Negotiating Socio-economic Opportunities in Payments for Environmental Service Schemes

The Case of Bhoj Wetlands, Madhya Pradesh

Scoping Report

WINROCK INTERNATIONAL INDIA

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1. Introduction and objective of the scoping study

Bhoj Wetlands in Madhya Pradesh (MP) is facing major ecological threats owing to declining water quality and failing storage capacity due to siltation from upland erosion. While the government attempted to mitigate the urban downstream pollution through a Japanese Bank for International Cooperation (JBIC) funded project, water quality impacts linked to upland farming practice still remains a threat to the wetlands. The increase in use of chemical inputs by upland farmers since the last few decades has contributed to negative impacts on the wetland ecology, fish catch and drinking water supplies.

Winrock International India (WII) in collaboration with IIED, UK, has recently initiated a project to promote wetland friendly agriculture farming practices in the upper catchment of the Lake through promoting a switch to organic farm inputs with improved land management initially in the selected 8 villages adjacent to the lake. A study was undertaken jointly by WII and its local partner- the Lake Conservation Authority (LCA), Madhya Pradesh, to analyse and identify villages which have maximum impact on the lake in terms of its land management practices. Based on these studies, 8 villages located along the two feeding channels (*gora nallah* and *neel nadi*) were selected for the promotion of organic farming (See Figure 1).

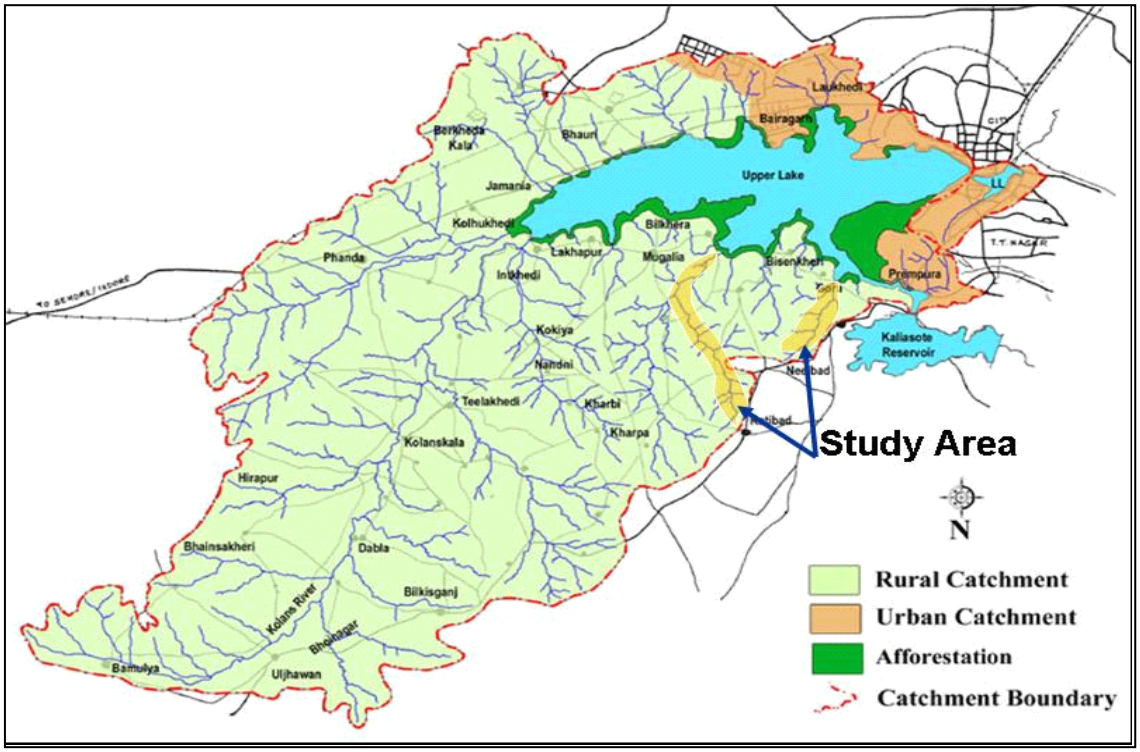


Figure 1: Location of the 8 selected villages (study area)[1]

[1] Source: LCA internal report July 2005

This collaborative 'scoping study' between Winrock International India and CLUWRR, University of New Castle, UK, aims to arrive at 'choice attributes' of upland farmers, to help arrive at a negotiation system of compensation mechanisms that can be evolved between the upland farmers and downstream water users in the Bhoj Wetlands. The findings from this study could provide a base for devising an appropriate compensation mechanism under the broader, WII-LCA collaborative project.

In order to understand and arrive at the 'choice attributes' this scoping study was carried out in the study area. The main objective of this scoping exercise was to understand and analyse the historical and current factors (socio-economic, land use practices, use of organic and inorganic farming practices, agriculture marketing links etc) that affect the land use decision making of the upland farmers in the study area.

This document is based on the findings of the scoping study. Information was collected both from secondary and primary sources. To gather information at the primary level, a checklist was prepared (see Annexure 2) for the selected 8 villages in the upper catchment (villages with agriculture area near the lake) of the lake. Focus group discussions were held with farmers[2]. In addition, semi structured interviews with selected farmers were also held.

In the section below, we present a brief description of the Bhoj Wetlands and the study area

2. Bhoj wetlands

The Bhoj wetlands in the city of Bhopal comprising of two man made lakes- the upper and the lower lake, is a site of international importance. See Figure 2

Figure 2: Satellite imagery of Upper and Lower Lake

[2] Most of the numbers mentioned in this report are estimates arrived from the focus group discussions and semi structured interviews.

Constructed in the 11th century by King Bhoj of Dhar, the Upper Lake was created by building an earthen dam across the Kolans River. It has a catchment area of 361 km2 and a water spread of 31 km2. While its catchment areas are predominantly rural, there are some urban areas in the catchment as well.

The Bhoj wetlands are an important source of drinking water and recreation for the residents of Bhopal. The Upper Lake provides about 40% of the city's drinking water, about 29 million gallons per day (UK or USA). Additionally both the lakes provide important recreational services like boating and water sports facilities.

The wetlands also support a wide variety of flora and fauna. Several species of phyto and zooplankton, macrophytes, aquatic insects, amphibians, fishes and birds (resident as well as migratory) are found in these wetlands. Over 160 species of birds and 14 rare macrophytes have been reported from the area. Considering its ecological importance, the Government of India has declared the area as a Ramsar Site[3]

Livelihoods of many people are directly linked to the wetlands. A fishermen's co-operative consisting of some 500 fishermen's families has been given fishing rights on a long lease by the local authorities. Some people grow water chestnut in the wetlands, for sale locally. Many washer-men were also dependent on the wetlands but washing areas have been recently shifted to another site to reduce detergent pollution.

The wetlands have high cultural value as well. The *Mazaar* (tomb of a Muslim saint) of Shah Ali Shah Rahamatulla Alliah, which has religious significance, is located on Takia Island – a small island in the Upper Lake.

2.1. The problem

Currently, the Bhoj wetlands are facing twin problems of deteriorating water quality and reduction in storage capacity due to siltation. The water quality is being affected by a number of factors such as inflow of sewage and solid waste from the urban areas and run off from agriculture farms in the peri-urban/ rural catchment.

In recent years, a number of steps have been taken to control pollution from sewage and solid waste generated mainly in the urban areas by the Lake Conservation Authority of Madhya Pradesh (LCA). The city's sewage treatment infrastructure has been strengthened. Over 85 kilometres of new sewage pipes have been laid. Ten pump houses and four sewage treatment plants have been constructed for diversion and treatment of 56 million litres of sewage per day. A dhobi ghat (washermen's work area) has been shifted from the Lower Lake to an alternative site outside the catchment. All these activities have been carried out under a project funded by the Japanese Bank for International Cooperation. While there still are

[3] A *Ramsar Site* is a wetland that has been designated as internationally important according to a set of criteria under the terms of the (Ramsar) Convention on Wetlands, by the Administrative Authority of the Contracting Party State (www.wetlands.org/RSDB/default.htm).

problems related to sewage and solid waste inflow[4], the above-mentioned interventions have significantly reduced the threat to the water quality of the wetlands from these sources. These problems are likely to reduce further as more and more people connect to the newly laid sewage system.

The problems related to agricultural runoff, on the other hand, have not been addressed so far. There are 87villages in the catchment of the Upper Lake in the Bhopal and Sehore Districts and the major part of the catchment is under agriculture. There are problems of nutrient (mainly nitrate and phosphate) and pesticide run off and soil erosion leading to the pollution as well as siltation of the wetlands. Due to increasing use of chemical fertilisers and pesticides for crops such as wheat and soyabean, pollution due to agricultural runoff has increased in recent years. Regular tilling of soil for agriculture and non-availability of proper field bunds leads to erosion of the topsoil, which flows into the lakes, especially during the monsoon season. The importance of addressing agriculture related problems can be gauged from the fact that over 60% of the catchment of the Upper Lake is cropland.

Agriculture is the main source of livelihood for people in the villages in the catchment of the Bhoj wetlands and most farmers have small to medium landholdings (3-15 acres). Keeping with the trend in many other parts of the country, use of chemical fertilisers and pesticides has increased over the years and most farmers have also shifted from subsistence crops to cash crops. Unless steps are taken to address the issue of agricultural run off, the water quality as well as storage capacity of the Bhoj wetlands is likely to deteriorate further. This would affect the quality of drinking water supplied (and thus public health), as well as the flora and fauna, the livelihoods of fishermen and the recreational value of the wetlands. In this context, change in management practices in the agriculture farms in the upstream could be a cost-effective and sustainable solution to the problem of agricultural run off related pollution and siltation in the wetlands. This may be tackled by promoting wetland friendly agricultural practices, and building on the encouraging results obtained by pilot studies promoting organic compost as a replacement for chemical fertilisers under the Bhoj Wetlands project. However, there is uncertainty as to whether such change in agricultural practices will be adopted by poor upland farmers with few livelihood alternatives.

As part of the Winrock International India and LCA project, 8 villages have been selected where efforts are being made to promote organic farming amongst the farmers, as a wetland friendly agricultural practice.

These 8 villages were selected because of their physical proximity to the Lake. The assumption behind the selection of these 8 villages is that the land use and land management practices in these villages will have a greater impact on the lake pollution, in-terms of higher probability of the fertilizer and pesticides runoff from these villages into the lake. Further, two control villages have also been identified.

[4] For instance, many houses are not yet linked to the sewerage system and several idols are immersed in the wetlands during festivals.

In the above context, based on the scoping work, we discuss below the historical and current socio economic scenario that drives current land use and management decision making processes in 8 villages and an institutional stakeholder map illustrating water service linkages and pathway.. This will help us to analyse and provide a mechanism for arriving at a negotiating compensation mechanism between the upland farmers and downstream water users. Much of the discussion and analysis is based on the information provided by the farmers during the survey work

3. Description of the study area- catchment of upper lake

The catchment of the upper lake is about 361 sq km and is spread over two districts- Bhopal and Sehore. The main *nala* is a seasonal river that originates from Sehore district and covers a distance of about 35 kms before flowing into upper lake in the district of Bhopal. The soil in the catchment area is fertile black cotton soil. Wanganeo (1995) divided the whole catchment area of lake into eleven sub watersheds (based on their drainage pattern) for the micro level analysis (Fig.3). Watershed numbers I, II, III & XI are of urban nature. Watershed No's IV, V & X are representing countryside, while watershed No's VI, VII, VIII and IX come under rural areas. Watershed no. VI is the largest in area (255.912 km2) and basically it is agricultural in nature.

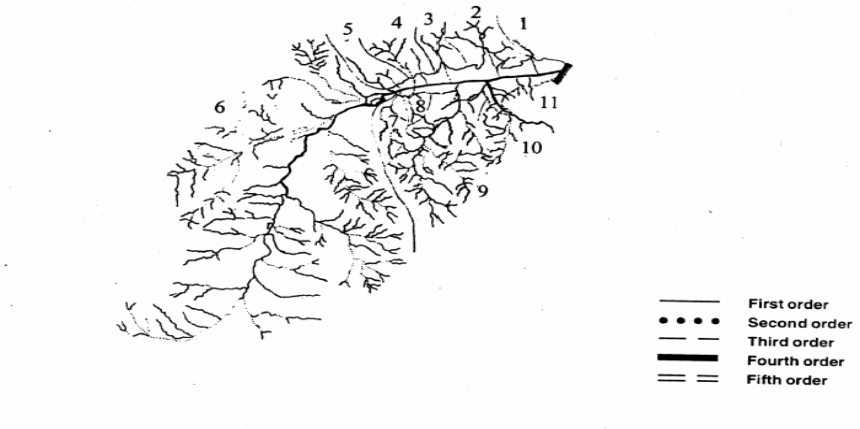


Fig. 3: Division of watersheds

There are 87 villages in the catchment of the Upper Lake. The main land use is agriculture, while forest forms a very small component of the catchment area[5]. See Figure4[6]. Besides, there are also some wastelands in the area. The catchment area is well connected by roads and railways. The village population in the catchment constitute mainly of Schedules Castes.

The Land use Land cover during a decade reveals that built-up land is increasing at a rapid speed in the watershed areas no's 1 to 5 and 11. This activity has started creeping into the rest

[5] This plantation activity was part of the Bhoj Wetlands project

[6] Estimated based on 1991 census data

of the watershed areas. The crop land has been considerably reduced while fallow land is increasing. Secondly, the deciduous forest cover has also started declining (cf. Wanganeo, 1998)

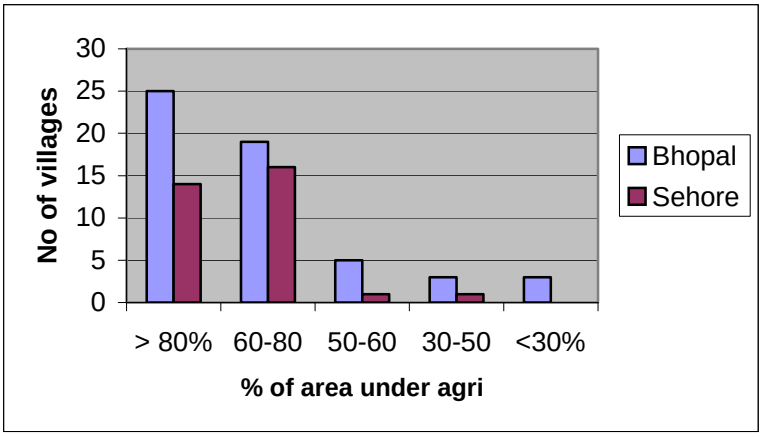


Figure 4: Area under agriculture

3.1. Socio economic description of the selected villages

Table 1 provides the socio economic description of the 6 villages out of the 8 villages that were visited as part of the scoping study.

Table 1: Socio economic description of selected villages[7]

Name of the village	Bhilkheda	Sewadia Gaud	Gora gaon	Bishen Khedi	Rolu Khedi	Mughaliyachhap
Within Municipal Boundary	Yes	yes	Yes	yes	yes	Yes
Location vis a vis lake	Adjoining Niljhi	Adjoining Gora	Adjoining Gora	Adjoining Gora	Adjoining Niljhi	Adjoining Niljhi
Total No of households	60	450	200	109	40	500
Total no of landless and marginal farmers	30	0	50	84	38	230
Total no of small farmers	10		150	25		
Total no of medium farmers						250
Total no of large farmers	20				2	20
Primary occupation	Agriculture and dairy farming	Mainly dairy and few practice agriculture	Mainly livestock rearing and other services, only 5% of the villagers practice commercial agriculture	Services/labour and agriculture	Agriculture and dairy	Mainly agriculture. livestock and services

[7] All numbers mentioned here are estimates based on the information gathered from FGDs and interviews.

Agriculture Practice	Mainly inorganic farming and few use organic manure for subsistence farming	Mainly inorganic and few practice organic farming and in some cases a mix of organic manure with fertiliser	Dairy farmers are using organic manure, others use inorganic fertiliser	Mainly inorganic manure, and a combination of organic manure and inorganic fertilizer	Combination of organic and inorganic	Combination of organic and inorganic
Other comments		Rich village, and most of the farmers have sold off their land to residents of Bhopal who now own farmhouses in the village	In the last few years, due to large scale submergence of agriculture land due to increasing water level, large tracts of grazing land has been encroached for agriculture			The cooperative society office is in this village.

Note: Based on the field observations, the following landholding categories were made:

Landless and marginal farmers (0-3 acres) have been clubbed together since there seems to be overlap between these two classes. Officially landless households were found to be practicing agriculture in erstwhile common lands
Small farmers- landholding size between 3-7 acres
Medium farmers- land holding size between 7-15 acres
Large farmers- land holding size more than 15 acres

3.2. Historical and current land use and management practices

A. Land use pattern

The 8 selected villages in the catchment of the upper lake are close to Bhopal city and in many case, they are included in the Municipal boundary of Bhopal (see Table 1). In the last ten years, the land use practices in these villages have undergone dramatic changes. While earlier in these villages agriculture was the predominant occupation, however, in the last ten to fifteen years, there has been an increasing tendency in these villages to shift towards services[8] and the unorganized sector as the major occupation. Although, commercial agriculture is still the mainstay of livelihood in these villages, increasing number of family members are now migrating to Bhopal for work. This trend is more obvious amongst the younger generation. The fact that most of these villages are within the municipal boundary has also influenced the changes that are taking place in these villages.

The advent of electricity and other facilities like improved all weather road connectivity to Bhopal has also added to the changes that are taking place in these villages. The relative proximity to Bhopal has led to another interesting pattern emerging in these villages. Large tracts of agriculture land are being sold to residents of Bhopal, and are being converted to farm houses. As a result of which, in some villages only 5% of the households own land, and

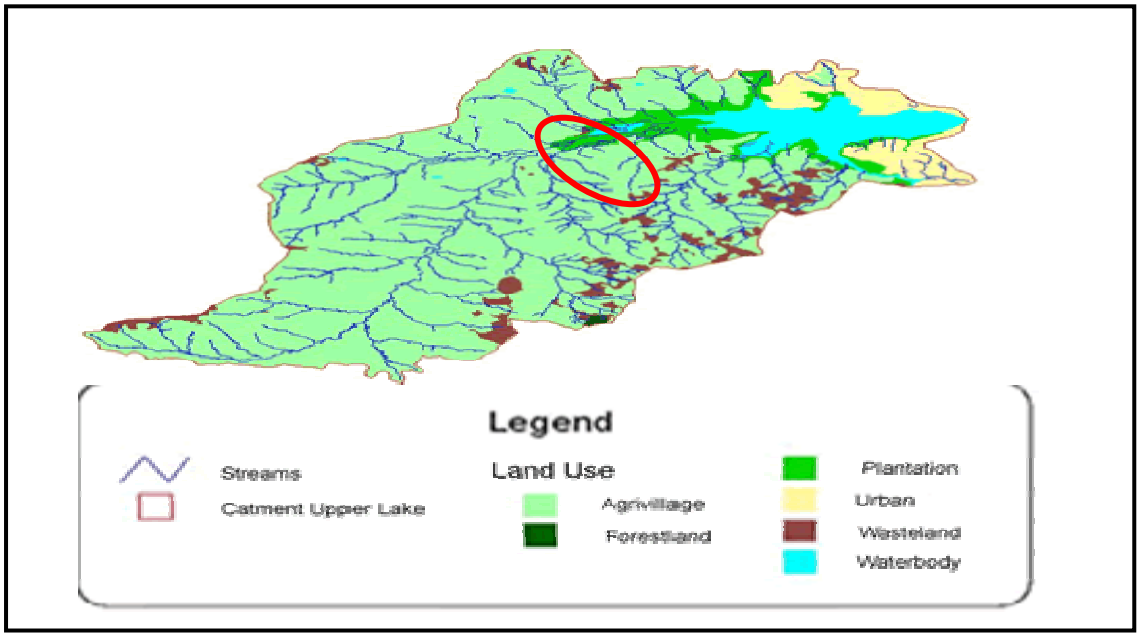
[8] Villagers working mainly in government departments

some are practicing share cropping (on lands leased out by these non resident farm owners to the villagers).

In terms of land use, another notable point is that there are hardly any common lands (or grazing land) left in the village. Two reasons were attributed. In 1966 the government of MP introduced an Act called 'Madhya Pradesh Padat Bhoomi ka Krishikaran Adhiniyam', which provided for bringing fallow lands under cultivation in the state. Under this scheme, several common lands were distributed amongst landless families in the state under what is commonly known as the 'grow more food' scheme. Even till very recent, the government has from time to time distributed fallow and common lands (government owned land)[9] to landless households, leading to almost negligible common land left for grazing. Further, in the 1960s, the dam height was increased as a result the water level in the lake increased. Many villagers lost considerable areas of agricultural land due to submergence. While compensation was paid, these villagers 'encroached' upon the common land leading to increased 'extension' of agriculture in common lands.

Figure 5 below shows the land use map in the catchment area. The encircled area is where the 8 selected villages are located. As is clear from the Figure, in the upper catchment, the main land use is agriculture. Further in the 8 villages (encircled in the Figure), there is hardly any common land.

Figure 5: Land use map in upper catchment of Lake



9 In 1970, the 'Vishesh Upbandh' Adhiniyam, the 1978 Vishesh Upbandh Adhiniyam, 1986 Adhikar Abhiyan, to name few.

B. Land management pattern

❖ Cropping pattern

It was reported that since the 1970s, the cropping pattern started changing in these villages. With the advent of 'Green Revolution' in India, the government initiated several schemes to promote the use of fertilizer and irrigation with the objective of 'growing more food' in the state. Fertilizer and pesticides were made available to the villagers through the 'Agriculture Extension Services' and loans were provided to purchase fertilizer and pesticides and also to install tube wells. As a result, the use of fertilizer and pesticides more than doubled in the area, and in many cases farmers who earlier used only organic manure started use of fertilizer and pesticides. The fact that these villages are close to Bhopal and some of them were subsequently included into the Municipal boundary led to better infrastructure like roads, electricity and better linkages to markets, influencing the cropping and land management practices in these areas. The advent of electricity in these areas, led to increased irrigation and subsequent increase in irrigated area. In some villages an individual farmers have sunk as many as 12 bore wells (see Annexure 2).

During this period, a shift towards cash crops and more water intensive crops like vegetables also took place. The fact that these villages are well connected through roads provided them better linkages to markets in Bhopal and is one of the reasons why the villagers shifted from subsistence to cash crops on a large scale.

The impact of these changes were felt in terms of ground water availability- in one village (Bhilkhedi) farmers mentioned that earlier they used to take three crops in a year, but due to the large scale increase in irrigated area, ground water availability reduced and villagers had to shift to double cropping.

Earlier, in these villages, paddy was the main *Kharif* (monsoon cropping season) crop, while pulses and groundnuts were the main *Rabi* (winter cropping season) crop. Summer crops like jowar, bajra were also cultivated. In the last fifteen years, wheat is cultivated as the main *Rabi* crop, along with one variety of pulses (*chana dal* or grams). Ten years ago, soyabean was introduced in the state as one of the most profitable, commercial crops. The government also provided several incentives to promote soyabean cultivation in the state. Almost all the farmers are cultivating soyabean. However, for the past three years or so, the farmers in this area have incurred losses from soyabean cultivation due to failure of monsoon and resultant drought conditions in the state. Interestingly, vegetables are cultivated all throughout the year. Some farmers mentioned that they were considering undertaking 'floriculture'. In one village (Mali khedi), large scale horticulture is being practiced. The fact that there is a flower *mandi* (market) in Bhopal also provides good marketing linkages for horticulture and is proving to be an incentive for the farmers to shift towards horticulture.

❖ Crop cycle description

Currently the main crops in this area are:

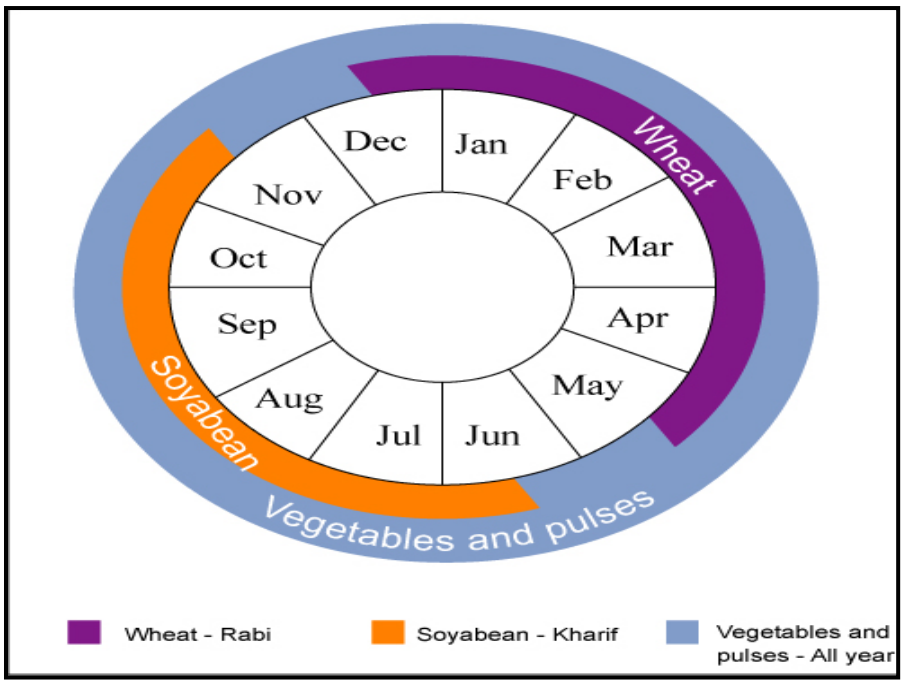
Main *Kharif* crops: soyabean, vegetables

Main *Rabi* crops: wheat, pulses and vegetables

Main *Zaid*[10] crops: fodder, fallow land

Figure 4 shows the crop cycle pattern in the selected villages.

Figure 6: Crop Cycle description



The various stages of the crop cycle of two major crops are described below:

Wheat: December to April (*Rabi*)

Stage 1: Ploughing (*binai*)

Stage 2: weeding and field leveling

Stage 3: application of super phosphate

Stage 4: sowing of seeds plus application of Di Ammonium Phosphate (DAP)

Stage 5: watering (4 times), use urea along with one cycle of watering

Stage 6: harvesting and threshing

Soya bean: June to November (*Kharif*)

Stage 1: two cycles of ploughing and adding organic manure/Urea

Stage 2: after the first monsoon shower, another round of ploughing

Stage 3: after one month, weeding, leveling and sowing

[10] A cropping season which falls in between *Rabi* and *Kharif* seasons (March-May)

Stage 4: re-weeding after the plants grow some inches

Stage 5: harvesting

- ***Major agriculture management practices***

Based on the focus group discussions in these villages, and interviews with individual farmers (See Annexure 1 for farmers' profile), three major types of land management zones (agriculture management) were currently observed in the selected villages.

The entire village area near and adjoining the lake can be divided into four broad zones. See figure 7.

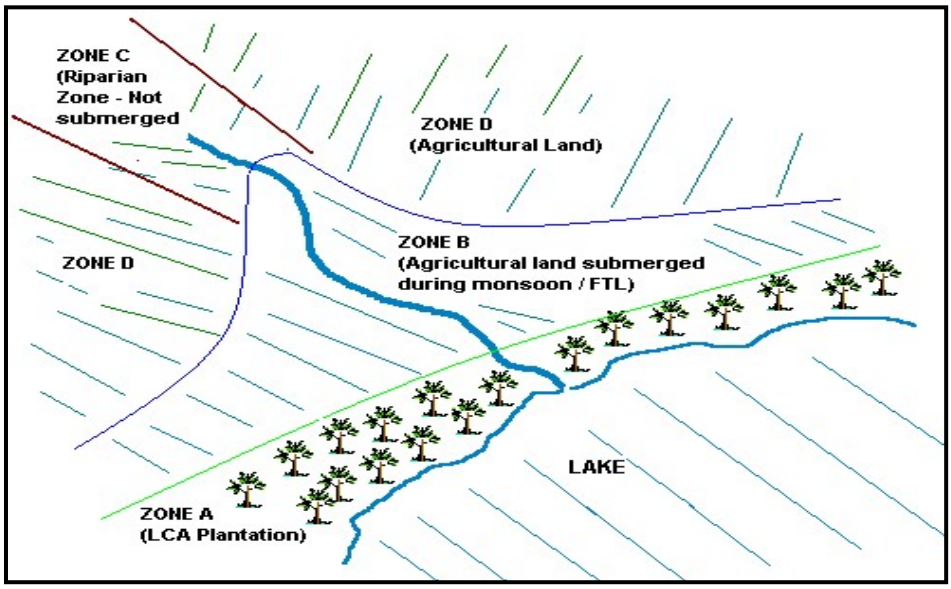
Zone A: Riparian Zone adjoining the lake, consisting of plantations. Major part of this land belonged to these 8 villages. These lands were acquired by the government from the villagers. As per some villagers, this area was earlier being used for grazing and for agriculture. Currently some villagers collect firewood for household use (mainly cooking). Most of these falls in the Full Tank Level submerged zone of the lake.

Zone B: Riparian Zone adjoining the plantation and *nalas* - mainly agriculture land which gets submerged when the lake achieves Full Tank Level (FTL), mainly during the monsoons. On an average, about 3-4 acres of agricultural land per household/farmer gets submerged during the monsoons.

Zone C: Riparian Zone adjoining the *nala* which does not get submerged during monsoons. This zone is a high priority area for implementing organic farming as the fields are adjoining to the *nala* and directly contribute runoff to the *nalas*.

Zone D: Agriculture land, which is mainly irrigated.

Figure 7: Land Management Zones



Different types of land management patterns emerged in these three Zones.

Zone A: Mainly referred to as 'forest area' by the villagers, some villagers collect firewood for household use (mainly cooking) from this Zone.

Zone B: A highly fertile zone, this area is also critical in terms of agricultural runoffs into the lake. Due to high moisture content in the soil in this zone, most of the farmers reported little use of fertilizer in this area as compared to Zone C. Some farmers use only organic manure in this patch of land and only for subsistence cultivation, while in the rest of the agricultural land (Zone C) they use fertilizers. Farmers who use fertilizer in this zone mentioned that precaution needs to be taken while using fertilizers particularly in this zone, since it was observed that normal use of fertilizer in this zone destroys the plants in many cases, and leads to 'lodging'[11].

Another significant point to be noted is that though the farmers claim that they do not use excess of fertilizers, the use of pesticide in this area may be more because vegetables are grown in this Zone, which are susceptible to pests. Though in majority of the cases, both the *Kharif* and *Rabi* crops are taken in this Zone, the preference is to grow water intensive crops like vegetables, soyabean and in some cases even sugar cane. Since the soil here is prone to erosion, the farmers use extra field bunding as a conservation method. Some farmers mentioned that they often leave the crop root stalks at the time of harvests, and later ploughs the stalks back into the soil, which helps in tapping silt in their field.

Some of the dairy farmers reported that they grow only fodder in this patch of land. In terms of tillage methods, the farmers reported ploughing at regular intervals (both while a crop is sown as well as in between two crops) and weeding as the two main method of retaining the soil moisture. Bore wells are still used in some cases for irrigation.

Zone C and D: Land management practices in both Zone C and D are largely the same**.** Both *Kharif* and *Rabi* crops are grown in this area. Majority of the farmers are using fertilizers and pesticides in this zone, except for those who use only organic compost. In some cases, a combination of fertilizer and organic manure was also reported. The land management pattern that emerges in this zone is that in majority of cases the use of fertilizer and pesticide is high. For soil conservation, regular tillage/ploughing and field bunding is resorted to. Bore wells are the primary source of irrigation in this area.

An interesting fact that emerged in these Zones is the mixed response on the status of 'water availability'. In some villages (Gora gaon, Bishen Khedi, Bhilkedi), cases of water shortage were reported (in many cases, farmers had as many as 12 borewells for 8 acres of land, with no water in any), while in some villages (Maugaliachap, Saemania Gaur), the status of water availability was reported to be satisfactory.

- ***Inorganic and organic farming systems***

As has been discussed in the earlier sections, in all the villages, a combined use of inorganic fretilisers and organic compost was found. Though about fifteen years ago, organic farming

[11] Due to fertilizer use, plants grow and bend down due to the excessive plant weight.

was the general practice in these areas, however, due to the changing socio economic environment (see discussions above), use of fertilizer and pesticides have increased.

The use of fertilizers and pesticides is most common amongst large landholders, and is used mainly for cultivation of cash crops. The use of organic manure on the other hand was found to be limited in most of the villages. However, it is interesting to note that the majority of the farmers are using organic manure in cultivation for own consumption. The reason as cited by them is the adverse health impacts of inorganic produce.

Another interesting observation is the increasing tendency amongst the marginal and small farmers to shift towards organic manure since the last three years. The rate of shift depends largely on the cattle holding of the farmer. One of the main reasons for the shift as quoted by the villagers is the increasing cost of fertilizers and pesticides. Table 2 below provides the farmers' perceptions (qualitative) on costs and benefits involved in shifting to organic manure.

Table 2: Perceived Implications of shifting to organic manure

Item	Implication	Remarks
Fertilizer	Reduced costs	Only cost incurred is on pesticides which is used in combination with organic manure
Labour	Increased costs	Using organic manure is labour intensive, as a result, the cost on labour increases, also given that labour supply is not sufficient, it adds up to the problem the costs are high
Electricity for irrigation	Reduced costs	Some farmers mentioned that since less watering is required when they use organic manure, their electricity cost goes down, (This point however needs to be further investigated)
Yield	Decreases initially and then increases.	
Transport	Increased costs	As compost is more voluminous that fertilizer (2-6 tonnes per acre versus 50-300 kgs), transporting it to the field requires using tractor trolleys

The main fertilizers used in these villages are Urea, DAP and Super Phosphate. Typically, for production of wheat in one acre of land, a ratio of 1:3:2 was observed.

For cultivation of soyabean in one acre of land about 50 kgs of urea is used. Besides, pesticides are also used for soyabean cultivation. Some villagers also reported using a combination of compost (mainly dung and agricultural waste) and urea for soyabean cultivation. In the case of vegetables, mainly organic manure is used along with pesticides/fungicides.

As far as organic farming is concerned, most of the farmers use a mix of dung and agricultural waste, which they locally call *gobar khad*. Two ways of making this compost were observed. In one case, the dung is dumped on the open agriculture field mixed with the agriculture waste, and left to compost for about 4- 6 months, after which it is used directly on the land. The other process involves, digging big holes, where the dung is dumped and left to compost for about 4- 6 months, and then used by mixing it with the top soil. In one village, vermicompost was used by some farmers. This is a recent phenomenon, and is a result of an organic promotional programme carried out by LCA. In one village a farmer reported using *neem* leaves as a pesticide. Few farmers reported that they earlier used improved organic manure while the LCA programme was undergoing On an average, in one acre of land, about 10 quintal

(1000kgs) of *gobar khad* was reported to be used in the study area. Cow dung is reported to be the best manure.

On an average, minimum 3-4 cattle holding size is required to cater to the manure demand in one acre of land. In one or two cases, some farmers had set up bio gas plants (mainly dairy farmers) and they were using the slurry directly on their field as organic manure.

During the focus group discussions as well as individual interviews with farmers, it emerged that almost all the farmers were aware of the benefits of organic farming, and were keen on shifting to it, but due to the lack of availability of organic manure in the village, and low cattle holdings, most of the farmers are not able to shift to complete organic farming.

Table 3 below provides a snapshot of the relative economic profitability in shifting towards organic farming in the production of Wheat, of two types of farmer- one who is practicing organic farming and the other who is using inorganic farming.

Table 3: Net average income from wheat

	Organic	**Inorganic**
Costs (fertilizer/pesticides/labour/other costs)	2500	16550
Income (Rs)	36500	32250
net income (Rs)	34000	157000
total acres of land cultivate (Rs)	4	5
net income per acre of wheat cultivated (Rs)	**8500**	**3140**

Box 1 below lists out the major reasons as to why the farmers in these villages have not shifted to organic farming as well as the reasons as to why some farmers have shifted towards organic farming, as reported by them.

Box 1: Organic vs Inorganic farming

Reasons for adopting organic farming

- Saving of at least Rs 2000- 3000 per acre for two crops in a year.
- Easily available cow dung, due to large cattle holding size (mainly dairy farmers are using only organic compost)
- Labour cost is the main cost incurred
- Once treated with organic manure, no further treatment is required for at least next three years, as compared to fertilizer, where the impact is just for 15 days
- The quality of the agricultural produce is better as compared to inorganic produce
- Yield from organic farming is much higher as compared to yield from inorganic farming
- Net income from organic wheat is higher than from inorganic wheat

Reason for continuing with inorganic farming

- small cattle holding
- non availability of organic manure
- easy availability of inorganic fertilisers (from the cooperative marketing society)
- loans available for purchasing fertiliser and pesticides (from the cooperative marketing society)
- Organic farming is labour intensive and labour is not available in the villages even at higher wages

4. Shifting to organic farming: the scope for negotiation

The following points need to be considered for arriving at any negotiations to shift the farmers in the selected villages in the upper catchment of the lake to organic farming

- There exists a general willingness amongst all farmers to shift to organic farming, and most farmers interviewed acknowledged the positive aspects of organic farming in terms of reduced agriculture related expenditure on fertilser, better yield, and better quality produce, amongst others.
- The current practice of using traditional farmyard manure (*gobar khad*) is labour intensive. Given the high rate of migration of labour to Bhopal and the changing occupational profile in these villages, this is one of the major hurdles that need to be tackled while promoting organic farming. Moreover, fertilizer and pesticide is more readily available through the 'Cooperative Marketing Society'.
- Though due to LCA's promotional activities, some degree of knowledge exists amongst the farmers regarding vermicomposting, NADEP, etc. In some villagers, farmers have adopted these technologies. However, it is being practiced at a very small level. During a training programme of farmers on organic farming attended by the author, it was noted that most of the farmers expressed hesitations on their ability to technically implement these processes. Further the one time installment costs for these methods were also a matter of concern for the farmers[12].
- Currently, no supply chain of processed manure exists in the village, as a result, dung from own cattle is the main source of organic manure, therefore the rate of shift towards organic farming will be highly dependent on the cattle holding size of households.
- Given that there is hardly any grazing land left in these villages, livestock management is a major problem. Stall feeding on the other hand is expensive.
- Though almost all households own cattle, the cattle holding varies from 3 cattle to as many as 15 per households in the same village. There are a significant number of households who practice dairy, and they could be targeted as the early adopters of organic manure.

[12] There is low awareness amongst farmers regarding the several government subsidy schemes available for adopting these technologies.

- Some of the marginal and small farmers are already shifting towards organic farming, and this class of farmers might be more willing to shift, since the amount of dung required is less as compared to other farmers[13]..
- Subsistence agriculture is currently more or less organic in nature, while fertilisers and pesticides are being used more in the case of cash crops. To promote use of organic farming for cash crops require the following incentives (as pointed out by the large farmers)
    - Easy and timely availability of processed manure
    - Better price for organic produce through lucrative marketing linkages
    - Certification of produce that will help them in increased marketing to urban areas

4.1. Proposed Sampling

Based on the observation and analysis done during this scoping phase, Limnology report (Wangane, 2005), and reports from LCA, and based on the discussion in London meeting (June 05), the following sampling criteria could be considered:

- Use stratified random sampling
- Selection of village- Use the watershed division map (figure 3) for categerising the villages into different watersheds. These villages could then be Use the land use map (figure 7) for selection of villages. Since the assumption is that the probability of agricultural runoff from lands near the lake is more, the 8 villages studied in this scoping report should be selected since they are all in close proximity to the lake and streams and most of them are also within the municipal boundary.
- Distance of agricultural land from the lake: For the purpose of household sampling, the three zones mentioned in figure 7 can be the basis of selection of households, since the land management practice, in these three zones will have the highest impact on the inflow to the lake
- Size of land holding: Further, the size of landholding could be another criteria for selection of households, since what is evident from the scoping work is that small and marginal farmers might be more willing to shift to use of only organic farming
- Nature of crops grown- as is evident from the study the use of cash crops is more inorganic intensive than subsistence crops, this level of segregation between farmers

[13] Assuming that these farmers have sufficient cattle holding to meet the dung demand

who only do subsistence farming and those who do commercial farming will provide us a better picture of different choice profiles required for different groups of farmers

5. Institutional mapping

In the section below we present the institutional mapping of the players who have (or may have) major stakes in conservation of the Bhoj Wetlands. The identification of the stakeholders and their relative stakes in the Bhoj Wetland is based on the observations of the field team during the scoping field work and discussions with the Lake Conservation Authority of Madhya Pradesh.

5.1. Bhopal Municipal Corporation (BMC)

- Owns the Bhoj wetlands. Some of the assets created under the earlier Bhoj wetlands project have been handed over to it.
- Supplies water to the city. The Water Supply Department under the BMC is staffed by people from the Public Health and Engineering Department (PHED). The salary of these staff is paid directly by the PHED.
- This Water Supply Department undertakes the following:
    - Lifts water from lake and supply to the treatment plants
    - Treats raw water at plant
    - Distributes to consumers
    - Provides water connections to consumers
    - Maintains raw water treatment plant, and pipes, for distribution of potable water
    - Sets water charges for consumers
    - Collects water charges from consumers
    - Provides household sewerage connection against the charges fixed by the BMC. However, operation and maintenance of the sewerage system is done by the PHED of the state Government.
    - In time of crisis, when there is irregular water supply, the BMC supplies water through tankers to the affected localities. This water is mostly comes from Upper lake.
    - BMC also has bore wells through which it provides approximately 5 mgd of water.
- The average water supply bill for the BMC is about 50 crores a year. Of this approximately 10 crores is generated from the water tariffs. The rest (approximately 80%) is covered by the state government or from BMC's own resources.
- The water from the lake is supplied to around 40% of the residents of Bhopal town, mostly residing in the older part of the city, on an average of about 25 mgd, with a maximum limit of about 29 mgd. Most of the newer areas are supplied water (30 mgd) from the Kolar dam about 35 km away.
- There is no catchment improvement/treatment undertaken by BMC at present. However, the BMC has recently set up a lake conservation cell to manage lake related assets and matters.

- Water charges are at the following rates:
    - Domestic connection Rs 60 / per month per tap
    - Commercial – Rs 600 pm
    - Industrial – Rs 14/1000 lit
    - Institutional – Rs. 1.25/1000 lit for raw water

5.2. Direct Water Consumers

- Residents of Bhopal- domestic drinking water consumers
- The individual consumers are the local residents of Bhopal town. A 1/2 inch tap connection costs Rs. 60 p.m.
- Commercial users are mostly restaurants, offices, hotels, etc
- Industries are covered under industrial users. They also have the option of boring their own wells to create their water supply (subject to existing regulation)
- Institutional users include mostly governmental departments, research institutions and other such bodies
- Some institutions draw the raw water directly from the lake (manage their own infrastructure) and pay a royalty to the BMC, e.g. Bharat Heavy Electrical (BHEL) township

5.3. Fishermen

- Livelihood of the fishermen is dependent on the lake on two counts, (1) fishing and (2) water chestnut and lotus cultivation. While fishing is regulated by the fishermen cooperative society, which has the lease right from the BMC, water chestnut and lotus cultivation are at present being done by about 100 fishermen families without any control. This cultivation also involves application of small quantities of fertilizers. There is considerable potential for development of fisheries in the Upper lake, if done in a scientific manner.

5.4. General People of Bhopal

- Immersion of Idols of Lord Ganesha and Goddes Durga and Tazias are done in the lake. This causes pollution of lake water. Immersions has been controlled to a significant extent, and the immersion site has been moved as well.

5.5. Farmers in the Catchment

- There are an estimated 87 villages in the upper catchment of the lake.
- Villagers in the fringe of the lake draw raw water directly from Upper lake for irrigation crops. Villagers in the fringe also use bore wells, which are recharged indirectly from the upper lake. Both affects the water level of the Upper lake.
- Residues of the inorganic fertilizers used in farmer fields ultimately find their way into the lake affecting its water quality.

5.6. Indirect consumers-

- Tourism industry. Bhopal is settled around the lakes and the upper lake has a commanding presence in the town. Lake view properties are sought after. The lake is projected as an important tourist destination with water sport options (canoeing, paddle boating), walking around it, and bird watching. A few hotels on the lake side have a direct stake in the lake water quality and water level. The tourism department and sports department of the state government are also stakeholders. Sports Authority of India is also building a sports complex adjacent to the lake, that includes water sports.
- In addition to tourists, city residents are also consumers of these indirect services described above

5.7. Recreational users-

The lake offers several recreational services to the residents of Bhopal, such as:

- A dedicated joggers' track surrounding the lake is a major attraction for the residents of Bhopal.
- Water sports: several water sports agents (and the sport department of the government) organise regular recreational activities like boating, karoeking competitions etc.
- Bird watching: The lake is a major bird watching site and species sighted include the sarus crane. An informal bird watching club also organises regular bird watching camps.

5.8. Public Health Engineering Department (PHED)

- A nodal agency of water supply in the state of MP. It decides the irrigation and non-irrigation uses of the water body. (Basically it prioritizes the supply)
- Its staff, which is deputed to the BMC, manage the water supply system. Sewage system is managed by PHED staff under the direct control of PHED.
- Also there are a large number of private vendors which supply potable water to the residents of Bhopal through bore wells located at various places in Bhopal.

5.9. Water Resource Department

- It is basically a policy making body of the GoMP. Prepares the state water policy in terms of its usage pattern, cost recovery, guidelines, tariff regulations. They are mostly focused on irrigation and irrigation infrastructure. Not directly a stakeholder for the lake, but by virtue of managing the other dams in the area (Kolar Dam) that also supply water to Bhopal, it impacts on the total water supply of the city.

5.10. NGOS and associations

- Several NGOs are engaged in water supply and landuse related activities. The groups can be important stakeholders who if convinced about our approach could mould opinion in its favour.
- Another set of stakeholders are organizations that represent a trade or sector society at large. The former include hotel associations, fishermen associations, Confederation of Indian Industry, the later include the Rotary Club, Lions Club.

5.11. Health Department

- Are broadly responsible for medical treatment of citizens of Bhopal (and the state). Poor quality of water supply can lead to increase in the incidence of water-borne diseases and increase in costs

5.12. Private doctors and hospitals

- Provide health services for citizens of Bhopal privately. Poor quality of water supply can lead to increase in the incidence of water-borne diseases and may increase their revenue but also stretch their capacity

5.13. Department of Agriculture

- Indirectly influence the land use in the catchment by affecting land use and management practices of the farmers in the catchment through their subsidies and extension activities that promote certain type of techniques, practices and technology. Their extension and subsidies promote both chemical based as well as organic compost based farming systems. In the longer run, the subsides may not encourage farmers in the long run for adopting wetland friendly practices. Their activities include:
- Subsidy for bio-gas
- Supply of and subsidy on chemical fertilizers and pesticides
- Demonstration and extension of various composting techniques, new crop varieties etc
- Schemes for adoption of organic farming
- Regular training of the farmers in their training centres
- Coordinate with the cooperative department on regulating agricultural mandis, for sale of farm produce.
- No substantial effort has been made by the department in Upper lake catchment. It is the Bhoj wetland Project which had created CAT structures which have been transferred to Panchayats for their maintenance.

5.14. Lake Conservation Authority of Madhya Pradesh (LCA)

- Lake Conservation Authority has been created recently (2004) by the Government of Madhya Pradesh to sustain the Bhoj Wetlands Project efforts and to initiate holistic conservation and management of other lakes in the state. It is responsible for regular monitoring of the status of ecological health of the lakes., the preparation of inventories of flora and fauna, and for increasing awareness. It prepares projects for funding undertaking most of these activities. However, it does not have any regulatory powers.

5.15. Capital Projects (Forest Division)

- It is the custodian of the Afforestation areas created around the Upper lake and the plantations along the road in the catchment of the Upper lake.

5.16. Van Vihar National Park

- Located in the southern fringe of the lake, it facilitates conservation of biodiversity and fringe area management.

5.17. State Biodiversity Board

- It is a newly created organisation under the state government to facilitate conservation of biodiversity in the state. It has shown interest in implementation of conservation programme for the avifauna of Upper lake.
- There is preliminary talk about declaring the lake a conservation area.

5.18. IIFM, WALMI, MPCOST

- Indian Institute of Forest Management (IIFM) is the premier institution of the country engaged in creating cadre in forest management. It is also involved in under taking research for sustainable management of Upper lake.
- Water and Land Management Institute, Bhopal (WALMI) undertakes research and training on watershed treatment.
- MP Council for Science and Technology undertakes various GIS and other technological projects and has undertaken research on silt levels in the lake.

5.19. Revenue Department

- The common lands in the catchment area are legally owned by the Revenue Department. In the last few decades, and especially in the last few years there has been a steady expansion of agriculture into these commons. Two main reasons are attributed to this, (1) farmers lost agricultural land to submergence, due to the increase in height of dam in the 1960s, when the government acquired

agricultural land from the villagers, and around the same time, (2) the Government of MP started leasing out common lands to landless households as part of 'grow more scheme' as a result, currently there is very little land left as common lands. Legally, the Revenue department still owns these lands and therefore is a stakeholder in the lake catchment.

5.20. MP Agro Industry Corporation

- They generate compost from urban waste. The BMC collects the waste and delivers it to their plants free of charge. The compost is then sold.

Tabular Representation of users and other stakeholders of the lake

USERS ↓	**IMPACTS →**		
	Positive	**Negative**	**None**
Productive		• **Farmers in the riparian zone-**adjoining the lake and the nala in the upper catchment (draw water) • **Water sports –** motor boating, which caused pollution due to noise and fuel spills has been stopped • **Water Chestnut cultivators in the lake** (add fertilisers) • **Hotels on the lake side** (negative if sewage untreated, or draw excessive water – confirm)	• **Fishermen** • **Farmers in the non riparian Zone** • **Water sports providers** • **Hotels on the lake side (enjoy view)** • **Industrial , institutional and commercial users of water** • **Tourism operators**
Consumptive		• **Residents of Bhopal** (idol, tazia immersions – mostly stopped)	• **Domestic drinking water users** • **Users of public taps**
Non-consumptive		• **Tour operators and tourists** (if they litter the lake)	• **Morning walkers, bird watchers,** • **Tourists**
OTHER STAKE-HOLDERS			
Processors/ suppliers	• **Bhopal Municipal Corporation-** owns the lake and supplies water to consumers and is responsible for treating polluted water		
Administrative role	• **Public health and Engineering Department-** nodal agency for water supply and also manages the sewerage system in the city • **Water resources department-main** policy making body mainly irrigation related • **Lake Conservation Authority of MP** • **Agriculture Department-** its activities and subsidies influence agriculture and hence land use (positively)	• **Agriculture Department-** its activities and subsidies influence agriculture and hence land use (negatively)	• **Health Department**

Institutions/ Associations	• **Local NGOs and Associations- NGOs** working for water supply and landuse related issues • **IIFM, WALMI, MPCOST**		**Fishermen associations/hotel associations/Confederation of Indian Industries/ Rotary clubs etc**

Annexure 1: Farmer Profiles

Farmer Name	**Ramesh Maweda**	**Bhagwan Singh Maweda**	**Dr Verma**	**Parashar**	**Kedar Saran**
Village	Bhilkheda	Bhilkheda	Bhilkheda	Bhilkheda	Bhilkheda
Total agriculture land (in acres)	4 acres	10 acres	25 acres	30 acres	25 acres
Location of agriculture land	Land adjoining the lake	Land adjoining the lake	12 acres near the lake and 13 acres away from the lake	10 acres of land near the lake and the rest Away from the lake	Near the lake
Submerged area (in acres)	1 acre	5 acres	None	4 acres	0
Measures adopted to check soil erosion	Extra Field bunding	Extra Field bunding	Grows sugarcane and fodder	Grows sugarcane	Field bunding
Agriculture assets owned	Borewell (1)	borewell (1)	2 borewells	Borewell	Borewell
Total livestock	2	2	8-9	12	12
Livestock type	Cows	Buffaloes	Buffaloes		Mainly cows and buffaloes
Cropping pattern					
Main Kharif Crops	Soyabean, seasonal vegetables, flowers (thinking of starting rose cultivation this year) Sometimes grows	Soyabean, vegetables(lady finger, tomatoes)	Soyabean	Soyabean, vegetables-seasonal	Soyabean, seasonal vegetables

	wheat in the submerged area in December				
Total Area under Kharif crop	4 acres	10 acres (of which in 2 acres he grows vegetables)	25 acres	Soyabean- 25 acres Vegetables-5 acres	Soya bean- 20 acres Vegetables- 3-5 acres
Source of Irrigation	Soyabean-Rainfed, vegetables- borewell	Soya-mainly rainfed, For vegetable- uses borewell	Borewell	Soyabean- mainly rainfed, uses borewell sometimes Vegetables- mainly borewell	Mainly borewell
Main Rabi Crops	Wheat, pulses (*chana dal*)	Wheat, pulses (chana dal)	Wheat, pulses	Wheat, pulses	Wheat, pulses
Total area under Rabi crops	4 acres	10 acres	25 acres	25 acres	20 acres
Source of irrigation	Borewell	Borewell	Borewell	Borewell	Borewell
Type used per acre	Has shifted to organic fertilizer since the past three years. Currently he only uses insecticides in vegetable cultivation.	DAP: 50 kgs Urea:150 kgs Super phosphate: 100 kgs	DAP: 50 kgs Urea:150 gs Super phosphate: 100 kgs	DAP: 50 kgs Urea:150 gs Super phosphate: 100 kgs	Does not use inorganic
Cost incurred	None	DAP- Rs 500 Urea- Rs 765	DAP- Rs 500 Urea- Rs 765	DAP- Rs 500 Urea- Rs 765	

		S.Phospate- Rs 310 Pesticides-	S.Phospate- Rs 310	S.Phospate- Rs 310	
Source of purchase	Not applicable	Cooperative marketing societies	Cooperative marketing society	Cooperative marketing society	
Other costs	None	Labour: Rs 2000 Tractor- Rs 6000	Labour : 4000	Labour and other costs: 10000	
Total cost incurred on one crop	Not applicable	Rs 16650[1]	Rs 24475	Rs 49375	
Use if inorganic farming					
Type used per acre	Compost (mix of dung and agriculture waste)	Does not use	In 12 acres of land he uses the agriculture waste and dung mix	In 10 acres of land he practices organic farming (area near to the lake)	Mix of agriculture manure and compost
Amount used per acre		0	12 kgs	10 kgs	
Cost incurred per unit	None (own compost)	Not applicable	Rs 70/acre	None	None
Source of purchase	Own	Not applicable	Gaushala	Own	Own
Compost making process	Piles it up as heaps lets it dry and then mixes it with the agriculture waste and uses it.	Not applicable	Piles it up as heaps dries it (for six months) and then mixes it with the	Same	Same

[1] Labour cost is assumed to be Rs 4000 per crop, dividing the total labour cost by 2 assuming that there are two main crops

			agriculture waste, uses it.then uses it		
Cost incurred per acre	Ploughing- Rs 2500 (Rs 1000/acre + plus 25 quintals of wheat)	Not applicable			None (uses hhold members for labour)
Total cost	Rs 2500	Not applicable			
Wheat- total production	100 quintals	200 quintals	500 quintals		
Wheat- Own consumption	50 quintals	50 quintal	75 quintal		
Wheat- sold	50 quintals	150 quintal	Not yet sold		
Price per kg	Rs 730/bori (1 bori is 50 kg)	Rs 730/bori (1 bori is 50 kg)			
Soyabean - total production	Crop failure	Crop failure	Crop failure	Crop failure last year	
Soyabean- Own consumption	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
soyabeant- sold	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Price per kg	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Vegetables- total production	Grows seasonal vegetables	Onions-1 quintal Lady finger- negligible	Does not grow vegetables dues to water scarcity	Grows seasonal vegetables	Grows seasonal vegetables
Vegetables- own consumption	All own consumption	1 quintal		Only for own consumption	Only for own consumption
Vegetables-sold	None	Did not sell		Does not sell	Does not sell
Price/kg	Not applicable	Not applicable			
Market -Wheat	Wheat: he sells in Bhopal and Sehore	Cooperative marketing society	Sell it to a private businessman in the	Sells to the Bhopal mandi	

	Mandi	in Maugaliachap and in Bhopal mandi	village		
Market-Soyabean	Crop failure, earlier used to sell it in Sehore Mandi	Crop failure	Crop failure	Crop failure	
Market-Vegetables	Own consumption	Own consumption			
Reasons for shifting/not shifting to organic farming	Has shifted to total organic • Uses only insecticides on vegetables, because of pest problem, and also because a combination of compost and pesticides gives good return • Raw material from compost was available (own- he had 12 cattle, but sold 10 this year) • Saves about Rs 15000, by converting to organic • Productivity has	Has not shifted to organic • Lack of availability of manure • Not enough cattle holding.	Does organic farming only in 12 acres of land • Not enough manure from own livestock to use in the rest of the land • Lack of supply of manure in the gaushala • Because of good quality, he uses for produce that is for own consumption. • There is one time cost in three years. Once applied do not have to use any manure for atleast three	Does organic farming only in 10 acres of land • Not enough supply of manure from own livestock • No grazing land • Livestock managemen t is expensive • Labor intensive and no labor available in the village	Does only organic farming • Saves around Rs 20000, (fertilizer costs)annu ally • Yield has increased by six to seven times

	increased (e.g. wheat productivity has increased approximately by 7 quintals per acre). • There is no recurrent costs on organic fertilizer, once applied, no cost is incurred for the next three years • The plants are also stronger		years. • The yield in more in using organic farming		
Other comments	Estimates of costs on inorganic farming that he used to incur earlier Wheat: Rs 8710 He intends to sell flowers to the local contractor, who sells it in the local mandi in Bhopal. All costs are borne by the contractor. He thinks that the e-chaupal is a good place to market products- efficient and good price.	He prefers selling wheat to the cooperative society since the payment is immediate and also there is no transaction cost. He took a loan of Rs 10000 from the society to purchase fertiliser	Has shifted to double cropping twenty years ago. Earlier they used to do only organic farming (pre 70s). with the green revolution, fertilizer use was promoted even by the government, moreover with village electrification, irrigated area also increased in the village. There is no grazing land in the village, as a result of which	There are problems in selling to the marketing society- long hrs of waiting E chaupal is very good, but they buy only specific varieties Transaction cost to sell in e chaupal is high, there should be local agents Certification for organic products (from	Sells his produce to a local middleman who charges 20% commission Uses neem as pesticide.

			livestock management is becoming expensive, more and more people are selling off livestock and investing in other agriculture assets like tractors, threshers, and borewells Water scarcity is a major problem and is the reason why he is not growing vegetables	LCA) and especial price for organic products will help in shifting from inorganic farming	

Farmer profile 2

Farmer Name	**Ramlachan Singh**		**Mrs Phulbai**	**Srimal**	**Dwarka Prasad**	**A S Rajput**
Village	Saemania Gaud	Gora gaon	Gora gaon	Gore gaon	Bishen khedi	Maugalia Chap
Total agriculture land (in acres)	4 acres	8 acres	8 acres	15 acres (7 acres as share cropper)	10 acres	30 acres
Category of Land-use (A/B/C/D)	Land is about 2 km from the lake (1 km from the plantation)	Land is adjacent to nala	Near the lake	Near the lake	5 acre near the lake and 5 inside	21 acres near the nala
Submerged area (in acres) (area within FTL?)	None	3 acres, grows only fodder for own cattle in this patch of land	12 acres of land has been lost due to submergence	None	none	4 acres
Measures adopted to check soil erosion	Extra field bunding, regular	Field bunding	Field bunding	Field bunding	Field bunding	Field bunding
Agriculture assets (owned/hired)	Borewell 1	Borewell (12)	Borewell (2)	Borewell	Borewell	Borewell
Total livestock	35 (dairy farmer)	12-15	6	None	5	9
Livestock type	Buffaloes	Buffaloes	5 buffaloes and 1 cow		3 cows 2 buffaloes	Buffaloes

Cropping pattern						
Main Kharif Crops	Vegetables, fodder	Soya bean,vegetables, fodder	Vegetables, pulses, have stopped soya bean since very bad returns	Soya bean	Soya bean and vegetables	Soya bean and vegetables
Total Area under Kharif crop	4 acres	5 acres, of which in 1 acre he grows only vegetables	8 acres	12 acres	5 acres	21 acres
Source of Irrigation	borewell	borewell	Borewell (2)	borewell	borewell	Borewell
Main Rabi Crops	Wheat,vegetables, fodder	Wheat, pulses, and vegetables	Wheat, vegetables, fodder	Wheat, vegetables	Wheat, pulses and vegetables	Wheat, vegetables, pulses
Total area under Rabi crops	4 acres	5 acres	8 acres	12	5 acres	21 acres
Source of irrigation	Borewell	borewell	Borewell	Borewell	Borewell	Borewell
Use of inorganic farming						
Type used per acre	none	2 bori DAP 6 bori urea	None	Urea 4 bori DAP 1 bori Gramor (Super phosphate)- 2 bori	Urea 2 bori DAP 1 bori	Urea- 2 bori DAP- 1 bori Super phosphate- 4 bori

Cost incurred per unit	None	DAP- Rs 500 Urea- Rs 765 Pesticides: Rs 200		DAP- Rs 500 Urea- Rs 765 Super Phosphate- Rs 310	Urea- Rs 260/ bori DAP Rs 500/bori	Urea- Rs 260/bori DAP- Rs 480/Bori Super- Rs 140/bori
Source of purchase	None	Cooperative marketing society		Cooperative marketing society	Cooperative marketing society	Cooperative marketing society
Other costs	None	Labour charge Rs 1800/crop Hiring of tractor- Rs 300/hr (4 hrs for 10 days)		Labour- Rs 50/day for 7 days for 6 labour Tractor hire Rs 500 Thresher Rs 300 for 12 hrs	wheat- Labour- Rs 1500 Soya- Rs 4000 for purchase of seed Labour- Rs 2000 (for spraying insecticides)	Labour Rs 15000 Threshing Rs 3000/crop
Total cost incurred on agriculture	None	Rs 42750 (?)		Rs 40000 on fertiliser plus Rs 12000 (other costs)	Rs 14000	Rs 30000/crop About Rs 50000 annual
Use of organic farming						
Type used per acre	Mix of dung and agriculture waste Also the slurry from the gobar	Mix of dung and agriculture waste (uses a combination of	Mix of dung and agriculture waste	Does not use organic manure	Mix of dung and agriculture waste	Mix of dung and agriculture waste

	gas plant	dung and fertilizer for wheat, while in soya bean uses only compost)	Also uses the slurry from the gobar gas plant			
Amount used per acre	5/6 trolleys (1 trolley is equal to 600 cubic feet of dung)	For 1 quintal of wheat about 50 kgs of compost mix is used	No idea		No idea	Dung of 9 cattle used in 4 acre
Cost incurred per unit	Rs 2500/month (for two labourers)	None :Own source	None: Own source		None-own source	None- own source
Source of purchase	Own (he practices dairy farming)	Own (dairy farmer)	own		own	own
Compost making process	Mixes manure and agriculture waste and dumps them, dries it and then uses it on the land Has created small pathways for the sludge to deposit in a dump and then ploughs that soil and uses it in the agriculture land	Mixes manure and agriculture waste and dumps them, dries it and then uses it on the land	Mixes manure and agriculture waste and dumps them, dries it and then uses it on the land Has created small pathways for the sludge to deposit in a dump and then ploughs that soil and		Tried the LCA technique did not work out, so now uses the traditional technique of dumping	Mixes manure and agriculture waste and dumps them, dries it and then uses it on the land

			uses it in the agriculture land			
Cost incurred per acre	Rs 600	None	none		None	None
Total cost	Rs 4000	Labour charges of Rs 1800	None (own household labour)		None (own household labour)	None- own household labour
Wheat- total production	Enough for own consumption	100 quintals	No idea	160 quintals	100 quintals	300 quintals
Wheat- Own consumption	All- own consumption	50 quintals	All own consumption	50 quintals	60 quintals	50 quintals
Wheat- sold	None	50 quintals		110 quintals	40 quintals	250 quintals
Price per kg	None	Rs 645/quintal		Rs 650/quintal	Rs 650/quintal	Rs 650/quintals
Soyabean - total production	Does not grow soya	Incurred loss in soyabean	none	Crop failure	Crop failure	Crop failure
Soyabean- Own consumption						
soyabeant- sold						
Price per kg						
Vegetables- total production		Own consumption		14 quintals of onions	Own consumption	Own consumption
Vegetables- own consumption	All for own consumption	All own consumption	Own consumption	14 quintals	Own consumption	Own consumption
Vegetables-sold	none	None	none	None		None
Price/kg						
Market- Wheat		Dairy clients	Own	Nearby	Village	Bhopal Mandi

			consumption	market (Surajnagar)		
Market- Soyabean		Bhopal Mandi			E chaupal	
Market -Vegetables		Own consumption	Own consumption	Own consumption	Own consumption	Own consumption
Reasons for shifting/not shifting to organic farming	Since he is a dairy farmer, he uses only organic • Dung is available • Better yield • Less water intensive as compared to inorganic farming	Dairy is his main source of livelihood, for the past three years, he is slowly shifting towards organic farming: • Dung is available • Better yield	Has shifted to organic farming since the last two years • Dung is available • Better yield • Less cost	Does not use organic manure • No own livestock • Non availability of compost	Problems in shifting to organic manure • Not enough dung available • Organic farming is labour intensive and there is no labour available in the village even at twice the rate since the village is near to bhopal and there is heavy migration to bhopal	He is using organic manure only in 4/5 acres for own consumption only because • Not enough dung • Not enough labour- while organic farming is labour intensive • Is ready to shift to complete organic if they get twice the rate of produce
Other comments	He has migrated from UP, bought	Ten years ago, they used to	Water is a major		Water is a major problem	Electricity is a problem

	this land in the 70s, initially the land was not productive, regular application of dung has increased land productivity Water scarcity is a major problem in the village	cultivate mainly pulses like moong dal, and groundnuts, but since the plantation (near the lake by LCA), the number of wild pigs in the are has increased and started destroying our crops, due to which we had to change our cropping pattern(since the pigs do not destroy the wheat) The grazing land in the village has decreased, therefore livestock management is a major problem and has become very expensive One of the	problem in the village, though they have two borewells there is no water			Areas near the nala less fertilizer is required, since the soil is clayey

		reason for the loss of grazing land is the rising lake water, due to which many tracts of agriculture land is lost, farmers therefore encroach upon the common lands and convert it into agriculture. Water is a major problem, there are two pumps in the village but no water in the tank.				

Annexure 2: Checklist used for Focus Group Discussion and Farmer Interviews

Village profile:

- Name of village
- Name of hamlets (household no)
- No of households by hamlet
- Caste profile by hamlet
- Landholding wise breakup
- Main crops by season
- Source of irrigation and % wise breakup (types)
- Existing institutions
- Organic and inorganic farmers (season wise)
- Area under Common lands and use (cultivation, grazing etc)
- Who has tractors and dairy

Farmer profile

- Farmers Name
- Map of land (of total landholding) location vis a vis nala and lake, demarcations if any etc
- Agriculture assets and details if hired
- Land use and quality (depth of water, bores? Submergence area, bunding when and how often, riparian zone use and management)
- Crops – area under each crop, season wise,
- Crop cycle with details on each step (mainly on wetting, whether less wetting is required for organic)
- Details on the compost- dung (when available, process, labour etc)
- Costs- detail break up mainly on labour
- Yields (organic/inorganic)- consumption and sale
- Price
- Markets
- constraints and opportunities/benefits in shifting to organic
- views on erosion, what techniques do they use