

# Challenges & Management of Environment & Disaster



**Dr. Ritu Jain**

*c : Authour*

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***Challenges & Management of Environment & Disaster***  
***by***  
***Dr. Ritu Jain***



## STRUCTURE OF THE BOOK

*Rahul Verma and Suresh Chand Rai* in their joint paper “*Flood Management Strategies for Community Resilience: A Case Study of the Ghagra River Basin*” investigated flooding behavior, and existing flood management techniques in India, especially concerning the Ghagra River Basin that has been advocated as an advanced means to traditional flood management. The monsoon rainfall-induced excessive discharge of water from the upper riparian region is the major cause of floods in the Ghagra River basin. Climate change and other hydro-climatological factors are intensifying its frequency and intensity over the decades. Large-scale investments in flood-proofing infrastructures and extensive planning for community resilience are not getting desired results due to improper implementation of structural and non-structural measures, less outreach of welfare schemes, and lack of community participation in planning and implementation processes, etc. This research paper identifies the basin-specific flood problems and explains both structural and non-structural measures taken by government agencies at all levels. The effectiveness of all the measures is discussed. In addition, needful measures for achieving more effective, cost-efficient and successful flood management are also indicated.

*Joystu Dutta and Anil Kumar Sinha* in their joint paper “*Understanding Solid Waste Management Options in India with Special Reference to Manipat: A Popular Tourist Gateway of Chhattisgarh, India*” analysed the waste generation scenario and implementation of ‘*Swachh Bharat Abhiyan*’ with special reference to Mainpat which is also regarded as ‘*Shimla of Chhattisgarh*’. It is one of the prominent tourist destinations of Surguja district in Northern Chhattisgarh. The study conclusively reports that tourist inflow and waste generation across selected tourist destinations in Mainpat are positively and significantly correlated with each other. Waste generation increases with an increase in the seasonal inflow of tourists. The organic and inorganic waste in Mainpat is categorized into different types which are detailed in the study. Hence, the paper

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## **Understanding Solid Waste Management Options in India with Special Reference to Manipal: A Popular Tourist Gateway of Chhattisgarh, India**

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**Joystu Dutta  
Anil Kumar Sinha**

Waste management or waste disposal is all the activities and actions required to manage waste from its inception to its final disposal (UNSD). Solid waste is generated from households, offices, shops, markets, restaurants, public institutions, industrial installations, water works and sewage facilities, construction and demolition sites, and agricultural activities (Hoorweg and Thomas, 1999). Solid waste management practices include collection, recycling, solid waste disposal on land, biological and other treatments as well as incineration and open burning of waste. Solid waste could be defined as non-liquid and non gaseous products of human activities, regarded as being useless (Baba Yemi and Dauda, 2009). According to the Municipal Solid Waste (MSW) Rules 2000, MSW includes commercial and residential waste generated in a municipal or notified area, in either solid or semisolid form, excluding industrial hazardous wastes, but including treated bio-medical wastes (Toolkit for Solid Waste Management, 2012). Management of such solid waste is one of the major environmental issues as urban population growth and economic development lead to the increasing generation of MSW (Waste Composition Study, 2009). Solid waste management is an important facet of sustainable development for any nation and prioritizing solid waste management is greatly supported by global initiatives.

Agenda 21, the Rio Declaration on Environment and Development, explicitly affirmed that environmentally sound management of wastes was among the environmental issues of major concern in maintaining the quality of Earth's environment and especially in achieving environmentally sound and sustainable development in all countries (UNDESA, 2005).

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Waste quantities are increasing and municipal authorities are not able to upgrade or scale up the facilities required for the proper management of waste. In many cities and towns, garbage is littered on roads and foot - pathe. Citizens are either unaware or are not accustomed to use the available storage facilities (dust bins) set up by the authorities. In many cases, social responsibility of waste disposal seems lacking among fellow citizens which add to the problem. The lack of organized system of house-to-house collection of waste has created the littering habits among citizens. There is a general gap in awareness on waste management across the country.

The population of India has been estimated to increase from 1029 million to 1400 million during the period 2000-2026, an increase of 36 percent in 26 years at the rate of 1.2 percent annually (Census of India, 2001). About 742 million people live in rural areas and 285 million in urban areas. The level of urbanization of the country has also increased from 17.6 percent to 31.16 percent during the last 60 years and is expected to rise further to 40 percent by the year 2026. The urban population of India generated 114,576 tons/day of municipal solid waste (MSW) in 1996, which was predicted to increase by four times to about 440,460 tons/day by the year 2026 (Talyan et. al, 2008).

In numerous cities, the municipal solid waste contains human and animal excreta as well as hazardous chemical pollutants, which are causative of numerous diseases, injuries and perils, especially among the children, rag pickers, and employees working in the waste management sector. Various studies have also shown that a high percentage of workers handling the refuse and also the residents who live near or on disposal sites, are frequently infected with gastrointestinal parasites, worms, and related organisms.

According to the World Health Organization (WHO) 5 million people die due to diseases caused by the faulty waste disposal system and poor waste collection practices in function over the years. As per the WHO report, there are twenty-two types of diseases directly related to improper solid waste management. Rodent and insect vectors transmit diseases such as dysentery, cholera, plague, typhoid, infective hepatitis and others (Singh, 2004).

**Some Quick Facts relating to Solid Waste Management (SWM) are as follows:**

- According to the WHO, 50 lakh people die worldwide every year due to diseases related to improper waste disposal.

- India produces about 75 million tonnes of waste every year of which only 60-70 percent is collected in the urban areas;
- Uncollected garbage lying around on streets had aggravated the outbreak of plague in Mumbai and Surat cities of India.
- Other potentially hazardous circumstances such as in Jwalapuri Market in New Delhi, which had been gutted due to unsafe and unplanned plastic waste management, are also becoming frequent occurrences.

India being the world's second most populated country and one of the fastest urbanized superpowers is increasingly facing the problem of solid waste management. It is one of the burning issues of the day. The situation is further accelerated by the industrial development in urban areas, consequently adding to the tremendous growth of urban solid waste. The last few decades have witnessed considerable growth in solid waste generation. During the mid-seventies, the estimated per capita solid waste generation ranged from 0.15-0.35 kg/ day for various Indian cities (CPCB, 1999); whereas two decades later it ranged from 0.3-0.6 Kg/day (CPCB, 2001). India produced approximately 46 million tonnes of urban solid waste annually at the start of the millennium (Kumar et. al, 2004).

Most Indian cities have adopted the practice of dumping waste in open landfill sites. Open dumping of waste presents a casting threat to the environment and also to human health in cities. It has become difficult to obtain adequate land for garbage disposal and most existing sites have over reached their limits. In Delhi, there are 16 landfill sites that have already been filled up and existing landfill sites (Bhalswa, Gazipur and Okhla) have reached their saturation points and are consequently overflowing. Solid Waste generation is the by-product of urbanization. It is highly related with economic growth, degree of industrialization, and consumption pattern. With the increase of urban population of the cities and towns, all other activities associated with population also increases resulting in more and more generation of Municipal Solid Waste. The absence of proper technology and efficient methods of disposing of refusal worsens the air quality of the urban centers have detrimental impacts on human health. The most common problems associated with improper management of solid waste include disease transmission, odour, nuisance, atmospheric, land & water pollution, fire hazards, aesthetical nuisance and economic losses. (Yeny and Yulinah, 2012)



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More or less every human activity creates some kind of waste. (World Bank, 2012). As countries develop economically, socially, and technologically waste generation also increases. Both developed and developing countries face problems associated with solid waste generation and its management. Rapid urbanization directs to the densification and an increase of large amounts of solid waste within a concentrated area and World Bank in its 2012 report highlights to major challenge as how to manage the ever-increasing waste generation, especially in developing countries which lacks a sufficient public service infrastructure to manage municipal waste. Poverty and unplanned settlements led to humongous waste generation in third-world countries. This report also stresses the fact that our consumptive and often wasteful behavior needs to be examined, and changed, so that we can live more sustainably. (World Bank, 2012).

A new, far-reaching report on the state of municipal solid waste around the world predicts a sharp rise in the amount of garbage generated by urban residents between now and 2025. The report estimates the amount of municipal solid waste (MSW) will rise from the current 1.3 billion tons/year to 2.2 billion tons/year, with much of the increase coming in rapidly growing cities in developing countries (World Bank, 2012).

Globally, waste volumes are increasing quickly even faster than the rate of urbanization. The World Bank report shows that the amount of municipal solid waste is growing fastest in China (which surpassed the US as the world's largest waste generator in 2004), other parts of East Asia, and part of Eastern Europe and the Middle East. In the last two decades the amount of waste generated in China is very high due to increased number of population and economic growth. For instance, the waste generation in China is parallel to its economic growth, i.e. from 1979 the average annual rate of increase in its solid waste had been 9% slightly below the average annual growth of its economy 10% (Zang, 1998).

There is a direct correlation between the per capita level of income in cities and the amount of waste per capita that is generated. In general, as a country urbanizes and populations become wealthier, the consumption of inorganic materials (e.g. plastics, paper, glass, aluminum) increases, while the relative organic fraction decreases (UNEP, 2001).

The World Bank, 2012 report estimates that the amount of municipal solid waste (MSW), one of the most important by-products

of an urban lifestyle, is growing even faster than the rate of urbanization. Ten years ago there were 2.9 billion urban residents who generated about 0.64 kg of MSW per person per day (0.68 billion tons per year). These amounts have increased to about 3 billion residents generating 1.2kg per person per day (1.3 billion tonnes per year). By 2025 this would likely increase to 4.3 billion urban residents generating about 1.42 kg/capita/day of municipal solid waste (2.2 billion tons per year) (World Bank, 2012).

India is having the second largest population in the world after China with more than 1.27 billion population contributing 17.6% of world's total population (Official population clock). On the contrary, India is sharing only 5% of the world's area accounting 3,185,263 km<sup>2</sup>. Out of the total population, 68% lives in rural areas, while 32% lives in urban areas (World Bank, 2014).

Currently, 1,27,486 tons per day of municipal solid waste is being generated due to various household activities and other commercial and institutional and activities in India (CPCB, 2012). A substantial amount of these wastes is extremely dangerous to living organisms including human beings (Misra et al. 2004). The management of MSW is going through a critical phase, due to the unavailability of suitable facilities to treat and dispose of the larger amounts of MSW generated daily in metropolitan cities (Kaushal et al., 2012).

**Swachh Bharat Abhiyaan: Zeroing In Cleanliness is next to Godliness.** This phrase was first recorded in a sermon by John Wesley in 1778, but the idea is ancient, found in Babylonian and Hebrew religious tracts.

*Swachh Bharat Abhiyaan* (English: Clean India Movement) is a campaign by the Government of India to clean the streets, roads and infrastructure of the country's 4,041 statutory cities and towns. The Swachh Bharat Mission (SBM) emanates from the vision of the Government articulated in the address of The President of India in his address to the Joint Session of Parliament on 9th June 2014: "We must not tolerate the indignity of homes without toilets and public spaces littered with garbage. For ensuring hygiene, waste management and sanitation across the nation, a "Swachh Bharat Mission" will be launched. This will be our tribute to Mahatma Gandhi on his 150th birth anniversary to be celebrated in the year 2019."

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### Objectives of *Swachh Bharat Abhiyaan*

**Swachh Bharat Mission (Gramin):** The main objectives of the SBM (G) are as follows:

- a) Bring about an improvement in the general quality of life in rural areas, by promoting Cleanliness, hygiene and eliminating open defecation.
- b) Accelerate sanitation coverage in rural areas to achieve the vision of Swachh Bharat by 2<sup>nd</sup> October, 2019.
- c) Motivate Communities and Panchayati Raj Institutions to adopt sustainable sanitation Practices and facilities through awareness creation and health education.
- d) Encourage cost-effective and appropriate technologies for ecologically safe and sustainable sanitation.
- e) Develop where required, Community managed sanitation systems focusing on scientific Solid & Liquid Waste Management systems for overall cleanliness in rural areas.

**Swachh Bharat Mission (Urban):** The main objectives of the SBM (U) are as under:

- a) Elimination of open defecation.
- b) Eradication of manual scavenging.
- c) Modern and Scientific Municipal Solid Waste Management.
- d) To effect behavioral change regarding healthy sanitation practices.
- e) Generate awareness about sanitation and its linkage with public health.
- f) Capacity Augmentation for ULB's (Urban Local Bodies).
- g) To create an enabling environment for private sector participation in Capex (Capital Expenditure) and Opex (Operation and Maintenance).

### Objectives

1. To study the Scenario of selected tourist sites.
2. To generate a database of different types of wastes.
3. To quantify the amount of various types of waste at selected study sites.
4. To understand the level of implementation of Swachh Bharat Abhiyaan in Mainpat.
5. To recommend suitable strategies towards effective management of waste in Mainpat.

## Review of Literature

Rapid increase in urbanization and per capita income lead to high rate of municipal solid waste generation. In recent times, E-waste and plastic waste also contribute considerably to total waste stream due to utilization of electronic and other items. These wastes may cause a potential hazard to human health or environment if any of the aspects of solid waste management is not managed effectively (Nandan, A. *et. al* 2017). In India, approach towards Solid waste management is still unscientific Solid Waste collection efficiency in India is around 70%, while same is almost 100% in the developed countries (Sharholy et al. 2007). Various studies reveal that out of total solid waste, 80% can be utilized again either by recycling or reusing. Improper waste segregation and other factors lead recycling sector to work on outdated technology. However, plastic and paper recycling have been especially growing due to continuous increasing consumption of both the commodities.

Agrawal, A. *el. al* (2016) throws light on waste management concept in smart cities. The main consideration should be given on smart waste management to make a city smart. Waste management should be intended as well-beyond the simple installation of sensors on bins, and it should welcome an integrated planning strategy tailored for resource recovery and efficiency within a circular economy framework.

The main aim of this paper is to quantify the present generation of Solid Waste and project the generation in future by projecting population growth in Delhi Mega City. This study is an eye opener for the city planners, managers, stakeholders and different Organizations and agencies which are actively engaged in the Management of this "Urban Menace" (Tahir, M. *et. al* 2015).

(Trivedi, J. 2015) analyses the waste collection and disposal practices in and around Gandhinagar city. On the demand side, the research examines the behaviour and perception of residents of the city towards the existing waste management practices by the government bodies as well as the private agencies. On the supply side, the study highlights in detail the activities and operations of Gujarat Municipal Corporation's waste collection and disposal system in Gandhinagar city. Waste reduction is recognized by the United Nations as a logical starting point for sustainable solid waste management (Post, J. L. 2007). The USEPA defines waste reduction as "a broad term encompassing all waste management methods -

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source reduction, recycling, and composting – that result in a reduction of waste going to a landfill or combustion facility.”

(Sarkar, P. 2003) observes that management of burgeoning solid wastes has become a critical issue for almost all the major cities in India. Although the responsibility of solid waste management remains primarily with the municipal bodies, several other stakeholder groups play significant role in the processes involved. In the Indian scenario the so-called waste pickers, who come from highly vulnerable social backgrounds, play a unique role. In the process they make a significant contribution to the environmental management in different metropolis' over and above rendering a service to the local economy.

### Materials and Methods

1. Primary Data Collection by the help of Focused Group Discussion, Questionnaire based surveys, Personal Interviews, Random Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA).
2. Secondary Data Collection from Government Reports, Panchayat Registers, Hotel Registers, available documentation in tourist places.
3. Sample Surveys from tourist destinations of the study area.
4. Photographic as well as video graphic documentation.
5. Critical analysis of the results obtain during our study is done through creation of box plot and other statistical implementation is done with the help of Mini Tab software.

**Participatory Rural Appraisal (PRA):** It is an approach used by non-governmental organizations (NGOs) and other agencies involved in international development. The approach aims to incorporate the knowledge and opinions of rural people in the planning and management of development projects and programmes. Castletoe et al. (2005), Chambers et al.(1994), Narayanasamy et al.(2009). Over the years techniques and tools have been described in a variety of books and newsletters, or taught at training courses. Castletoe et al. (2005), Chambers et al. (1994), Narayanasamy et al. (2009), Sontheimer et al. (1999). However, the field has been criticized for lacking a systematic evidence-based methodology Leurs et al. (1997).

As reported by Castletoe et al. (2005), Chambers et al. (1994), Narayanasamy et al. (2009), Sontheimer et al. (1999), Pretty et al. (1997); the basic techniques used include:

- Understanding group dynamics, e.g., through learning contracts, role reversals, feedback sessions
- Surveying and sampling, e.g., transect walks, wealth ranking, social mapping
- Interviewing, e.g., focus group discussions, semi-structured interviews, triangulation
- Community mapping, e.g., venn diagrams, matrix scoring, ecograms, timelines

To ensure that people are not excluded from participation, these techniques avoid writing wherever possible, relying instead on the tools of oral communication and visual communication such as pictures, symbols, physical objects and group memory. Efforts are made in many projects, however, to build a bridge to formal literacy; for example, by teaching people how to sign their names or recognize their signatures. Often developing communities such as in India are reluctant to permit invasive audio-visual recording.

**Rapid Rural Appraisal (RRA):** According to Chambers, R. (1981), decision makers need the right information at the right time but in rural development much information generated is too costly and inappropriate. Rapid rural appraisal forms part of the attempt to learn about rural conditions in a cost-effective way. Such appraisal involves avoiding the traps of quick and dirty or long and dirty methods and using instead methods that are more cost effective. To do this means ignoring inappropriate professional standards and instead applying a new rigour based on the two principles of optimal ignorance—knowing what it is not worth knowing—and proportionate accuracy—recognizing the degree of accuracy required. The article reviews a range of approaches and techniques for rapid rural appraisal that are less rigid and exhaustive than many traditional methods and yet more rigorous in relation to cost and use. Time is emphasized as a critical factor in effective appraisal and rapid rural appraisal methods increase the chance of reducing the bias against the poorer rural people in the promotion of rural development.

**Study Site:** Mainpat is a small hamlet in the Surguja district in the northern part of the state of Chhattisgarh, India. Lying about 45 kilometers (28 mi) by road from Ambikapur, the hill station features the Tiger Point Waterfall, Fish Point waterfall, Jaljali, Buddhist Monastery and Mehta Point (Tourism Surguja District Government) apart from host of other adventurous and exciting places of tourist interest.

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The place displays an exquisite natural beauty with pristine landscapes and mighty waterfalls breaking across the hills and lush green forests. The romantic dawn and dusk is very enchanting and soothing to the busy souls away from the hustles and bustles of daily urban life and filled with soulful music of nature. Mainpat is said to be the best honey moon destination as well. In Surguja, 'Pat' is ascribed to a 'plateau' region. Mainpat is on a plateau with the area surrounded by jungles. The place has beautiful hill slopes, jungles, waterfalls and is an unexploited hill station. There is a Tibetan settlement that offers an excellent opportunity for interaction with them. In fact, Mainpat is also known as 'Mini Tibet' because of the settlements (Chhattisgarh Tourism Board).

The products of this place are very famous such as woolen clothes or handicrafts. One can enjoy dishes like thupka, momos, bamboo rice, etc. specialty of Tibetan food. At this place one can feel cold even during hot summer days. So, the place is also popularly termed as '*Shimla of Chhattisgarh*'. The altitude of the place is 1075 m ASL with dense forest. Mainpat consists of 24 villages with a population of 25,000 approx. It is considered to be one of the Emerging ecotourism hotbeds of Chhattisgarh.

### Place to Visit in Mainpat:

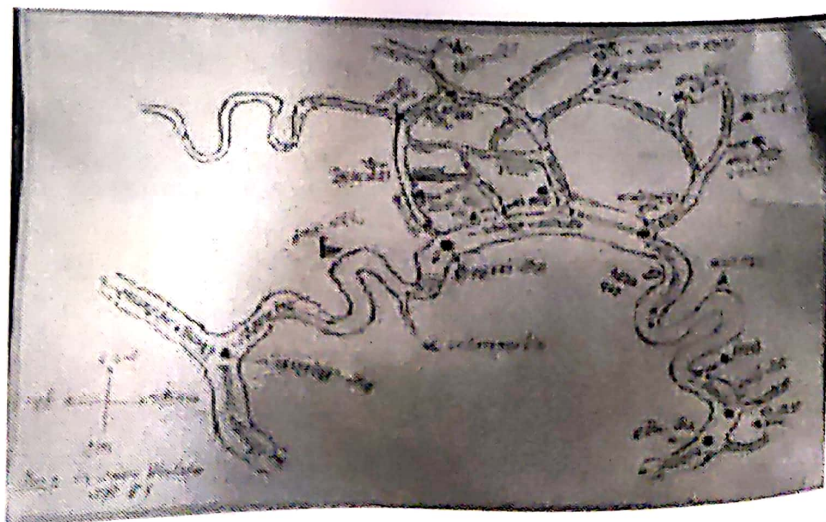
- **Dhakpo Monastery:** This is a Gelug Monastery and unlike all other monasteries, this monastery is small.
- **Fish Point:** This waterfall is near the Tibetan camp number 6. This is a beautiful place and a must-see place.
- **Tiger Point:** This is another waterfall near the Tibetan camp number six and a good place for picnics. There are steps leading to the falls. The other waterfalls are Sarbhanja and King's Waterfall. Tiger Point is also the gateway to Mainpat.
- **Tibet Refugee Camp:** There are four Tibetan camps located in the region which houses the Tibetan refugees since many years.
- **Mehta Point and Parpatia:** These two points present excellent view of the region with mighty Sal trees dotting the entire landscape
- **Jaljali:** This is the most exciting and ecologically unique place where the ground shakes as one walks or jumps around. Probably, this place is one of its kind in the world.

**History of Mainpat:**

The cluster of villages was traditionally home to the Yadavs and tribes including the Manjhi. The major livelihood of these tribes includes pastoralism and animal husbandry. Tibetan refugees have settled in this place since 1962. The population of the Tibetans in this place is approximately around 1825.

**Geography of Mainpat**

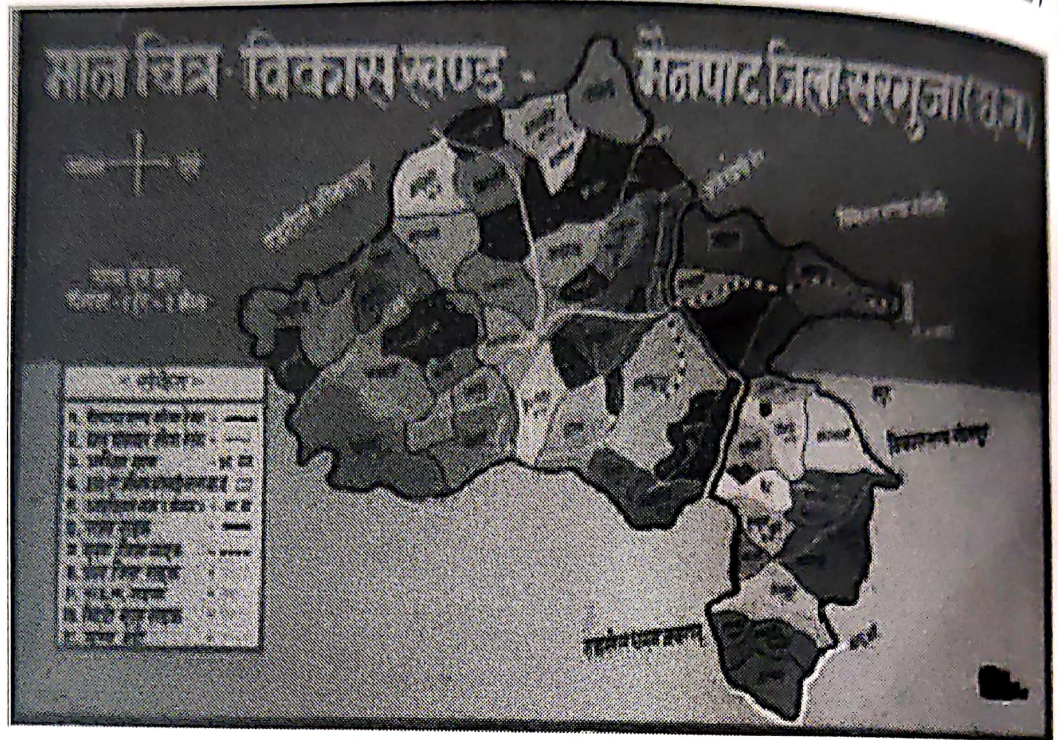
The Geographical area is 45, 466 hectares. It lies between 22°45' north latitude and 83°18' east longitude. Agriculture land area is around 19, 450-hectare, irrigated agriculture land area is 1350 hectares. The high-lands of Surguja district have peculiar 'pat formations' – highlands with small tablelands. Mainpat forms an ideal definition of a 'pat'. The soil of the Mainpat can be broadly classified into four major types: red and yellow soils, alluvial soils, laterite soils, and medium blue soils. Red and yellow soils are derived from the parent rocks of the Gondwana System including sedimentary rocks. They are formed in-situ from the erosion of such rocks caused by rain. The red color is due to wide diffusion of iron while hydration of ferric oxide results in a yellow color in the soil. This soil is of lighter texture and has a porous sand friable structure. Soluble salt is found in small quantities. Lime, kankar and free kankar are totally absent. These soils are poor in potash, nitrogen, humus and carbonate and differ greatly in consistency, color, depth and fertility. The colour of the soil is not uniform but varies from yellow to grey. Laterite soils are well developed on the summits of the plateau regions of Mainpat blocks. In winters temperature dips to below 2 °C (35.6 °F) and in summers it rises above 35 °C (95 °F).



**Fig.1: Route Map of Study area**







**Fig. 2: Series-wise map from India to Mainpat**

Results and Discussion

Table 1: - Site wise waste inventory

SITE NAME	WASTE CATEGORIES	
	Organic Waste	Inorganic Waste
Tiger Point	Biodegradable waste, Egg shells, Fruit peels, Card boards, News Paper	Plastics, Wrappers, Thermocol plates, Paper plates, Water bottles
Mehra Point	Biodegradable waste, Egg shells, Fruit peels, Card boards, News Paper	Plastics, Wrappers, Thermocol plates, Paper plates, Water bottles
Fish Point	Biodegradable waste, Egg shells, Fruit peels, Card boards, News Paper	Plastics, Wrappers, Thermocol plates, Paper plates, Water bottles
Amali Point	Biodegradable waste, Egg shells, Fruit peels, Card boards, News Paper	Plastics, Wrappers, Thermocol plates, Paper plates, Water bottles

Table 1 represents waste inventory of different sites. In all four sites the wastes collected are divided into categories as Organic wastes include Biodegradable wastes, Egg shells, Fruit Peels, Card boards, News Paper and the Inorganic waste include Plastics, Wrappers, Thermocol plates, Paper plates and Water bottles.

Fig. 3. Organic wastes and categorization in box plot: -

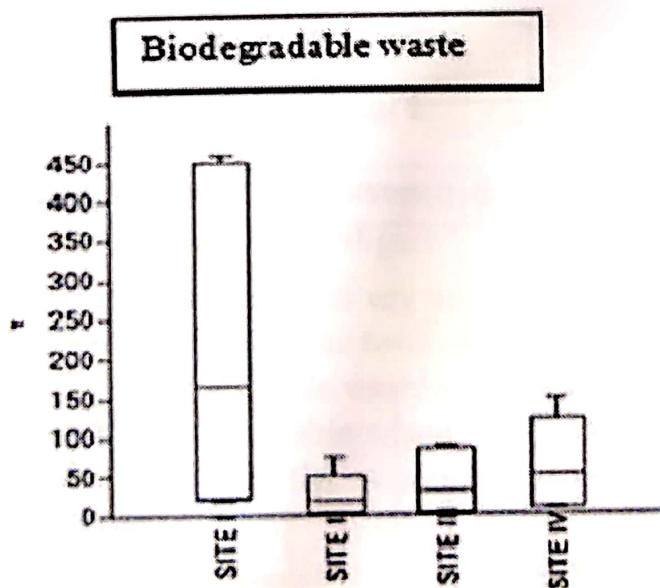


Fig.3.1

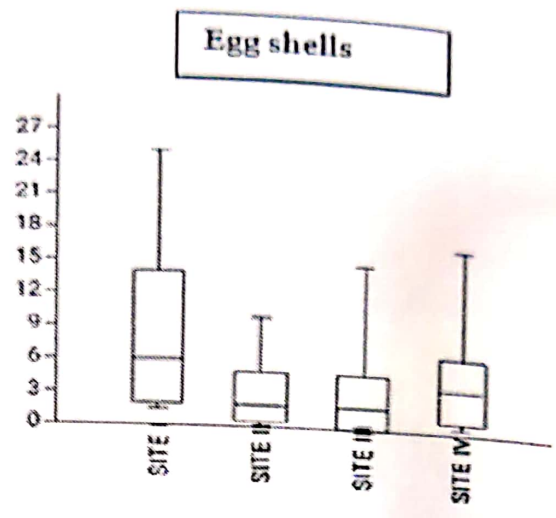


Fig. 3.2

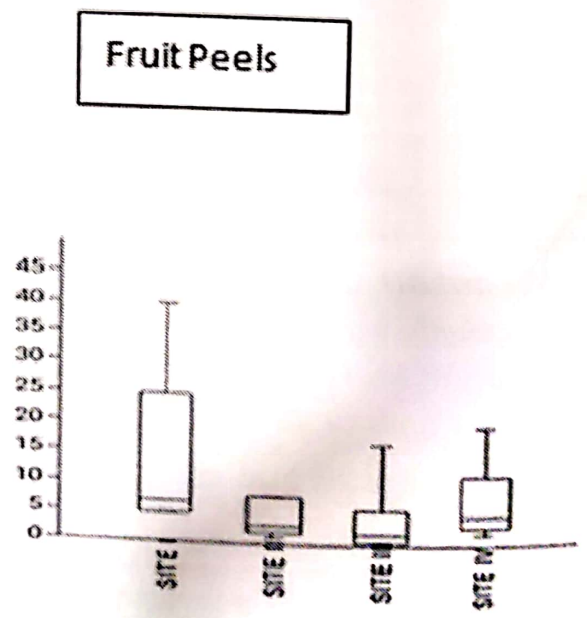


Fig. 3.3

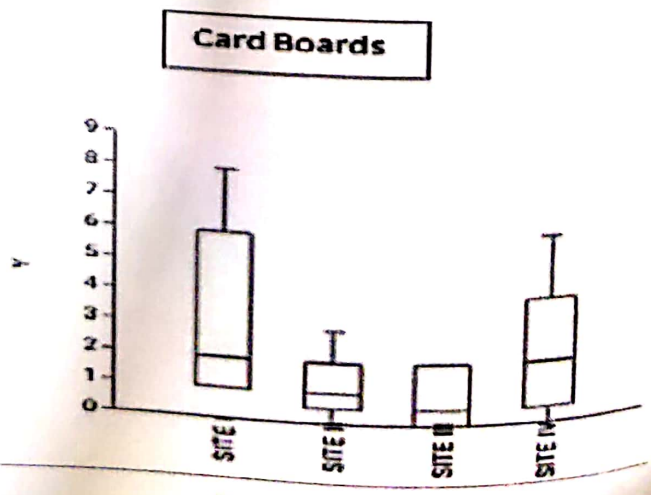
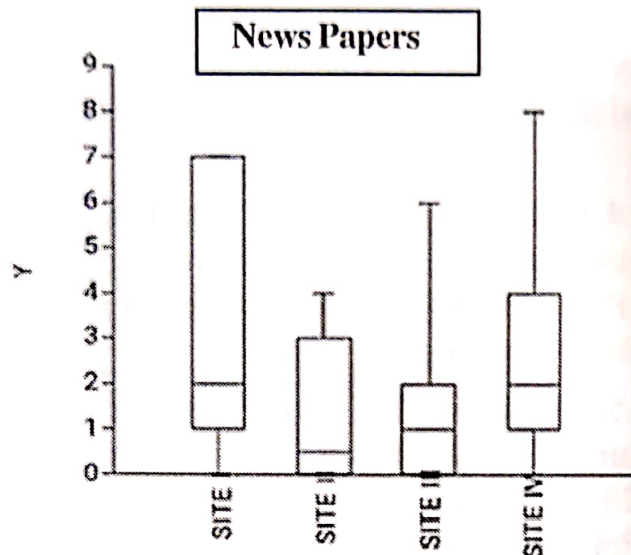


Fig. 3.4

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**Fig. 3.5**

The Different categories of waste found in four sites are :-

Category 1: - Biodegradable Waste

Category 2: - Egg Shells

Category 3: - Fruit Peels

Category 4: - Card Boards

Category 5: - News Papers

The four sites are:-

Site 1: - Tiger Point

Site 2: - Mehta Point

Site 3: - Fish Point

Site 4: -Jaljali Point

All these sites are different tourist destination of Mainpat, which is also known as “Shimla of Chhattishgarh”

- In the figure above, total organic wastes of all four sites have been displayed in the form of box plot, fig. 3.1 box plot shows the Biodegradable waste level in which the maximum quantity of Biodegradable waste is recorded in site I (Tiger Point 2034 kg.) and the minimum recorded from site II (Mehta Point 240 kg.)
- Fig. 3.2 box plot shows the Egg shells level in which the maximum quantity of Egg shells is recorded in site I (Tiger Point 71.71 kg.) and the minimum recorded from site II (Mehta Point 27 kg.)

- Fig. 3.3 box shows the Fruit peels level in which the maximum quantity of Fruit peels is recorded in site I (Tiger Point 122 kg.) and the minimum recorded from site II (Mehta Point 36 kg.)
- Fig. 3.4 box shows the Card board level in which the maximum quantity of F Card board is recorded in site I (Tiger Point 23.3 kg.) and the minimum recorded from site II (Mehta Point 9 kg.)
- Fig. 3.5 box shows the News Paper level in which the maximum quantity of News Paper is recorded in site I (Tiger Point 28.29 kg.) and the minimum recorded from site III (Fish Point 7.5kg.)

Fig. 4. Inorganic wastes and categorization in box plot: -

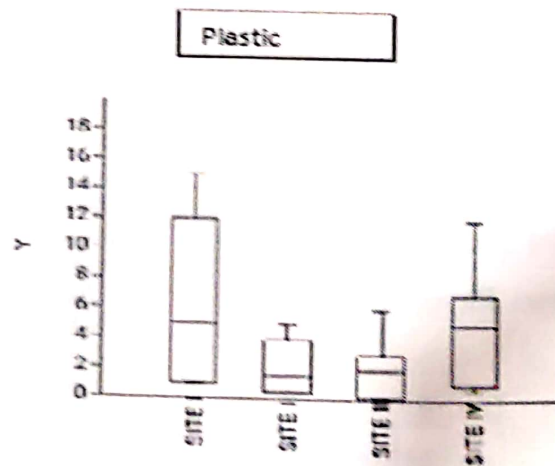


Fig. 4.1

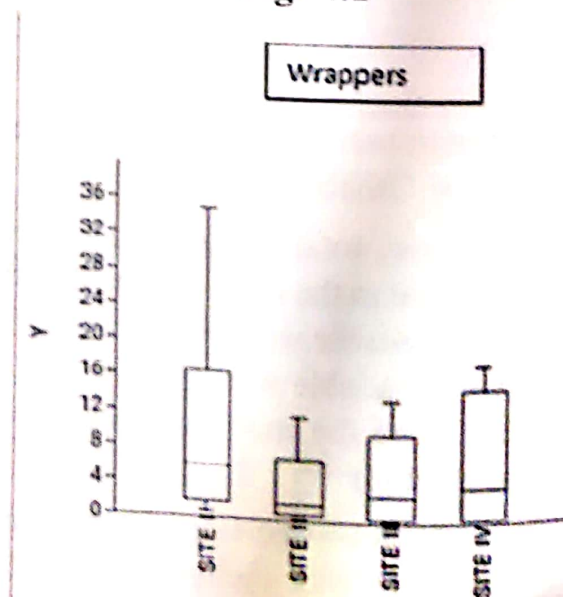


Fig. 4.2

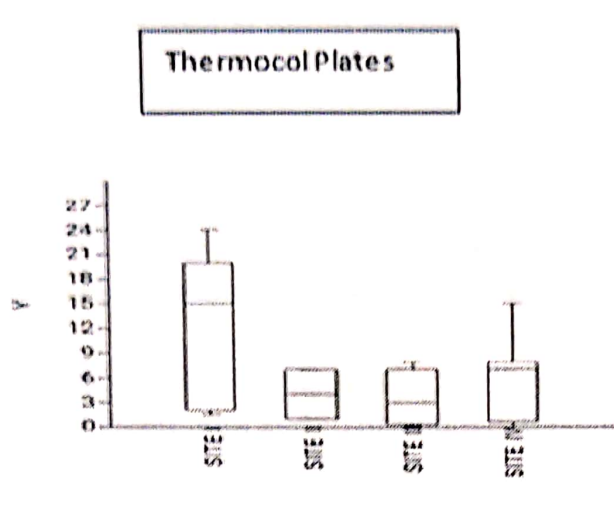


Fig. 4.3

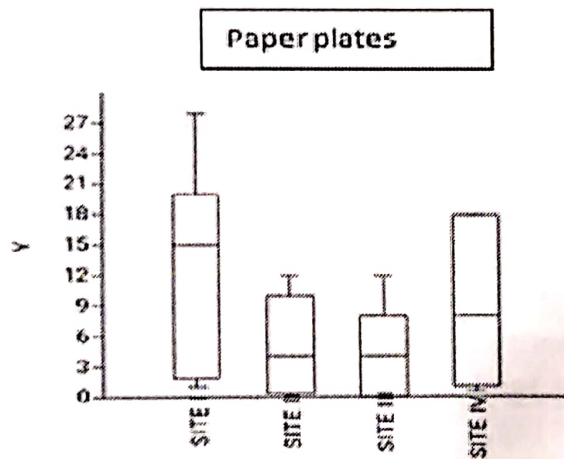


Fig. 4.4

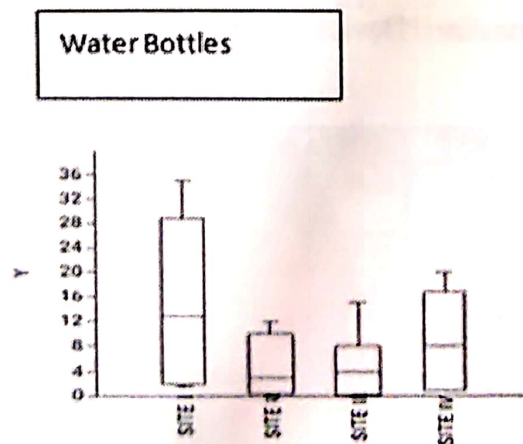


Fig. 4.5

The different categories of wastes found in four sites are:-

- Category 1: - Plastics
- Category 2: - Wrappers
- Category 3: -Thermocol Plates
- Category 4: - Paper Plates
- Category 5: - Water Bottles

And miscellaneous wastes which could not be categorized due to negligible quantities.

- In the figures above, Inorganic wastes of all four sites have been displayed in the form of box plot, fig. 4.1 shows box shows the Plastics level in which the maximum quantity of Plastics is recorded in site I (Tiger Point 88 kg.) and the minimum quantity from site II (Mehta Point 33.6 kg.)
- Fig. 4.2 box plot shows the Wrappers level in which the maximum quantity of Wrappers is recorded in site I (Tiger Point 55 kg.) and the minimum quantity is recorded from site III (Fish Point 19.4kg.)
- Fig. 4.3 box plot shows the Thermocol Plates level in which the maximum quantity of Thermocol Plates is recorded in site I (Tiger Point 97.5 kg.) and the minimum quantity is recorded from site III (Fish Point 27.8kg.)
- Fig. 4.4 box plot shows the Paper Plates level in which the maximum quantity of Paper Plates is recorded in site I (Tiger Point 112.76kg.) and the minimum quantity is recorded from site III (Fish Point 41kg.)
- Fig. 4.5 box plot shows the Water Bottles level in which the maximum quantity of Water Bottles is recorded in site I (Tiger Point 135.5 kg.) and the minimum quantity from site III (Fish Point 39.7kg.)

Table 2: - Mean and Standard Deviation values of different waste categories in Study Sites:-

NAME OF ITEM	TIGER POINT	MEHTA POINT	FISH POINT	JALJALI POINT
Biodegradable Wastes	226 ± 192.94	26.66 ± 24.32	38.66 ± 36.11	61.44 ± 33.81
Eggs	7.96 ± 7.46	3 ± 3.09	3.33 ± 4.63	4.94 ± 5.07
Fruits	13.55 ± 11.85	4 ± 2.44	4.22 ± 5.13	7.88 ± 5.73
Card Board	2.58 ± 2.58	1.27 ± 1.41	1.38 ± 1.90	2.44 ± 2.40
News Paper	3.14 ± 2.44	1.18 ± 0.95	0.83 ± 0.82	2.11 ± 1.94
Plastics	9.77 ± 10.76	3.73 ± 3.74	4.25 ± 4.80	6.33 ± 6.39
Rapper	6.11 ± 5.06	2.24 ± 1.76	2.15 ± 1.77	4.8 ± 3.68
Thermocol Plates	10.83 ± 8.67	3.55 ± 2.60	3.08 ± 2.98	5.611 ± 4.88
Paper Plates	12.52 ± 10.18	4.21 ± 4.02	4.55 ± 4.18	8.5 ± 7.43
Water Bottles	10.05 ± 12.95	4.75 ± 4.25	4.41 ± 4.79	8.55 ± 6.91



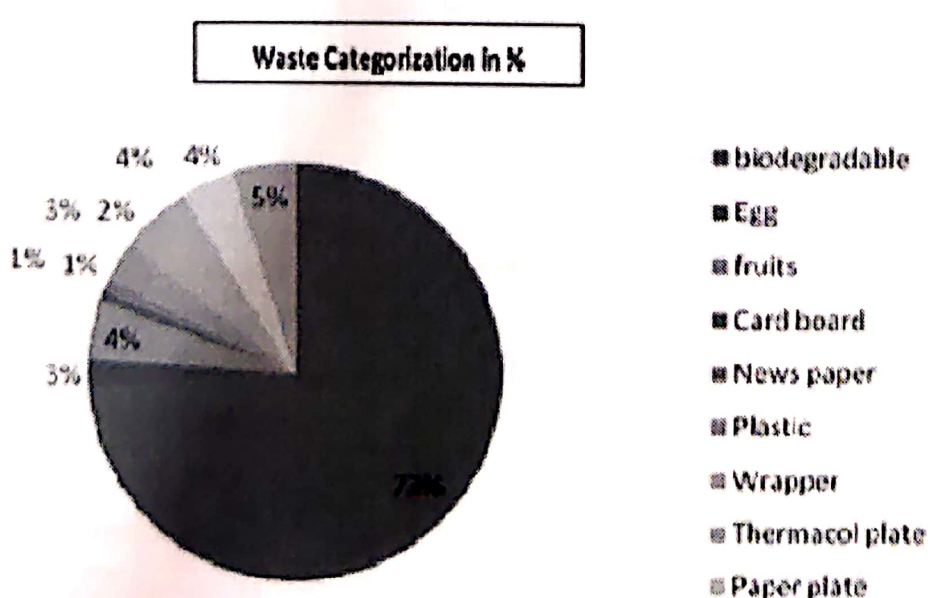
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#### Explanation: -

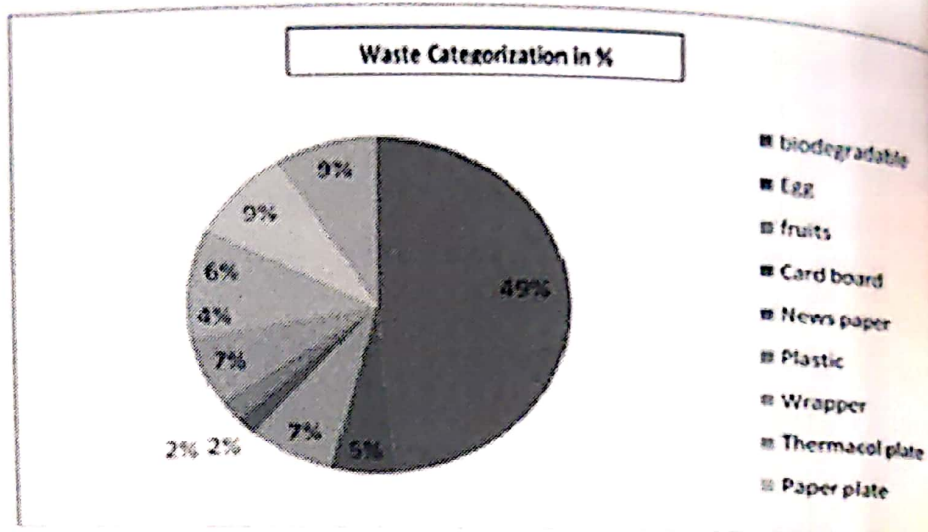
Four study sites namely are Tiger Point, Mehta Point, Fish Point, Jaljali Point and the Wastes are categorized into 10 types. This includes both Organic as well as Inorganic Wastes. Organic Wastes includes biodegradable waste, egg shells, fruit peels, card board, newspaper and Inorganic Wastes includes plastics, wrappers, thermocol plates, paper plates and water bottles as recorded from study sites. The Mean and Standard deviation values are calculated for different categories of wastes in four study sites. The values for biodegradable waste in Tiger Point, Mehta Point, Fish Point and Jaljali Point (mean and standard deviation values) are respectively  $226 \pm 192.94$ ,  $26.66 \pm 24.32$ ,  $38.66 \pm 36.11$  and  $61.44 \pm 53.81$ . Egg shells shows  $7.96 \pm 7.46$ ,  $3 \pm 3.09$ ,  $3.33 \pm 4.63$ ,  $4.94 \pm 5.07$ . Fruits peels shows  $13.55 \pm 11.85$ ,  $4 \pm 2.44$ ,  $4.22 \pm 5.13$ ,  $7.88 \pm 5.73$ . Card board shows  $2.58 \pm 2.58$ ,  $1.27 \pm 1.41$ ,  $1.38 \pm 1.90$ ,  $2.44 \pm 2.40$ , Newspaper shows  $3.14 \pm 2.44$ ,  $1.18 \pm 0.95$ ,  $0.83 \pm 0.82$ ,  $2.11 \pm 1.94$ , Plastics shows  $9.77 \pm 10.76$ ,  $3.73 \pm 3.74$ ,  $4.25 \pm 4.80$ ,  $6.33 \pm 6.39$ , Wrappers shows  $6.11 \pm 5.06$ ,  $2.24 \pm 1.76$ ,  $2.15 \pm 1.77$ ,  $4.8 \pm 3.68$ , Thermocol plates shows  $10.83 \pm 8.67$ ,  $3.55 \pm 2.60$ ,  $3.08 \pm 2.98$ ,  $5.611 \pm 4.88$ , Paper plates shows  $12.52 \pm 10.18$ ,  $4.21 \pm 4.02$ ,  $4.55 \pm 4.18$ ,  $8.5 \pm 7.43$ , Water bottles shows  $10.05 \pm 12.95$ ,  $4.75 \pm 4.25$ ,  $4.41 \pm 4.79$  and  $8.55 \pm 6.91$ .

Figure 5: - Pie chart

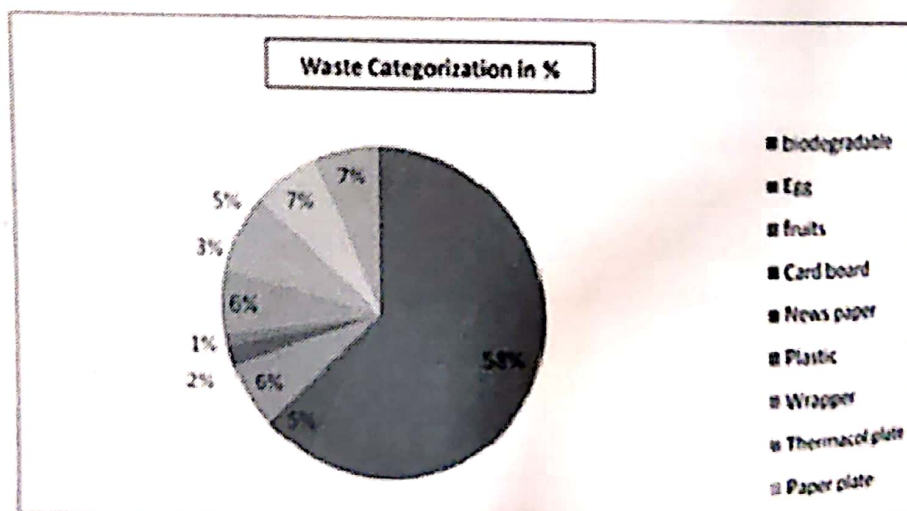
Site 1: Tiger point



Site II: Mehta point



Site III: Fish point



Site IV: Jaljali point

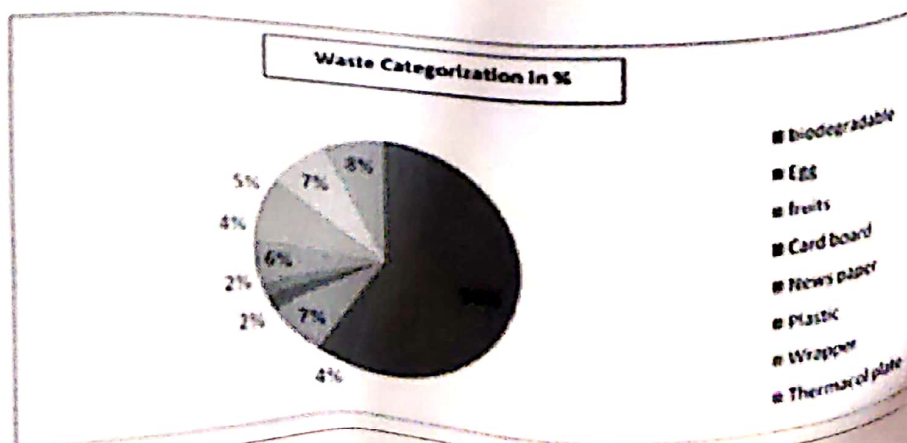


Table 3: - Site Wise Population of Tourist Visiting and Total Waste Category in Mainpat.

Site	Population of Tourist Visiting the Sites	Biodegradable Waste	Egg Shells	Fruit Peels	Card Boards	News Papers	Plastics	Wrappers	Thermocol Plates	Paper Plates	Water Bottle
I	39,278	2034	71.71	122	23.3	28.29	88	55	97.5	112.76	135.5
II	24,630	240	27	36	9	10.7	33.6	20.2	32	42.9	42.8
III	9,223	348	30	38	12.5	7.5	38.3	19.4	27.8	41	39.7
IV	39,180	553	44.5	71	22	19	57	43.2	50.6	76.5	77

- Site I :- Tiger Point  
 Site II :- Mehta Point  
 Site III :- Fish Point  
 Site IV :- Jaljali Point

(The Study period is between August 2016 to April 2017)

The population of tourist visiting Site I are 39,278, Site II 24,630, Site III 9,223 and in Site IV are 39,180.

	Population	Biodegradable Waste	Egg Shells	Fruits Skin	Card Board	News Paper	Plastics	Wrappers	Thermocol Plates	Paper Plates
Biodegradable Waste	0.598									
Egg Shells	0.727	0.973								
Fruits Skin	0.761	0.965	0.999							
Card Board	0.788	0.738	0.870	0.878						
News Paper	0.874	0.909	0.968	0.980	0.883					
Plastics	0.736	0.964	0.999	0.998	0.889	0.970				
Wrappers	0.873	0.860	0.953	0.964	0.956	0.982	0.961			
Thermocol Plates	0.743	0.981	0.991	0.992	0.814	0.972	0.996	0.933		
Paper Plates	0.819	0.935	0.989	0.995	0.906	0.993	0.991	0.985	0.931	
Water Bordes	0.772	0.968	0.996	0.999	0.858	0.984	0.994	0.958	0.997	0.994

Table 4: -Correlation Table Between Population and Waste Generation in Mainpat.

### **Interpretation of the Correlation between Tourist inflow and Waste Generation: -**

During the present investigation population count from different study were correlated with different waste items found in various study sites. From the results it was found that population count was positively and significantly correlated with different categories of wastes such as fruit peels, card boards, news papers, plastics, wrappers, thermocol plates, paper plates and water bottles at 5% level of significance. This, there for suggest that increase in population strength due to tourism and other activities have significantly contributed towards the accumulation of those waste items across selected study sites of Mainpat.

### **Discussion**

Four Study Sites namely Tiger Point, Mehta Point, Fish Point and Jaljali Point. Our study period was between June 2016 to April 2017. During our study, both tourist movement as well as Waste generation in Mainpat was identified. Four study sites were selected according to population of tourists in these destinations. The Waste generated in Mainpat was categorized into organic and inorganic waste. The organic waste includes biodegradable waste, egg shells, fruit peels, card board, newspaper and the inorganic waste includes plastics, wrappers, thermocol plates, paper plates and water bottles. The seasonal variations in different categories of Wastes were also studied. The results show that maximum waste generation is during November to February while minimum waste generation is between March to June while medium waste generation took place between July to October. This waste generation exactly coincides with the tourist inflow in Mainpat. The annual tourist inflow in Mainpat shows maximum tourists come during winter month (Nov.-Feb.) while minimum tourist inflow is observed during (march-june) and medium tourist inflow is observed between (july-oct.).

The results indicate tourist centric waste generation in Mainpat. The waste generation trends indicate that maximum waste is generated as a result of seasonal tourist inflow in the area. This requires holistic management between tourist inflow and waste generation in Mainpat. Government interventions and public private partnership on waste management is the need of the hour. In this context, success story of Ambikapur would be implementation in Mainpat. Mainpat displays a fragile ecology. The society and culture of Mainpat is unique and

Table No.5: - Seasonal distribution of different waste types at various sites

Waste Items	August				September				October				November				December				January				February				March				April							
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV				
Biodegradable	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Eggs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fruits	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Card Boards	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
News Papers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
Plastics	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
Rappers	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
Thermocol Plates	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
Paper Plates	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				
Water Bottles	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+				

In the table above (+) sign represents the presence of waste and (-) sign depicts the absence of waste categories.

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one of its kind. Hence, successful interventions in waste management are essential to maintain sustainable development of the area. From the surveys, regarding implementations of Swacchh Bharat Abhiyaan in Mainpat it is recorded that total targets in ODF are 15829 in which the baseline survey is 12593, the number of approved toilets is distributed in three programs, which is S.B.M. 9586, MNREGA 6037 and in 14<sup>th</sup> finance is 206. Besides ODF mission, tourist zones of Mainpat needs to be 'plastic free' to prevent plastic pollution in the area. It is also to be mentioned that, door to door garbage collection and recycling of waste is absent in my study sites. This to be strictly implement across Mainpat to maintain the fragile ecology of the area.

### Conclusion and Recommendations

The current study analyzes the waste generation scenario and implementation of 'Swachh Bharat Abhiyaan' with special reference to Mainpat which is also regarded as '*Shimla of Chhattisgarh*'. It is one of the prominent tourist destinations of Surguja district in Northern Chhattisgarh.

Our study conclusively reports that tourist inflow and waste generation across selected tourist destinations in Mainpat is positively and significantly correlated with each other. Waste generation increases with increase in seasonal inflow of tourists. The organic and inorganic waste types in Mainpat are categorized into different types which are detailed in our study. Hence, we present a snapshot of waste generation scenario of Mainpat in our current research.

In the second phase of our study, we attempt to understand the level of implementation of *Swacchha Bharat Abhiyaan* in Mainpat as a whole. There are 39 village Panchayats in Mainpat and schemes of waste generation is currently ongoing and satisfactory. However, stringent rules are to be implemented for door to door collection and recycling of wastes. Solid and Liquid resource management can be implemented further in Mainpat as in Ambikapur for greater success. Awareness creation among locals and positive sensitization among tourists would definitely yield good and sustainable results in coming times.

### Recommendation

The following recommendations are suggested for successful waste management in Mainpat:

- Mainpat is ecologically fragile and biodiversity rich zone. It is our moral duty to protect the area from overexploitation

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either by local activities or by limitless tourist infringements. Government in collaboration with private bodies and NGOs must ensure in maintaining the beauty and sanctity of the place intact.

- Stringent monitoring of tourist sites and complete prevention of littering by tourists.
- Drinking and cooking activities generate a lot of wastes. Strict guidelines to be implemented on self- cleaning of the wastes generated by tourists.
- More dustbins to be installed in tourist sites for smooth collection of garbage. Tourists visiting Mainpat often complain of lack of waste collection facilities.
- There is a general lack of awareness among tourists. Awareness creation among tourists through slideshows in tourist sites, documentaries, puppet shows and *Nukkad Natak* by locals and students from neighboring schools and colleges to be encouraged.
- Local administration must employ local youths as civil volunteers to monitor the day to day activities in tourist sites.
- Solid and Liquid resource management system to be employed across all Panchayats in Mainpat. This would help in holistic management of the study area. Motivation of such interventions can be taken from success stories of Ambikapur.
- Day wise waste generation data is to be documented across tourist destinations in Mainpat. This would require a development of localized Data Center specifically dedicated to Mainpat.
- *Swachh Bharat Abhiyaan* is currently ongoing and first phase of the scheme would culminate in 2019. The level of the implementation of the scheme in Mainpat is satisfactory but requires more optimistic intervention of locals. Youth and Women must be encouraged to make the scheme widely - Social forestry schemes would do wonders for Mainpat. Village level social forestry groups would play a pivotal role in ensuring afforestation activities across Mainpat. Surguja Forest Department can play a positive role in ensuring success to the scheme of '*Hariyar Chhattisgarh*'.



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- Major programmes of Mainpat include '*Mainpat Carnival*' when there is huge tourist inflow. Mega awareness programmes in such festivals would go a long way in ensuring positive response from the communities in scientific management of waste.
- All the tourist zones of Mainpat are to be declared as '*Plastic Free*'. Successful interventions in tourist places such as Mussorie can motivate people here in ensuring the positive implementation of the programme.
- Eco-task force to be constituted across the entire village Panchayats of Mainpat. This task force would include students, youth and women. They would play a successful role in timely intervention in terms of waste management, mega plantation, checking of soil erosion and holistic management. The Eco-Task force would work in tandem with government bodies and NGOs currently active in Mainpat.
- The tourist accommodation is ill managed in Mainpat. Private bodies do not pay attention to scientific waste management. Immediate interventions in such aspects are necessary.
- A cadre of volunteers is to be instituted in the hotels, resorts and public places such as bus stands, tourist sites that would monitor the cleanliness of the area on a daily basis.

### References

- Agarwal, A. et. al (2016). A Review on the Present Status of Municipal Solid Waste Management. SSRG International Journal of Civil Engineering (SSRG-IJCE) Vol 3, Issue 5.
- Babayemi, J. O., Dauda, K. T. (2009). Evaluation of Solid Waste Generation, Categories and Disposal Options in Developing Countries: A Case Study of Nigeria. Journal of Applied Sciences and Environmental Management. 13(3), 83-88.
- Castelloe, P.; Gamble, D. N. (2005). "Participatory methods in community practice: popular education and participatory

rural appraisal". In Weil, Marie; Reisch, Michael. *Handbook of community practice*. Thousand Oaks, CA: Sage Publications, pp. 261-275.

- Census of India,(2001): Primary Census Abstract and Administrative Tables-Delhi, Census of India, Delhi.
- Chambers, R. (1981).Rapid rural appraisal: rationale and repertoire. *Public Administration and Development*, Vol.1 95-106.
- Chambers, R. (1994). The origins and practice of participatory rural appraisal. (PDP). *World Development* 22 (7): 953-969.
- Hoornweg, D. and Laura Thomas. 1999. *What A Waste: Solid Waste Management in Asia*. Working Paper Series No. 1. Urban Development Sector Unit. East Asia and Pacific Region.
- Kaushal, R., Varghese, G., Chabukdhara, M. (2012). Municipal Solid Waste Management in India-Current State and Future Challenges: A Review. *International Journal of Engineering Science and Technology*, 4(4). 1473- 1489.
- Kumar, et al. (2004): "Qualitative Assessment of Methane Emission Inventory from Municipal Solid Waste Disposal Sites: A Case Study, *Atmospheric Environment*, 38, 4921-29.
- Leurs, R. (1997). Critical reflections on rapid and participatory rural appraisal. *Development in Practice*. 7(3): 290-293. JSTOR 4029070.
- Misra, V. And Pandey, S. D. (2004). Hazardous waste, impact on health and environment for development of better waste management strategies in future in India. *Environment International*, 31, 417-431.
- Nandan, A. (2017). Recent Scenario of Solid Waste Management in India. *World Scientific News* 66.

#### 44 Challenges & Management of Environment & Disaster

- Narayanasamy, N. (2009). Participatory rural appraisal: principles, methods and application. Los Angeles: Sage Publications. ISBN 9788178298856.
- Post, J.L. (2007). Solid Waste Management in Jamaica: An Investigation into Waste Reduction Strategies. Thesis submitted to Michigan Technological University.
- Pretty, J. N.; Vodouhê, Simplicie D. (1997) [1984]. Using rapid or participatory rural appraisal. In Swanson, Burton E.; Bentz, Robert P.; Sofranko, Andrew J. Improving agricultural extension: a reference manual (2nd ed.). Rome: Food and Agriculture Organization of the United Nations. ISBN 9251040079.
- Robinson-Pant, Anna (1995). "PRA: a new literacy?". PLA Notes. 24: 78–82.
- Sontheimer, S., Callens, K., and Seiffert, B. (1999). "PRA tool box". Conducting a PRA training and modifying PRA tools to your needs: an example from a participatory household food security and nutrition project in Ethiopia. Rome: Food and Agriculture Organization of the United Nations.
- Sarkar, P. et. al (2003) "Solid Waste Management In Delhi – A Social Vulnerability Study" Proceedings of the Third International Conference on Environment and Health, Chennai. Chennai: Department of Geography, University of Madras and Faculty of Environmental Studies, York University. Pages 451 – 464.
- Singh, D.N. and Singh, J. (2004): "Studies on Solid Waste Disposal and Management: A Review", Annals of NAGI, XXIV, No. 2. 74-88.
- Tahir, M. Dr. et. al (2015). Scenario of Present and Future of Solid Waste Generation in India: A Case Study of Delhi Mega City. Journal of Environmental and Earth Science ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online) Vol 5, No. 8.
- Talyan V., Dahiya, R.P., Anand, S., Sreeprishman, T.R. (2008): "State of municipal Solid Waste Management in

## Understanding Solid Waste.....of Chhattisgarh, India

Delhi, the capital of India , Waste Management, 28, 1276-87.

- Toolkit for Solid Waste Management. (2012). Retrieved December 10, 2014 from <http://jnnurm.nic.in/wp-content/uploads/2012/11/SWM-toolkit.pdf>.
- Trivedi, Dr. J. (2015). A Study on Household Waste Management Practices in Gandhinagar City ISSN 0971-1023 NMIMS Management Review Vol XXVII
- UNDESA. 2005. Agenda 21- Chapter 21 Environmentally Sound Management of Solid Wastes and Sewage-related Issues. Division for Sustainable Development, United Nations Department of Economic and Social Affairs. (Available online at <http://www.un.org/esa/sustdev/documents/agenda21/index.htm> ).
- UNEP (United Nations Environment Program) (2001). State of Waste Management in South East Asia. [http://www.unep.or.jp/ietc/publications/spc/State\\_of\\_waste\\_Zang](http://www.unep.or.jp/ietc/publications/spc/State_of_waste_Zang)
- WC (1998) Current status of solid waste and its management and countermeasures in China (in Chinese). Chinese Environ Prot Ind 8:14-16
- United Nations Statistics Division- Environment Statistics. <http://unstats.un.org>.
- Waste Composition Study. (2009). Retrieved December 17 2014, from [http://www.co.thurston.wa.us/solidwaste/regulations/docs/Thurston County Waste Comp-08 09.pdf](http://www.co.thurston.wa.us/solidwaste/regulations/docs/Thurston%20County%20Waste%20Comp-08%2009.pdf).
- WHO (1995). Solid Waste and Health , Briefing Pamphlet 5, European Series, Regional Office for Europe, Copenhagen, WHO.
- World Bank (2012). WHAT A WASTE A Global Review of Solid Waste Management. Urban development series knowledge papers. World Bank.
- Dhokhikah, Y. and Trihadiningrum, Y. (2012). Solid Waste Management in Asian Developing Countries: Challenges and Opportunities. Journal of Applied Environmental and Biological Sciences. J. Appl. Environ. Biol. Sci., 2(7)329-335.

## ANNEXURE 1- 1

Our survey during primary data collection includes a Questionnaire Based Survey. The following questions were asked to the respondents randomly surveyed in different sites of the study area.

Questionnaire Survey (As asked to the locals of the study sites)	Questionnaire Survey (As asked to the tourists visiting the study sites)
1. Do you feel that the surroundings are sufficiently clean?	1. What is the purpose of visiting Mainpat?
2. Which campaign has been started by the government of India for making India a clean and green country?	2. What is the duration of stay in Mainpat?
3. Are you aware of Swachh Bharat Abhiyan?	3. What is your feeling on <i>Swachh Bharat Abhiyan</i> ?
4. Who is the inspiration behind the concept of Swachh Bharat Abhiyan?	4. What would be your contribution in <i>Swachh Bharat Abhiyan</i> ?
5. What is the full form of ODP?	5. What is your perception on cooperating with locals in maintaining cleanliness of Mainpat?
6. How do you dispose of your house waste?	6. How do you manage wastes in your houses?
7. How would you keep your locality clean?	7. Can you suggest some measures for waste collection and management?
8. How many toilets are there in the village?	
9. How many toilets are constructed by Village Panchayat?	
10. How many toilets are self-constructed by villagers?	
11. How do you want to participate in Swachh Bharat Mission?	
12. What according to you can make the Swachh Bharat a successful Mission?	
13. How can the beauty of Mainpat be maintained?	
14. What role would be played by the locals in preserving the beauty of Mainpat?	
15. What are the awareness programmes that can be launched by the villagers to educate tourists visiting Mainpat?	

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## ANNEXURE: 2

NO.	NAME OF VILLAGE PANCHAYAT	BASELINE SURVEY GOAL	NUMBER OF SANCTIONED TOILETS			TOTAL GOALS	DETAILS OF THE AMOUNT (IN LAKH OF JANAPAD PANCHAYAT ATISRM)
			S.B.M	MNREGA	14 <sup>th</sup> FINANCE		
1	ROPAAKHAAR	699	366	0	0	366	0
2	JAJGA	453	453	221	0	674	21.60
3	SAPNAADAR	456	181	46	10	237	0
4	KALAJEEVA	456	312	138	0	450	0
5	BISARAPANEE	442	218	0	10	228	0
6	KARMHA	442	176	0	10	186	0
7	CHIDAAPARA	479	300	67	0	367	0
8	MAHARANIPUR	479	179	91	10	280	0
9	DAANGBUDA	303	297	117	0	414	0
10	HARRAMAAR	280	138	154	10	302	0
11	JAAMKAANI	280	131	279	0	410	0
12	JAAMDHODHEE	134	132	200	0	332	0
13	KADANEE	297	294	52	10	356	0
14	KAMLESHVARAPUR	626	211	0	10	221	0
15	KUDARIDHIH	626	288	0	10	298	0
16	KESRA	624	577	0	20	597	0
17	KHADGAOW	185	175	189	08	372	0
18	KUNIA	539	310	314	10	634	0
19	LURAINA	309	297	56	0	353	0
20	PAIGA	610	239	72	0	311	0
21	ASGAWAN	610	331	0	6	337	0
22	PARPATIYA	360	359	164	0	523	0
23	PEINT	229	215	154	06	375	0
24	SAMNIYAA	377	210	0	08	218	0
25	AMGAOW	377	160	75	10	245	0
26	SARBHANIA	459	386	110	05	501	0
27	SUPLGA	341	323	13	0	336	0
28	RAJAPUR	67	67	235	08	310	0
29	SALAI NAGAR	67	0	210	0	210	0
30	KOTE CHHAL	228	0	367	05	372	0
31	PIDIYAA	75	0	255	06	261	0
32	CHAINPUR	179	0	401	0	401	0
33	KARABEL	256	0	240	0	240	16.80
34	KOTE	330	189	437	0	626	0
35	BANDANA	404	0	669	0	669	0
36	UDUMKELA	230	0	379	0	379	0
37	NARMDAPUR	1384	1182	46	15	1243	0
38	BARIMA	506	341	142	0	483	34.30
39	KATKALO	732	549	144	19	712	73.60
	TOTAL	12593	9586	6037	206	15829	