

3.1 Introduction

Geographical location and environment of the region has enriched the agriculture of Purba Medinipur district. Soil, climate, drainage system, topography are conducive for cultivation. Not only the geographical factors, but also the sufficient skilled worker in agriculture is available here. It has estimated that 40 percent of the total population of the district is cultivator. Most of the income of the people comes from agriculture. The main characteristics of agriculture of the district are as follows:

- a) Agriculture is the intensive subsistence in nature.
- b) Population pressure on agriculture is high.
- c) There are varieties of crop cultivation in a crop season.
- d) Cropping pattern has changed with the changing of seasons.
- e) Mixed cropping is also observed.
- f) There are high percentages of cultivated land of the district.

The main problem of agriculture is as follows:

- a) The agriculture is mainly monsoon dependent which is uncertain, unreliable and irregular.
- b) Crop cultivation is disrupted due to lack of fresh water in the dry season.
- c) Despite the abundance of tidal water throughout the district, it cannot be used in many places due to the salinity of the water.
- d) The agricultural land holding are small and fragmented.
- e) Due to small land holding, the agricultural mechanization is not properly implemented.

In addition to crop cultivation, another important economic activity is pisciculture. It has been studied that day to day the inland fishery is growing at a highly rate in the district. Besides, the other economic activity is agro-forestry and the social forestry of the local people.

3.2 Agriculture

Agriculture is the systematic practice of using land for raising of crops, fruits, vegetables. It also includes animal husbandry, agroforestry and pisciculture. The Oxford English Dictionary (1971) has given a definition in the broadest sense that agriculture is the science and art of cultivating the soil for harvesting the crops, rearing live stock, tillage, husbandry, farming etc. However the term agriculture is mostly used to refer the crop cultivation (Harris et al., 2014). So, in the present study, the term agriculture has been used solely for crops cultivation. The chapter describes the agricultural types, system of agricultural practiced and spatial distribution of different agricultural crops in the district.

The agricultural system of Purba Medinipur district is diverse in nature and varieties of crop cultivation are found in different seasons. The variation in crop cultivation is also found in the case of spatial distribution.

3.2.1. Types of agriculture

Agricultural system of the district is classified in three types on the basis of seasonal change, such as kharif cultivation, winter cultivation and summer cultivation.

A. Kharif Cultivation

The term ‘Kharif’ is an Arabic word which has been familiar in the Indian subcontinent during Mughal Empire and has been widely used ever since. The word literally means ‘autumn’ in Arabic, which is a season in the Indian subcontinent when the different crops are cultivated. Generally, in the district, kharif cultivation is started at

early June when the monsoon starts and at the beginning of winter that is the month of November, is the time of harvesting. This period is called kharif season and the cultivated crop is known as kharif crop. As the kharif cultivation is started based the onset of southwest monsoon, therefore the crop is also called monsoon crop. These cultivation is practiced almost all the cultivating land of the district. Paddy is the main crop of this cultivation. Besides rice, the jute, vegetable, flower, some amount of pulses also cultivated in this season. The main feature of this cultivation is monsoon dependent and sometimes it is hampered due to the vagaries of the monsoon rain.

B. Winter Cultivation

Winter cultivation starts from the early November and is harvested in the month of April. This cultivation is done in the winter season, so this is called winter cultivation and cultivated crop is called winter crop. Regionally, this crop is more popular as a name of 'Rabi crop' and this period is called rabi season. The word 'Rabi' comes from Arabic word which literally means 'spring' is a season in Indian subcontinent. This cultivation is done during the dry season but in the wet soil which has been soaked in rainy season. Therefore, irrigation is very essential for this cultivation. The major crops in this period are vegetables, flower, pulses, mustard etc.

C. Summer Cultivation

Summer cultivation is raised in summer season which starts from the end of winter that is the month of February/March and harvested in the month of May, before the monsoon begins. The season in between the rabi and kharif crop is called the summer month known as the 'Zaid season'. So the cultivated crop is known as 'Zaid crop'. This cultivation is done in almost dry soil during summer season when rainfall is very low. Therefore, this cultivation is completely irrigation dependent. As this cultivation is irrigation dependent, the success of this cultivation depends on the

availability and ability of the irrigation system, the amount of irrigated area and the availability of water at the right time etc. Boro paddy is the main crop in this cultivation and drought tolerant crops such as vegetable, pulses, groundnut and flower are cultivated.

3.2.2. Types of cropping system

A cropping system is a way in which varieties of crops are cultivated in the same field in an agricultural year. It represents the cropping pattern and their interaction with the farm resources. The main objective of cropping system is to find out the efficient utilization of all resources related to farm environment such as land, soil, air, water, sunlight, nutrients and labour. Cropping system depends on farm resources, population growth, the amount of land, labour, capital, farm technology, earning etc. There are four types of cropping system practised in Purba Medinipur district, i.e.,

- a. Single cropping
- b. Double cropping
- c. Multiple cropping
- d. Inter cropping

a. Single cropping

The single cropping system is a method in which one crop is cultivated in a particular season in an agricultural year. In other season, the cultivated land remains vacant. In the district, very small amount of land is engaged for the single cropping system. It is practiced in the some villages of the block of Egra-II and Bhagawanpur-II block. Amon paddy is grown only during the monsoon. The rest of the year it is not cultivated due to the lack of water.

b. Double cropping

In this cropping system the crops are cultivated two times in an agricultural year with the favourable environment. In Purba Medinipur district, most of the area is

practiced double cropping system. In double cropping system, kharif crops are cultivated during the monsoon season and rabi crops in winter season.

c. Multiple cropping

In this method the crops are cultivated three or more times in an agricultural year. The different crops are cultivated in different season in the district such as kharif crops in monsoon season, rabi crops in winter season and zaid crops in summer season. Multiple cropping systems has widely spread in the villages of Panskura, Sahid Matangini, Mayna, Kolaghat, Tamluk and Nandakumar block. Multiple cropping systems has developed in the district due to the availability of irrigation water, availability of labour, high-yielding seeds, fertilizers, good connectivity etc.

d. Inter cropping

Inter cropping is a technique where various types of crops are cultivated on the same land at the same time. In this case, different crops are produced in different rows like vegetable, flowers and fruits. This pattern of cropping system is found in many villages of the district, especially in the villages of Panskura, Mayna and Kolaghat block.

3.2.3. Types of crops and its' distribution

In the district, different types of crops are cultivated on the seasonal basis. The crops grown in the district can be divided into three types such as:

- a. Kharif crops
- b. Rabi crops
- c. Zaid crops

The present study reveals the distribution of major crop cultivated area of Purba Medinipur district which covers minimum 5 percent of cultivated area out of total agricultural land. The name of major crops is given in the table 3.1. The individual crop area of each village has been calculated as a percentage on the basis of total cultivated land. Village wise agricultural data regarding the different crops area has been collected from the block agricultural office that were last recorded in 2015-16.

Table 3.1 Major crops practiced in Purba Medinipur district in different season, 2015-16.

Types of crops	Major cultivated crops
Kharif crops	Amon Paddy, Aus Paddy, Jute, Flower, Vegetable
Rabi crops	Vegetable, Mustard, Flower, Potato, Khesary (Pulses)
Zaid crops	Boro Paddy, Flower, Ground Nut, Moong (Pulses), Vegetable

A. Distribution of Kharif crops

The major kharif crops grown in the district are aus paddy, amon paddy, jute, flower, and vegetable. Rice is the most productive food crop of the district. The rice is produced for both subsistence and commercial purposes. Aus paddy is cultivated at the end of the summer that is the month of May and harvested in September. This rice cultivation is done on both rain and irrigation dependent land. Aus paddy is produced on average 9000 to 9550 kg/hectare. The villages of Bhagawanpur-I & II, Chandipur, Mayna, Tamluk, Nandakumar and Sahid Matangini block are notable for this type of rice cultivation (Fig. 3.1). Amon paddy is a significant kharif crop of the district (Fig. 3.2). Due to the availability of water in the rainy season, the amon paddy cultivation is done throughout the district. Amon paddy is better grown in low land where water logging is a common phenomenon. This paddy cultivation is done purely on the basis of monsoon rain and therefore, it is affected by excess or absence of rain. Besides paddy cultivation, jute is the important commercial fiber crop of the district. Jute fiber is the raw material of jute textile and the remaining part of jute called jute stick is used for fence of houses or land, betel leaf cultivation and fuel. Jute is cultivated in several places, such as the villages of Moyna, Nandakumar, Sahid Matangini, Nandigram-I, Khejuri- II, Mahisadal (Fig. 3.3). The amount of vegetable cultivation during the monsoon is lower than in other seasons of the year (Fig. 3.4). Since, the maximum cultivated land is used for paddy production, therefore, the amount of vegetable cultivation is low. Vegetables are usually cultivated in areas where rain water is not logged. In addition, a lot of kharif vegetables are also grown on high land area which is locally called 'Kala land' or 'Kala Bari'. The kharif

vegetable cultivation is predominant in the villages of Ramnagar-I, Contai-III, Panskura, Moyna, Nandigram-I and II. The major types of vegetables in Kharif cultivation is pumpkin, luffa, snake gourd, bitter gourd, carrot, brinjal, cucumber, okra etc.

One of the special feature of agriculture of Purba Medinipur district is floriculture. It is commercial form of agriculture in the district. The growth and production of flower cultivation of the district has gained national importance in the last few decades. The flower of this region has a great impact on the flower market of West Bengal as well as India (Sahu et al., 2011). Two main blocks of the district, namely Kolaghat and Pnskura are important flower growing area (Fig. 3.5). The people of this block earn more money from flower cultivation than other crops. However, in kharif season the flower cultivation is less than the other seasons. During the monsoon season, heavy rain disrupts the flower cultivation, causing the financial losses of the farmers. Here, the major kharif flower is marigold, rose, tuberose, jasmine, beli, lotus, balsam etc.

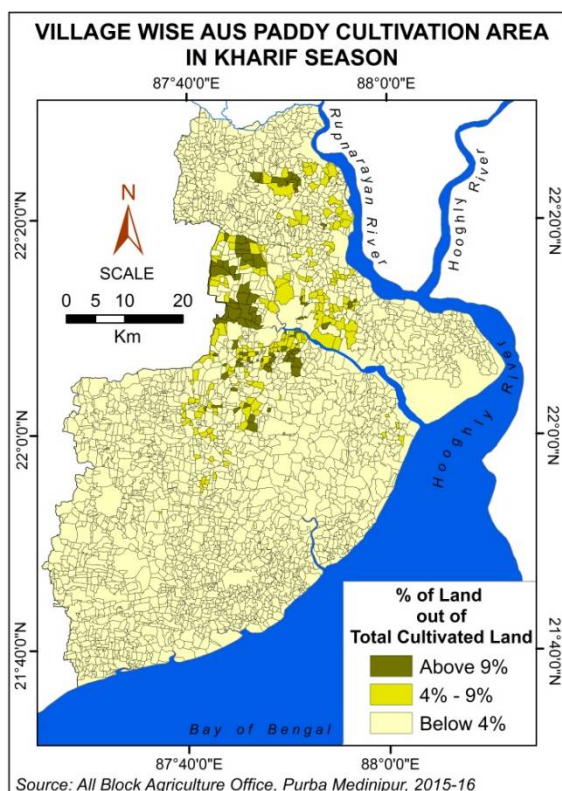


Fig. 3.1 Distribution of aus paddy cropped area in kharif season.

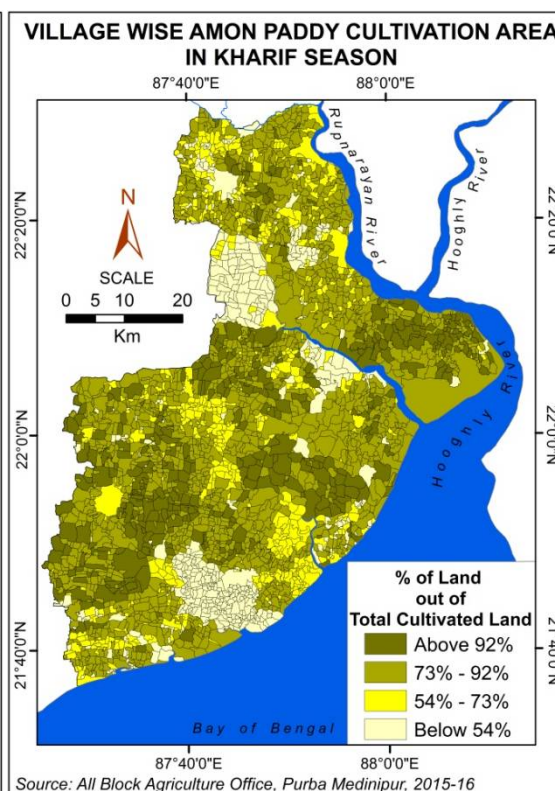


Fig. 3.2 Distribution of amon paddy cropped area in kharif season.

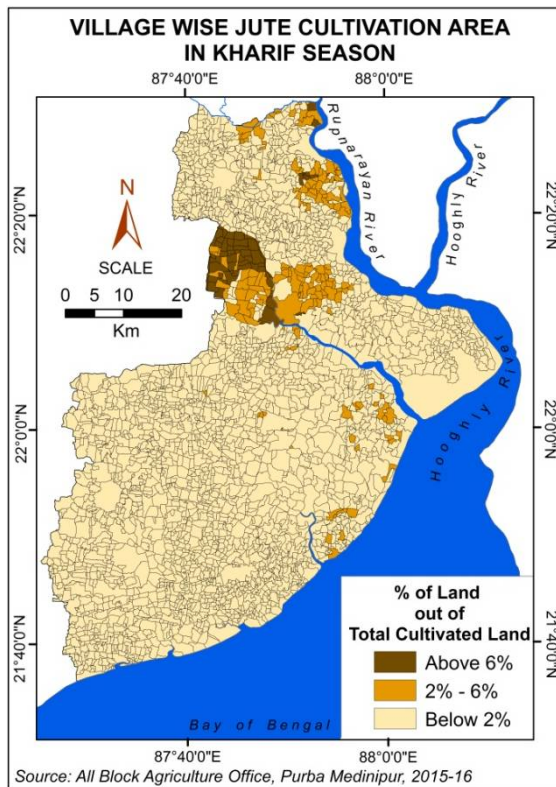


Fig. 3.3 Distribution of jute cultivated area in kharif season.

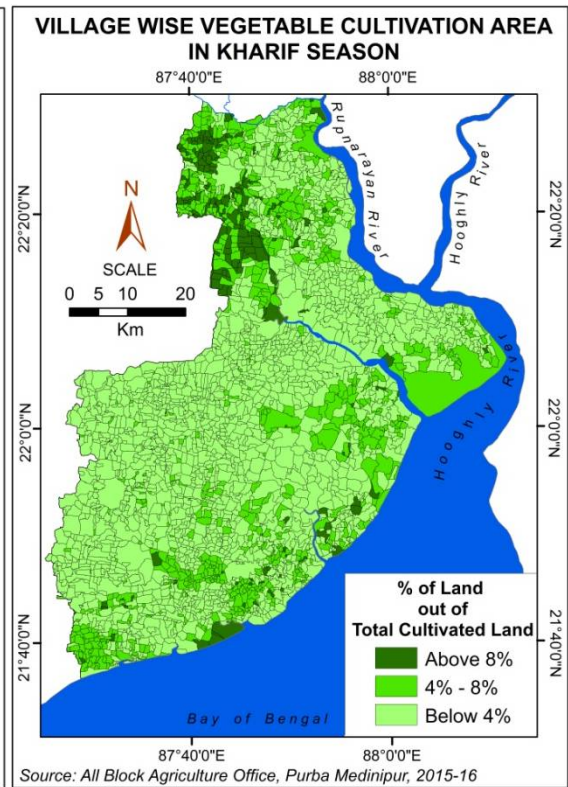


Fig. 3.4 Distribution of vegetable cultivated area in kharif season.

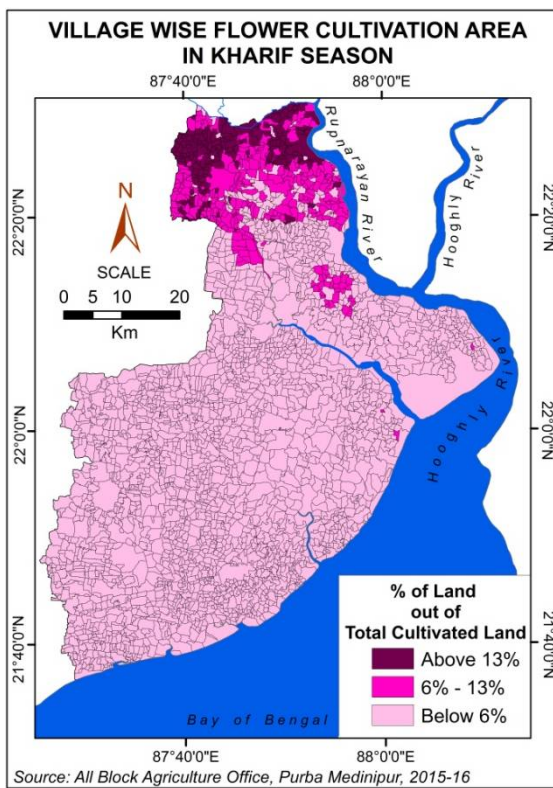


Fig. 3.5 Distribution of flower cultivated area in kharif season.

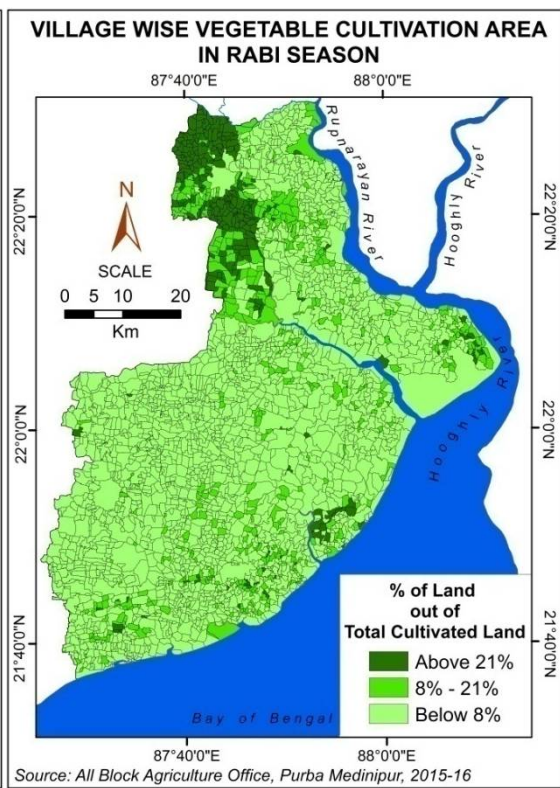


Fig. 3.6 Distribution of vegetable cultivated area in rabi season.

B. Distribution of Rabi crops

Vegetable, mustard, flower, potato, khesary (pulses) are the dominant rabi crops grown in the district. Among them, more prevalent rabi crops is vegetable, especially in the village of Panskura and Mayna blocks (Fig. 3.6). Panskura block is the largest producer of vegetables. The major winter vegetables are cabbage, cauliflower, kohlrabi, radish, bean, green bean, spinach, Carrot, beetroot, and coriander etc. The winter floriculture is famous in the district especially in the villages of Panskura and Kolaghat block (Fig. 3.7). There are many types of flower are cultivated in rabi season, such as marigold, aster, chrysanthemum, dahlia, erica, gladiolus etc. Mustard cultivation is found more or less in some blocks of the district, especially in the villages of Kolaghat, Mayna, Ramnagar-I, Khejuri-II, Panskura and Bhagawanpur-I blocks (Fig. 3.8). Some villages of Nandigram-I & II, Khejuri-I & II are more famous for khesary cultivation (Fig. 3.9). Khesary is the one type of pulses and cultivated mainly in the dry season. Potato cultivation also found in some village of Moyna and Panskura block (Fig. 3.10).

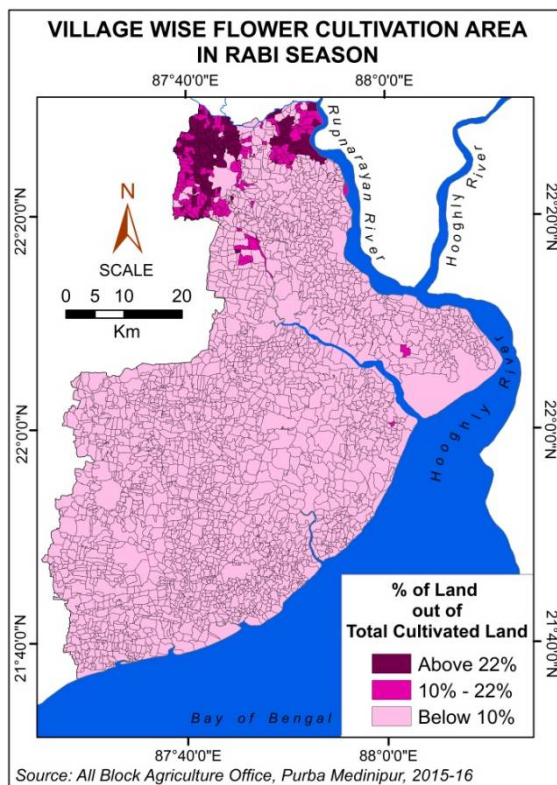


Fig. 3.7 Distribution of flower cultivated area in rabi season.

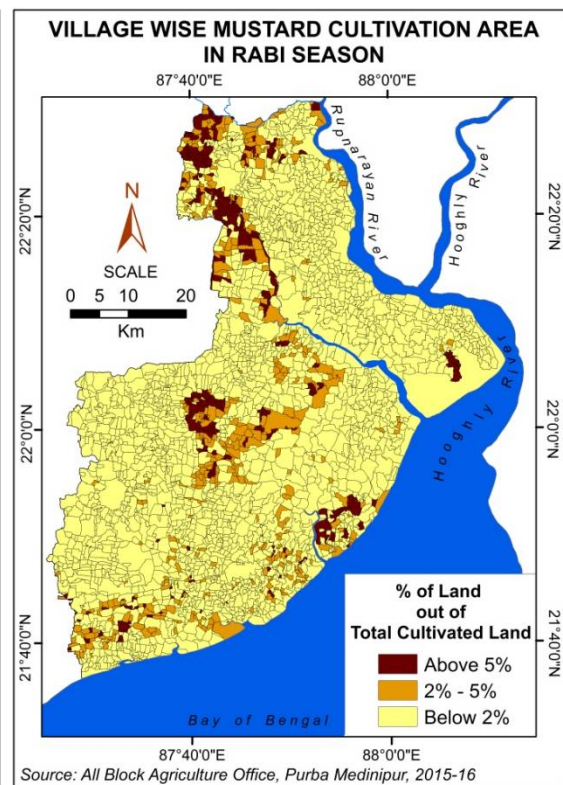


Fig. 3.8 Distribution of mustard cultivated area in rabi season.

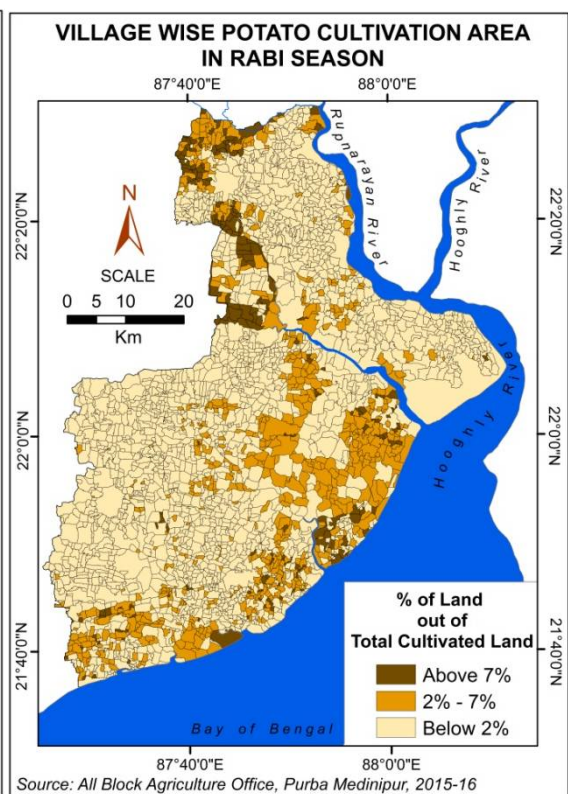
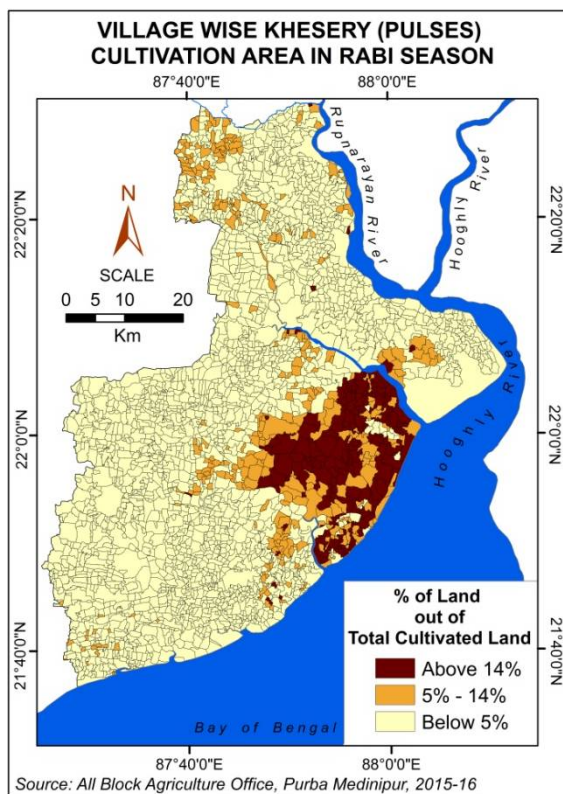


Fig. 3.9 Distribution of khesery cropped area.

Fig. 3.10 Distribution of potato cropped area.

C. Distribution of Zaid crops

Zaid crops are practiced in summer season when temperature is high and rainfall is low. Therefore, this cultivation is highly depends on irrigation. Boro paddy, ground nut, moong (pulse), flower, vegetable are the major zaid crops of the district. Boro paddy is one of the significant cultivation in the district which depends on technology, high yielding seeds and irrigation system. It is the main crop of intensive agriculture. However, this paddy cultivation is not followed everywhere in the district due to the lack of water in summer or unavailable irrigation water. It is widely spread in the villages of Kolaghat, Panskura, Sahid Matangini, Tamluk, Nandakumar, Mahisadal, Patashpur-I, Bhagawanpur-II, Egra-II and Chandipur block (Fig. 3.11). Summer flower cultivation is also significant in the district but limited to Panskura and Kolaghat block (Fig. 3.12). The Major summer flower is marigold, rose, tuberose, lotus, etc. Another important crop in the district is ground nut. Groundnut is grown in the village of Ramnagar-II, Contai-III, Egra-II and Panskura block (Fig. 13). Villages of Mayna and Panskura block are also

important for zaid vegetable cultivation (Fig. 3.14). More or less moong cultivation is observed in different villages of the district. Moong is the one type of pulses. This cultivation is done in different villages of Ramnagar-I and II, Kolaghat, Nandigram-I and II and Mayna blocks (Fig. 3.15).

Another important cash crop in the district is the betel leaf. Betel leaf belongs to the ‘Piperaceae’ family and it is one type of vine species. Betel leaf is mostly consumed in South-East Asian countries. Betel leaf is produced throughout the year. It is planted once and the leaves can be collected repeatedly. However, the leaves are collected at a certain time interval, i.e. 12 to 15 days interval. On an average, about 2000 to 2500 leaves are collected per one decimal of land area at a time depending on the varieties of leaf species. There are number of villages in different blocks of the district where betel leaf cultivation is more important than rice cultivation such as Tamluk, Moayna, Nandakumar, Sahid Matangini, Ramnagar-I and Egra-I (Fig. 3.16).

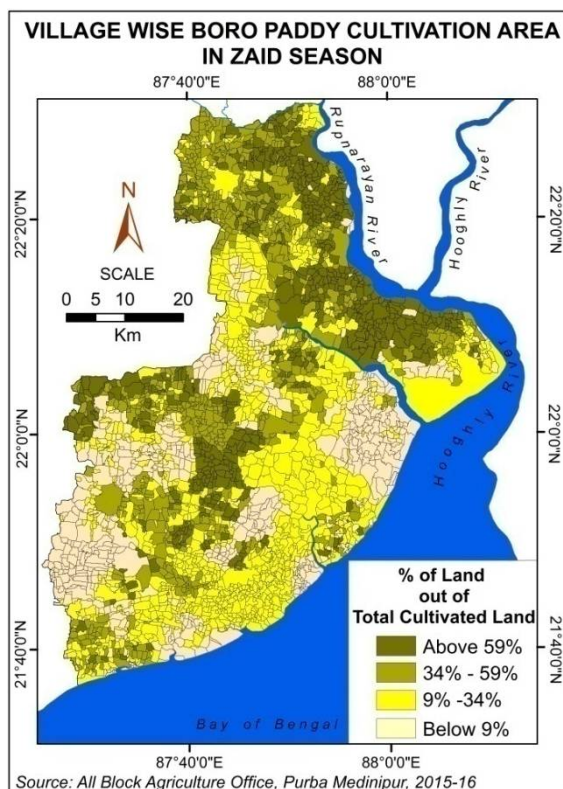


Fig. 3.11 Distribution of boro paddy cropped area in zaid season.

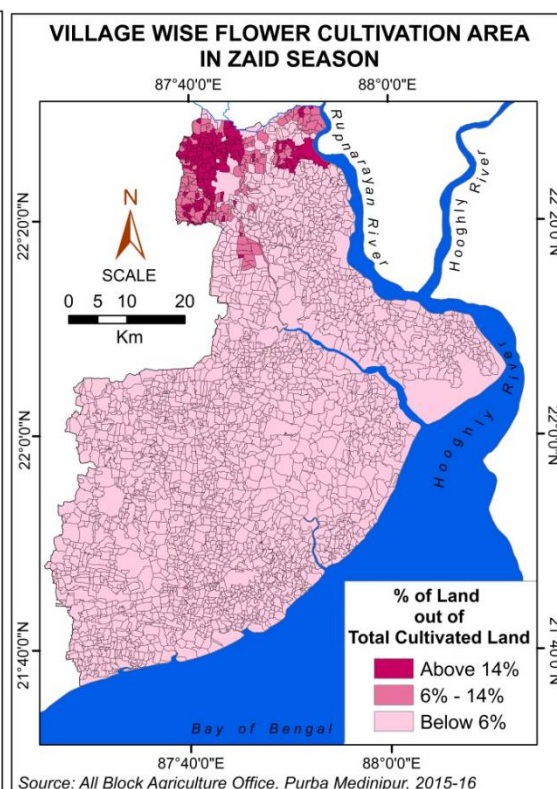


Fig. 3.12 Distribution of flower cultivated area in zaid season.

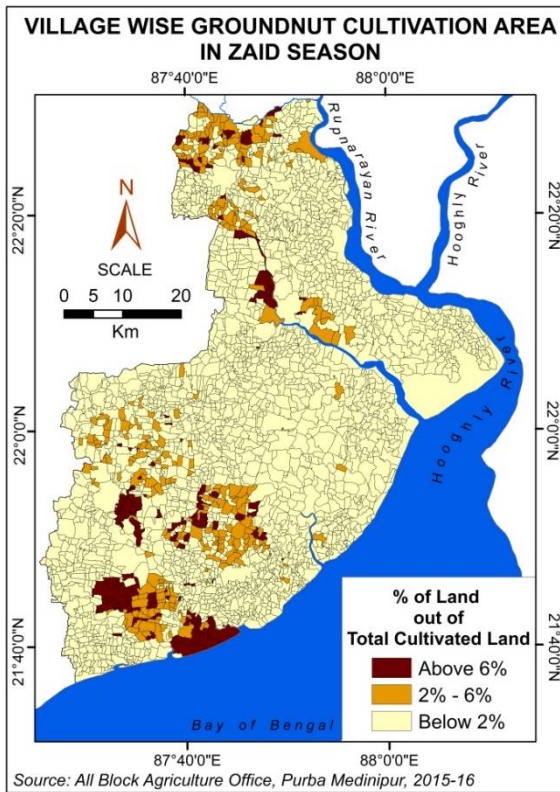


Fig. 3.13 Distribution of groundnut cultivated area in zaid season.

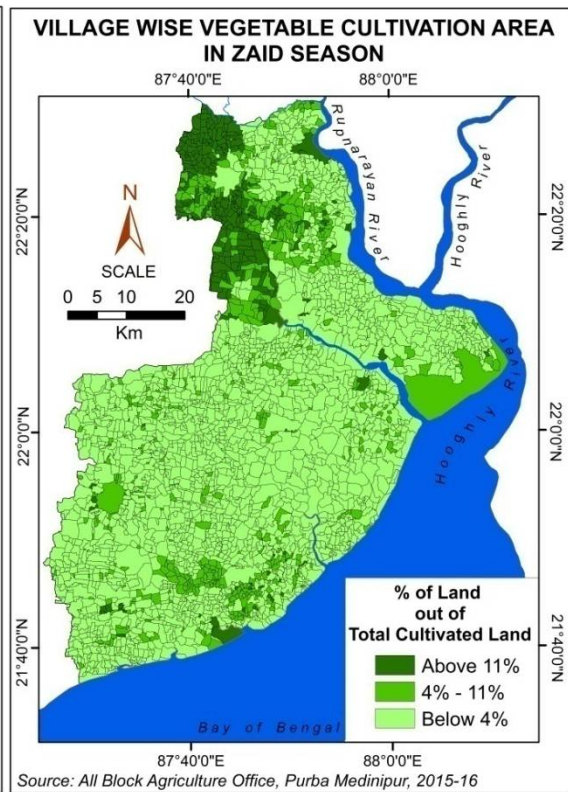


Fig. 3.14 Distribution of vegetable cultivated area in zaid season.

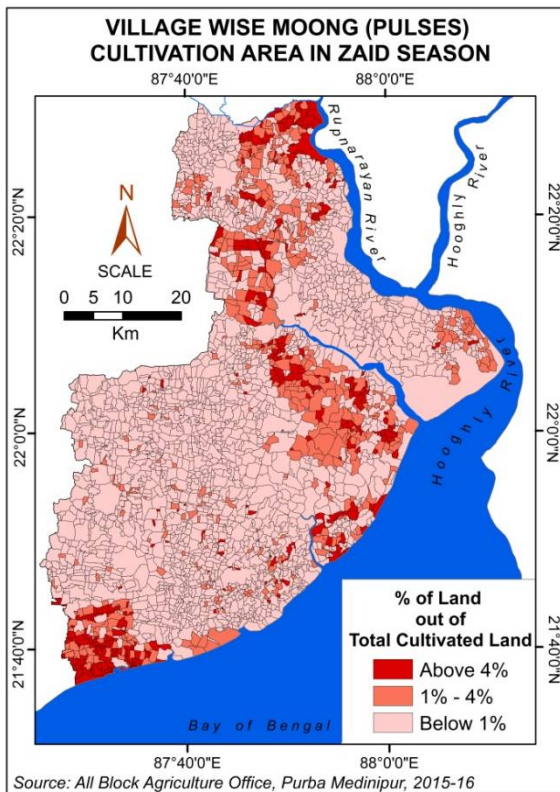


Fig. 3.15 Distribution of moong cropped area in zaid season.

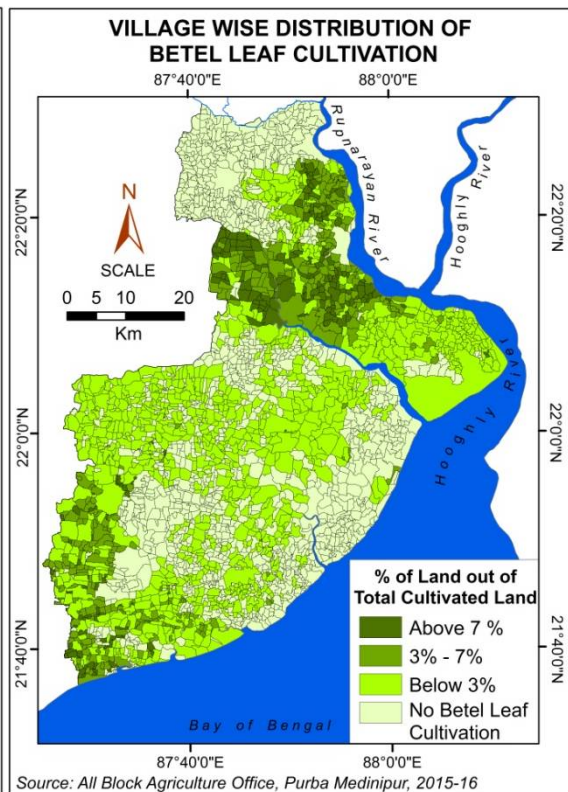


Fig. 3.16 Distribution of betel leaf growing area.

3.3 Vegetation

There is no such type of forest in Purba Medinipur district, which is created in a natural way. So, there is no revenue yielding reserved or protected forest in the district. The forest of the district is mainly made by the local people, called social forestry and which is planted in two ways, one by the farmers and other by the government or semi-government organization. Since, the district is under tropical monsoon climate, therefore, most of the trees are deciduous in nature. Some evergreen trees are also found here. Grass can be found in the marshy tracts of the Hooghly and Rupnarayan river and southeast side which resembles to that of savannah swamps of the Sundarbans. The principal species are Nal grass and it is used for fence of house or land and fuel. The map (Fig. 3.17) represents the distribution of vegetation in Purba Medinipur district. The vegetation cover area has been extracted from the satellite image using the supervised image classification technique. The multi spectral image acquired by the Sentinel-2 sensor, June 2019 has been used whose spatial resolution is 10 meters. Total forest cover area of the district is 80119.92 hectares (Table 3.2). The village wise amount of forest cover area is shown in Fig. 3.18 where, more than 22 percent land out of the total geographical area is forest cover area in 42 percent villages of the district (Annexure 3). There are also 43 percent villages where forest cover area is 7 to 22 percent of their total area (Table 3.3). The class division of the map has been determined based on mean and standard deviation of the data set and considered the round figure of the class value.

Table 3.2 Estimation of forest cover area of Purba Medinipur district using satellite image.

Year	Pixel Count	Total Area (Hectare)
June, 2019	8011992	80119.92

Table 3.3 Different classes of vegetation cover area with number of village.

Percentage of vegetation cover area	Number of village
Above 22	1276
7 - 22	1286
Below 7	437

3.3.1. Forestry by Government and Semi-Government organization

Government and Semi-government organisation play an important role in the growth of forestry of the district. The forest department creates forest land by planting trees in its jurisdiction. Government land, such as canal terrace, river side, dam, both sides of the railways and roadways are used for afforestation. On both sides of the road or pathway, an average of 20 to 25 meters stretches of forest cover area has been identified as a government forest area. Various agencies like B.D.O, Zila Parishad, Panchayet samitis, Gram Panchayets, School and Colleges etc. perform such activities. Generally, fast growing trees are selected for this forestation such as Akashmoni (Earleaf acacia), Eucalyptus, Mahua, Subabul, Tamarix etc. Total forest cover area under the government or semi-government organisation is 7540.12 hectare in the district (Table 3.4). The map (Fig. 3.19) shows the village wise distribution of forest cover area planted by government or semi-government organization. The class division of the map has been determined based on mean and standard deviation of the data set and considered the round figure of the class value. In 60 percent villages of the district have below 10 percent forest and 15 percent villages have above 21 percent forest planted by Government and Semi-Government organization (Table 3.5). This type of forest is found more in the northern and eastern villages of the district than in the southern and western.

Table 3.4 Different types of forest cover area of Purba Medinipur using satellite image.

Forest Types	Pixel Count	Total Area (Hectare)
Forestry by Government and Semi-Government organization	754012	7540.12
Forestry by farmer	7257980	72579.8

Table 3.5 Number of villages in different classes of forest covers area planted by Government and Semi-Government organization.

Percentage of forest	Number of village
Above 21	455
10 - 21	745
Below 10	1799

3.3.2. Forestry by farmer

The farmer builds forest land by planting trees in their own land for various purposes. These forests are commonly known as agro-forestry. Usually, farmers build this forest by planting trees on their fallow land, along the edge of the pond, embankment of agricultural land and in the open land around their houses. Agro-forestry practices contribute a wide range of economic and social benefits. Farmers collect a variety of products from these forests such as fruits, fodder, wood, flower, raw materials for craft and cottage industry etc. Agro-forestry system can also provide a variety of services as well as the important for the environment by increasing soil fertility replenishment, controlling land erosion, carbon sequestration, shelter and increase income level etc. The growing trees of these forests in the district are mango, jam, jackfruit, guava, banana, coconut, betelnut, bamboo, neem, arjun, challa, siris, simul, sissoo, khair, babul etc. The map (Fig. 3.20) shows the village wise distribution of forest planted by farmer which depicts that the southern and western villages of the district have the high concentration of this forest. The class division of the map has been determined based of mean and standard deviation of the data set and considered the round figure of the class value. The amount of forest planted by farmer in 63 percent villages of the district is above 89 percent and in 13 percent villages is below 77 percent of their total forest. There are also 24 percent villages where the amount of this forest is 77 to 89 percent out of total forest (Table 3.6). This type of vegetation has been identified from the total forest area excluding the government forest area. Total forest cover area under this category is 72579.8 hectare in the district (Table 3.4).

Table 3.6 Number of villages in different classes of forest covers area.

Percentage of forest planted farmer	Number of village
Above 89	1899
77 - 89	702
Below 77	398

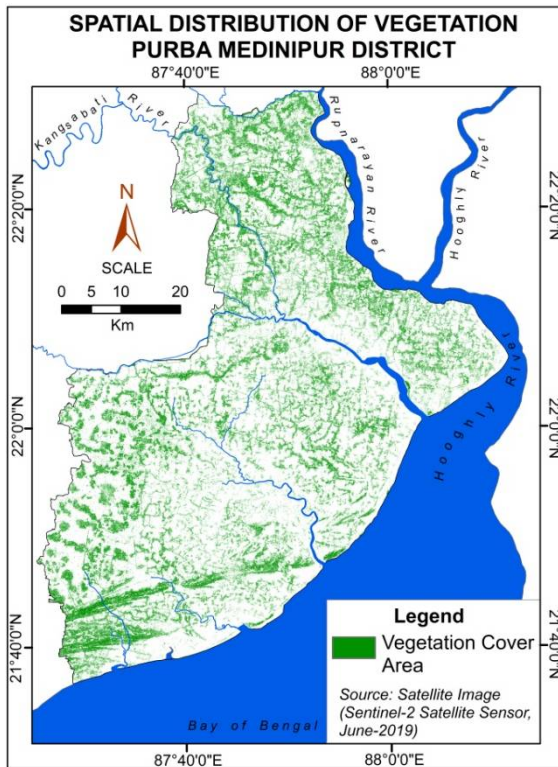


Fig. 3.17 Spatial distribution of vegetation.

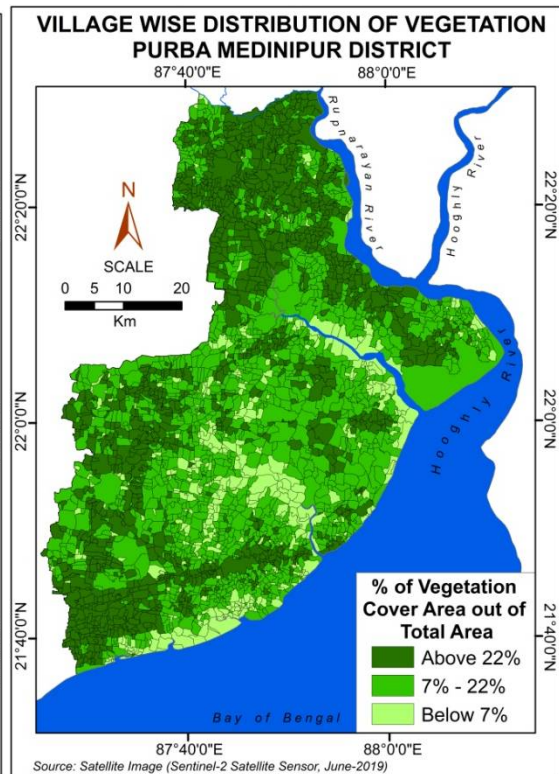


Fig. 3.18 Village wise vegetation covers area.

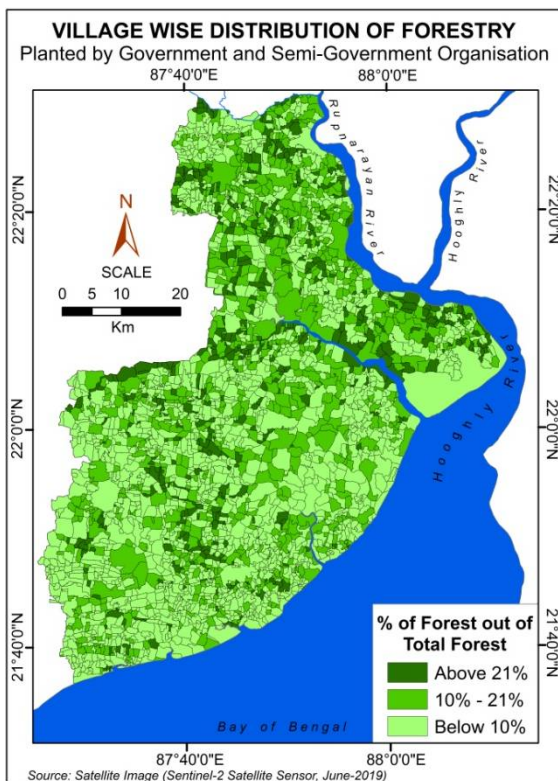


Fig. 3.19 Village wise forestry by government/semi-government organisation.

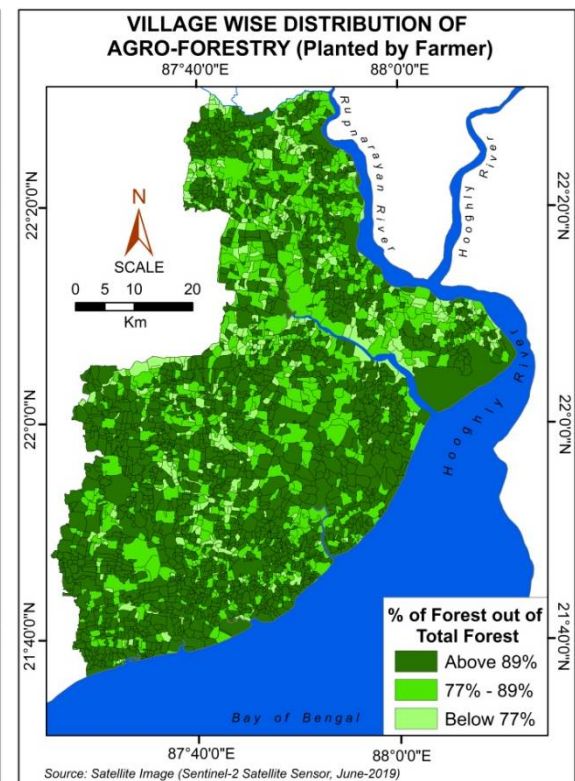


Fig. 3.20 Village wise forestry by farmers.

3.4 Fishery

At present, inland fishing is the most important economic activity of the district. The district is famous for inland fishing zone of the West Bengal. It is noticeable that a large amount of land is used for commercial fishing in the district. Availability of water, suitable land, good communication, availability of labour and both internal and external demand helped to grow the fisheries in the district. The map (Fig. 3.21) shows the distribution of inland fisheries of the district with total land of 36437.27 hectares. The Sentinel-2 image has been used to extract the water body where spatial resolution for Band 2(Blue), Band 3(Green), Band 4(Red), Band 8(NIR) is 10 m. There are several method and techniques in remote sensing and GIS to identify the water bodies considering band variations of different multi-spectral images. The Normalised Difference Water Index (NDWI) of McFeeters (1996) and Xu (2006) is most appropriate for the water body mapping. The NDWI technique can extract the water information accurately in most cases by analysing the signature of different spectral bands. This index extracts the water body using the green and Near-Infra-red bands of satellite images. The result value is varies between -1 to +1 (McFeeters 1996). Here, +1 indicates the presence of extensive deep water bodies and -1 is for vegetation cover.

Formula:

$$\text{NDWI} = \frac{\text{Green} - \text{NIR}}{\text{Green} + \text{NIR}}$$

Using the NDWI, the water body and other features have been differentiated from the satellite image of the district where value ranges from -0.87 to 0.99. For the water body mapping, the range of NDWI value -0.1 to 0.99 has been considered, because the actual water bodies in the ground have been identified by this value range. The estimated values of NDWI, considered values for water bodies' delimitation and the total fishery area accordingly are shown in the Table 3.7.

Table 3.7 Estimation of the area of fishery in Purba Medinipur district using NDWI technique.

Year	Estimated value of NDWI	Consider the range of NDWI value for water bodies	Total Area (Hectare)
2019	-0.87 – 0.99	-0.1 – 0.99	36437.27

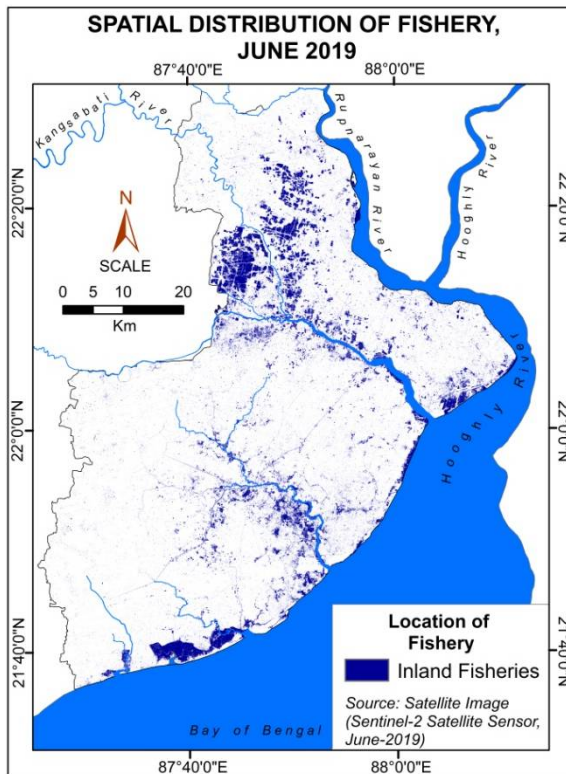


Fig. 3.21 Spatial distribution of fishery of Purba Medinipur district.

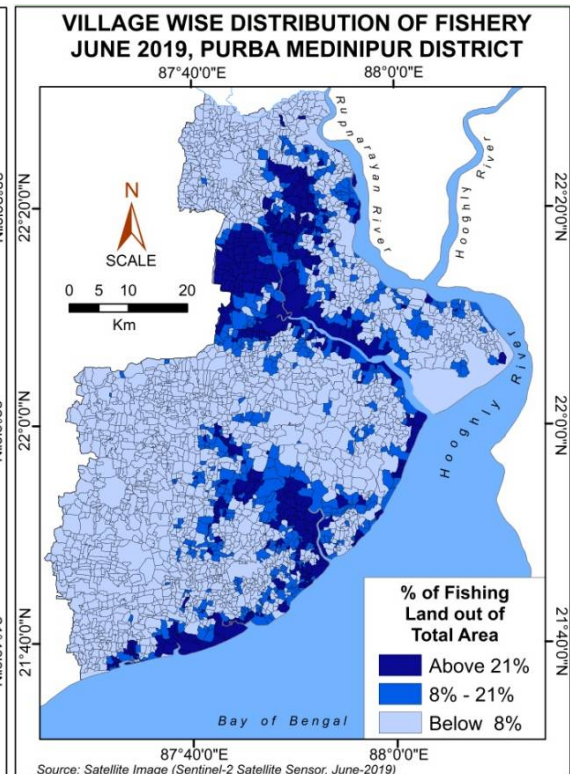


Fig. 3.22 Village wise area of fishery in Purba Medinipur district.

Table 3.8 Different classes of fishery land with number of village.

Percentage of land for fishery	Number of village
Above 21	341
8 - 21	429
Below 8	2229

The map (Fig. 3.22) shows the village wise area of the fishery land of the district (Annexure 4). The class division of the map has been determined on the basis of mean and standard deviation of the data set and considered the round figure of the class value.

From the map it is observed that most of the fisheries have developed along the Kangsabati, Haldi and Rasulpur river because of the availability of both fresh and tidal water. Rohu, catla, mrigal, bata, silver carp, prawn etc. are the major cultured fish of the district. There are 11 percent villages of the district where the amount of fishery is above 21 percent and 74 percent villages where the amount of fishery is below 8 percent of their total land. About 15 percent villages have 8 to 21 percent fishing land out of total land (Table 3.8).

This chapter has described the distribution of agro-natural resources of Purba Medinipur district which is the important objectives of the study. In this chapter, the characteristics of agriculture, types of agriculture, types of cropping system, various crop area of the district has been explained in details which indicates the level of agricultural development and agricultural prosperity of the district. Some agricultural problems have also been highlighted which need proper management. In addition, the chapter has analysed the different types of forest cover area, i.e., forestry by Government and Semi-Government organization and forestry by farmer and also its amount which represents the nature of afforestation and the level of environmental preservation of the district. Another important discussion of the chapter is the distribution of fishery and its amount in the district. Since, the fishery is commercial basis so, it indicates the nature of economic development of the district.