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IMPACT OF URBAN SPRAWL IN WASTE DISPOSAL MANAGEMENT: NEED ACTIONS REQUIRED MANAGING IN ALMORA TOWN

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ABSTRACT

*Urban sprawl, **also called** suburban sprawl, **the rapid expansion of the geographic extent of cities and towns and urban sprawl is caused in part by the need to accommodate a rising urban population. Almora is one newly sprawl town in the hilly region of Uttarakhand and due to newly sprawl town Almora facing many kind of waste disposal problems. According to censes year 2011 Almora town has 11 wards (total population 33755) and 14 villages (total population 14547) are situated near town sprawl border. There is 49 most waste disposal site in all 11 wards at Almora town but 25 waste disposal location are found without dustbin and wastage are over spread to the ground. The town wastage dumping zone is not a right place, which is outside the town but this is very harmful for environment and as well as human being who want to enter the town. A detailed field investigation was conducted in the study area to find out the cause of town sprawl, waste disposal, origin of wastage sources and need actions required to manage in Almora town of Kumaun Himalaya. Based on this study a detailed mitigation strategy has been worked out which may be useful for the government for management impact of urban sprawl in waste disposal in future.***

KEY WORD: ***Urban Sprawl, Waste Disposal, Wastage Sources, Actions Required, Almora***

1.0 INTRODUCTION

Audirac, 1990 studied present the term "Urban Sprawl" was first used in an article in The Times in 1955 as a negative comment on the state of London's outskirts. Definitions of sprawl vary; researchers in the field acknowledge that the term lacks precision. Fouberg (2012) studied urban sprawl is the unrestricted growth in many urban areas of housing, commercial development, and roads over large expanses of land, with little concern for urban planning. James et al., 2013 studied present the term urban sprawl is highly politicized and almost always has negative connotations and it is criticized for causing environmental degradation, intensifying segregation, and undermining the vitality of existing urban areas and is attacked on aesthetic grounds. Waste generation is continuous and occurs in all places where there are living things. As part of living things generate various type of waste products which are discharged directly to the environment. Nkwocha et al., 2019 presented a study which is define urban wastes can be defined as materials which are regarded un-useful by its producers or holders and therefore discarded and wastes occur in three different forms- solid, liquid and gaseous. Kalu et al., (2017) studies defined solid waste as any material which comes from industrial, commercial and domestic sources arising from human population activities which has no value to people.

Municipal solid waste management is the process of collecting of wastes, storing, treatment and disposal of solid waste in such a manner that they are harmless to environment, ecology, plants, animals, and

humans in general (Ezerie et al., 2017). Uwakwe (2013) studied that activities of man such as agricultural work, food processing, wood work, building and construction as well as others also produce various forms of wastes into the environment.

The overall aim of this study is to develop an optimum municipal solid waste collection and disposal system in Almora town area, Kumaun Himalaya India through recommending best work flow chart suggestion for waste disposal.

2.0 OBJECTIVES OF THE STUDY

The fundamental objectives of the present investigation to study the impact of urban sprawl in waste disposal and actions required to manage in Almora town of Kumaun Himalaya, which incorporates the following aspect:

- Study about urban sprawl and origin problems by Almora town sprawl.
- Problem of waste disposal in Almora town.
- Suggest locations for needed dustbin in the Almora town.

3.0 USED OF DATA AND METHODOLOGY

Primary data was collected from field study/observation method like GPS point and images. Secondary data are collected from research article, research papers, research Journals and books and population data based on census 2011 collected from municipal office Almora. Used of Arc GIS 10.2.2, Q-GIS, Google Earth Engine (GEE) and MS office word, excel, and paint software and techniques for the present study. Arc GIS 10.2.2 software was employed to recommend suitable sites for locating dustbins in order to enhance regular waste throwing based on convenient distance to households and maximum service coverage. The location of dustbin needed dustbin places collected by GPS and GEE software. Location map, dustbin location map, dustbin needed places map preparing by using Q-GIS. The source of ward map is NRDMS- Natural Resource Data Management System, Geography Department S.S.J. Campus, Almora (Uttarakhand). Diagrams making by using MS excel and picture adding with map by using MS paint.

4.0 LOCATION OF STUDY AREA

Almora town is districts headquarter of Almora district and the town falls in the Lesser Himalayan zone of Kumaun Himalaya. The town is set on a 6 km. long horse saddle ridge and is sprawl rapidly in the eastern and western hill slope. The study area viz., Almora town extends from $29^0$05’16’’N to $29^0$17’28’’N latitudes and $79^0$24’07’’E to $79^0$37’05’’E longitudes and total extends area of the town is 7.27 km^2 and town elevated at 1646 meter above the mean sea level (Figure-1). The average temperature of the town in summer is 28°-12°C and in winters 15°-2°C. According to census of 2011, total population of the town is 32518, while the total population of district Almora is 630567. The density of Almora district was 198 people/km^2 as per census 2011 and average literacy rate in 2011 was 80.47 compared to 73.64 of 2001. The sex ratio has declined from 1145/1000 (2001) to 1139/1000 (2011) in the Almora district.

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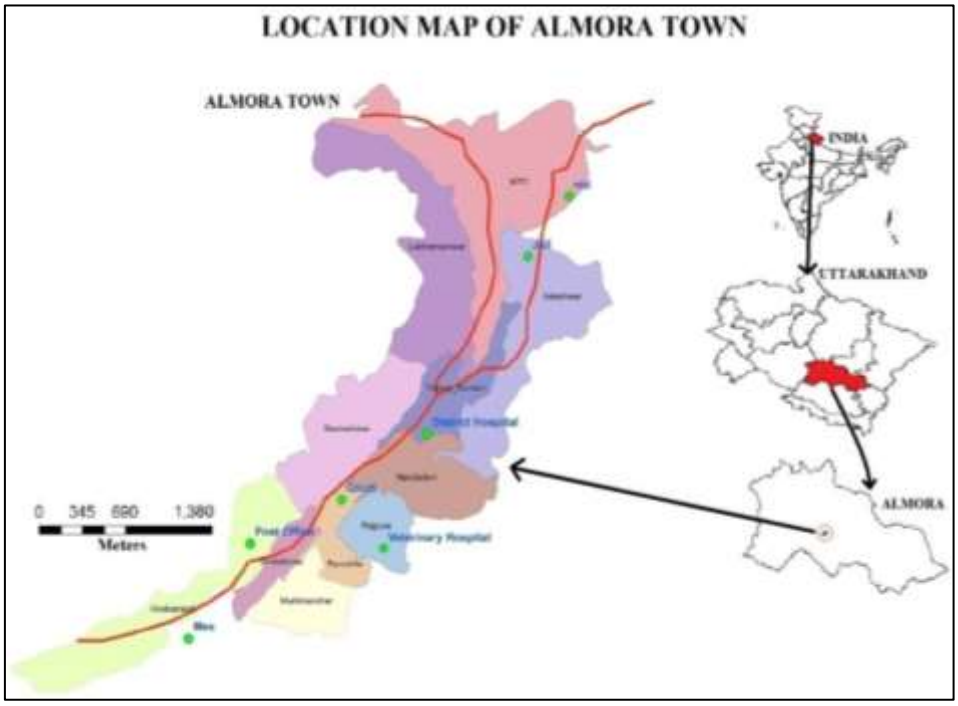

Figure-1: Location map of the study area viz. Almora town, Kumaun Himalaya, Uttarakhand.

5.0 DISSCUSSION

In this study, GIS technology is used to prepare dustbin location map, ward map and dustbin needed place maps. Table-1 and Figure-2 depicts population growth histories, Table-2 and Figure-4 depicts ward wise population growth in past three decades, Table-3 and Figure-5 depicts ward wise number of houses, Table-4 and Figure-6 depicts Land use land cover dynamics, Table-5 and Figure-7 depicts location of dustbin and Table-6 and Figure-8 depicts ward wise number of cleaners in the Almora town. Figure-3 depicts ward map of the study area viz. Almora town. Plate-1 depicts waste disposal management, depicts drinking water crisis, depicts drainage system blockage, depicts waste disposal near road and depicts construction on waste disposal, Figure-8 depicts dustbin needed places in Almora town and Figure-9 depicts work flow chart suggestion for waste disposal in Almora town.

5.1 Almora Town Sprawl

Bhatta et al. wrote in 2010 that despite a dispute over the precise definition of sprawl there is a *"general consensus that urban sprawl is characterized by unplanned and uneven pattern of growth, driven by a multitude of processes and leading to inefficient resource utilization."* according to Cobbinah and Darkwah 2016 studied, urban sprawl is one of the major outcomes of transformations resulting from population agglomeration in urban centers. Natural growth of population, reclassification of habitation, and migration are important factors in increasing the town and urban areas. Sprawl of town directly contributes to waste generation and unscientific waste handling causes health hazards and urban environment degradation.

Table-1 and Figure-2 presented population growth in Almora town since 1951 to 2011. Figure-3 is describing all 11 wards in Almora Town. Therefore, the size of the population is among the significant parameters for social, economic and environmental sustainability in any locality.

Table-2 and Figure-4 are presented ward wise population growth in different censes years i.e., 1991, 2001 and 2011. The rapid expansion of Almora town and population growth of the town area has affected the ecosystem in the area, both in terms of land degradation, water supply and loss of agricultural land. Likewise, the town population, area and built-up area growth collectively exert demand pressure on food, infrastructure, water, energy, roads, drainages, and health-care facilities. The result of the Table-3 and Figure-5 shows that the number of built-up in the Almora Town municipality expanded during the study period as the sprawl between 2011 and 2019. The increase number of houses in built-up areas is an ecosystem disservice because it has led to negative impacts such as massive road congestion, waste management, unsustainable land development, a decrease in public spaces and increased pressure on nearby environment and public services. The results of Table-4 and Figure-6 presents the land use land cover changes that the built-up area percentage increasing very rapidly and vegetation cover shrinking of the Almora town municipality expanded during the

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study period as the sprawl corresponded with increase in population of the Almora town municipality between 1990, 2000 and 2010.

Table-1: Population growth history of Almora town *(based in Municipality Office Almora Town).*

Censes years	Population growth of Almora town	Censes years	Population growth of Almora town
1951	12116	1991	27332
1961	16004	2001	30153
1971	19671	2011	32518
1981	20758		

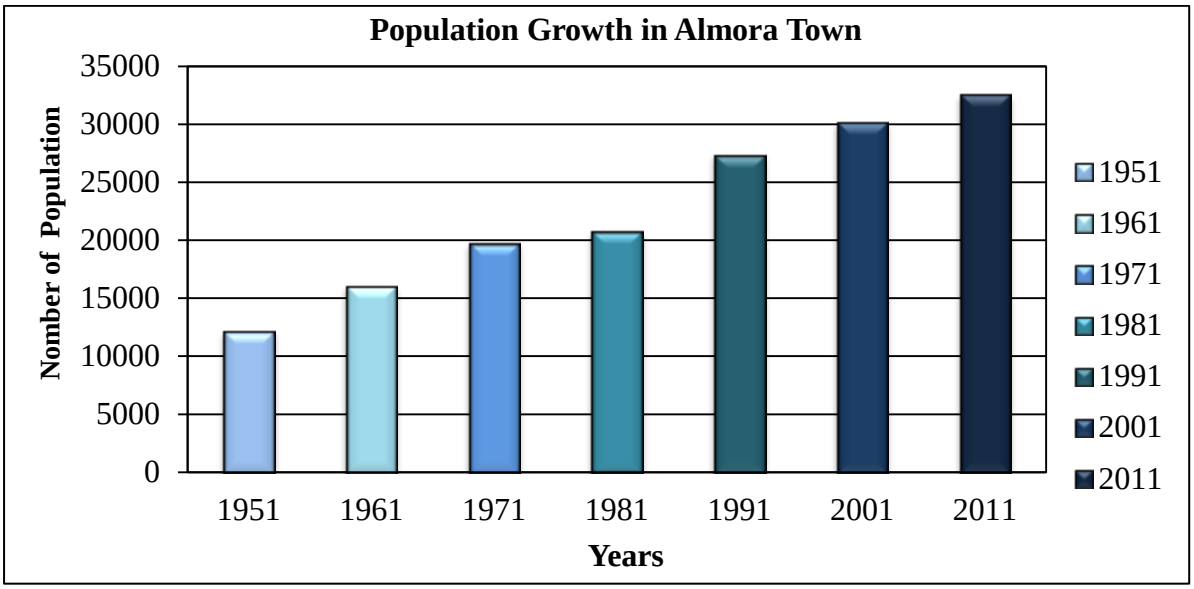

Figure-2: Population growth of Almora town *(based in Municipality Office Almora Town).*

All evidences of Almora town sprawl have also shown that the high population, accompanied by poverty, often leads to increased incidences of environmental degradation. In addition, improving the quality of life of a population requires sufficient provision of social services like waste management and sanitation services, education, health, water, transport and housing. This has led to some residents to dump their waste in unauthorized collection points in the town area. This, coupled with inadequate drainage facilities, has led to annual town floods, while liquid waste is dumped in the open creating sanitation challenges.

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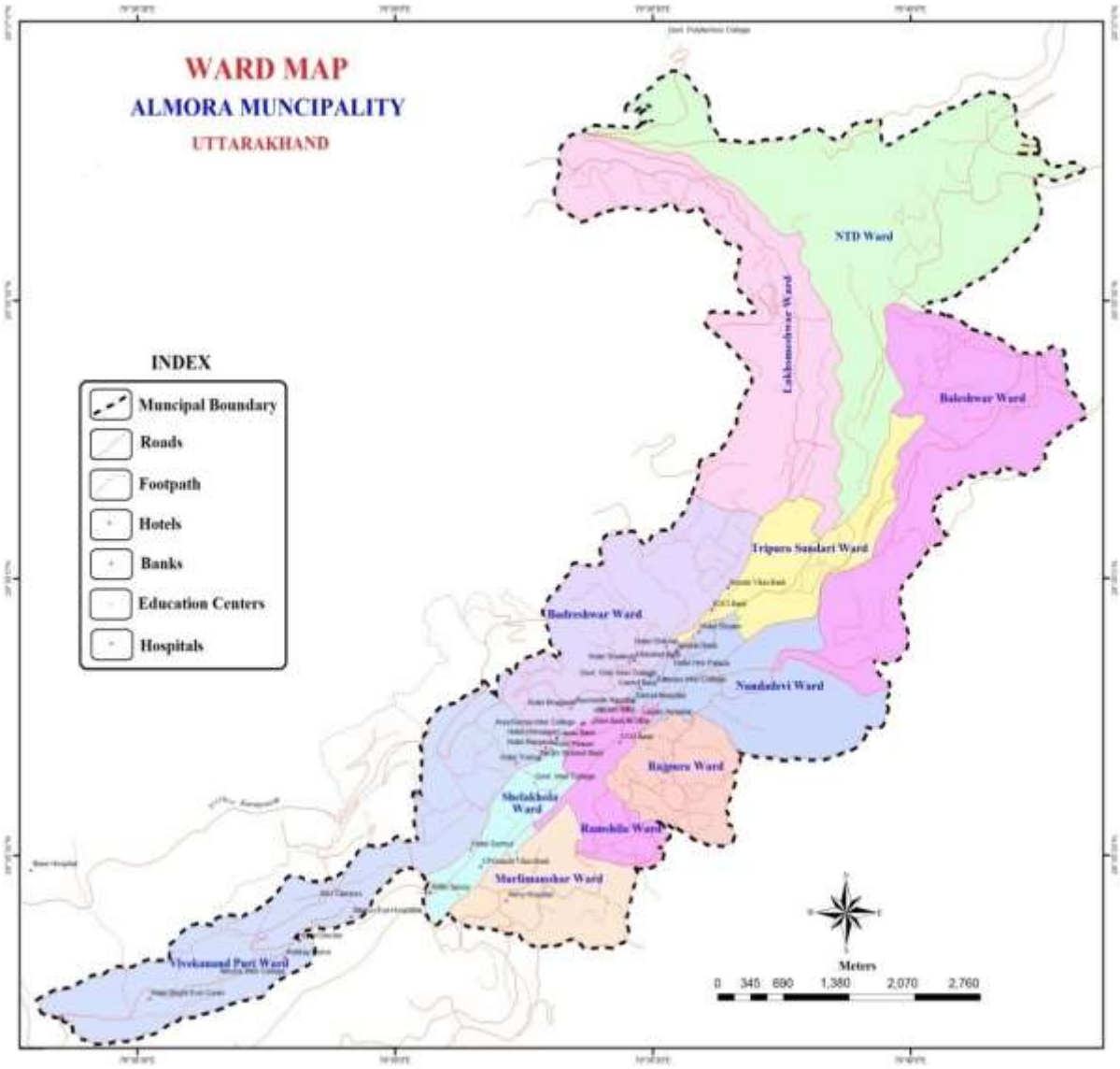

Figure-3: Ward map of the study area viz., Almora town *(Source: Natural Resource Data Management System- Almora).*

Table-2: Ward wise population growth in past three decades in Almora town *(based in Municipality Office Almora Town).*

S.N.	Name of ward	1991	2001	2011	S.N.	Name of ward	1991	2001	2011
1	Sailakhola	2128	2655	1437	7	Murlimanohar	2427	2589	2953
2	Ramshila	2224	2667	2259	8	Baleshwar	2563	2836	4616
3	Badreshwar	2299	2799	3468	9	Vivekanandpuri	2411	2666	2401
4	N.T.D.	2299	2867	3116	10	Rajpura	2446	2733	3907
5	Tripurasundari	2298	2637	2459	11	Nandadevi	3837	2823	2600
6	Lakshmeshwar	2400	2881	3302	Total		27332	30153	32518

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Table-3: Ward wise number of houses in Almora town in 2011 and 2019
(based in Municipality Office Almora).

S.N.	Name of ward	Houses in 2011	Houses in 2019	S.N.	Name of ward	Houses in 2011	Houses in 2019
1	Sailakhola	457	341	7	Murlimanohar	475	690
2	Ramshila	547	506	8	Baleshwar	616	1088
3	Badreshwar	543	829	9	Vivekanandpuri	539	514
4	N.T.D.	593	955	10	Rajpura	630	812
5	Tripurasundari	442	592	11	Nandadevi	661	862
6	Lakshmeshwar	668	825	Total Houses		6171	8014

Table-4: Land use land cover dynamics of Almora town *(based on J. S. Rawat et al. 2013).*

Land Use Land Cover	1990		1999		2010	
	in km^2	percentage	in km^2	percentage	in km^2	percentage
Vegetation Cover	3.04	41.82	2.82	38.79	1.72	23.66
Buildup Area	2.30	31.63	2.97	40.85	4.34	59.68
Others	1.93	26.55	1.48	20.36	1.21	16.66
Total	7.27	100	7.27	100	7.27	100

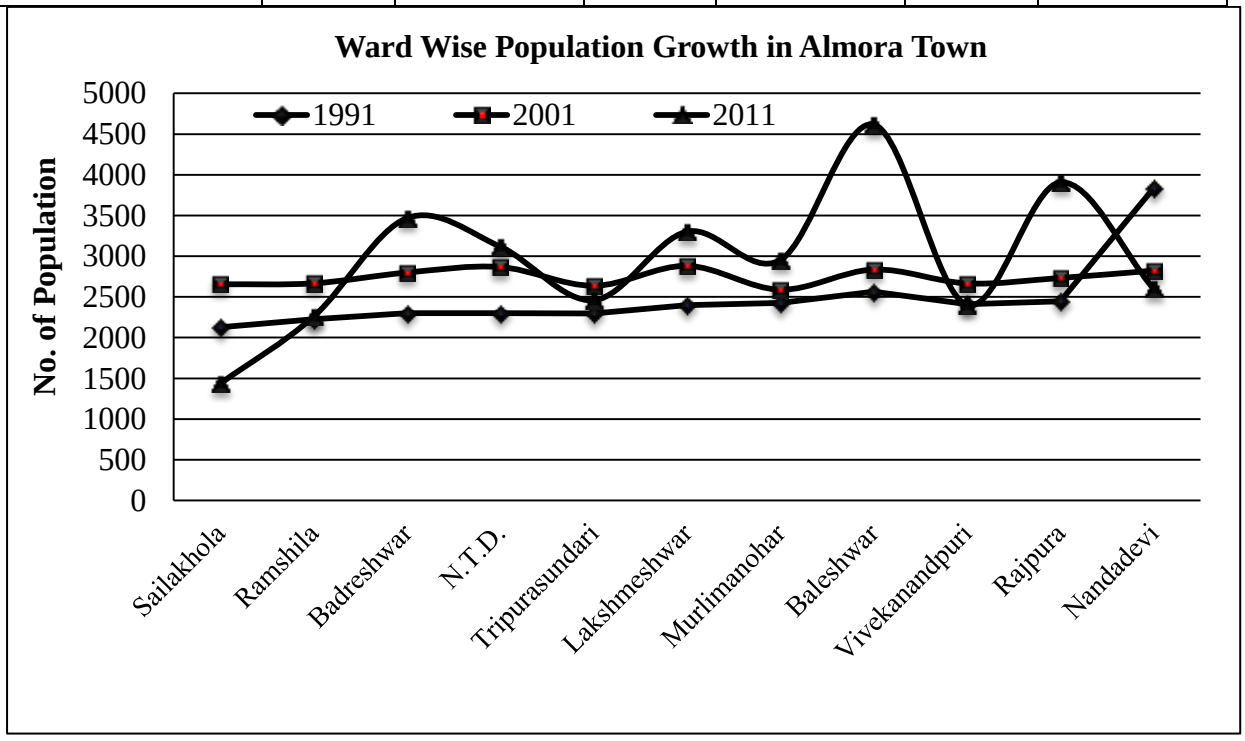

Figure-4: Ward wise population growth in past three decades in Almora town
(based in Municipality Office Almora Town).

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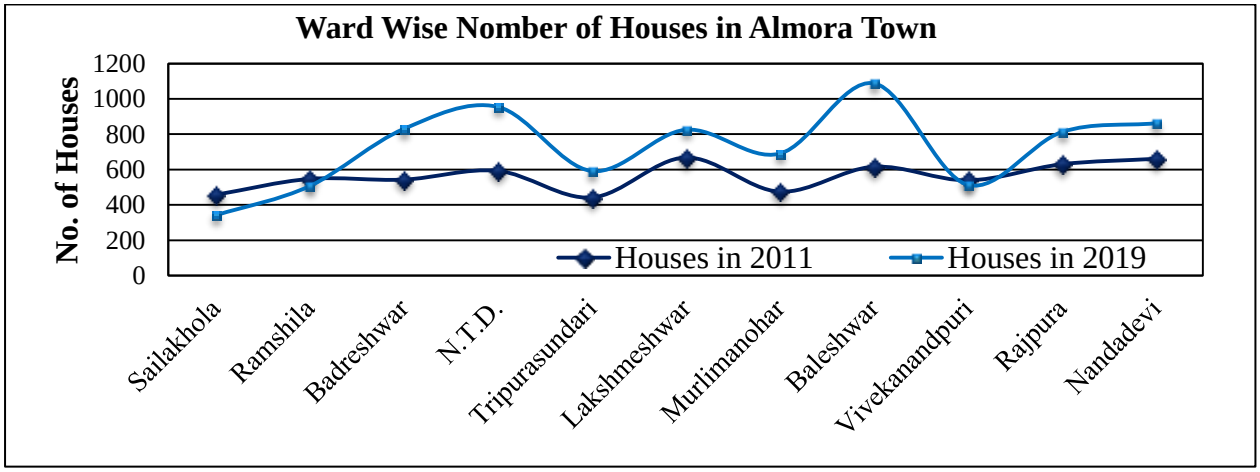

Figure-5: Number of houses in Almora town (ward wise) in 2011 and 2019
(based on Municipality Office Almora Town).

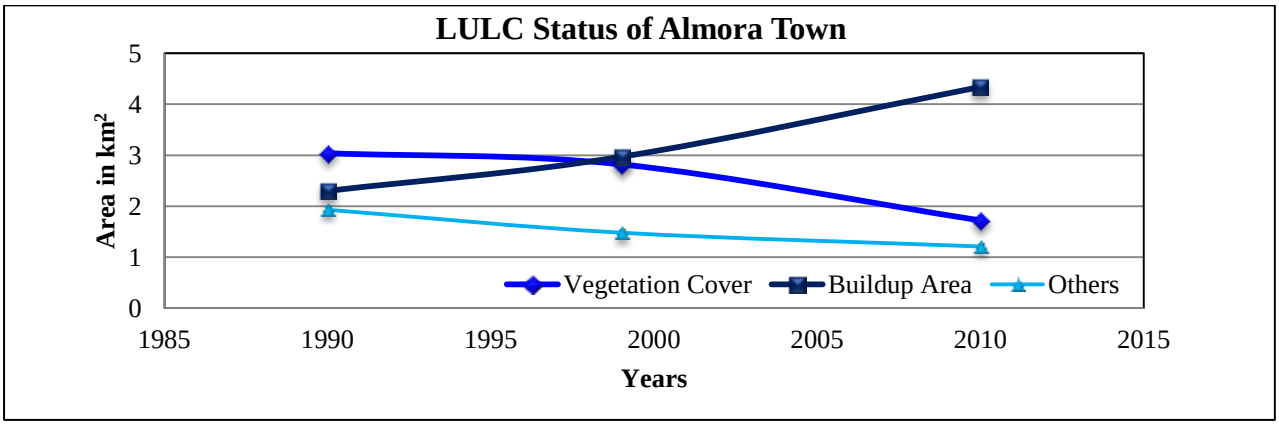

Figure-6: Status of Land Use Land Cover (LULC) of Almora town *(based on J. S. Rawat et al. 2013).*

5.2 Origin Problems by Town Sprawl

In Almora town, there is over 7-8 ton waste collected daily basis by Municipality Almora from which the percentage of plastic material is about 65-80% on average over that waste which is produced daily, which also include rubbers, tires, shoes soles etc. These waste polluted the environment, pose a danger to wildlife, do not degrade quickly and pose difficulties during recycling. The waste disposal and plastic pollution has become very serious case in Almora town due to town sprawl. The consumption of plastic packed food is increasing daily because of hotel and restaurants number increasing rapidly. This fact is also valid that most of people are now moving to the packed food or ready to go food service because most of the people live in Almora town from nearby villages and they lived on rented rooms. Almora town is basically known for education hub, district head quarter, important market for the nearby villages, shopping malls, theaters, district level games etc. that is the region behind the Almora town sprawl. Plates-1 is presenting impact of Almora town sprawl.

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Plate-1: Large impacts of town sprawl in Almora Town: (1) Waste disposal management, (2) Drinking water crisis, (3) Drainage system blockage (4) Waste disposal near road and (5) Construction on waste disposal *(based on Field Survey)*.

5.3 Status of Waste Disposal in Almora Town

The findings of the present survey clearly demonstrate the lack of proper planning in relation to the waste status of an Almora town and the need for including treatment and disposal facilities for town waste management as part of a town's master plan. While the efforts of town such as Nainital, Masoori, Kausani etc must be acknowledged, the fact remains that the major generators like Delhi and Greater Mumbai still have a long way to go. Almora town has total family in 11 wards 8014 in March, 2019 (based in municipality office Almora town), total dustbin in different wards is 49 (Table-5 and Figure-7), Total Wastage of the town is 7-8 Tons per day and Total Cleaners are184 in all wards (88 Women, 96 Male), ward wise number of cleaners distribution is presented on Table-6 and Figure-8.

Table-5: Geographical location of dustbin numbers in wards of the Almora town (*based on Field Survey and GPS Coordinates*).

No.	Latitude	Longitude	No.	Latitude	Longitude	No.	Latitude	Longitude
1	$29^0$35.534'	$79^0$39.109'	18	$29^0$36.750'	$79^0$40.118'	35	$29^0$35.319'	$79^0$38.517'
2	$29^0$35.752'	$79^0$39.296'	19	$29^0$36.628'	$79^0$40.061'	36	$29^0$35.336'	$79^0$38.403'
3	$29^0$35.827'	$79^0$39.418'	20	$29^0$36.494'	$79^0$40.039'	37	$29^0$35.087'	$79^0$38.417'
4	$29^0$35.932'	$79^0$39.560'	21	$29^0$36.361'	$79^0$40.024'	38	$29^0$35.107'	$79^0$38.529'
5	$29^0$36.106'	$79^0$39.722'	22	$29^0$35.510'	$79^0$38.995'	39	$29^0$35.101'	$79^0$38.556'
6	$29^0$36.165'	$79^0$39.751'	23	$29^0$35.497'	$79^0$38.935'	40	$29^0$35.109'	$79^0$38.655'
7	$29^0$36.187'	$79^0$39.758'	24	$29^0$35.695'	$79^0$38.895	41	$29^0$35.187'	$79^0$38.847'
8	$29^0$36.248'	$79^0$39.819'	25	$29^0$35.687'	$79^0$38.790'	42	$29^0$35.246'	$79^0$38.977'
9	$29^0$36.410'	$79^0$39.837'	26	$29^0$35.660'	$79^0$38.668'	43	$29^0$35.247'	$79^0$39.122'
10	$29^0$36.466'	$79^0$39.835'	27	$29^0$35.598'	$79^0$38.548'	44	$29^0$35.302'	$79^0$39.184'
11	$29^0$36.537'	$79^0$39.838'	28	$29^0$35.579'	$79^0$38.444'	45	$29^0$35.283'	$79^0$39.286'
12	$29^0$36.653'	$79^0$39.809'	29	$29^0$35.544'	$79^0$38.399'	46	$29^0$35.449'	$79^0$39.351'
13	$29^0$36.692'	$79^0$39.767'	30	$29^0$35.597'	$79^0$38.271'	47	$29^0$35.451'	$79^0$39.444'
14	$29^0$35.651'	$79^0$39.129'	31	$29^0$35.589'	$79^0$38.204'	48	2935.523'	$79^0$39.514'

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15	$29^0$36.644’	$79^0$40.679’	32	$29^0$35.476’	$79^0$38.278’	49	$29^0$35.625’	$79^0$39.564’
16	$29^0$36.838’	$79^0$40.338’	33	$29^0$35.475’	$79^0$38.788’			
17	$29^0$36.789’	$79^0$40.780’	34	$29^0$35.425’	$79^0$38.785’			

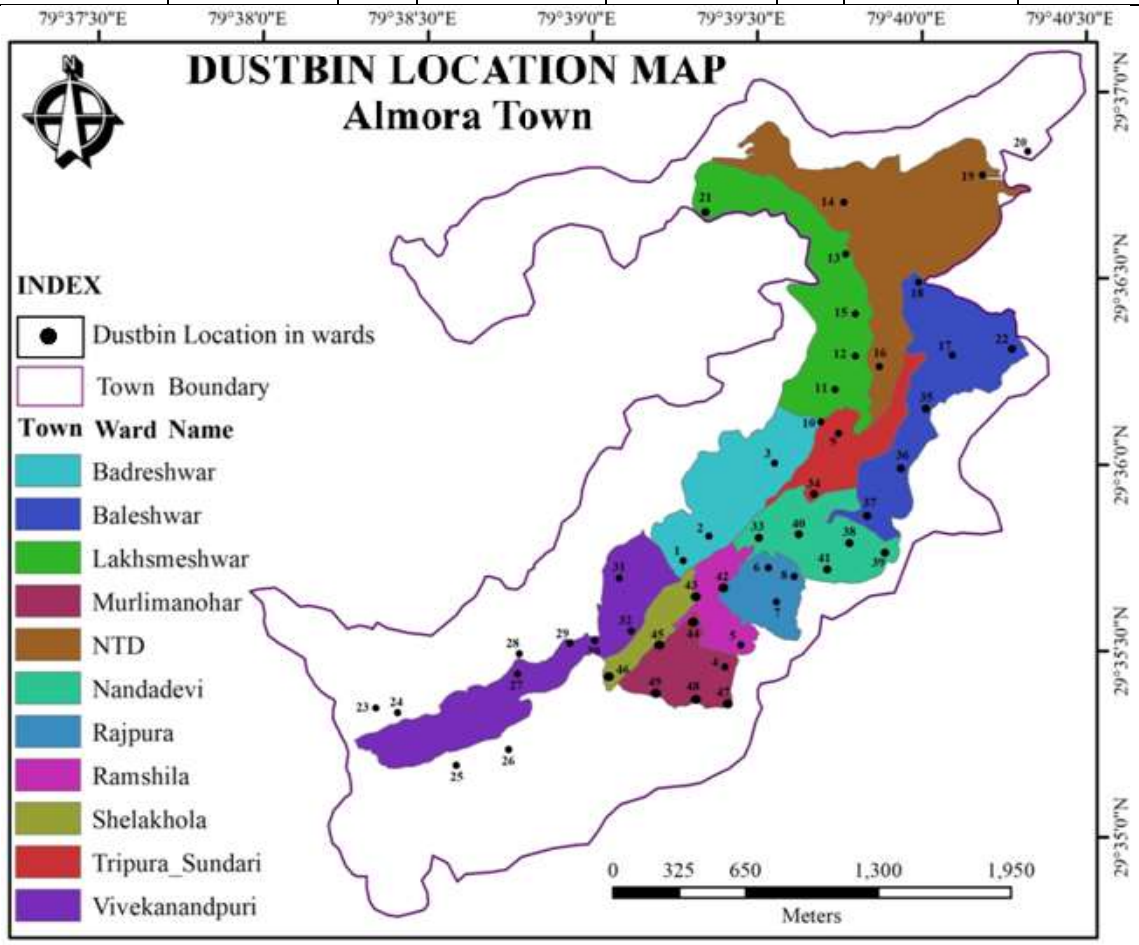

Figure-7: Ward wise dustbin location and number in Almora town
(based on Field Survey and GPS Coordinates).

Table-6: Ward wise number of cleaners in Almora town *(based in Municipality Office Almora Town).*

S.N.	Name of ward	Number of cleaners	S.N.	Name of ward	Number of cleaners
1	Vivekanandpuri	15	7	Badreshwar	19
2	Baleshwar	10	8	Ramshila	13
3	Murlimanohar	11	9	Sailakhola	12
4	Lakshmeshwar	17	10	Rajpura	15
5	Tripurasundari	11	11	Nandadevi	19
6	N.T.D.	18			

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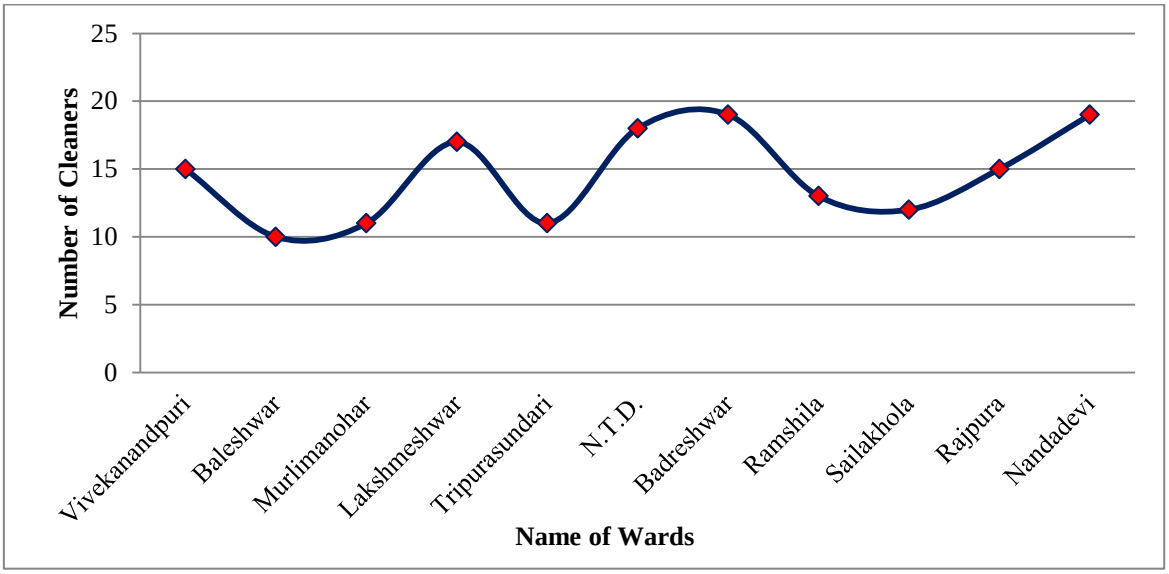

Figure-8: Ward wise cleaners in Almora town *(based on Municipality Office Almora Town).*

6.0 DUSTBIN NEEDED IN ALMORA TOWN

Due to the improper management of the plastic waste, the most of the dustbins are loaded with more than their capacity. Here in the Figure-9 you can see the amount of solid waste overloaded in different part of the town near the houses in 2019. As the improper management of solid waste can also determines shortage of dustbins in these locations of the town. Which impact on health of the wild animals, local people, cows and wild animals like monkeys, pigs, dogs etc to migrate to the town areas and disturbing the ecological balance.

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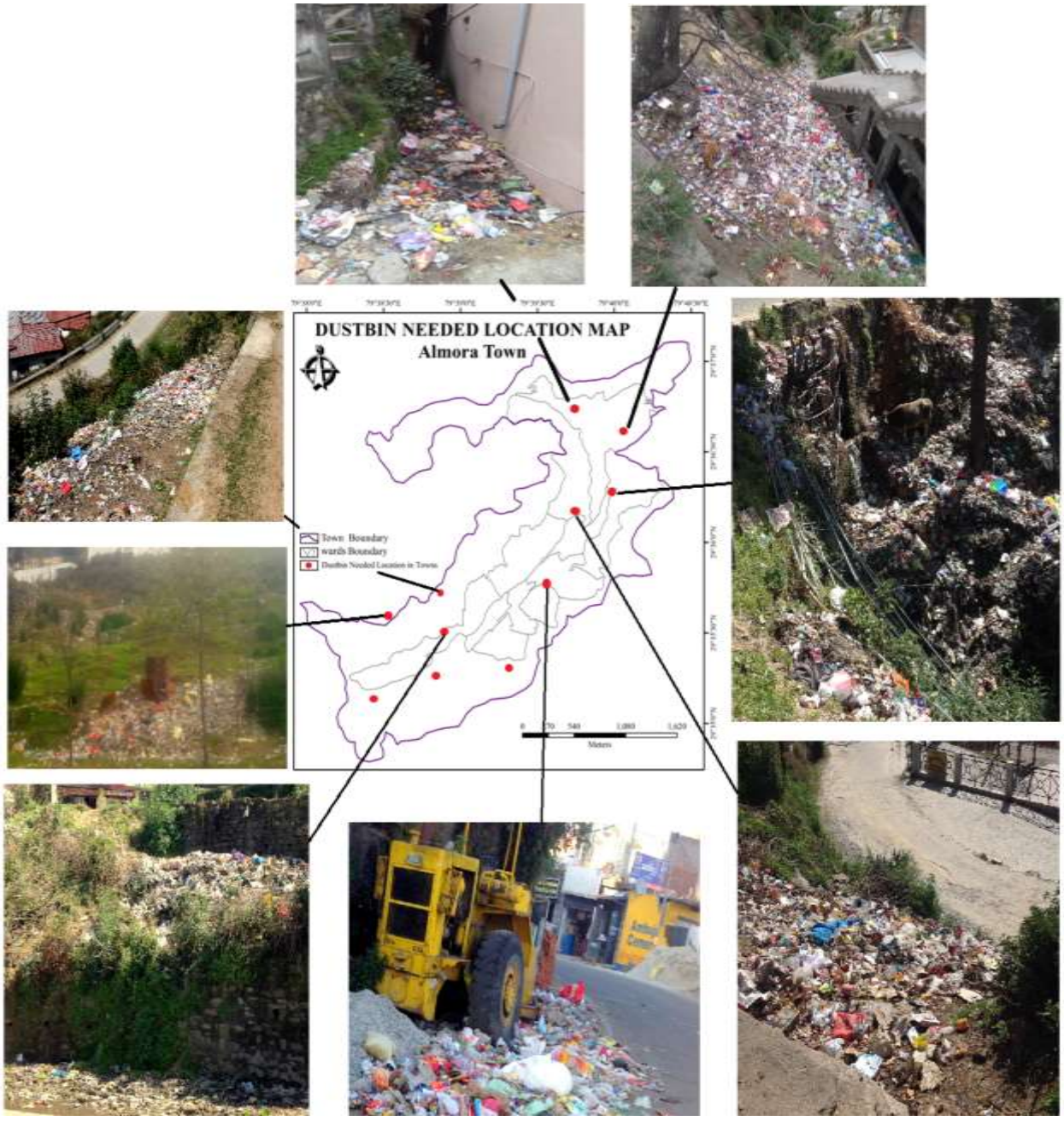

Figure-9: Dustbin needed places in Almora town *(based on Field Survey and GPS Coordinates).*

7.0 WASTE DISPOSAL PROBLEM IN ALMORA TOWN

Present study about the origin of waste disposal problem in the study area is follows-

- Due to population growth and urbanization, very big amount of solid wastes are generated.
- Per day 7-8 tons wastes disposal are challenging for limited worker in the municipal Area Almora.
- Almora is a hilly town and garbage mixed with plastics interference cause problems in landfills operations and requires large area for waste disposal near town.
- Landfill sites of the Almora town are also not scientifically designed so create air, water and soil pollution. Waste workers work on these sites work without any protective measures are prone to various diseases. Also incineration method is usually followed in maximum places to reduce the waste which itself releases many toxic elements and gases to the environment making the people ill.
- Garbage containing large amount of plastics, when disposal burnt may cause air pollution by emitting polluting gases.

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- Lack of awareness and lack of participation of public, the problem of solid waste has increased day by day according to population growth.
- Figure-10 suggesting a model for waste disposal management in Almora town.

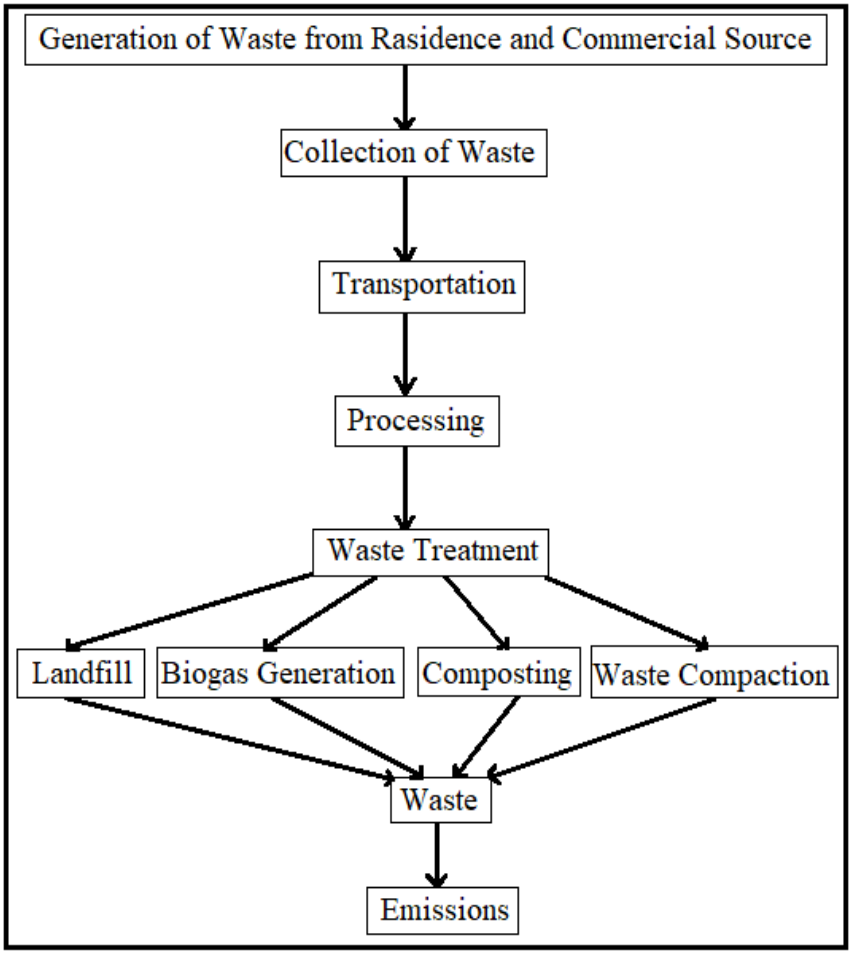

Figure-10: Model suggestion for waste disposal management in Almora town *(After First Author)*.

During the survey, the municipal corporations of Almora town itself accepted that they are ill-equipped to handle and effectively manage the large quantum of waste generated per day in the town. The corporations face constraints in terms of technology, know-how, manpower and most importantly adequate funds to tackle the menace. This survey is about the town only but if we go to nearby rural areas/villages the situation is even worse there the garbage is lying on the roadside with no sanitary landfills and inviting major threats to the health and environment of the residents.

8.0 CONCLUSION

This study focused on identifying the extent and Town sprawl in Almora town municipality using remote sensing data, GPS data and social sensing data. Important source of Almora town sprawl is migration from villages for better education, job, health etc. Town sprawl rapidly and very soon town will be merge in nearby villages because villages also sprawl day by days. Due to town sprawl occurs many types of problems in the Almora town like land cover changes, waste disposal, water supply/drainage system blockage in the town, drinking water crisis etc. municipal corporation has to increase limit of dustbin capacity 5 metric tons to 8 metric tons and no. of dustbin in the study area for better management of waste disposal. Though in town and nearby rural areas earlier it was practiced that kitchen waste was used to feed to the animals but with increasing income, changing lifestyles, use of more packaging and plastic material all waste are mixed now and put into one dustbin which make the problem of waste management more complex.

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