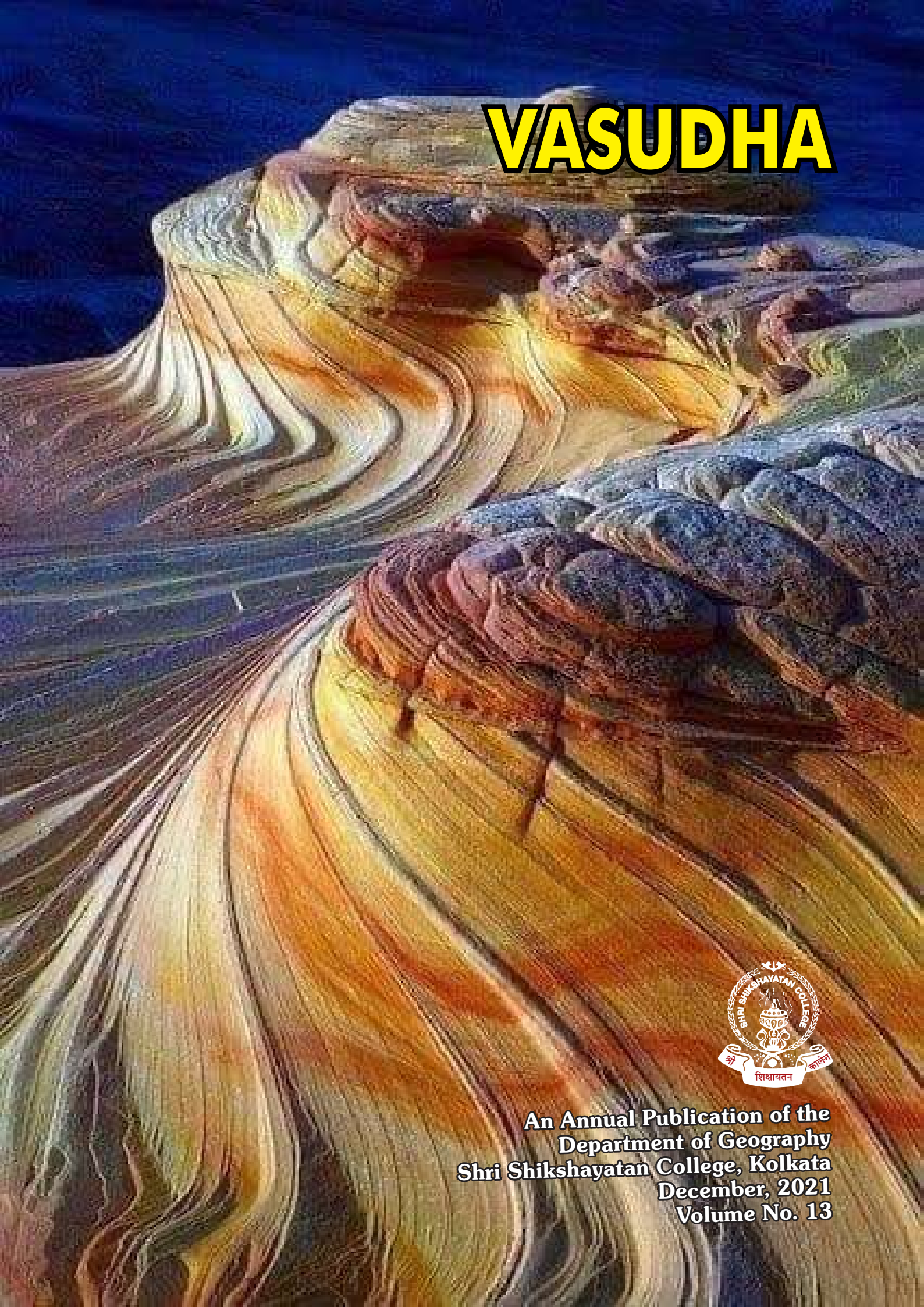

VASUDHA

An Annual Publication of the
Department of Geography
Shri Shikshayatan College, Kolkata
December, 2021
Volume No. 13

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SHRI SHIKSHAYATAN COLLEGE

KOLKATA

FROM THE EDITORIAL DESK

Geographical departmental journal VASUDHA, primarily aims at providing opportunities for improving creativity skills and triggering the imagination into reality. This magazine also encourages research among our students. It intends to initiate their interest in academic enquiry and provide a platform to showcase their efforts. This is a time of great changes. In education also we see fast changes. The student today is an individual. We need to recognise, appreciate, applaud and foster the fine blend of sensibilities. The orientation of young minds at the undergraduate level in mono-disciplines, overlapping disciplines or interdisciplinary studies has definitely opened up new windows of perception. The journal nurtures the latent creative talents and provide a platform to exhibit students' interests on varied topics. Shared knowledge and information may further accentuate research endeavours, enabling a break, free from mono-disciplinary investigations to pluri-disciplinary, holistic research. In this edition, we have also captured this year's excitement and activities.

This new issue of VASUDHA is a testimony to our resolve and commitment.

Editorial Board
December 2021

CONTENTS

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Cover : Source : Vermilion Cliffs National Monument is located in Arizona, immediately south of the Utah state line, USA. They are steep eroded escarpments consisting primarily of sandstone, siltstone, limestone, and shale which rise as much as 3,000 feet (910 m) above their bases.

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SALT PANS AND URBANISATION : A STUDY OF THE MIRA-BHAYANDAR PANS IN MUMBAI

Dr Chandani Bhattacharjee,
Professor, H R College of Commerce and Economics, Mumbai

Abstract

Salt pans are currently labelled as eco-sensitive zones. The urban areas of Mumbai and the adjoining MMR has a significant number of salt pans which are either in governmental hands or private lands under lease. The study stretch of Mira Bhayandar has salt pans which are under threat from land sharks, infrastructure lines and industrial development. The attempt in this paper has been to identify these concerns and the pathways which may be taken by the Governments to save the ecosystem of the salt pans and wetlands of Mumbai and Mira Road- Bhayandar area also known as the Salsette Islands in the olden times.

Key Words : Salt Pans, MMR, eco-sensitive zones, mangroves.

Introduction

A low-lying area which is formed in areas of saline or potentially saline stretch and which upon evaporation leaves behind minerals and salts is a salt pan. They have been found in arid, semi-arid and coastal areas, with a potential source of saline water to form the pans. These have been used by humans for centuries to extract the minerals and salts for our consumption. In India salt pans they have been found in Rajasthan, Kashmir, Gujarat, Maharashtra and Tamil Nadu. The study area, is adjoining the megacity of Mumbai, in the stretch of Mira Bhayandar, the North Western side, where the salt pans lie. They have been largely been artificial in the low-lying stretches of the coastal areas. These have been in existence for over 100 years and currently stand the threat of being converted into urban housing due to the massive demands for free hold land. Currently under the threat from urbanisation which would result in the conversion of these marshes into land blocks for redevelopment of urban housing and amenities.

Study Area

The salt pans of Mira-Bhayandar city, lie in the Thane district of Maharashtra. It covers an area of 79.4 square kilometer. Mira-Bhayandar City is located on the threshold of Brihan Mumbai Metropolis under the MMRDA (Mumbai Metropolitan Region Development Authority). It has the Arabian Sea in the West and the Vasai Creek and Ulhas River in the North. The total population is estimated approximately 814656 (Census, 2000). Mira-Bhayandar city is demarcated natural water tanks which are spread out in different parts of the city and there are many salt pans located in this region. It is about 20 kms to the north of Mumbai on the Mumbai Ahmedabad Highway andextends 18º42' N to 20º20' N latitude and 0º25' E to 73º44' E.Formed in 1985, Mira Road and Later Bhayandar, have been important threshold areas for the Mumbai city providing the residentslow-cost living. The boundaries between these two administrative units have blurred over time. The presence of the Government owned salt

pans in Bhayandar and the private ones in Mira Road have restricted the development of residential houses in the southern and western areas respectively.

As the city is located in vicinity to Vasai creek some of the salt pans have connection to Arabian Sea via Vasai creek. In Uttan and Morva village of Mira-Bhayandar city the salt pans are actually shallow man-made ponds that produces salt from sea water in this case the sea water is introduced into the enormous pans and then the water drains out with the help of natural evaporation and it helps the salt afterwards to be gathered in. The important pans are Rai, Murdhe, Morva, Ramradhe and in Bhayandar .

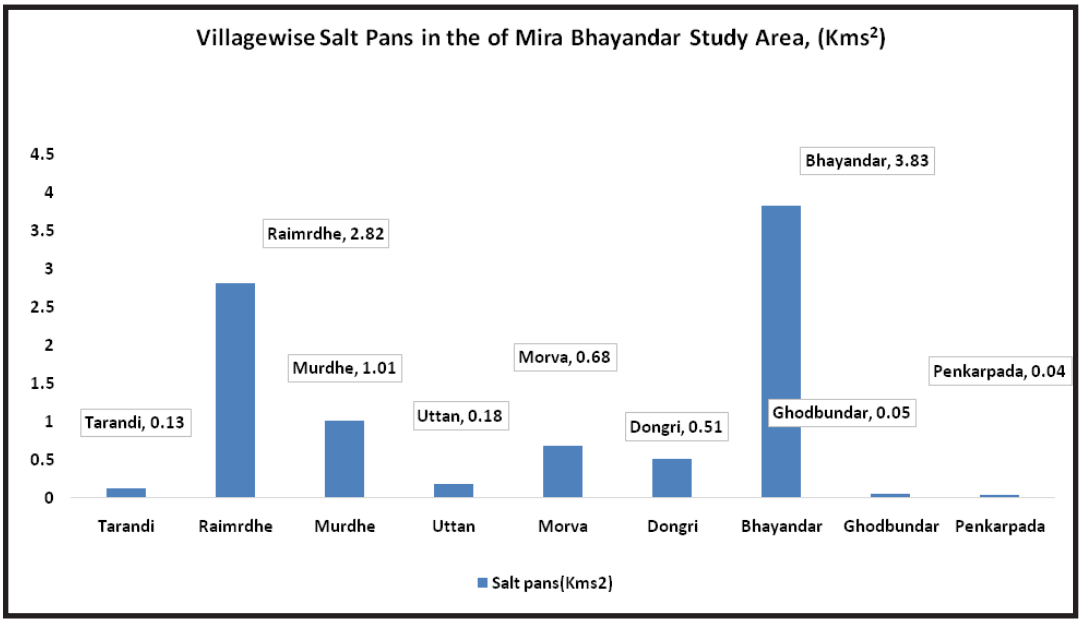

Figure: 1 Showing the Village Wise Salt Pans in the Mira Bhayandar Area.
Source : Mpcb.

Issues in Salt Pans in the Study Area

The MMR is one of the densest populated stretches in the western Konkan area. It is also one of the uninterrupted coastlines, sporadic mangrove covers, tourism resources, mineral exploitation, cultural niche pockets, developed infrastructure lines and finally pristine beaches. The Salt pans too have been located in these areas. There is a cover of about 5300 acres of salt pans in the Mumbai stretch while about 2000 acres in the Palghar and Thane area(MPCB, ENVIS Report,2010). The salt pans remain as one of the most fragile eco sensitive hotspots in this belt. The potential threat that they face are largely from the land sharks and the infrastructure building requirement for the urban cities, whether Mumbai or Mira Road or Bhayandar. The paucity of land has triggered the development of stretches of plots right into the Coastal Regulation Zone. The Development Plan 2034, for the MMRDA, outlines proposal to place salt into the concurrent list of the Constitution. It also suggests unlocking of the plots up to 321 acres, for affordable housing. The Development of the Churchgate-Virar Elevated Corridor has proposed to build a car depot on 40 acres of land on the salt pans. All such suggestions paint a gloomy picture for the state of affairs of the salt pans which already are facing problems of poor branding, manpower retrenchment, threat from the local land mafia, land under lease, lower productivity and also pollution which degrades or elongates the manufacturing process.

Mangroves is another matter of concern in the vicinity of the salt pans. Mira Bhayandar has a mangrove cover of 12.32 sq. kms., generally sparce cover. The continuous pushing back of the Coastal Regulation Zone by modifying the policies have resulted in the deforestation and removal of the brackish wetlands of the city. The destruction of the vegetation buffer puts the city and the nearby coastal areas into a vulnerable position with regard to coastal flooding, waterlogging during the monsoons and overflowing of the creeks. 2018, saw unprecedented rainfall, flood the Vasai creek and resultant spillage into the adjoining areas of Nalasapora, Bhayandar. Rampant urbanisation, lack of desilting, deforestation of the mangroves and pollution have been the causes ascertained.

Discussion and Conclusion

The salt pans fall in the eco-sensitive zones and under the Wetland Conservation and Management Rules, 2017, updated subsequently. The Maharashtra Government with its intention to protect the remaining coastal areas from deforestation and degradation, have invoked Section4 of the Indian Forest Act, 1927, with an intention to declare around 1,387 hectares of the mangrove land of Thane for 49 villages. This would help protect and regrow the mangrove forests in the region and control the sea line flooding that is a potential threat to the city. The ENVIS Environmental Status Report of the MBMC has hinted at treatment of the creek water, regrowing and conservation and maintenance of mangroves.Salt pans are generally of two types Natural and Man-made salt pans. This would impact the salt pans immensely as the water drained from the Vasai Creek will be relatively pollution free. The entire coastline of the Mumbai – Konkan belt has interconnectedness in the physiography, vegetation, climatic similarities and cultural expose. Urban problems largely emanate from the aspect of population pressure and lack of urban amenities. As the urban stretch along the Mumbai- Virar stretch expands, the protection, preservation and conservation of the environmentally threatened zones in the coastal areas need to be tackled on a priority basis.

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A VISIT TO THE ANCIENT TOWN OF KHEDBRAMHA

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Khedbramha is an ancient town situated in the north eastern part of Gujarat which is also a taluka headquater in Khedbramha Taluka of Sabarkantha District, Gujarat, India. Its exact geographical location is at 24.028334^{0}N Latitude and 73.041389^{0}E Longitude. There is a confluence of three small rivers namely Hirnakshi, Bhimakshi and Kosambi. After the confluence the river is known as Harnav river on the banks of which the town is situated. The river eventually merges with Sabarmati River down-stream. I recently got an opportunity to visit the place in the month of March 2022 and stayed there for 10 days in a field camp of Geological Survey of India.

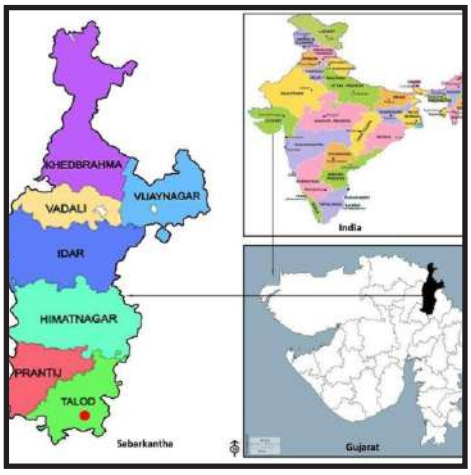

Fig 1 : Map of Sabarkatha district locating Khedbramha

HISTORICAL SIGNIFICANCE :

The town is connected with a lot of mythological history and has been a prominent pilgrim site for centuries. According to the Padma Purana Khedbrahma is an ancient town that was originally known as Brahmpur, during the Satya Yuga.

The 11th century temple of Bramha, Ambika and Panknath Mahadev temples are the oldest monuments here. The town has an old step well known as the Bramha Vav which is not in a very good condition. It also has beautiful Jain temples which are approximately 2500 years old according to the local people.

Khedbramha was under the Parmaras, Chalukyas and Pariharas before it came under Idar State. During the British period, Khedbrahma was under Idar State which was under Mahi Kantha Agency until 1933 when it was included in Sabar Kantha Agency. Sabar Kantha Agency was merged with Eastern Kathiawar Agency on 1 September 1943 which was subsequently merged in Western India States Agency in 1944 followed by Baroda, Western India and Gujarat States Agency (BWIGSA) in 1947. After independence of India in 1947, BWIGSA was merged in Bombay State and Khedbrahma fell under Sabarkantha district. In 1960, Bombay State was later divided along linguistic lines in Gujarat and Maharashtra. Sabarkantha became part of Gujarat. It is situated 120 km north from Ahmedabad.

Fig 2 : Granitic Outcrops in Khedbramha and surrounding Idar area.

GEOGRAPHICAL & GEOLOGICAL SIGNIFICANCE :

As already mentioned above Khedbhramha is situated in the banks of river Harnav. The town is surrounded by Granitic outcrops which

mainly owe their origin to the process of exhumation. Due to the tectonic movement of the earth's crust the process of exhumation occurs. Generally in the process of exhumation there is a vertical upward movement of a rock particle toward the surface of the earth. Deep-seated igneous and metamorphosed rocks are commonly found in the interior of many divergent and convergent orogens. Plate tectonics can account for high-pressure metamorphism by subduction and crustal thickening, but the return of these metamorphosed crustal rocks back to the surface is a more complicated problem. In fact, most of our understanding of crustal deformation and metamorphism is based on studies of exhumed rocks. Exhumation occurs by three processes: normal faulting, ductile thinning, and erosion. These processes are important, not only for the exhumation that they cause, but also for their influence on the formation of orogenic topography and the contribution to production of synorogenic sediments. Exhumation can occur in virtually any geological setting, regardless of age or tectonic regime. Specifically in this area of Gujarat exhumation happened in a much later phase during the post tectonic times.

Fig 3 : Hill ranges that belongs to the Aravallis captured on our way to Polo forest.

Rocks in this region comprises of calcsilicates, granites, quartzite, and other metamorphic rocks of Protozoic age. These rocks belong to Aravalli Supergroup. The hill ranges that are present in that area belongs to the Aravallis.

CLIMATIC CONDITION :

During my hours of stay it was a dry arid climate with no rainfall. In the month of February-March the day temperatures would shoot upto 38^{o}C and night temperatures were around 15^{o}C-16^{o}C. Thus, the daily range of temperature was relatively high.

Fig:4 Kesaria Trees

VEGETATION :

Mainly xerophytic plants were noticed in their natural habitat apart from some deciduous trees. Cactus, Kesaria trees, shrubs, Aloevera plants, babul trees were predominant in Khedbramha.

Deciduous trees were mainly present in the Polo forest which was very close to the place where I was staying situated within the Aravallis.

TRANSPORTATION :

Khedbrahma is connected to all major towns of Sabarkantha district by State Highway No. 9. There is a bus-station of Gujarat State Road Transport Corporation connecting all major cities of Gujarat. There is a railway station but the rail service has currently stopped.

PLACES TO VISIT IN KHEDBRAMHA AND ITS SURROUNDING AREAS :

1. Bramha Temple : Khedbrahma has a temple dedicated to Brahma which is rarely seen in India, only second to Pushkar situated in Rajasthan. It was built in third quarter of the 11th century during reign of Chaulukya king Karna. This east facing temple is built of white sandstone and cement-covered bricks. It is fifty-seven feet long, thirty feet broad, and thirty-six feet high.

Fig 5 : Taranga Caves

2. Taranga Caves : On 28th Feb I visited this ancient cave situated in Mehsana. The cave, locally known as Jogida ni Gufa, was found and used by Buddhist monks thousands of years ago. It has Buddhist sculptures carved in stone that resemble the Bodhi Vriksha or Kalpavruksha and other Buddhist motifs. I came across some beautiful Buddhist sculptures on the mountain on the way to the cave.

3 .

Fig 6 : Newly excavated site by ASI at Taranga Hills.

Taranga Hills : On 1st March I visited the Taranga Hills. It is 20 km from Vadnagar, on the Aravali range and harbours profound connections with Buddhism. The main idols enshrined in the Taranmata and Dharanmata temples are of Buddhist goddess Tara. Broken terracotta images of Buddha, four carved images of Dhyani Buddha on a stone plate, stone and brick walls inside rock shelters, etc. have been discovered from here.

Recently a team of archaeologists working on excavations in the Taranga Hills in the state Gujarat, have identified a new archaeological site linked to the Buddhist history of the region. Their excavations at Taranga Hills have so far revealed an assembly or prayer hall with votive stupas, a mahastupa on the peak of Dhagolia hill, 22 platforms, 50 rock shelters, brick structures resembling viharas, and about 54 votive stupas, all dated to between the 1st and 7th centuries CE. Because of the presence of an image of Taran Dharan Mata, a manifestation of the goddess Tara, experts believe that tantric Buddhism might have been practised in the region.

4. Taranga Jain Temple: On 1st March I visited. the ancient Jain temple situated on the Taranga hills. The Ajitnatha temple, was constructed in 1161 by the Chaulukya king Kumarapala, under the advice of his teacher, Acharya Hemachandra. Both the main sects of Jainism are represented, with adjoining walled compounds: the Svetambara compound consists of 14 temples in all, and there are also five Digambara-affiliated temples at Taranga hill. Taranga became an important Jain pilgrimage site in the 12thcentury. In 2009, Gujarat State Archaeology Department found 4 km long fortification southwest of Taranga hills. It is estimated that it belongs to 3rd or 4th century BCE.

Fig 7 : Curved Marble Structure of a deity at the Jain temple

5. Ambaji Temple and the Gabbar Hills : The magnificient temple of Goddess Amba is situated in Banaskatha district 50kms from Khed Bramha. On 2nd March I went to this shrine of goddess who is known to have been worshipped since the pre-vedic era. Made of white marble with gold cones, the temple was originally built by Nagar Brahmins. There is a main entrance in the front and only a small side-door, because it is believed that Ambaji has forbidden the addition of any other door. The temple is surrounded by an open square called chachar chowk where ceremonial sacrifices called havans are performed. The inner sanctum of the temple has silver-plated doors. There is a gokh, or niche, in the wall on which is fixed a old-plated marble inscription of the Viso Yantra, a Vedic text on sacred geometry, which is the main focus of worship. There is no idol of the goddess, perhaps because the temple is so ancient that it predates idol-worship, but the priests decorate the upper portion of the gokh in such a way that it looks like an idol of a goddess from a distance. Across the temple at the other temple on the Gabbar, considered the original abode of the goddess. At a short distance from the Ambaji temple is a large rectangular water storage facility known as a kund, with steps on all its four sides, called Mansarovar.

Fig 8 : Gabbar Hills on the way to Ambaji, captured from the ropeway

Fig 9 : Idar Fort

6. Idar Fort : On the very next day I visited Idar Fort . It is a very popular tourist location and a trekking spot in Gujarat.

The path to Idar Fort is well maintained, so the trek is not difficult to complete. One will need to climb several stairs to reach the main fort. The Maharaja Daulat Singhji built this palace fort in the 20th century. There is Jain Temple and a Hindu temple inside the fort.

Upon reaching the top of the fort we get a birds-eye view of the entire Idar town located in the valley of the Aravallis. The palace, though in ruins, has a charm of its own.

Fig 10 : Polo Forest

The aspect that first strikes most about the Idar fort is the defacing of the walls of the fort. Idar fort is not in entirely in ruins per say, but one visit to it, and one will agree that the authorities need to do something about maintaining it.

Fig 11 : River Inside Polo Forest

7. Polo Forest : On 3rd March I visited Polo forest a beautiful recreational place for tourists. The ancient Polo city was built around the river Harnav, It is believed to have been

established in the 10th century by the Parihar kings of Idar, and was then conquered in the 15th century by the Rathod Rajputs of Marwar. The name is derived from pol, the Marwari word for "gate," signifying its status as a gateway between Gujarat and Rajasthan. It was built between Kalaliyo in the east, the highest peak in the area, and Mamrehchi in the west, considered sacred by the local tribe. Together they block sunlight for most of the day, which might provide an explanation for the otherwise mysterious abandonment of the ancient city.

Fig 12 : Dharoi Dam

The 400 square km area of dry mixed deciduous forest is most lush between September and December after the monsoon rains when the rivers are full, but at any time of the year it provides a rich wildlife experience. There are more than 450 species of medicinal plants, around 275 of birds, 30 of mammals, and 32 of reptiles. There are bears, panthers, leopards, hyenas, water fowl, raptors, passerines, all living under a canopy of diverse plants and trees. During winter, many types of migratory birds occupy the forest; during the rainy season there are wetland birds.

8. Dharoi Dam : Dharoi Dam is a gravity dam on the Sabarmati river near Dharoi, Mehsana district of northern Gujarat in India. Constructed in 1978, the dam is meant for irrigation, power generation and flood control. The scenic beauty of the surrounding area of the dam is worth mentioning. Though the entire stretch of the dam is restricted to the public yet it has become a popular tourist spot.

I had a very unique experience during my stay at Ramnagar village which lies within the jurisdiction of Khedbramha, a remote town in Northern Gujarat. The village has severe water crisis. Water is available in every 2 days interval. So one has to use one's resource very cautiously and judiciously. Village life is simple and the community in which I stayed is very friendly. The standard of living of the people in the village is relatively high. The road conditions are excellent and the farmers lived in pucca houses. Almost all the farmers possess tractors and own proper concrete houses. There is one primary school located nearby and the area is mostly surrounded by agricultural fields. The village of Ramnagar is surrounded by hillocks, lacks basic health care facilities. The market area is far away (7km) from the village. Polo forest is visible from the village along with the Aravalli Hills.

Fig 13 : View from Ramnagar Village

Fig 14 : The small village community where I stayed.

SEROPOSITIVITY AND RELIGIOUS MINORITY : CONTEMPLATING HIV PREVALENCE IN INDIA

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Background :

History reflects that AIDS epidemic have been many times interpreted by religious groups in the light of their beliefs and teachings and those interpretations have often led to public pronouncements on AIDS education, prevention, and care, as well as to the shaping of attitudes. When HIV epidemic was on a rise, religion was considered detrimental to prevention efforts. public promotion of sex education and condom use was opposed by some religious communities (Balogun, 2010; Monshipouri& Trapp, 2012; Francesca, 2002). India has the highest number of HIV cases in the world according to UNAIDS, with an estimated 5.7 million people living with HIV/AIDS [4]. The National AIDS Control Organisation (NACO) estimated that 2.14 million people lived with HIV/AIDS in India in 2017. On this backdrop, this study aims to look at HIV seropositivity with focus on religious sections of the society.

Objective :

This paper aims to look at the overall prevalence of HIV in India and more specifically among the religious minorities with a gender lens.

Data :

HIV file and household file of National Family Health Survey2015-2016 (NFHS-4) were merged and used for analysis. NFHS provides updates and evidence of trends in key population, health and nutrition indicators, including HIV prevalence. Moreover, the survey covers a range of health-related issues, including fertility, infant and child mortality, maternal and child health, perinatal mortality, adolescent reproductive health, high-risk sexual behaviour, tuberculosis, and malaria, non-communicable diseases, domestic violence, HIV knowledge, and attitudes toward people living with HIV. For this study, we have used the HIV section.

Results :

Results indicated that in India HIV prevalence was higher among Christians, Neo-buddhists when religion was considered. Prevalence was also high among those residing in urbanareas, having less or no education and those who were ever married. Peoplebelonging to the richer/richest wealth quintile and living in a nuclear family also had high prevalence.

HIV prevalence among the formerly married Christian males was 1.7% as compared to 0.4% among the formerly married Hindus and 0.2% never married Hindu men. Also, 0.7% male respondents who were never married but belonged to Christian religion also had HIV.

Gender segmented analysis suggests that religious minority specifically Christians women had high prevalence of HIV. As high as 2.6% formerly married females and belonging to Christian religion

were HIV positive as compared to 1.5% Hindus. Again this percentage among the currently married Christian females was also very high (1.0%). Among the HIV positive Christian females who were formerly married, 61% belonged to urban areas, a quarter of them was less than 30 years and half of them belonged to 35-39 years age group.

Type of family played a pivotal role in explaining seropositivity among religious minorities since 89% of those HIV positive Christian females were from nuclear families.

Conclusion :

Results portray that HIV prevalence is high among the respondents belonging to religious minorities,particularly among Christians and Neo Buddhists. It is well known that Christian religious discourse often also results in misguided epidemiological understandings about HIV/ AIDS, so the study results hold importance in the arena of public health. The results were more apprehensive and concerningfor females indicating that women are also vulnerable among Christian minorities who are historically considered demographically advanced and informed.

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FIRST WAVE OF COVID-19 IN THE DISTRICTS OF WEST BENGAL

Akansha Bhual, Pratiti Bhattacharya, Ritobina Biswas, Puspika Das, Debanjali Das Roy, Ishani Ghosh, Shreya Ghosh, Pritha Majumder, Rajanya Manna, Smriti Rai

Class of 2021

ABSTRACT

The coronavirus or the Covid-19 outbreak has shaken the entire world and India has been badly affected by the outbreak. China started reporting cases towards the end of 2019 while India reported it's first case in January, 2020 in Kerala. West Bengal reported it's first case on March 15th, when a student returned from the UK, tested positive. The bio-hazard was soon declared as a Pandemic by the World Health Organization. The present study attempts to record the spread of the disease in each State of West Bengal during the first wave and the actions taken by the State government to tackle the unknown disaster. The spread was quite severe in the district, however, the death rate was low. This was mainly due to the quick response of the government.

INTRODUCTION

A sudden outbreak of the coronavirus in 2020 caused massive havoc in the entire world. In the first week of January, 2020, China declared its first case and thereafter the spread of the disease in the Wuhan Province and eventually everywhere in China. The country went for a complete lockdown following the events. Connection was cut with the outside world, however, innumerable people had already travelled to and from the country, unknowingly acting as carriers of the disease. The SARS-CoV-2 strain of the coronavirus is what caused the disaster. Soon several countries started reporting cases and started closing down. India reported it's first case in Thrissur, Kerala at the end of January. West Bengal reported it's first case on 15th March, when a student returned from UK, tested positive. The World Health Organization soon declared the bio-hazard as a Pandemic and suggested the countries to take necessary measures. West Bengal slowly started reporting more and more cases, however, the death rate was low. The State Government tried it's best to stop the spread of the disease by incorporating various necessary measures.

LITERATURE REVIEW

The psychological impact of COVID-19 on the general population of West Bengal was studied by Chakraborty K., Chatterjee M., (2020). Biswas et. al, (2021) studied the geographical appraisal of the pandemic in West Bengal. The possible duration of the pandemic was estimated in a study by Khatua D., (2020). The impact of COVID-19 on education was by Rashid S., and Yadav Singh S., (2020). Chattopadhyay S., (2020) studied the impact of COVID-19 on agriculture. Zonation of areas based on symptoms, preparedness measures and other things were also discussed (Nayar M., Sinha R., Saha A., (2020).

STUDY AREA

The study area has been confined to West Bengal since it is not only our place if residence, but also is densely populated with a population of 19.3 crore and also has Kolkata, the seventh biggest city in the country with a density of 24 persons per square kilometres (Kolkata Municipal Corporation, 2021). The State has been chosen for the study to get a good perception of the situation. West Bengal reported it's first case on 15th March when a student returned from UK tested positive. Continuous movement of travellers to the state resulted in the large number of cases.

OBJECTIVES

- ★ To analyse the total affected and mortality in the state
- ★ To highlight the preparedness of the state government to tackle the disaster

RESEARCH METHODS

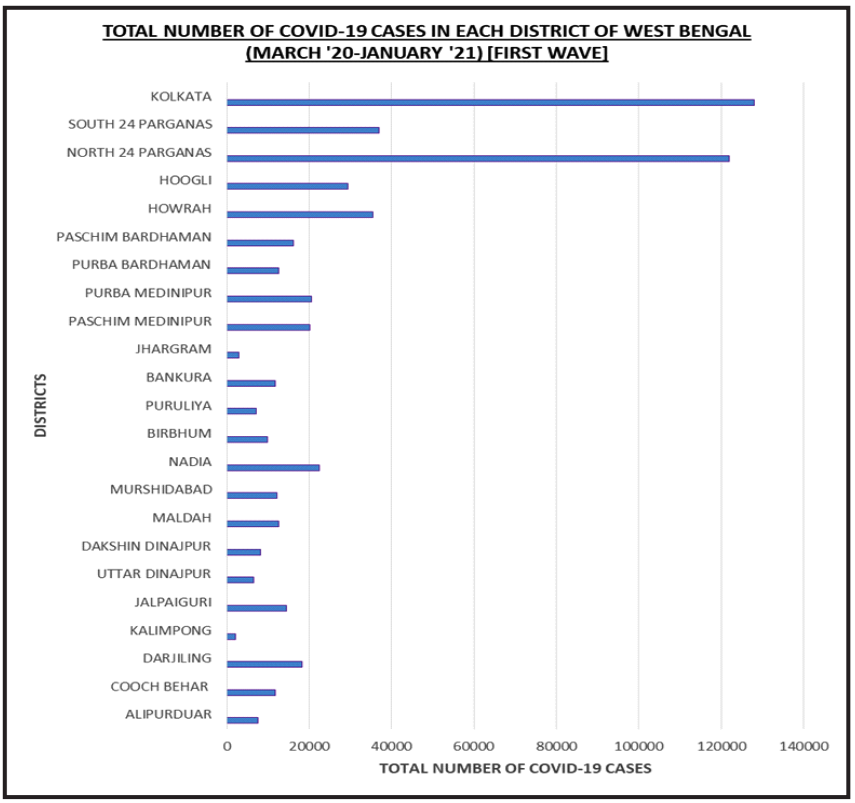
Secondary data has been used to satisfy the objectives from various international, national and state-based websites and other institutions of learning. Qualitative and quantitative data on the emergence and spread of the disease along with its impact has been analysed. The data has been represented by various cartograms to infer conclusions.

RESULTS AND DISCUSSION

1. Emergence and spread of Covid-19 in West Bengal

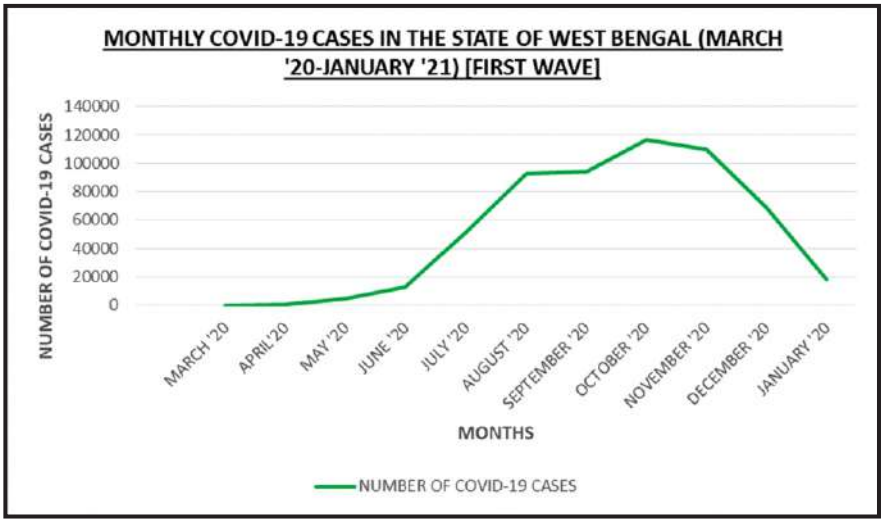
In December 2019, World Health Organization first took note of the SARS-CoV-2 strain of the coronavirus, that originated in the Wuhan Province of China. This sudden breakout caused havoc in the world causing major challenges to the public health, food storages, livelihood of people along with social and economic disruption with loss of human lives.

The first wave of Covid-19 has been extremely devastating since every country was caught off guard without any preparation or knowledge about the unknown disease. The total number of affected persons in the state of West Bengal in the first wave has been found to be 5,70,515, out of which, 5, 55, 127 people has recovered while 10,192 persons died. Not all districts were affected at the same rate. Districts of Kolkata (1,27,982 cases) and North 24 Parganas (1,21,930 cases) recorded very high number of cases while Kalimpong (2,226 cases) and Jhargram (3040 cases) recorded very few number of cases compared to the other states. (DoH&FW, GoWBa, 2021)



SOURCE : DoH & FW, 2021

West Bengal reported it's first case on 17th March, 2020, after which the spread was at its peak. The high number of cases were mainly due to the in-migration of workers from other states and also due to the return of people from abroad. The State went into a lockdown along with the country on 23rd March. After almost one and a half months of lockdown, the cases somewhat started decreasing, aided by the quick response of the State government. But, the number of cases started increasing once more, as lockdown was being withdrawn from the country step by step. Thus, more people were affected as they came in contact with each other due to opening of workplaces. July 2021 and August 2021 reported very high number of cases. However, the highest number of cases was recorded in the month of October, which is the festive season in West Bengal and hardly safety measures were followed. But, once again, the situation was well controlled by the State government and gradually, the number of cases dropped, marking the subsidence of the first wave. (Covid19india.n.d)



SOURCE : www.covid19india.org

It is found that the district-wise highest recovery rate percentage was in the district of Koch Bihar (98.87%) (Fig No., Table No.) Very high recovery rates, i.e. above 98% were also found in the districts of Dakshin Dinajpur (98.57%), PurbaBardhaman (98.46%), Alipurduar (98.45%),

Malda (98.40%), Jalpaiguri (98.13%), Jhargram (98.06%), and Darjiling (98.01%). In the rest of the districts the rates were fairly high, between 96-98% (DoH&FW, 2021).

2. Preparedness of the government to tackle the disaster

India reported it's first case on January 27, 2020 in Kerala after which the virus had spread rapidly across all states. Both the Central Government and the State governments tried implementing several strict policies to prevent the spread. Even before West Bengal reported it's first case, the State government had already instructed the medical institutions and other healthcare centres to follow covid appropriate protocols. On March 16, the government formed the Epidemic Disease Covid-19 Regulations, 2020 (DoH&FW, GoWBb, 2020) including the treatment procedure of an affected person, screening test regimen and gave authority to the district administrative bodies to demarcate containment zones and take appropriate actions.

On March 17, the first confirmed case was reported in West Bengal (Hindu, 2020). 66 covid hospitals and 582 institutional quarantine centres were declared by the State government to keep the affected persons separate from other patients. Following the measures given by WHO, the state started making people aware about the safety protocols, travelling restrictions and other tests. (DoH&FW, GoWBc, 2020). RT-PCR tests were also carried out after the increased cases in October.

The State government tried their best to keep all the affected persons separate and safe and give them all kinds of facilities to recover faster.

Some measures adopted by the State government include limited number of people in gatherings, complete shutdown of educational institutions, restaurants, cinema hall and other places of public gathering. Factories, offices and workshops were also totally closed initially. However, emergency services like banks, and other health related services were available. Then, as a part of the step by step withdrawal of the lockdown, the government started resuming operations in these areas. Special trains were given to bring back the migrant workers stuck in other cities. However, among all these, the government focused the most on maintaining proactive measures like wearing masks, maintaining social distance, washing and sanitizing hands, home isolation for patients, supplying essential items to the affected, making PPE kits available, carrying out thermal screening tests and increasing the number of beds and treatment centres and testing every person entering the state from outside.

COVID-RESPONSERT-PCR TESTS FOR DETECTION OF THE DISEASE

SOURCE: www.tribuneindia.com

SOURCE: www.newindiaexpress.com

Lastly, the government created three categories of containment zones namely Red Zone (places with highest number of cases; no activities were allowed), Orange Zone (there were limited number of cases in the past but recently cases subsided; some activities were allowed) and the Green Zone (areas with no confirmed cases in the last 21 days; just few restrictions were there with no other bindings). The process of vaccination was also initiated since January 2021.

CONCLUSION

Since the first case was reported in West Bengal, the disease spread rapidly infecting innumerable people. However the death rate was low. Lack of awareness in the society and in-migration, caused quite an increase in the number of cases. The State government, though caught off guard, managed the situation quite efficiently.

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LANGUAGE DIVERSITY IN PAPUA NEW GUINEA

Adrija Sengupta, *Class of 2022*

INTRODUCTION

"To understand a sentence means to understand a language. To understand a language means to be a master of a technique." – Ludwig Wittgenstein

There are approximately 820 languages spoken by the Papuans. These 820 languages mainly fall between the two language groups of Austronesians and Papuans. Constitution of PNG takes into account Tok Pisin, English and Hiri Motu as their official Language however none of them are considered as National language. The language study of PNG gives us an idea as to how the recently independent country (1975) deals with this extreme language diversity.

OBJECTIVE

This paper was written to understand the language diversity of Papua New Guinea, PNG, and what are the pros and cons of having a heavily diversified culture in an island nation like PNG.

METHODOLOGY

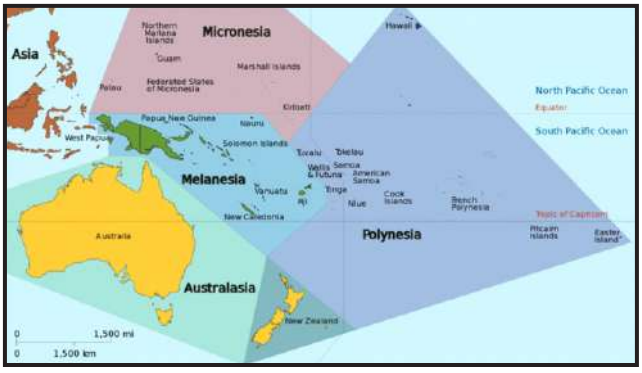
To understand the languages of Papua New Guinea explicit Literature Review of various

1. Government Sources
2. Research Journals and
3. Reliable Articles available online

have been made

Location

Papua New Guinea (PNG) is an island nation in the southwestern part of the Pacific Ocean. It is one of the closest neighbors of Australia and falls under the Melanesia sub region of Oceania. It shares a land border with Indonesia and has a coastline of 5152 km.



UN's Geoscheme for Oceania.
Source : Wikipedia

Physical Diversities

As far as physical diversity is concerned, PNG have it all. The country is known for its coral reefs, beaches, active volcanoes, dense rainforest, hiking routes and granite mountain, Mt. Wilhelm. It is believed that since PNG is geographically diverse, its isolation is the main reason for its cultural and language diversity. The real reason of this diversity is still unknown.

Languages in PNG

The official languages of Papua New Guinea are English, Tok Pisin and Hiri Motu. These languages belong to two groups the Austronesians and the Non-Austronesians or Papuans. The Papuan languages are difficult to distinguish and may not fall into the same group of languages and hence they are grouped as Non-Austronesians. The 820 languages are languages and not dialects and hence it is different from one another. Dialects are easily recognizable and can be understood however these are languages of different groups and hence cannot be understand by people other than the native speakers. In PNG, English is the language in which formal education is imparted, Hiri Motu the pidgin of Motu is spoken in and around the coastal areas and since it is an Austronesian language hence its presence near the coasts explains its origin. Tok Pisin on the other hand have their relevance in the Southern provinces. Other than that, the native languages are prevalent in the country.

Language Diversity Real or Myth ?

On a surface level we can easily point out and say that PNG has the highest language diversity however a detail analysis will tell us how far this is true.

– Formal Education is imparted in English language mostly. This gradually endangers the language groups and ultimately endangers the culture, turning them into fossil.

– Hiri Motu, now claimed a national language, was pushed into the system by the Australians as a lingufranca and it now it is overshadowing several other native languages of the country.

– The language Tok Pisin also has its origin outside New Guinea in the Pacific and with the concept of “opening up to the World” this language also got into the system. However Tok Pisinhave eventually developed and now it is more of a Papuan language than that of English which the Papuans have adopted as a colony of the Brits.

Therefore we can claim that one foreign language have the capability to endanger several other cultures owing to its dominance and its superiority.

How Far has PNG been affected ?

Speaking of preserving cultures, natives have understood the cost it has to pay culturally when a child is being schooled in a foreign language. Introducing a child to a foreign established education system meant losing their identity gradually and eventually getting wiped off from the pages of History forever. Due to this they were initially taught their native languages and then this idea became popular and was taken up by several provincial governments and later on the National Government as well. However, this policy of vernacular education is limited only to primary school and has not been promoted to the secondary and higher sections of education. Various reasons like difficulty in Governance, maintaining of Law and Order and other political reasons have been shown to stop this spread of vernacular study.

Is Diversity Good or Bad ?

It is much difficult to give a straight forward answer when the country's HDI is not that great and it is not doing so well over the years. There had been crime and conflicts between different cultural groups from time to time and all these have been attributed to the Language diversity. Other than that due to this semi-English education system it is believed that there has been an increase in unemployment.

Languages are important to preserve the History and History helps the humanity to move forward hence compromising with one's cultures means accepting the fact that at some point their existence will be lost forever.

Indigenous People of Papua New Guinea
Source : Wikipedia

Conclusion

In conclusion it is important to point out that we as the protector of our culture and heritage should definitely learn where to draw the line and stop the overshadowing. As for PNG, young researchers, policy makers and government officials should be concerned with the problem and should definitely come up with new ideas to eradicate the problem.

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INDIAN POPULATION : STABILISING OR EXPLODING

Ahelee Bera, *Class of 2022*

INTRODUCTION

After independence India's population growth rate peaked between 1961 and 1971 and the total fertility rate was as high as 5.9. This led to concerns about the future and the predictions made at that time all pointed to a massive population explosion in the proceeding years. The policies implemented by the government, increasing female literacy, decreasing child mortality rate and many such factors led to a fall in the growth rate after 1971and it has been falling ever since.

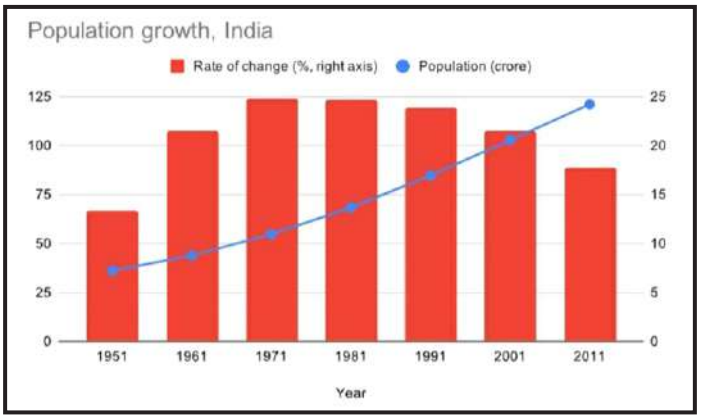

Fig. 1

The census of 2011 counted 121 crore people in the country. While Total Fertility Rate in rural areas remains higher than in urban areas it has been declining at a faster rate than the later according to the successive National Family Health Surveys. In India the average Total Fertility Rate (2.20 births per woman,2019) is reaching replacement level (2.10 births per woman according to the UN), that is, the rate at which a population exactly replaces its numbers from one generation to the next without migration. This means that while there may not be any immediate noticeable changes, our population will become stable after the next three decades.

Urban, Rural and Total Fertility Rate in India

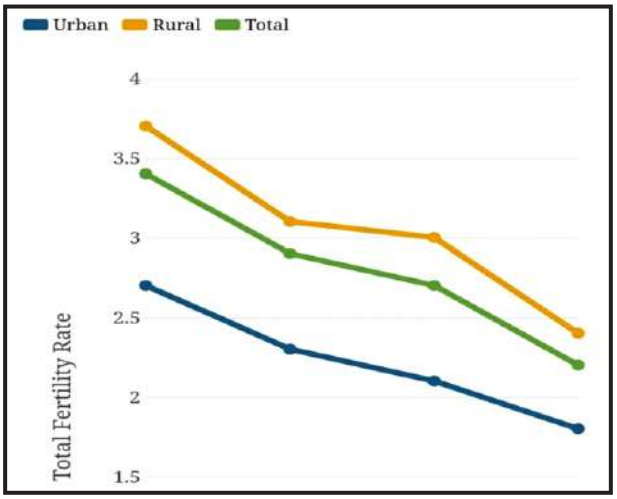

Fig. 2

POPULATION PROJECTIONS AND STUDIES CONDUCTED

According to a new study published in the highly regarded journal, The Lancet, prepared by the Seattle based Institute for Health Metrics and Evaluation (IHME),India is destined to be the largest country in the world, its population will peak by mid century. As the 21st century closes its ultimate population will be far smaller than anyone could have anticipated, about 1.09 billion instead of approximately 1.35 billion today. It could even be as low as 724 million.

Population size in India in the reference, slower, faster, fastest and SDG pace scenarios, 1990-2100

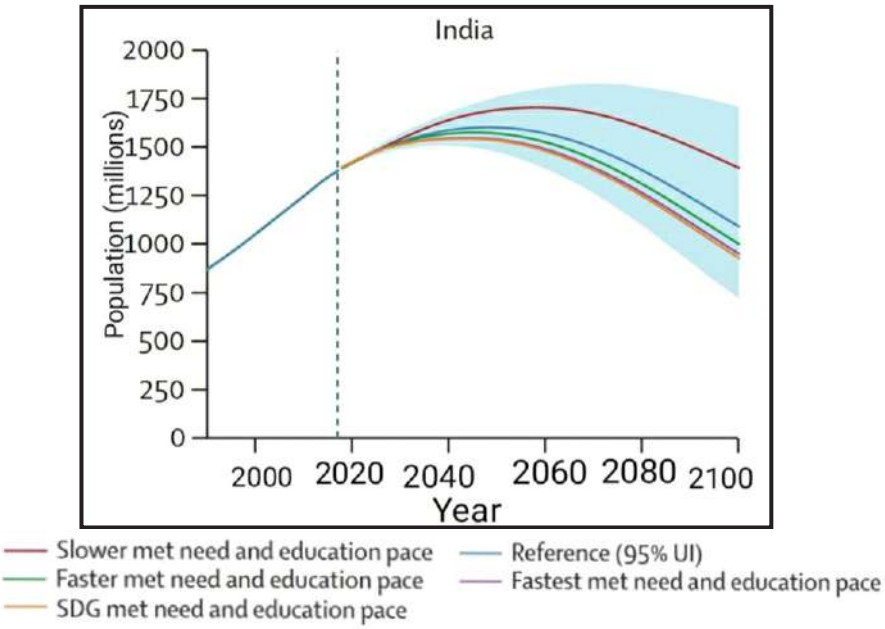

Fig. 3

Until 2050, the IHME projections are almost identical to widely used United Nations projections. The UN projects that India's population will be 1.64 billion by 2050, the IHME projects 1.61 billion by 2048.It is only in the second half of the century that the two projections diverge with the UN predicting a population of 1.45 billion by 2100 and the IHME 1.09 billion. The cause of such divergence can be that the UN predictions were dependent on the TFR values while the IHME predictions considered factors like completed cohort fertility at age 50 years, availability of contraceptives and migration rates.

Number of working age adults from 1950 to 2100 in the reference scenario in the 10 most populous countries in 2017

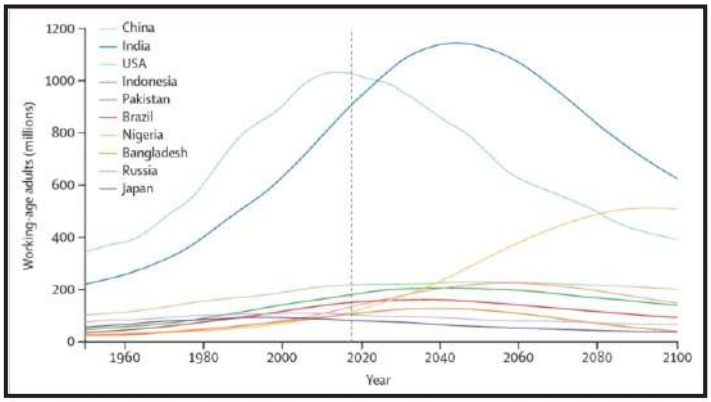

Fig. 4

According to the study by IHME the number of working age adults in India is projected to fall from 762 million in 2017 to around 578 million in 2100, compared to that of China where number of workers are estimated to decline from 950 million in 2017 to 357 million in 2100.It is said that India may be one of the few - if not only - major powers in Asia to protect its working age population over the century. It is expected to surpass China workforce population in the mid-2020s rising up the GDP ranking from 7th to 3rdmaking it one of the superpowers in the future multipolar world along with China, USA and Japan.

CONCLUSION

From these projections and the current trends in our demographics we can see that the future holds many promises for India. Today India is home to 17.7% of the total world population and is the second most populated country in the world right after China. We face many problems due to our large population like unemployment, poverty and poor sanitation. These problems are however predicted to end after 2048 when after reaching the peak, we will see a decline in our population.

These projections are however predicted based on today's scenarios and might change according to the policies applied by the Government in the future. Though there is no immediate cause for alarm at this stage, we must still try to lower our population at a faster pace. There are still small pockets in our country, especially in Uttar Pradesh and Bihar, where the TFR is greater than 3.5. The Government must promote appropriate regulations in such areas to curb the increasing birth rate.

In all, we can say that the progress we are making is slow but sure. We cannot rest until we have reached our goal of attaining a TFR of 1.24 by the year 2100. For this, we have to develop our family planning schemes and pay special attention to female education and empowerment. We must remember that the hard work and effort we put in now will surely bear fruit in the future and bring us one step closer to the ultimate goal of becoming one of the superpowers of the future world.

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COCOA CULTIVATION IN GHANA

Dipannita De, *Class of 2023*

INTRODUCTION :

Chocolate is preparation of raised and ground cocoa seeds that is made from a liquid paste. The consumption of chocolate is huge. People in the United States in 2015 spend around $22B USD on chocolate. They eat around 12 lbs of chocolate per person. Switzerland, Austria, Ireland, Germany, Norway are the top five nations who like chocolate most. According to Harvard School of Public Health a few pieces of chocolate per month can make our life longer.

LOCATION OF GHANA :

Ghana is a country along the Gulf of Guinea and the Atlantic Ocean in the sub region of West Africa.

LOCATION OF COCOA CULTIVATION REGION IN GHANA :

Today six regions of Ghana produce Cocoa.

1) Eastern 2) Ashanti 3) Brong Ahafo 4) Central Region 5) Western Region 6) Volta.

Production has moved westward to the point where the western region is now Ghana's main producer of Cocoa. The reason behind this is the fluctuation of rainfall and decreasing fertility of soil. Cocoa Triangle is the triangular area between Takoradi, Kumasi, Accra.

OLD HISTORY OF COCOA CULTIVATION :

In 1895, Tetteh Quarshie is said to have brought some amelendo cocoa pods from the island of Fernando Po and established the first Cocoa farm in the highly fertile soil of the Eastern Region, in Akwapim Mampong.

COCOA HARVESTING PROCESS :

The word "COCOA' is derivative of "CACAO". Cocoa harvest occurs over several months. The cocoa tree produces 40 pieces of fruit annually and these yield about 2kg of cocoa beans each year. Fruits need to be out from the trees by machetes. Fruits are harvested by hand and gently pried open with a machete. Then cocoa beans piled in mounds and covered with banana leaves.

The beans remain under the leaves for five to eight days and the fermentation process

releases the delicious aroma of the chocolate. The beans are then left dry in to the sun . To preserve the flavours of the beans, the drying process must be done slowly, they are turned regularly by hand . Then beans are cleaned, roasted the shell of the cocoa bean is removed to produce cocoa nibs and nibs are then ground to produce cocoa mass or pure chocolate in rough form.

CLIMATIC ADVANTAGES :

Cocoa tree need warm wet ultimate, forest protection, Ghana is being in the Equatorial belt, so all conditions met, Equatorial environment with high temperature and heavy rainfall is best. According to MDPI cocoa trees need temperature between 21^{0} to 23^{0}, rainfall 1000-2500 mm annually to achieve optimum yield.

Favourable weather, shade, protection from strong wind, soil, labour, transport are needed for cocoa cultivation.

PROBLEM FACED IN COCOA CULTIVATION IN GHANA :

- **POVERTY :**

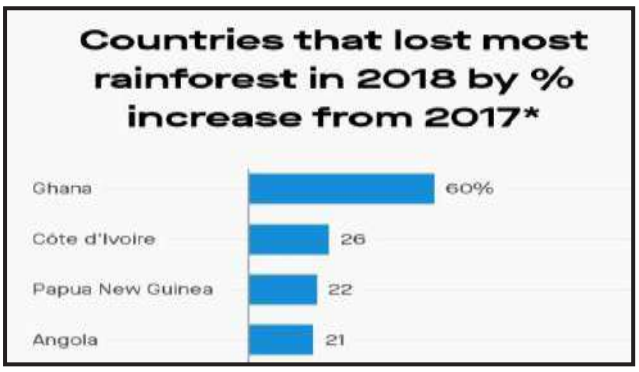
  Most production is carried out by present farmers on plots of less than three hectares. One fourth of all cocoa farmers receive just over half of the total cocoa income.

- **CHILD LABOUR :**

  Child slavery was major concern in 2018. 2.1 m children in various countries of West Africa are involved in this production. Work done by children in cocoa production often involves hazardous takes such as spraying pesticides, carrying heavy loads, opening cocoa pods with sharp tools. International attempts to improve condition for children were failing because of persistant poverty absence of schools, increasing cocoa demand, continued exploitation for child labour.

- **DEFORESTATION AND LOSS OF BIODIVERSITY, DEPLETION OF EQUATORIAL RAINFOREST :**

  Ghana is losing it's rainforest faster than any other country in the world.



OTHER REASONS :

(i) Lack of access to finance. (ii) The threat of climate change. (iii) Inadequate infrastructure. (iv) Plant Disease. (v) Decreasing area under cultivation and low yields per hectare. (vi) Lower producer price. (vii) Lack of amenities.

STEPS TAKEN TO IMPROVE COCOA CULTIVATION :

I) 20 Rural service centers to aid farmers to adopt best farm management. (ii) Liberal use of fertilizers (iii) Developing high yielding varieties of cocoa plants. (iv) Modernizing the process and putting innovations.

COCOA AND FOREST INITIATIVE :

The Cocoa and Forest Initiative is an agreement reached between the Government of cote d' Ivorie and Ghana and over thirty seven major cocoa and chocolate companies. The purpose is to end deforestation and replenish the trees that have been destroyed as a result of cocoa production in that area.

CONCLUSION :

Ghana's main cash crop is cocoa. Ghana's cocoa cultivation is noted within the developing world to be one of the most modeled commodities. Though the consumption of chocolate is higher in richer countries, the most cocoa production is carried out by poor farmers. One fourth of the cocoa farmers receive just over half of total cocoa income and the real dark truth is that over 2 million children of Ghana are involved in this very risky production due to poverty and increasing cocoa demand. But international attempts to reduce this condition are failing due to different reasons.

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DEMISE OF CONSTELLATION : ID2299

Shreya Upadhyay, *Class of 2023*

Milky way galaxy, that houses our planet earth is just 13billion years old. In the dynamic history of Solar System, galaxies are born and die just like humans but definitely the life span of galaxies is of several billion years.

A galaxy which is 9 billion light years away from earth, formed 4.5 billion years ago is dubbed as ID2299 and is ejecting gases equivalent to 10,000 sun-worth of gas a year in a form of cold gas ejection. Which means, it is rapidly losing its fuel core. It is estimated that the galaxy is currently removing 46% of the total cold gas it contains. It was discovered using the telescope Atacama Large Millimeter Array (ALMA). This event of losing fuel started by a galactic collision between two galaxies some 9 billion years into the past. This is the first time when we can practically observe a typical massive star-forming galaxy in the distant universe is about to die because of a massive cold gas ejection. Most astronomers believe that winds caused by star formation and the activity of black holes at the center of massive galaxies are responsible for launching star-forming material into space, thus ending galaxies ability to make new stars. But, the rate at which the gas is being expelled from ID2299 is too high to have been caused by the energy created by a black hole or stardust as seen in some previous studies. The fact that why ID2299 is ejecting gas in such large amount is because of the collision between two galaxies, which eventually merged. Colliding galaxies are identifiable by their 'tidal tail' which is an elongated streams of gas and stars traced out in space behind the galaxies. Such tails in distant galaxies are usually too dim for astronomers on Earth to see, though they have been detected on hundreds of galaxies. The researchers spotted this one just as it started to extend into space.

The galaxy is still forming new stars very rapidly, but it is also quickly running out of fuel, due to which the remaining gas will be consumed and the galaxy is likely to be dead within few million years. The finding could also offer hints about where our own galaxy is headed. The Milky Way is also releasing its own cold gas into the void, and it's also on track to collide with the Andromeda Galaxy in about 4 billion years. With this the year 2021 becomes yet another year for geography to discover and know something more than what already exists.

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- Paper published by European Southern observatory
- Views of Annagrazia Puglisi

THE RISE OF THE GREEN TOXINS (ALGAL BLOOM)

Shreya Wadhwa, *Class of 2022*

Introduction

While crossing a bridge, have you ever wondered about the green-coloured matter floating in the water ? Well, that green-coloured matter is known as algae. They are an essential part of the marine ecosystem.

Algae are a diverse group of organisms that are present in water bodies. These can conduct the process of photosynthesis which helps in maintaining the balance of life in the water bodies. Most people have an idea about certain algae-like seaweeds, pond scum, etc. But there is a vast range of algae that isharmful to aquatic organisms and human beings, and when a rapid increase in the population of this type of algae takes place, it is called Algal bloom, water bloom, or marine bloom.

Types of algal blooms

Algal blooms are mainly composed of bio-toxins and are characterized by a distinct discoloration of water because of the presence of a large number of pigmented algae cells. The colours range from green, red, yellow, and brown, and the major types of algal boom found in the water bodies are :

- Cyanobacteria (blue-green algae) (Fig. 2)
- Red tides (red algal blooms) (Fig. 3)

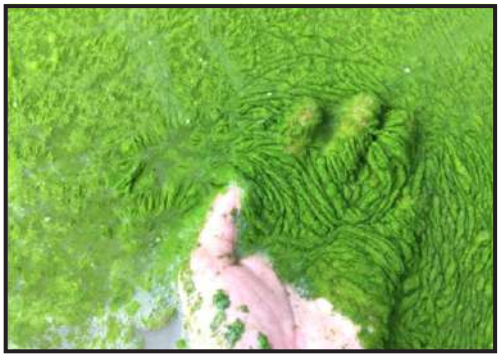

Fig. 1

Fig. 2

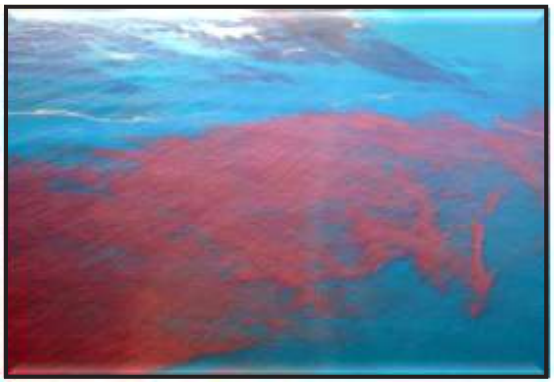

Fig. 3

Causes of algal blooms

Availability of Nutrients

One of the top causes of algal blooms in water bodies is the presence of a large amount of nitrogen and phosphorus. These nutrients are generally washed away from farms and lands that are heavily loaded with phosphorus and nitrogenous fertilizers.

Agents responsible for the transportation of these nutrients are –

- Rain – nutrients from farms and other lands are washed away into the rivers and other water bodies.
- Drainage system – poor sewage treatment is considered to be one of the main sources of algal bloom because when untreated sewage, rich in nitrogen compounds finds its way to the water bodies it further fuels the process of algal bloom

High Temperature

The rise in the global temperature is another major cause for the increase of algal cover in the water bodies. Example : The blue-green algal blooms usually develop when the water temperatures are high. A decline in their growth has been recorded when the water temperatures are low.

Also, the increase in the temperatures has led to the rapid decomposition of nutrients like ammonia and nitrates which further helps bacteria to grow in quantity.

Slow-Moving Water

Most algal bloom like that of blue-green algae needs still or stagnant water to grow in quantity. Stable conditions like less turbulence, low flow, and light winds are perfect for their growth whereas others prefer a mixed environment.

Presence of Dead Organic Matter

Like different bacteria present in the atmosphere and water needs a suitable media for growth and nutrients, algae bacterium also needs dead organic matter for the continuous supply of nutrients .

Nutrients from the water and dead organic matter together make it a suitable situation for an algal bloom.

Fig. 4

Light

When exposed to high light intensity, algae, especially the blue-green algae are diminished but they have optimal growth when irregularly exposed to high light intensities. These conditions are fulfilled with underwater surfaces where the light environment is regularly fluctuating.

Even under different conditions like less availability of light or turbid water, blue-green algae have a higher growth rate than any other algae and the ability to adapt under the variable light conditions gives cyanobacteria an advantage over the others.

Turbidity

Turbidity is caused due to the presence of suspended particles and organic matter in the column of water. High turbidity occurs when a lot of water is running through the system and vice versa.

The stagnant water can cause low turbidity that allows the particle to settle out of the water. When there is low turbidity, more light can penetrate through the water column. As a result, it creates an optimal condition for algal growth.

Conclusion

From all the points mentioned above, it is clear that some causes of algal bloom do involve natural phenomenon's like sunlight and high temperature but if we take a thorough look, we realize that all of these situations like the rise in temperature and washing away of nutrients are happening because of the interference of human beings in the natural processes.

So to reduce algal bloom we must all take some drastic measures because water is an essential ingredient for the survival of living beings. We should always keep in mind that if water is an element that gives us life, it is also an element that can take our lives away.

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PECULIARITIES OF THE BERMUDA TRIANGLE

Nila Mukherjee, *Class of 2024*

The ocean is dark and secretive yet ominous and majestic, hiding endless mysteries. One such enigma of the boundless ocean is the Bermuda Triangle where several unexplained disappearances of ships, aeroplanes and people have been observed since the mid 19th century. People claim this place to be supernatural and often refer to it as the Devil's triangle - but what if there are actual logical reasons behind these disappearances? And yes, several geographical aspects have proved that the region is probably not supernatural but a baffling creation of nature. These reasons also reflect why numerous ships and aeroplanes going over it have disappeared without a trace.

LOCATION

The Bermuda Triangle is located in the western part of the North Atlantic ocean and is bounded by the three islands of Bermuda, Miami and Puerto Rico. This region whose boundaries are not universally agreed upon, has a vaguely triangular shape which is marked by the Atlantic Coast of the Florida Panhandle, Bermuda and the greater Antilles.

UNCANNY DISAPPEARANCE

It is estimated that more than 50 ships and 20 aeroplanes have peculiarly vanished in the Bermuda Triangle leaving many people missing. Even the rescue teams who passed through the mythical region are said to have disappeared as well.

GEOGRAPHICAL EXPLANATIONS BEHIND THE LONG AWAITED MYSTERY

1. COMPASS VARIATIONS

The region of the Bermuda Triangle belongs to one out of the two places on earth where instead of the magnetic north, the compass points towards the true or geographical north. When this compass variation is not taken into account beforehand, ships and aeroplanes are bound to loose track of their destination. Magnetic(compass) north and geographical i.e. true north are exactly the same only for a small number of places on earth. For example, as of the year 2000, in the United States of America only those places on align running from Minsk on to the Gulf of Mexico have this type of anomaly.

2. TOPOGRAPHY AND INFLUENCE OF METHANE

The coral islands of Bermuda consists of a layer of 200 feet thick marine limestone which caps an extinct and submerged volcanic mountain range rising more than 14,000 feet above the ocean floor. The limestone surface is overlain by a shallow layer of fertile soil and the islands are fringed by coral reefs and have no lakes or rivers. Being one of the deepest spots on earth, the underwater topography of the Bermuda triangle can possibly be a reason behind this long history of mysterious disappearances. The underwater topography goes from a gently

sloping continental shelf to an extremely deep drop off .Many of the deepest trenches of the world are found in this particular region which makes it quite evident that ships or planes sinking into these deep trenches will probably forever be buried in the ocean.

Large concentrations of methane gas which have been formed because of the decomposition of sea organisms, are trapped in the ocean floor as stated by many scientists. This methane accumulates together as super concentrated methane ice. If one of these pockets ruptures, the gas surges up and erupts on the surface without any warning. If a ship is passing through an area of such a blow out, the water beneath it would suddenly become much dense which in turn will sink the ship and the sediments would swiftly enshroud it as it settles down on to the sea floor.

3. THE GULF STREAM

The Gulfstream is a crucial surface current which is essentially driven by thermohaline circulation that originates in the Gulf of Mexico and then flows through the Strait of Florida into the North Atlantic Ocean. In essence, it is actually a river within an ocean .Just like a river ,it can and does carry floating objects. It has a maximum surface velocity of about 6.6 feet per second and any small aeroplane making a water landing or a boat having engine trouble can be carried away from its reported position by this Gulf stream.

4. WEATHER DISTURBANCES

The Bermuda Triangle is located in an area of the Atlantic Ocean where storms from multiple directions can converge making rogue waves likely to occur.

Hurricanes are violent storms that gets formed in tropical waters. These powerful storms have taken away the lives of many people and are responsible for creating great havoc and damage in places affected by it. These storms in the past have led to a number of incidents related to the Bermuda triangle. Numerous Atlantic hurricanes pass through the Bermuda triangle. Before the invention and advancement of weather satellites, ships often did not receive any warning regarding the approach of these hurricanes. It has also been hypothesised that periodic meeting eruptions, sometimes also known as mud volcanoes may produce regions of frothy water which are no longer capable of providing adequate buoyancy to the ships .If this was the case, such an area forming around the ship could cause it to sink very rapidly and without warning.

A large portion of the ocean still remains unexplored and hence, there might be many other reasons behind these unusual disappearances which are yet to be discovered.

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FINGAL'S CAVE : ISLE OF STAFFA, SCOTLAND

Abhipriya Datta, *Class of 2024*

INTRODUCTION :

Fingal's cave is a sea cave on the uninhabited island of staffa, in the Inner Hebrides of Scotland, known for its natural acoustics. The National Trust for Scotland, owns the cave as part of a national nature reserve

LOCATION	STAFFA,SCOTLAND
DISCOVERY	1772
GEOLOGY	PALEOCENE BASALT FLOW
ENTRANCES	ONE
HAZARDS	PARTIALLY FILLED BY THE SEA, SLIPPERY ROCKS
ACCESS	PUBLIC

Entrance of Fingal's Cave

FORMATION :

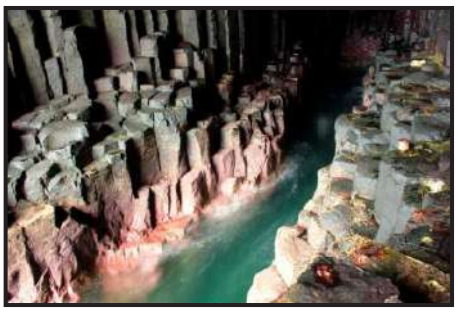
Fingal's Cave is formed entirely from hexagonal jointed basalt columns within a Paleocene Lava flow, similar in structure to the Giant Causeway in Northern Ireland and those nearby Ulva. At 72 feet tall and 270 feet deep, the hexagonal columns of basalt, shaped in neat six-sided pillars that make up the interior walls makes the sea cave so visually astounding.

In all these cases, cooling on the upper and lower surfaces of the solidified lava resulted in contraction and fracturing, starting in a blocky tetragonal pattern and transitioning to a regular hexagonal fracture pattern with fractures perpendicular to the cooling surfaces. As cooling continued these cracks gradually extended toward the centre of the flow, forming the long hexagonal columns we see in the wave – eroded cross-section today. Similar hexagonal fracture patterns found in the desiccation cracks in mud contraction is due to loss of water instead of cooling.

Interior of Fingal's Cave representing hexagonally jointed basalt columns within a Paleocene lava flow

SIGHTSEEING :

The cave has a large arched entrance and is filled by the sea. Several sightseeing cruises organised from April to September by local companies pass the entrance to the cave. In calm conditions , one can land at the island's landing place (as some of these cruises permit) and walk the short distance to the cave, where a row of fractured columns forms a walkway just above high-water level permitting exploration on foot. From the inside, the entrance seems to frame the island of Iona across the water. One can visit the cave via cruise, though boats cannot enter the cave , they make regular passes by it or can travel to the small island of Staffa and hike into the cave by stepping from column to column. On the way, northern shores of Staffa host a puffin colony during the summer months.



HISTORY :

The cave was a well known wonder of the ancient Irish and Scottish Celtic people and was an important site in the legends. The cave was bought to the attention of the English-speaking world by the 18th century naturalist Sir Joseph Banks in 1772. It became known as fingal's cave after the eponymous hero of an epic poem by the 18th century Scots poet-historian James Machherson. It formed part of his Ossian cycle of poems claimed to have been based on old Scottish Gaelic poems

IN THE SUMMER PUFFINS BURROW NEARBY :

Staffa is home to more than 600 confirmed puffin burrows , so if you are hoping to see these colourful seabirds in their natural habitat , be sure to schedule your visit during the summer. They begin breeding in April and stay near their burrows until August. The birds are typically on the opposite side of the Fingal's cave and you will stand a better chance of catching them by taking a tour of the nearby Treshnish Islesa , an archipelago of small islands with higher puffin populations.


Puffins in Fingal's Cave


Puffins in Fingal's Cave

CONCLUSION :

Whether you make a quick trip to Staffa on a pleasure cruise or you spend some time exploring the surroundings isles, You will fall in love Fingal's cave. Be prepared to take photos as soon as you see it on the horizon; the approach to the cave is absolutely magical. You will want to remember the experience for the rest of your life.

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AUSTRALIAN BUSHFIRE CRISIS (2019-2020)

Aratrika Biswas, *Class of 2023*

INTRODUCTION :

Australia is no stranger to bushfires but the bushfire of 2019-20 seemed to be unprecedented in many ways to the people. It started in June and then new out-of-control fires sprung up at the beginning of September 2019. All the fires were either extinguished or contained by 4 March 2020. The 2019-20 Australian Bushfire season is also colloquially known as Black Summer.

CAUSES OF THE BUSHFIRE :

The wide extent of the bushfires of 2019-20 is claimed due to extremely dry conditions that persisted over the past two years. These dry conditions were further linked to negative Indian Ocean Dipole(IOD) and absence of La Ni˜na.

REGIONS AFFECTED :

The Australian Bushfire Crisis has led to hazardous air quality in major cities throughout Australia and affected New Zealand and cities in South America after smoke reached both Argentina and Chile. For months, hazardous bush fire smoke has intermittently blanketed heavily populated areas including Sydney, Melbourne and Canberra.

IMPACTS :

1. Over 18 million hectares (almost double area of the state of Bihar) have burned in the Australian bushfire season 2019-20 as of mid – January according to media reports, destroying over 5,900 buildings including over 2,800 houses.
2. The damage to the environment and native Australian fauna is colossal. The National Farmer's Federation estimates more than 100,000 sheep and cattle have been lost. It has led Koalas to be an endangered species.
3. Wildfires produce harmful smoke which can cause fatalities. According to World Health Organization (WHO), older people , people with cardiorespiratory diseases or chronic illnesses, children, and people who work outdoors are particularly vulnerable.
4. The Bushfire damages height up to $4.4 billion on financial terms.

GOVERNMENT RESPONSE :

On January 2020, the Australian federal government announced the formation of National Bushfire Recovery Agency. In addition, the government pledged $A2 billion(US$1.4 billion) to help the families, farmers and business owners hit by this unprecedented bushfires.

CONCLUSION :

Australian Bushfires are natural disasters catalyzed by global human negligence towards nature. As all things are related to each other, we have no right to infringe on the livelihood of any other species. So we must change how we influence the land. We must respect the natural order of things and find a way to live accordingly.

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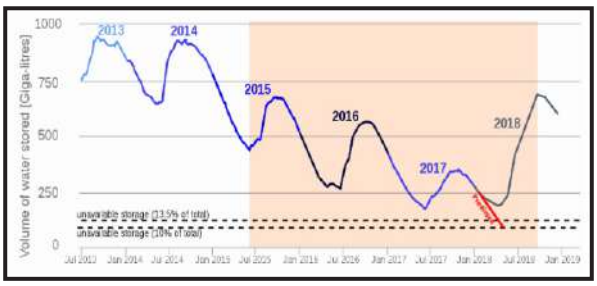
DAY ZERO-WHEN CAPE TOWN ALMOST RAN OUT OF WATER

Shreya Wadhwa, *Class of 2022*

Introduction

Water is the most essential and indispensable resource that makes life possible on our planet earth. It is available to us through various sources like rain, groundwater, ocean, etc. It is useful for us in many ways in our day to day lives.

So we can say that we are dependent on this precious resource completely. But what if a day arises when the water we once used recklessly is not available to fulfill our needs anymore? Well, we think that this day is never going to come, or at least not in the next hundred years but little did we know that a city in South Africa was already facing this problem.



Cape town the second-most populous city in South Africa suffered from a period of severe water crisis from the year 2015 to 2018. The dam water level started declining in 2015. It peaked in mid-2017 and mid-2018. That's when the plans for 'Day Zero' a day when the water levels of the major dams supplying the city would fall below 13.5% was firstmentioned.

To control this situation, the city of capetown implemented water restrictions and was able to reduce its daily water usage by more than half in march 2018 that lead to the postponement of the Day Zero that they estimated.

Causes

The three major causes that fueled this crisis were :

1) Severe droughts : The city of Cape Town faced extreme dry spells from 2015 to 2017. It is one of the many reasons for water scarcity as it was considered an extreme and rare event. The changes in the atmospheric and oceanic circulation, the poleward shift of the Southern Hemisphere moisture corridor, displacement in the jet stream, and the expansion of the semi-permanent South Atlantic high-pressure system resulted in the decline of rainfall and hence making 2017 the driest year since 1933.
2) Government failure : The national government is the one that ensures that water is protected, conserved, managed, and controlled equitably for the use of every person. Unfortunately, the differences between the two major parties and also debt and the corruption in the Department of Water and Sanitation made the situation even tougher to handle.

3) Long term demand and supply management: The difference in the rate of growth of population and the dam water storage was another challenge faced by the city. The increase in population was about 71 % in the last 20 years in comparison to the dam water storage, which was only 17%. So this long-run demand was amplified by the stains on the long-run supply.

4) Spread of the water thirst plants and climate change : The spread of water thirst plants in the major catchment areas has reduced the water supply to Theewaterskloof Dam, which is a major component of Western Cape Water Supply Systems.

Also, the increase in the global temperatures by one degree Celsius may increase the extremity of droughts.

Measures

To control the situation, some measures were taken by the city that mainly focused on increasing the water supply and reducing the demand in the Western Cape Water Supply System. They were:

1) Uniting the city

The first thing that the city did to bring down the water demands was to take all the residents and the businessmen on board. Everyone was instructed to shower for no longer than two minutes and they promoted to use recycled water or greywater. Slogans such as “If it's yellow, let it mellow” were used to promote flushing only when necessary.

Also, the residents were allowed to use not more than 50 liters of water per day which was quite difficult because a shower alone can use 15 liters per minute. But even after that, all these people stood up together and shared some ideas on social media.

2) Restricted supply

The city limited the allowance of water and introduced some strict restrictions. Washing cars, filling of swimming pool and fountains were all banned.

Houses that used more than their limit were forced to pay big fines. With this, the city also increased the tariffs and introduced new management devices that would set a daily limit on the water supply to properties.

Along with the different measures that targeted domestic use of water, the city also imposed some restrictions on the commercial and agricultural sectors. Limitations on the agricultural water quotas were introduced.

Conclusion

With the help of all these strict measures and the return of some rainfalls, the city was able to postpone the estimated day zero. Cape Town managed to save itself from being the “First country in the world to run out of water”. But even after all this, the threat of future water shortages remains.

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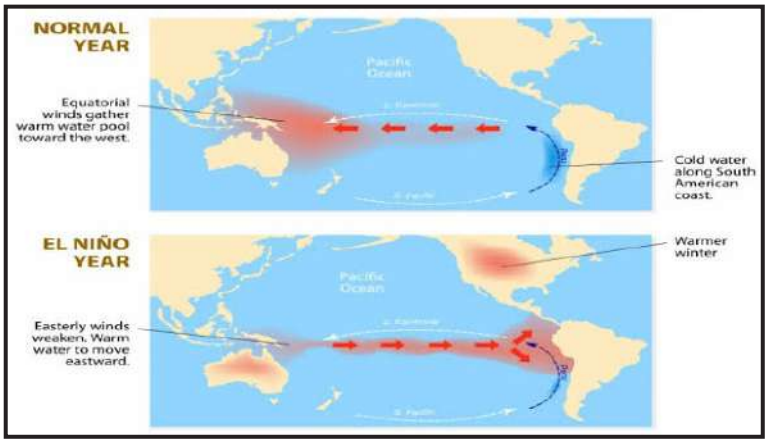
EL NINO EFFECT

Debanshi Mondal, *Class of 2023*

What is El Nino ?

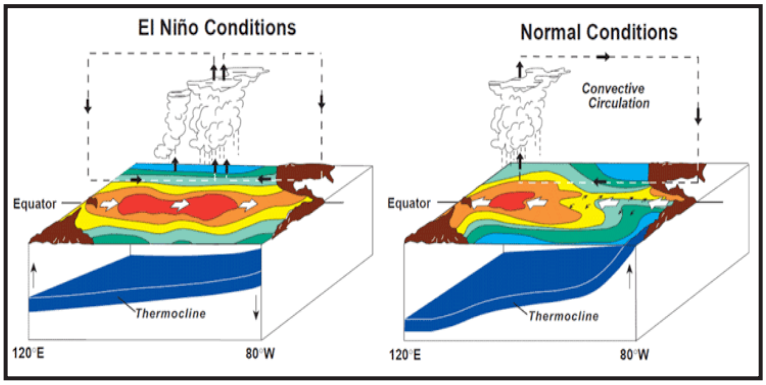
El Nino is the warm phase of the El Nino Southern Oscillation (ENSO) and is associated with a band of warm ocean water that develops in the central and east central equatorial pacific (between approximately the International Date Line and 120°W) including the area off the coast of South America.

What causes El Nino ?



The winds near the surface in tropical Pacific usually blow from east to west, however for reasons scientists don't yet fully understand, why these relatively steady winds sometimes weaken or strengthen for weeks or months in a row. These weak winds allow surface water to build up in the eastern Pacific. Sometimes, the atmosphere responds to this warming with increased rising air motion and above average rainfall in the eastern Pacific. This coordinated change in both ocean temperatures and the atmosphere begins an El Nino event; and as this develops, the warmed waters cause the winds to weaken even further, which can cause the waters to warm even more.

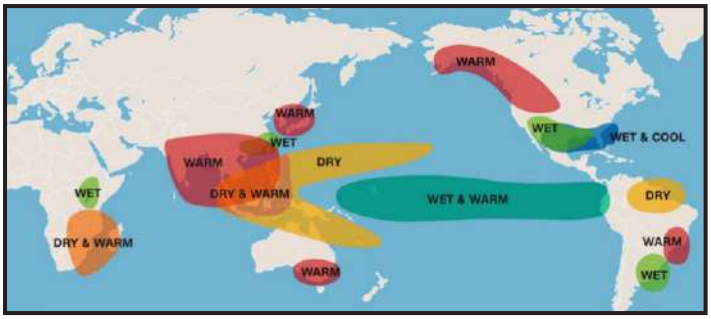
Occurrences of El Nino



The EL Nino effect is believed to have been occurring for thousands of years. Although records conclude that there have been at least 30 events since 1900, with the 1982-83,1997-98 and 2014-16 events among the strongest on records. Major ENSO events were also recorded in the years 1790-93, 1828, 1876-78, 1891, 1925-26, 1972-73. When this warming effect prevails for seven to nine months, it is classified as El Nino “conditions” and when its duration is longer, it is termed as El Nino “episode”.

Effects on the global climate and Regional Impacts

El Nino affects the global climate and disrupts normal weather patterns, which as a result can led to intense storms in some places and droughts in others. Most tropical cyclones form on the side of the



subtropical ridge closer to the equator and then moves poleward past the ridge axis. Also, western areas of Japan and Korea experiences many September-November tropical cyclones during the El Nino effect.

In South America El Nino causes major flooding in the coasts of northern Peru and Ecuador while in North America a drier weather varies in the Pacific Northwest associated with a much cooler weather in North Canada. The risk of Atlantic hurricane season is usually diminished during El Nino while the tornado season prevails actively in the United States. In Australia, the shift in rainfall away from Western Pacific and a decreased cloud cover results in warmer than average daytime temperature across Southern Australia due to El Nino effects. In Antarctica, El Nino conditions results in the high-pressure anomalies over the Amundsen and Bellingshausen seas, causing reduced sea ice and increased poleward heat fluxes in these areas and Ross Sea. The Weddell Sea, conversely, tends to become colder with more ice during El Nino effects. In Africa, East Africa including Kenya, Tanzania and the White Nile Basin experiences long rains from March to May; Drier than normal conditions from December to February prevails in South Central Africa, mainly in Zambia, Zimbabwe, Botswana and Mozambique due to El Nino. In Asia, as warm water spreads from West Pacific and the Indian Ocean to the east Pacific, it carries the rain with it, causing extensive drought in the Western Pacific and rainfall in the normally dry eastern Pacific. El Nino effects in Europe are quite controversial, complex and difficult to analyze as the influence of other factors strongly prevails there.

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EVALUATING THE RELATIONSHIP BETWEEN PHYSICAL AND CULTURAL LANDSCAPE OF GARANGA VILLAGE, GARHBETA I, PASCHIM MEDINIPUR

Class of 2021

Introduction :

The students of the geography department had visited the Garanga village in the Garhbeta I block of Paschim Medinipur from 20th January to 22nd January, 2020. The main economic activity of the village is agriculture and the area is drought-prone which makes the area quite vulnerable and poverty stricken.

Objective :

Since the area is drought-prone and people depend on agriculture, there is a heavy pressure on the groundwater resource. The main objective of the study is to highlight the effects of seasonal groundwater level fluctuations and soil degradation on the way of life of inhabitants of the village.

Methodology :

The report was prepared based on three important aspects of field study. They are as follows –

- **Pre-field study :** includes the collection of information from various books and government offices before visiting the study area.
- **Field study :** includes both primary and secondary data collection. Primary data collection includes the household survey and dumpy level while the secondary data collection includes the collection of information from various government offices in the study area.
- **Post-field study :** includes the analysis of the data collected and representation of that data through various maps and diagrams so that the inter-relationship between the physical setting and socio-economic factors can be clearly established.

Physical Setting :

The physical conditions of lithology and structure, relief, drainage, climate and soil exert an influence on the socio-economic life of the people.

Lithology and structure : There are two natural divisions of the district. To the east is the fertile and fully cultivated alluvial soil and to the west is the undulating waves of lateritic rocks. The elevation and slope of Paschim Medinipur is between 50-100m in the west and decreases from 50-10m eastwards. Paschim Medinipur has fluvio-deltaic sediment with lateritic capping to the west followed by older and younger alluvium to the east.

Relief : On the basis of the physiographic characteristics, the entire district (Purba and Paschim) has broadly been divided into two natural divisions- the western upland including the undulating lateritic Rarh plain and the eastern Gangetic alluvial plain along with southern maritime tract. Our study area is a part of the Silai plain which is a part of the eastern fringe of the Chhotanagpur plateau and consists of lateritic formation. The character of the relief of the area is more or less monotonous, ranging in elevation between 40-60 metres.

Drainage : The river system of Paschim Medinipur district constitutes of the Rupnarayan, the Kansai and the Subarnarekha which enters from Jhargram and passes into Balasore district, where it falls into the Bay of Bengal. The drainage density map of the district shows a variation between 0-1.10 km/sq.km shows coarse drainage structure. Groundwater withdrawal has increased over the years due to erratic rainfall and insufficient surface water bodies resulting in drying up of dug and bore wells. Our study area lies to ths south of Silai River flowing towards east. Khatra main canal is found to the south of Garanga.

Climate : The climate of the district follows a hot tropical monsoon pattern. The highest rainfall of more than 1600mm occurs in the eastern part of the district. Garanga in Garhbeta I receives the same amount. An isotherm of 26.5°C traverses the region. The temperature in the district ranges from 17°C to 32°C. The average cloud cover varies between 3% to 63% and the humidity varies between 100-200%. The pressure pattern shows high pressure during the winter months which gradually decreases in the monsoon.

Soil : On the basis of the predominant soil type, the soil of Paschim Medinipur can be divided into two types- a) Lateritic soil and b) Alluvial Soil. Garhbeta I accounts for 85% lateritic soil and 15% alluvium (Source : PAO, Dept. of Agriculture). In Paschim Medinipur, loamy soil covers the largest area (84%) followed by clayey loamy soil (12%), loamy sandy (3%) and gravelly loamy (1%).

Natural Vegetation : The natural vegetation is mainly of tropical deciduous type comprising of mixed forests, trees, grasses and shrubs. The total forest area of Paschim Medinipur is 19.35% of the total geographical area. There are four divisions in the district. These are-

1. Medinipur Forest Division
2. Jhargram Forest Division
3. Kharagpur Forest Division
4. Rupnarayan Planning and Survey Division

Environmental Issues : The Gully erosion is the most serious environmental problem in the area. Garanga village, located in the Southern part of Garanga Gram Panchayat, Garhbeta Block I faces the problem of soil erosion which adversely affects agriculture. It is also aggravated by the fluctuations of groundwater level during the monsoon and pre-monsoon periods.

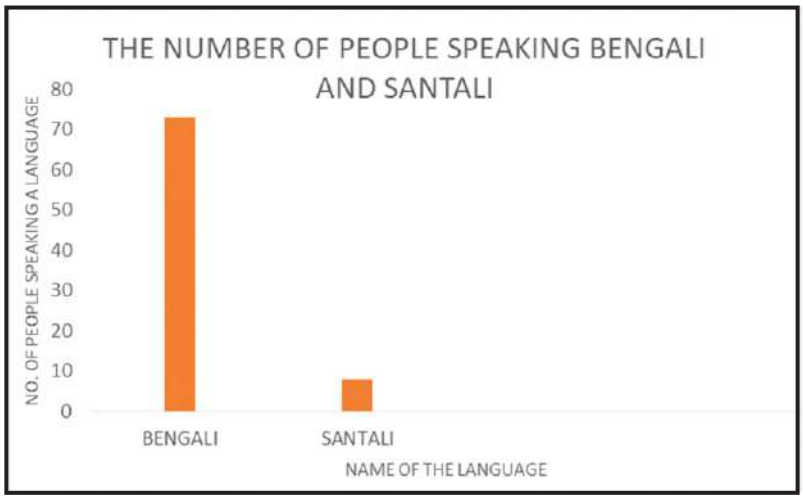
Natural Hazard : A part of Paschim Medinipur has been suffering from the crucial problem of drought, cyclone, flood, soil erosion and crop failure. Garhbeta I is a drought prone area due to its undulating topography, lateritic and porous soil having a little water holding capacity together with fluctuating groundwater problems and soil erosion sometimes resulting in crop failure. This block is also particularly affected by floods which may be due to the rivers like Silabati and it's tributaries.

Socio-economic Survey :

- **Demographic Structure :**

  Garanga village which is situated at the southern part of the Garanga Gram Panchayat in the

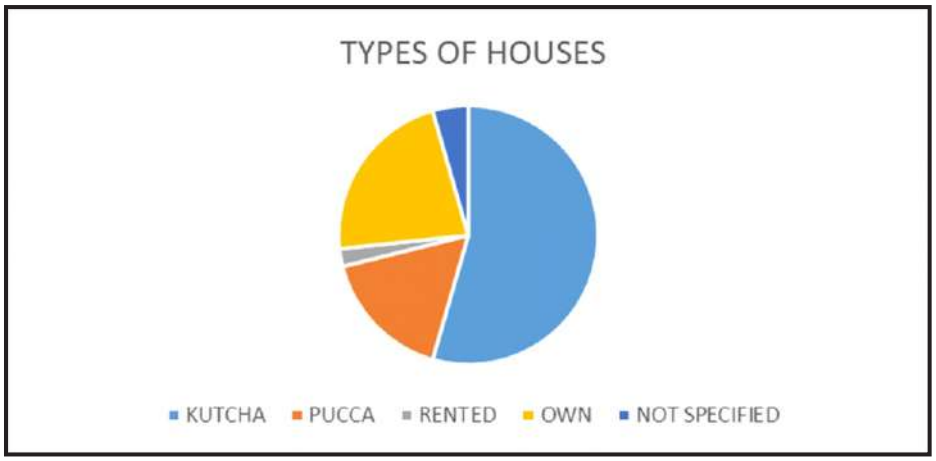
Garhbeta I block of Paschim Medinipur has a population of 1179, out of which 578 are males and 601 are females according to the Population Census, 2011. The population of children between age 0-6 is 149, which makes up 12.64% of the total population of the village. Child Sex Ratio for Garanga is 1129, higher than West Bengal average of 956. There are two major languages spoken in the village namely, Bengali and Santali. Bengali speakers are more in number. The working population (between 21-59 years) is more than other categories. Majority of the villagers follow Hinduism and are Scheduled Caste.



- **Village Scenario :**

The studied aspects include the ownership of houses, types of houses, building materials, roof material, floor material, number of rooms per house, quality of ventilation, sanitation, whether electricity is available.

There are five categories of house types present in the village- kutcha, pucca, own, rented and not specified. Kutcha houses constitute the majority in the village. Asbestos is the main roof material while mud is the main floor material as well the main building material. 1 room houses are majority in the village. The quality of ventilation is medium and the main mode of sanitation is open field. Most of the houses are electrified.



- **Occupational Structure and Health Condition:**

The occupational structure and monthly income of the surveyed villagers of Garanga is less which adversely affects their health conditions. 98.47% of workers describe their work as Main Work (Employed or earning more than 6 months) while 1.53% are involved in Marginal activities.

Seven categories of occupations have been identified namely-Agricultural labourers, carpenters, domestic labourers, cultivators, industrial workers, school teachers and other workers. Agricultural labourers constitute the highest occupation category. The monthly income of the villagers vary from less than 2000 rupees to rupees 8000. Very few people have earnings more than this average range. There is one primary health centre in the village a private hospital in the Garhbeta I block. The main mode of treatment availed is Allopathy.

- **Agricultural Setup :**

Garanga village is totally dependent on agriculture and the fact that it lies in a drought prone area makes it extremely difficult for the villagers to practice cultivation. The extension of irrigation facilities has helped in the process. The types of crops grown by the villagers include paddy, wheat, other food crops, mustard, other oilseeds, vegetables, flowers and fruits. Among the 5 types of cultivators found namely, sharecroppers, barga, marginal, medium cultivators and big cultivators, marginal workers constitute the majority. Double cropped farms are found in majority. Government canal serves as the main source of irrigation.

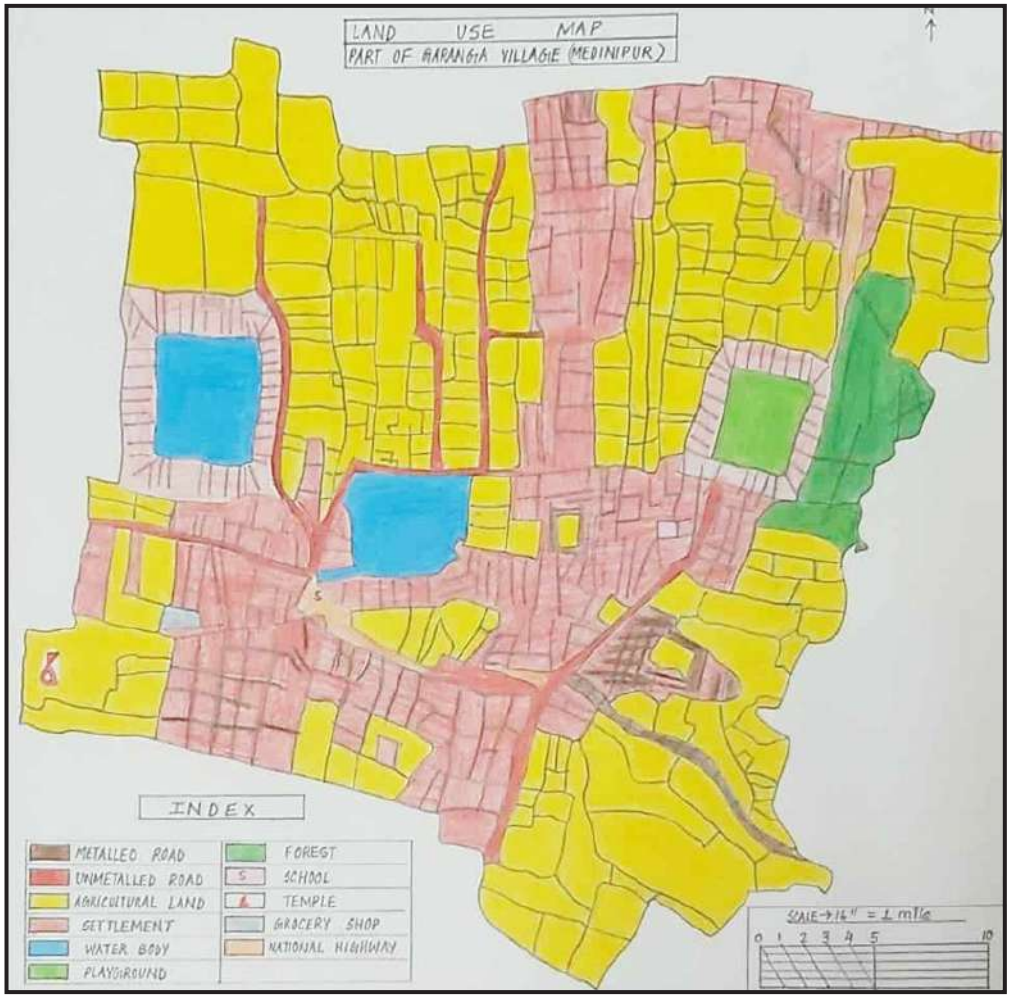
- **Literacy and Savings, Movement and Market, Requirements :**

As per the 2011 Census, the total number of literates in Garhbeta I CD Block was 144,728 (72.21% of the population over 6 years) out of which males numbered 80,544 (78.80 % of the male population over 6 years) and females numbered 64,184 (65.41 % of the female population over 6 years). The gender gap in literacy rate was 13.39%. Most of the students go to primary school. Graduation level is very negligible and a small percentage of the male population has received technical education.

After conducting the survey in the village, it is found that male literacy is higher at all levels. The percentage of literacy of the village according to the survey is 72. 75% of the villagers do not have any savings. The main mode of transportation is bicycle, followed by toto, bus and the rest prefer walking. Weekly market is the most famous form of market availed by the villagers. Sanitation facilities are a major requirement of the villagers.

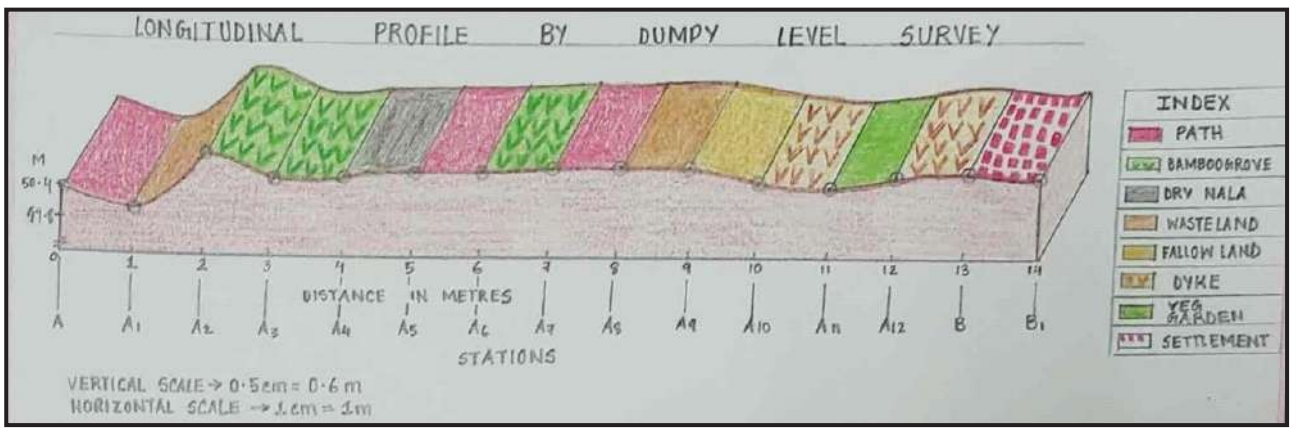
- **Landuse :**

After collecting information about the landuse in the Garanga village from the Village Panchayat, a Chorochromatic map has been prepared. The map shows that the village is essentially agricultural in nature as most of the plots are put to agricultural use. Agriculture is facilitated by the presence of the two water bodies, one, almost in the central part of the village and the other, in the western part. The east-northeastern part of the village has some area under forest cover, adjacent to which is a playground to the west. The agricultural and settlement areas are connected by intermediate unmetalled roads. However, the village is well connected to the block (Garhbeta I), by metalled roads. The primary school of the village is next to a water body. Settlement is well distributed in the village from north to south. However, the eastern fringe has no settlements as it is under forest cover and agriculture. There is a temple at the south-western tip of the village. A grocery shop is located at the confluence of the agricultural fields and the settlements, a few meters away the temple. National highway runs from near the village.



- **Dumpy Level Survey :**

A Dumpy level survey was conducted in a part of the Garangamauza along few selected lines to show the different landuse patterns of the village. The Benchmark of the area is 50m above mean sea level (BM of Garhbeta town). The study area is characterized by a monotonous flat terrain. The various landuse patterns observed along the line of the survey include bamboo grove, vegetable garden near the settlements, fallow, wasteland, dry nala, path etc.



- **Influence of Physio-Socio-Economic Factors :**

Human life is influenced by several physio-socio-economic factors such as relief, climate, availability of water and so on. After the survey at Garanga village, we could identify, 10 physio-socio-economic factors that influenced the life of people there. These include - relief, water, climate, vegetation, soil, transport and communication, tourism, employment, health services, and government and NGO help. These factors affect human life in both positive and negative ways.

Factors such as relief, water, climate, vegetation, soil and health services have more positive impacts than the negative impacts, than the other factors including transport and communication, tourism, employment, and government and NGO help, which mostly affect the lives of people adversely in the surveyed village.

Availability of suitable relief, water, climate, vegetation and soil facilitates the growth of vegetation and therefore these have more positive impacts on human lives. The government has set up school and hospitals in the village which ensure good education and health services. The people know the importance of availing medical treatment in time of need. However, due to lack of good transport network, often it becomes difficult for the people to avail the facilities which are available at a distance. Also, since, the village is visited by tourists, the villagers often feel insecure and therefore find negative influence of tourism more than positive influence. Employment has a negative influence on the people since, people mostly migrate to the urban areas to find the job which often creates problem in their place of origin i.e. their family at the village. Lastly, since the village is at the grass root level, often the funding of government and other agencies do not reach for the benefit of the people, and they continue to live their poor lives.

Conclusion :

The morphometric attributes of the terrain governs and correlates strongly with the prevalent land use. The right bank of the river varies greatly from the left bank, in relative height and bank material composition. The elevation of the right bank is much higher than that of the left bank. The bad land topography lies on the right bank while the left bank is totally used for agricultural purposes. Some small agricultural plots are also found at the foot of the right bank, where the laterite bad land cover has receded.

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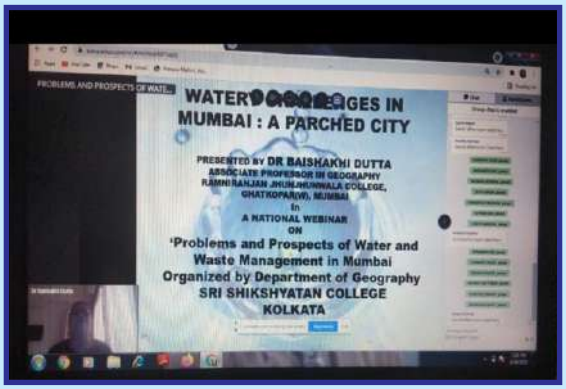

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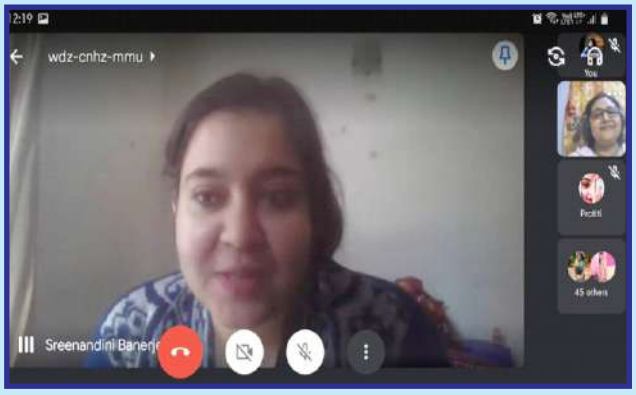

ONE DAY ONLINE GIS WORKSHOP FOR FINAL SEMESTER STUDENTS