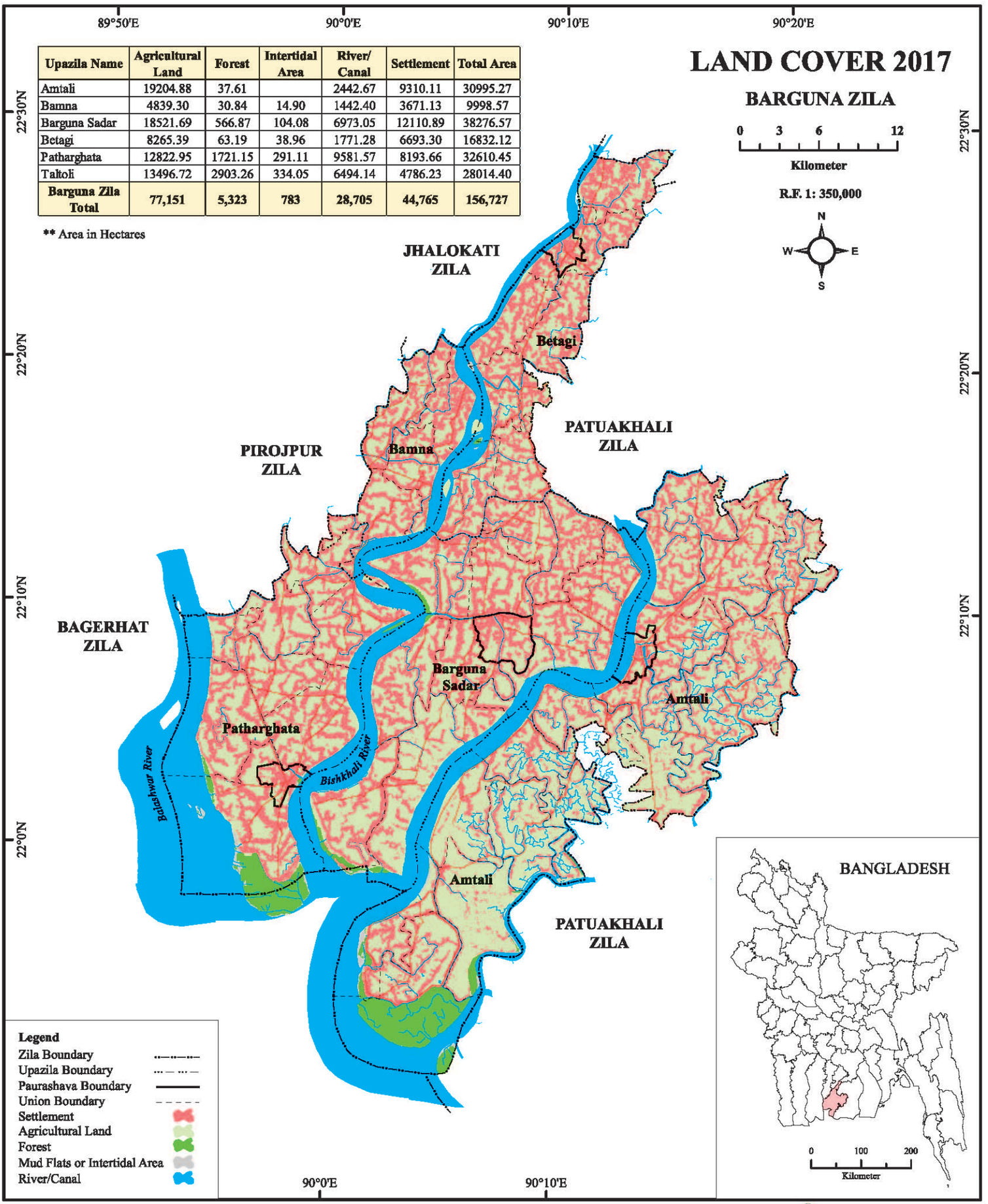
Land Use
Land Cover

LAND COVER 2017

BARGUNA ZILA

Upazila Name	Agricultural Land	Forest	Intertidal Area	River/ Canal	Settlement	Total Area
Amtali	19204.88	37.61		2442.67	9310.11	30995.27
Bamna	4839.30	30.84	14.90	1442.40	3671.13	9998.57
Barguna Sadar	18521.69	566.87	104.08	6973.05	12110.89	38276.57
Betagi	8265.39	63.19	38.96	1771.28	6693.30	16832.12
Patharghata	12822.95	1721.15	291.11	9581.57	8193.66	32610.45
Taltoli	13496.72	2903.26	334.05	6494.14	4786.23	28014.40
Barguna Zila Total	**77,151**	**5,323**	**783**	**28,705**	**44,765**	**156,727**

** Area in Hectares



Source: Google Earth Image 2017

Stat4Dev. Project, BBS 2017

LAND COVER 2017

AMTALI UPAZILA

0 2 4 8

Kilometer

R.F. 1: 125,000

N W E S

Union Name	Agricultural Land	Forest	River/ Canal	Settlement	Total Area
Amtali	3019.05		250.38	1399.23	4668.66
Amtali Paurasava	203.51	0.00	312.93	342.73	859.17
Arpangashia	1578.02	3.09	709.92	805.85	3096.87
Atharagashia	2271.38	13.94	89.32	1205.89	3580.52
Chowra	1862.41	5.30	285.50	1026.98	3180.18
Gulisakhali	2711.26	3.31	498.95	1594.13	4807.66
Haldia	5093.62	6.11	259.94	1772.39	7132.06
Kukua	2465.62	5.87	35.74	1162.92	3670.14
Amtoli Upazila Total	**19,205**	**38**	**2,443**	**9,310**	**30,995**

** Area in Hectares

90°8'E 90°12'E 90°16'E 90°20'E

22°16'N 22°12'N 22°8'N 22°4'N

PATUAKHALI SADAR UPAZILA

BARGUNA SADAR UPAZILA

GALACHIPA UPAZILA

KALAPARA UPAZILA

Burishwar River

Gulisakhali

Kukua

Atharagashia

Chowra

Haldia

Amtali Paurashava

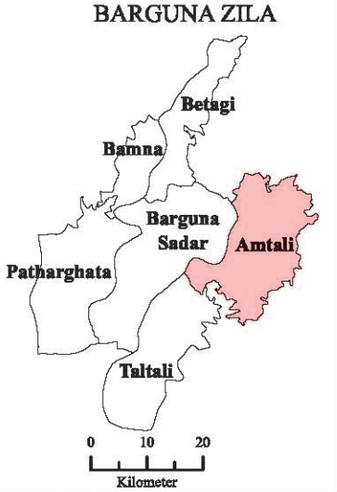
Amtali

Arpangashia

Legend

- Zila Boundary
- Upazila Boundary
- Paurashava Boundary
- Union Boundary
- Settlement
- Agricultural Land
- Forest
- Mud Flats or Intertidal Area
- River/Canal

BARGUNA ZILA

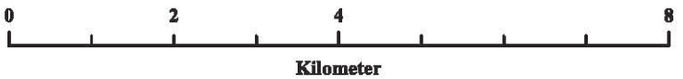


Source: Google Earth Image 2017

Stat4Dev. Project, BBS 2017

LAND COVER 2017

BAMNA UPAZILA



R.F. 1: 85,000

Union Name	Agricultural Land	Forest	Intertidal Area	River/ Canal	Settlement	Total Area
Bamna	873.11	7.15	14.90	604.38	861.56	2361.11
Bukabunia	1376.22	6.81		62.91	1104.83	2550.76
Dauatala	1392.58	4.50		331.49	908.39	2636.96
Ramna	1197.39	12.38		443.63	796.35	2449.74
Bamna Upazila Total	**4,839**	**31**	**15**	**1,442**	**3,671**	**9,999**

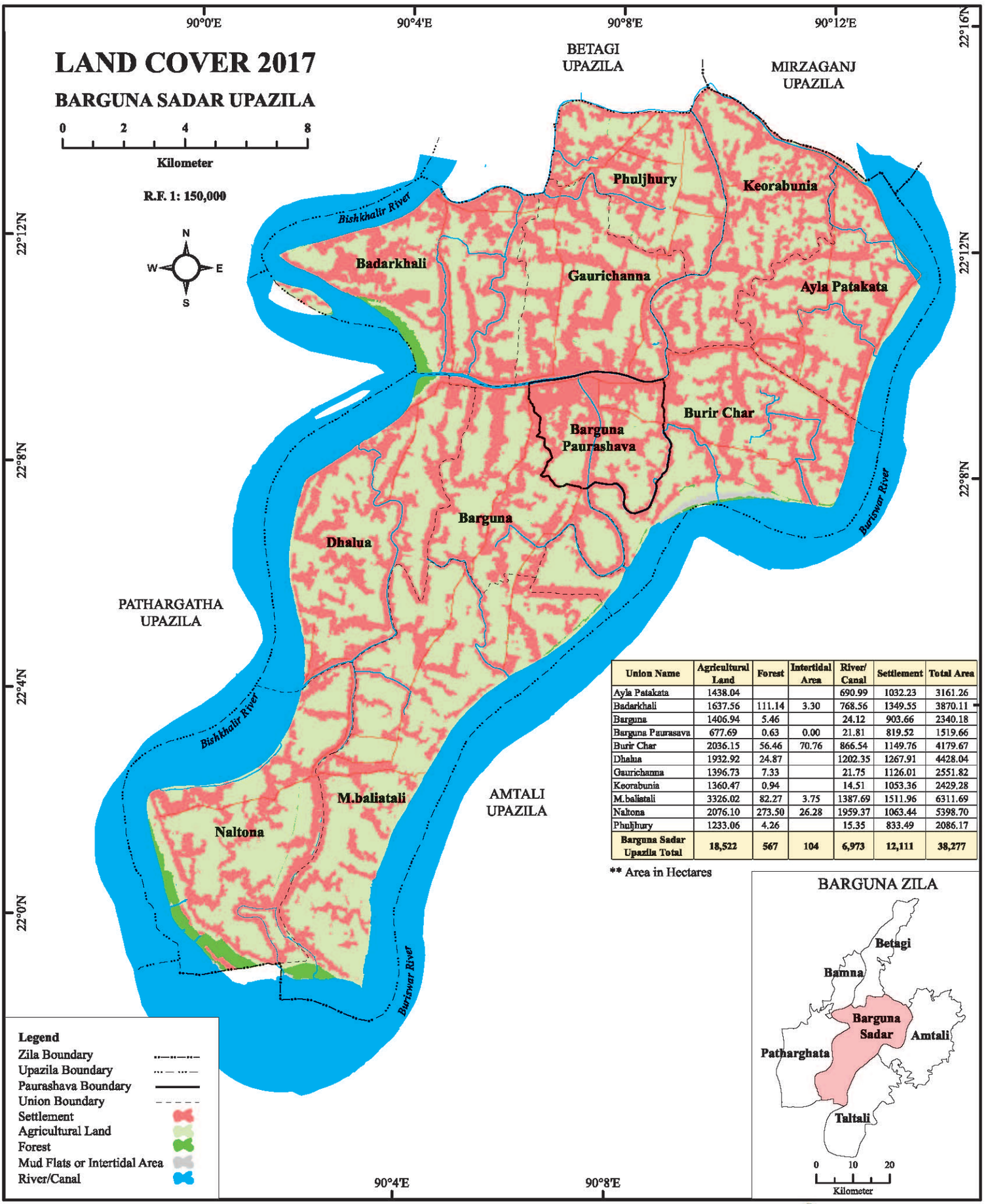
** Area in Hectares

Source: Google Earth Image 2017

Stat4Dev. Project, BBS 2017

LAND COVER 2017

BARGUNA SADAR UPAZILA



Union Name	Agricultural Land	Forest	Intertidal Area	River/ Canal	Settlement	Total Area
Ayla Patakata	1438.04			690.99	1032.23	3161.26
Badarkhali	1637.56	111.14	3.30	768.56	1349.55	3870.11
Barguna	1406.94	5.46		24.12	903.66	2340.18
Barguna Paurasava	677.69	0.63	0.00	21.81	819.52	1519.66
Burir Char	2036.15	56.46	70.76	866.54	1149.76	4179.67
Dhalua	1932.92	24.87		1202.35	1267.91	4428.04
Gaurichanna	1396.73	7.33		21.75	1126.01	2551.82
Keorabunia	1360.47	0.94		14.51	1053.36	2429.28
M.balistali	3326.02	82.27	3.75	1387.69	1511.96	6311.69
Naltona	2076.10	273.50	26.28	1959.37	1063.44	5398.70
Phuljhury	1233.06	4.26		15.35	833.49	2086.17
Barguna Sadar Upazila Total	**18,522**	**567**	**104**	**6,973**	**12,111**	**38,277**

** Area in Hectares

Legend

- Zila Boundary
- Upazila Boundary
- Paurashava Boundary
- Union Boundary
- Settlement
- Agricultural Land
- Forest
- Mud Flats or Intertidal Area
- River/Canal

Source: Google Earth Image 2017

Stat4Dev. Project, BBS 2017

LAND COVER 2017

BETAGI UPAZILA

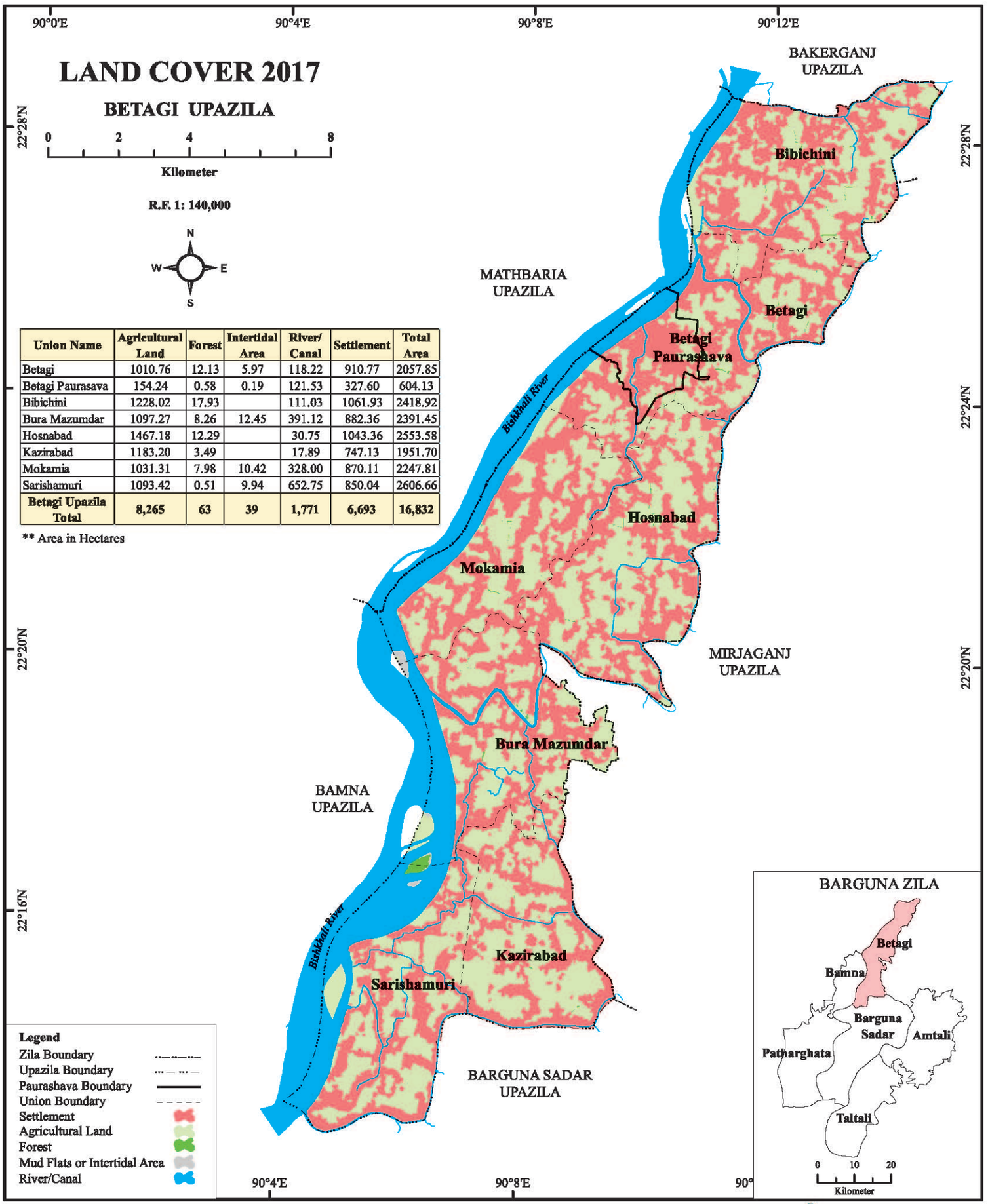
0 2 4 8

Kilometer

R.F. 1: 140,000

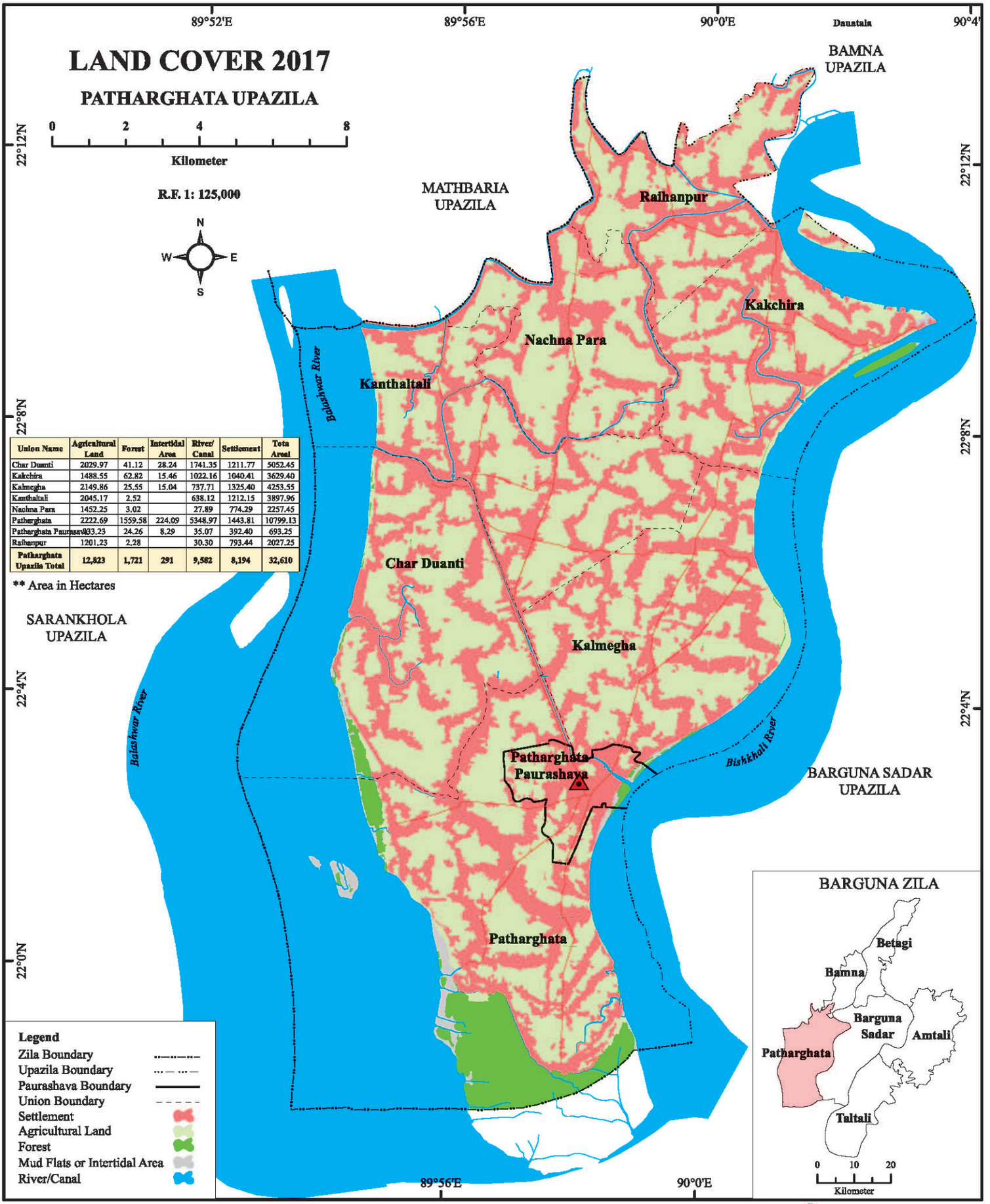
Union Name	Agricultural Land	Forest	Intertidal Area	River/ Canal	Settlement	Total Area
Betagi	1010.76	12.13	5.97	118.22	910.77	2057.85
Betagi Paurasava	154.24	0.58	0.19	121.53	327.60	604.13
Bibichini	1228.02	17.93		111.03	1061.93	2418.92
Bura Mazumdar	1097.27	8.26	12.45	391.12	882.36	2391.45
Hosnabad	1467.18	12.29		30.75	1043.36	2553.58
Kazirabad	1183.20	3.49		17.89	747.13	1951.70
Mokamia	1031.31	7.98	10.42	328.00	870.11	2247.81
Sarishamuri	1093.42	0.51	9.94	652.75	850.04	2606.66
Betagi Upazila Total	**8,265**	**63**	**39**	**1,771**	**6,693**	**16,832**

** Area in Hectares



Source: Google Earth Image 2017

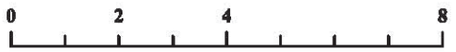
Stat4Dev. Project, BBS 2017



Union Name	Agricultural Land	Forest	Intertidal Area	River/ Canal	Settlement	Tota Areal
Char Duanti	2029.97	41.12	28.24	1741.35	1211.77	5052.45
Kakchira	1488.55	62.82	15.46	1022.16	1040.41	3629.40
Kalmegha	2149.86	25.55	15.04	737.71	1325.40	4253.55
Kanthaltali	2045.17	2.52		638.12	1212.15	3897.96
Nachna Para	1452.25	3.02		27.89	774.29	2257.45
Patharghata	2222.69	1559.58	224.09	5348.97	1443.81	10799.13
Patharghata Paurasava	433.23	24.26	8.29	35.07	392.40	693.25
Raihanpur	1201.23	2.28		30.30	793.44	2027.25
Patharghata Upazila Total	**12,823**	**1,721**	**291**	**9,582**	**8,194**	**32,610**

LAND COVER 2017

TALTALI UPAZILA



R.F. 1: 130,000

Union Name	Agricultural Land	Forest	Intertidal Area	River/ Canal	Settlement	Total Area
Barabagi	3142.07	184.04	40.26	300.70	986.83	4653.90
Chhota Bagi	1994.78	3.53		820.12	620.45	3438.88
Karaibaria	2312.63	2.32	17.90	276.16	694.36	3303.38
Nishanbaria	1073.51	199.29	197.34	1654.50	686.73	3811.37
Pancha Koralia	1618.00			652.36	605.36	2875.72
Sarikkhali	1472.43	43.34	16.71	253.47	392.59	2178.54
Sonakata	1883.28	2470.73	61.84	2536.82	799.93	7752.61
Taltoli Upazila Total	**13,497**	**2,903**	**334**	**6,494**	**4,786**	**28,014**

** Area in Hectares

Source: Google Earth Image 2017

Stat4Dev. Project, BBS 2017

3.6 Education

The Literacy rate of Barguna district is 62.1%. The total educational institutions is 1332. The distribution is of those institutions are- colleges are owned by 2 government, 22 private non-government organizations, secondary schools 150 government 2, non-governmental 148, government primary schools 814, madrasas 339, higher 136, ebtedayee 203, B.Ed college 01 private, PTI 01 government, polytechnic institute 01 government, Technical School and College 01 Government, Textile Vocational Institutes: 01 Government.

3.7 Health facilities

There is a modern general hospital with 100-bed but 250-bed hospital construction work is in the final phase. In addition, there are 5 Upazila Health Complex, 08 Union Health Center, 123 Community Clinics.

3.8 Transportation

The total length of Upazila road is 464 km where 352 km is pucca and 112 km is katcha road. In addition, among 568km union road, 336 km is pucca road and 232 km is katcha road. There are 250 Nautical mile is water ways in Barguna district.

3.9 Cyclone Shelters

There are 206 number of cyclone shelters in Barguna district with capacity of 187615 population, which covers only 19% of total district population. The Upazila specific number of cyclone shelters are given below:

Table 3.7: Upazila specific cyclone shelter distribution for Barguna District.

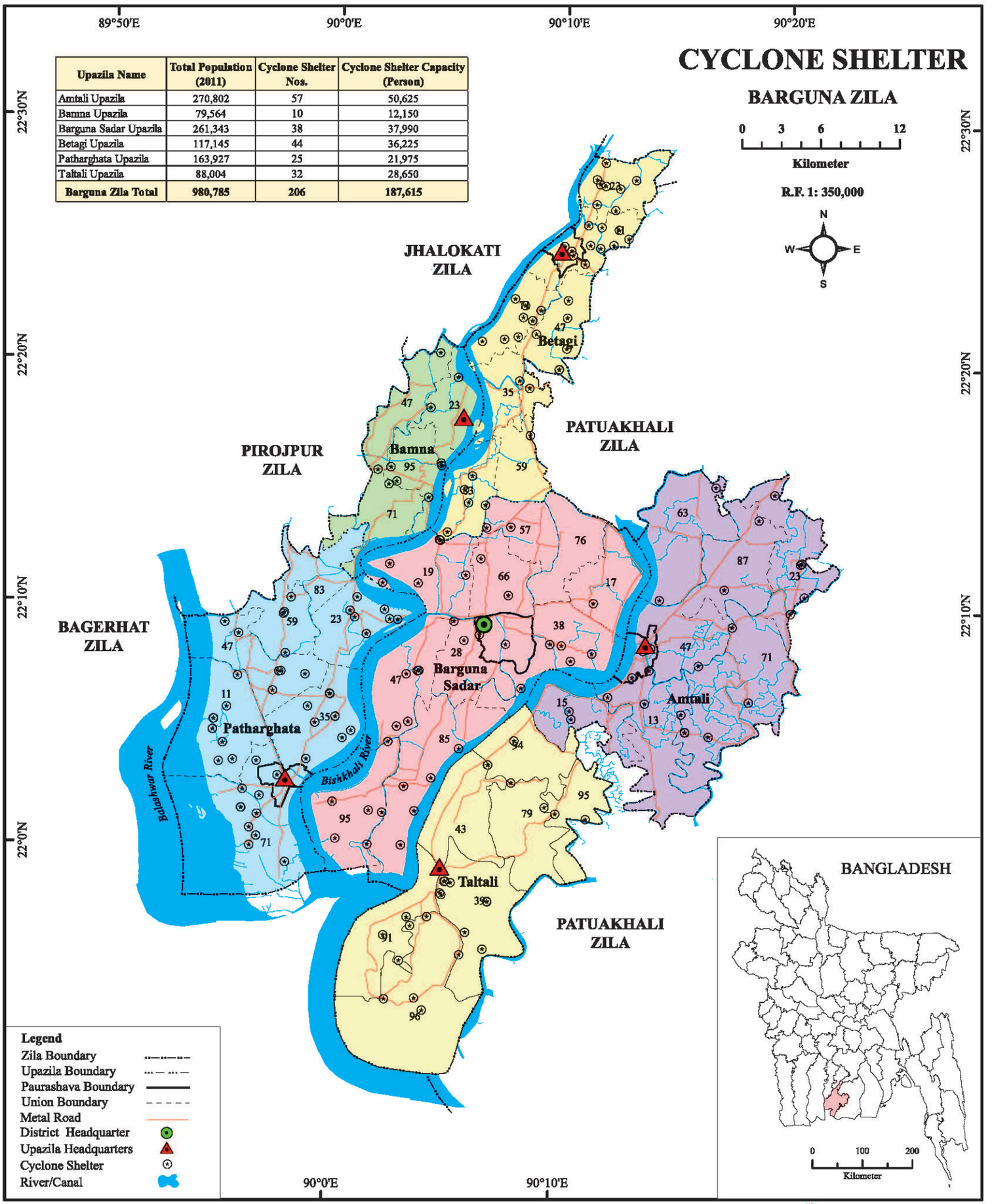
Upazila Name	Population 2011	Cyclone Shelter Nos.	Capacity (Population)
Amtali Upazila	270,802	57	50,625
Bamna Upazila	79,564	10	12,150
Barguna Sadar Upazila	261,343	38	37,990
Betagi Upazila	117,145	44	36,225
Patharghata Upazila	163,927	25	21,975
Taltali Upazila	88,004	32	28,650
Barguna Zila Total	**980,785**	**206**	**187,615**

Cyclone Shelters
Area Map

CYCLONE SHELTER

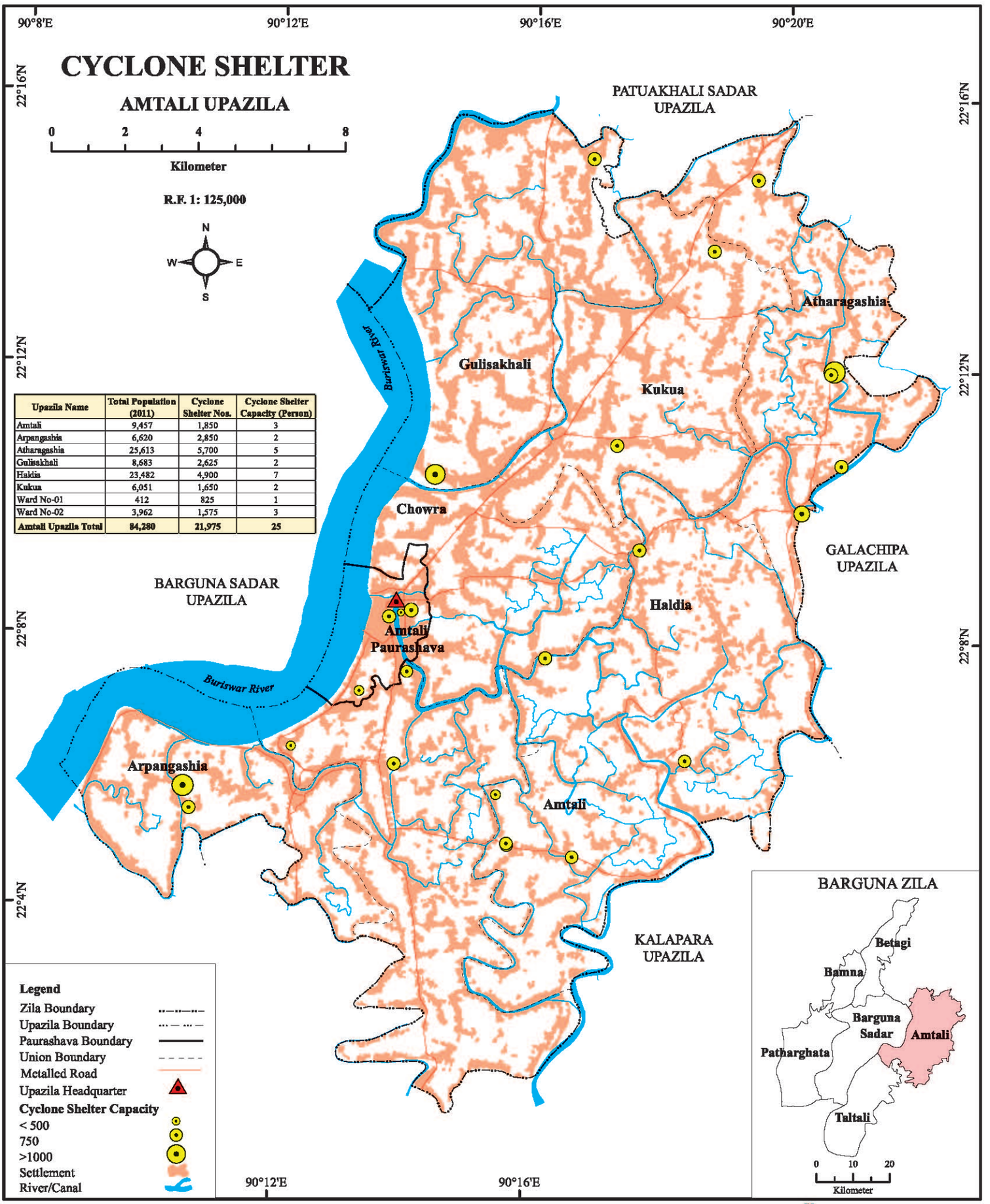
BARGUNA ZILA

Upazila Name	Total Population (2011)	Cyclone Shelter Nos.	Cyclone Shelter Capacity (Person)
Amtali Upazila	270,802	57	50,625
Bamna Upazila	79,564	10	12,150
Barguna Sadar Upazila	261,343	38	37,990
Betagi Upazila	117,145	44	36,225
Patharghata Upazila	163,927	25	21,975
Taltali Upazila	88,004	32	28,650
Barguna Zila Total	**980,785**	**206**	**187,615**



Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



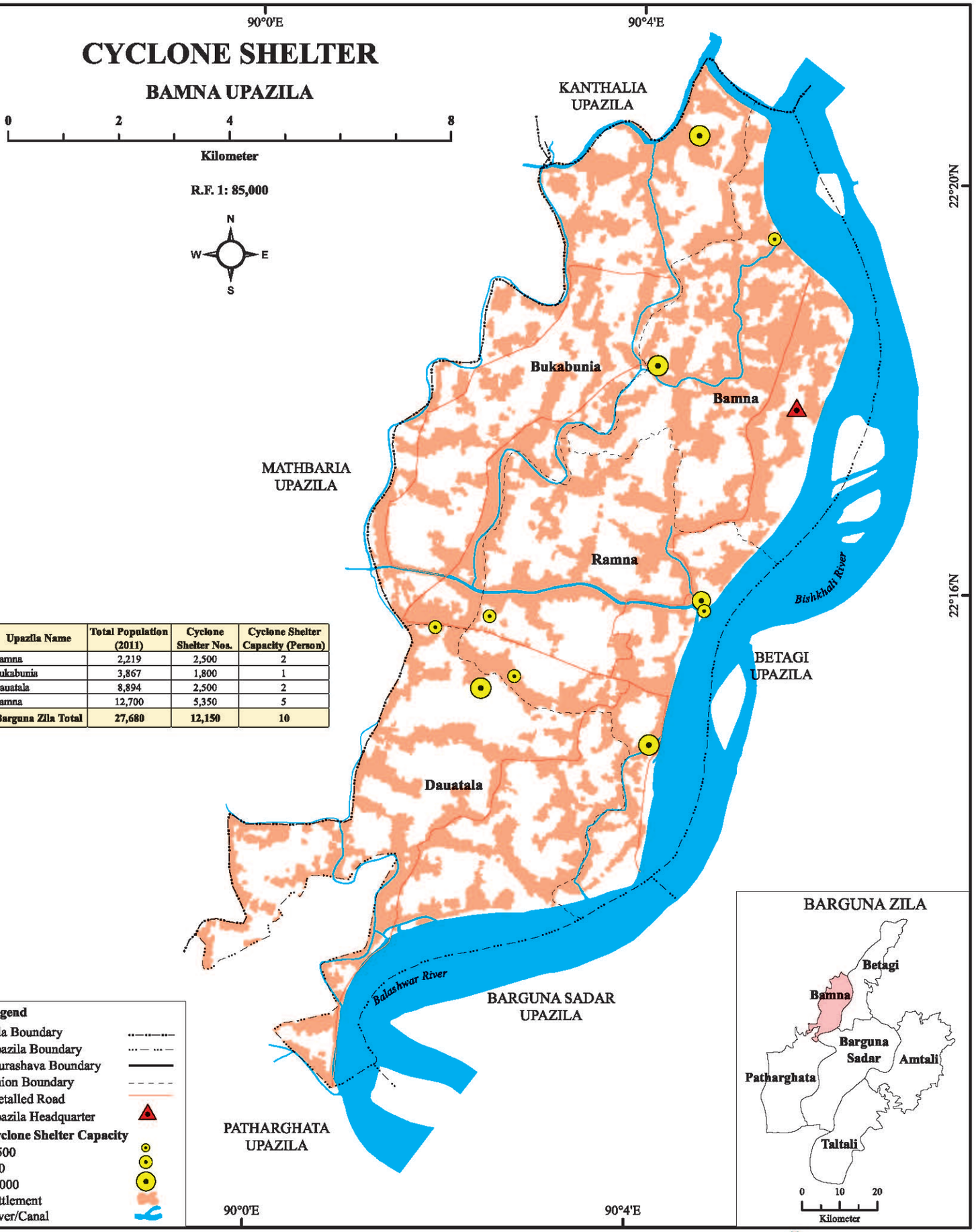
Upazila Name	Total Population (2011)	Cyclone Shelter Nos.	Cyclone Shelter Capacity (Person)
Amtali	9,457	1,850	3
Arpangashia	6,620	2,850	2
Atharagashia	25,613	5,700	5
Gulisakhali	8,683	2,625	2
Haldia	23,482	4,900	7
Kukua	6,051	1,650	2
Ward No-01	412	825	1
Ward No-02	3,962	1,575	3
Amtali Upazila Total	**84,280**	**21,975**	**25**

Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017

CYCLONE SHELTER

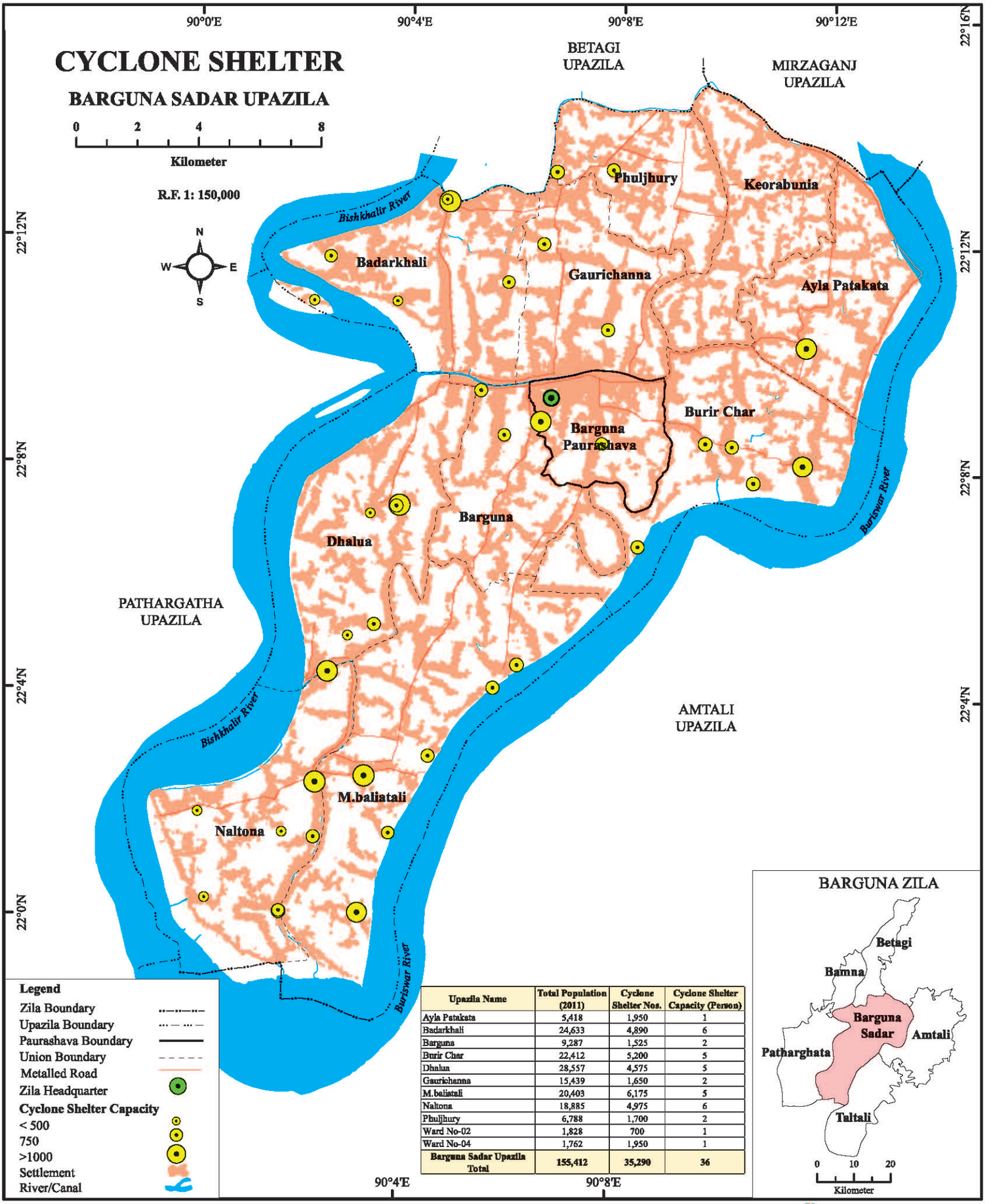
BAMNA UPAZILA



Upazila Name	Total Population (2011)	Cyclone Shelter Nos.	Cyclone Shelter Capacity (Person)
Bamna	2,219	2,500	2
Bukabunia	3,867	1,800	1
Dauatala	8,894	2,500	2
Ramna	12,700	5,350	5
Barguna Zila Total	**27,680**	**12,150**	**10**

Source: After DDM, Field Survey 2017

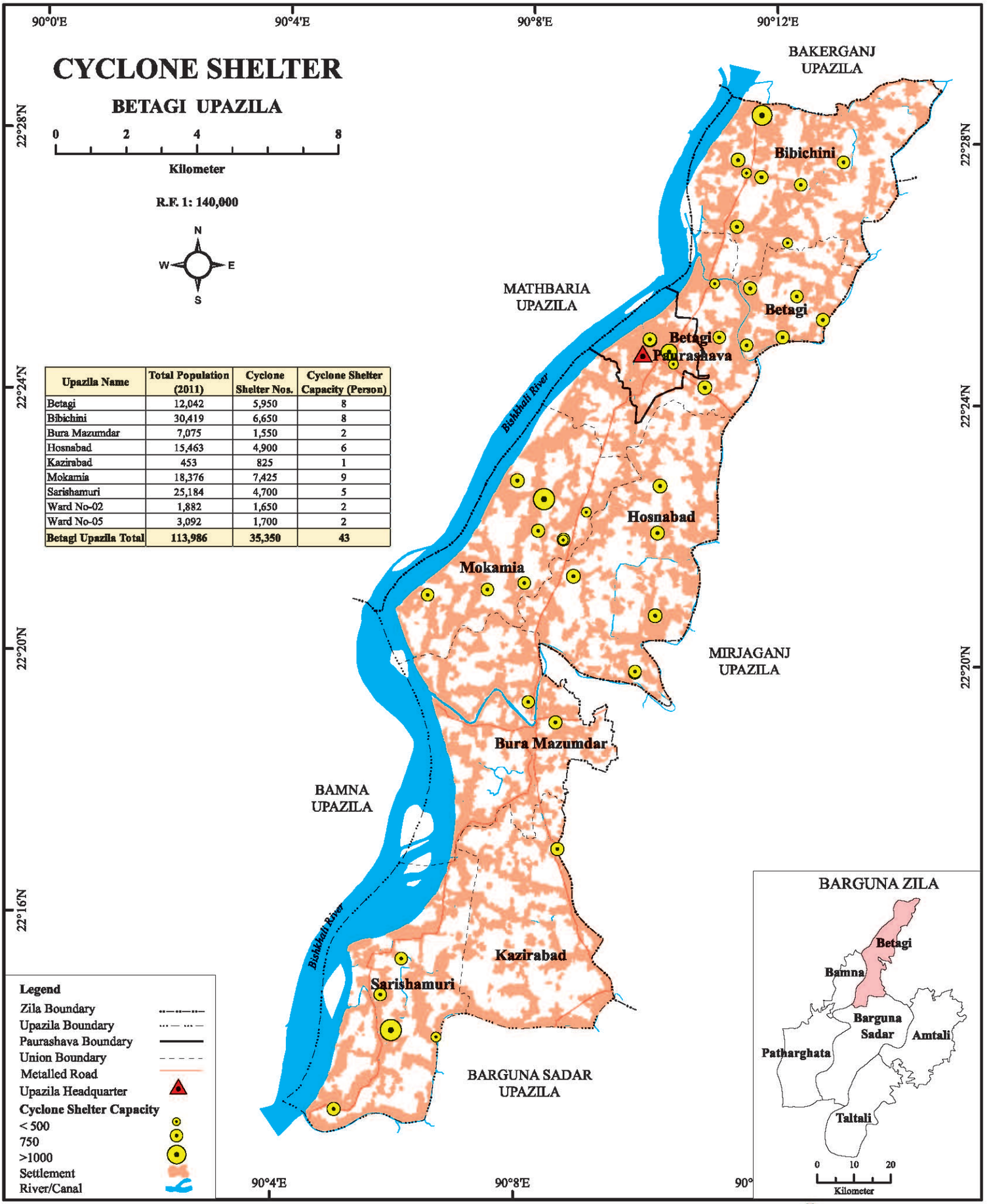
Stat4Dev. Project, BBS 2017



Upazila Name	Total Population (2011)	Cyclone Shelter Nos.	Cyclone Shelter Capacity (Person)
Ayla Patakata	5,418	1,950	1
Badarkhali	24,633	4,890	6
Barguna	9,287	1,525	2
Burir Char	22,412	5,200	5
Dhalua	28,557	4,575	5
Gaurichanna	15,439	1,650	2
M.baliatali	20,403	6,175	5
Naltona	18,885	4,975	6
Phuljhury	6,788	1,700	2
Ward No-02	1,828	700	1
Ward No-04	1,762	1,950	1
Barguna Sadar Upazila Total	**155,412**	**35,290**	**36**

Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017

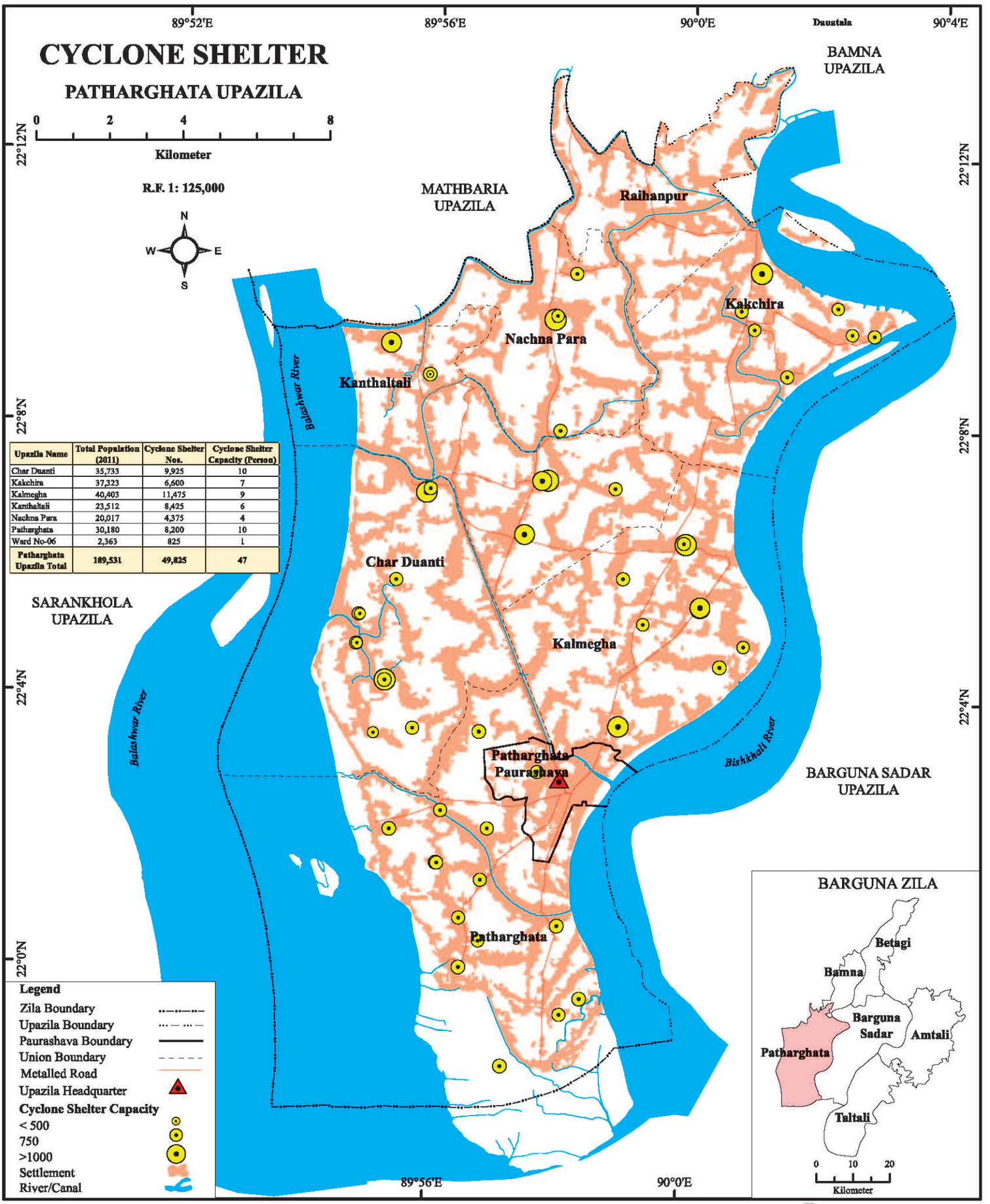


Upazila Name	Total Population (2011)	Cyclone Shelter Nos.	Cyclone Shelter Capacity (Person)
Betagi	12,042	5,950	8
Bibichini	30,419	6,650	8
Bura Mazumdar	7,075	1,550	2
Hosnabad	15,463	4,900	6
Kazirabad	453	825	1
Mokamia	18,376	7,425	9
Sarishamuri	25,184	4,700	5
Ward No-02	1,882	1,650	2
Ward No-05	3,092	1,700	2
Betagi Upazila Total	**113,986**	**35,350**	**43**

Source: After DDM, Field Survey 2017

CYCLONE SHELTER

PATHARGHATA UPAZILA



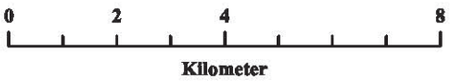
Upazila Name	Total Population (2011)	Cyclone Shelter Nos.	Cyclone Shelter Capacity (Person)
Char Duanti	35,733	9,925	10
Kakchira	37,323	6,600	7
Kalmegha	40,403	11,475	9
Kanthaltali	23,512	8,425	6
Nachna Para	20,017	4,375	4
Patharghata	30,180	8,200	10
Ward No-06	2,363	825	1
Patharghata Upazila Total	**189,531**	**49,825**	**47**

Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017

CYCLONE SHELTER

TALTALI UPAZILA



R.F. 1: 130,000

Upazila Name	Total Population (2011)	Cyclone Shelter Nos.	Cyclone Shelter Capacity (Person)
Barabagi	220,788	10,025	12
Chhota Bagi	6,814	1,650	2
Nishanbaria	26,049	2,425	3
Pancha Koralia	6,782	2,650	2
Sarikkhali	12,822	2,775	3
Sonakata	61,236	6,575	7
Taltali Upazila Total	**334,491**	**26,100**	**29**

Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017

3.10 Poverty status

According to Household Income and Expenditure Survey (HIES, 2016), the lower poverty line of Barguna is 19.3% and the upper poverty line is 32.1%. The following table shows the Upazila specific poverty level for Barguna district in 2010.

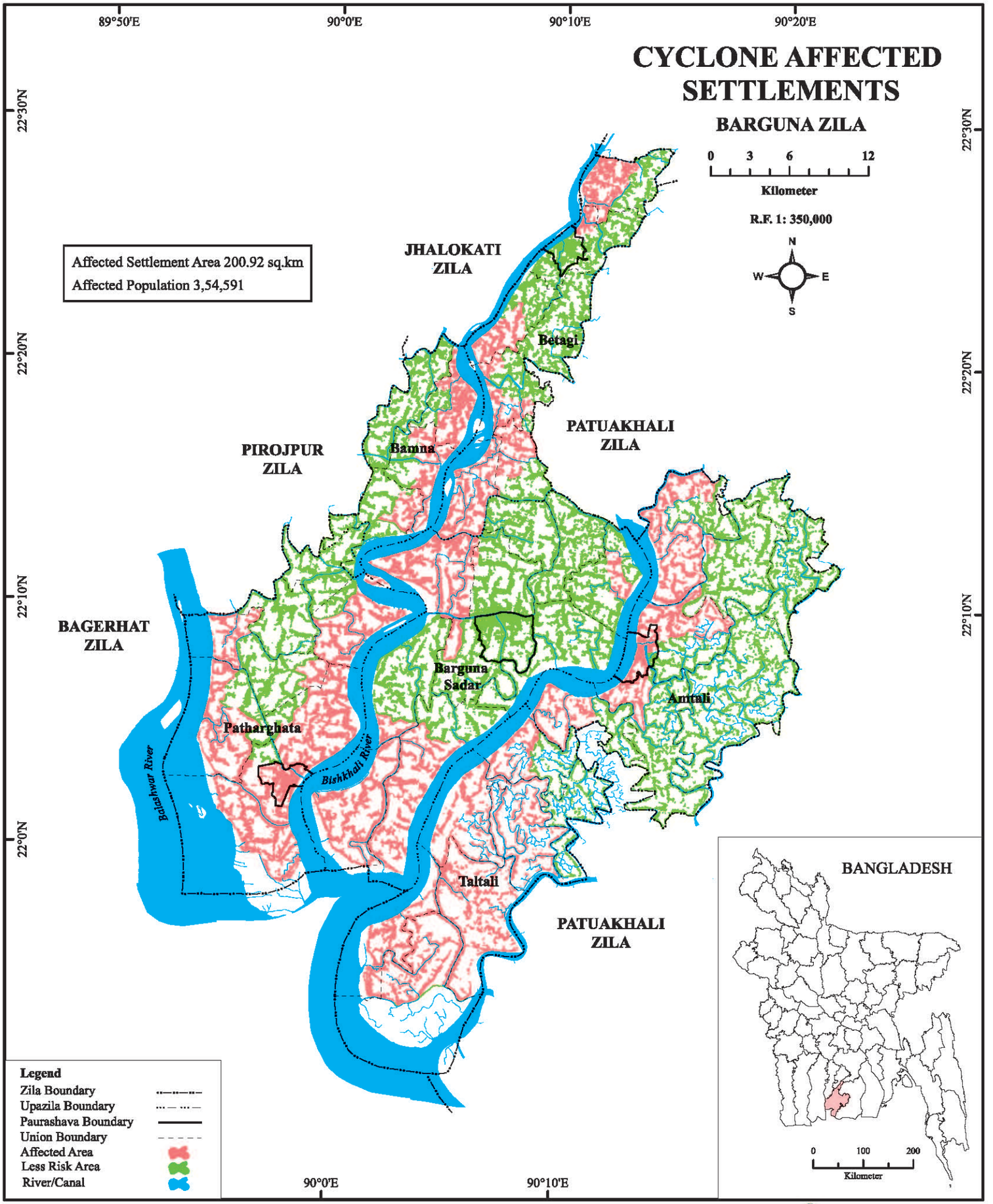
Table 3.8: Upazila specific poverty situation of Barguna District

Upazila Name	Lower limit	Upper Limit
Amtali	12.0	22.8
Bamna	8.9	17.1
Barguna sadar	9.9	19.2
Betagi	10.3	19.6
Patharghata	6.1	12.9

Chapter 4

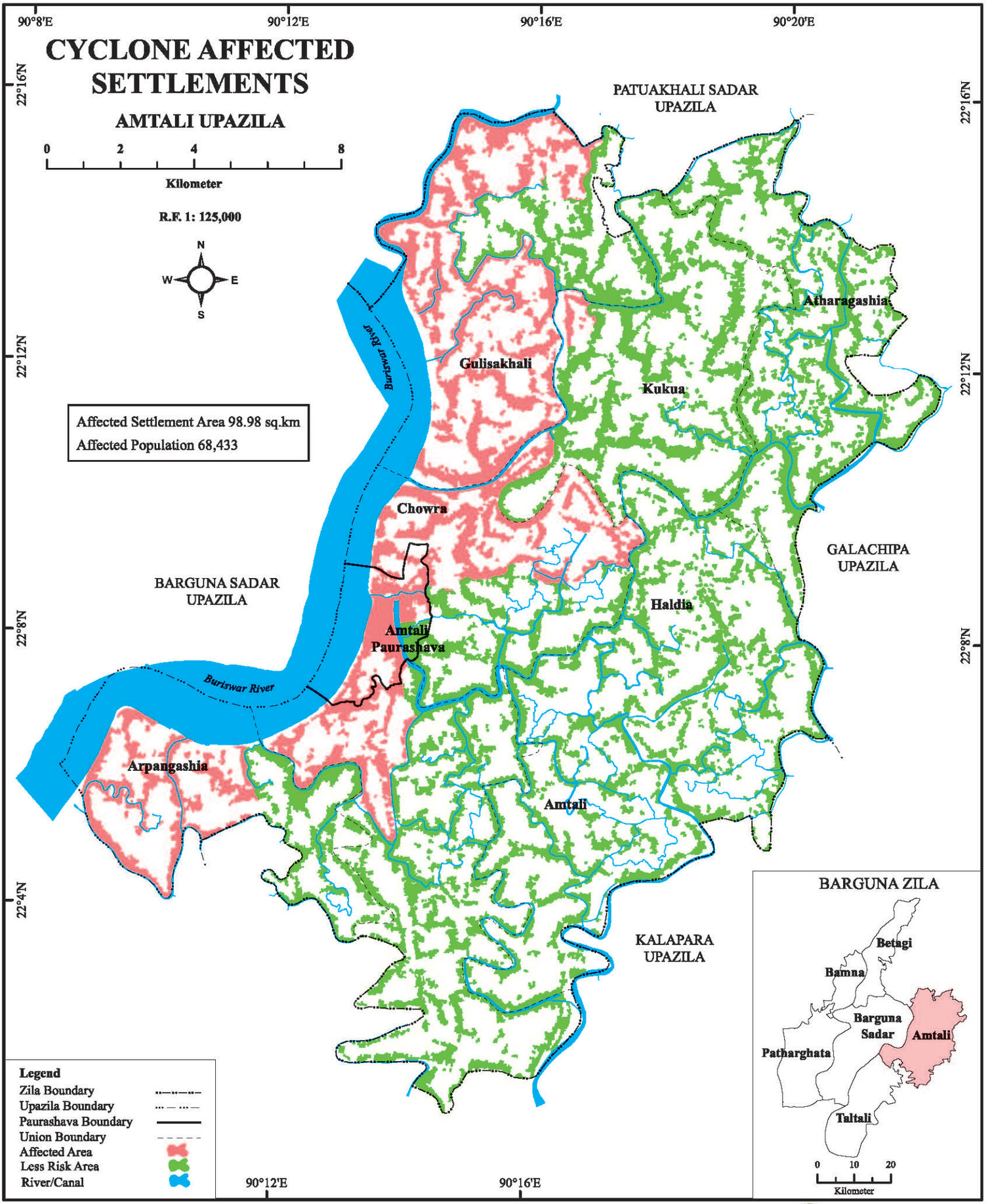
Hazard Assessment and Mapping

Cyclone Affected Area Map



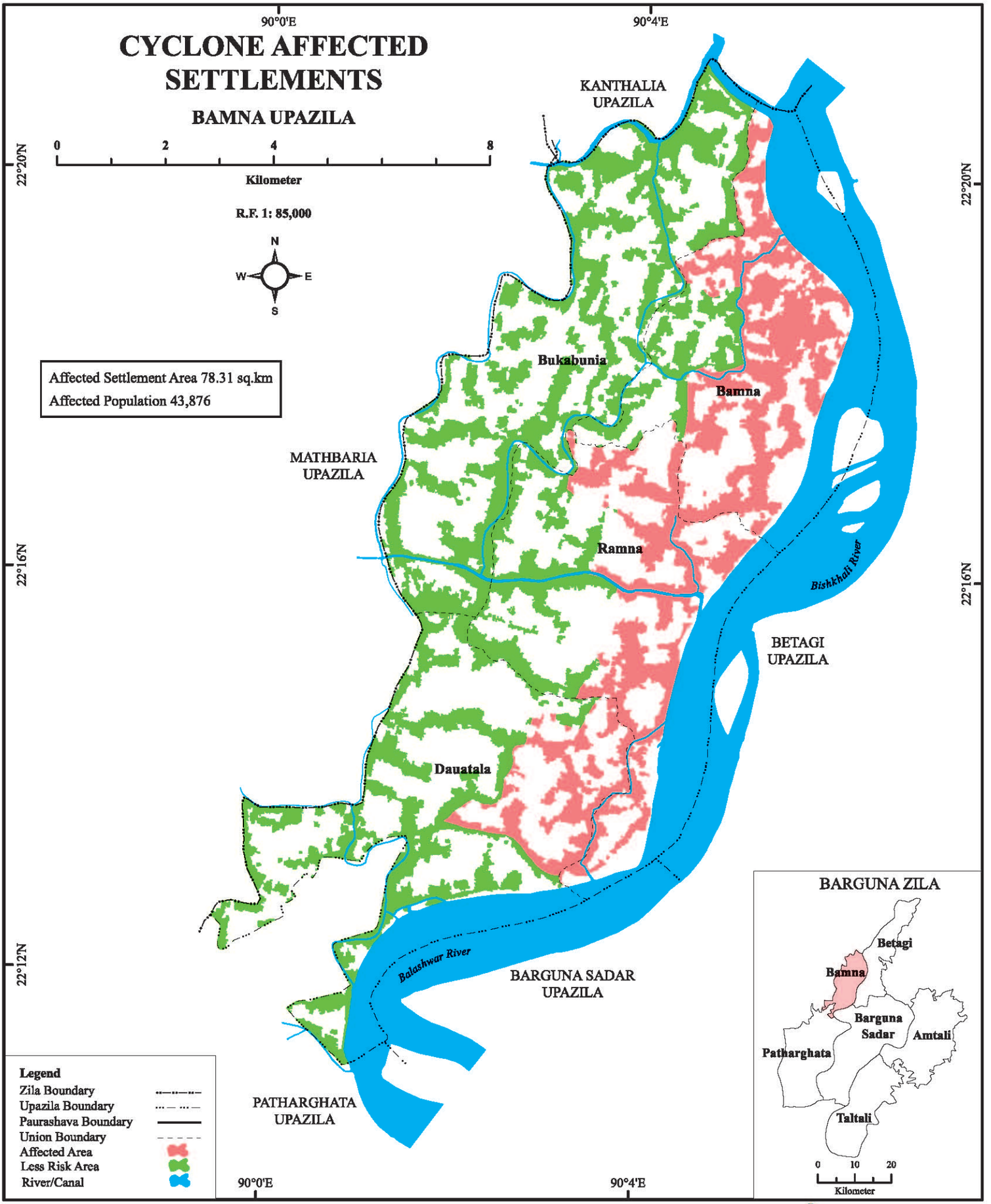
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



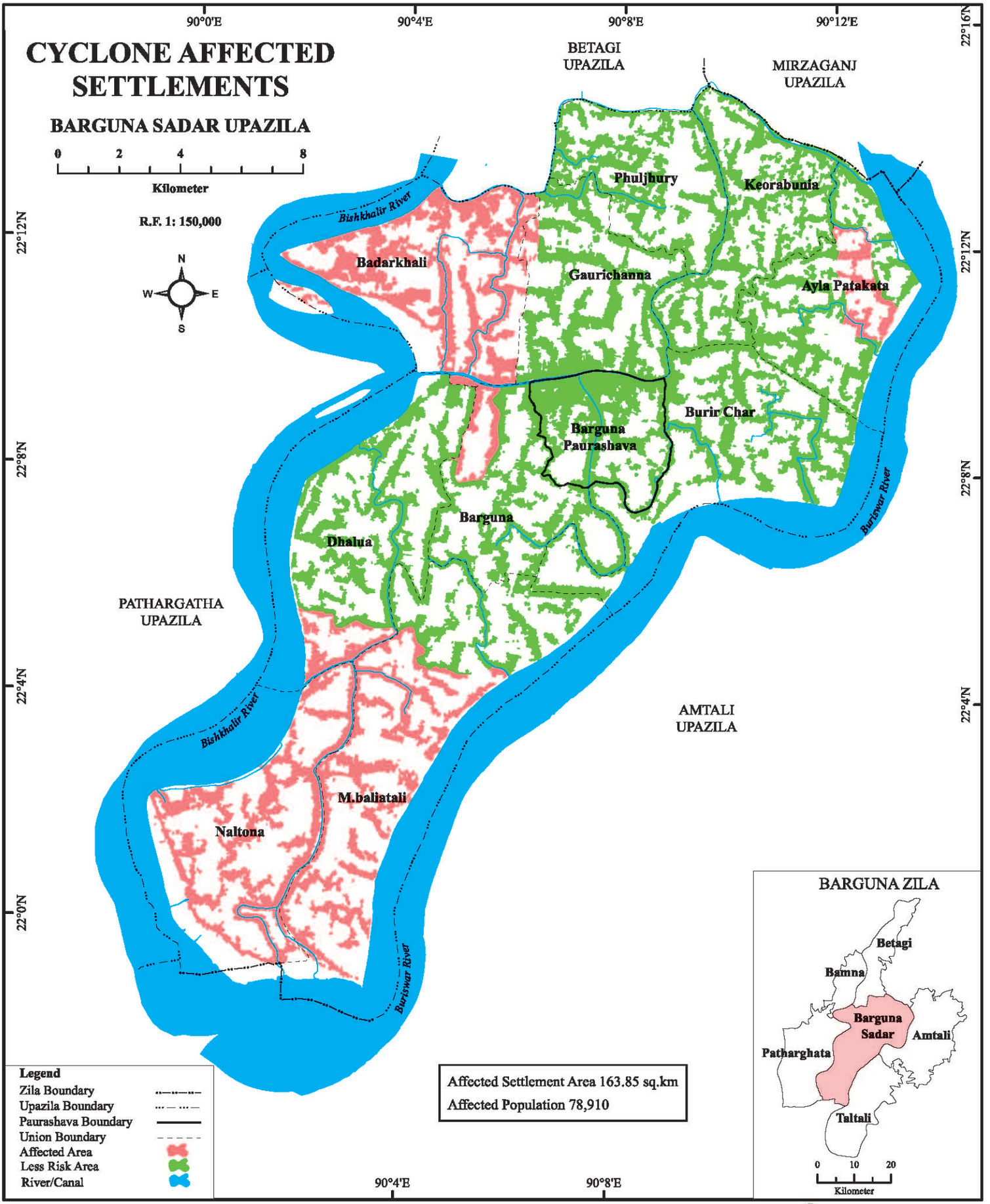
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



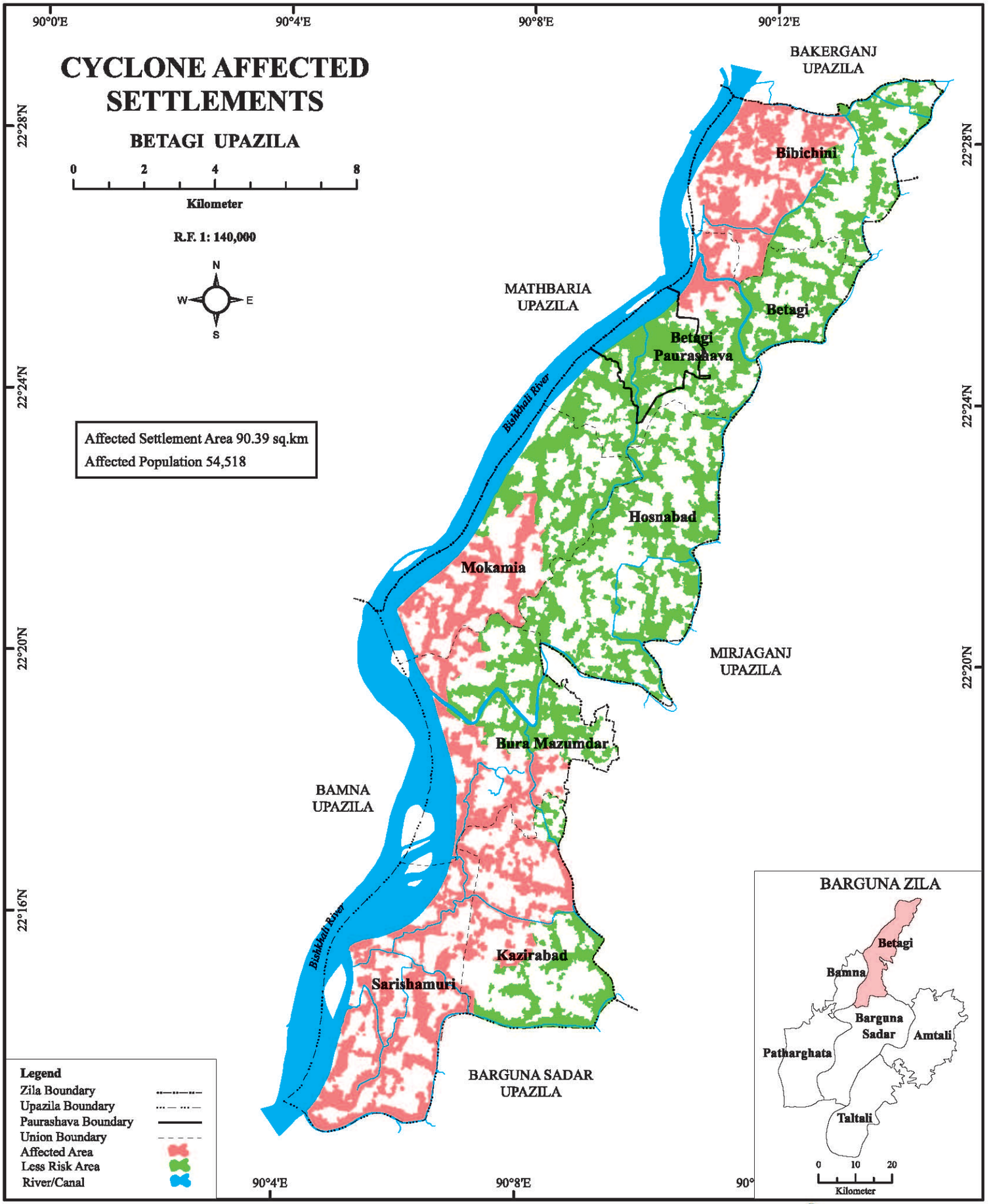
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



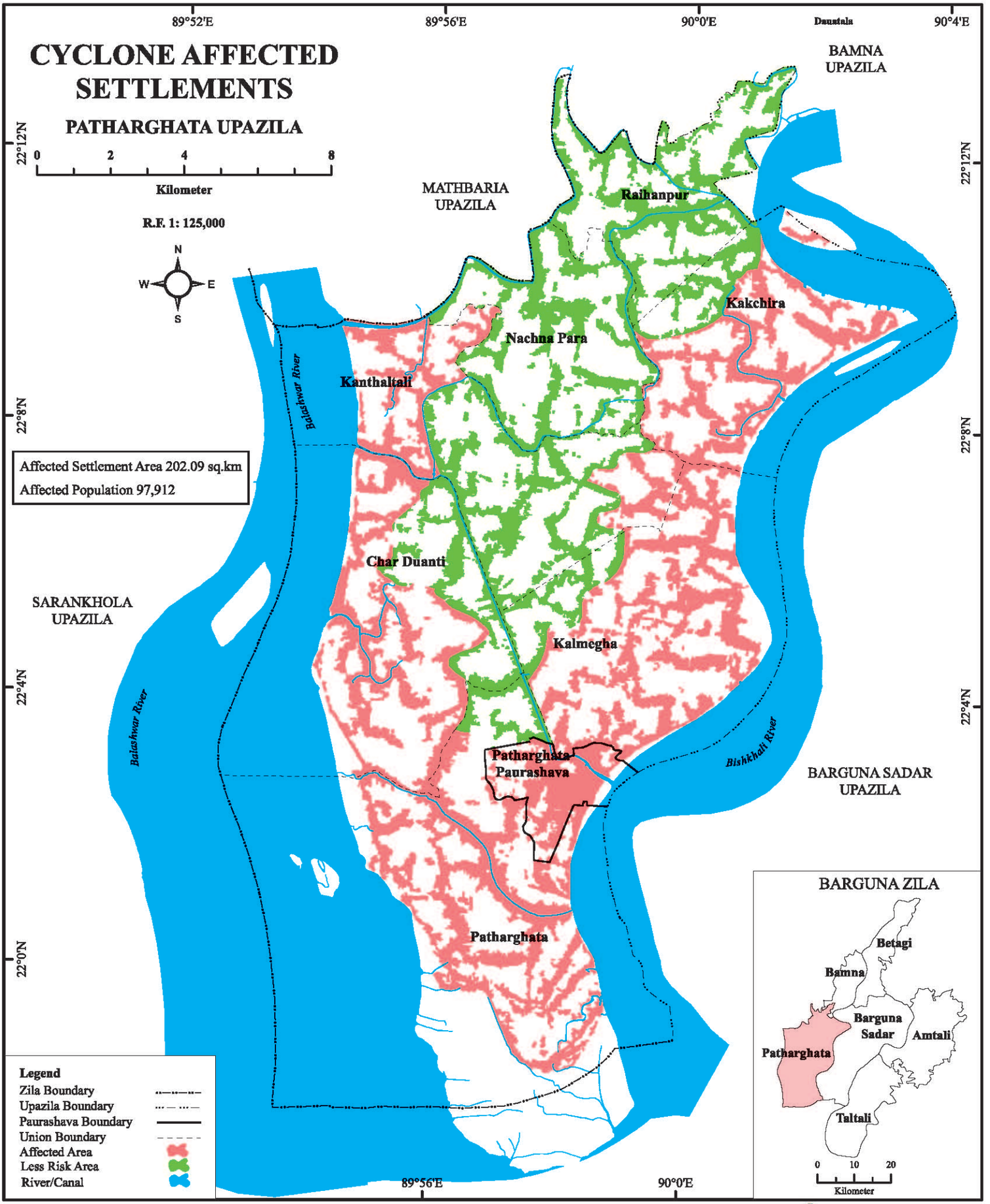
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



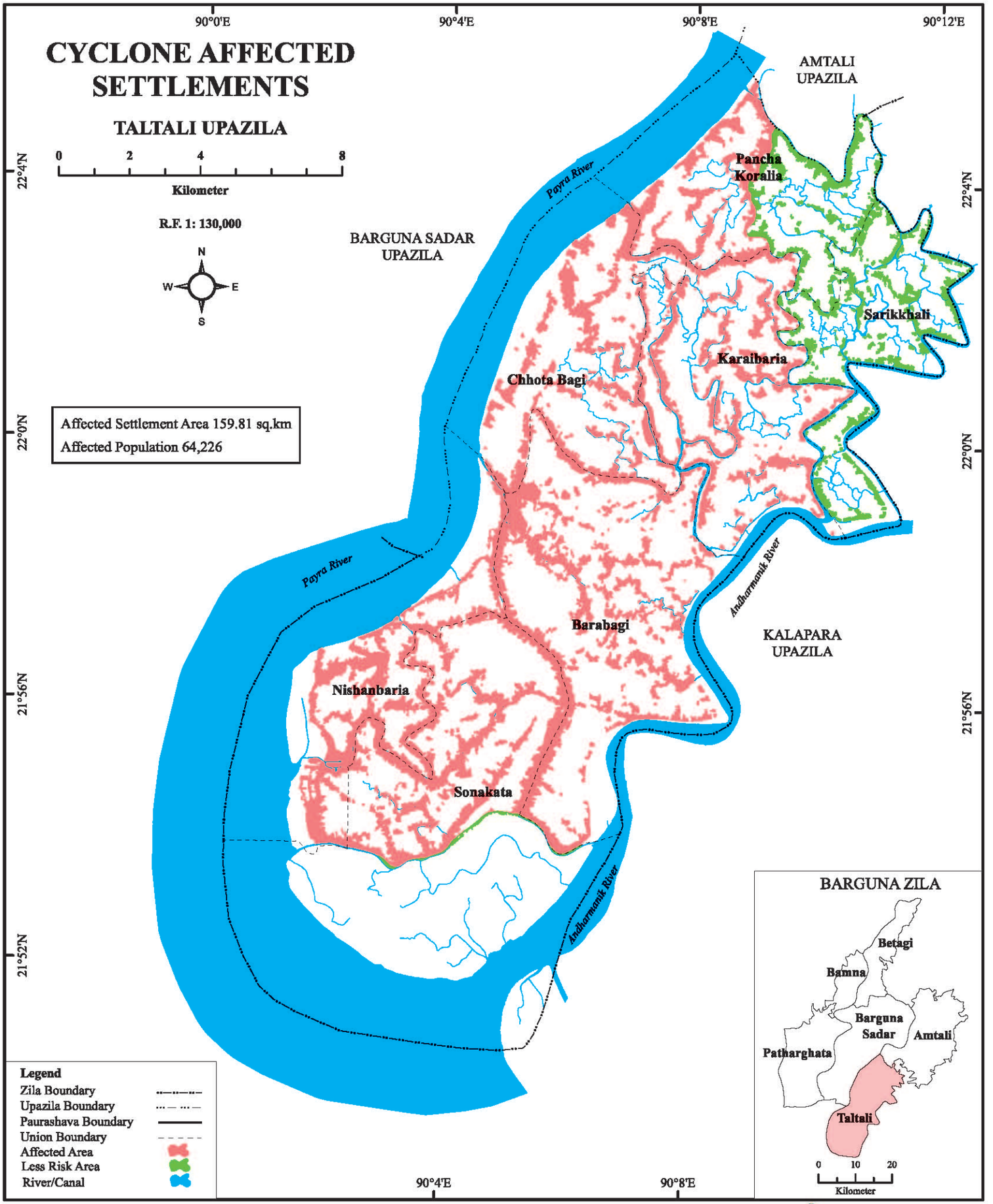
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

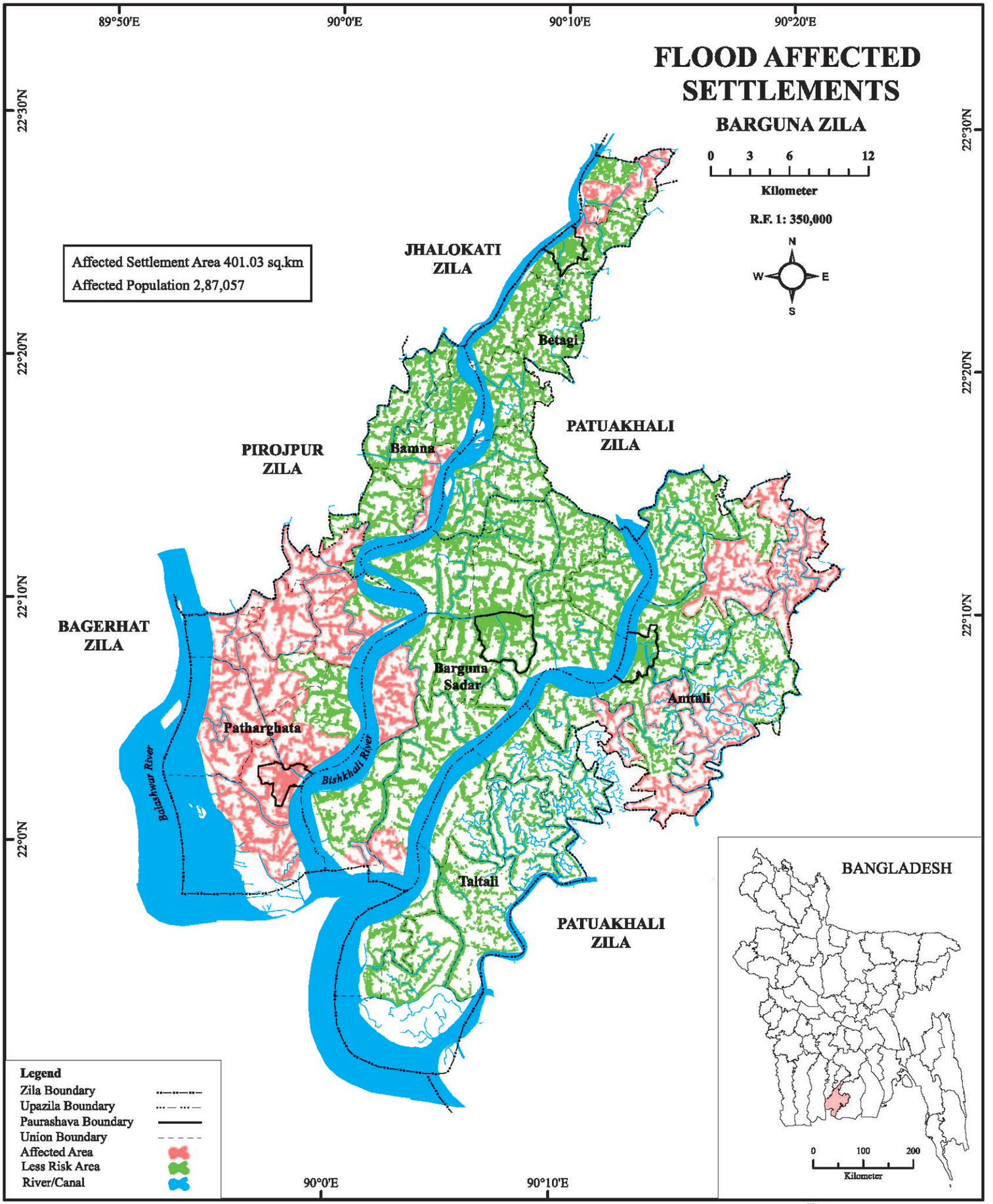
Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

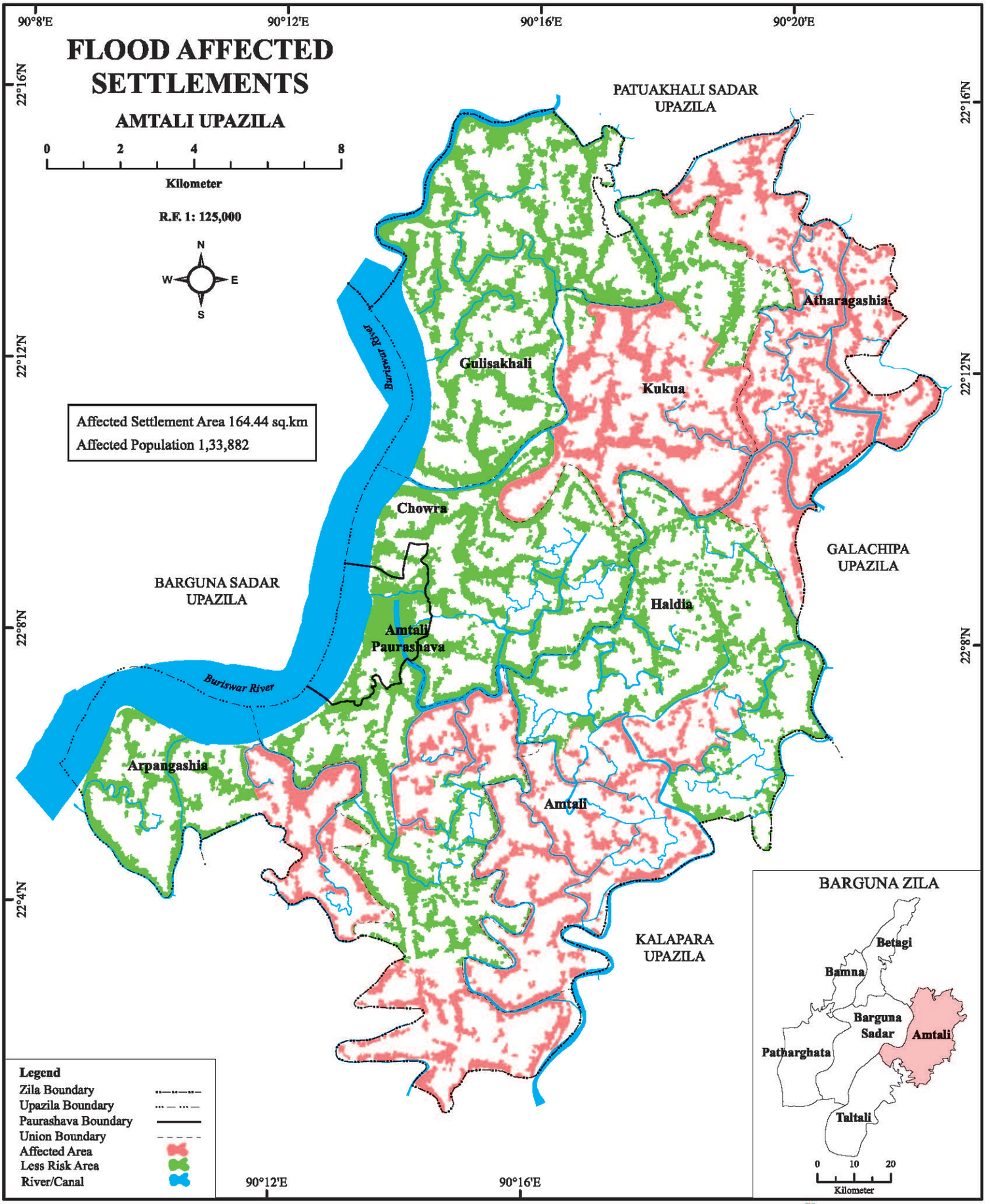
Stat4Dev. Project, BBS 2017

Flood Affected
Area Map



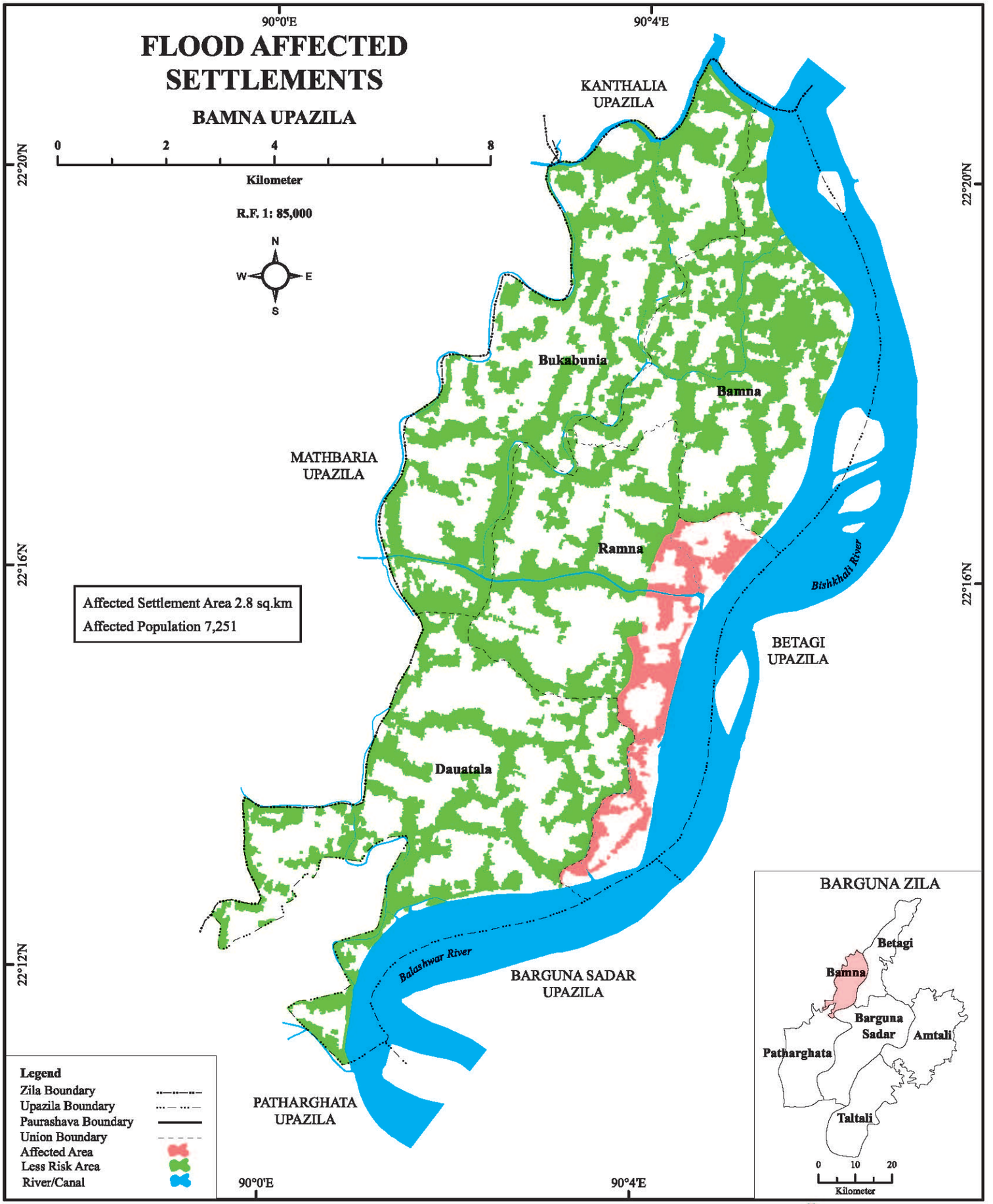
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



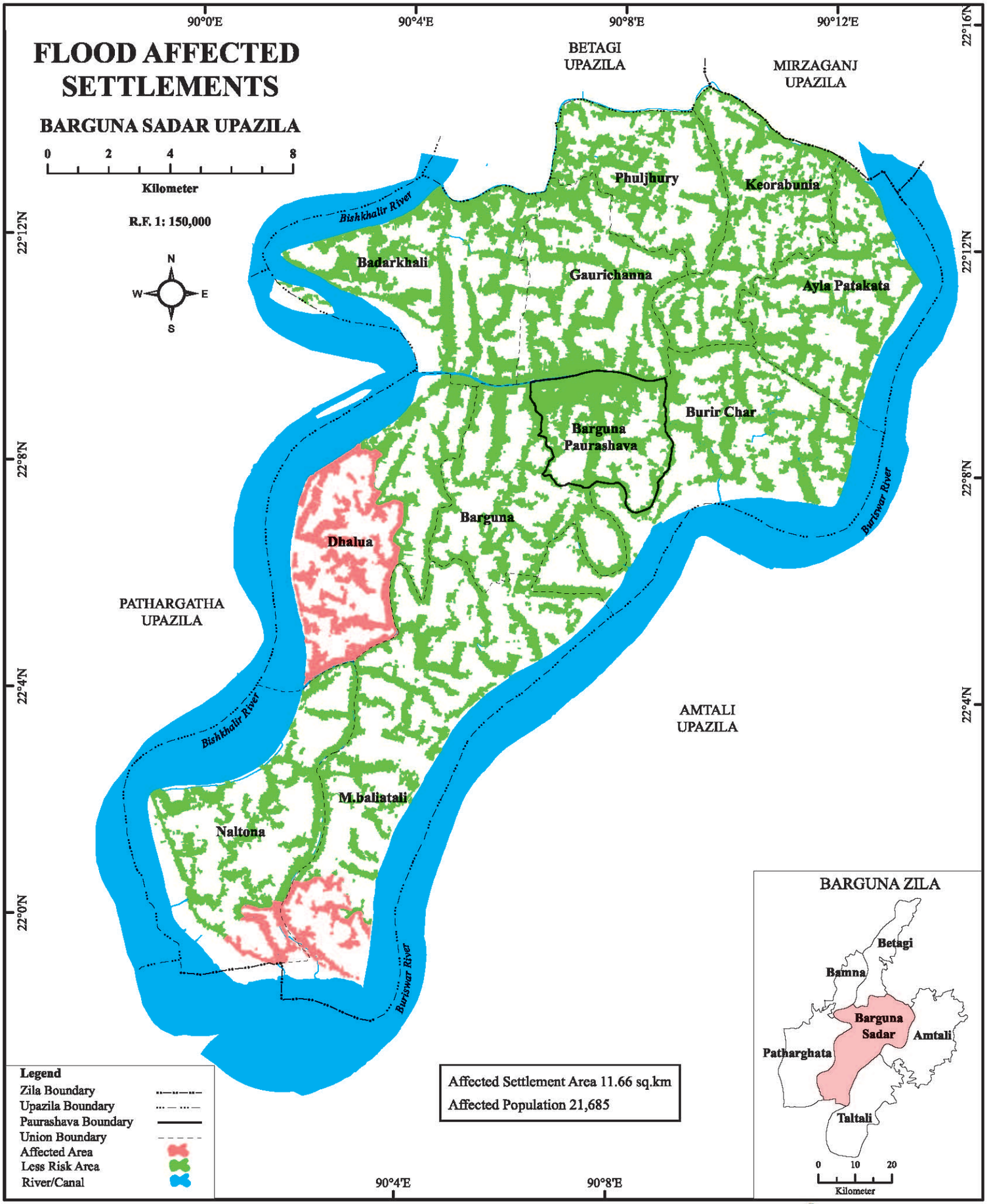
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



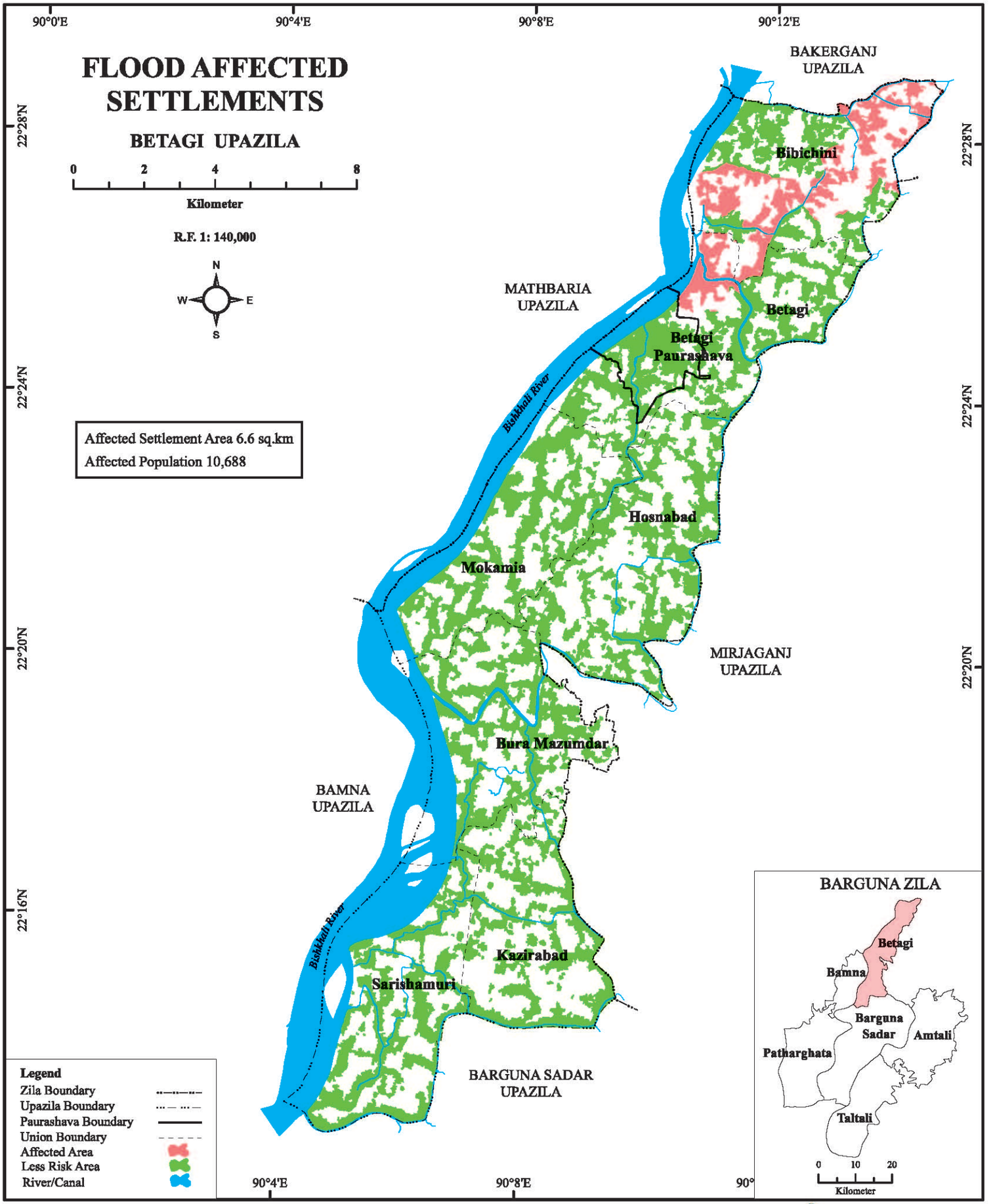
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



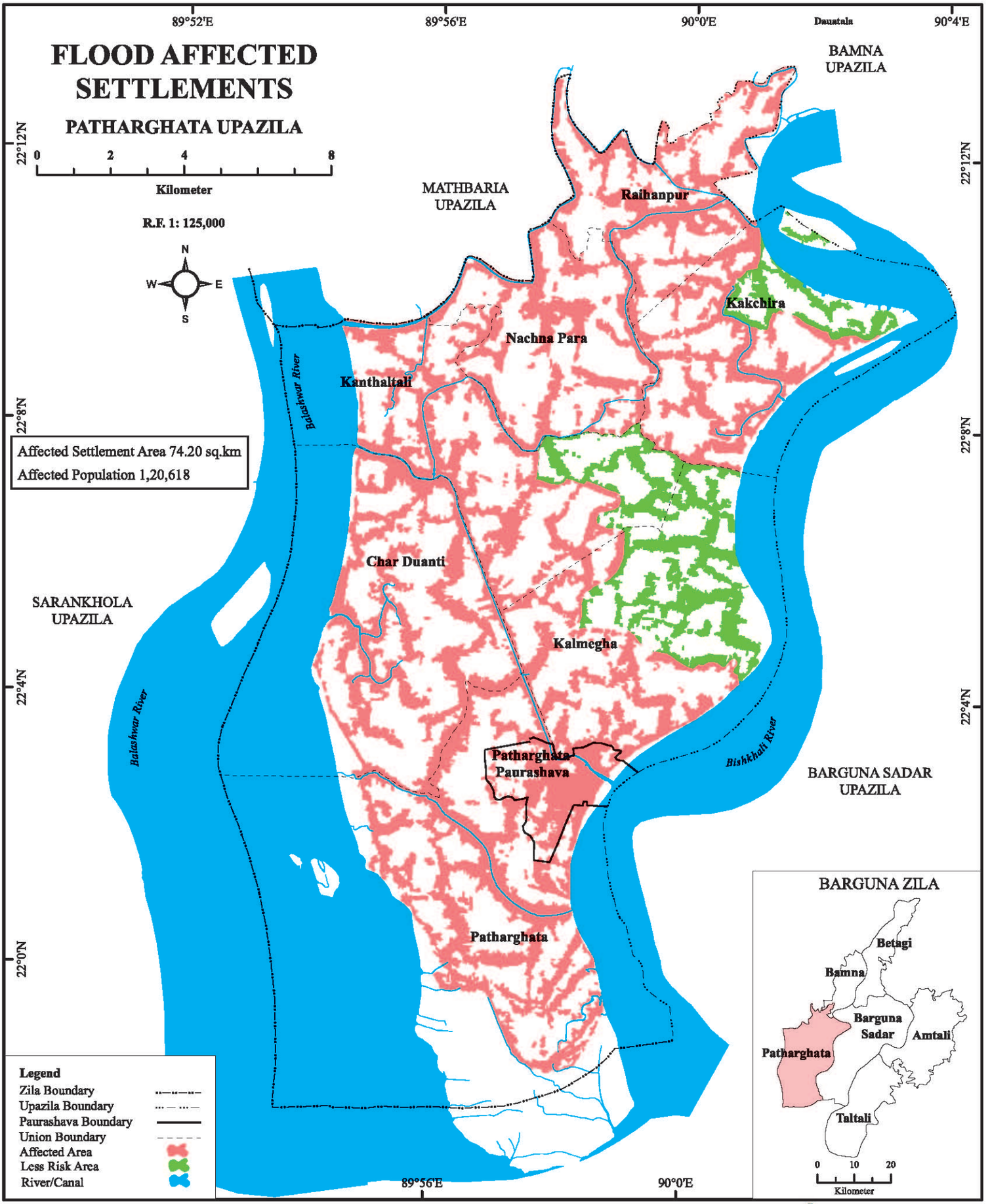
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



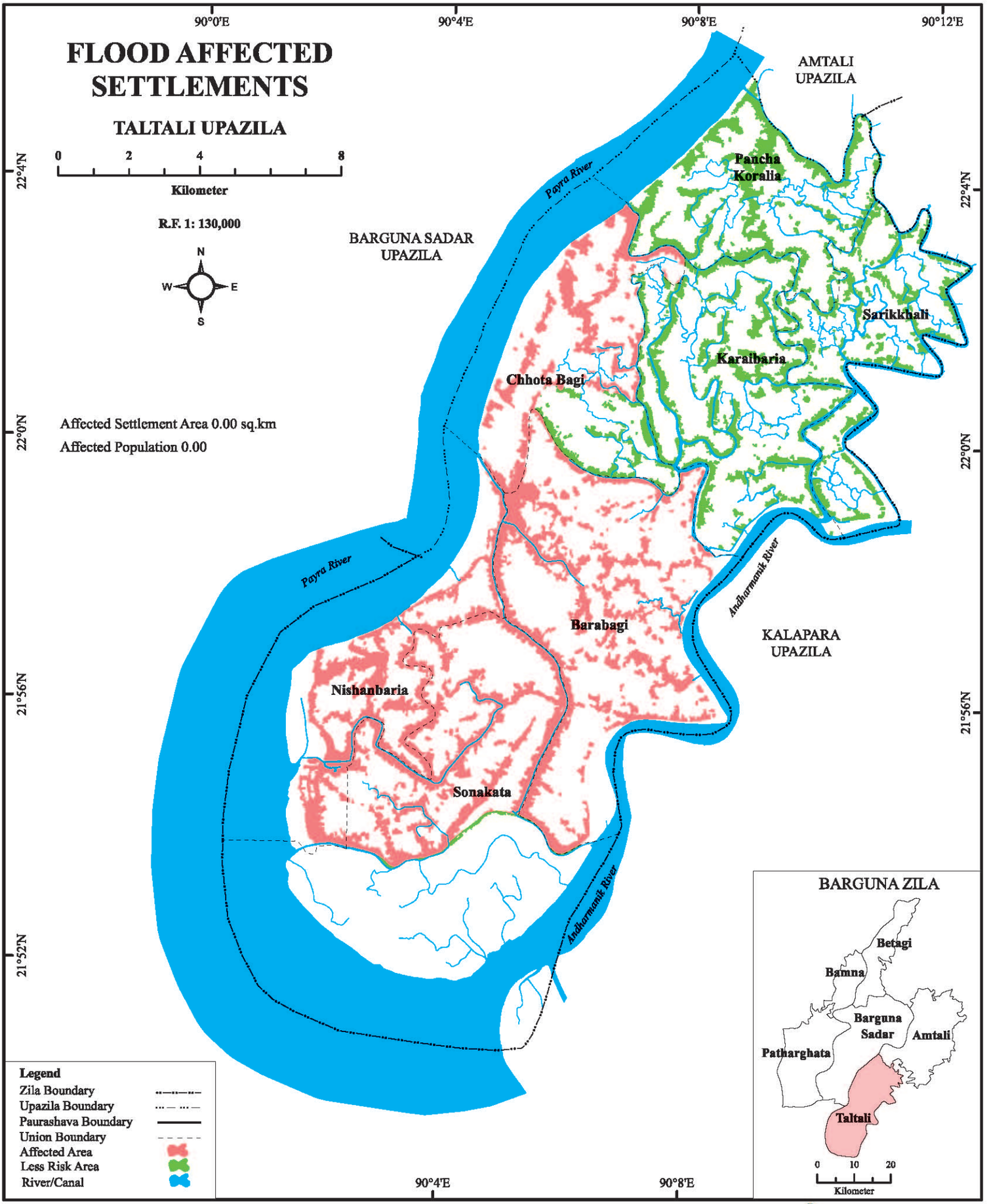
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

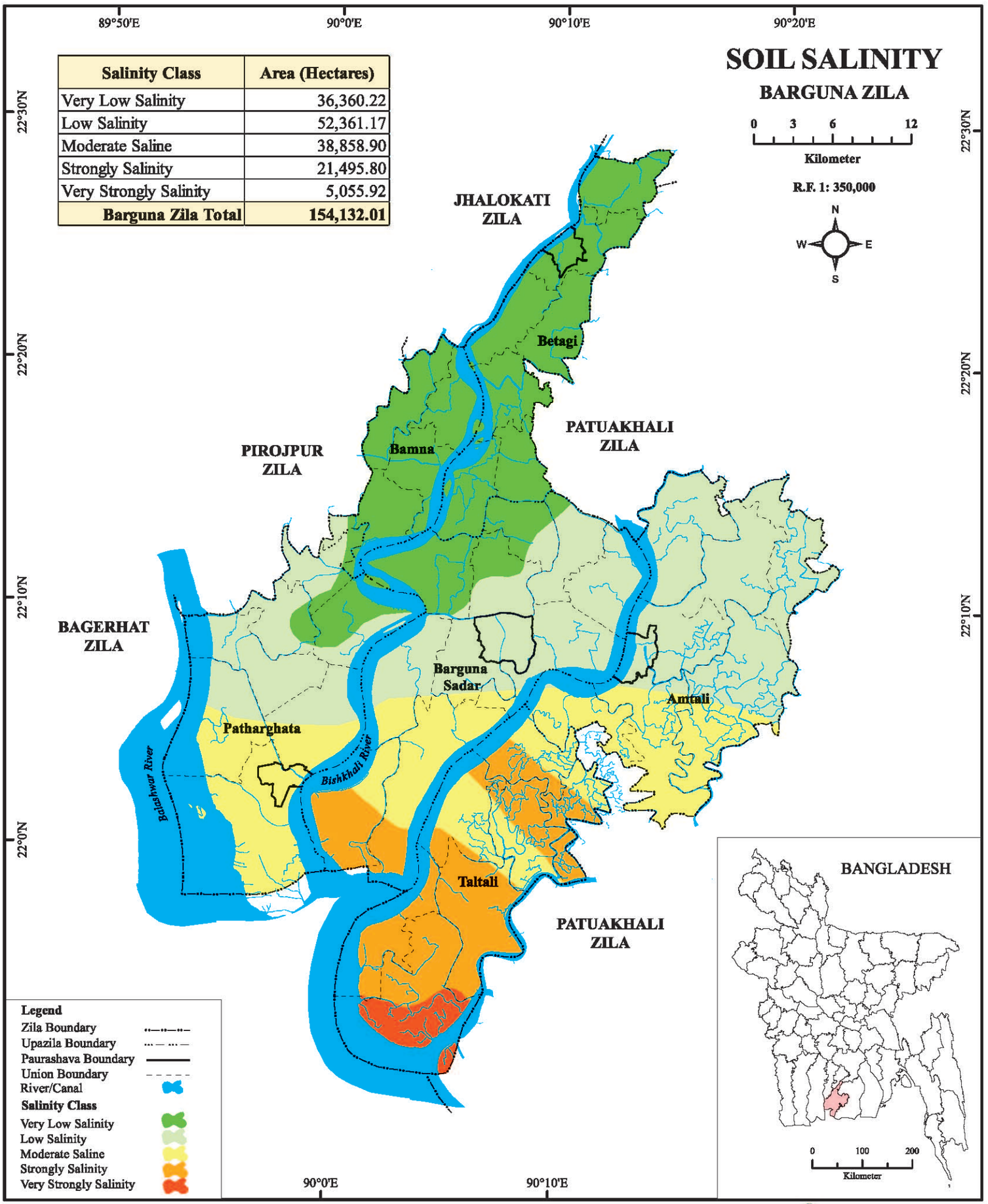
Stat4Dev. Project, BBS 2017

Salinity Affected Area Map

SOIL SALINITY

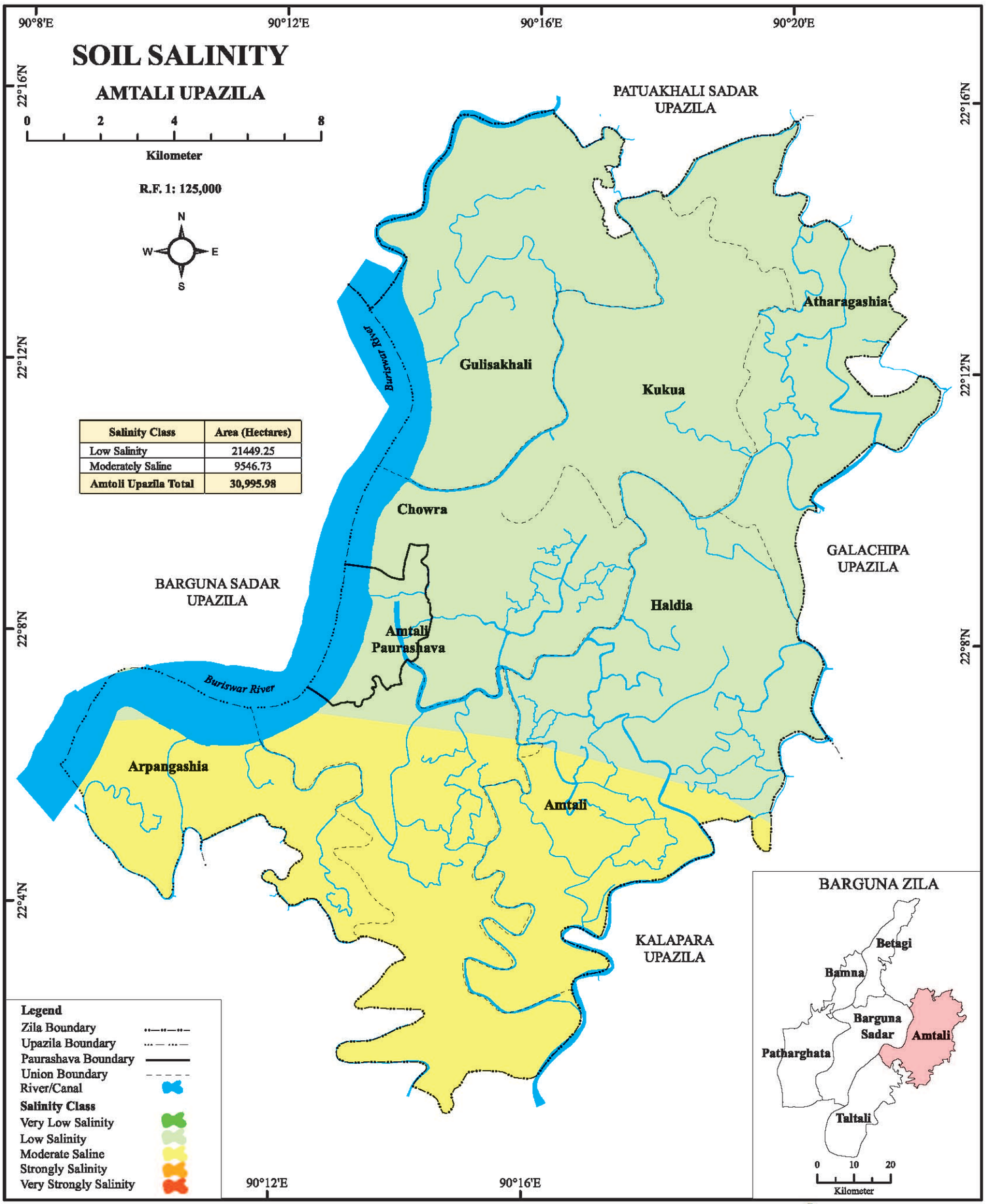
BARGUNA ZILA

Salinity Class	Area (Hectares)
Very Low Salinity	36,360.22
Low Salinity	52,361.17
Moderate Saline	38,858.90
Strongly Salinity	21,495.80
Very Strongly Salinity	5,055.92
Barguna Zila Total	**154,132.01**



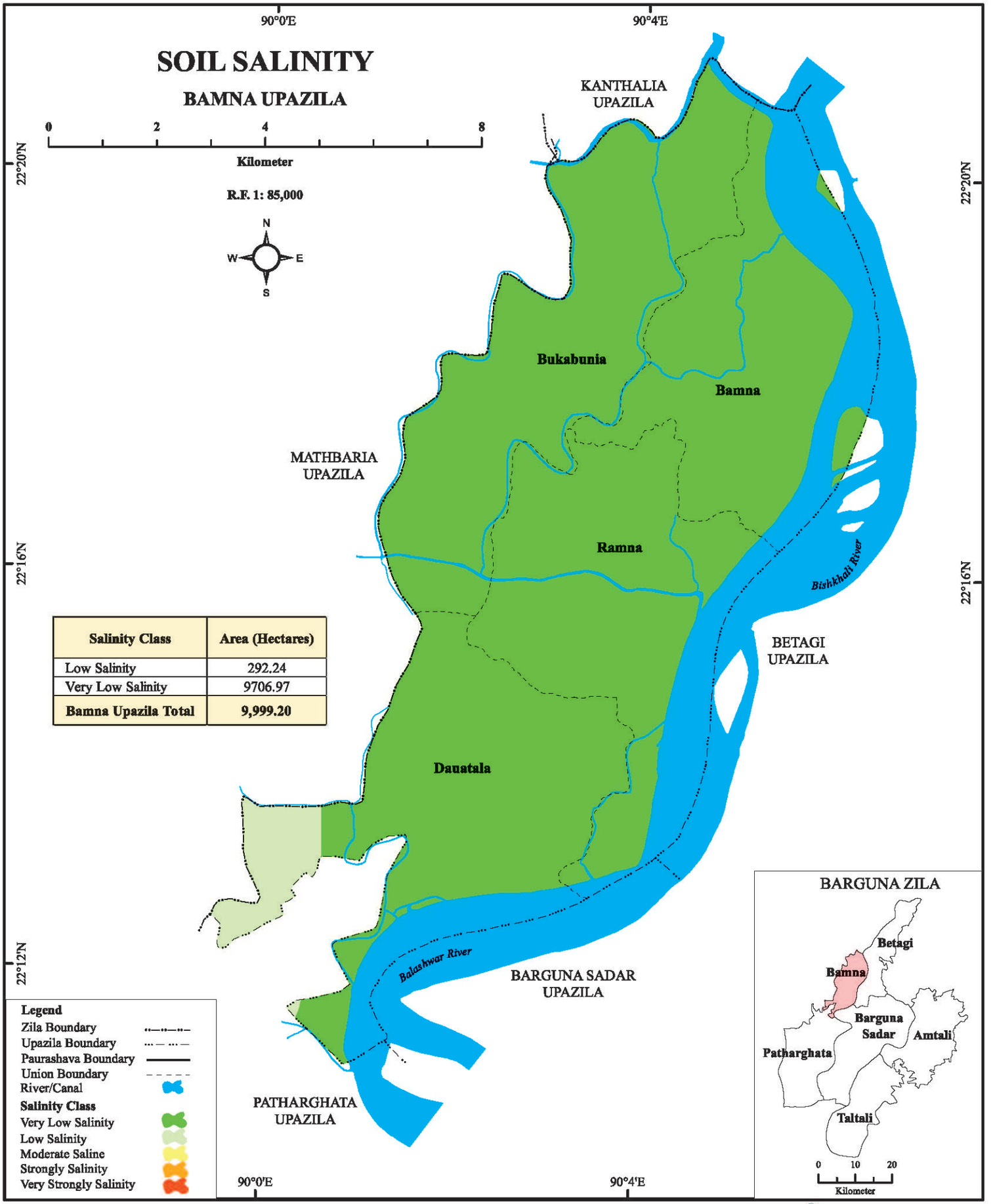
Source: After SRDI, Field Survey 2017

Stat4Dev. Project, BBS 2017



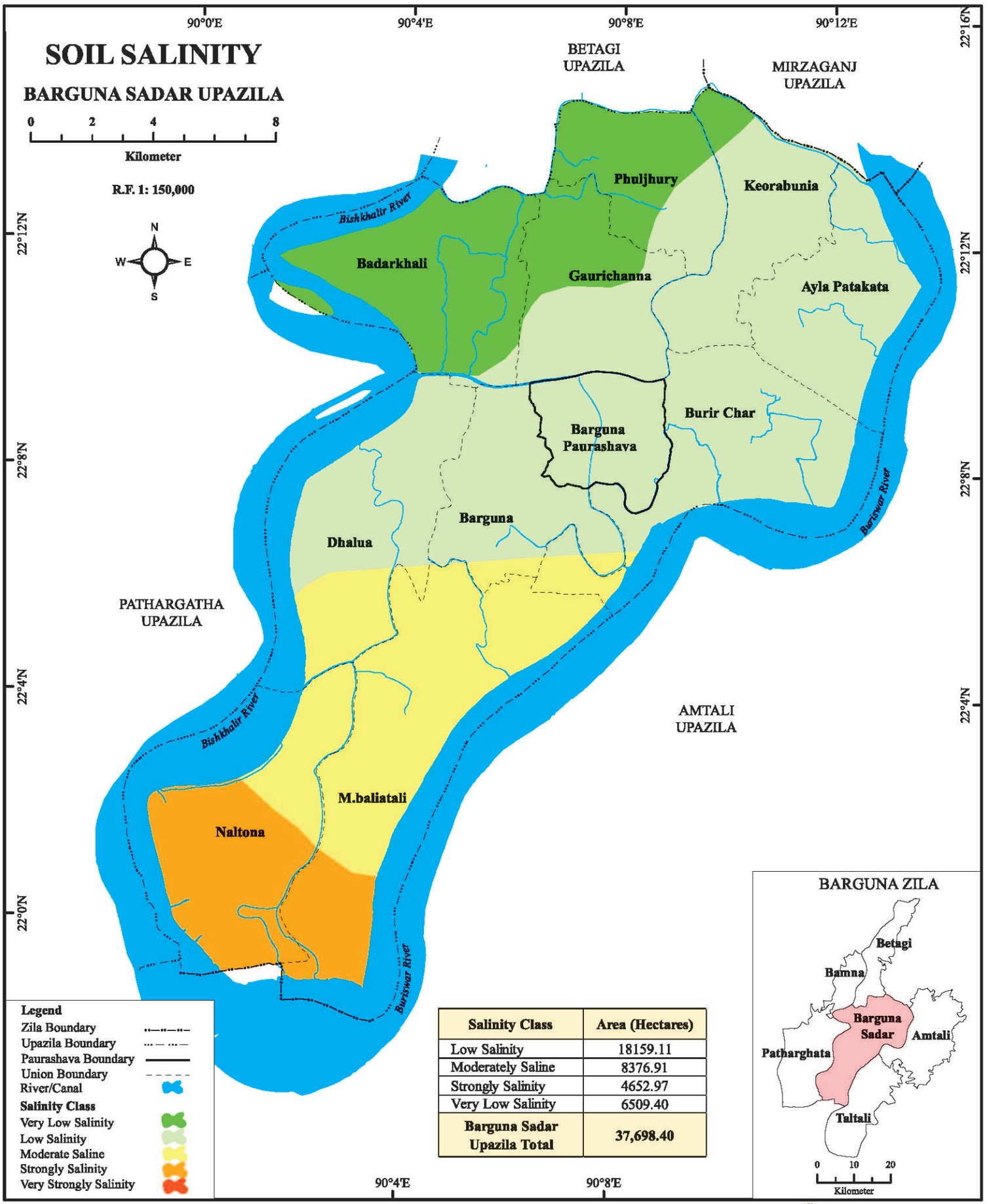
Source: After SRDI, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After SRDI, Field Survey 2017

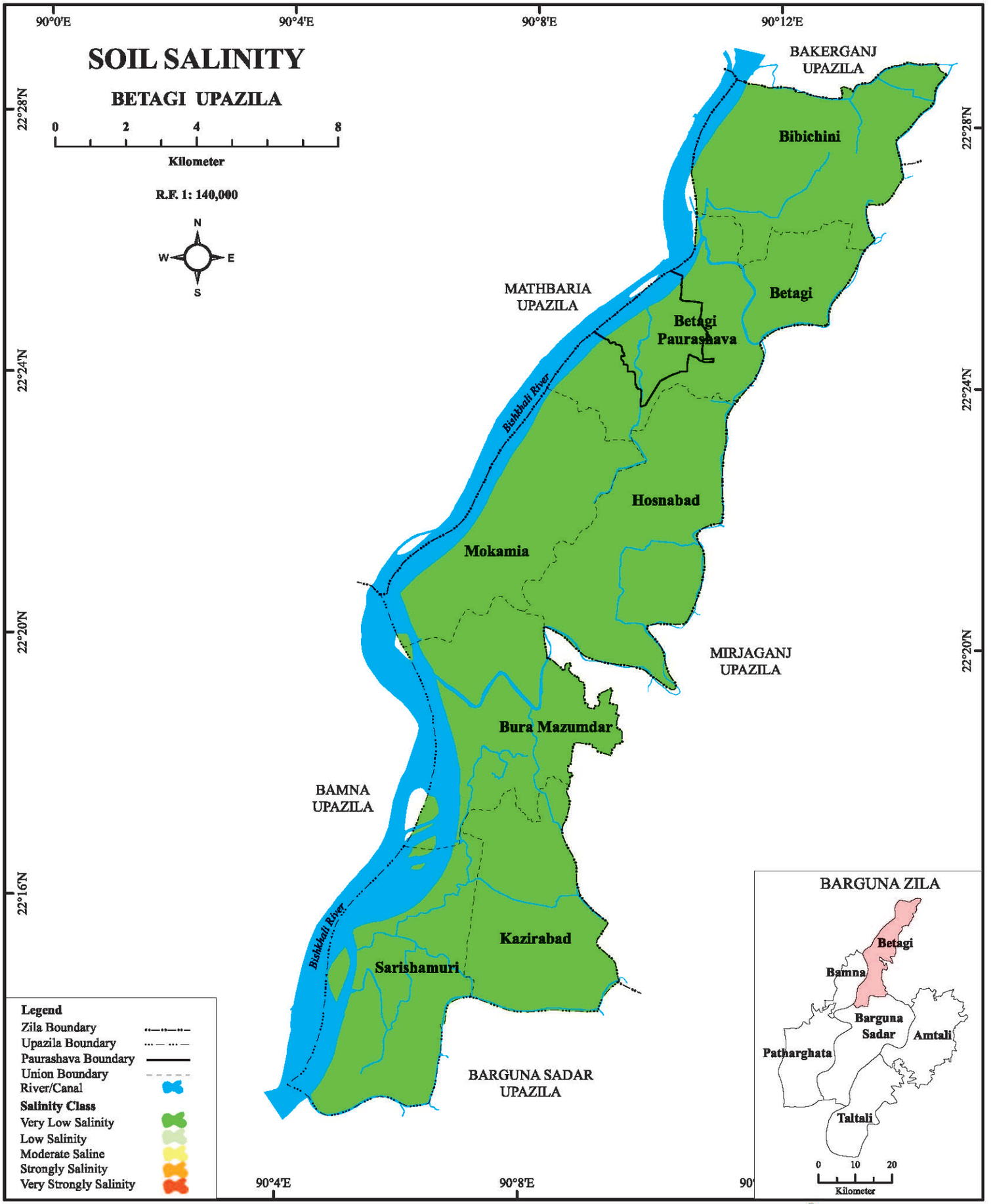
Stat4Dev. Project, BBS 2017



Salinity Class	Area (Hectares)
Low Salinity	18159.11
Moderately Saline	8376.91
Strongly Salinity	4652.97
Very Low Salinity	6509.40
Barguna Sadar Upazila Total	**37,698.40**

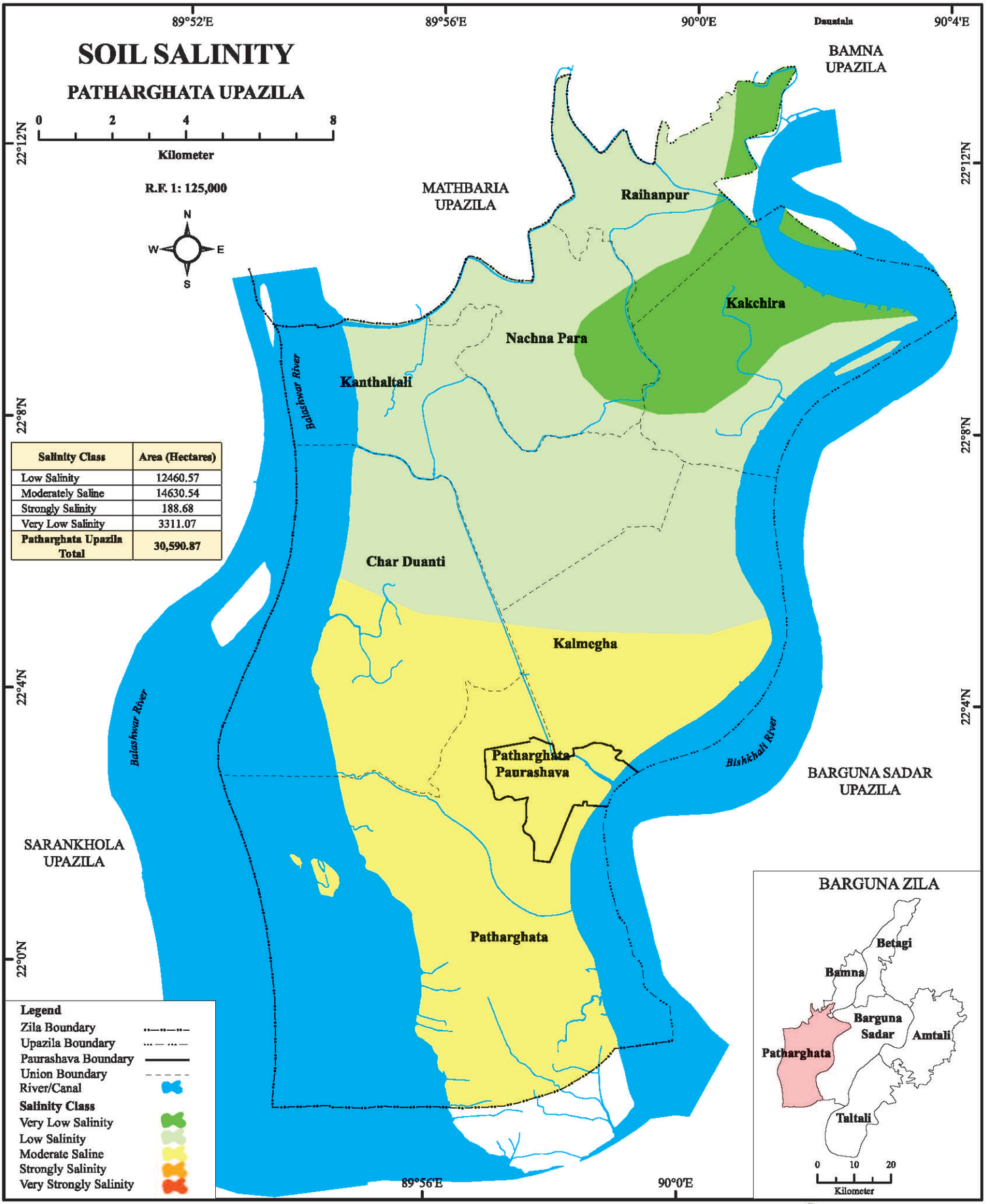
Source: After SRDI, Field Survey 2017

Stat4Dev. Project, BBS 2017



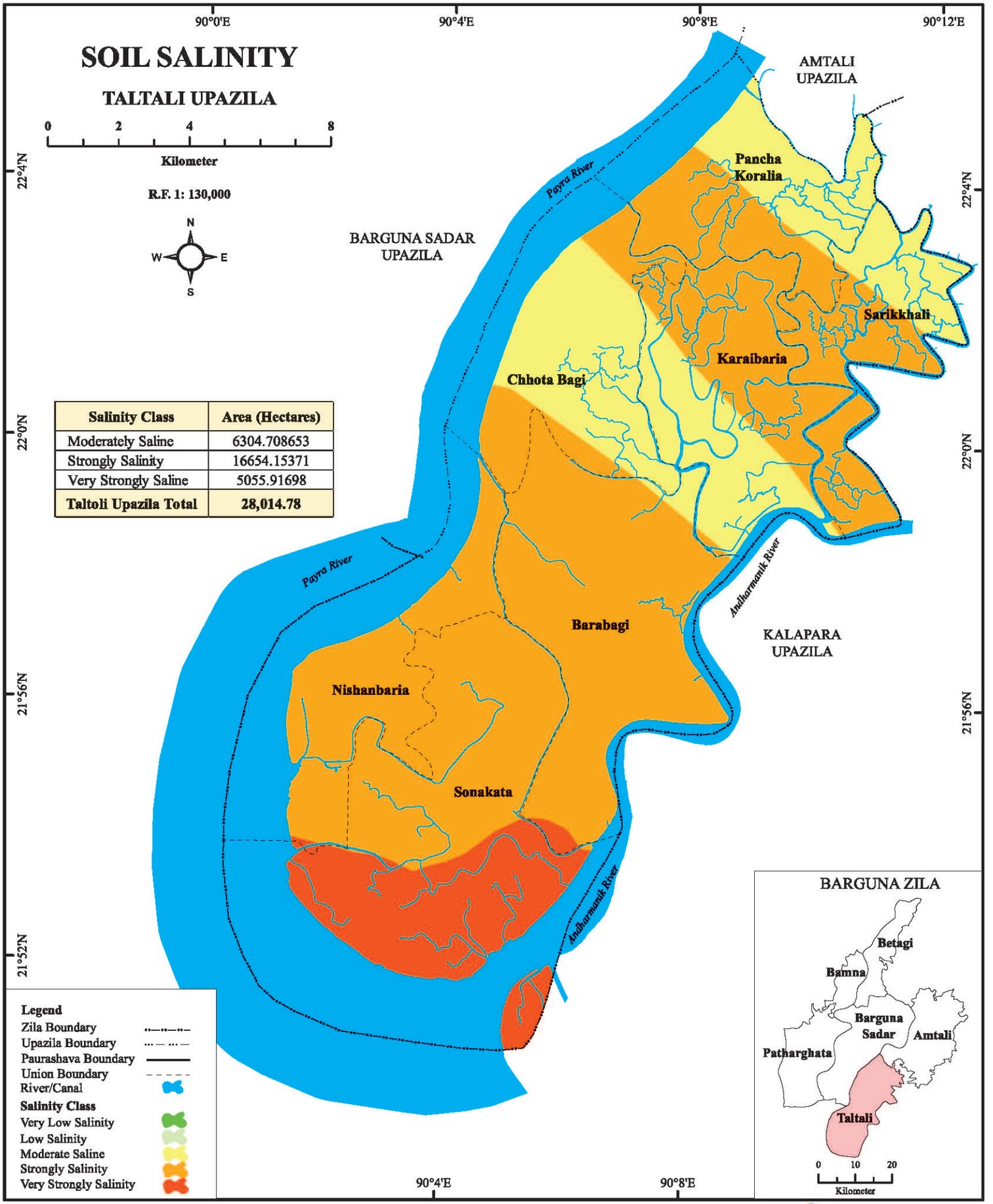
Source: After SRDI, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After SRDI, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After SRDI, Field Survey 2017

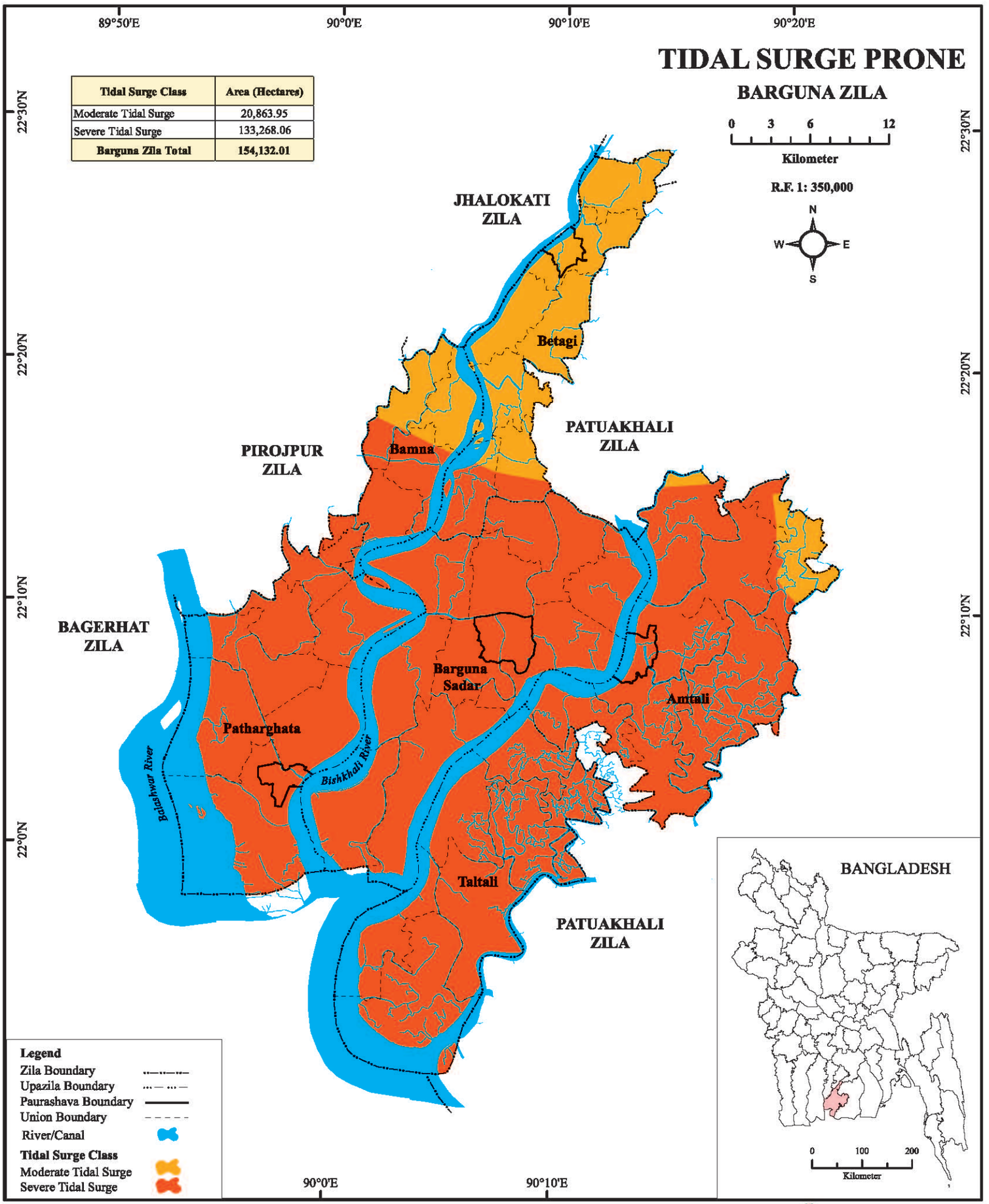
Stat4Dev. Project, BBS 2017

Tidal Surge Affected Area Map

TIDAL SURGE PRONE

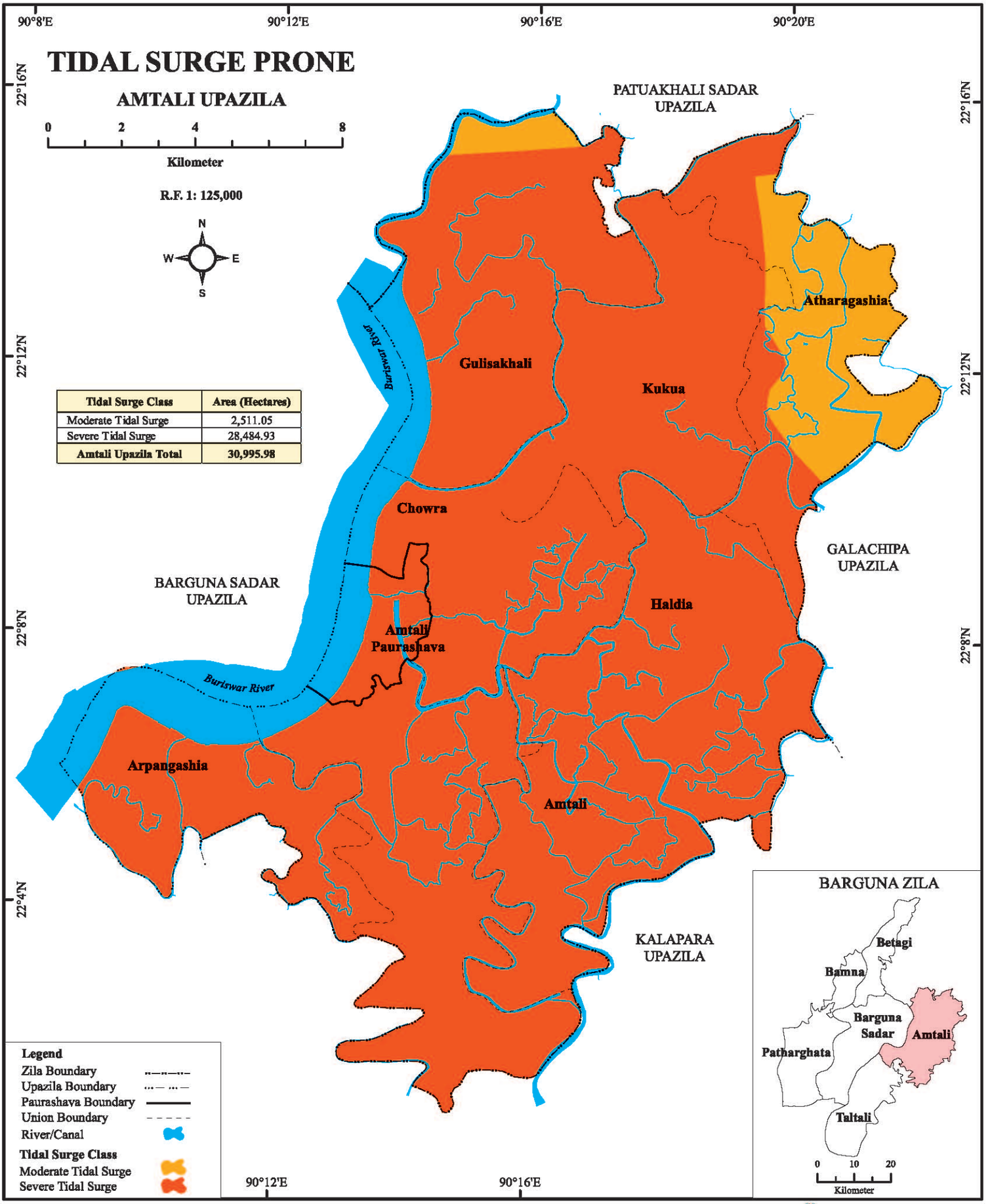
BARGUNA ZILA

Tidal Surge Class	Area (Hectares)
Moderate Tidal Surge	20,863.95
Severe Tidal Surge	133,268.06
Barguna Zila Total	**154,132.01**



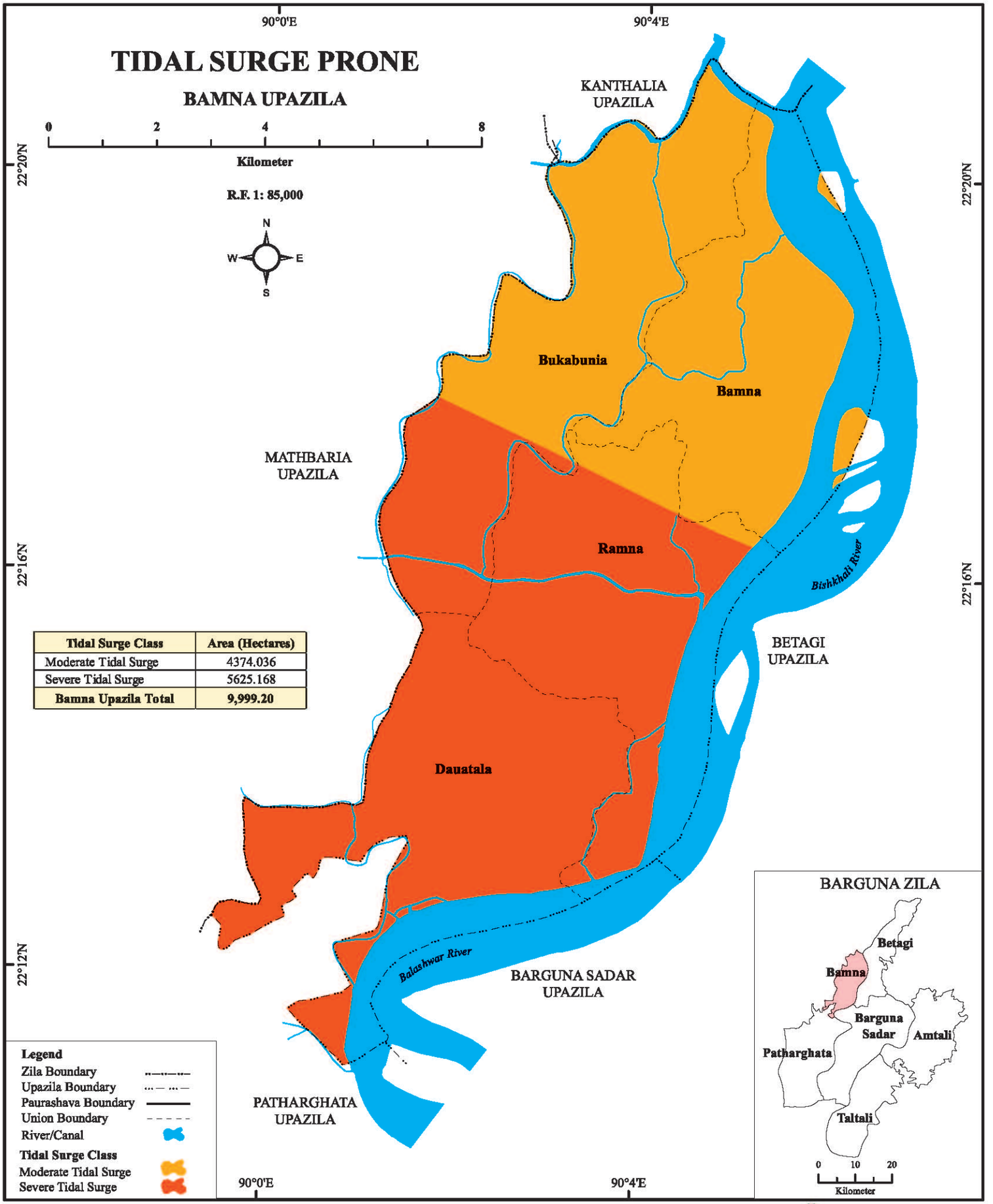
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



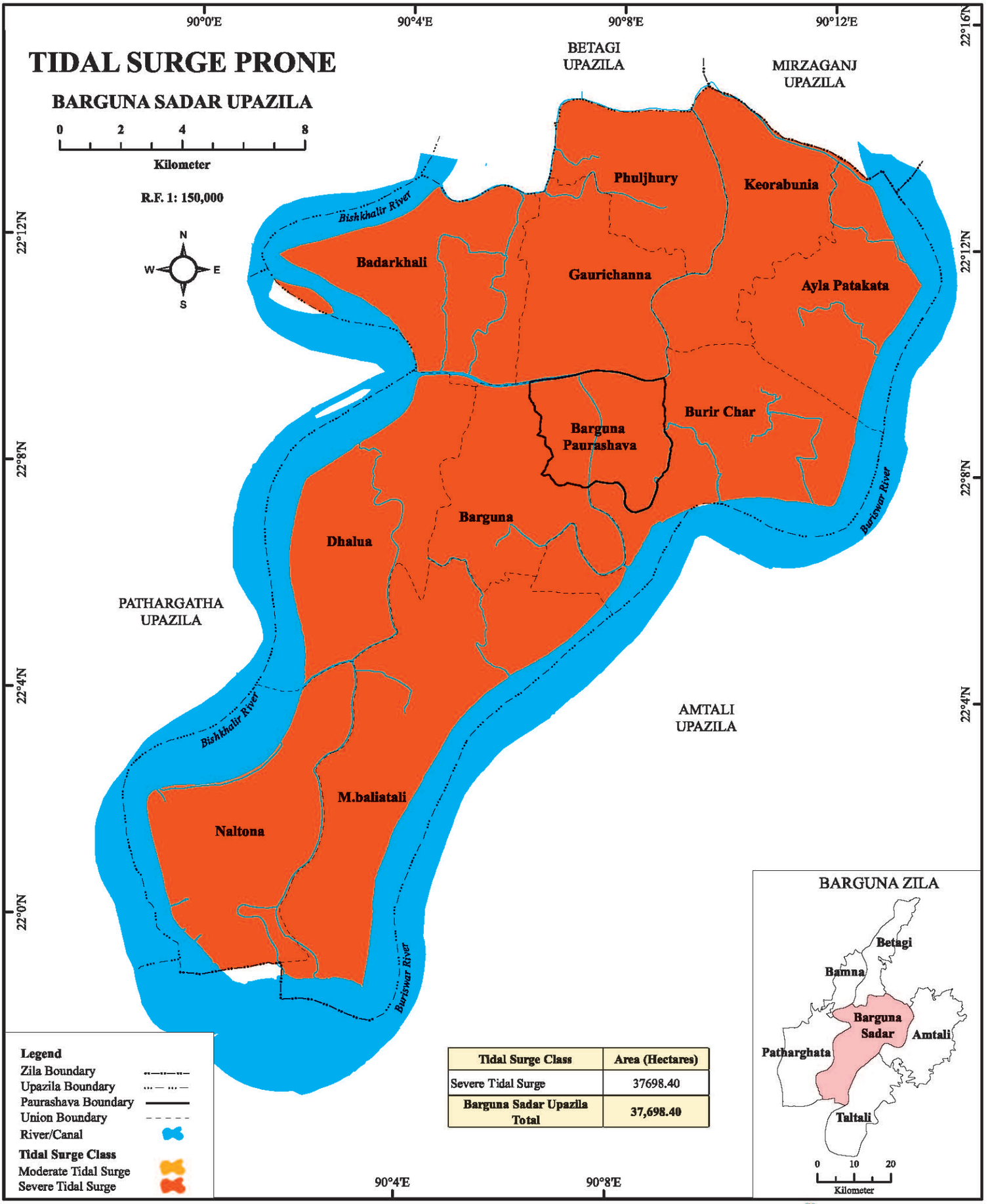
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

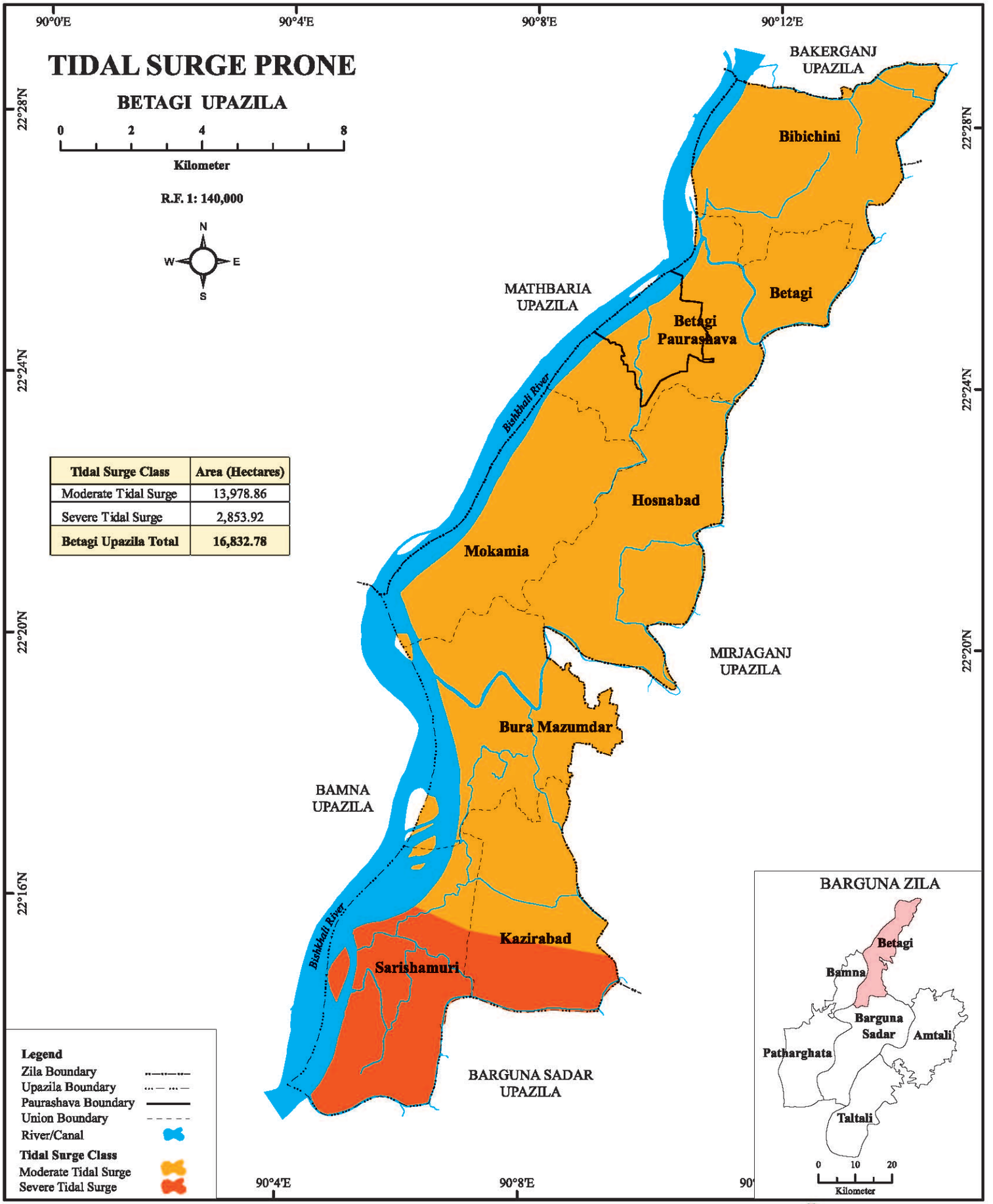
Stat4Dev. Project, BBS 2017



Tidal Surge Class	Area (Hectares)
Severe Tidal Surge	37698.40
Barguna Sadar Upazila Total	**37,698.40**

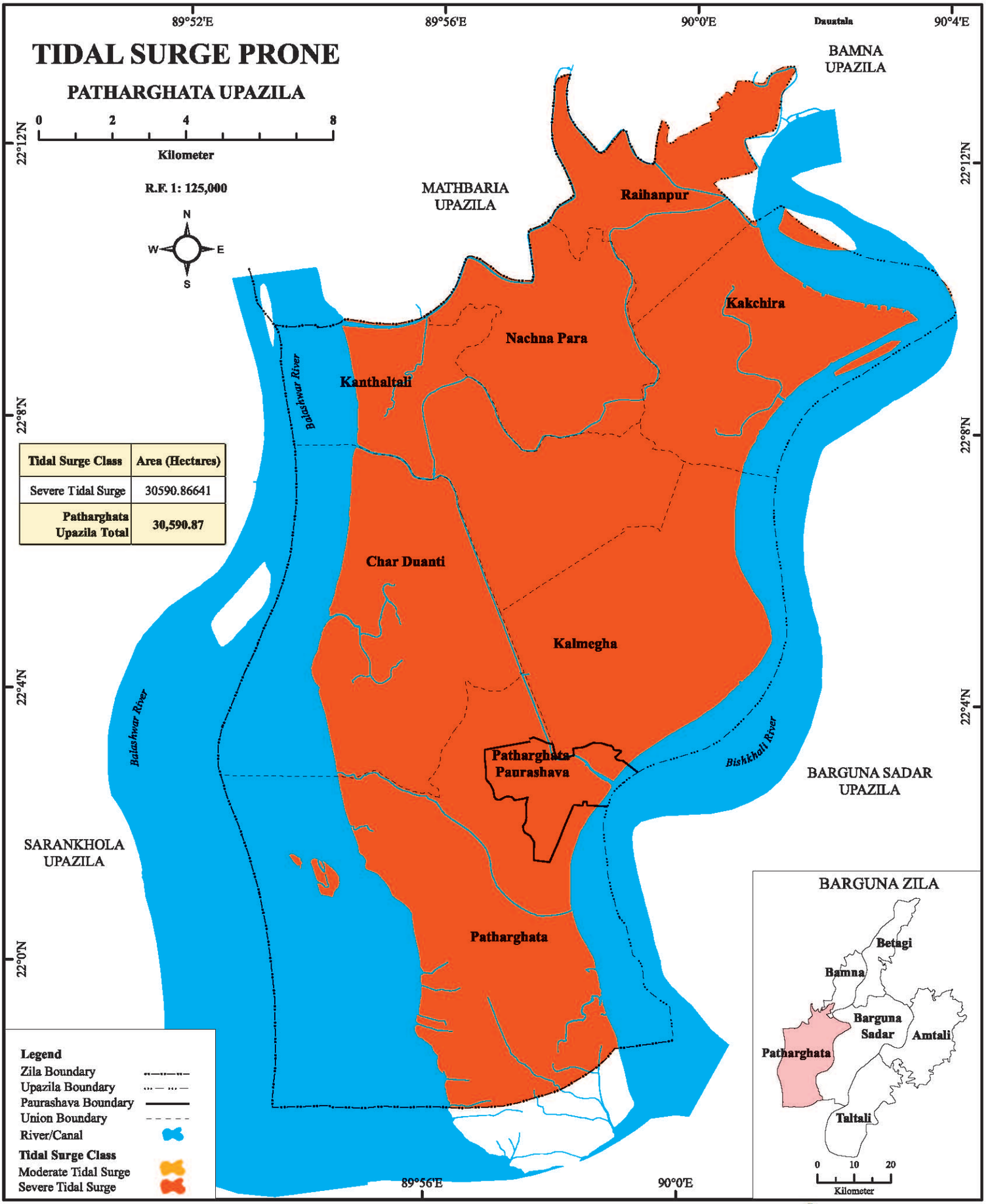
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



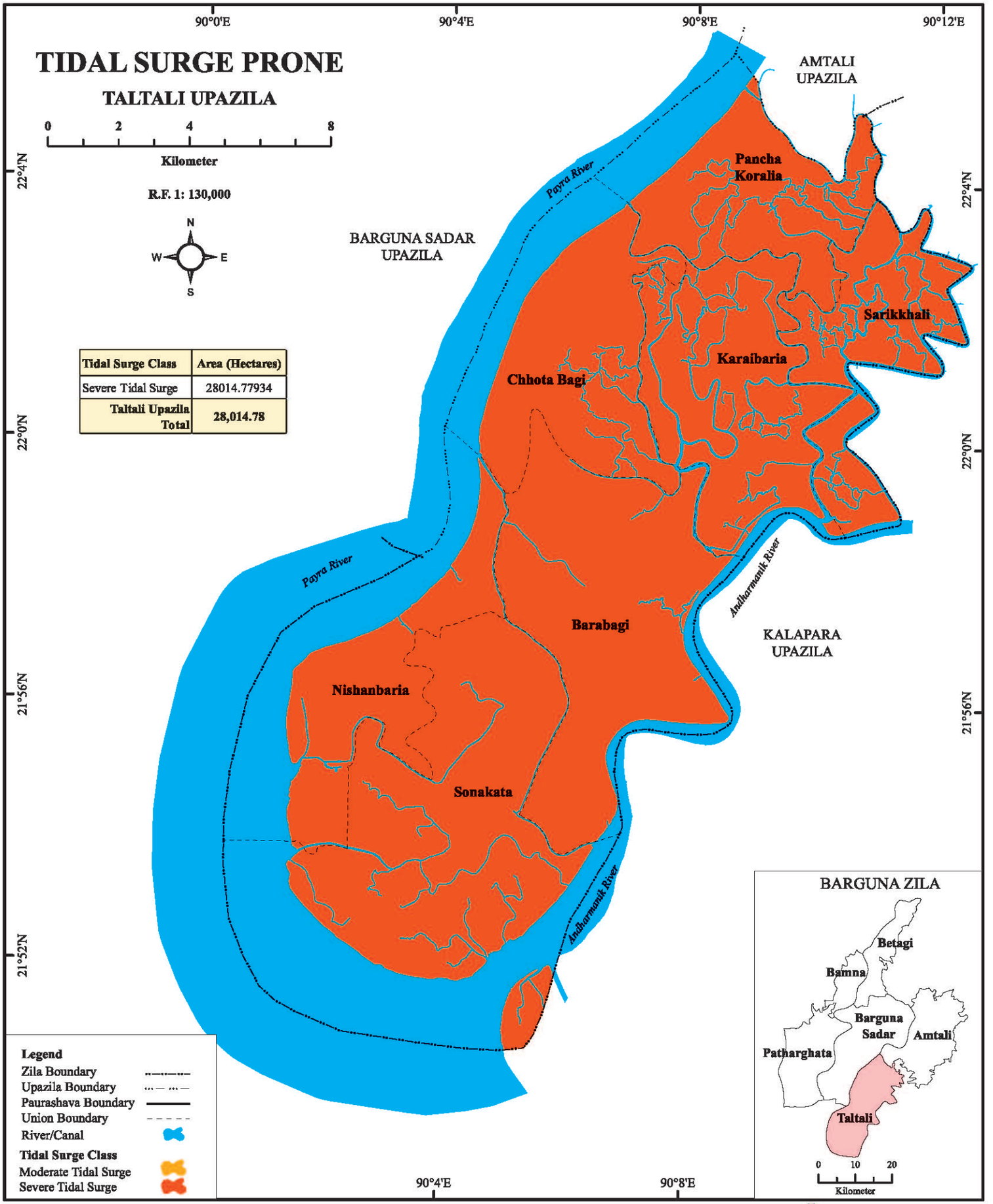
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

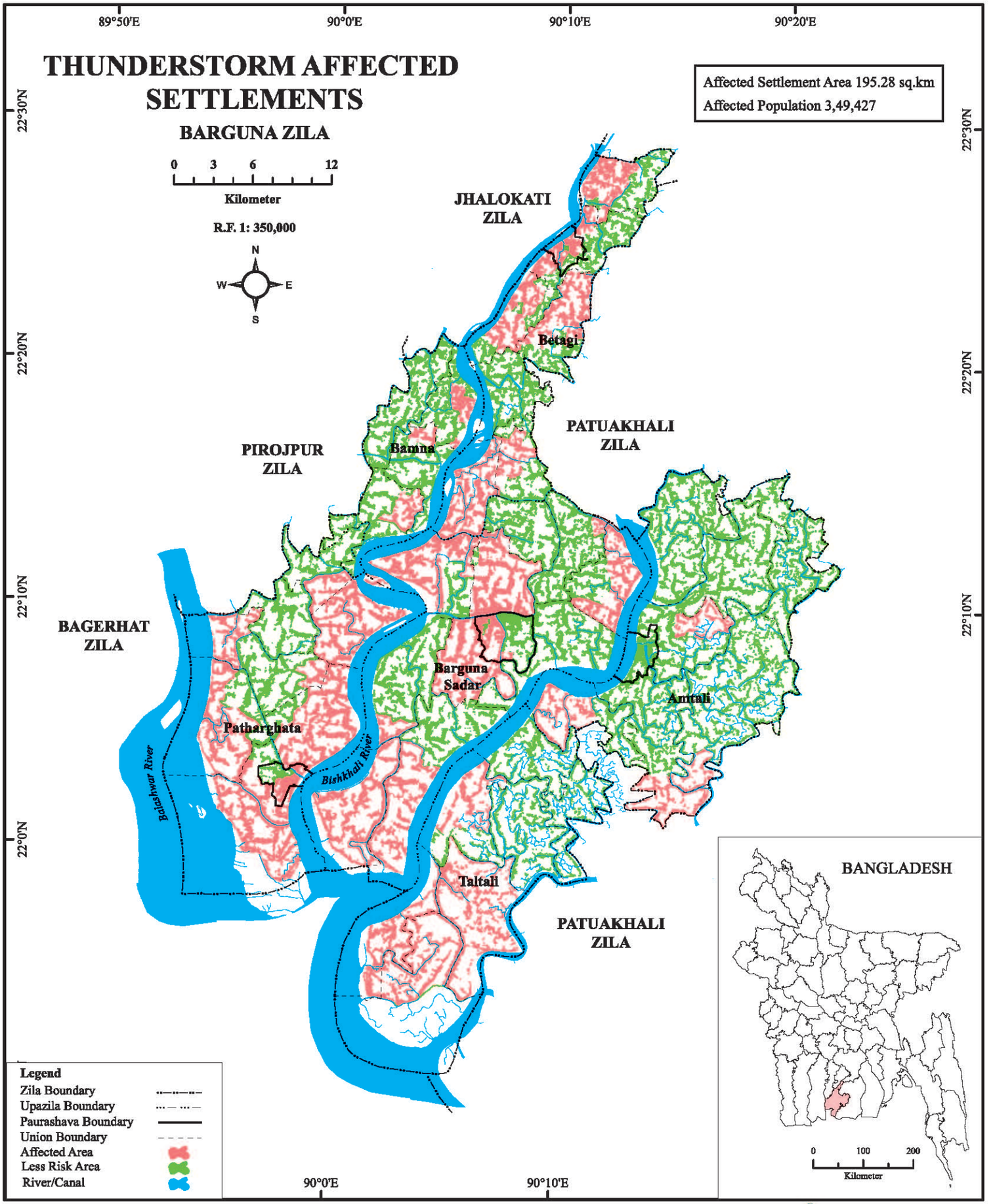
Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

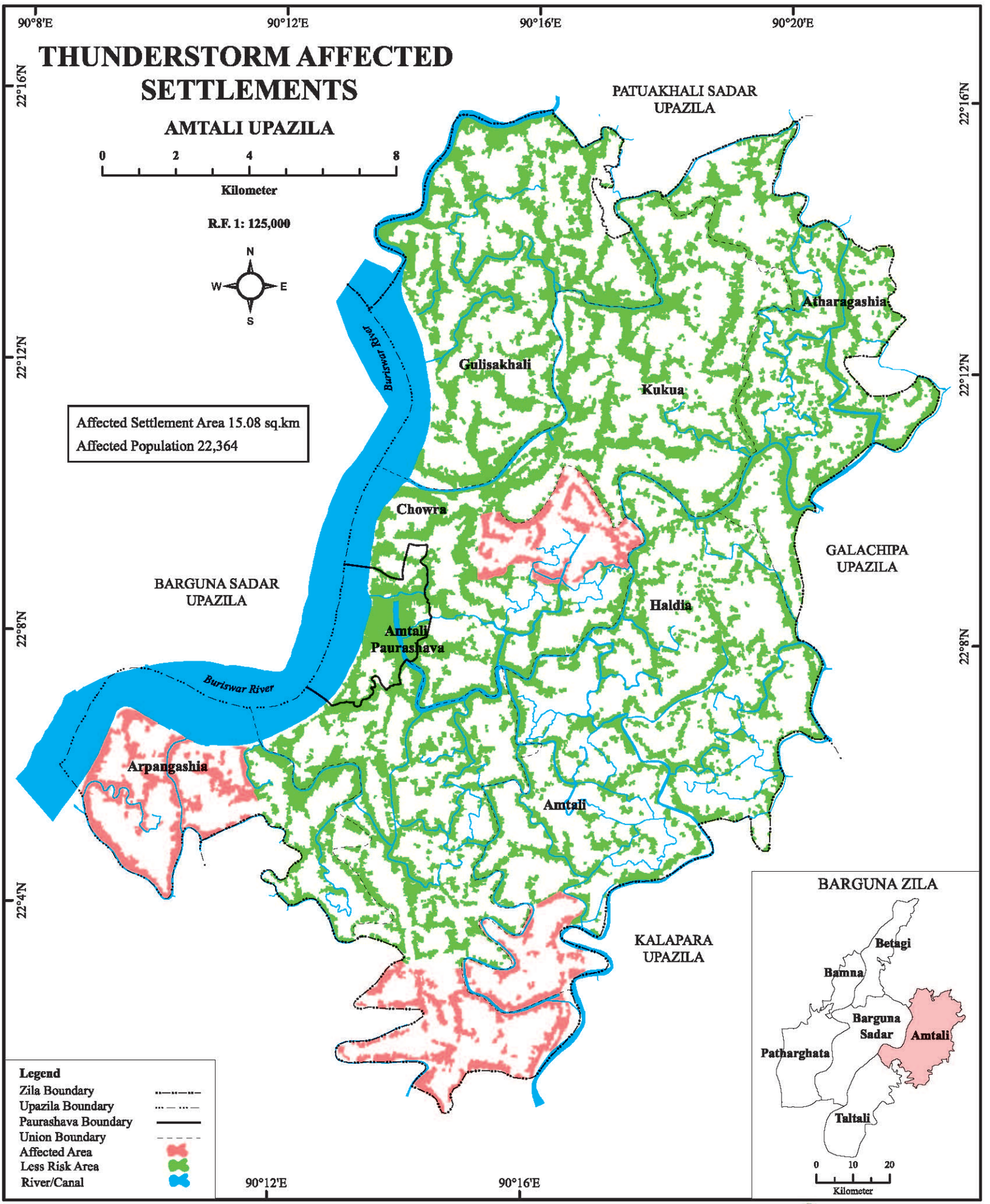
Stat4Dev. Project, BBS 2017

Thunderstorm Affected Area Map



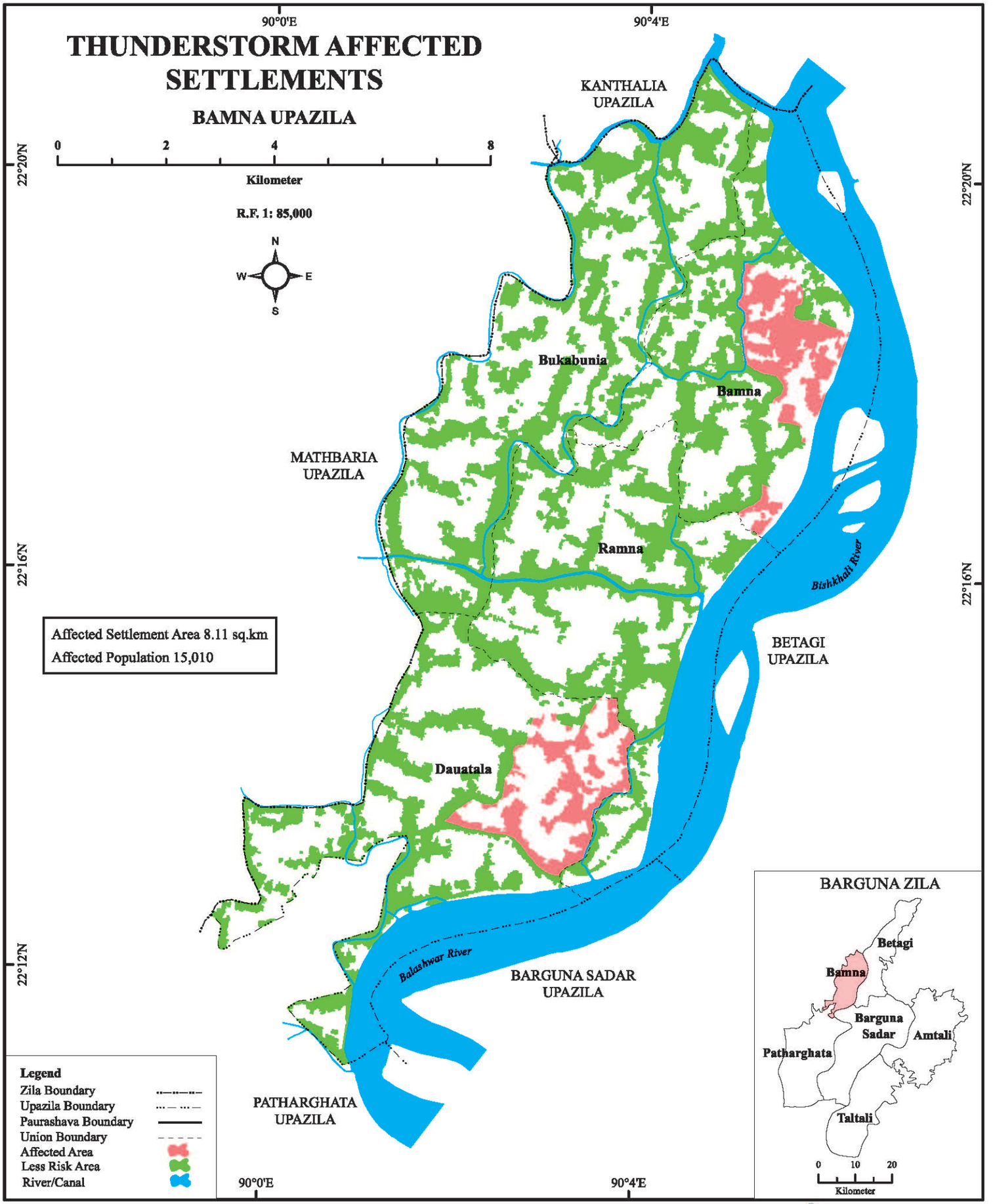
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



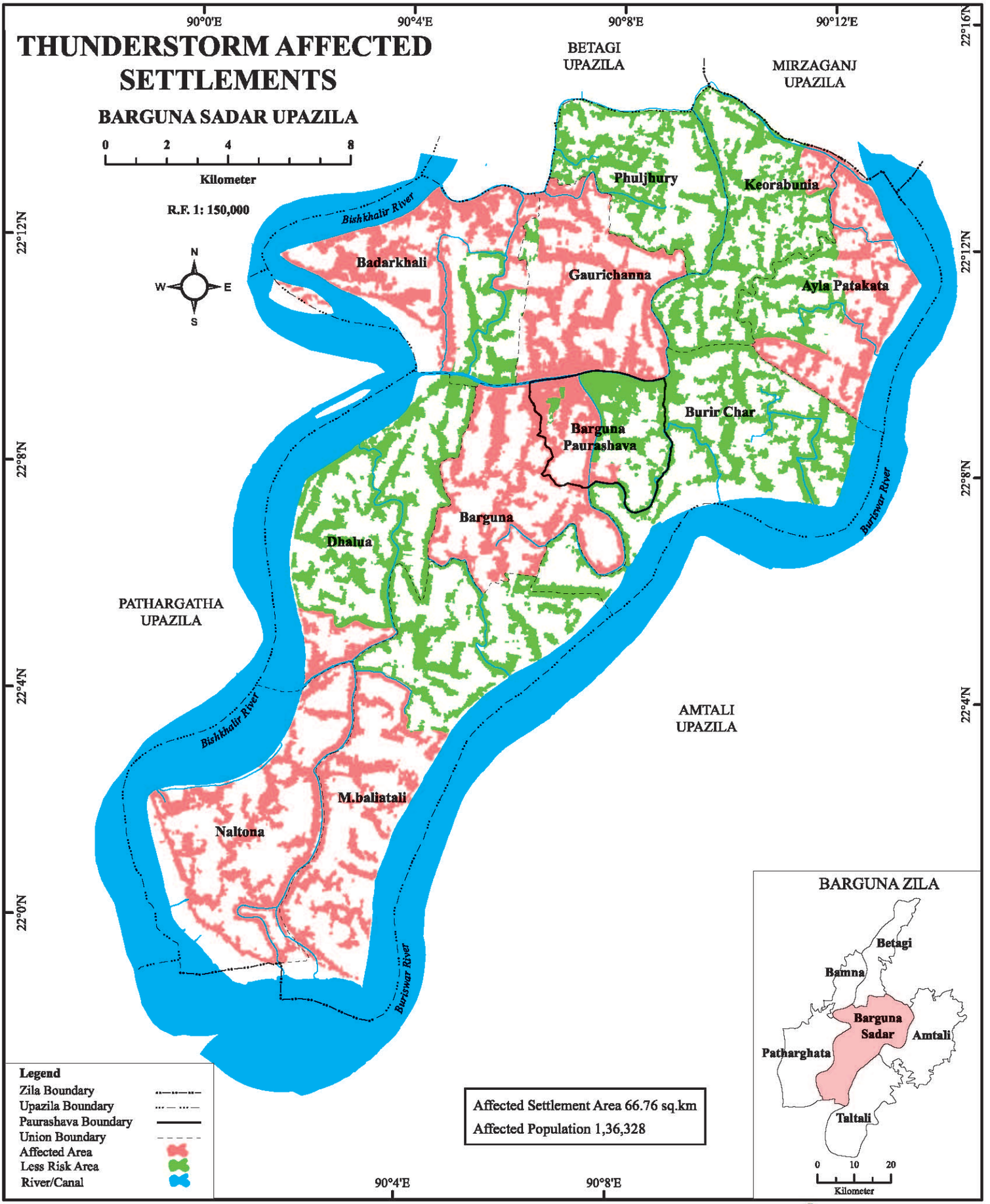
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



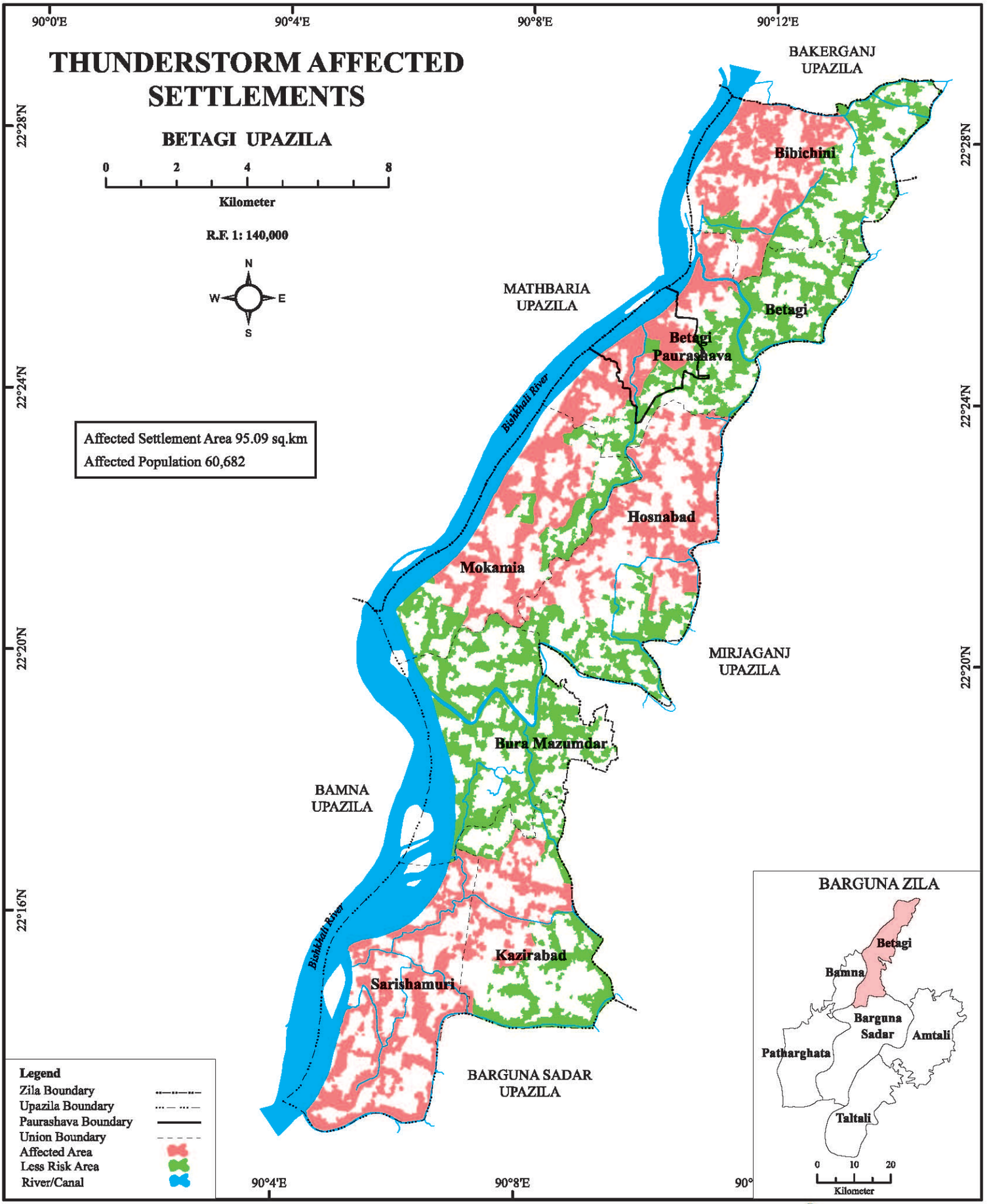
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



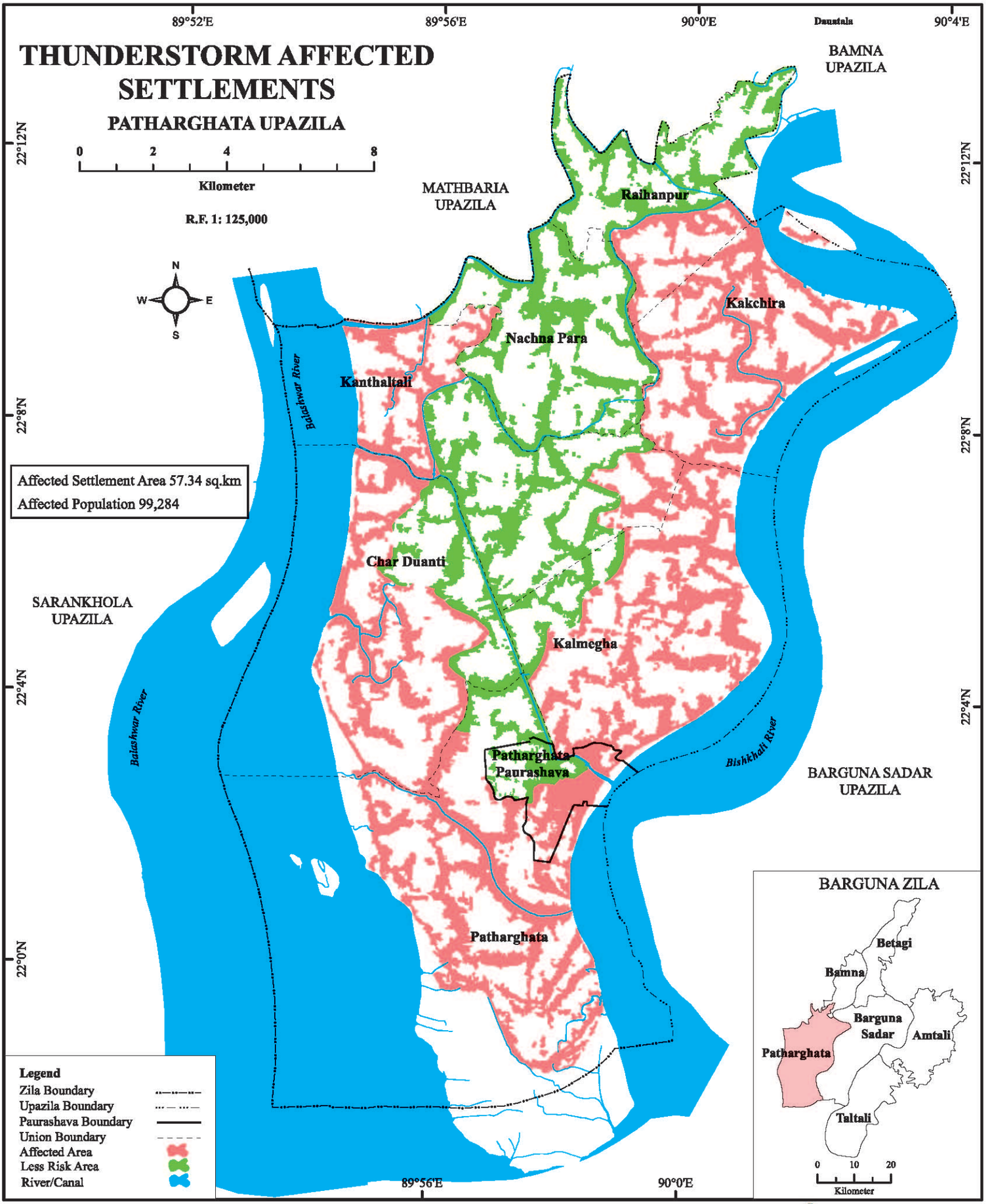
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



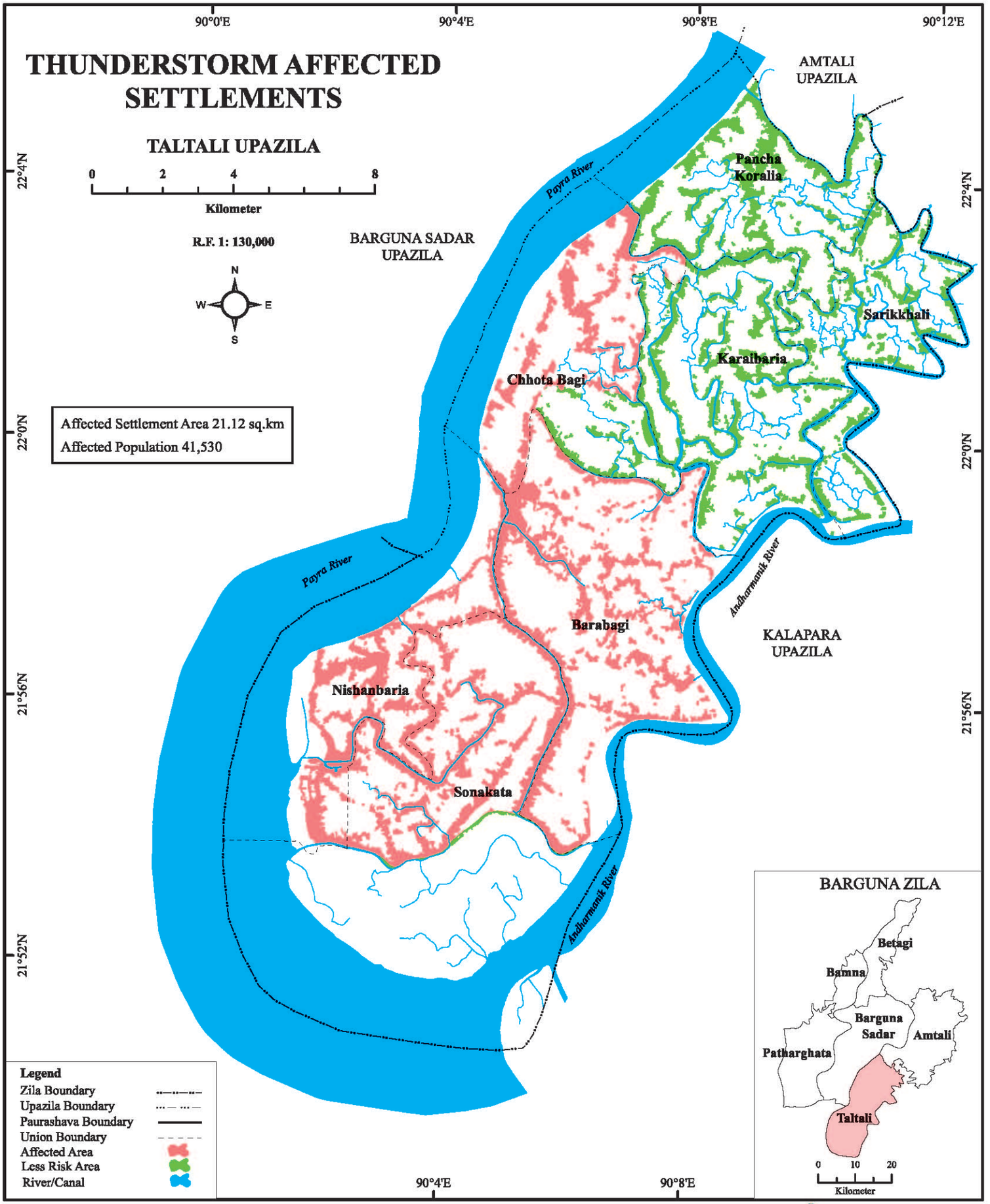
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

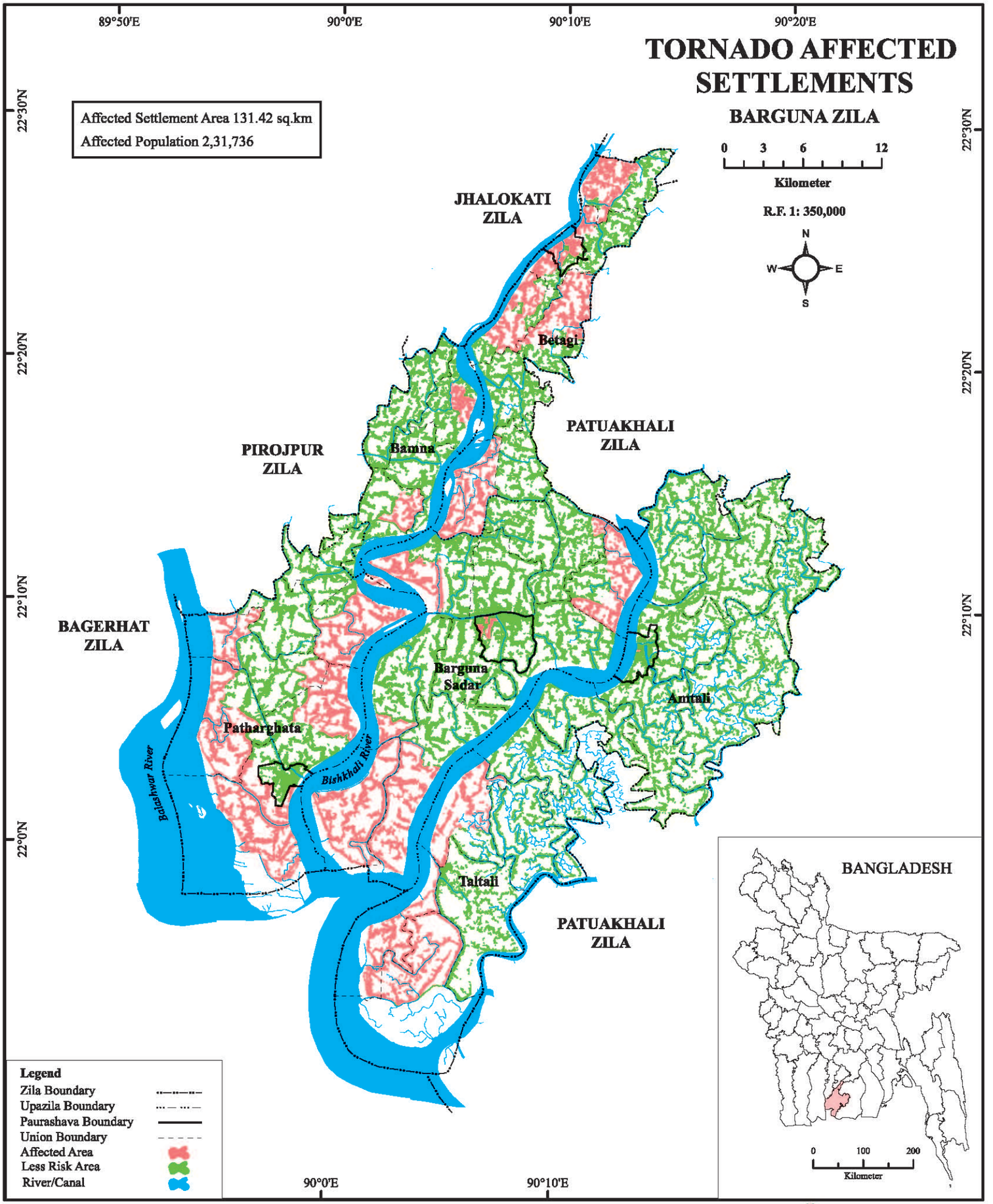
Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

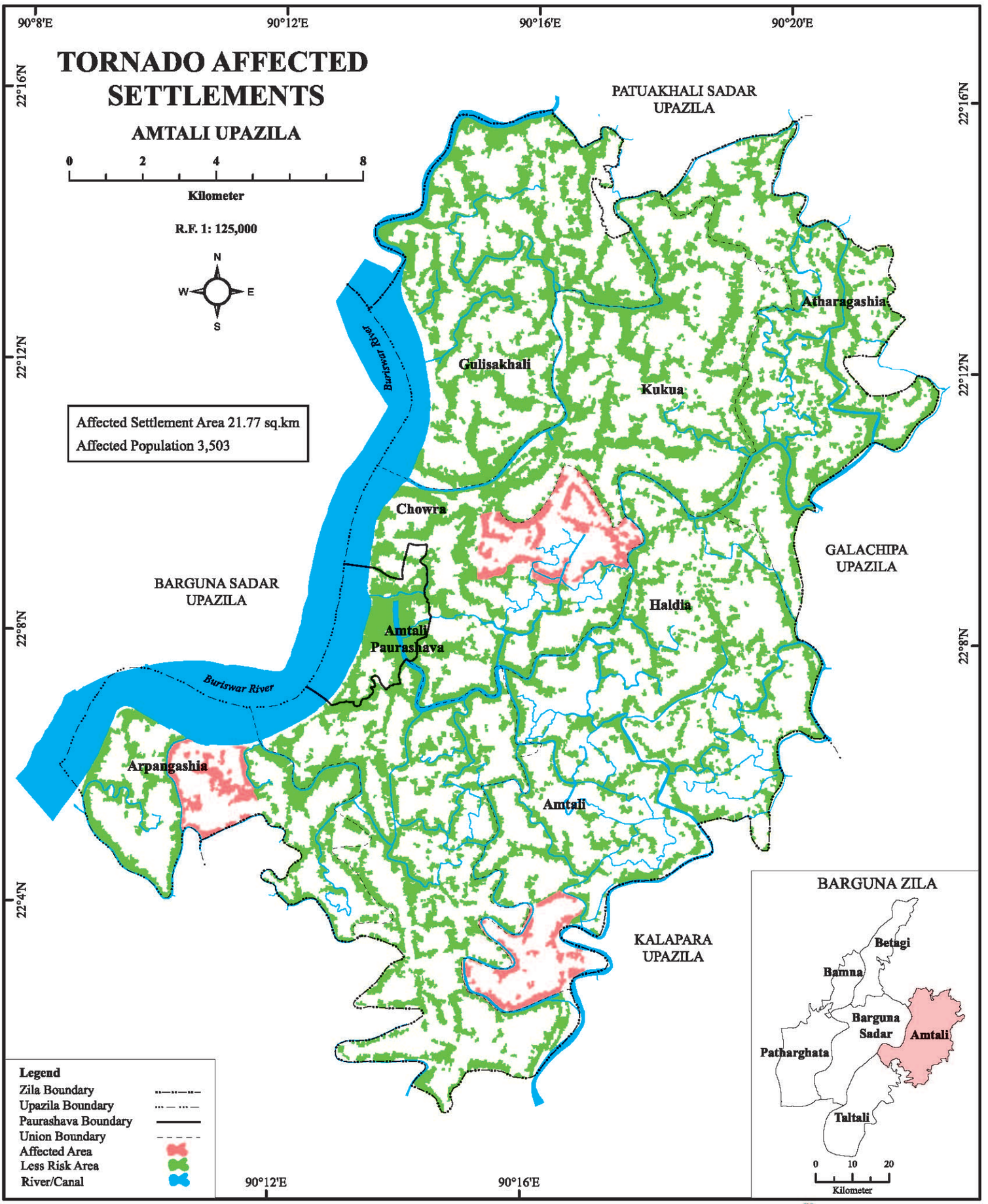
Stat4Dev. Project, BBS 2017

Tornado Affected Area Map



Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



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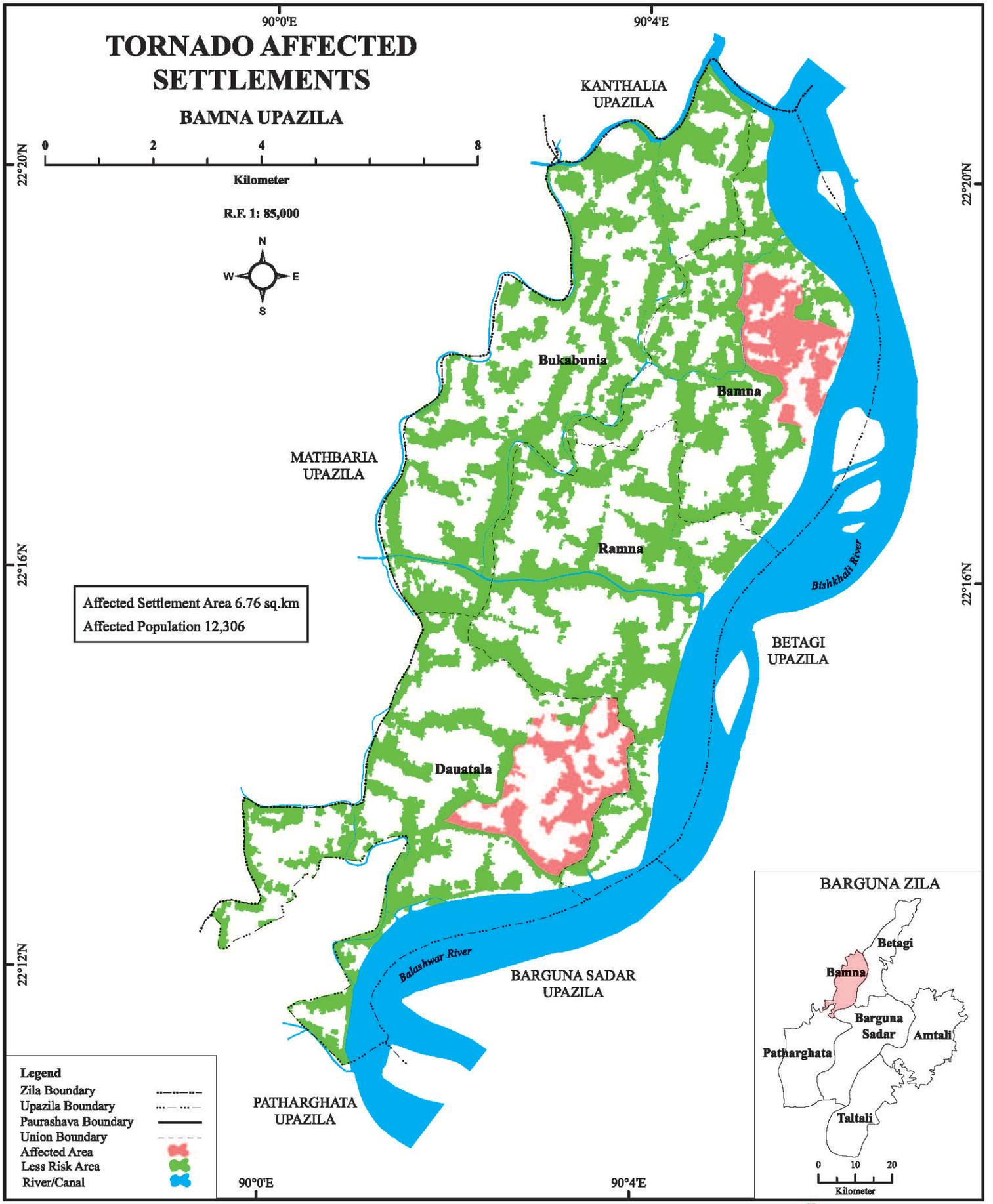
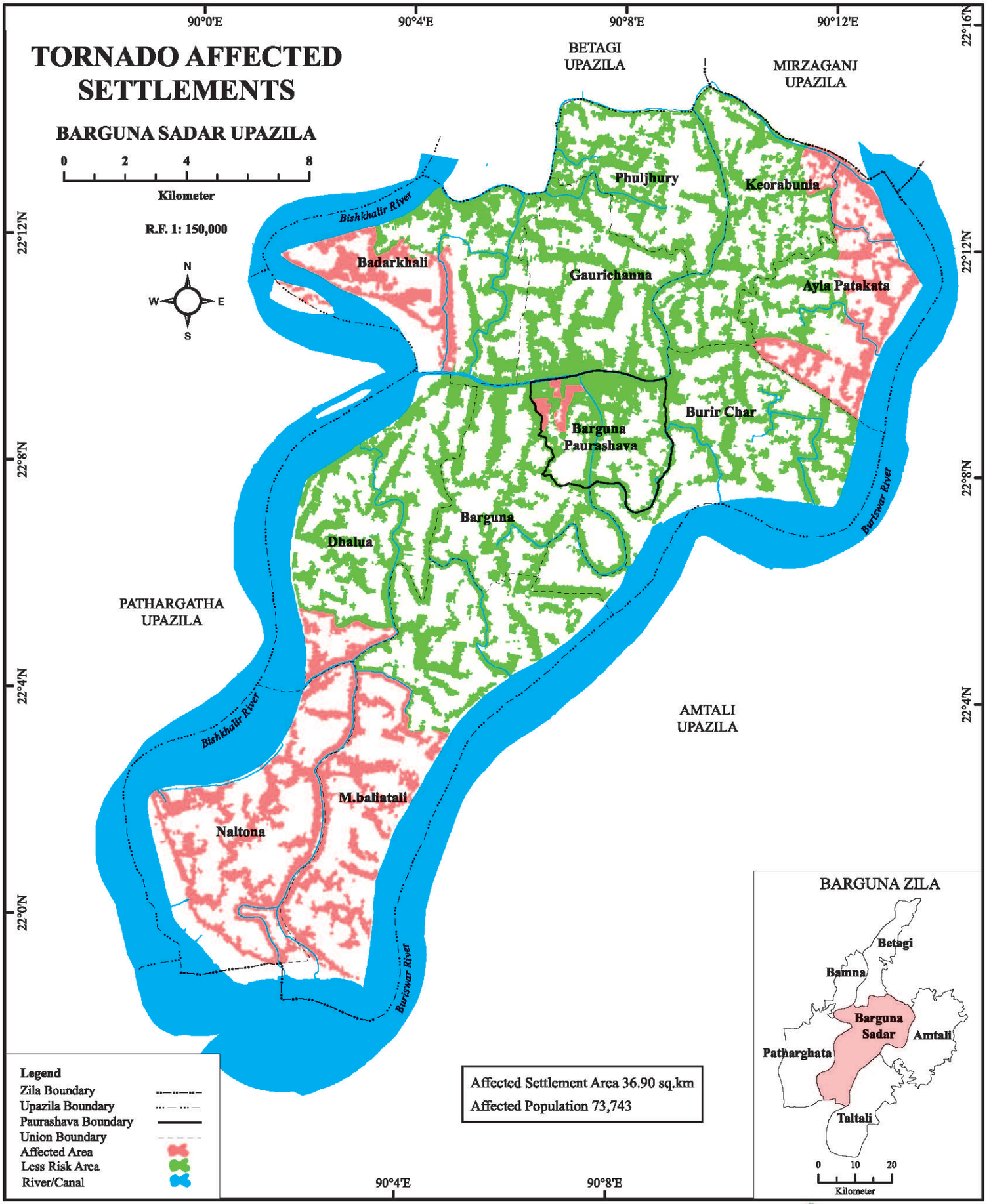
Stat4Dev. Project, BBS 2017



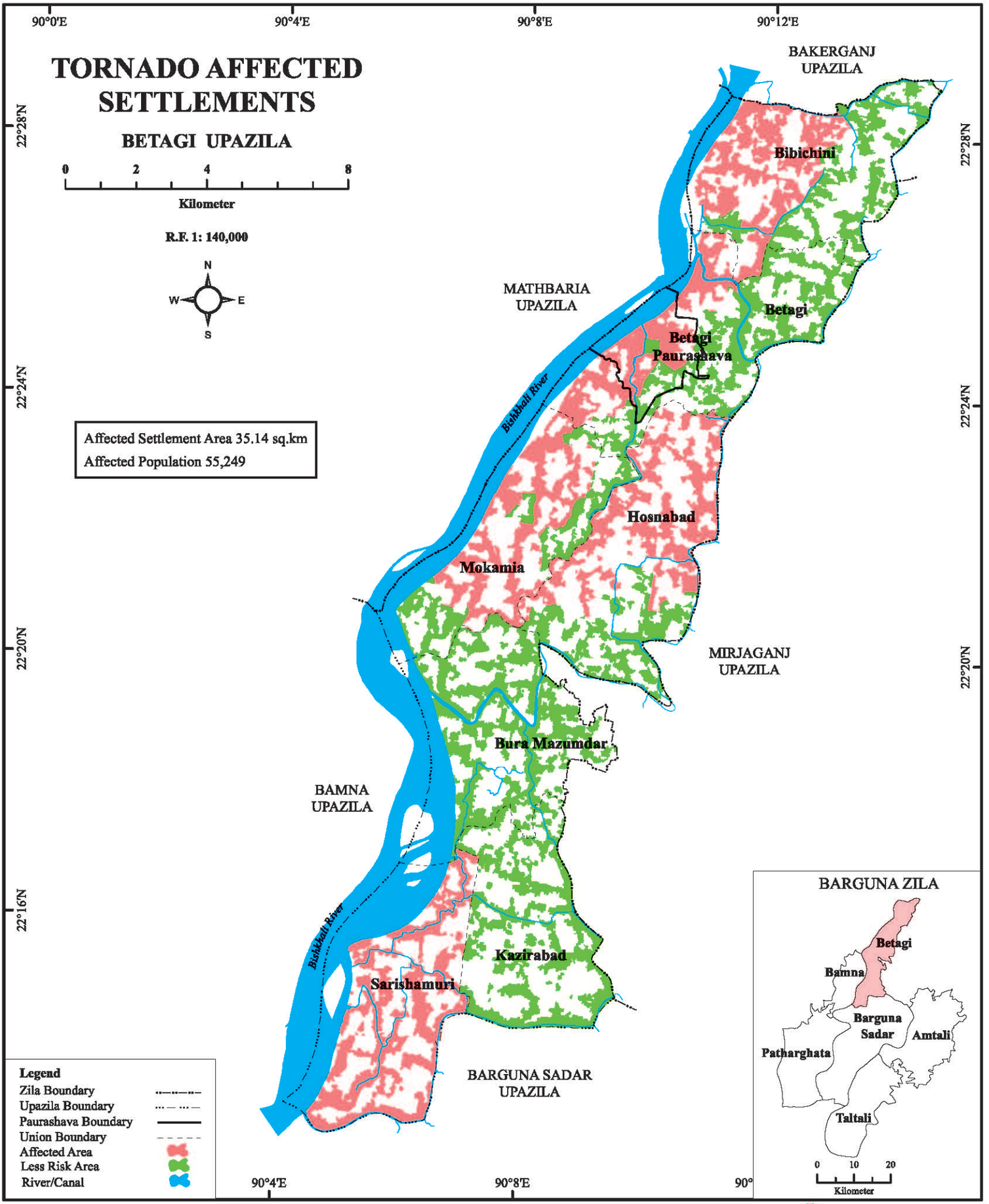
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



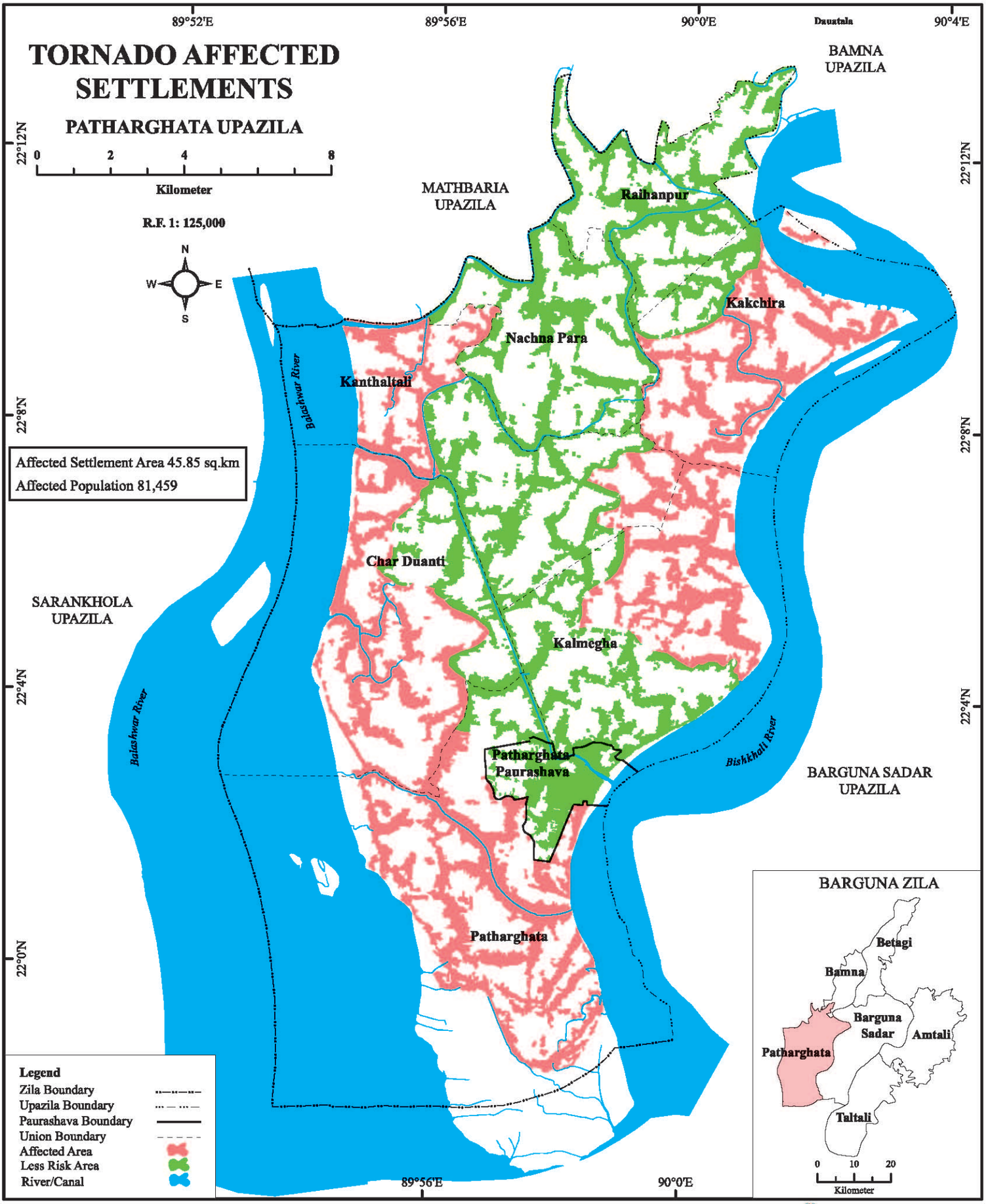
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



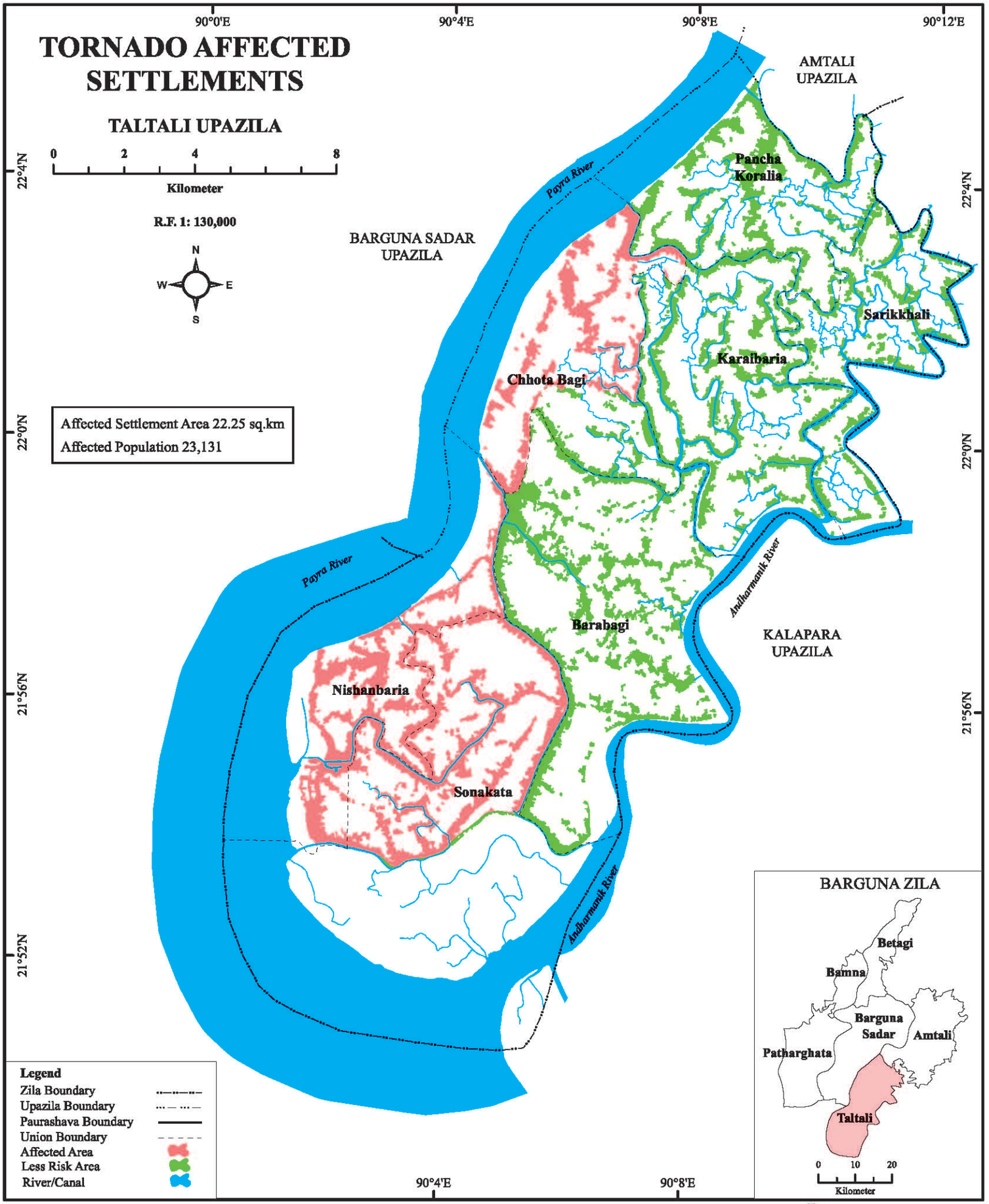
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

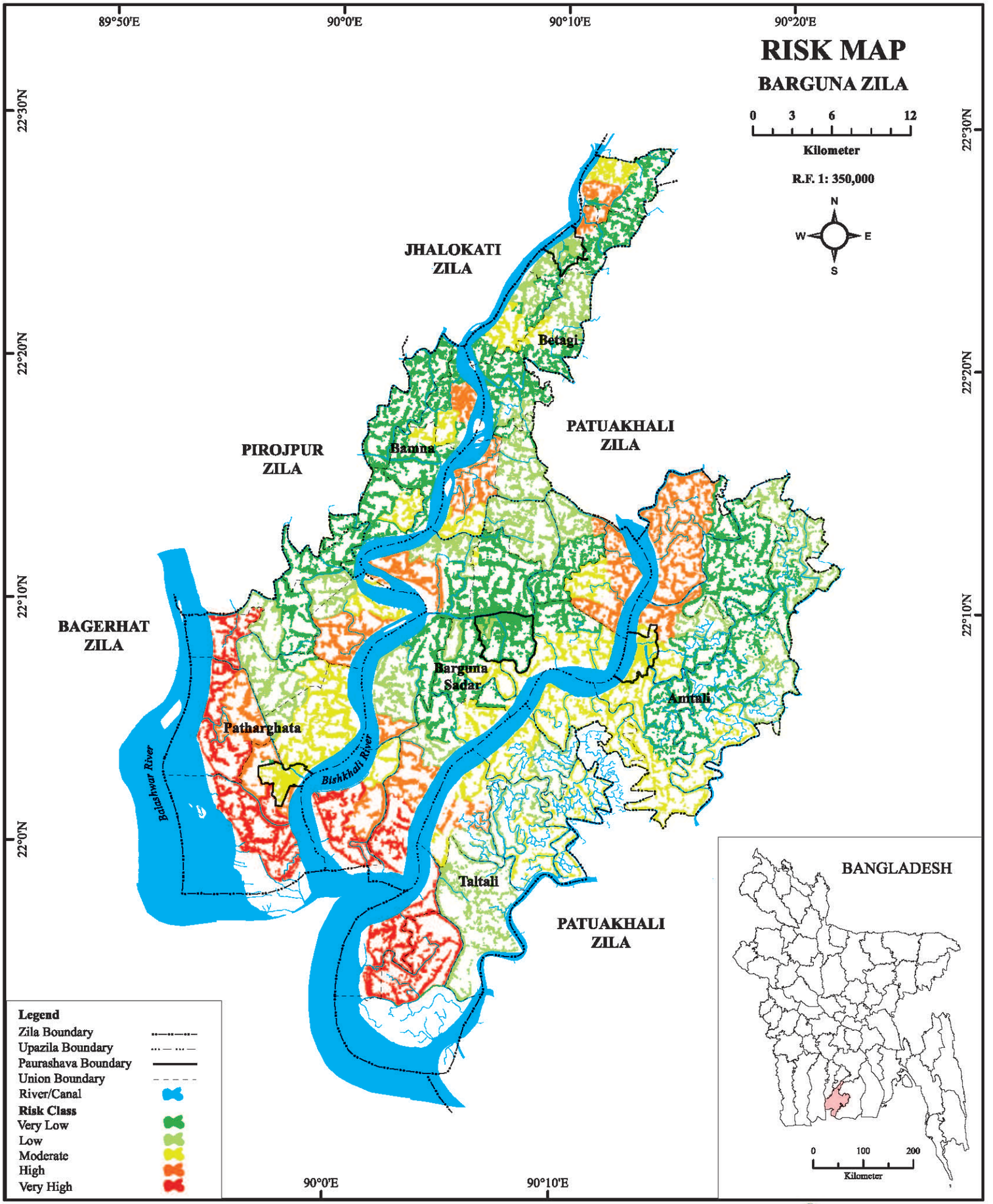
Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

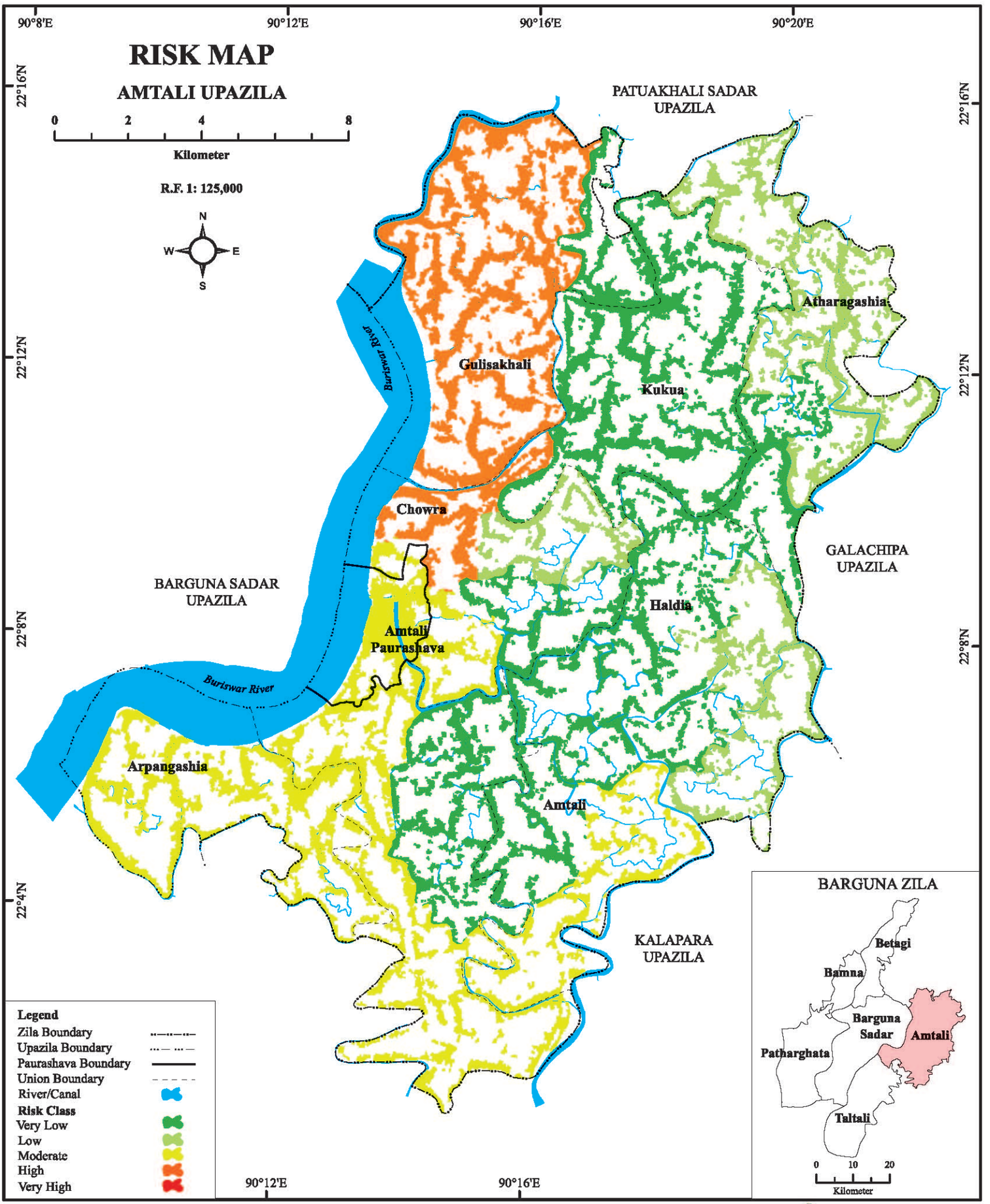
Stat4Dev. Project, BBS 2017

Risk Mapping Based on Settlements



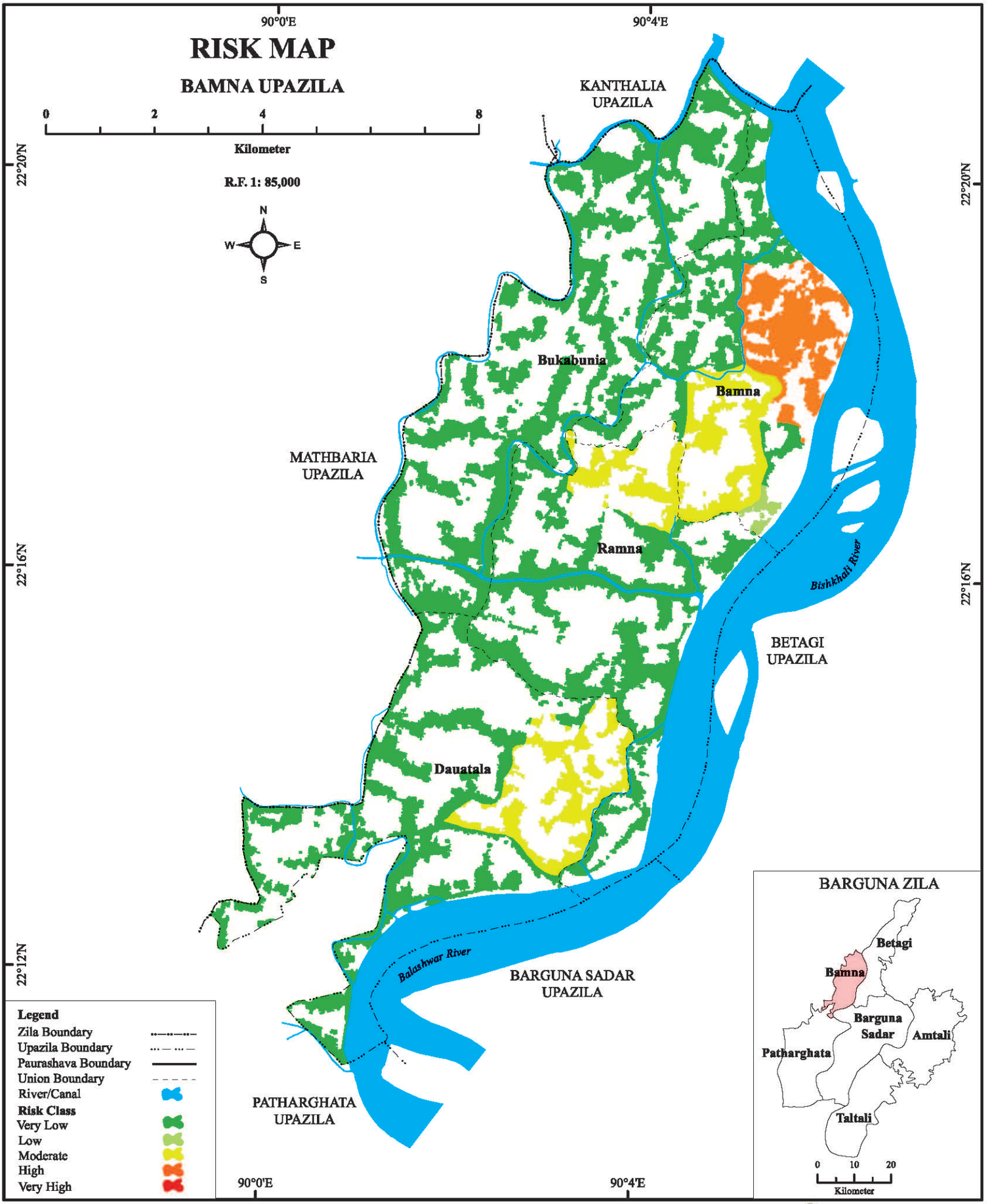
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



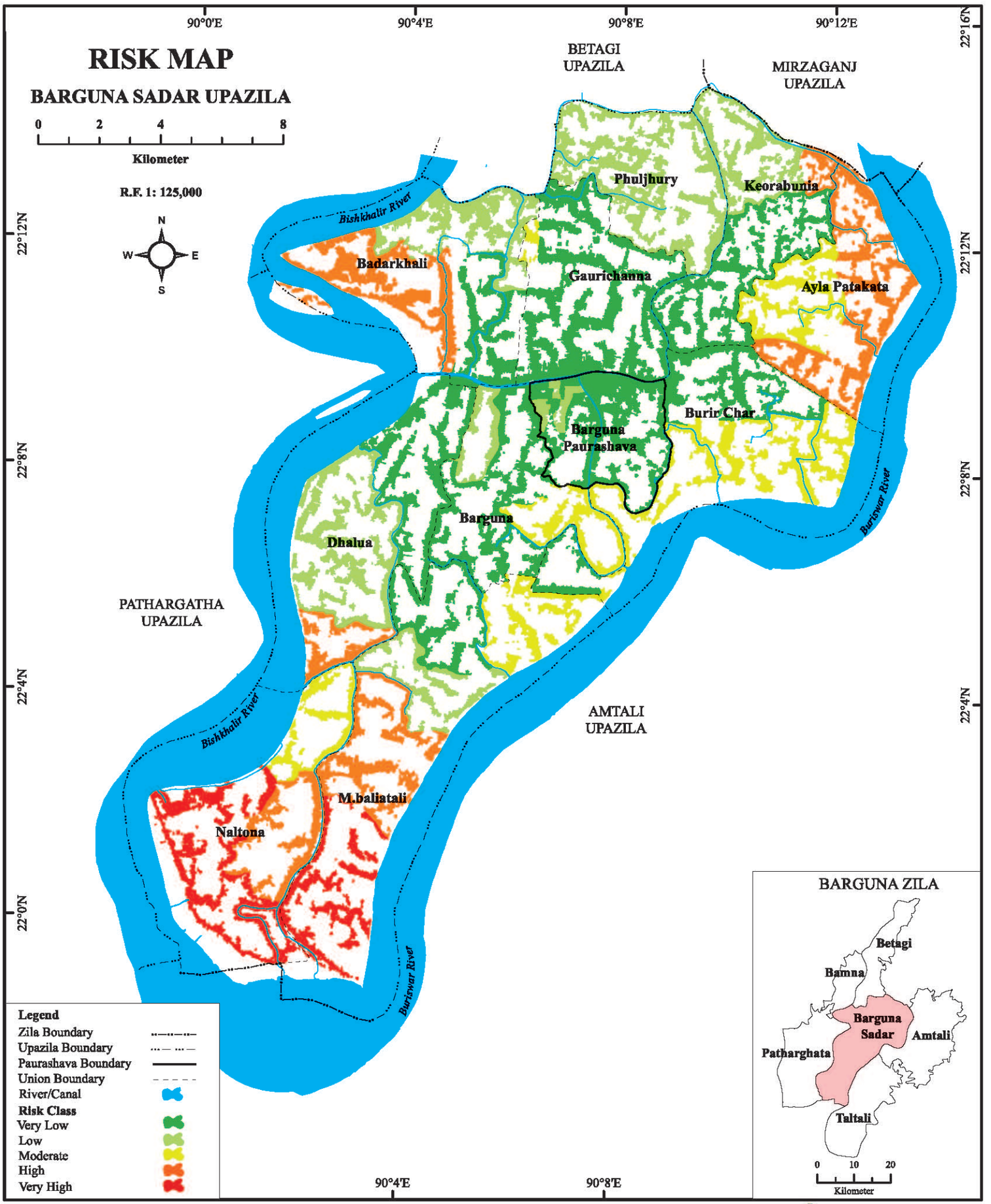
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



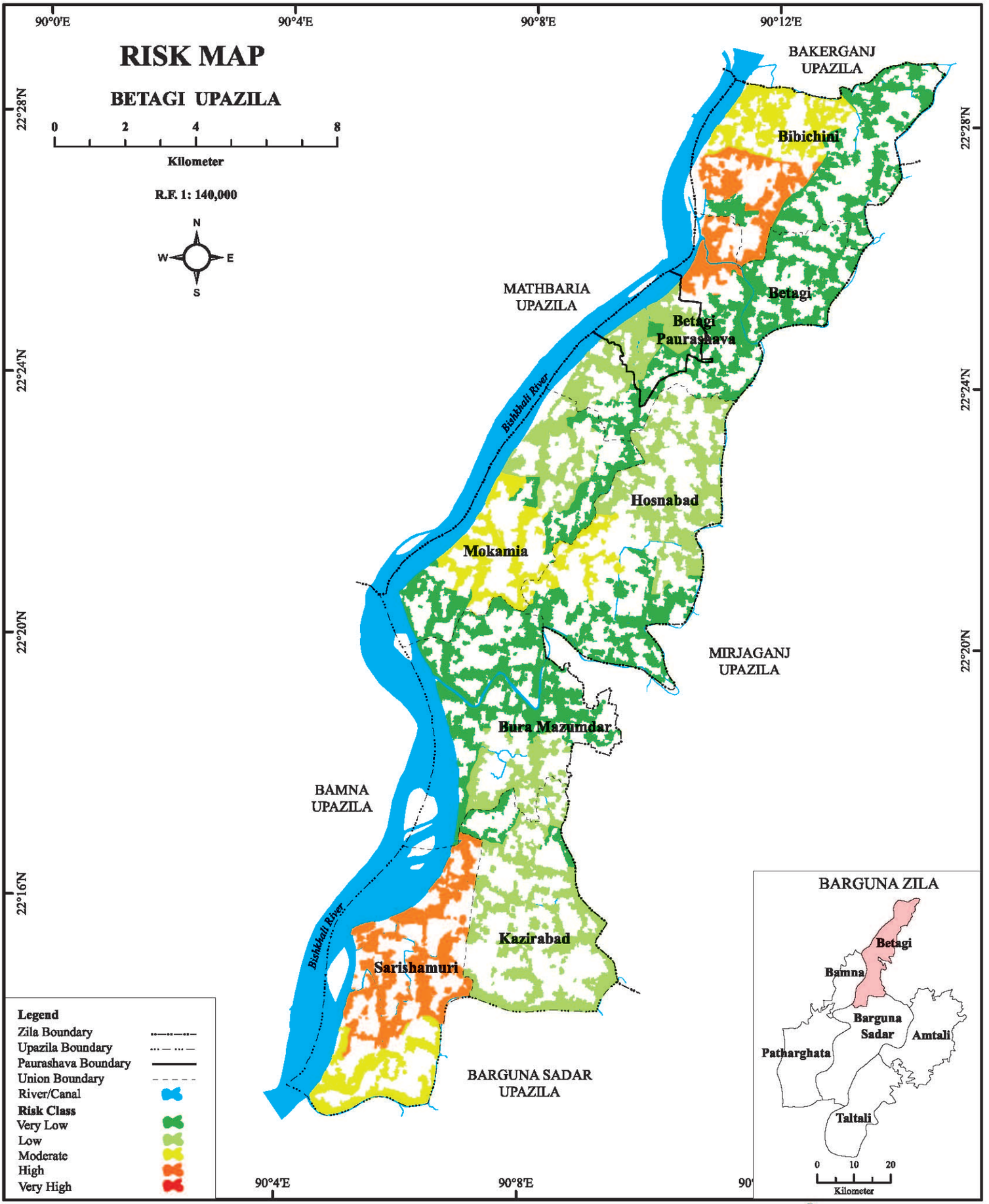
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



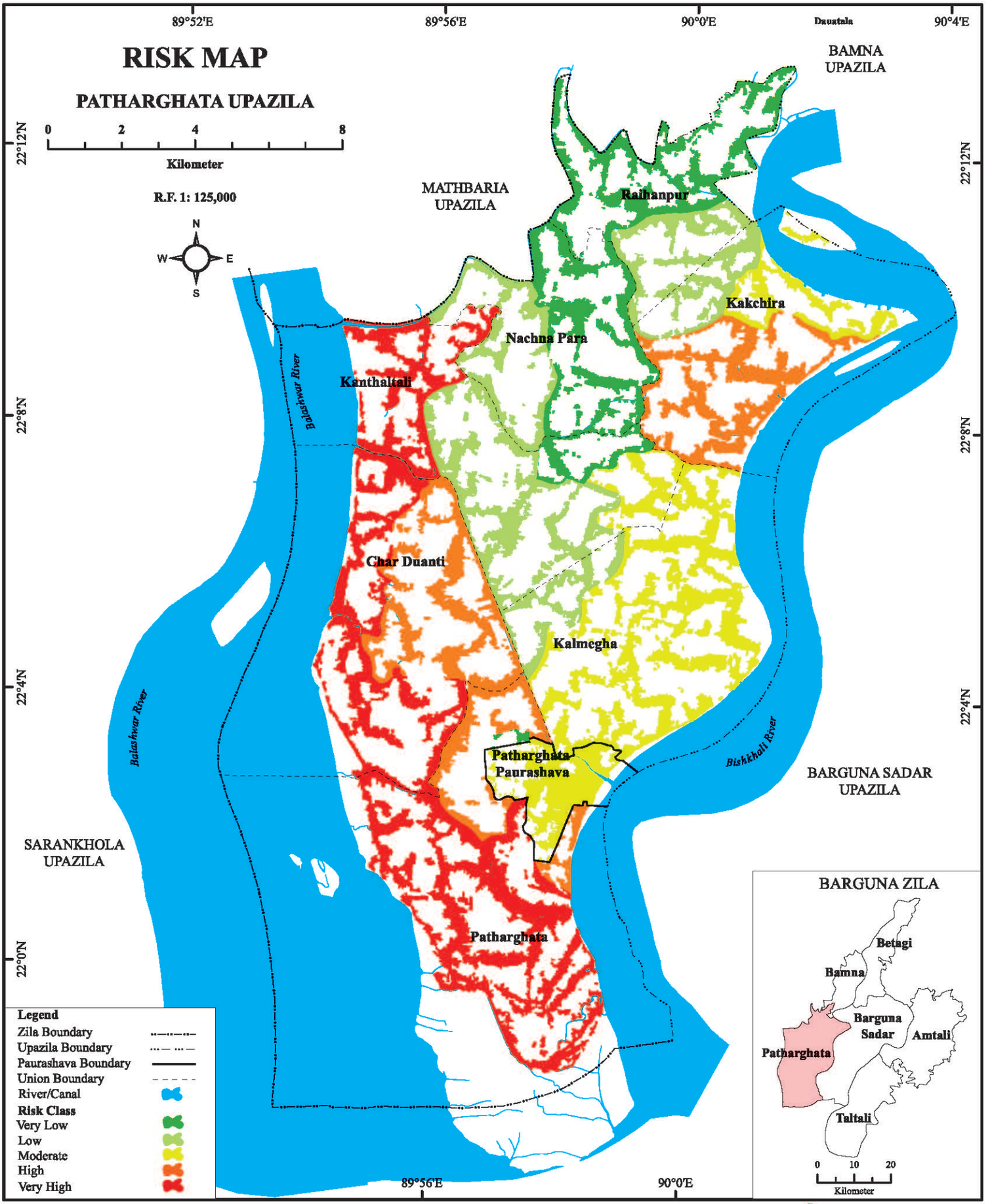
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



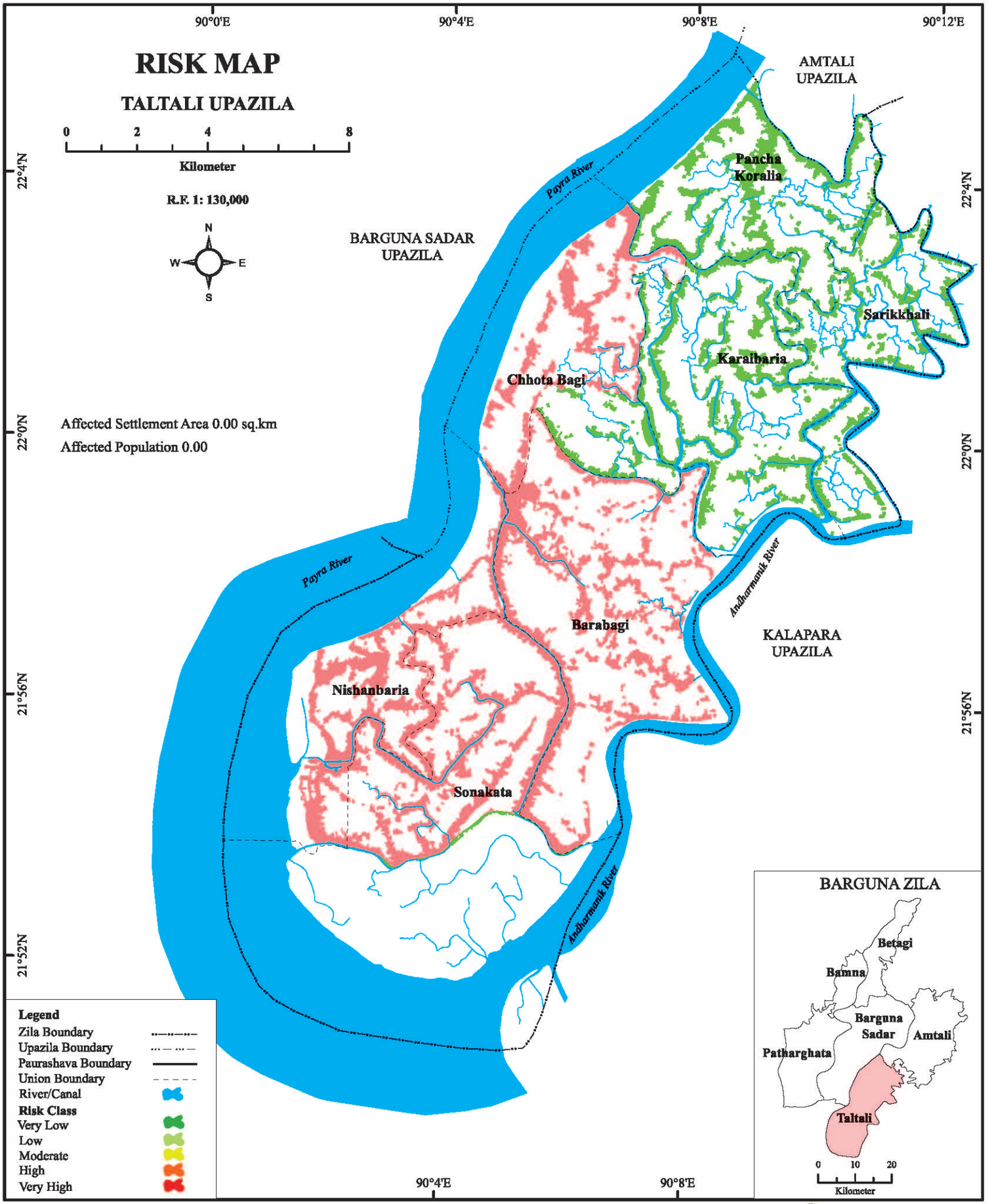
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

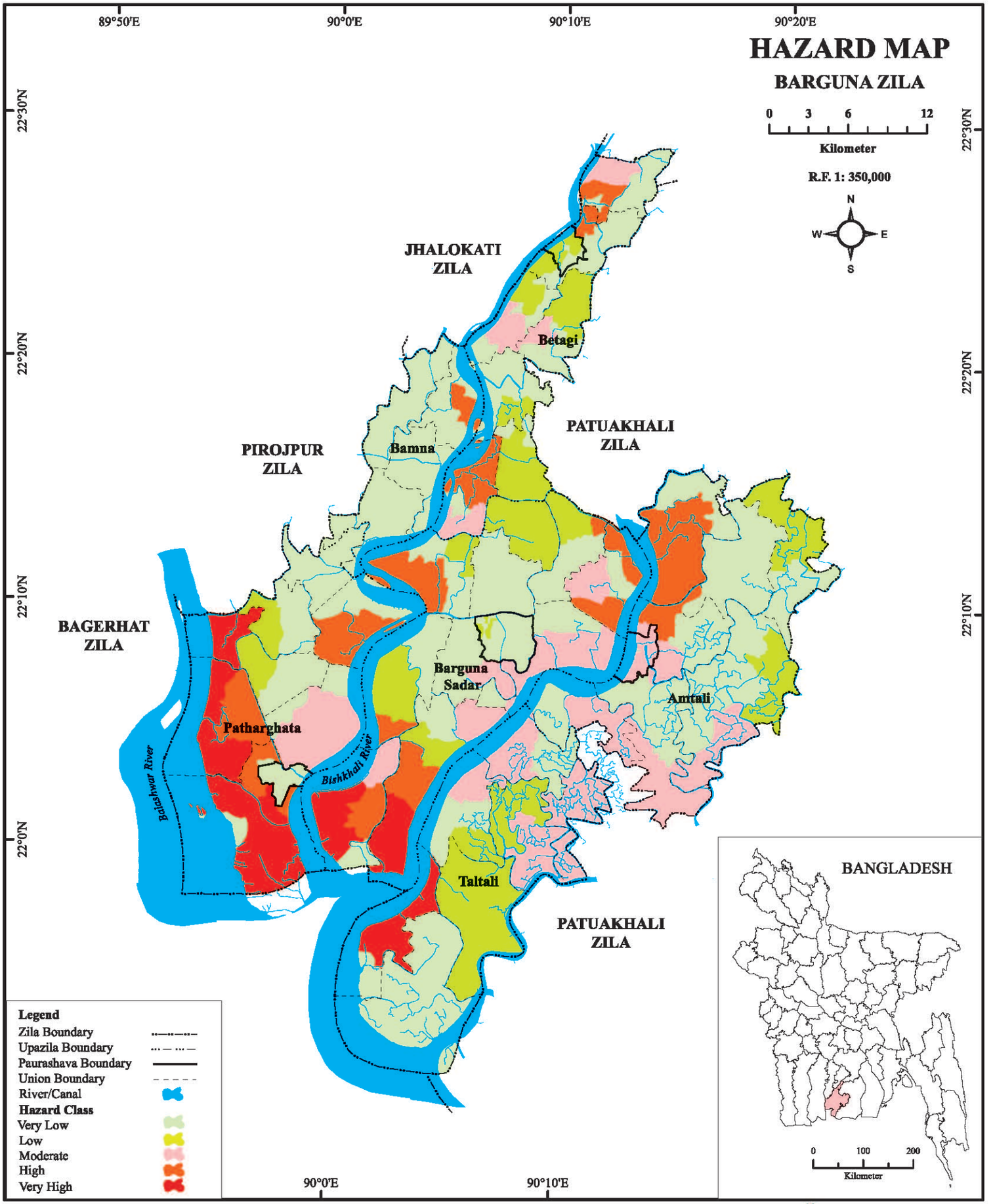
Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

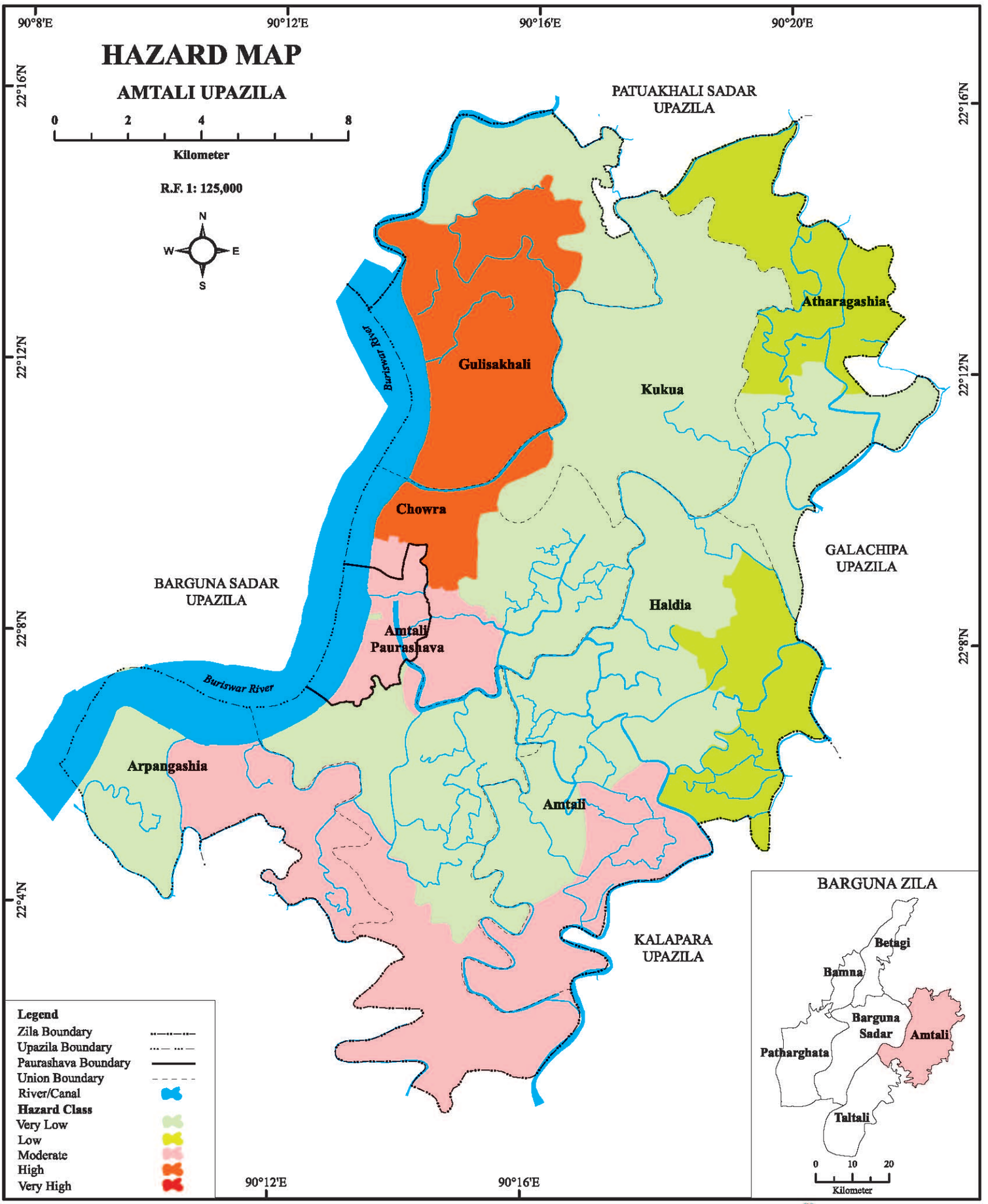
Stat4Dev. Project, BBS 2017

Hazard Mapping
by Mauza



Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



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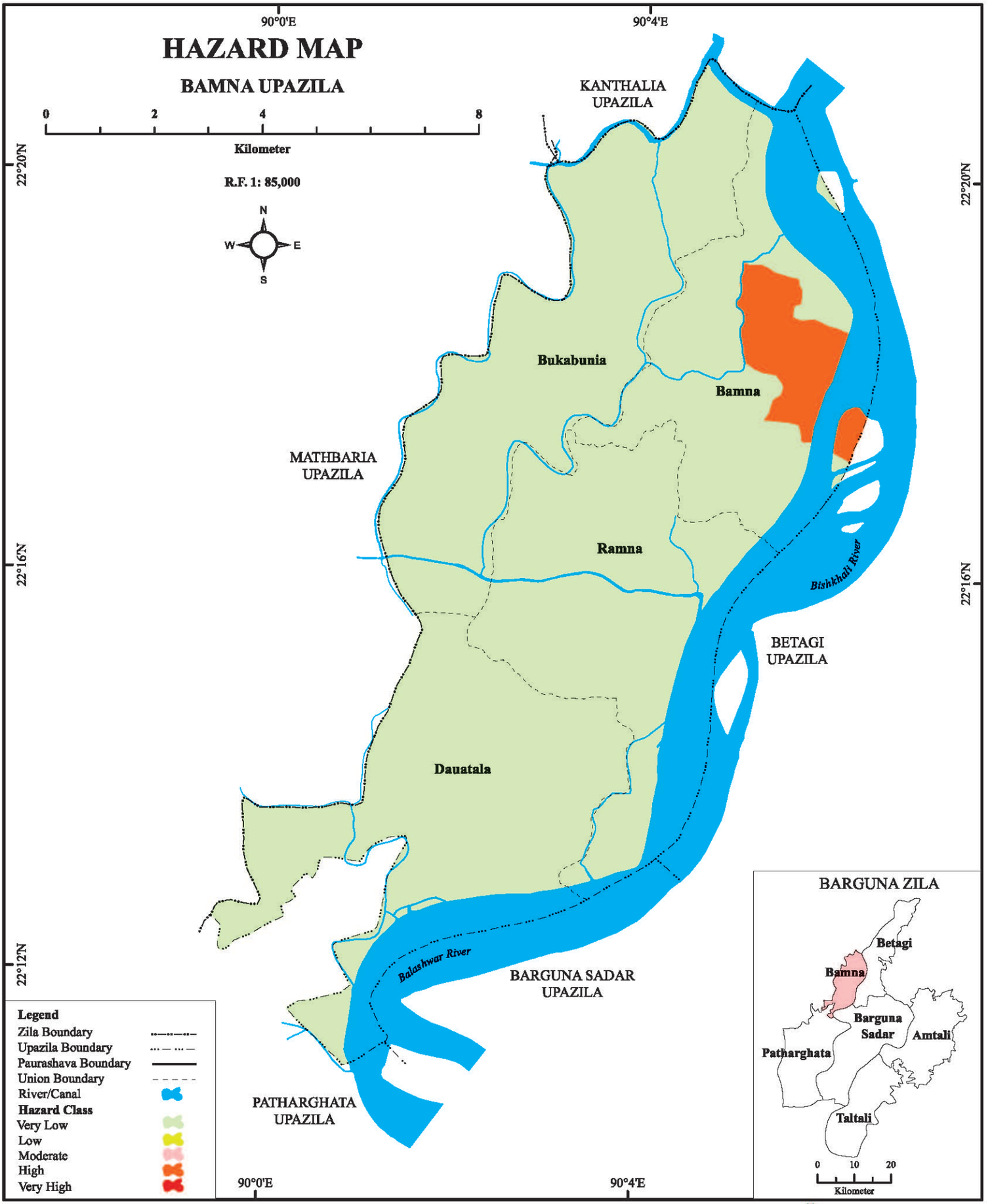
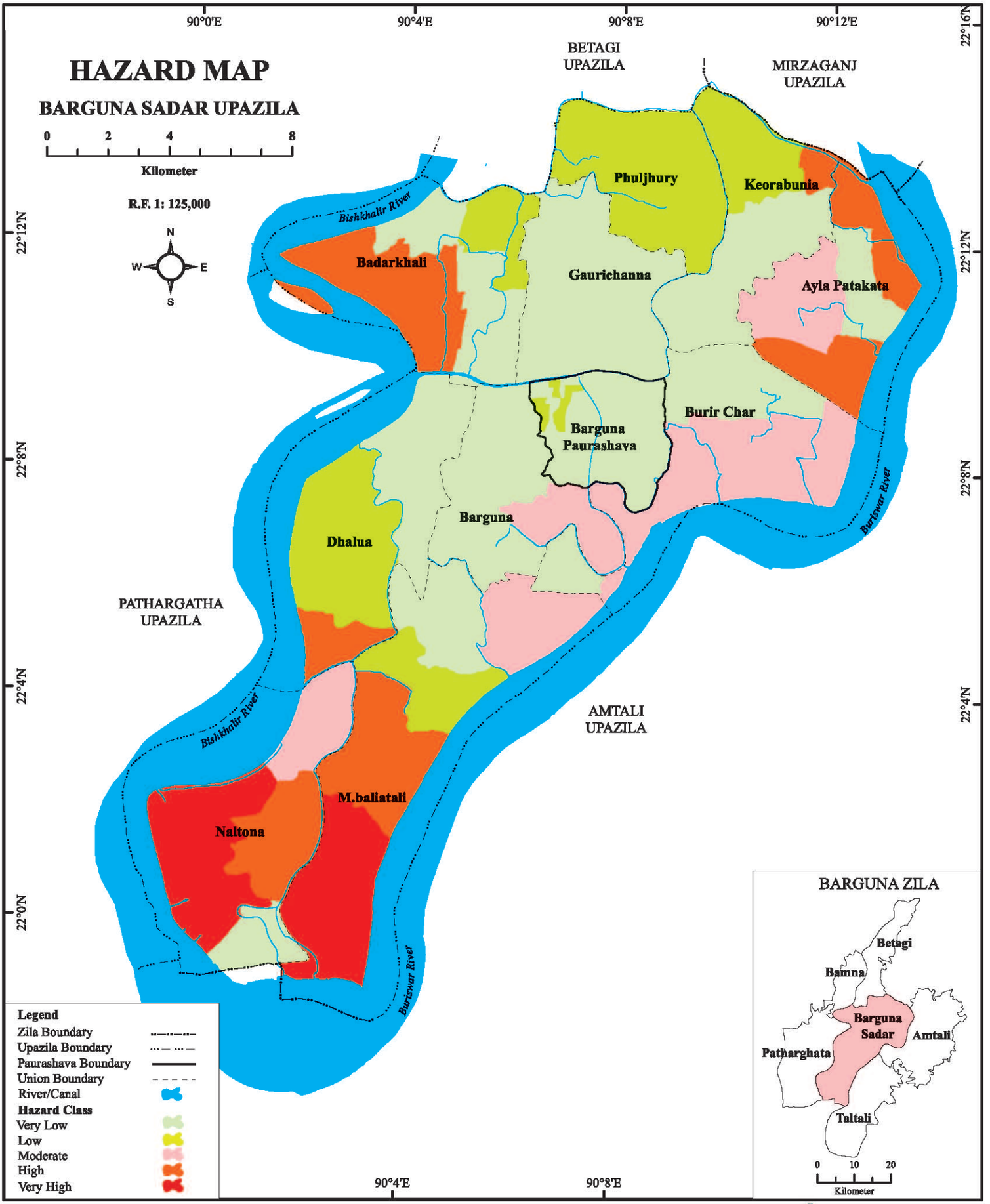
Stat4Dev. Project, BBS 2017



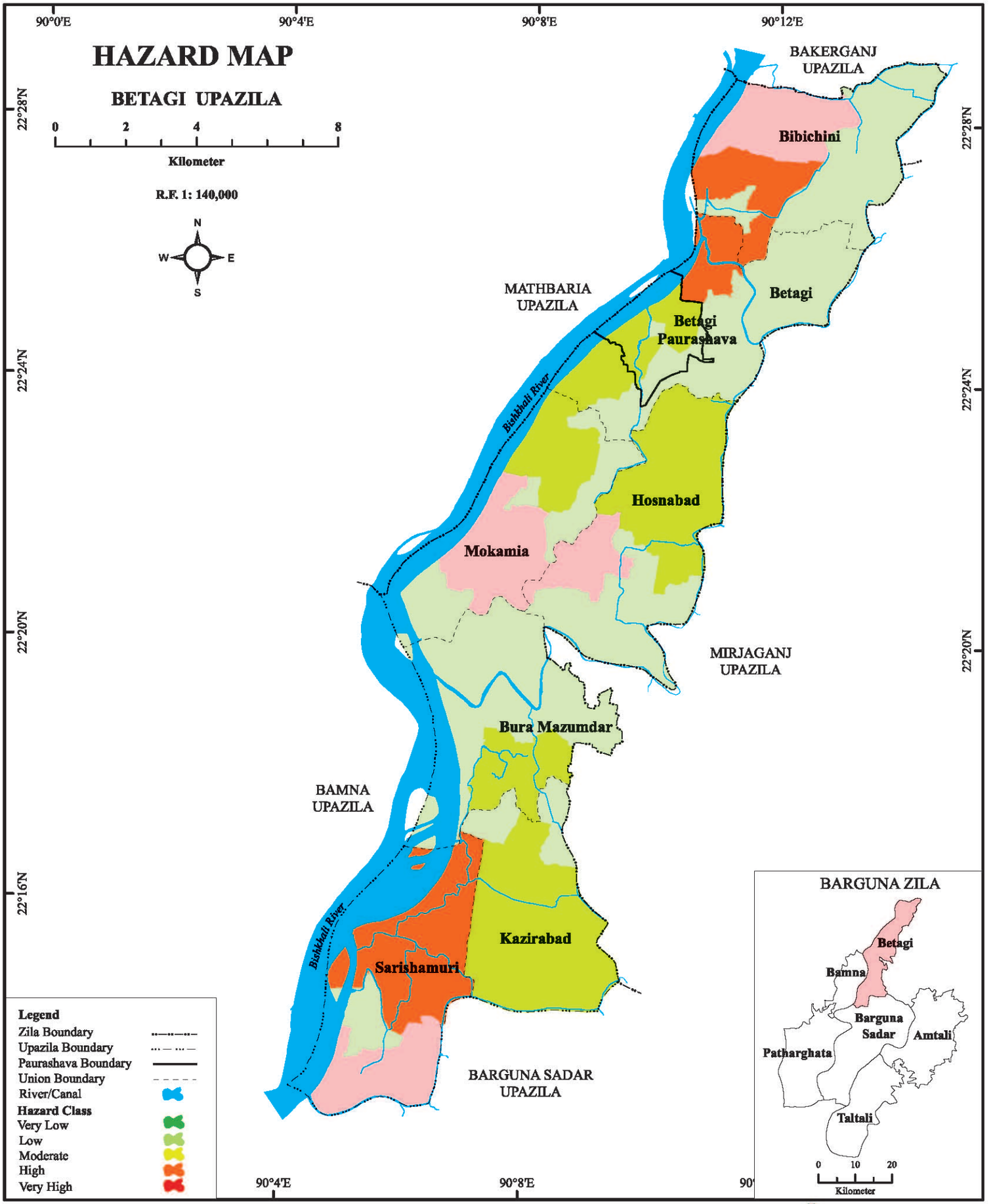
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



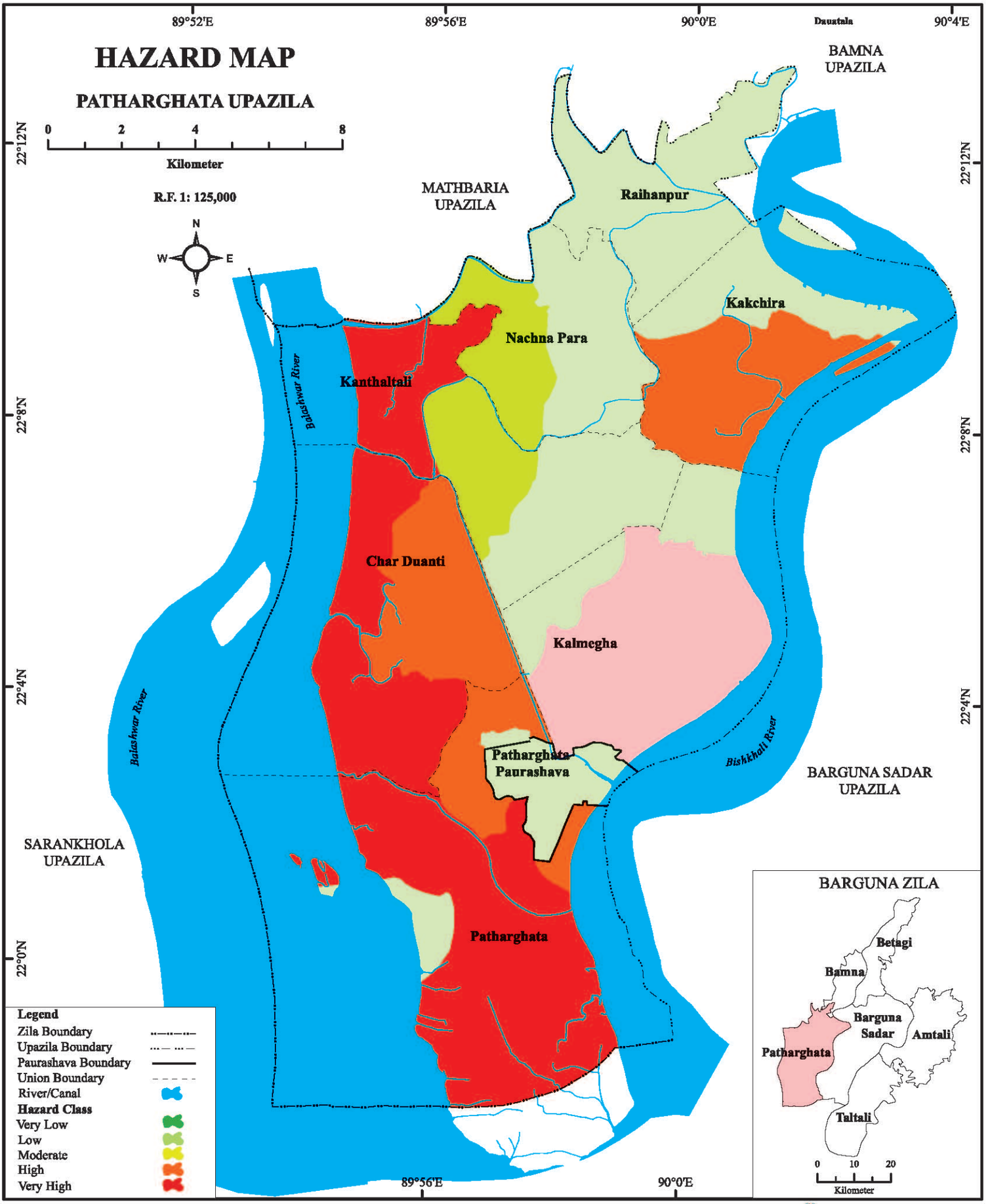
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



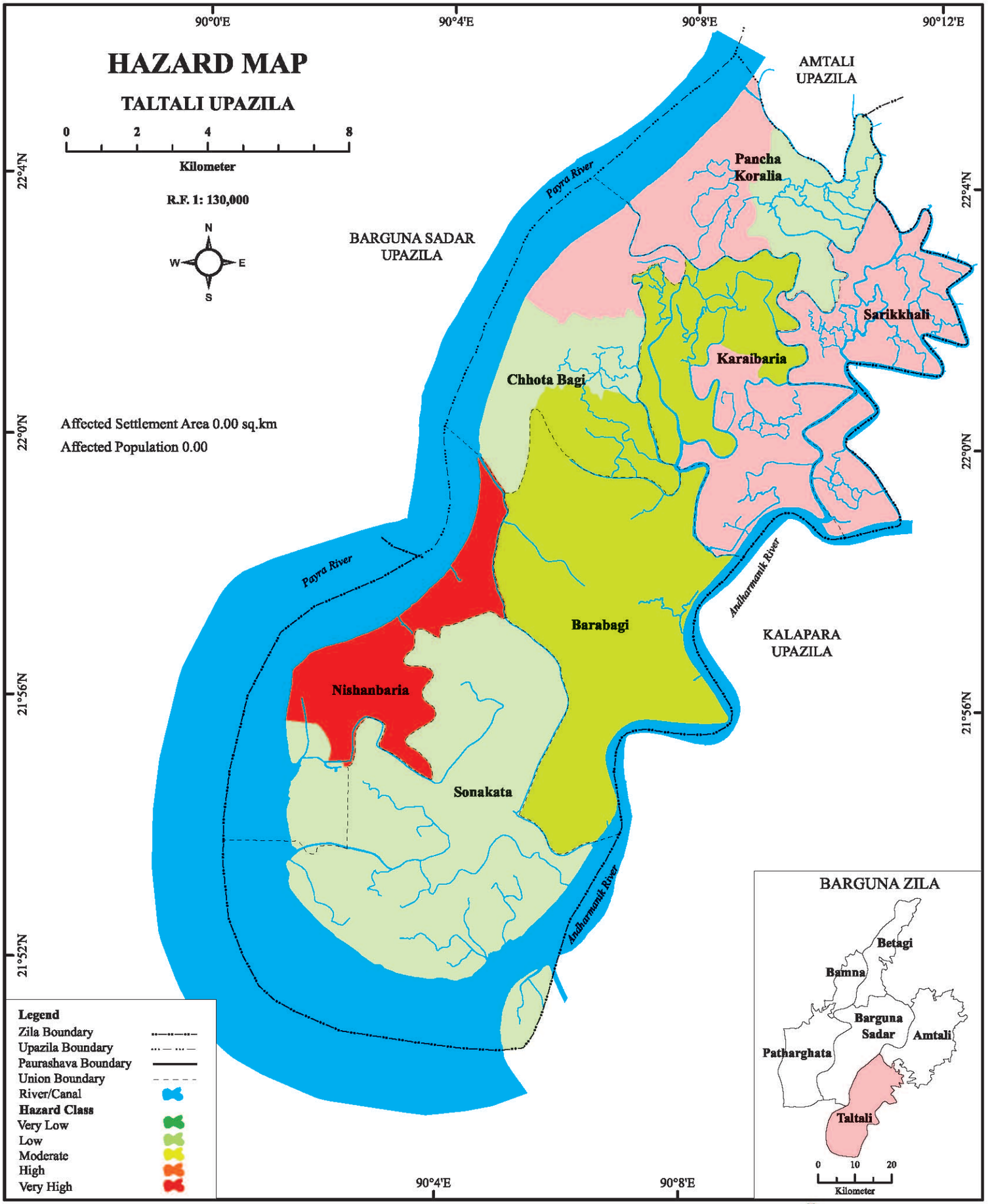
Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017



Source: After DDM, Field Survey 2017

Stat4Dev. Project, BBS 2017

Appendix A

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ পরিসংখ্যান ব্যুরো
Stat4Dev প্রকল্প
পরিসংখ্যান ভবন
ই-২৭/এ, আগারগাঁ, ঢাকা১২০৭

দুর্যোগ প্রবণ এলাকা এটলাস (Disaster Prone Area Atlas) তৈরির জন্য তথ্য সংগ্রহ ফরম

জেলার নামঃ কোডঃ	সিটি কর্পোরেশনের নামঃ কোডঃ	উপজেলার নামঃ কোডঃ	পৌরসভার নামঃ কোডঃ
ইউনিয়নের নামঃ কোডঃ	ওয়ার্ডের নামঃ কোডঃ	গ্রামের নামঃ কোডঃ	মহল্লার নামঃ কোডঃ

১. অবকাঠামো / স্থাপনার নামঃ			
২. অবকাঠামো / স্থাপনার অবস্থানঃ	অক্ষাংশ (Y):	দ্রাঘিমাংশ (X):	
৩. স্থাপনার প্রতিষ্ঠাকালঃ		৪.স্থাপনাটি কত তলাবিশিষ্টঃ	তলা
৫. স্থাপনার ধরন (অবকাঠামো):	**(নিচের নোট অনুযায়ী লিখুন)	পাঁকা 1	.আধা পাঁকা 2
৬. মোট কামরার সংখ্যাঃ		৭. মোট আয়তন (বর্গফুট):	বর্গফুট
৮. জেলার সংগে যোগাযোগের মাধ্যমঃ ৯. উপজেলার সংগে যোগাযোগের মাধ্যমঃ	ক. সড়কপথঃ কাঁচা / পাকা ..... কি.মি. ক. সড়কপথঃ কাঁচা / পাকা ..... কি.মি.	খ. জলপথ: ..... কি.মি. খ. জলপথ: .....কি.মি.	গ. রেলপথ: ..... কি.মি. গ. রেলপথ: ..... কি.মি.
১০. খোলা মাঠআছে কি?	হ্যাঁ 1	না 2	হ্যাঁ হলে,আয়তন (বর্গফুট): বর্গফুট
১১.বিদ্যুৎসুবিধা আছে কি?	হ্যাঁ 1	না 2	১২. টেলিভিশন আছে কি? হ্যাঁ 1 না 2
১৩. সংঘঠিত দুর্যোগের বিবরণঃ			

দূর্যোগের ধরণ (কোডসহ)	কারণ (কোডসহ)	সময়কাল (কোডসহ) (কোন মাসে)	উৎস(কোডসহ) (প্রাকৃতিক/ মানবসৃষ্ট)	স্থায়িত্ব (দিন/মাস)	ব্যাপ্তি (মৌজা /গ্রামের নাম)	কত দিন পর পর সংঘঠিত হয়	গত ৫ বছরে কতবার সংঘঠিত হয়েছে

**** যে সমস্ত তথ্য সংগ্রহ করতে হবে:** 1. শিক্ষাপ্রতিষ্ঠান (প্রাথমিক /নিম্নমাধ্যমিক/উচ্চ মাধ্যমিক বিদ্যালয়, মাদ্রাসা, কলেজ/বিশ্ববিদ্যালয়) 2. সাইক্লোনসেল্টার 3.হাসপাতাল/ক্লিনিক 4.ব্যক্তি মালিকানাধীন বহুতল ভবন 5.বাস/রেলস্টেশন 6.হেলিপ্যাড 7. স্টিমার/লঞ্চঘাট 8. বিমানবন্দর

দুর্যোগ কালীন সময়ে লোকজনদের আশ্রয়স্থল, অসুস্থ লোকজনদের জরুরি চিকিৎসার জন্য ফিল্ড হাসপাতাল স্থাপনের জায়গা, জরুরী ত্রাণ সহায়তা প্রদান ইত্যাদির জন্য অবকাঠামোর নাম, দুর্যোগকালীন সহায়তা, উদ্ধার ইত্যাদির জন্য যোগাযোগ ব্যবস্থার পূর্ণাঙ্গ বর্ণনা ম্যাপে প্রদর্শন এবং প্রদত্ত ফরমে সঠিক তথ্য সংগ্রহ করা আবশ্যক। জিপিএস রিডিংয়ের জন্য স্থাপনার নিকট গিয়ে রিডিং নিতে হবে।

তথ্য প্রদানকারীর নামঃ পিতার নামঃ মাতার নামঃ বয়সঃ পেশাঃ মোবাইল নম্বরঃ	তথ্য সংগ্রহকারীর স্বাক্ষর: নাম: পদবি: তথ্য সংগ্রহের তারিখ:	তত্ত্বাবধায়ক কর্মকর্তার স্বাক্ষর: কর্মকর্তার নাম: পদবি:

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
বাংলাদেশ পরিসংখ্যান ব্যুরো
Stat4Dev প্রকল্প
পরিসংখ্যান ভবন
ই-২৭/এ, আগারগাঁ, ঢাকা১২০৭

Paurashava/Union Wise Disaster Calendar for Coastal Area of Bangladesh

জেলার নামঃ কোডঃ	সিটি কর্পো: নামঃ কোডঃ	উপজেলার নামঃ কোডঃ	পৌরসভার নামঃ কোডঃ	ইউনিয়নের নামঃ কোডঃ	ওয়ার্ডের নামঃ কোডঃ

DISASTER	Jan পৌষ/মাঘ	Feb মাঘ/ফাল্গুন	Mar ফাল্গুন/চৈত্র	Apr চৈত্র/বৈশাখ	May বৈশাখ/জ্যৈষ্ঠ	Jun জ্যৈষ্ঠ/আষাঢ়	Jul আষাঢ়/শ্রাবণ	Aug শ্রাবণ/ভাদ্র	Sep ভাদ্র/আশ্বিন	Oct আশ্বিন/কার্তিক	Nov কার্তিক/অগ্রহায়ণ	Dec অগ্রহায়ণ/পৌষ	RANK

তথ্য প্রদানকারীর নামঃ পিতার নামঃ মাতার নামঃ বয়সঃ পেশাঃ মোবাইল নম্বরঃ	তথ্য সংগ্রহকারীর স্বাক্ষর: নাম: পদবি: তথ্য সংগ্রহের তারিখ:	তত্ত্বাবধায়ক কর্মকর্তার স্বাক্ষর: কর্মকর্তার নাম: পদবি:

Statistics for DEVELOPMENT

Strengthening Statistical Capacity of BBS for Collecting Data on Population and Development Project

Bangladesh Bureau of Statistics (BBS)
Statistics and Informatics Division (SID)
Ministry of Planning

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