Sustaining Agriculture: Development and Challenges of Soil Erosion in Ibrampur and Sal Villages along the Chapora River in North Goa

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DECLARATION BY STUDENT

I hereby declare that the data presented in this Dissertation report entitled, "Sustaining Agriculture: Development and challenges of Soil Erosion in Ibrampur and Sal villages along the Chapora River in North Goa" is based on the results of investigations carried out by me in the Environmental Science programme at the School of Earth, Ocean and Atmospheric Science, Goa University under the supervision of Prof. Ganasha Somayaji and the same has not been submitted elsewhere for the award of a degree or diploma by me. Further, I understand that Goa University will be not be responsible for the correctness of observation/experimental or other findings given in the dissertation.

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COMPLETION CERTIFICATE

This is to certify that the dissertation report **"Sustaining Agriculture: Development and Challenges of Soil Erosion in Ibrampur and Sal villages along the Chapora River in North Goa"** is a bonafide work carried out by Ms. Nisha Namdev Chari under my supervision in partial fulfilment of the requirements for the award of the degree of MA in Environmental Science at the School of Earth, Ocean and Atmospheric Sciences, Goa University.

Date: 02 May 2024

Prof. Ganesha Somayaji

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Signature of Dean of the School

Date:

Place: Goa University

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Preface

Born, brought up and presently living in a village near Chapora river in North Goa, I have been a witness to transformations in the river over the past two decades which have affected the ecosystem in more than one way. Siltation in the river basin, sand mining and siltation affecting marine life are just a few concerns in the village where I stay. The saline water flows during high tide until Ozre village and afterwards the water could be used for agriculture. When my relatives and friends who stay in the villages of Ibrampur and Sal informed me about the challenges of soil erosion due to developmental activities I decided to study the issues related to ecological transformations relating to Chapora river in Ibrampur and Sal villages.

This study explores how farming continues and how the cultivators deal with soil erosion in the villages of Ibrampur and Sal on the banks of Chapora River. My main aim has been to understand more about how people grow crops and take care of their land, especially when the soil gets washed away and to learn more about how farming is changing. I had used different methods like visiting fields, talking to farmers, and studying published data to learn about life in Ibrampur and Sal villages.

Nisha Namdev Chari

Acknowledgment

I would like to express my sincere gratitude to my guide, Prof. Ganesha Somayaji, for his invaluable guidance, support and continuous encouragement throughout my research. I would also like to extend my heartfelt thanks to Sarpanch of Ibrampur village and Panch members of Sal village who shared information about the village people, and their agricultural fields. I am thankful to Shri Mase Vishnu Gawas, a farmer from Ibrampur village who shared me his experiences and provided information about agricultural practices and methods he used to grow crops, where he spends his whole life in practicing agriculture.

I am also thankful to Shri Surendra Raut, a farmer from Sal village who shared me his experiences and information about agricultural fields and gave me a brief information on Chapora river water and their agriculture. And also, thanks to women from Ibrampur and Sal villages for giving me information on growing crops. I would like to thank Public Works Department and its staff, Assonora Water Treatment Plant for giving me information on treatment plant. Their help has been really important for my research. I am also thankful to Ms. Sulochana Pednekar from the Women's Studies programme. I am equally thankful to my family and friends, who have been a constant source of motivation and encouragement throughout my academic journey. I am deeply grateful for their valuable contribution to my study.

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ABSTRACT

India in general and Goa in particular are experiencing economic development which impinges on varieties of environmental transformations. What happens especially to agrarian communities which dwell along the river Chapora which flows in the North Goa, India is the main focus of this study. In view of the limited time available for the researcher, the study has been confined to the villages of Ibrampur and Sal both are agrarian settlements. With the help of the primary data from field work and secondary published literature the researcher has found out that developmental activities such as building Bandaras, canals and bridges have led to various negative consequences such as soil erosion.

Key Words: Chapora River, Development, Soil Erosion, Agriculture

CHAPTER I

INTRODUCTION

The study focuses on understanding the significance of Chapora River for the agricultural villages of Ibrampur and Sal in North Goa. It focusses primarily on soil erosion issues in these villages. The Chapora River, serves as a lifeline for the villages, providing water for various purposes such as drinking, irrigation, and fishing. However, the villages have been experiencing issues relating to soil erosion which impact on the agricultural productivity, livelihoods, and the overall ecosystem.

The study recognises the interdependence of water resources and land management practices in sustaining rural livelihoods. It looks into the intricate relationship between the Chapora River, local communities, and soil erosion dynamics. By understanding the current situation and identifying key challenges, the study seeks to propose feasible solutions that promote sustainable water resource management and soil conservation practices.

1.1 Agriculture in India

Agriculture in India is the backbone of her economy, employing a significant portion of the population and contributing significantly to the nation's GDP. India's agricultural practices are diverse, ranging from traditional subsistence farming to modern, technology-driven methods. The country's vast and varied geography allows for the cultivation of a wide range of crops, including rice, wheat, pulses, sugarcane, cotton, and fruits and vegetables.

Traditional farming methods often involve manual labour, use of organic fertilizers, and reliance on seasonal rainfall. In contemporary times, there has been a shift towards modern agricultural practices, including mechanization, irrigation infrastructure, genetically modified crops, and the use of chemical fertilizers and

pesticides. However, agriculture in India is facing challenges for continuation and once such challenge is soil erosion caused by environmental transformations.

Several factors contribute to soil erosion in India, including deforestation, overgrazing by livestock, improper land management practices, intensive agriculture, and climate change-induced extreme weather events such as heavy rainfall and droughts. Soil erosion has severe consequences for local communities and the environment. It leads to loss of fertile soil, reduced crop yields, decreased water quality due to sedimentation in water bodies, and increased vulnerability to flooding and droughts. Moreover, soil erosion contributes to environmental degradation, loss of biodiversity, and exacerbation of climate change.

1.2 Agriculture in Goa

Goa, one of the small states located on the southwestern coast of India, has a rich history of agricultural practices. Traditional agriculture in Goa involves small-scale, subsistence farming with farmers cultivating a variety of crops such as rice, pulses, coconut, cashew, and spices. Traditional methods often include manual labour, organic fertilizers, and dependence on seasonal monsoon.

Goa's favourable climate allows for cultivation of a wide range of fruits and vegetables, including mangoes, bananas, pineapples, papayas, tomatoes, and chilies. Horticulture plays a significant role in supplementing farmers' incomes and providing nutritious food for local consumption.

Agriculture in Goa is facing various issues and soil erosion is one among them. Soil erosion is a significant problem faced by local communities in Goa, particularly in areas with hilly terrain and heavy rainfall. Factors contributing to soil erosion in Goa include deforestation, improper land management practices, intensive agriculture, construction activities, and climate change-induced extreme weather events.

After the conclusion of this study the researcher proposes that raising awareness among farmers about the causes and consequences of soil erosion and educating them of the methods of soil conservation and sustainable agricultural practices is very crucial.

1.3 Ibrampur and Sal Villages

The field of this study comprises of Ibrampur and Sal villages which are at the entry point of river Chapora to Goa. Ibrampur village, is in the Pernem taluka of North Goa district, India, lies 26km away from the sub-district headquarters of Pernem and 46 km from the district headquarters of Panaji. According to 2009 statistics, Ibrampur is also designated as a gram panchayat. Ibrampur has a lot of banana plantations.

Sal or Salem village, is in the Bicholim taluka of North Goa district, India, is positioned 17km away from Bicholim and 40km from Panaji. Sal Dam is situated in this village. Tourists are drawn to Sal village, particularly after the construction of a bridge where they engage in leisure activities. However, some tourists engage in such behaviours as consuming alcohol, engaging in altercations, and causing accidents as told to the researcher by the villagers. Despite its current status as a popular picnic spot, Sal village was relatively unknown in ancient times, which now caters to various services such as laundry, watering cattle, and vehicle washing. Industrial development has reshaped the village's landscape over time, with polluted water from industrial sectors directly affecting the water quality.

Imbrampur and Sal villages are picturesque rural communities nestled amidst scenic landscapes. Imbrampur, located in the Pernem taluka, is renowned for its serene ambiance, traditional Goan architecture, and lush greenery. Similarly, Sal village, situated nearby, boasts a similar charm with its tranquil surroundings and closely-knit community.

These villages thrive on agrarian economies, with agriculture serving as the primary livelihood source for residents. The fertile lands of Imbrampur and Sal are cultivated for various crops including rice, vegetables, fruits, and spices.

One of the defining features of these villages is the presence of Chapora river, which meanders through the region, enriching the surrounding lands and acting as a lifeline for the communities. The Chapora river serves as a vital water source for these villages, supporting agricultural activities, drinking water needs, and various daily activities. Additionally, the river provides livelihood opportunities for fishing communities, contributing to the local economy and sustenance. Rivers in general often hold cultural significance for communities, with rituals, festivals, and traditions associated with them. The Chapora river also plays a pivotal role in the cultural practices and identity of villages like Ibrampur and Sal.

Soil erosion poses a significant threat to the agricultural lands in the villages under study leading to the loss of fertile topsoil and reducing productivity. Erosion also contributes to sedimentation affecting water quality, aquatic ecosystems, and navigation. Excessive sedimentation results in shallowing of river channels and heightened flood risks. Furthermore, erosion can transport pollutants such as pesticides and fertilizers from agricultural fields into water bodies resulting in water pollution impacting aquatic life and human health.

Understanding the causes and consequences of soil erosion challenges helps to mitigate environmental degradation. Implementing sustainable agricultural practices can preserve soil quality, and maintain biodiversity. Agriculture is a primary source of livelihood for many residents of Ibrampur and Sal. Sustainable agriculture practices can lead to more stable incomes for farmers by reducing the vulnerability of crops to

environmental hazards. This stability contributes to the economic development of the villages and improves the standard of living for residents.

1.4 OVERVIEW OF LITERATURE

We will now look in to some scholarly works consulted while conceiving this study.

In their research paper "Land Degradation by Soil Erosion in Nepal" Devraj Chalise, Lalit Kumar and Paul Kristiansen examine how Nepal faces significant challenges related to soil erosion, exacerbated by factors such as rapid population growth, a predominantly subsistence-based rural economy, and increasingly intense rainfall events during the monsoon season. This study aims to explore the causes, impacts, and management strategies for soil erosion in Nepal. Intense rainfall and conventional tillage practices, combined with factors like poor soil structure and steep slopes, are identified as primary drivers of soil erosion in Nepal. Impacts of Soil Erosion: Soil erosion leads to substantial losses in soil and crop productivity, contaminates land and water resources, and contributes to a decline in farm income, thereby posing significant challenges to agricultural sustainability in Nepal. Management Strategies: Various management strategies are proposed to mitigate soil erosion in Nepal, including mulching, cover cropping, contour farming, strip cropping, conservation agriculture practices, and bioengineering techniques. According to their findings, involvement of local communities and stakeholders is crucial for controlling land-degradation processes and promoting sustainable agricultural practices in Nepal.

Pradeep M. Ronge and P.A. Hangargekar in their research paper "A case study of Integrated Watershed Management Programme at Aapsinga Village in Maharashtra" examine water related issues in Aapsinga village in Maharashtra's Osmanabad district. To address these challenges, the Central Government initiated the Integrated Watershed

Management Programme (IWMP), focusing on techniques such as farm ponds, check dams, and vanrai bandharas. Aapsinga village is situated in the hilly terrain of Tuljapur Taluka, Osmanabad District, Maharashtra, surrounded by the Balaghat ranges. The region experiences high temperatures ranging from 27 to 38 degrees Celsius, with an average annual rainfall of approximately 730 mm. However, the Marathwada region, including Aapsinga, faces drought conditions for most of the years in the past decade. Construction of small reservoirs to capture and store rainwater, facilitating groundwater recharge and providing supplemental irrigation for agriculture. Installation of low-level dams across seasonal streams to impede water flow, promote sediment deposition, and recharge groundwater aquifers. Traditional earthen embankments constructed along the contours to harvest rainwater and prevent soil erosion, thereby conserving moisture and enhancing vegetation growth. Challenges and Solutions: Implementation of IWMP techniques aims to reduce surface runoff by enhancing infiltration and water retention capacity of the landscape, thereby mitigating soil erosion and replenishing groundwater reserves. Active involvement of local communities in planning, implementation, and maintenance of watershed interventions is crucial for ensuring sustainability and maximizing benefits. Regular monitoring of watershed management interventions is essential to assess their effectiveness, identify areas for improvement, and adapt strategies to changing environmental conditions. Integrated watershed management initiatives, including the implementation of farm ponds, check dams, and vanrai bandharas, offer promising solutions to address water scarcity challenges in Aapsinga village and neighbouring areas. By local knowledge, community participation, and scientific expertise, IWMP-21 demonstrates the potential for sustainable water resource management and improved livelihoods in drought-prone regions of Maharashtra.

Soil Conservation issues and soil erosion remain significant environmental challenges worldwide, exacerbated by changing climate patterns. In India, despite years of study and substantial investment in remediation efforts, soil erosion persists as a major concern. Focusing on the interplay of production, environmental, social, economic, and policy-related factors. The transformative role of watershed management in addressing soil erosion and improving agricultural sustainability. Soil Conservation Challenges in India: Soil erosion poses a threat to agricultural productivity, biodiversity, and ecosystem health, leading to land degradation and loss of soil fertility. Changing climate patterns, including erratic rainfall and increased frequency of extreme weather events, exacerbate soil erosion risks, further compromising soil and water resources. Soil erosion affects rural livelihoods, food security, and socio-economic development, particularly in rainfed and dryland regions where agriculture is the primary source of income. Effective soil conservation policies require coordinated efforts across institutions, utilizing a holistic approach that integrates scientific knowledge, community participation, and policy interventions. Watershed programs emerge as a promising strategy for soil conservation, facilitating socio-economic transformation by aligning various sectors through technological interventions and land-use diversification. Impact of Watershed Management Programs: Watershed management programs employ a range of soil and water conservation techniques, including contour bunding, afforestation, check dams, and farm ponds, to reduce soil erosion, enhance water retention, and improve soil health. Integration of agroforestry, horticulture, and livestock rearing within watershed management schemes promotes diversified livelihoods, reduces dependency on rainfed agriculture, and enhances resilience to climate variability. Watershed management emerges as a transformative approach to soil conservation in India, addressing the

complex interplay of environmental, social, economic, and policy-related factors. By fostering integrated strategies that align technological interventions with community participation and policy support, watershed programs have revolutionized agriculture, reduced land degradation, and improved livelihoods in diverse landscapes.

A study in Bangladesh by Hossain, M. M., Chowdhury and others looks into the impact of river erosion on livelihood and coping strategies of displaced people in South-Eastern Bangladesh. Bangladesh, situated in the riverine and deltaic region of South Asia, faces the devastating consequences of riverbank erosion, particularly in the South-Eastern region. investigates the profound impact of riverbank erosion on the lives and livelihoods of displaced communities in Bangladesh. Utilizing both quantitative and qualitative data from in-depth interviews, focus group discussions, and questionnaire surveys, the study sheds light on the multifaceted challenges faced by affected populations and explores indigenous coping strategies. The findings underscore the urgent need for policymakers to develop and implement effective approaches to mitigate vulnerability and enhance local adaptation processes, thereby improving the livelihoods of households affected by riverbank erosion across Bangladesh. Riverbank Erosion: Bangladesh's geographical location in the riverine and deltaic region renders it highly susceptible to riverbank erosion, exacerbated by climate change-induced factors such as sea-level rise and intensified monsoon rainfall. Riverbank erosion leads to displacement, loss of land, and identity crisis among coastal populations, exacerbating poverty, food insecurity, and social marginalization. Socio-Economic and Cultural Impacts: Displaced persons face social, economic, and cultural stigma within their communities, stemming from loss of land, livelihoods, and social status, leading to heightened vulnerability and exclusion. Despite challenges, affected communities employ indigenous knowledge and adaptive strategies to mitigate the

impacts of riverbank erosion, including community-based early warning systems, alternative livelihoods, and collective resilience-building initiatives. Policy Implications and Recommendations: Policymakers must prioritize the formulation and implementation of effective approaches to reduce vulnerability and enhance resilience among communities vulnerable to riverbank erosion. Policies should focus on empowering displaced communities through inclusive decision-making processes, access to resources, and social support networks, fostering self-reliance and sustainable development. Riverbank erosion poses significant challenges to the lives and livelihoods of communities in South-Eastern Bangladesh, perpetuating poverty, food insecurity, and social marginalization. By understanding the multifaceted impacts of riverbank erosion and leveraging indigenous coping strategies, policymakers can develop context-specific interventions to reduce vulnerability and enhance local adaptation processes, ultimately improving the resilience and livelihoods of affected households across Bangladesh.

1.5 OBJECTIVES OF THE STUDY

The main objectives are:

1. to study the livelihood of local communities in Ibrampur and Sal villages;
2. to analyse the agricultural practices in Ibrampur and Sal villages; and
3. to find out the developmental activities which impact on soil.

METHODOLOGY

To understand more about soil erosion and how it affects farming in Ibrampur and Sal villages along the Chapora river I followed fieldwork method and observed the changes and interpreted them. I observed how the river erosion affects the land and makes farming more difficult. I talked to the select people of Ibrampur and Sal villages and

found out the nature of soil erosion and its impact on farming. I gathered information from articles and research papers to learn more about soil erosion and farming in similar contexts. I also used GIS (Geographic Information System) technology to create maps showing the river and its surroundings. This helped me visualize the areas affected by soil erosion and understand the landscape better.

CHAPTER II

DESCRIPTION OF FIELD

Ibrampur village is a small village with approximately 628.25 hectares land. Sharing administrative setup with Hankhane village under the same village panchayat, Ibrampur is home to around 536 households. The people of Ibrampur and Hankhane live together under the same village council.

The village is equipped with a network of well-maintained roads, facilitating smooth connectivity within and beyond its borders. These roads not only provide access to essential services but also facilitate transportation for residents for education and other activities. Ibrampur village has healthcare facilities, ensuring that residents have access to medical services when needed. From primary healthcare centre to the healthcare infrastructure in the village plays a crucial role in promoting the well-being of its inhabitants.

The main benefit for the Ibrampur village is that the Chapora river which flows from Tillari dam in Maharashtra and crosses the border of Maharashtra state. The river enters Goa in the Ibrampur village. When the river enters in Goa it is called as Colvale or Chapora river. During Portugues period Chapora river was known as Shapora river. The Chapora river joins the Arabian sea after following a zigzag course.

As the Chapora river wind through the picturesque landscapes of Ibrampur village in Pernem taluka, it brings vital resources and opportunities for the local community. The way the river flows, with its bends and curves, makes a special and always-changing environment along its edges.

One of the primary benefits of the Chapora river for Ibrampur village is its role in irrigation and agriculture. The river's flow provides essential water resources that

sustain agricultural practices, supporting the cultivation of crops and ensuring food security for the villagers.

The presence of the Chapora river offers recreational opportunities, with its scenic banks attracting visitors and tourists. The Chapora river serves as a vital transportation route, facilitating trade and commerce for the village. Its navigable waters enable the transportation of goods and people, fostering economic activities and connectivity with neighbouring regions.

The Chapora river shows how beautiful and important Ibrampur village is. It affects how the land looks and how people make a living. This highlights the need to take care of the river so that it can continue to help the village for a long time.

Figure 2.1: The Chapora river flow from Tilari to Arabian sea

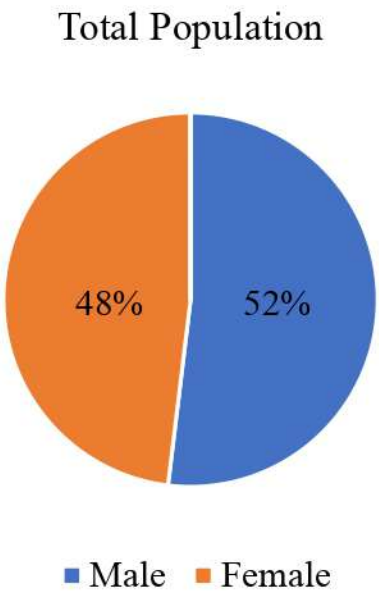
2.1 The Village Panchayat of Ibrampur and Hankhane

Figure 2.2 Village Panchayat of Ibrampur and Hankhane

The village panchayat of Ibrampur and Hankhane is the local governing body responsible for managing various aspects of village life. The village panchayat plays a key role in initiating and overseeing development projects and initiatives aimed at improving the quality of life in Ibrampur and Hankhane. The village panchayat actively engages with the local community to understand their needs and priorities.

Table 2.1: Population of Ibrampur and Hankhane Villages

Total Population: 2,429	
Male	Female
1,262	1,167



Agriculture is the primary activities in Ibrampur village; many farmers are depended on irrigation to sustain their livelihood. In Ibrampur, an important part of watering the field is the *bandara* or the check dam on the Chapora river. This *bandara* works like a small dam, helping to manage how much water flows into the fields. In the olden days, villagers used simple mud *bandaras* to channel water from the river to their fields for irrigation.

To gather primary information about the village, I conducted interviews with local community members. My first interview was with Shri Mase Vishnu Gawas, who is actively involved in agriculture in the village. He provided valuable information on various aspects of village life, including the *bandara*, the current status of the village, and the significance of the Chapora river.

Shri Mase Vishnu Gawas shared information about the *bandara*, which plays a crucial role in irrigation practices in the village. He explained that the *bandara* functions like a small dam, helping to regulate the flow of water from the river. This controlled flow of water makes it easier for farmers to irrigate their fields, ensuring

consistent water supply for their crops. He mentioned that in the past, villagers used traditional methods like mud *bandaras* to divert water from the river for irrigation purposes.

Shri Mase Vishnu Gawas shared information on the current status of the village, highlighting both its strengths and challenges. He mentioned that while the village has made progress in various aspects, there are still areas that require attention and improvement. He highlighted the importance of the river in the villager's livelihood and ecosystem. He explained how the river serves as a lifeline for the community, providing water for irrigation, drinking, and other domestic purposes. He highlighted the ecological significance of the river, mentioning its role in supporting biodiversity and sustaining the local ecosystem. By recognizing the importance of the Chapora river, he highlighted the need for its sustainable management and conservation.

I also interviewed several women in the village who are actively involved in agriculture. They provided valuable insights into the types of crops grown in the village and shared their experiences and challenges related to farming. They mentioned cultivating a variety of crops such as rice (Paddy), vegetables, and pulses, highlighting the diversity of agricultural practices in the village, they discussed the importance of agriculture for their livelihoods and the well-being of their families.

2.2 Sal Village

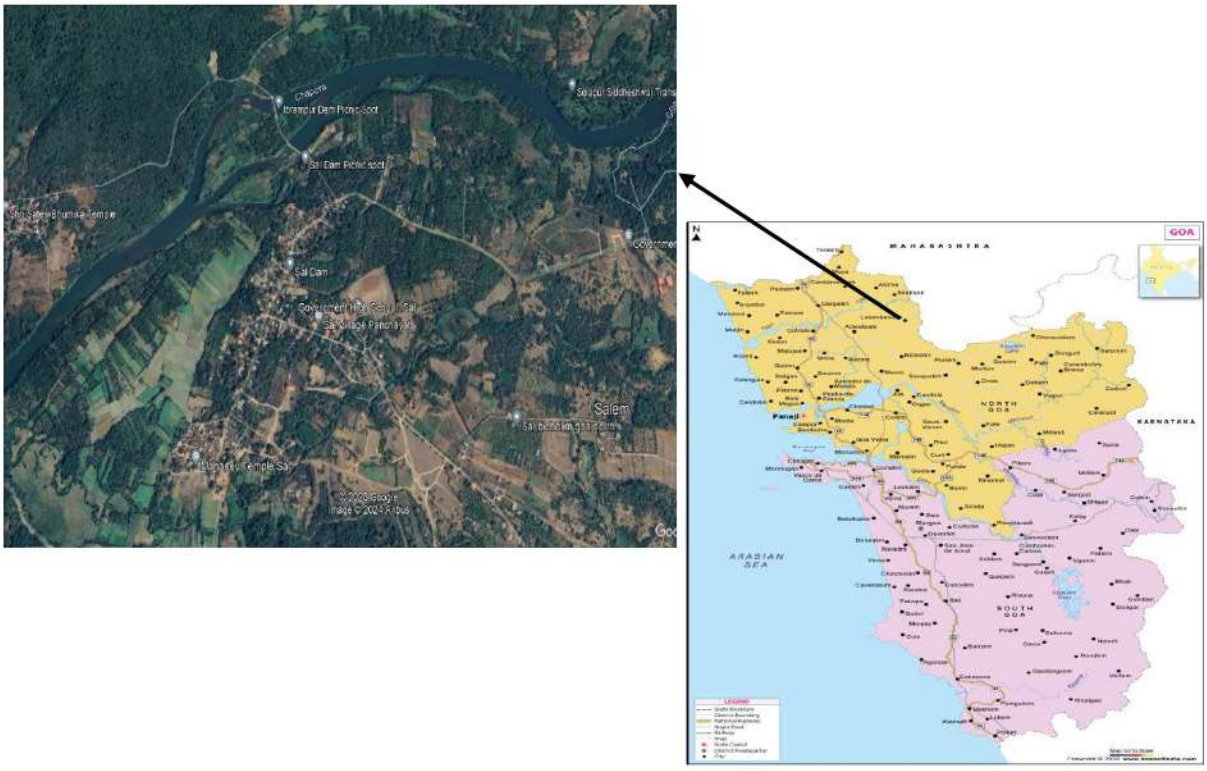


Figure 2.3: Location of Sal Village

Sal village is located in Bicholim Taluka within the North Goa District of Goa State. Situated approximately 36 kilometers north of the district headquarters, Panaji, and 16 kilometers from Bicholim, Sal village boasts a total geographical area of 1069.53 hectares. Despite its relatively small size, Sal village is home to a vibrant community with approximately 761 households spread across seven wards.

One of the defining features of Sal village is its commendable literacy rate, standing at 78.84%. This statistic reflects the community's commitment to education and intellectual development. Interestingly, the literacy rate among males is slightly higher at 83.06% compared to females at 74.57%. Efforts to bridge this gender gap in literacy are crucial for promoting gender equality and empowerment within the village.

The socio-economic landscape of Sal village revolves primarily around agriculture, with the fertile land supporting a variety of crops. From rice paddies swaying in the gentle breeze to lush fields of vegetables, agriculture forms the backbone of the local economy. The village's reliance on the Chapora river for irrigation underscores the importance of water resources in sustaining agricultural livelihoods. The Sal dam, a significant infrastructure project, plays a pivotal role in harnessing the river's flow to support farming activities throughout the year.

In terms of infrastructure, Sal village is relatively well-developed, with essential amenities such as schools, healthcare facilities, and transportation networks in place. These amenities play a vital role in enhancing the quality of life for residents and promoting overall well-being within the community. Ensuring sustainable agricultural practices and environmental conservation are ongoing priorities for the community.

Figure 2.4 Village Panchayat of Salem

The Village Panchayat of Sal is the local governing body responsible for administering and managing the affairs of Sal village. The primary role of the Village Panchayat of Sal is to oversee and manage various aspects of local governance within the village.

This includes implementing government schemes and programs, maintaining local infrastructure such as roads and water supply systems, managing public amenities like schools and healthcare centers, and addressing the needs and concerns of the residents.

Table 2.2 Population of the Salem village

Total Population: 3,427	
Male	Female
1,724	1,703

To gather primary data to understand Sal village better, I took interviews with local community members. The first interviewee was with Shri Surendra Raut, a farmer in the village involved in agricultural practices. His information was valuable, and he shared the current status of agriculture in Sal and the role played by the Sal dam and the Chapora river.

The Chapora river, a lifeline of the village Sal, is essential for the village's agricultural activities. Surendra highlights the significance of the Sal dam, a vital infrastructure project designed to harness the river's flow for irrigation and drinking water purposes. It not only facilitates agriculture but also serves as a source of drinking water.

Shri Surendra's highlight into agricultural practices provided a peek into the diversity of crops cultivated in Sal. From rice (Paddy) and pulses and vegetables, the village boasts a rich agricultural. They grow a variety of crops throughout the year, Surendra explained,

I had the privilege of communication with several women from the village. Their contributions to farming were valuable. Women play a vital role in agriculture their knowledge of traditional farming practices, passed down through generations. My conversations with Shri Surendra Raut and the women of Sal village highlighted the complex relationship between agriculture, water resources, and community well-being.

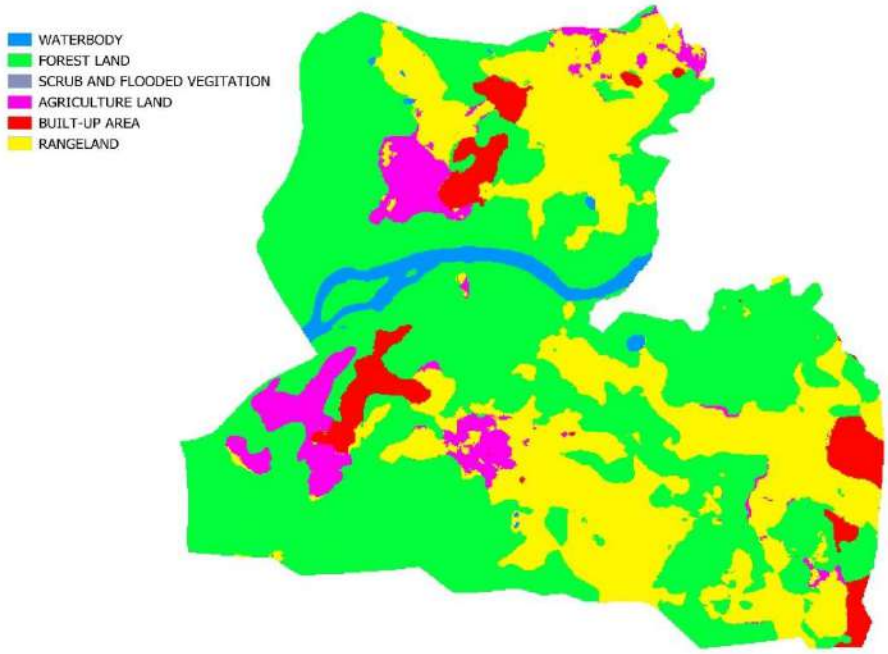


Figure 2.5: GIS Map in 2017

The map 2.5 illustrates the geographical layout of both Ibrampur and Sal villages in the year 2017. It provides a visual representation of the land features and topography of these villages during that year.

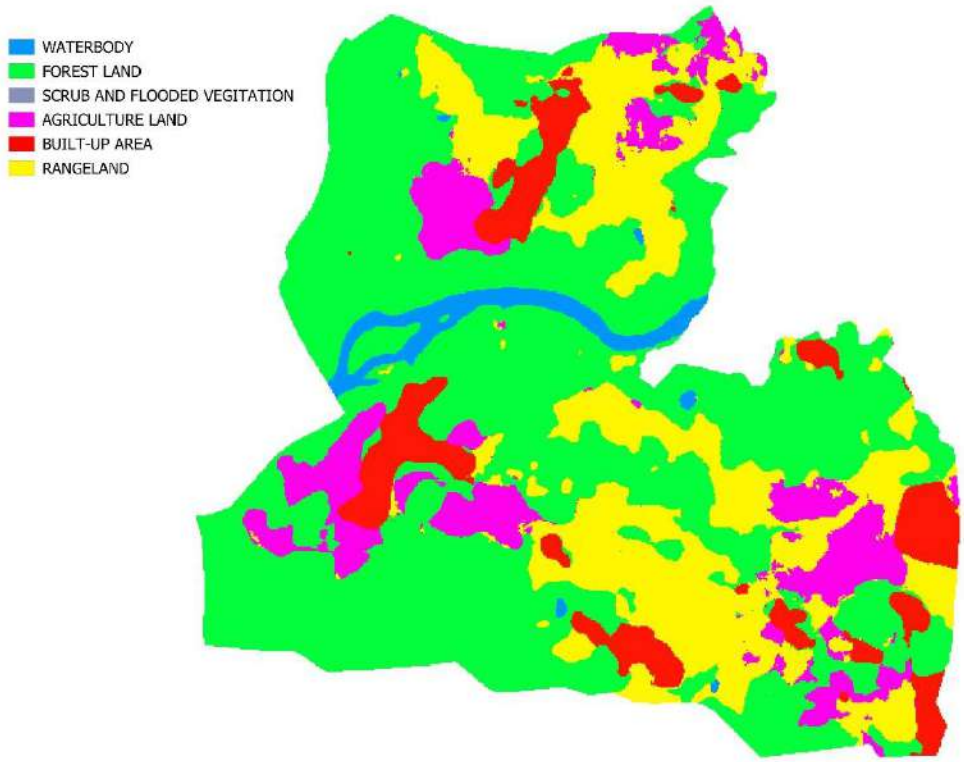


Figure 2.6: GIS Map in 2024

The map 2.6 illustrates the changes in the geographical land of both Ibrampur and Sal villages from 2017 to 2024. It highlights any alterations or developments in the land features and landscape of these villages over the specified time period.

CHAPTER III

DESCRIPTION OF DEVELOPMENT IN IBRAMPUR AND SAL VILLAGES

In Ibrampur village, agriculture is the main way of life for most people. However, the village hasn't seen much development over the years. Despite this, it's well-known for its agricultural land and the ways people irrigate their crops.

One key aspect of irrigation in Ibrampur is the bandara built on the Chapora river. This bandara is like a small dam that helps control the flow of water from the river, making it easier to water the fields. In the past, villagers used traditional methods like mud bandaras to divert water from the river for irrigation. These were simple structures made from mud and rocks, but they did the job. However, about 10 to 12 years ago, they upgraded to concrete bandaras, which are stronger and more reliable. The bandara plays a crucial role in the village's irrigation practices. It collects water from the Chapora river during the rainy season when the river is full. This water is then stored in the bandara, providing a steady supply for irrigation throughout the year, even during the dry season when rainfall is scarce.

Those who have access to motor water pumps can easily draw water from the Chapora river for their fields. However, everyone has not able to purchase. For those without pumps, there's another option: the canal. This canal carries water from the river and distributes it to areas without direct access. It's a lifeline for many farmers in Ibrampur, ensuring they have the water they need to grow their crops.

The transition from traditional mud bandaras to concrete ones marks a significant advancement in the village's irrigation infrastructure. Concrete bandaras are more durable and efficient, allowing for better water management and increased

agricultural productivity. They also require less maintenance compared to their mud bandara. Overall, the bandara system plays a vital role in sustaining agriculture in Ibrampur village.

Figure 3.1: Bandara on Chapora River

Before the *bandara* was built in Ibrampur village, life was tough for the villagers. They faced a lot of problems because there was no structure to control the Chapora river's flow. The river would often flood, causing the land to get covered in water. This made it impossible for farmers to grow crops, as their fields would be submerged. The flooding also led to soil erosion, where the soil would wash away with the water, leaving behind barren land. It was a difficult situation for the villagers, especially those who relied on farming for their livelihoods.

However, everything changed when the bandara was constructed. It acted like a big barrier, controlling the river's flow and preventing floods. This was a huge relief for the villagers. Finally, they could breathe easy knowing that their land and homes

were safe from the destructive floods. With the bandara in place, farmers could now grow crops without worrying about their fields getting flooded. They had a steady supply of water for irrigation, which meant they could cultivate their land throughout the year, even during the dry seasons.

But along with the benefits, the bandara also brought some problems. Storing water behind the dam could lead to soil erosion. When water is stored for a long time, it puts pressure on the soil, causing it to erode or wash away. This was bad news for the fertile land in Ibrampur, as it could lose its topsoil and nutrients, making it less productive for farming. Additionally, the stored water could increase the risk of landslides, especially in areas near the coastal line of the village. Landslides could damage crops and homes, posing a threat to the safety and stability of the villagers. Moreover, soil erosion could also extend the area of the river flow, further increasing the risk of floods and land degradation. This meant that while the *bandara* solved one problem by preventing floods, it inadvertently created new challenges related to soil erosion and landslides.

Figure 3.2 *Bandara* Causes Soil Erosion and Land Slides

In 2019, there was a lot of rain during the rainy season, and it caused a problem at the Tillari dam. The dam had too much water, so they had to let some of it out. When they released the water, it overflowed into the river and flooded areas in Pernem, Bicholim, and Bardez. Even small islands in the Chapora river were covered with water, along

with the surrounding areas. This caused a lot of trouble for the people living there and changed their way of life.

One big problem that came from the flooding was soil erosion. The strong force of the water washed away the soil from the land, especially in Ibrampur and Sal villages. This soil was really important for growing crops because it was rich and healthy. Losing this good soil made it hard for people to grow good-quality crops to eat and sell.

In Ibrampur and Sal villages, many people lost their farmland because of the flooding. This land was essential for their livelihoods, as they depended on it to grow food and make a living. With their land damaged or washed away, these villagers faced challenges in rebuilding their lives and sustaining their families.

The flooding didn't just affect the land; it also impacted the local communities and their daily routines. People had to deal with damaged homes, and disrupted access to basic necessities like food and clean water. The floodwaters forced many families to leave their homes and seek shelter elsewhere, adding to their hardships.

Recovering from such a disaster wasn't easy. It required help from the government, aid organizations, and neighbouring communities. Together, they worked to provide emergency assistance, rebuild infrastructure, and support affected families in getting back on their feet.

The 2019 flooding served as a reminder of how vulnerable communities can be to the forces of nature. It highlighted the importance of being prepared for emergencies and taking steps to protect the environment and people's livelihoods. By learning from this experience and working together, communities can become more resilient and better equipped to handle future challenges.

3.1 The Canal

Figure 3.3: The Canal

In Ibrampur village many farmers depended on the canal water for agricultural practices. Those farmers who have motor water pump they directly use water from Chapora river, and those who don't have motor pump their using water from canal. Farmers can grow a variety of crops and faster than the earlier. Farmers don't need to rely only on rain water for irrigation. Farmers get help of water from the canal but not for every time when they actually need water for irrigation, they didn't get sometimes so this was the disadvantage of the canal.

In Ibrampur village, agriculture is the lifeline for many families, with the availability of water being crucial for their livelihoods. While some farmers have access to motor water pumps that draw water directly from the Chapora river, others rely on

the canal for irrigation purposes. This division in access to water sources impacts the agricultural practices and yields of the farmers in the village.

Those fortunate enough to possess motor water pumps enjoy a more reliable and convenient water supply from the Chapora river. This enables them to efficiently water their fields and cultivate crops throughout the year. As a result, these farmers often experience faster growth and better yields compared to their counterparts who depend solely on canal water.

For farmers reliant on the canal, the situation is less favorable. While the canal provides an additional water source beyond rainwater, its availability is not consistent. Farmers face challenges when the canal water supply is insufficient or irregular, especially during critical stages of crop growth. This inconsistency disrupts their irrigation schedules and can negatively impact crop productivity and quality.

The unpredictability of canal water availability highlights a significant disadvantage for these farmers. Despite the benefits of having access to an alternative water source, its unreliability poses a constant challenge. Farmers must navigate this uncertainty, often resorting to alternative irrigation methods or adjusting their planting schedules to cope with fluctuating water availability.

In essence, while the canal serves as a valuable resource for irrigation, its unreliability creates vulnerabilities for farmers in Ibrampur village. Addressing this issue and ensuring more consistent access to water could significantly improve agricultural practices and livelihoods in the community. Efforts to enhance water management and infrastructure may help mitigate the challenges faced by farmers and promote sustainable agricultural development in the village.

Figure 3.4: Canal Water to Coconut Groves

3.2 Sal village

In Sal village, agriculture serves as the primary livelihood for the majority of its local communities, with agricultural land being the backbone of the local economy. However, despite the agricultural focus, the village has seen limited developmental progress over the years.

One of the notable landmarks in Sal village is the Sal dam, which holds recreational significance. Originally constructed to support agricultural activities by providing irrigation water to nearby fields, the dam has also evolved into a popular leisure destination. Its serene surroundings and the availability of water have turned it into a favoured spot for picnics and family outings.

The attraction of Sal dam extends beyond the village boundaries, attracting visitors from neighbouring talukas and even further afield. Whether it's for a leisurely day out, a refreshing swim in the dam's waters, or simply to enjoy a picnic by the shore, Sal dam offers a respite from the boring routines of daily life. Its significance goes beyond being just a water reservoir; it represents a shared space where people come together to relax, socialize, and create lasting memories.

Figure 3.5: Old Sal Dam and Foot Bridge

3.3 New Bridge in Sal Village

The ongoing construction of a new bridge in Sal village is a significant development that has both positive and negative implications for the local community. The primary purpose of the new bridge is to divert the flow of water towards Mopa village, a neighbouring village which got a new Airport recently. While this may seem like a necessary infrastructure project to improve water management and irrigation in Mopa village, the construction of the bridge has raised concerns among the residents of Sal village.

One of the major concerns voiced by the villagers is the potential impact of the new bridge on their agricultural land. The increased height of the bridge may result in the collection of water at a higher level, which could lead to the submergence of nearby land that is currently utilized for agriculture. This poses a significant threat to the livelihoods of farmers in Sal village, as their ability to cultivate crops and other plants could be severely compromised. The loss of arable land could have far-reaching consequences for food security and economic stability in the community, exacerbating existing challenges faced by rural farmers.

In addition to the threat of land submergence, the construction of the new bridge has also raised concerns about water pollution. The process of building infrastructure projects like bridges often involves the use of heavy machinery, excavation, and construction materials that can introduce pollutants into the surrounding environment. The disturbance of soil and sediment during construction activities can result in the release of pollutants such as sediment, oil, and construction debris into nearby water bodies, leading to water pollution. This poses risks not only to the aquatic ecosystem but also to human health, as contaminated water may be used for drinking, irrigation, and other purposes.

Furthermore, the disruption caused by construction activities can have broader environmental impacts beyond water pollution. Habitat destruction, soil erosion, and disturbance to wildlife are some of the potential consequences of large-scale construction projects in natural landscapes. These environmental disruptions can degrade ecosystem health, reduce biodiversity, and diminish the overall resilience of the local environment to environmental stressors such as climate change.

Despite these concerns, it is important to acknowledge that the construction of the new bridge may also bring benefits to the community, particularly in terms of improved transportation infrastructure and access to services. The diversion of water towards Mopa village could potentially enhance water availability for irrigation and other purposes, contributing to agricultural productivity and rural development in the region. Additionally, the new bridge may facilitate connectivity between Sal and Mopa villages, fostering economic opportunities, social exchange, and cultural exchange between the two communities.

Figure 3.6: New Bridge Construction

3.4 Raw Water Pumping Station in Sal

The presence of a raw water pumping station in Sal village plays a crucial role in the water supply infrastructure of the region, facilitating the provision of clean and safe drinking water to communities across Bardez taluka. This pumping station serves as a vital link in the water supply chain, supplying raw water to both the Amthane dam and the Assonora water plant, which are key components of the region's water supply system.

The primary function of the raw water pumping station is to extract water from a natural water source, such as a river or reservoir, and transport it to treatment facilities for purification and distribution. In the case of Sal village, the pumping station draws water from a nearby source, likely a river and pumps it to the Amthane dam and the Assonora water plant for further processing.

At the Assonora water plant, the raw water received from the pumping station undergoes treatment to make it suitable for domestic use. This treatment may involve additional processes such as sedimentation, coagulation, and pH adjustment to further improve water quality and ensure compliance with health and safety standards. Once treated, the water is distributed to households, businesses, and public facilities throughout Bardez taluka via a network of distribution pipes and storage tanks.

The significance of the raw water pumping station in Sal village extends beyond local water supply considerations, as it plays a critical role in ensuring access to clean and safe drinking water for a large population across Bardez taluka. Access to reliable and potable water is essential for public health, sanitation, and overall quality of life, serving as a fundamental prerequisite for socio-economic development and human well-being.

However, the operation of the raw water pumping station also presents challenges and considerations that must be addressed to ensure sustainable water management and environmental stewardship. These may include concerns related to water resource sustainability, energy consumption, infrastructure maintenance, and regulatory compliance. Additionally, factors such as population growth, urbanization, climate change, and land use changes may further influence the demand for water and impact the operation of the pumping station over time.

Figure 3.7: Raw water pumping station in Sal

Assonora Water Treatment Plant

Figure 3.8: Assonora Water Treatment Plant

Screening

Screening is the first unit operation in water treatment plant. Screen is the device used to retain floating material which are bigger in sizes like wood chips, leaves, aquatic plants and floating, impurities, etc.

Aeration

Aeration is the process where in water is brought in contact with the air with help of aerator in order to remove dissolved gasses and oxidizes dissolved metals such as iron, hydrogen sulphide and volatile chemicals. Aeration is often first major process at the treatment plant. During aeration, constituents are removed or modified before they can interfere with the treatment processes.

Figure 3.9: Aerator

Sedimentation

Sedimentation is a physical water treatment process using gravity to remove suspended solids from water. In this process water is taken to the sedimentation tank where in it is allowed to retention time of 2 and half hours. Solid particles.

Before sedimentation proceed additional chemicals like Alum and Lime are added to raw water through solution and then mixed rapidly with help of Clariflocculator and this processis known as Coagulation

Clariflocculator – Clariflocculator isa combination of flocculation and clarification in a single tank. It has two concentric tanks where inner tank serves as a flocculation basin and the outer tank serves as a clarifier.

Filtration

In filtration process rapid gravity sand filters have been constructed at Assonora water treatment plant. Where in water is from Clariflocculator taken to filter house (filter tank).

Disinfection

Water disinfection means of the removal, deactivation or killing of pathogenic microorganisms. Microorganisms are destroyed, resulting in termination of growth and reproduction. When microorganisms are not removed from drinking water, drinking water usage will cause people to fall ill.

Chlorine and chlorine-based compound are the only disinfectants that can efficiently kill microorganisms during water treatment, and maintain the quality of the water as it flows from the treatment plant to consumer's tap.

3.10: Sedimentation tank and clariflocculator

CHAPTER IV

PRESENT PRACTICES OF AGRICULTURE IN TWO VILLAGES

In Ibrampur, agriculture is the primary livelihood for the majority of the villagers. The fertile land surrounding the village, sustained by the river, supports a diverse range of crops and farming activities. The villagers of Ibrampur cultivate a variety of crops to sustain their families and generate income. The river that flows through Ibrampur serves as a vital source of water for irrigation. Farmers use methods such as canal systems and sluice gates to divert water from the river to their fields. In recent years, some farmers have adopted more modern irrigation techniques to improve water efficiency and reduce wastage. As per records in village panchayat there are 90 farmers those who have Krishi cards.

In Ibrampur, I interviewed Mase Vishnu Gawas, who shared important insights about the village and the significance of agriculture and irrigation practices. He explained how the village relies on irrigation to support farming, particularly through a system called "bandara." Bandara involves using government schemes for irrigation, which include supplying water through canals. However, Gawas highlighted a major problem with the canal system.

According to Gawas, the canal system doesn't always work well for the villagers. They face a significant challenge because they need water for agriculture during November, but the canal water supply doesn't come until the end of January. This delay causes serious problems for the farmers because they require water precisely when their crops need it the most. The issue arises from the lack of proper maintenance of the canal system. Because of this, the villagers find it difficult to rely on the canal for consistent water supply to support their farming needs.

This situation underscores the importance of reliable irrigation practices for the agricultural community in Ibrampur. Despite the government's efforts to provide irrigation through canals, the villagers face significant challenges due to the delayed and inconsistent water supply as a result, they are unable to trust the canal system.
He explained that there were instances where the canals were damaged or broken, resulting in a 15-day period with no water flowing through them. Such disruptions not only disrupted the farming schedule but also caused frustration and financial losses for the farmers. As a consequence of these problems, some farmers were compelled to abandon their agricultural practices altogether.

Mase Vishnu Gawas brought attention to a pressing issue in Sal: the construction of a new bridge aimed at supplying water to Mopa, a neighbouring area. However, this development has caused headaches for the people of Sal. The bridge's height requires storing a large amount of water, which, unfortunately, leads to flooding in Sal's agricultural lands. This flooding poses a severe threat to the villagers, as their livelihoods depend on farming these lands. The situation is worsened by the fact that the project doesn't seem to benefit the local community but rather serves the needs of Mopa. This imbalance in resource allocation has left the villagers feeling neglected and frustrated, as they bear the negative consequences of the project without reaping any benefits.

Moreover, Gawas highlighted another troubling instance in Maneri village, where a similar bridge construction occurred. This bridge was built at a high height, disrupting the natural flow of water and resulting in the submergence of agricultural lands in Maneri. Once again, the agricultural community suffers the brunt of infrastructure development projects that fail to consider their needs and concerns.

The impact of these bridge constructions is profound. The flooding of agricultural lands not only jeopardizes the livelihoods of farmers but also undermines the sustainability of rural communities like Sal and Maneri. The villagers are left grappling with the consequences of projects that prioritize external interests over their own well-being. This highlights the urgent need for infrastructure development that takes into account the needs and concerns of local communities, ensuring their prosperity and sustainability in the long term.

Mase shared that due to water problems in agriculture, some villagers in Ibrampur decided to switch to dairy farming. This means they stopped growing crops and started raising cows for milk instead. As a result, some farmers moved to Ibrampur village to focus on dairy farming. Dairy farming is seen as a more reliable source of income because it needs less water than growing crops. It also provides steady demand for products like milk. However, switching to dairy farming comes with its own challenges. Farmers need to learn new skills and invest in things like cow sheds and milking equipment. Despite the challenges, this shift shows the villagers' determination to adapt and find new ways to support themselves.

Mase Vishnu Gawas, in his interview, highlighted how some farmers have shifted their focus to cultivating gajraj grass on one to two-acre plots to support their dairy operations.

Gajraj grass, also known as elephant grass, is a highly nutritious fodder crop that provides essential nutrients for dairy cattle, promoting healthy growth and increasing milk yield. This transition reflects the farmers' recognition of the importance of providing their cattle with a steady supply of high-quality fodder to maximize dairy production. Unlike annual crops that require replanting each year, gajraj grass is a perennial grass that regrows annually without the need for cultivation. This

characteristic not only saves farmers time and effort but also ensures a consistent and reliable source of fodder for their cattle throughout the year.

However, the decision to prioritize gajraj grass cultivation comes with its own set of challenges, particularly related to soil fertility. Gawas noted that the fertility of the soil in Ibrampur has significantly declined over time, making it difficult to cultivate other crops alongside gajraj grass. The impoverished soil conditions pose a serious obstacle to traditional agriculture, as crops struggle to thrive in such environments. To address this challenge, farmers employ practices such as regular ploughing of agricultural land and the application of organic fertilizers like cow dung to improve soil fertility. By enriching the soil with organic matter, farmers aim to create a conducive environment for gajraj grass growth and ensure the long-term sustainability of their dairy operations.

Additionally, farmers in Ibrampur allocate a portion of their land to maize cultivation, albeit in small quantities. While maize is not the primary focus of agricultural activity in the village, it serves a crucial role in supplementing the diet of dairy cattle. Maize provides essential nutrients and energy for cattle, contributing to their overall health and milk production. Farmers grow maize specifically for feeding their cows, ensuring that their livestock receives a balanced and nutritious diet to support optimal milk production.

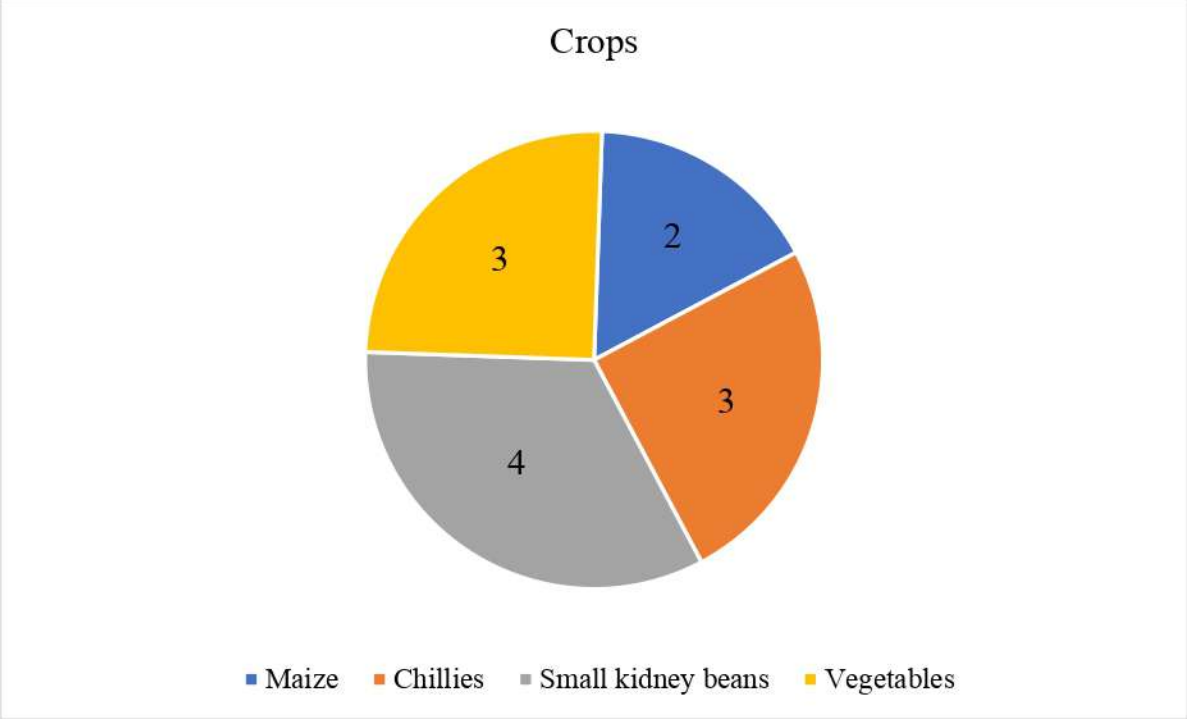
In the interview with Mase, it was mentioned that farmers who work hard and consistently engage in farming activities are rewarded under a government scheme called Kisan Samman Nidhi. This scheme aims to provide financial support and recognition to farmers for their dedication and efforts in agriculture. Essentially, it's a way for the government to show appreciation for the hard work of farmers by providing

them with financial assistance. This helps to encourage and motivate farmers to continue their farming activities and contributes to their well-being and livelihoods.

As per my field visiting, I had interviewed 15 peoples and out of them 12 peoples including Shri Mase Vishnu Gawas given information about the agricultural practice in the Sal village and remaining 3 peoples had not responded to me.

Table and Figure 4.1: Crops Grown

Sr. No	**Farmers Respondents**	**Crops**
1	2	maize
2	3	Chillies
3	4	Small kidney beans
4	3	Vegetables
5	3	Non-respondent



Among the responses, small kidney beans were mentioned by 4 respondents in Ibrampur village. Chilies were mentioned by 3 respondents. Maize was mentioned by 2 respondents, highlighting their presence in agricultural practices. Vegetables were mentioned by 3 respondents. the lack of response from 3 individuals, the gathered information provides valuable of agricultural practices in Sal village.

4.1 Sal village

Shri Surendra Raut shared that in the upper part of Sal village, farming activities have stopped completely. This means that people in that area are no longer growing crops or raising animals for food or income. Instead, they have shifted away from farming altogether. This change might be due to various reasons, such as changes in the land's condition, economic factors, or other opportunities that have arisen in the community. In Sal village, most people focus on growing paddy because the soil there is just right for it. Surendra Raut, who lives in the village, owns a piece of agricultural land called "malo." This land is where he and others grow their crops. Paddy is the main crop grown there because it thrives in the soil conditions.

Shri Surendra Raut and other villagers grow various crops in their agricultural land, or malo. The crops they cultivated like Paddy is the main crop grown in the malo. It's a type of rice that grows well in the soil conditions of Sal village. Kulthi dal, also known as horse gram, is a type of pulse. Kulthi dal is highly nutritious, rich in protein, and various vitamins and minerals such as iron, calcium, and magnesium. Alsande, also known as cowpeas or black-eyed peas, are a type of kidney bean. Alsande kidney beans are nutritious and offer several health benefits. They are rich in protein, dietary fiber, vitamins and minerals Consuming Alsande beans can help boost energy levels, support muscle growth. Black-eyed peas, also known as ‘chavli’ in Marathi, Black-eyed peas are highly nutritious, they are an excellent source of plant-based protein, vitamins and

minerals. Mung beans, also known as green gram or moong dal, are small. Mung beans are highly nutritious and offer numerous health benefits. Sunflowers are grown for their seeds, which can be processed into oil. Sunflower oil is used for cooking and other purposes, providing an additional source of income for the villagers.

Chillies are grown in agricultural fields and home gardens throughout Sal village. Peanuts, also known as groundnuts, and many peoples grow peanuts in Sal village. Peanut cultivation provides income opportunities for farmers in Sal village.
In Sal village, there has been a notable change in farming practices over the past decade. Previously, the primary crop cultivated by the villagers was groundnuts, also known as peanuts. However, about 10 years ago, many farmers made the decision to stop cultivating groundnuts. This shift was influenced by the presence of guar animals in the area.

Guar animals, also known as Indian bison or gaur, are large and powerful creatures that can cause significant damage to crops. In Sal village, the presence of these animals posed a threat to groundnut crops, leading many farmers to abandon groundnut cultivation altogether. The fear of crop damage and financial losses prompted the villagers to seek alternative crops that were less susceptible to damage by guar animals.

As a result, many farmers in Sal village opted to discontinue groundnut cultivation and explore other agricultural options. However, this change in crops has not been without its challenges. Some villagers have experienced losses as a result of transitioning away from groundnuts. The new crops chosen by some farmers may not have yielded the expected profits, leading to financial difficulties for those individuals. The agricultural landscape of Sal village has been shaped by environmental factors such as floods and soil erosion. Before the construction of the Tillari dam, the village

experienced floods approximately 5 to 6 times. These floods caused soil erosion, which is the process by which soil is washed away by water, leaving the land less fertile and suitable for farming.

Despite facing these challenges, the villagers of Sal have employed traditional farming practices to sustain their agricultural activities. One such practice involves the use of cow dung as a natural fertilizer. Cow dung is rich in nutrients and organic matter, making it an effective way to replenish the soil and enhance its fertility. By spreading cow dung on their fields, farmers in Sal village can improve soil quality and promote healthy crop growth.

The use of cow dung as fertilizer highlights the villager's resourcefulness and reliance on traditional knowledge passed down through generations. Surendra Raut shared that after building the Tillari Dam, Sal village didn't have floods for 15 to 16 years. But in 2019, heavy rain caused floods, leading to soil erosion. This means the rain washed away the soil, which can harm crops. It showed that even though the dam helped prevent floods for many years, heavy rain can still cause problems. Soil erosion can make it hard for farmers to grow crops because the soil loses its nutrients and structure. This event highlighted the need for ongoing efforts to manage floods and protect the land in Sal village.

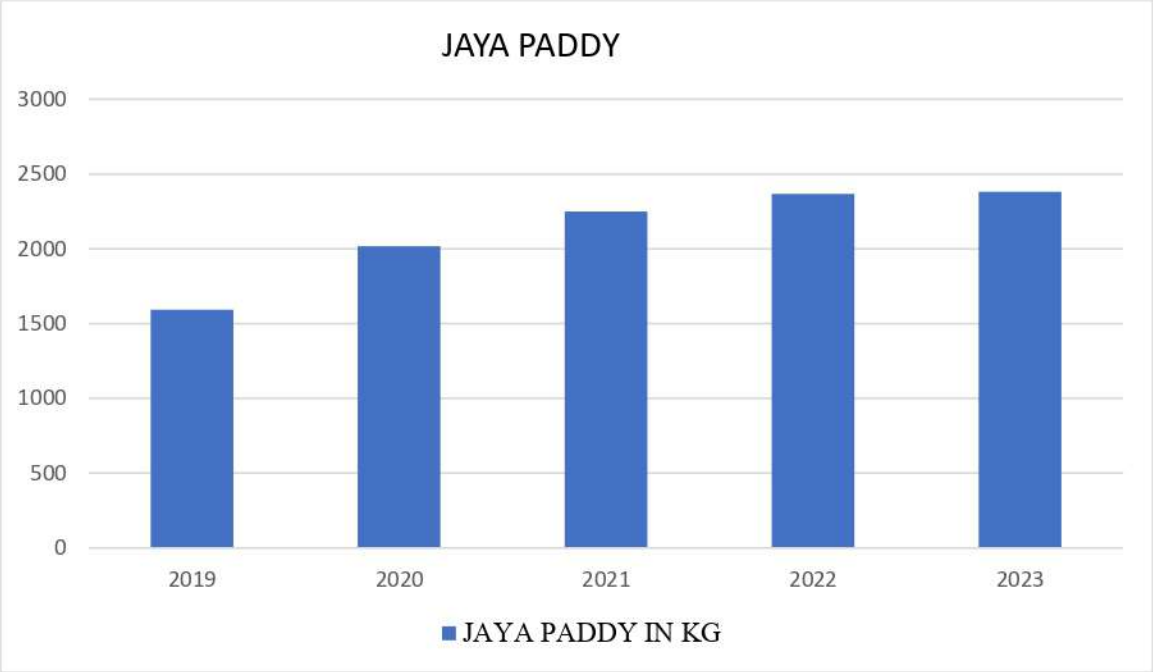
Shri Surendra Raut shared information about agriculture in Sal village, including banana cultivation and concerns regarding groundnut farming's impact on soil fertility. He told the importance of fertilizers for successful farming, especially considering potential soil depletion from continuous groundnut cultivation. By providing essential nutrients to the soil, fertilizers can help sustain agricultural productivity and ensure successful crop yields. In the past, farmers needed a significant workforce to carry out agricultural tasks, such as planting, harvesting to crops. These

labourers were typically paid daily wages for their work, contributing to the local economy and livelihoods of the villagers. However, with the advent of machinery and modern farming equipment, the need for manual labour has decreased significantly. Surendra Raut told that in Sal village, during the rainy season, there were no issues with gaur, but from November to April, these animals completely destroyed agricultural fields. This problem persists even today. To address this issue, the villagers formed a community fencing group. Members of the community take care and staying in the fields from 9 pm to 12 am to protect fields from gaur. This initiative has led to a decrease in gaur sightings in the fields, making it possible to grow crops successfully. By working together and taking care to guard the fields, the villagers have found a practical solution to protect their agricultural livelihoods from gaur damage.

According to Surendra Raut, in Sal village, some people sold their land to get money, which made it hard for them to continue farming. Additionally, some farmers who still had land and they also do other jobs alongside farming. However, despite these challenges, the farmers in Sal village support each other and encourage one another to keep farming. The agriculture department also provides help to the farmers, but they have to buy their own seeds and fertilizers.

Table and Figure 4.2: Jaya Paddy Grown

Sr. No	**Year**	**Field**	**In Kg**
1	2019	Jaya Paddy	1592 Kg
2	2020	Jaya Paddy	2016 Kg
3	2021	Jaya Paddy	2250 Kg
4	2022	Jaya Paddy	2365 Kg
5	2023	Jaya Paddy	2383 Kg

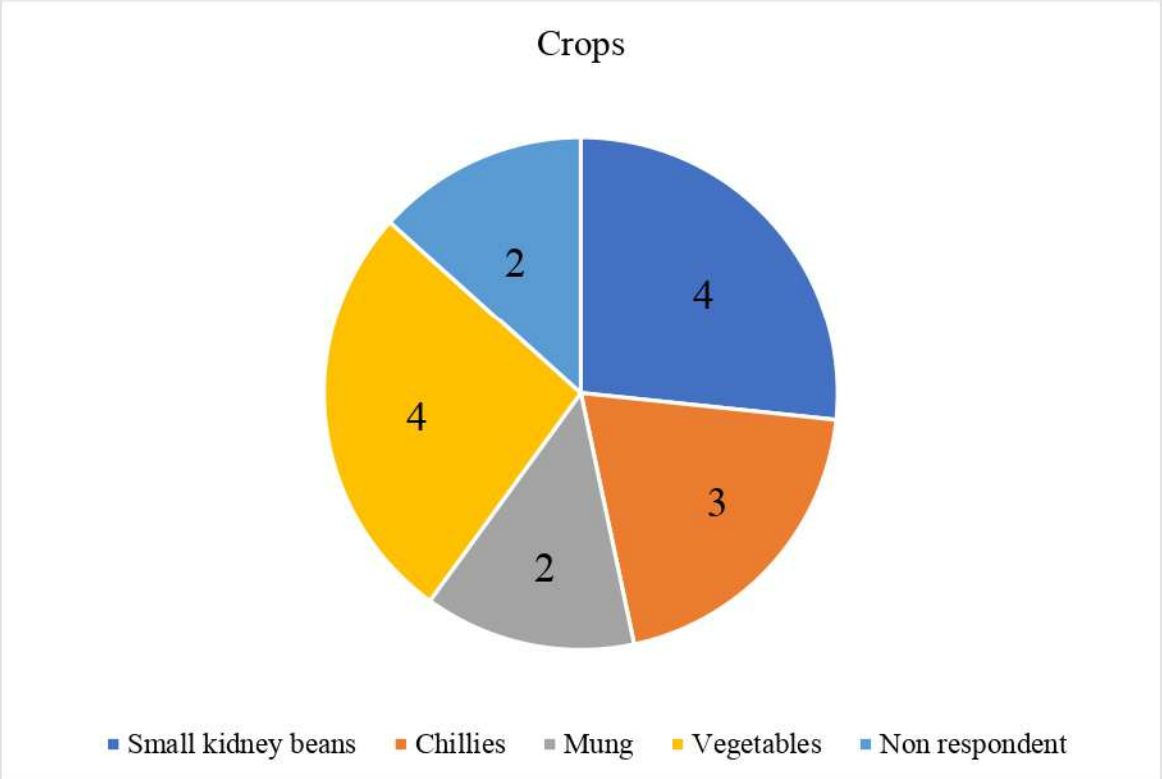


According to Surendra Raut's interview, he provided data on Jaya paddy collection over the past five years. In 2019, only 1592 kg were collected due to reduced rice production caused by heavy rain. However, there was slight increase in production in subsequent years. In 2020, the collection increased to 2016 kg, followed by further growth to 2250 kg in 2021. This trend continued in 2022, with a collection of 2365 kg, and in 2023, production further increased to 2383 kg.

As per my field visiting, I had interviewed 15 peoples and out of them 13 peoples including Surendra Raut given information about the agricultural practice in the Sal village and remaining 2 peoples were not responded to me.

Table and Figure 4.3: Other Crops

Sr. No	Farmers Respondent	Crops
1	4	Small kidney beans
2	3	Chillies
3	2	Mung
4	4	Vegetables
5	2	Non respondent



Among the responses, small kidney beans were mentioned by 4 respondents, indicating their significance in the agricultural landscape of Sal village. Chilies were mentioned by 3 respondents, suggesting their importance as a cultivated crop. Mung beans were mentioned by 2 respondents, highlighting their presence in agricultural practices. Additionally, vegetables were mentioned by 4 respondents, indicating their cultivation alongside other crops in the village. the lack of response from 2 individuals, the

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However, the decision to prioritize gajraj grass cultivation comes with its own set of challenges, particularly related to soil fertility. Gawas noted that the fertility of the soil in Ibrampur has significantly declined over time, making it difficult to cultivate other crops alongside gajraj grass. The impoverished soil conditions pose a serious obstacle to traditional agriculture, as crops struggle to thrive in such environments. To address this challenge, farmers employ practices such as regular ploughing of agricultural land and the application of organic fertilizers like cow dung to improve soil fertility. By enriching the soil with organic matter, farmers aim to create a conducive environment for gajraj grass growth and ensure the long-term sustainability of their dairy operations.

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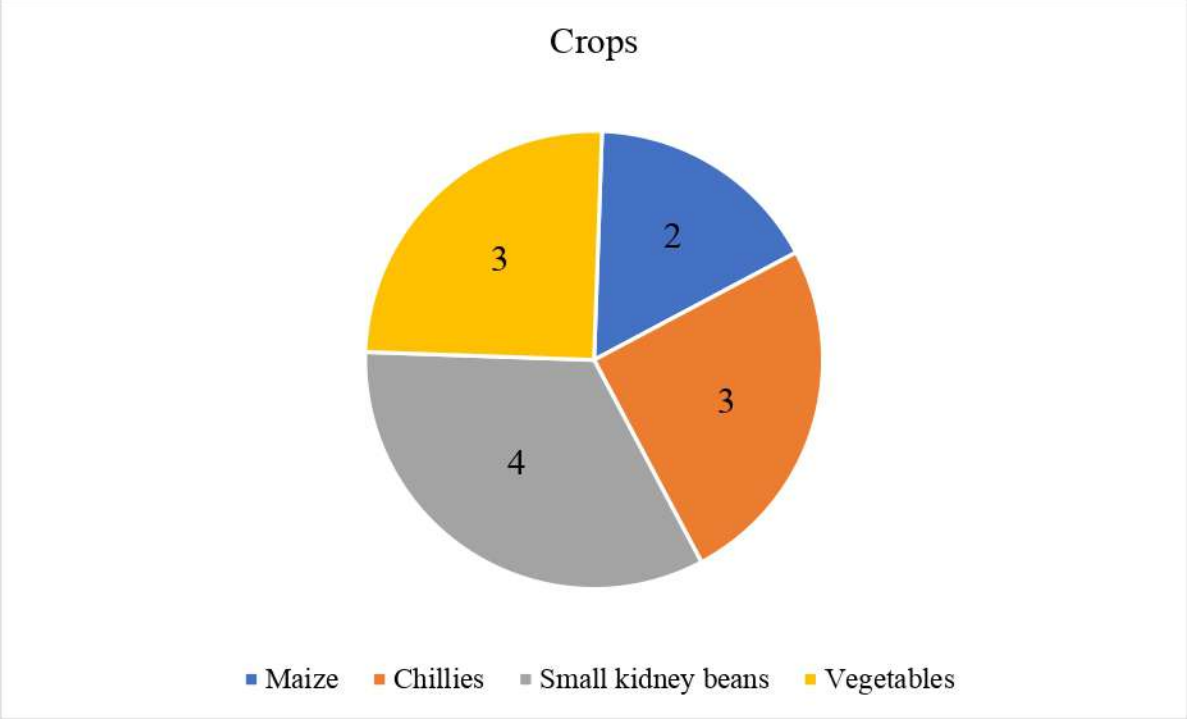

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Guar animals, also known as Indian bison or gaur, are large and powerful creatures that can cause significant damage to crops. In Sal village, the presence of these animals posed a threat to groundnut crops, leading many farmers to abandon groundnut cultivation altogether. The fear of crop damage and financial losses prompted the villagers to seek alternative crops that were less susceptible to damage by guar animals.

As a result, many farmers in Sal village opted to discontinue groundnut cultivation and explore other agricultural options. However, this change in crops has not been without its challenges. Some villagers have experienced losses as a result of transitioning away from groundnuts. The new crops chosen by some farmers may not have yielded the expected profits, leading to financial difficulties for those individuals. The agricultural landscape of Sal village has been shaped by environmental factors such as floods and soil erosion. Before the construction of the Tillari dam, the village

experienced floods approximately 5 to 6 times. These floods caused soil erosion, which is the process by which soil is washed away by water, leaving the land less fertile and suitable for farming.

Despite facing these challenges, the villagers of Sal have employed traditional farming practices to sustain their agricultural activities. One such practice involves the use of cow dung as a natural fertilizer. Cow dung is rich in nutrients and organic matter, making it an effective way to replenish the soil and enhance its fertility. By spreading cow dung on their fields, farmers in Sal village can improve soil quality and promote healthy crop growth.

The use of cow dung as fertilizer highlights the villager's resourcefulness and reliance on traditional knowledge passed down through generations. Surendra Raut shared that after building the Tillari Dam, Sal village didn't have floods for 15 to 16 years. But in 2019, heavy rain caused floods, leading to soil erosion. This means the rain washed away the soil, which can harm crops. It showed that even though the dam helped prevent floods for many years, heavy rain can still cause problems. Soil erosion can make it hard for farmers to grow crops because the soil loses its nutrients and structure. This event highlighted the need for ongoing efforts to manage floods and protect the land in Sal village.

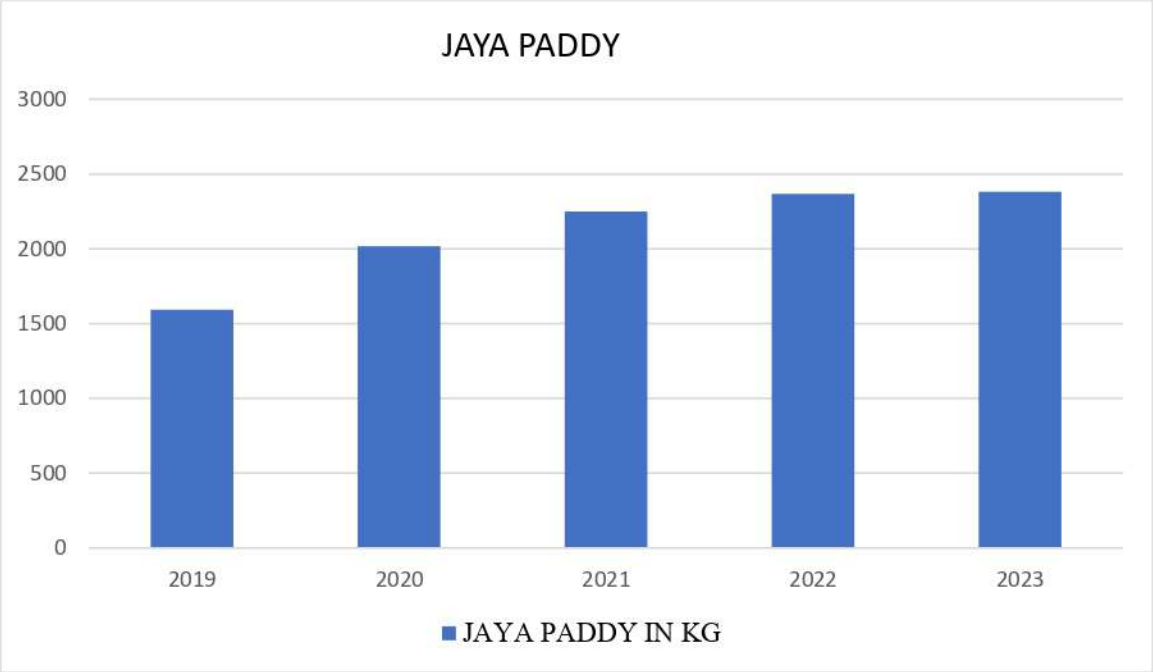
Shri Surendra Raut shared information about agriculture in Sal village, including banana cultivation and concerns regarding groundnut farming's impact on soil fertility. He told the importance of fertilizers for successful farming, especially considering potential soil depletion from continuous groundnut cultivation. By providing essential nutrients to the soil, fertilizers can help sustain agricultural productivity and ensure successful crop yields. In the past, farmers needed a significant workforce to carry out agricultural tasks, such as planting, harvesting to crops. These

labourers were typically paid daily wages for their work, contributing to the local economy and livelihoods of the villagers. However, with the advent of machinery and modern farming equipment, the need for manual labour has decreased significantly. Surendra Raut told that in Sal village, during the rainy season, there were no issues with gaur, but from November to April, these animals completely destroyed agricultural fields. This problem persists even today. To address this issue, the villagers formed a community fencing group. Members of the community take care and staying in the fields from 9 pm to 12 am to protect fields from gaur. This initiative has led to a decrease in gaur sightings in the fields, making it possible to grow crops successfully. By working together and taking care to guard the fields, the villagers have found a practical solution to protect their agricultural livelihoods from gaur damage.

According to Surendra Raut, in Sal village, some people sold their land to get money, which made it hard for them to continue farming. Additionally, some farmers who still had land and they also do other jobs alongside farming. However, despite these challenges, the farmers in Sal village support each other and encourage one another to keep farming. The agriculture department also provides help to the farmers, but they have to buy their own seeds and fertilizers.

Table and Figure 4.2: Jaya Paddy Grown

Sr. No	**Year**	**Field**	**In Kg**
1	2019	Jaya Paddy	1592 Kg
2	2020	Jaya Paddy	2016 Kg
3	2021	Jaya Paddy	2250 Kg
4	2022	Jaya Paddy	2365 Kg
5	2023	Jaya Paddy	2383 Kg

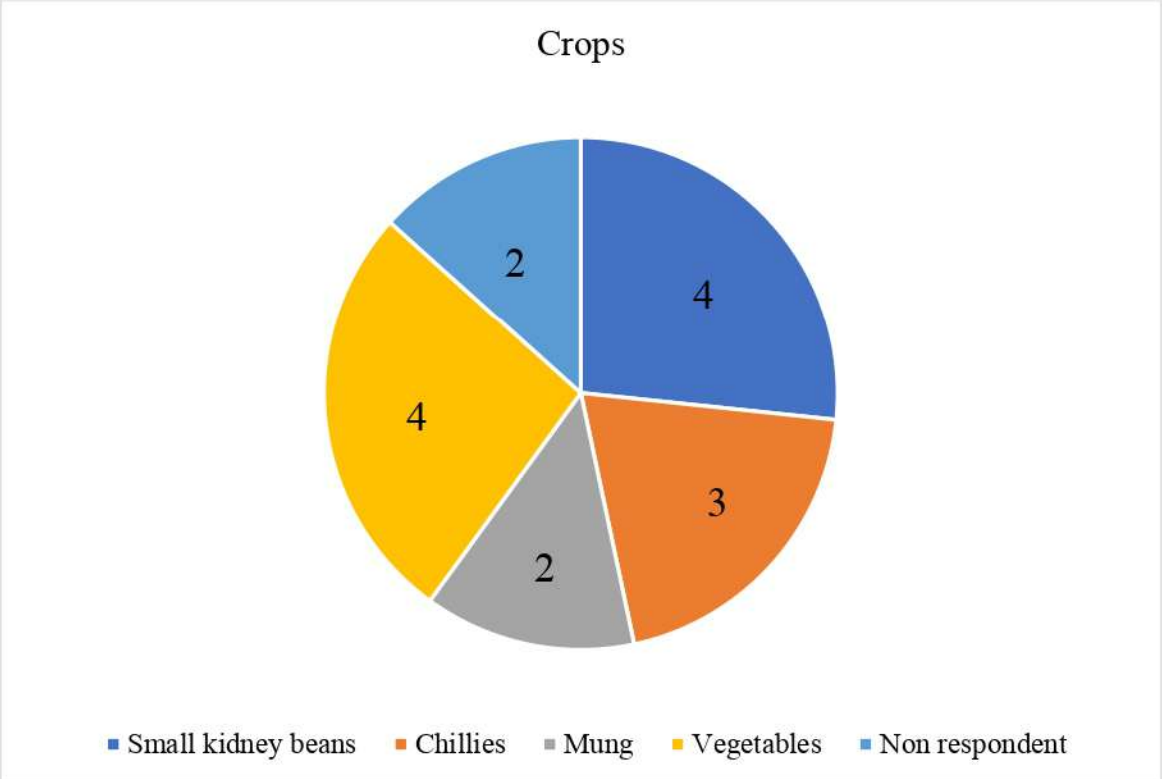


According to Surendra Raut's interview, he provided data on Jaya paddy collection over the past five years. In 2019, only 1592 kg were collected due to reduced rice production caused by heavy rain. However, there was slight increase in production in subsequent years. In 2020, the collection increased to 2016 kg, followed by further growth to 2250 kg in 2021. This trend continued in 2022, with a collection of 2365 kg, and in 2023, production further increased to 2383 kg.

As per my field visiting, I had interviewed 15 peoples and out of them 13 peoples including Surendra Raut given information about the agricultural practice in the Sal village and remaining 2 peoples were not responded to me.

Table and Figure 4.3: Other Crops

Sr. No	Farmers Respondent	Crops
1	4	Small kidney beans
2	3	Chillies
3	2	Mung
4	4	Vegetables
5	2	Non respondent



Among the responses, small kidney beans were mentioned by 4 respondents, indicating their significance in the agricultural landscape of Sal village. Chilies were mentioned by 3 respondents, suggesting their importance as a cultivated crop. Mung beans were mentioned by 2 respondents, highlighting their presence in agricultural practices. Additionally, vegetables were mentioned by 4 respondents, indicating their cultivation alongside other crops in the village. the lack of response from 2 individuals, the

gathered information provides valuable insights into the diversity of agricultural practices in Sal village.

CHAPTER V

SUMMARY AND CONCLUSIONS

The villages of Ibrampur and Sal, located in the North Goa district of India are renowned not only for their lush green landscapes but also for their agricultural practices. Ibrampur, located in the Pernem taluka, farmers rely heavily on the fertile soil and the waters of the Chapora River to cultivate their crops. The canal system ensures a steady supply of water for irrigation, allowing farmers to nurture a variety of crops throughout the year. The river not only serves as a lifeline for agriculture but also provides fresh water for domestic use, and no water scarcity in the village. While both villages benefit from the river's freshwater, they have unique features.

Sal, situated in the Bicholim taluka, the agricultural land extension along the coastal banks of the Chapora River. For the farmers a prime location for cultivation, with the river's providing essential moisture for their crops.

Despite the abundance of natural resources, both villages face a common challenge: the threat of Indian bison (gaur) animals damaging their crops and impacting the livelihoods of farmers. When crops get damaged, farmer make less money because they can’t harvest as much.

Villagers have explored various measures to protect their crops, including the use of fences to guard wild animals entering agricultural fields. In comparing Ibrampur and Sal villages along the Chapora River, that both communities rely on the river for their livelihoods and sustenance. In Ibrampur, canal water and direct river water are crucial for agriculture, with bandaras playing a vital role in managing water resources. Similarly, in Sal village, the Chapora River is essential for domestic use and supports a dam and water pumping station for wider water distribution.

Over time, both villages have evolved their agricultural practices. While Ibrampur once relied on traditional methods like using cow dung for soil fertility, they now incorporate chemical fertilizers for crop growth and increased productivity in agriculture.

Despite these changes, both villages remain rich in biodiversity and continue to prioritize sustainable agriculture. The communities recognize the importance of preserving their natural resources for future generations while adapting to meet the demands of modern agriculture.

Overall, the Chapora River serves as a lifeline for Ibrampur and Sal villages, providing water for irrigation, domestic use, and supporting local ecosystems. Despite differences, both villages share a commitment to sustainable agriculture and are rich in biodiversity.

In Sal village, traditional farming methods like using cow dung for soil fertility and implementing soil erosion prevention measures were once widespread. However, modern agricultural practices have introduced the use of chemical fertilizers for crop growth. Despite this shift, farmers in Sal village continue to prioritize sustainable agriculture, traditional wisdom with modern innovations to ensure the long-term health and productivity of their land.

Soil erosion presents a significant threat to agricultural productivity in both Ibrampur and Sal villages. Factors such as heavy rainfall, leading to loss of fertile soil and reduced crop yields. This erosion leads to the loss of fertile soil, diminishing crop yields, and threatening food security for residents.

While traditional methods like using cow dung were once common in Sal village for soil fertility, modern practices now include chemical fertilizers for crop

growth. Similarly, in Ibrampur, traditional mud bandaras were historically used for irrigation, but now the bandara on the Chapora river serves this purpose.

Infrastructure such as roads, healthcare facilities, and educational institutions play a vital role in supporting agricultural development and enhancing the quality of life for residents.

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