Chapter -1

Introduction

All human activities inevitably produce waste and we civilized and industrialized human beings produce unnaturally high concentration of wastes in course of our living, forgetting that earth's ecosystem has only limited capacity to recycle the waste. Ironically waste was not a problem for society when men were primitive and uncivilized. With the development of civilization drastic changes came in our life style and in every activity like education, recreation, feeding, travelling, clothing and housing we are generating lot of waste. The modern culture of consumerism has aggravated the waste problem. To this has added the culture of disposables where large numbers of goods in the society are being manufactured for only one time use and to be discarded after use. Proliferation of disposals in the human society has aggravated the problem of solid waste, disposable writing pens, safety razors, syringes and needles, tumblers, cups, plates, have become common in modern society leading to huge discard of material after one time use which eventually ends up as waste. Packing has become a part of our modern lifestyle. Everything needs packing today from cornflakes to computer. Life cannot be imagined without glass bottles, plastic bags, containers, cardboard boxes, tins, metallic cans with consequence of generation of huge amount of various categories of waste.

Rapid population growth accompanied by the proliferation of the culture of consumerism, industrialization and urbanization give birth to large amount of solid waste both domestic municipal and industrial hazardous waste. Indirectly we also generate toxic and hazardous waste through the use of everyday items like detergents, solvents etc. The waste from high density urban communities commonly exceeds the carrying capacity of the biosphere absorption and the urban ecosystem to recycle. Waste rapidly accumulates as pollutants unless they are directed into biological pathways of earth to return into an active human ecosystem. The main source of solid waste in our cities are the garbage from the house holds, the by

products from various leather, plastic, textile, metallic and automobile industry, the refuses from hospital, offices and business establishment, the left over from vegetable and fruit markets. According to 2001 the population of Kanpur was 25.51 lakh. As per the estimate given by NEERI waste generation in Kanpur is 350gm per capita per day and is 1015 MT in the year 2011, accordingly the quantity of waste generation in Kanpur is expected to go up and it will become 1155 MT in the year 2016, 1315 MT in the year 2021 and 1696 MT in the year 2031 whereas actually the waste generation at present is much more than estimated. It has been recorded that on an average, 300 to 500 kg of waste is generated deliberately or unconsciously by an individual every year. The rocketing population growth and industrialization has led to an indiscriminate increase in consumerism chiefly in the urban sectors. The cities in India, when put together, generate an estimated amount of waste which sums up to 0.115 million metric tons every day and further to 42 million metric tons annually. The per capita waste-generation ranges from 0.2 to 0.6 kg per day in the Indian cities. It has been observed that more the population of a city, the greater is the quantity of waste generated. The cities with a population of more than 0.1 million, take the credit for generating a major portion of the waste. Such cities contribute to generating 72.5% of the waste across our country against the other 3955 urban centers that produce merely 17.5% of the total.

1.1 Conceptual Framework :

Before dealing with the domestic waste it is supposed to mention conceptual frame work of waste, solid waste, municipal waste etc. An attempt has been made to provide various views according to the concept of above mentioned wastes and its generation. Waste is anything which it's producer or possessor no longer requires and is unusable whatsoever without further processing. Commonly called Trash, Garbage or Refuse are its synonyms and discarded by all and sundry. Waste has, from times immemorial, been an un-detachable ingredient of the ecosystem; however it is now changing face and rapidly becoming a fatal predicament because of its unstoppable outpour being immensely more than the originally uncontaminated nature can cope with. It is estimated that the municipal waste comprise of maximum share 58% of kitchen and garden waste followed by 18%

Dust and ash, 15% Paper, 4.1% Textile, 2.3% Glass and ceramics, 2% Plastic and 0.6% Metals. Besides the municipal solid waste there are many other categories such as Farm and forest residues, industrial solid waste, Municipal solid waste, human excreta, animals dung and poultry dropping, unwanted aquatic and terrestrial weeds, hospital waste and nuclear and radioactive waste of human society. The solid waste from these sources constitute the waste papers, plastic, cotton rags, can, bottle, metallic scrap, rubber, auto tyre, tin, glasses, broken crockery's, furniture and fixture, plaster of paris and ashes. The other class of solid waste constitutes the vegetables peels and crushes, the non-edible leaves and roots, the bones and the non edible parts of meat producing animals. Conventionally speaking "waste" is anything that has no further use and is for discard but in low income countries like India frugal habits, resources scarcity and poorly paid workers are largely responsible for waste minimizing. To live unsustainable is to over load the earths carrying capacity with our wants. Every useful sort of household, shop or institutional waste is reused or traded material include clothes rag small goods bottle, plastics of all kinds (especially milk pouches), metal toys and cinder from coal fire. Food wastes are sold to poultry and pig farmer. Construction waste are used and taken as fill for road repairs. It is noticeable that different types of wastes have different time for its degradation from few months to hundreds of years. Some important waste types and their degradation time are presented in Table No. 1.1.

Table No. 1.1
Waste Type and their Biodegradation Time

Sl. No.	Type of waste	Degradation Time
1	Banana peels	1 month
2	Paper bags	1 month
3	Paper	2-4 month
4	Cotton rags	5 month
5	Orange peels	6 month
6	Woolen socks	1 year
7	Wood	10-15 year
8	Leather shoes	40-50 year
9	Aluminum	80-100 year
10	Aluminum can	200-500 year
11	Disposable diaper	500 year
12	Styron foam cups	Eternity
13	Plastic/Plastic Bags	Unknown

Waste differs from economy to economy. Growing population and increasing consumption oriented lifestyle have created the problem of waste that assumed disturbing and dangerous dimension. Serious hostile impacts on public health and life-sustaining problems in our surrounding environment may be foreseen if disposal of refuse and its management is delayed or inefficiently done. Waste, that is not properly managed in households and communities, from where it originates, is a severe social health hazard and leads to the spreading of infectious diseases. Unattended waste attracts flies, rats and other agents that spread and transfer contagious diseases. An estimate reveals that about 70,000 houseflies can hatch out on one cubic feet of garbage. The decomposition of waste that is wet causes its surrounding to stink, leading to thoroughly unhygienic living conditions and ruining the surrounding view.

Plastic waste is one of the major causes of ill-health and road calamities. Excessively generated solid waste is haphazardly dumped by the roadsides, narrowing the roads and making them more prone to accidents. Hungry stray cattle chew upon plastic bags and are on most occasions suffocated to death. The consumed but intact plastic water bottles are rinsed, filled with whatever water available and resold; inviting severe health disorders, individually and socially.

Pre-school going children, garbage collectors and workers in the factories producing toxic and hazardous material are at the highest risk of health and life from the unscientific disposal of solid waste. Other high risk groups include the people temporarily settled close to garbage dumps and whose water has been contaminated either due to garbage dumping or leakage from landfill sites. Unattended solid waste attracts stray cattle and animals that nose around the dump consuming toxic waste resulting in their death. All summed up, overlooking waste management degrades the environment; land, water, air and above all affect human health.

Garbage in the city comes from our home, shops, Restaurant, local manufacturing units, street sweeping and even hospitals. The quantity of solid waste generation in a city depends on the Population, Socio-economic status of population and number of commercial, industrial, recreational, transportation, communicational, institutional and health establishment. On the basis of Bio-

degradation the wastes are of two types, one is Bio degradable waste which include paper, plants, animal products which can be degraded by the micro organisms like bacteria, fungi etc. These include kitchen waste, waste from fruits, vegetables, meat, fish markets etc. The other is non bio degradable which cannot be degraded by micro organism, bacteria and fungi e.g. plastic X-ray films, celluloid films, batteries, chemicals, radioactive waste, synthetics, heavy metals etc. The non-degradable wastes are most dangerous as they can remain in the environment for decades with out being degraded. They are the biggest source of environmental pollution today.

David Wann, Buzzworm, said that "The Packaging for a microwavable "microwave" dinner is programmed for a shelf life may be of six months, a cook time of two minutes and a landfill dead times of centuries."

With the rapid increase in global population and the rising demand for food and other essentials, there has arrived a surge in the household waste being generated every day. This heaping refuse should eventually find its place in the municipal waste-collection-centers where it should be collected by the specific area municipal authorities and be dumped as landfill. Sadly enough, this unhygienic, life-threatening trash never gets collected and transported to final dump sites, and the credit goes to our extremely inefficient infrastructure.

1.2 Theme of the Study :

The study is entitled "Domestic Waste Disposal And Its Management In Kanpur Metropolis" therefore the primary focus concentrates on the evaluation and analysis of day-to-day domestic solid and liquid waste disposal in Kanpur Metropolis.

This study of domestic waste explains the amount and variety of household waste in detail. It also provides analysis of spatial variation of waste disposal and left over. Therefore the sub-theme of this research work is classified into the following types:-

1- **Kitchen waste-** The vegetable, fruit, left over food and residues (*also called garbage*) resulting from handling, preparation, cooking and eating.

2- **Domestic waste -** Waste material like paper, cardboard, plastics, rubbers, wood, furniture, glass, broken utensils, used plastic bags etc.

3- **Domestic Effluent -** The water considered a waste, drained after use from houses.

1.3 Objectives :

The main objectives of the study are:-

1. To estimate the amount of daily domestic waste disposal.

2. To identify the waste types and their quantity.

3. To investigate daily domestic effluent.

4. To analyze spatial pattern of waste disposal.

5. To examine the impact of improper waste disposal on human health.

6. To evaluate environmental degradation caused by improper disposal.

7. To suggest remedial measures for the better waste disposal management and its utilization.

8. To generate awareness among the common mass and make them realize their moral responsibilities towards quality of environment.

1.4 Details of Hypothesis/ Model/Theory/ Experiments Used :

Present study is based on various hypothesis which we have formed at the time of initiating the study. These hypothesis have given a direction to work on them and get it tested. Some of them are as follows:

1. Attitude of people from different socio-economic group varies greatly towards the waste disposal.

2. More than half of the families of metropolis do not know the quantity of waste improperly disposed.

3. Only 2% families of Kanpur Metropolis disposed their waste in proper way while 98% disposed in a very improper way.

4. More than 90% people of Kanpur Metropolis are environmentally unaware and not sensitized.

5. Similarly 90% people do not segregate the waste produced by them and

disposed collectively.

6. Exclusively rich class families produce waste in large quantity but most of the waste such as food and recyclable are utilized by domestic servants.

7. Middle class families group is the only category which is more or less generous towards the generation and disposal of daily waste produced by them.

8. Only 50% of the families are aware to earn money by selling classified waste to waste-vendors.

9. Slum dwellers do not bother about the quantity of waste and the method of its disposal but if these can be properly segregated and sold then can earn and protect their surrounding environment as well.

10. Tea leaves, vegetable peels and fruit peels can be converted into manure by vermicomposting and used as biogas energy.

11. Vermicomposting practice is very rare phenomenon in Kanpur Metropolis but it can be popularized among the small family groups by generating environmental awareness.

1.6 Study Area :

Present study is related to Kanpur Metropolis which is biggest million city of Uttar Pradesh. Kanpur Nagar is divided into three sub divisions such as Kanpur Sadar, Ghatampur and Bilhaur. Kanpur Metropolis covers a major part of Kanpur Sadar sub division. Kanpur urban area or Kanpur city includes Armapur Estate, Chakeri, Cantonment Board, Northern Central Railway Colony and Kanpur Municipal Corporation. Armapur Estate is a Colony of Ministry of Defense where the employees of Ordinance factory, Small arms factory, and Field gun factory reside while Chakeri is Air Force area which is also under Ministry of Defense. Similarly Cantonment Board is Army unit area but some areas such as Meerpur Cantt, Rail Bazaar, Faithfulganj and Shanti Nagar are the civilian area in cantonment Board. In our study region, restricted areas are left so only Municipal Corporation and NCR colony are taken as a study region (Fig. 1.1). Kanpur Metropolis lies in the 26° 30' N latitude and 80°20' E longitude. The municipal area of the city has an

extension of 261.50 km^2 and the urban agglomeration of 2551337 as per 2001 census with literacy rate of 68.03%. The Kanpur Metropolis is nestled on the right bank of eternal Ganga River, stands as one of the North-India's major industrial centre with its own historical, religious and commercial importance. Although the region lies in the middle of Ganga plain at an altitude of 126 m above the sea-level but there is also variation in relief feature because of low altitude. There is a water divider along the Grand Trunk Road therefore, northern portion from Grand Trunk Road has slope towards north whereas the southern portion of the city has the slope towards the south. On the whole, the entire region slopes from west to east. The area is drained by two rivers, River Ganga and River Pandu and the city lies between the doab of these rivers. There are artificial nalas which help to drain the river water. Kanpur enjoys the climate of the plains i.e. warm and dry. Summer is fairly hot and temperature goes upto 48°. Hot winds and Loo blow during summer. Winters can be very cold. Four months, June to September forms the rainy season with 91.4 cm of rainfall. Being located in Ganga valley, it is blessed with fertile alluvial soil that supports all variety of crops, vegetable. A large variety of deciduous trees are found all over the city, in gardens, parks and along road side. Only Allen Forest is a forest patch in the city covering an area of about 76 hectares, which also serves as a Zoological Garden and a picnic spot. Settlement pattern in the city is planned partially by Kanpur Development Authority and rest is unplanned. Even then there are dense nucleated patterns found along the Grand Trunk Road, markets and important visiting places. Kanpur is believed to be founded by King Hindu Singh originally known as 'Kanhpur'. It was declared as district on March 24, 1803. After 1857, the development of Kanpur was even more phenomenal. Government harness and saddlery factories were started for supplying leather material for army in 1860, followed by Allen-Cooper and Company in 1880. The first cotton textile mills were started in 1862. With the growing number of industries Kanpur gradually converted into a industrial city. Within last two decades, many industries were closed due to their sickness and unproductiveness but still it is considered as Industrial Metropolis of UP. It is also an educational centre with institutions like Harcourt Butler Technological Institute, Agricultural College, Indian Institute Of Technology, GSVM medical college, National Sugar Institute and Government textile institute,

C.S.J.M. University and Chandra Shekhar Azad Agriculture and Technical University.

The most commonly spoken language is Hindi. Kanpur has mixed variety of people who are said to be very tolerant. All the major Indian religions have their representatives in Kanpur with its usual vigor and economic potential, the life style is fairly brisk and active contributing substantially towards the general economic development of the country as a whole. The city of Kanpur enjoys all modern and developed facilities of communication and transportation. Dense network of roads are found connecting almost every part of the city. The city lies along the Grand Trunk Road i.e. NH-2 (Delhi, Agra, Allahabad, and Kolkata) with other important National Highways such as NH-25 (Lucknow, Jhansi, Shivpuri) and NH-86 (Ghatampur, Hamirpur) and NH-91 Kanpur, Kannauj, Etah, Aligarh, Bulandshahar and Ghaziabad. It is located on the Delhi-Kolkata broad gauge double line electrified main rail-route. It is well connected with Jhansi, Farrukhabad, Lucknow and Raibareli by other broad gauge rail line. The city also enjoys air travel facility from Chakeri to Delhi. Chakeri Airport Kanpur has become operational since January 1996 and is served by UP. Kanpur city has grown from an area of 8236 hectare in 1946 to 29670 hectare in 1962 which includes the cantonment area too. In 1962, it was spread from Beri Akbarpur in the west to Ruma in the east and from Ganga River in the north to Pandu River in the south. As per master plan 1991, in 1962 out of total 29670 hectare, 8863.5 hectare(29.9%)was developed land, rest 18235.7(61.5%) was agricultural land with 2570.8 hectare (8.6%) was open land. In 1997-98, total metropolitan area increased to 89131.15 hectare out of which 4,743.9 hectare(5.31%) was non- defined (prohibited area) and rest 29683 hectare and 54704 hectare (61.39%) was urban and rural area respectively. Over a period of time, Kanpur has developed linearly from east to west along River Ganga and GT road. The central business district (inner city) is located in the north central part. It is heavily built up and characterized by mixed commercial and transportation related activities. The public, semi-public, residential and other land use activities have been mostly concentrated in the west. Due to physical constraints of river in the north and cantonment in the east, industrial concentration followed western / southern expansion. It is situated in the southern bank of Ganga River and has been an

important place in the history of modern India. Kanpur is the biggest city of the state Uttar Pradesh and is the main centre of commercial and industrial activities. The city formerly known as Manchester of the country is now called the commercial capital of the state.

The study area Kanpur Metropolis is administered by Kanpur Nagar Nigam. Kanpur Nagar Nigam is divided into six zones for the purpose of administration. There are 110 municipal wards in Kanpur nagar Nigam. The 110 wards are locationally divided into 6 zones where zone 1 to zone 4 has 18 wards each but zone 5 and zone 6 has 19 wards each. When the Nagar Nigam came into existence and the boundary of Municipal Corporation was finalized, 187 villages which were located earlier at the fringe came under Municipal boundary and they have become part of different wards but most of them are still rural in nature. Mainly these villages are confined in the zone 2, zone 5 and zone 6 while some villages are covered in zone 3 also. The Zone wise wards number, name and its population are presented in Table No. 1.2 and the location of these zones and wards is represented in Fig. No. 1.2

Table No. 1.2
Zone-Wise Ward Name, Number and its Population
Zone 1

Sl. No.	Ward Name	Ward Number	Population
1	Maheshwari mohal	101	24012
2	Patkapur	100	23871
3	Generalganj	102	25132
4	Collectorganj	109	22481
5	Civil lines	59	25418
6	Chowk Sarrafa	106	20354
7	Parade	103	21437
8	Anwarganj	40	23858
9	Harvansh Mohal	97	21562
10	Cooperganj	85	23098
11	Dalelpurwa	84	21283
12	Sisamau (S)	50	23647
13	Raipurwa	21	21267
14	Chammanganj	99	24835
15	Danakhori	105	24063
16	Laxmipurwa	2	26440
17	Chataimohal	92	22206
18	Nazirbagh	104	20074

Zone 2

Sl. No.	Ward Name	Ward Number	Population
1	Shyam Nagar	77	24952
2	Chandari	95	26213
3	Daheli Sujanpur	53	26629
4	Ompurva	44	23726
5	Safipur	29	19757
6	Yashoda Nagar(E)	91	25954
7	Sanigawa	19	25523
8	Krishna nagar	28	26137
9	Jajmau(N)	86	24650
10	Chakeri	10	20238
11	Yashoda Nagar(W)	67	25908
12	Tiwarpur	70	21081
13	Jajmau(S)	66	23430
14	Hanspuram	39	25255
15	Pashupati Nagar	48	24202
16	Naubasta(E)	30	25203
17	Gandhigram	71	20227
18	Harjinder Nagar	37	22736

Zone 3

Sl. No.	Ward Name	Ward Number	Population
1	Babupurwa Colony,	54	25360
2	Bakarganj	31	24593
3	Transport Nagar,	12	23358
4	Babupurwa	96	21758
5	Munshipurwa	75	21285
6	Begumpurva	108	22905
7	Usmanpur	24	25067
8	Juhi Kala	79	24733
9	Naubasta	83	21206
10	Basant Vihar	58	23064
11	Kidwai Nagar(s)	55	25270
12	Kidwai Nagar(n)	90	25963
13	Jarauli	81	20737
14	Bingawan	36	26455
15	Barra(e)	80	23553
16	Karrahi,	88	20805
17	Sabji Mandi Kidwai Nagar	23	23890
18	Juhi Hamirpur Road	25	25399

Zone 4

Sl. No.	Ward Name	Ward Number	Population
1	Sooterganj	76	24717
2	Sisamau(N)	41	20884
3	Gandhi Nagar	65	19895
4	Benajhabhar	22	19900
5	Khalasi Line	13	19716
6	Prem Nagar	78	19875
7	Swaroop Nagar	49	24001
8	Colonelganj	110	23183
9	Talaq Mohal	107	23941
10	Jawahar Nagar	11	21677
11	Chunniganj	5	21735
12	Parmath	15	22091
13	Mc Robertganj	6	21943
14	Beckanganj	94	20937
15	Purana Kanpur	1	24158
16	Nehru Nagar	51	20203
17	Gwaltoli	4	21130
18	Ashok Nagar	43	20243

Zone 5

Sl. No.	Ward Name	Ward Number	Population
1	Govind Nagar	3	26153
2	Juhi Parampurwa	35	25373
3	Bhannanapurva	47	21158
4	Govind Nagar(N)	98	25175
5	Fazalganj	38	20993
6	Gangaganj Panki	33	26282
7	Swaraj Nagar Panki	64	22860
8	Ravidas Puram	74	21733
9	Gujjaini Colony	69	20892
10	Dabauli	52	25828
11	Saraimeeta	17	26557
12	Barra (W)	73	21363
13	Barragaon	62	24322
14	Nirala Nagar	7	26532
15	Barra (S)	60	26080
16	Ratanlal Nagar	56	20422
17	Naseemabad	72	20642
18	Kaushalpuri	89	22655
19	Govind Nagar (S)	93	25304

Zone 6

Sl. No.	Ward Name	Ward Number	Population
1	Nawabganj	45	26588
2	Khyora	16	25960
3	Kakadeo Navin Nagar	57	20344
4	Masvanpur	8	24937
5	Vishnupuri,	9	26377
6	Kalyanpur	18	22402
7	Vinayakpur	46	26243
8	Kakadeo	87	20021
9	Geeta Nagar	63	19880
10	Ambedkar Nagar	14	19833
11	Awas Vikas	42	26111
12	Rawatpur Gaon	68	23775
13	Shashtri Nagar	82	25031
14	Vijay Nagar	26	24352
15	Sarojini Nagar	27	23357
16	Sarvodaya Nagar	34	19755
17	Lajpat Nagar	61	22073
18	Nankari	32	20530
19	Naramau	20	20970

According to Kanpur Nagar Nigam the physical characteristics of Municipal Solid Waste can be classified into 8 categories as mentioned in Table No. 1.3

Table No. 1.3
Waste Component/Classification and their Share

Classification of waste	Percentage
Garden/horticulture waste/dairy waste etc	30%
Food waste	16%
Paper/Card board	4%
Plastic	14%
Glass	0.5%
Metal	0.25%
Drain silt	19.25%
Construction waste	16.0%
Total	100%

According to KNN officials at present waste generation in the city is around 1500 MT for Kanpur organic waste constitute largest component followed by inert material such as building material and debris etc in over all composition of waste that is waste generation from household commercial establishment and institutions in Kanpur as shown in Table No. 1.4

Table No. 1.4
Waste Component and their Share (in percent)

Waste components	ICDP Report	NEERI Report	Own Investigation
Organic	47.27	56.67	46
Paper	3,58	3.18	17.5
Rubber, leather, synthetics	2.72	0.48	0.05
Plastics	4.5	-	5.36
Rag / Linen	3.97	-	1.22
Glass	-	0.48	12.38
Metal	0.24	0.59	15.32
Plastic bags	Unmeasured	Unmeasured	1.95
Inert material	38.82	40.07	0.22

1.6 Relevance of the Study :

The proposed work is a comparative unmatched and statistical representation of domestic waste disposal which is per person in Kanpur metropolis inclusive of all social level categories. As a matter of fact, no such study has been dealt with earlier in such an analytical method. This study has been done so as to depict the consequences of improper waste disposal which leads to environmental degradation and health hazards which is of cause of a great concern in the present scenario. Along with a devastating threat on the environment, improper disposal of domestic waste also leads to over utilization of Natural Resources resulting into their untimely exhaustion.

When dumped into the open or by the roadsides, garbage and other trash ruin the surrounding view and produce unbearable odor, not sparing the narrowing of roads and inviting road mishaps. To resolve these problems it is essential to start from the local and individual level in our own city Kanpur; as we stand in the second place in the world and the first in Asia to be honored in terms of causing and spreading pollution.

We are primarily responsible for the adverse impact on the environment to a great extent. If at all, effective and strategic counter- measures are taken for the management of domestic waste and its disposal, we will steadily abandon the

overuse of Natural Resources and ensure the prevention of environmental quality for the present as well as the future generation.

The aforesaid study is designed to generate environmental awareness among the residents of the city and to make them know the classification of bio-degradable and non-bio-degradable waste. The study encourages civic sense among the common ignorant people which will definitely maintain the aesthetic and civic facilities of the city. By guiding people to practice reducing waste, will minimize the domestic waste at the source where these problems of improper domestic waste disposal will be sorted out to quite an extent also saving national and individual wealth which is spent on further processing.

Through a proper and positive feedback by the local residents of Kanpur, we will assume definite ground for our future generations to come and help nature to recover her losses. The only thing we need is attention, awareness and concern which very well show the reliance and significance of this environmental and analytical study that is going to be a milestone in managing domestic waste of Kanpur metropolis. This study will not only enrich the Environmental Geography but also act as a guide line for further environmental studies. This study is significant and crucial in itself; as it has scrutinized the vicinities in and around. The emphasis has been centered and laid mainly on domestic waste which is generated so generously in our surroundings and is scarcely disposed in the way environmentalists propose.

1.7 A Brief Review of the Work Already Done in the Field :

Literature related to this topic is not sufficiently available in geography. Most of the work has been done in context of Municipal solid waste management/Urban solid waste management and sewage in Environmental Science. The work that has been done till date, has been unable to leave behind a fossil effect. Mr. F. Flinthoff from the WHO Regional Office in 1970, and later Tabasaran in 1976 and Croll in 1978, suggested some long term and short term diagnosis of Solid Waste Management basically meant for its smooth functioning. Wertz in 1976 discussed in his studies about the economic aspect of a household's decision to produce more or less refuse. He mainly analyzed the concept of household behavior

on waste generation due to changes and diversities in the income, the price of refuse service, the frequency of service and the site of refuse collection and packaging. In 1978, the study of Richardson et al shows that grass-yard waste and newspaper was positively co-related to the level of income.

A study by the Waste Management Research Unit in Grifith University prepared a report that Economic and Environmental impact of disposal of kitchen organic waste using traditional landfills were worked with home composting. Tuladhar in 1996 worked on organic nature of waste which can be used as manure; hence the waste collected was dumped in open fields for degrading. In 1996 a strategy paper on "Solid Waste Management in India" was given by National Environmental Engineering Research Institute (NEERI). The study of Sinha in 1997 reveals that burning of household waste in developing countries increases ample emissions of Green House Gases. As per a report of The Energy Research Institute (TERI) in 1998, about 90% waste is dumped in low lying areas and only 10% is processed in mechanical composed plants.

Daskalopoulas et al in 1998 showed in their work that the population and the main living standard of a country are two main parameters affecting annual quantity and composition of Urban Solid Waste generated. Julius N Fobila et al between the years 1985-2000 gave an analysis of waste collection system and worked out on "The influence of Institutions and Organizations Urban Waste in Accra, Ghana" which was published in The Journal of Environment Management. Sundaravadival in 2000 and Venkateshwaran in 1994 considered Urban Solid Waste dumping responsible for the Surat (*Gujarat*) epidemic. The study conducted by Kumar et al in 2001 reported that photocopying paper represents a large component of USW on the campus.

Sharma, in 2001 worked that "Unlike in developed countries, the waste of the Indian cities has a high fraction of Degradable organic matter from 35-75%. This fraction of garbage has high energy potential compared to 12-15% in USA and UK." R. A. Slater and J. Fredrickson, in 2001, studied composting municipal waste in Europe and prepared an article 'Composting Municipal waste in UK: Some lessons of Europe.' Deepa et al and Som Shekar et al, in 2002 studied that food habits,

cultural tradition, lifestyles, climate and income are responsible for composition of wastes in Indian Urban cities. Institutional and Community Development Project, India (ICDP) prepared a technical report in 2007 about solid waste management in Kanpur. The report contains the strategies of collection and disposal methods of all wastes.

The potential of solid waste was analyzed by Romeela Mohee of Mauritius in 2002 and her work 'The Assessment of Recovery Potential of Solid Waste' was published in The Resource Conservation and Recycling Journal. As per the study conducted by Srivastava in 2002, there are no estimates of people involved in waste recycling sector in Kanpur city and according to his estimate about 15,000-20, 000 people are working for waste recycling. According to Chakraborti and Hammer in 2003, Urban Solid Waste is dumped in shallow layers in unused areas around towns and cities. Jaffrin et al in 2003 concluded that most of the countries in the world utilize the option of landfill for the disposal of waste that gives rise to liquid and gaseous end product such as leach-ate and bio-gas. A study conducted by Srinivas et al in 2003 concludes that Urban Solid Waste component heaps are burnt either on the roadsides or at dump sites to reduce volume. Ahmad and Ali (2004) explored the micro and small 'enterprise with twenty employees having small capital and low cost technology'. Han et al found that another segment of people called 'informal sector' which are unregistered, unregulated are engaged in waste management to some extent in 2004, in India. Lemieux et al in 2004 studied the management of household waste in developed countries and concluded his work in the paper entitled 'Open burning of household waste in developing countries'. The desire of more sustainable use of resources and less waste generation encouraged to design efficient process. Susan et al in 2005 worked for 'Moving Solid Waste Disposal to Material Management' in US. Ministry of urban development, Government of India, prepared a report through a survey 'Management of solid waste in Indian cities, New Delhi' in 2005. Travis Wagna and Paul Arnold, in 2006, proposed a new model - 'Solid waste management and analysis of the Nova Scotia MSW strategy'. Very importantly, Jaya Nair et al, in 2006, studied composting and worked out 'Effect of pre-composting or vermicomposting of kitchen waste' in a journal 'Bio-resource technology', Stephen Salhofer et al, studied the potential of MSW and the article

'Potentials for the prevention of municipal solid waste' was published in journal 'Waste Management'. Erhan Ercut et al, in the year 2007, studied and designed 'A multi-criteria facility location model for MSWM in North Greece, to know the location of waste generation.

According to the study 'Household Behavior on Solid Waste Management: A case study of Kathmandu metropolitan city' conducted by Aggrawal et al in 2007, about 57% of households are served by door to door collection system. The work shows household behavior of Kathmandu residents towards solid waste management. 'Urban solid waste management in Kanpur, opportunities and perspectives was studied by H. Zia and V. Devadas, in the year 2007, which was published in 'Habitat International'. A preliminary report introduces numerous initiatives which have potential to create more sustainable operation in the city Kanpur. Solid waste and management studies were not only done by researchers, government organizations, but also by various NGOs. Assessment of kitchen waste and its applications were carried out in Delhi by Manik Thapar, MBA Businessman. As per a report published in 2007, in saving the planet, a national non-government organization of India, worked under a project *Kude se Dhaan* i.e. growing food on waste with people of Dindigul, South India. Similar strategy was worked out in Sagar, MP by the students of clean India with the help of local NGO, rural environment development society.

After reviewing the various literature related to waste disposal and management, it is found that various themes have been taken for study. No such work has been done in any region as we have taken up. Hence this work will fill the gap in the environmental geographic literature and will give a line of action for further researches.

1.8 Methodology of the Present Research Work :

The Methodology of present work consists of following steps:-

1.8.1 Data Collection :

The proposed study is mainly based on primary data which has been gathered from door to door survey with the help of filling a printed schedule

(Appendix 1,2 and 3) and measurement of disposed waste. The field survey has been conducted by the investigator through classified random sampling for the whole city. The samples are classified into following socio-economic groups on the basis of monthly family income.

Social Groups	Family Monthly income (In rupees)
1. Exclusive very high class	1, 00,000 and above
2. Very high class	75, 000 - 1, 00, 000
3. High class	50,000 - 75,000
4. Moderate class	25000 - 50,000
5. Low class	10,000 – 25,000
6. Very low class	5,000 – 10,000
7. Economical Weaker class	less than 5000

The total samples were 700 including 100 from each group of above mentioned seven social groups. The samples from above seven groups were selected from every administrative zone (six zones) of Kanpur metropolis to evaluate the waste disposal of whole Kanpur city. The quantity of waste was measured by weight scale or spring balance and the liquid disposal measured with the help of bucket used. Impact caused by improper waste disposal on environment and human health is assessed with the help of interviews from the doctors of various localities. It is worth mentioning that out of the 1500 households asked to participate in the pilot program 20% households refused to participate and 20% withdrew after participating for few days while 13.3% could not understand and gave improper information.

Information related to social, economical and demographical condition of the Kanpur city was collected from secondary sources such as :- Census of India, Kanpur Nagar Nigam, Kanpur development authority, Central pollution control board, State Pollution Control Board, Health department of the city, District statistical office, Gazetteer's etc. Number of houses and types of houses were measured with the help of satellite data.

1.8.2 Data Preparation and Analysis :

Collected information from the families has been compiled with the help of per sheet calculation for weekly and monthly total disposal along with the per person waste disposed. Further the prepared data has been classified and tabulated according to our objectives. The data is analyzed with the help of various statistical tools. Distribution pattern is analyzed with the help of GIS technique.

1.8.3 Cartography and Mapping :

All the analyzed results are represented through various cartographical techniques like line graph, bar graph, composite bar diagram, pie diagram, dot method, coropleth etc. GIS/Computer cartography is used for the generation of thematic maps of results.

1.8.4 Report Writing :

The whole analyzed work of this study is represented in the form of a report which contains nine chapters based on geographical conditions, domestic solid and liquid waste disposal and their impact on environment, health and disposal management. For example chapter first of the report is related to introduction whereas chapter second and third are related to physical and cultural environment of the study area. Chapter four namely Domestic solid waste disposal, include waste disposal of houses while chapter fifth is specifically concerned with the kitchen waste disposal. The liquid waste which is also known as domestic effluent is analyzed in chapter sixth. Environmental degradation and impact assessment of domestic waste disposal is presented in chapter seven while the management aspect of solid and liquid waste disposal is mentioned in chapter eight. Finally the last Chapter nine of this study entitled summary and conclusion denotes the summary of whole research along with the major findings, valuable suggestions and conclusion.