MSWM 2016

Conference on Municipal Solid Waste Management

Dates: 23-24th February 2016

Venue: CCE Lecture Hall

[behind J R D Tata Memorial Library, Next to IISc Students' Hostel Office & NESARA Restaurant]

Organised Jointly by

Energy and Wetlands Research Group (EWRG), CES, Indian Institute of Science (IISc);
Students for Development (SFD);
Karnataka Environment Research Foundation (KERF)

EWRG-CES

Municipal solid waste comprises of wastes generated from residences, markets, hotels and restaurants, commercial premises, slums, street sweeping and parks. Bangalore residences contribute 55% of total of wastes, which is highest among all sources. Bangalore city generates around 3000-4000 tons of waste. A major fraction (72%) of total waste is organic or wet waste, which degrades in natural environment. Mismanagement of waste has led to contamination of land, water, etc. apart from emissions of GHG's. Treatment and environmentally sound management of solid waste have posed serious challenges to the local administration. Municipal Solid Waste Management (MSWM) 2000, GoI emphasise the need for waste segregation and storage at source, primary collection, secondary storage, transportation, secondary segregation, resource recovery, processing, treatment, and final disposal of inert material. In this context a stringent regulatory framework for the treatment and management of solid waste through scientific insights is crucial for sustainable development. In this regard, MSWM 2016 would focus on dialogue among various stakeholders to evolve appropriate strategies to minimise mismanagement of waste and resource recovery. The conference at IISc during 23-24th February 2016 would provide a platform for all stakeholders including youth from academic institutions, city municipal authorities and planners, media, academia, industry, NGO's, representatives from urban local bodies and residents to deliberate on various issues related to sustainable waste management practices. Themes of the conference are:

Themes

- MSW Management: current approaches, gaps and solutions;
- Mismanagement of solid waste, climate change;

Solid Waste Management

Dr. Ramachandra T.V

Energy & Wetlands Research Group

Centre for Ecological Sciences [CES],

Centre for Sustainable Technologies [CST],

Centre for Infrastructure, Sustainable Transport & Urban Planning [CiSTUP]

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EVRG-CES

Celebrating 100 Years 1909 - 2009 CENTENNIAL

Energy and Wetlands Research Group CES Indian Institute of Science Bangalore-560012


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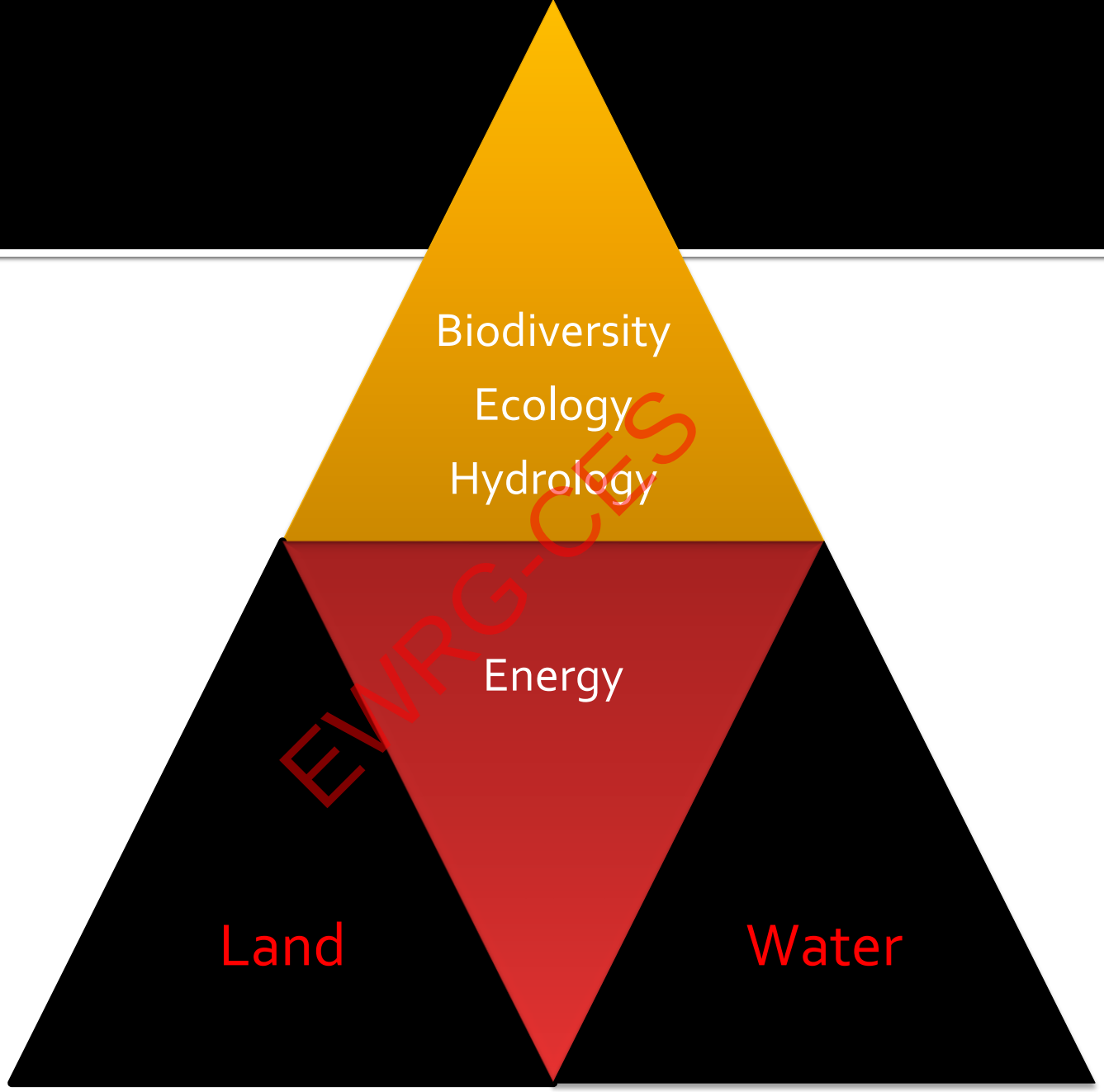

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Energy & Wetlands Research @

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- Courses: ST210,ST206
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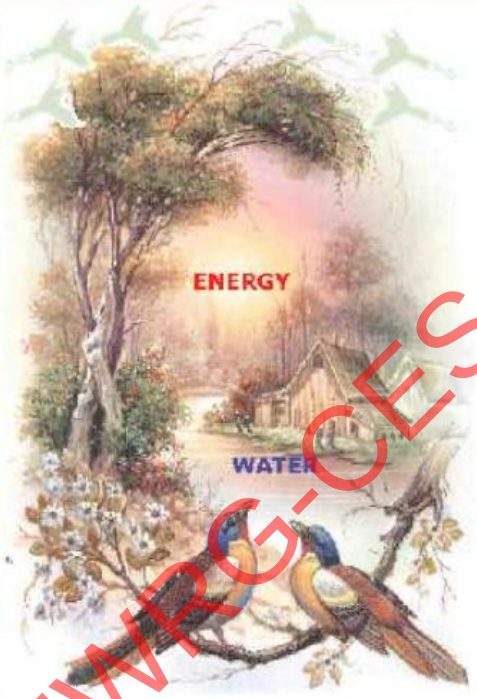

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- WETLANDS
- Research Papers

- LAKE 2014
- LAKE 2012
- LAKE 2010
- LAKE 2008
- LAKE 2006
- LAKE 2004
- LAKE 2002
- LAKE 2000

- Wetland News

NEW Integrated Ecological Carrying Capacity of Uttara Kannada District, Karnataka

NEW Internet Courses - Environmental Management

Job openings

RESEARCH OPENING :
ECOLOGICAL MODELLING IN THE HIMALAYAS AND THE WESTERN GHATS

- ENVIS
- RWEDP
- SUSLUP
- SOE
- HDL

- Research Team

Suggestions

- Solid Waste
- Limnology & GIS
- Urban Sprawl
- KERF
- Research Station

- Financial Support

Comments

E mail | Sahyadri | GRASS | I I Sc | C E S | Energy | ENVIS | Wetland | E mail

What is solid waste??

Solid wastes are those organic and inorganic waste materials produced by various activities of the society, which have lost their value to the first user.

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Classification based on source
(dependent on sectors and activities)

- **Residential Wastes:**
  - **Generated mainly from dwellings, apartments, etc.**
  - **consists of leftover food, vegetable peels, plastic, clothes, ashes, etc.**
- **Commercial Wastes:**
  - generated from stores, restaurants, markets, hotels, motels, auto repair shops, medical facilities, etc.
  - mainly consisting of leftover food, glasses, metals and ashes

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Institutional Wastes

- This mainly consists of paper, plastic, glasses etc.,
- arising from educational, administrative and public buildings like schools, colleges, offices, prisons, etc.

Municipal Wastes

- This includes dust, leafy matter, building debris, treatment plant residual sludge, etc.,
- from various municipal activities like demolition and construction, street cleaning, landscaping, etc.

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- **Industrial:**
  - This mainly consists of process wastes, ashes, demolition and construction wastes, *hazardous wastes*, etc., due to industrial activities.
- **Agricultural:**
  - This mainly consists of spoiled food grains and vegetables, agricultural remains, litter, etc., and is generated from fields, orchards, vineyards, farms, etc.

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Waste Management

- **Knowledge of the sources and types of solid wastes, along with information on composition and rates of generation, is essential**
  - **for the design and operation of the functional elements associated with the management of solid wastes.**
- It is important to define the various types of solid wastes that are generated from various sources, which includes sectors and activities.

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Classification based on types:

i.e. physical, chemical, and biological characteristics of wastes

- **Garbage:**
  - It is the term applied to animal and vegetable wastes resulting from the handling, sale, storage, preparation, cooking and serving of food.
  - Such wastes contain putrescible (rotting) organic matter, which produce obnoxious odour, and attract rats and other vermins.

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Ashes and residues

These are substances remaining from the burning of wood, coal, charcoal, coke, and other combustible materials,

from cooking and heating in houses, institutions, and small industrial establishments.

Ashes and residues are almost entirely inorganic, they are valuable in landfills.

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Combustible and non-combustible wastes:

- **They consist of wastes of households, institutions, commercial activities, etc., excluding food wastes and other highly putrescible (rotting) material.**
- **Typically, *combustible material* consists of paper, cardboard, textile, rubber, garden trimmings, etc.**

Non-combustible waste

- consists of items such as glass, crockery, tin and aluminium cans, ferrous and non-ferrous material, and dirt.

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- **Bulky wastes**
  - **This includes household wastes, which cannot be accommodated in normal storage containers. Hence, they require a special collection mechanism.**
  - **These include large household appliances such as refrigerators, washing machines, furniture, crates, vehicle parts, tyres, wood, trees and branches.**

- Street wastes:
  - **This applies to wastes that are collected from streets, walkways, alleys, parks and vacant plots.**
  - **Street wastes include paper, cardboard, plastics, dirt, leaves, and other vegetable matter.**

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Biodegradable and non-biodegradable wastes: Biodegradable

- Biodegradable substances are those that are degraded to simpler compounds by the action of micro organisms.
- This type mainly consists of waste from various households and industries consisting of organic matter like leftover food, vegetable and fruit peels, paper, textile, wood, etc.

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Non-biodegradable

- wastes consist of inorganic and recyclable materials like plastic, glass, cans, metals, etc.

- Dead animals:
  - With regard to municipal wastes, dead animals are those that die naturally or are accidentally killed on the road.
  - This category does not include carcasses and animal parts from slaughterhouses, which are regarded as industrial wastes.
  - Dead animals are divided into two groups, large and small.
- Abandoned vehicles:
  - This category includes automobiles, trucks, and trailers that are abandoned on streets and other public places.
  - Abandoned vehicles have significant scrap value for their metal and their value to collectors is highly variable.

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- **Construction and demolition Wastes**
  - generated by the construction, refurbishment, repair and demolition of houses, commercial buildings and other structures.
  - They consist mainly of earth, stones, concrete, bricks, lumber, roofing and plumbing materials, heating systems and electrical wires and parts of the general municipal waste stream.

- **Farm wastes:**
  - These wastes result from diverse agricultural activities such as planting, harvesting, production of milk, rearing of animals for slaughter, and the operation of feedlots.
  - In many areas, the disposal of animal waste has become a critical problem, especially from feedlots, poultry farms and dairies.

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Hazardous wastes

- *Hazardous wastes* are those defined as wastes of industrial, institutional or consumer origin that are potentially dangerous either immediately or over a period of time to human beings and the environment.

- This is due to their physical, chemical, biological or radioactive characteristics like ignitibility, corrosivity, reactivity and toxicity.

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Sewage wastes:

- The solid by-products of sewage treatment are classified as sewage wastes.
- They are mostly organic and derived from the treatment of organic sludge separated from both raw and treated sewage.
- The inorganic fraction of raw sewage such as grit and eggshells is separated at the preliminary stage of treatment, as it may entrain putrescible organic matter with pathogens and must be buried without delay.

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- The bulk of treated, dewatered sludge is useful as a soil conditioner but invariably its use for this purpose is uneconomical.

- The ***solid sludge*** therefore enters the stream of municipal wastes unless special arrangements are made for its disposal.

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Biodegradable and Non-Biodegradable Wastes with their Degeneration Time

	Type of waste	Approximate time taken to degenerate
	Organic waste such as vegetable	A week or two.
	Paper	10–30 days
	Cotton Cloth	2-5 months
	Woolen Items	12 months
	Wood	10-15 years
	Tin, aluminum….	100-500 year

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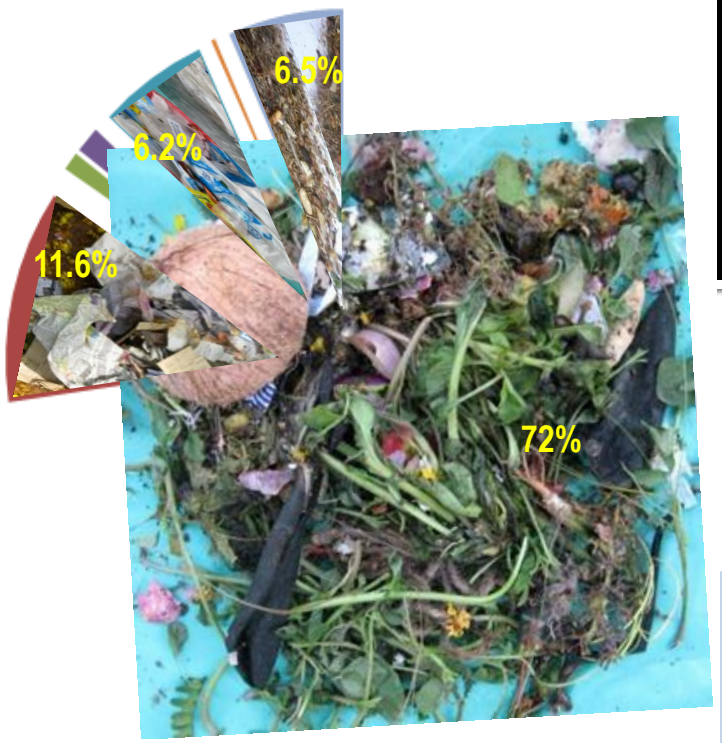

Waste composition

- Major component is biodegradable
- Waste composition varies from one place to other place

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Waste type	Composition (% by weight)			
	Year 2000 (all over Bangalore)	Year 2004-05 (all over Bangalore)	Year 2001 (IISc)	Year 2010 (IISc residential area)
Fermentable	72	69	73	69
Paper and cardboard	11.6	Recyclable = 22	18	8
Cloth, rubber, PVC, leather	1.01			2.32
Glass	1.43			8
Polythene/plastics	6.23		9.5	7
Metals	0.23			1.33
Dust and sweeping	6.53			
Reference	TIDE, 2000	TEDDY, 2009	Sathiskumar et al., 2001	Based on study conducted in

MSW (Management and Handling) Rule, 2000

- Door to door collection
- Segregation of waste
- Biodegradable wastes shall be processed by composting, vermi-composting or anaerobic digestion
- Recoverable non-biodegradable wastes shall follow the route of recycling
- Landfilling shall be restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing.

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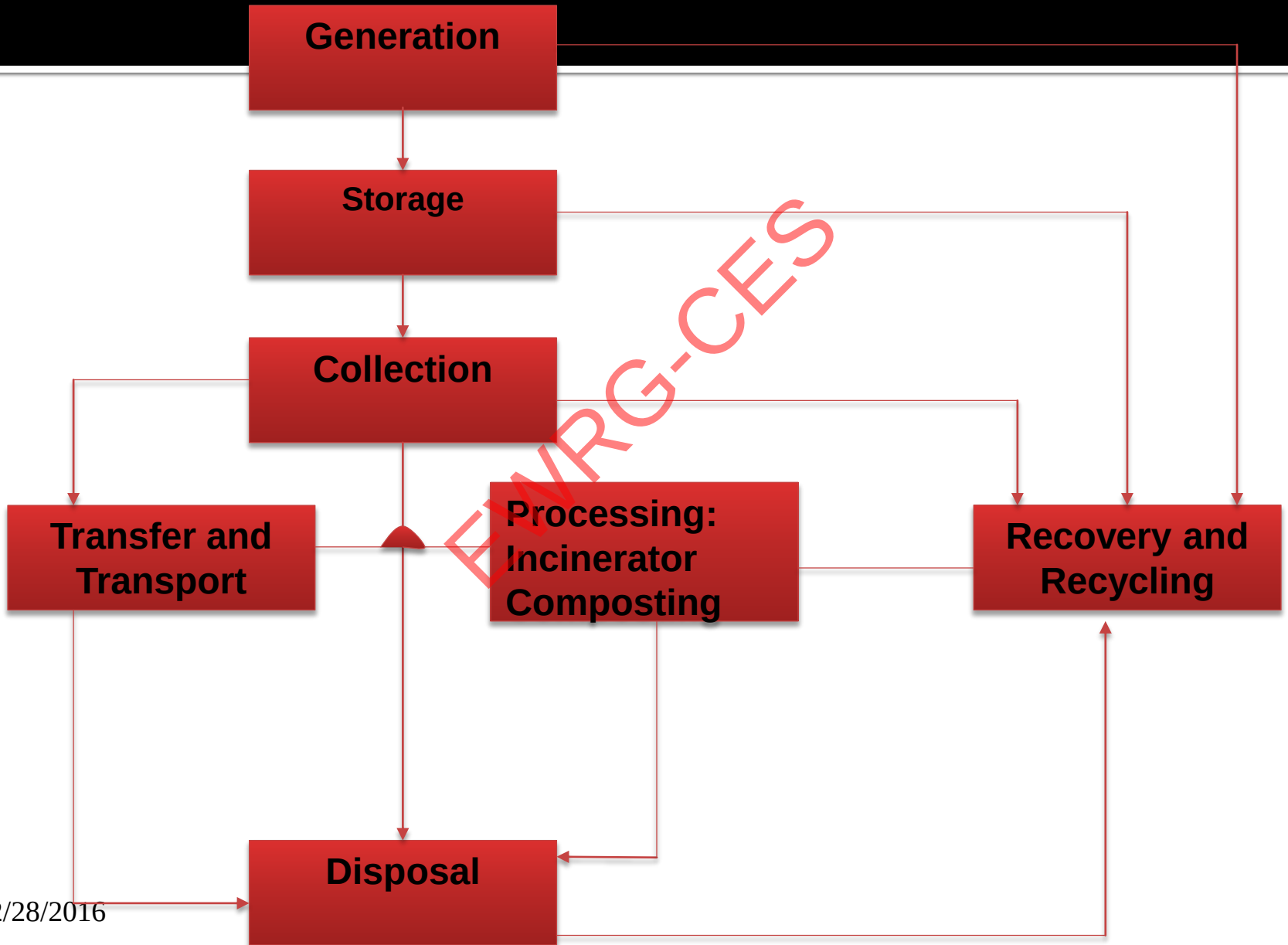
Functional Elements



1. Waste Generation.....

Wastes are generated at the start of any process and thereafter at every step as raw materials are converted into goods for consumption.

The most important step is identification of waste and this step varies with each individual.

It may be generated from households, commercial areas, industries, institutions, street cleaning and other municipal services.

The point of generation determines quantity, composition and waste characteristics.

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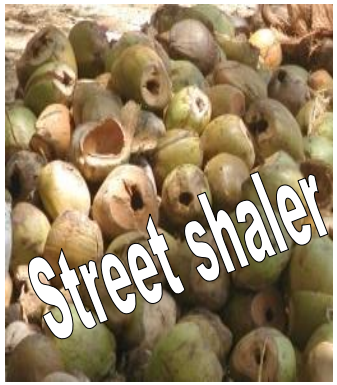
1. Waste generation



Waste sources

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Source	Fraction % (by weight)
Domestic	55
Markets	15
Hotels and eatery	20
Trade and commercial	6
Slums	1
Street sweeping and parks	3

Source: Chanakya and Sharatchandra, 2005

2. Waste Storage.....

- Storage is a key functional element because collection of wastes invariably never takes place at the source or at the time of their generation.
- The heterogeneous waste generated in residential area must be removed within 8 days due to shortage of storage space and presence of biodegradable material.

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- Onsite storage is of primary importance due to aesthetic consideration, public health and economics involved.

- Various options for storage are plastic containers, conventional dustbins (of households), oil drums, large storage bins (for institutions and commercial areas or servicing depots), etc., and they vary greatly in size, form and material.

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3: Waste Collection…..

- This includes not only the gathering of waste, but also hauling of waste after collection to the location where the collection vehicle is emptied, which may be a transfer station (i.e., intermediate station where wastes from smaller vehicles are transferred to larger ones and also segregated), a processing plant or a disposal site.

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- The solution to the problem of hauling is complicated by the fact that the motor vehicles adapted to long distance hauling are not well suited or particularly economic for house-to-house collection.
- Typically, collection is provided under various management arrangements, ranging from municipal services to franchised services, under various forms of contracts.
- Every system requires an individual solution to its waste collection problem.

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Current collection practices

- Quasi-centralized collection system with collection efficiency: 75-90%, which makes the city clean.
- City has still both the practices, which creates problem to waste management planning.
- Implementation of door to door collection has not able to collect segregated waste from houses.

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Function	Technique	Average %
Collection	1. Community bin	17.5
	2. Door to door	94.29

Source: Ramachandra and Bachamanda, 2007

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4: Transfer and Transport

- The transfer of waste from smaller collection vehicle (as lanes are narrow in most localities) to a larger one at the transfer station;
- The subsequent transport of the waste, usually over long distances, to the disposal site.
- Important factors considered while designing a transfer station include type of transfer operation, capacity, equipment, accessories and environmental requirements,

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4. Waste transportation

- Waste transportation is transfer of stored waste to final processing sites or disposal sites.
- It is important to avoid bin overflow and littering on road.
- Light and covered vehicles are used for waste transportation.
- Transfer station plays an important role in waste transportation.

Transfer station

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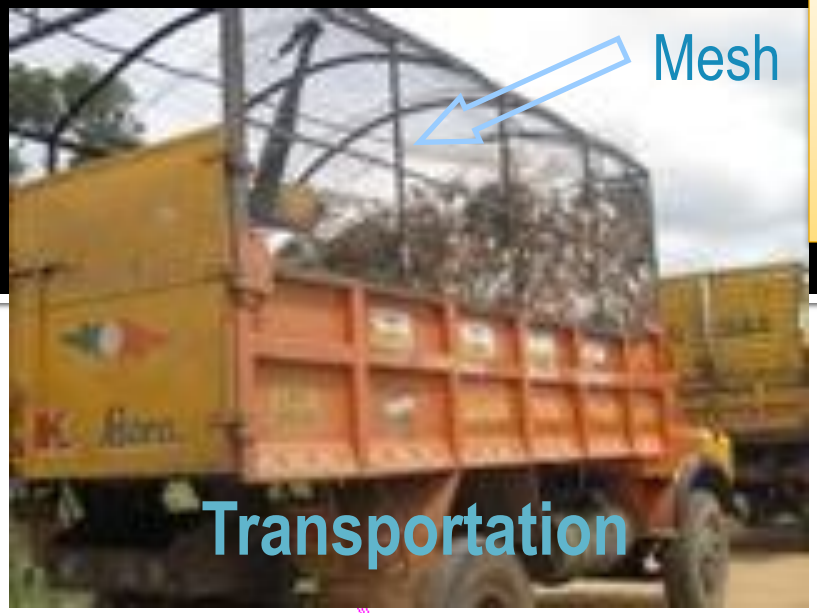
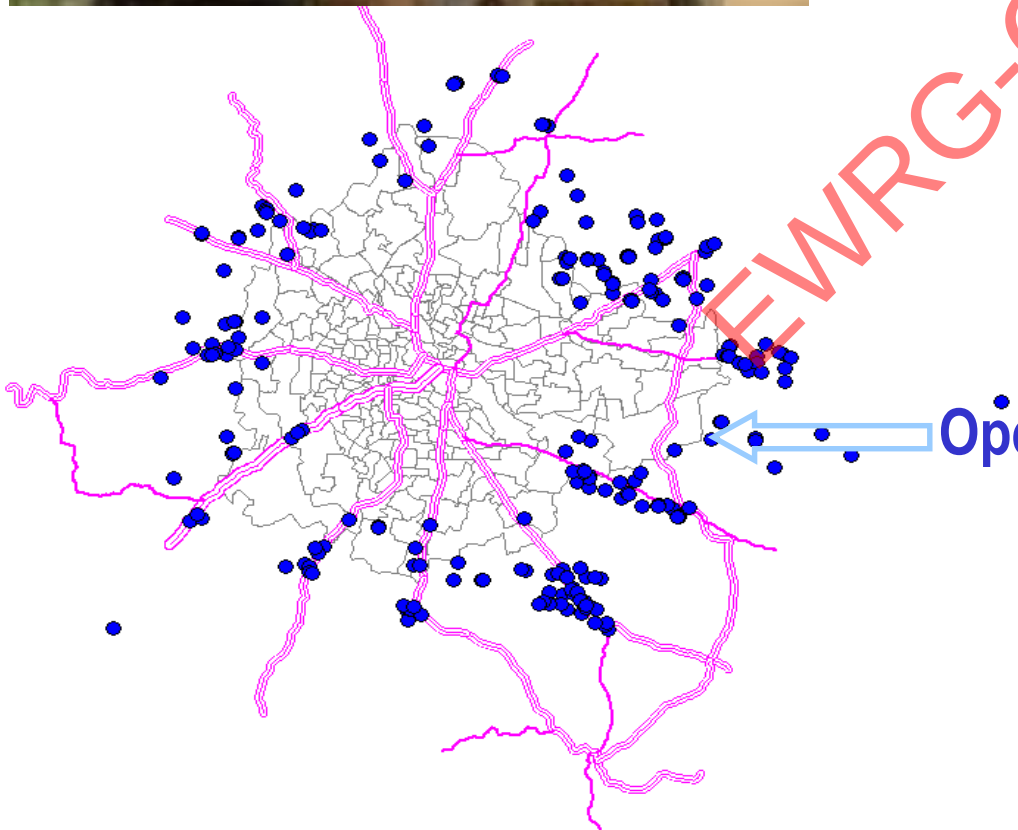
Current transportation practices





- Around 96% transportation vehicles have mesh to avoid garbage fall during transportation.
- Transportation is not efficient which lead to open dumping or illegal dump of waste.

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5: Processing….

- Is required to alter the physical and chemical characteristics of the waste for energy and resource recovery and recycling.

- Important processing techniques include compaction, thermal volume reduction, manual separation of waste components, incineration and composting.

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Current treatment practices

Windrow composting

Mavallipura

Mandur

Centralized treatment facility

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Small scale treatment facility

- Mavallipura and Mandir have capacity to treat 600t/d and 1000t/d of waste[1]

1 BBMP report, 2009

6: Recovery & Recycling

- includes various techniques, equipment and facilities used to improve both the efficiency of disposal system, and recovery of usable material and energy.
- *Recovery* involves separation of valuable resources from the mixed solid wastes delivered at transfer station or processing plants.
- These involve size reduction and density separation by air classifier, magnetic device for iron and screens for glass.

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- The selection of any recovery process is a function of economics - cost of separation versus the recovered-material products.

- Certain recovered materials like glass, plastics, paper, etc., can be recycled as they have economic value.

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7: Waste Disposal….

- Disposal is the ultimate fate of all solid waste whether residential waste, semisolid waste from municipal and industrial treatment plants, incinerator residue, compost or other substances that have no further use to the society.

- Thus, land use planning becomes a primary determinant in the selection, design and operation of landfill operations.

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5. Landfill disposal

- Final stage of waste disposal.
- Only restricted for non-biodegradable, non-recyclable and non-reusable materials (inert waste).
- Scientific development and planning sanitary landfill.
- Selection of landfill site.
- Installation of a landfill gas collection system from the point of view of odour control and safety of nearby properties.

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- A modern sanitary landfill is a method of disposing solid waste without creating nuisance and hazard to public health.

- **Engineering principles are followed to confine the wastes to the smallest possible area, reduce them to the lowest practical volume by compaction at the site, and cover them after each day's operation to reduce exposure to vermin.**

- One of the most important concepts, therefore, is to plan for the final use of the reclaimed land.

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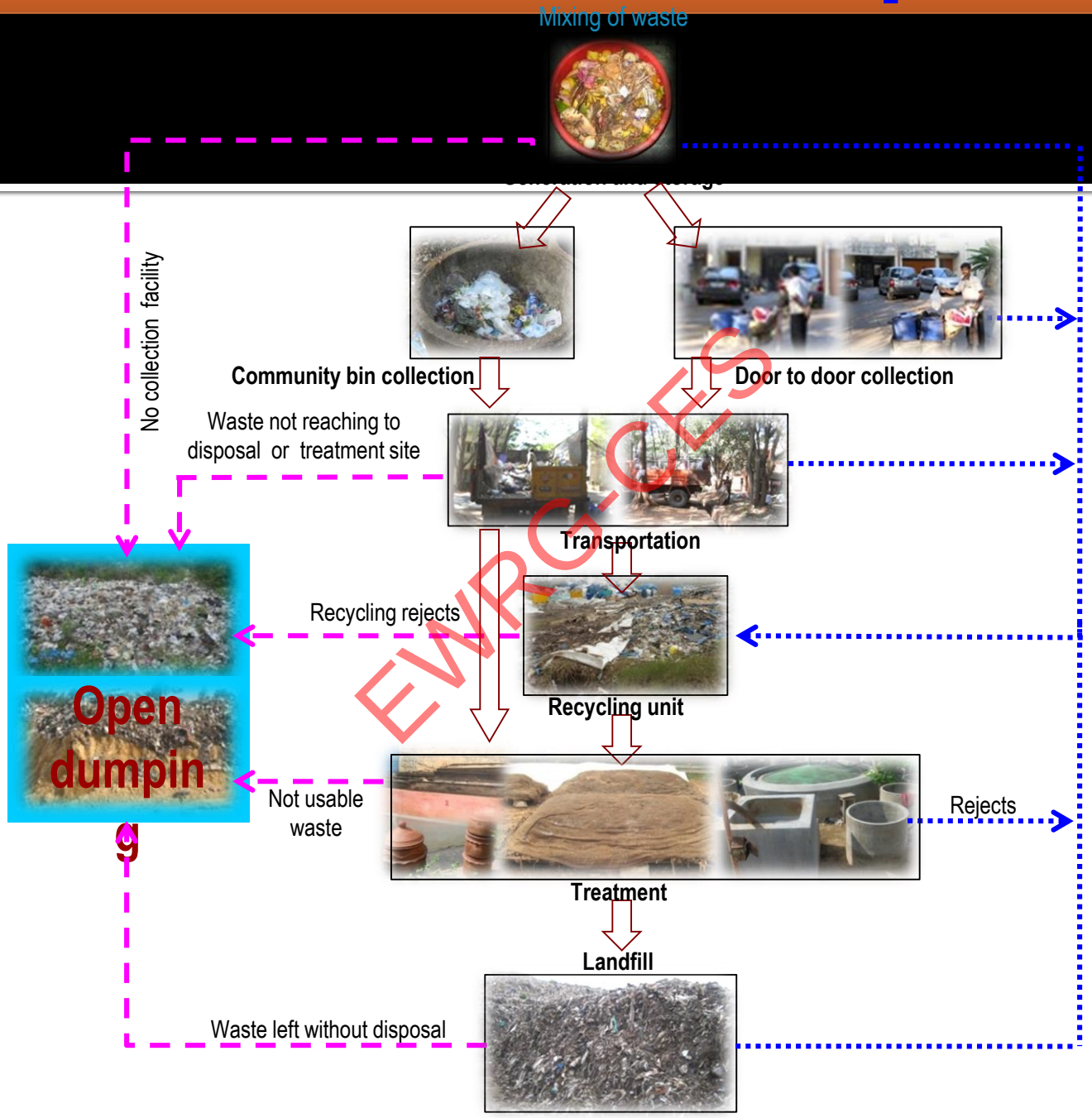
Deviations from the SWM practices



Current disposal practices

- Organic waste is reaching to disposal site.
- No segregation for recyclable and reusable items.
- Lack of planning and management of existing and upcoming landfill sites.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- ***Soft* EST's support and complement hard technologies and include "nature based technologies" and "management tools".**

  - **Nature based technologies include processes and mechanisms used by nature within a specific ecosystem and its carrying capacity**

  - **Management tools include system and procedures, policy and regulatory frameworks, environmental performance standards and guidelines**

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Factors Affecting SWM

- Quantity and Characteristics of Wastes
- Climate & Seasonal Constraints
- Physical Characteristics of Urban Area
- Financial and Foreign exchange constraints
- Cultural Constraints
- Management of Technical Resources

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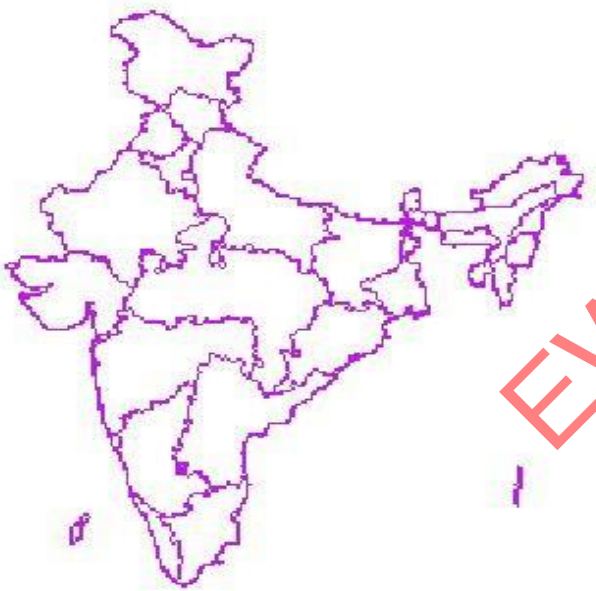
Indian Scenario



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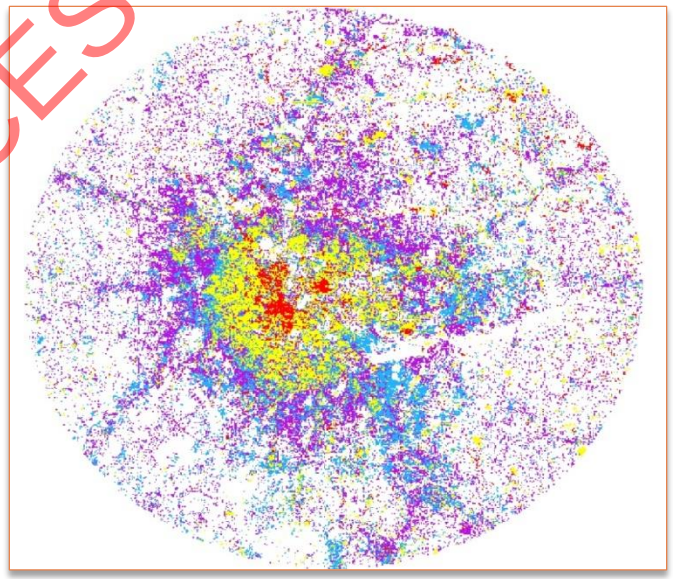
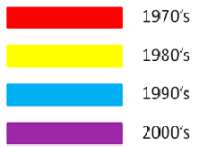
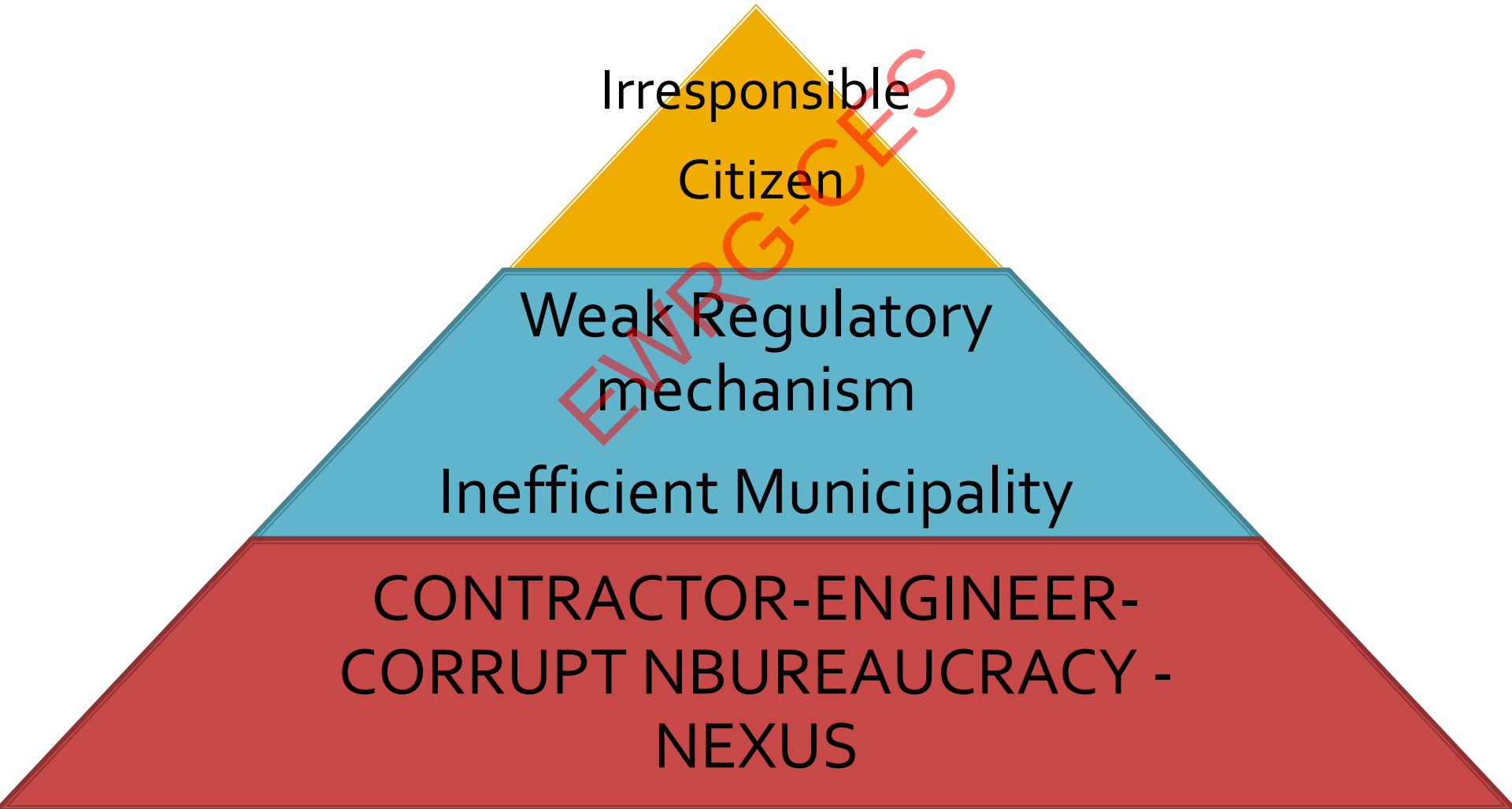


Bangalore



SOLID WASTE: Current Issues



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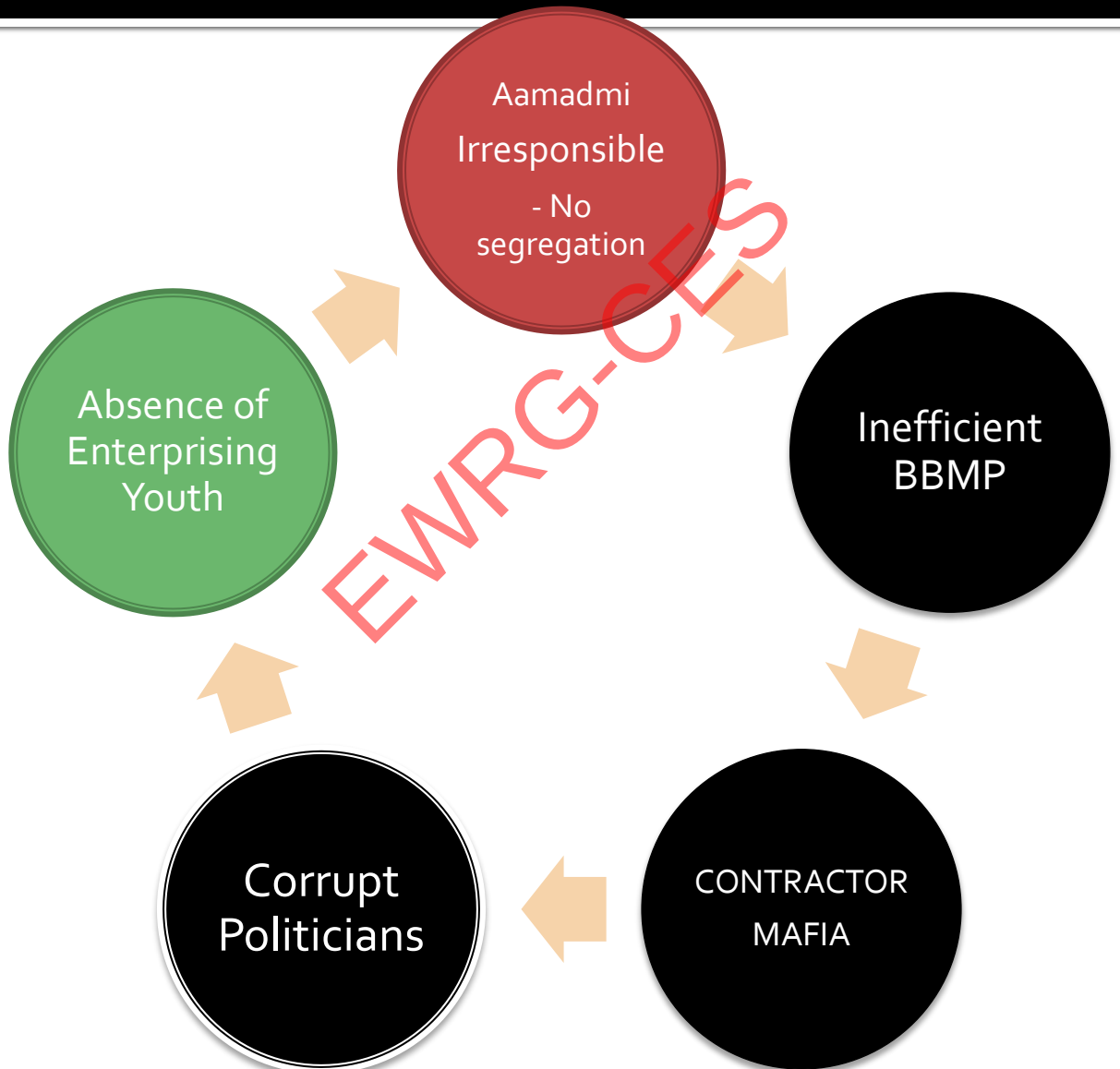
MISMANAGEMENT -SW



BENGALURU

- Bangalore – Garden CITY
- BENGALURU –
  - **Dirty CITY**
  - **POLUUTED CITY**
  - **Garbage City**
  - **LAND GRABBERS CITY**
  - **Arrogant and Egoists Paradise**
  - ~~**SMART PEOPLE, SMART BUREUCRACY, SMART POLITICIANS**~~

- DEAD CITY

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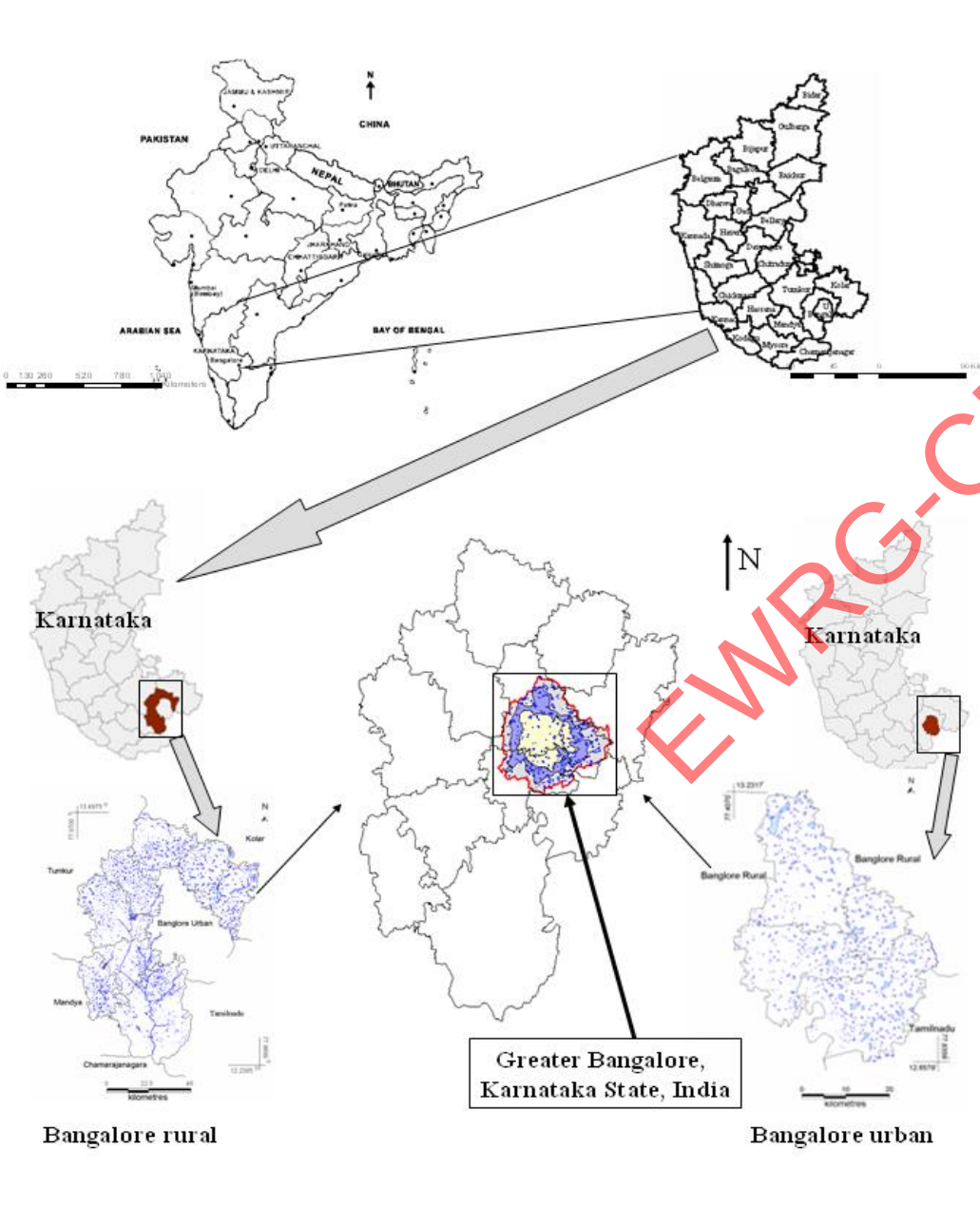
Bangalore (Garden city).....Bengaluru (Dead city)



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•Bangalore has grown spatially more than ten times since 1949 to 2007 (69 km2 to 716 km2) and is a part of both the Bangalore urban and rural districts.

Bangalore temperature in 1800 was 14-16 ºC (May)

Now 34-37 ºC

• The mean annual rainfall is about 880 mm with about 60 rainy days a year over the last ten years.

• The summer temperature 18° C – 35° C, while winter temperature ranges from 12° C – 25° C.

Carbon Footprint Increase in Bangalore

CARBON FOOTPRINT

- Unplanned Urbanisation – increased paved surface, Hapazard growth
- Loss of carbon sink (trees, wetlands, ..)
- Poor management of natural resources
- Building Architecture
- Higher Electricity Consumption
- Vehicle Pollution
- Mismanagement of Solid and Liquid wastes
- Poor Environmental Literacy

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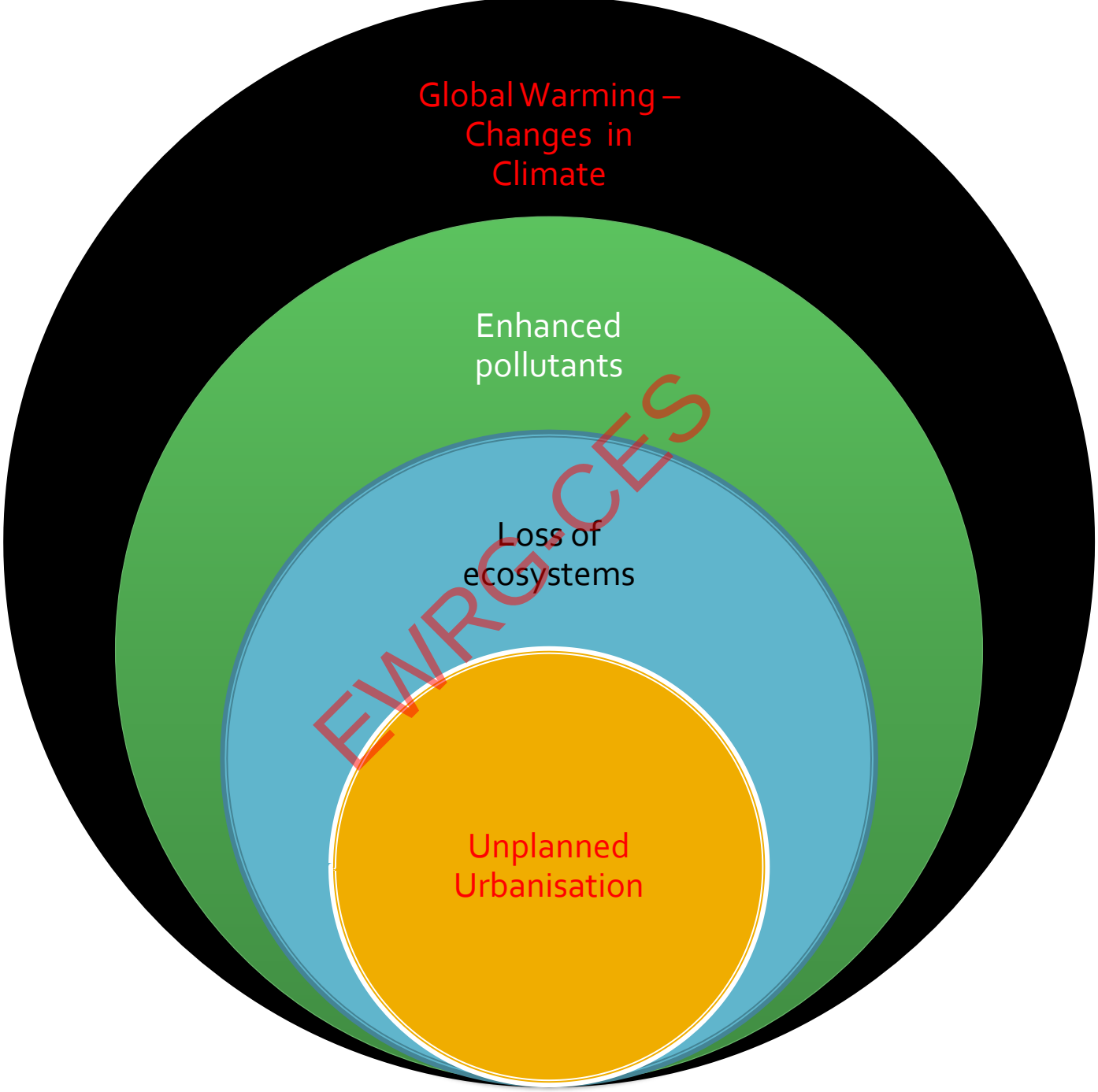
Global Warming – Changes in Climate
Enhanced pollutants
Loss of ecosystems
Unplanned Urbanisation
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Class → Year ↓		Built up	Vegetation	Water Bodies	Others
1973	**Ha**	5448	46639	2324	13903
	%	**7.97**	**68.27**	**3.40**	**20.35**
1992	**Ha**	18650	31579	1790	16303
	%	**27.30**	**46.22**	**2.60**	**23.86**
1999	**Ha**	23532	31421	1574	11794
	%	**34.44**	**45.99**	**2.30**	**17.26**
2000	**Ha**	24163	31272	1542	11346
	%	**35.37**	**45.77**	**2.26**	**16.61**
2002	**Ha**	26992	28959	1218	11153
	%	**39.51**	**42.39**	**1.80**	**16.32**
2006	**Ha**	29535	19696	1073	18017
	%	**43.23**	**28.83**	**1.57**	**26.37**
2009	**Ha**	39910	11153	489	16785
	%	**58.40**	**16.32**	**0.72**	**24.56**

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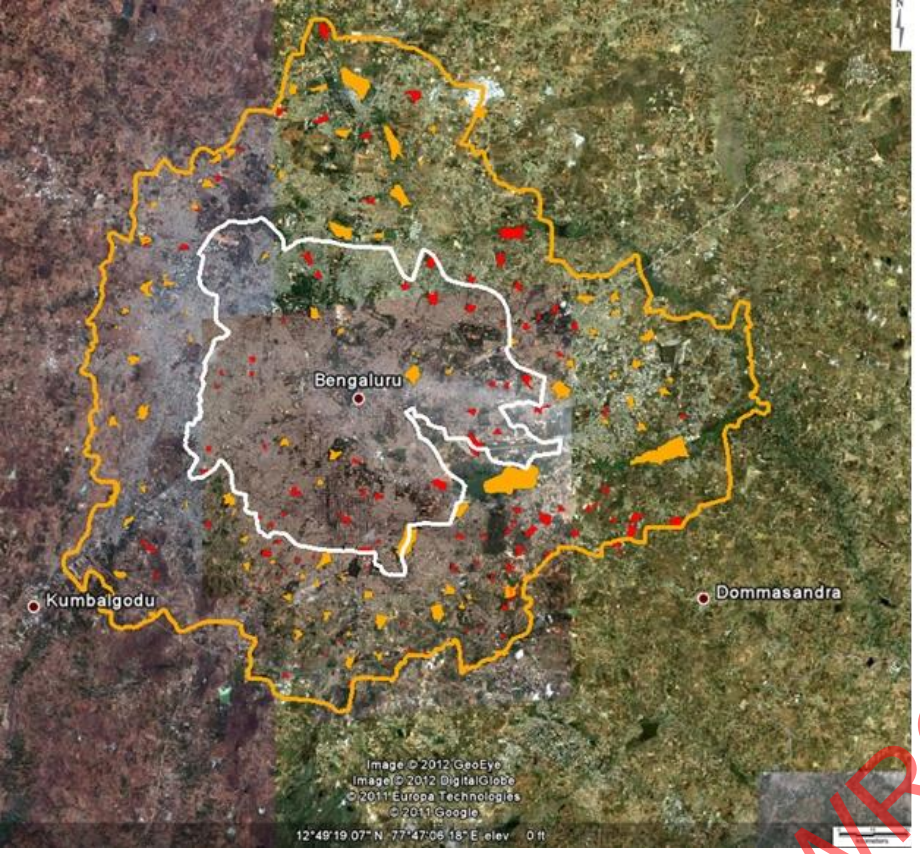
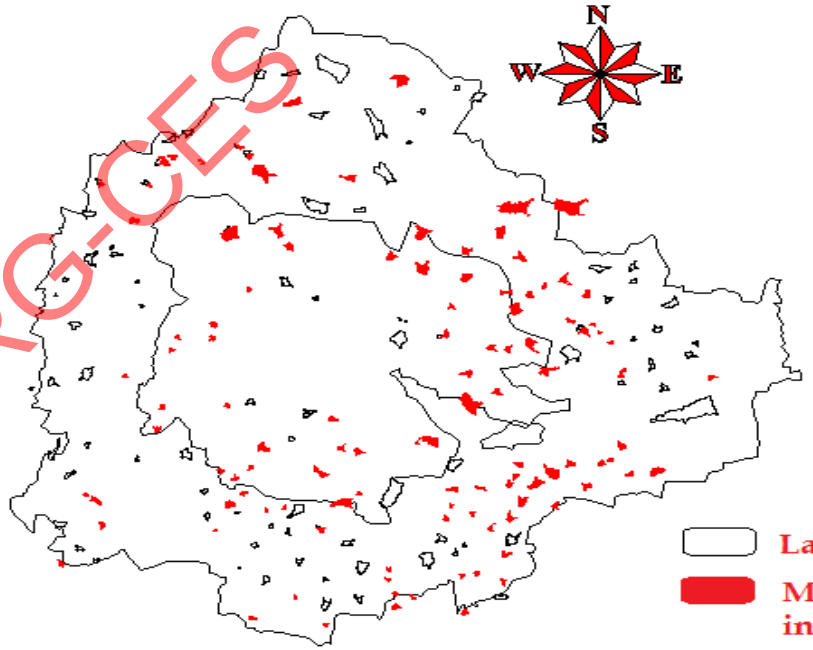
925% increase in built up area from 1973 to 2014 leading to a sharp decline of 78% vegetation, 79% area in water bodies in Greater Bangalore mostly attributing to intense urbanisation process



BBMP boundary & lakes in 2011

BMP Boundary

Missing Lakes in 2011



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Lakes in 2011

Missing Lakes in 2011

0 15 30

kilometers

	Bangalore city	Greater Bangalore
1973	58	207
2010	10	93

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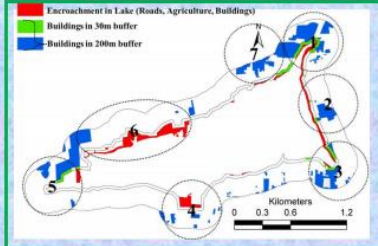
BURNING ISSUE

PATHETIC STATUS OF WETLANDS IN BANGALORE: EPITOME OF INEFFICIENT AND UNCOORDINATED GOVERNANCE

Froth

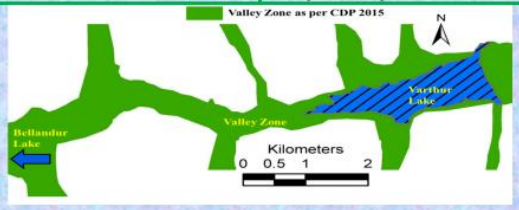
Fire

Ramachandra T V	Asulabha K S	Sincy V.	Vinay S
Bharath H Aithal	Sudarshan P.Bhat	Durga M. Mahapatra	



Violations in the lake bed and buffer zones

Valley Zone as per 2015 CDP



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Open Source GIS: http://ces.iisc.ernet.in/grass

Carbon footprint

- GHG's due to indiscriminate disposal of liquid and solid wastes
- Increase in Vehicular pollution
- Carbon emission due to building architecture (increased energy consumption and hence pollution)
- Increase of pollution from industries (due to number of industries as well as enhanced activities in a region)
  - Increase in carbon emission – changes in local temperature, disease, etc.

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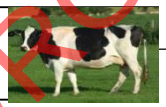
Emission sources

Domestic 

Transport 

Industry 

Agriculture 

Livestock 

Waste 

Commercial & Other sectors 

Road

Navigation

Paddy cultivation

Soils

Crop residue burning

Enteric fermentation

Manure management

Municipal solid waste

Domestic waste water

Industrial waste water

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GHG footprint of major cities in India

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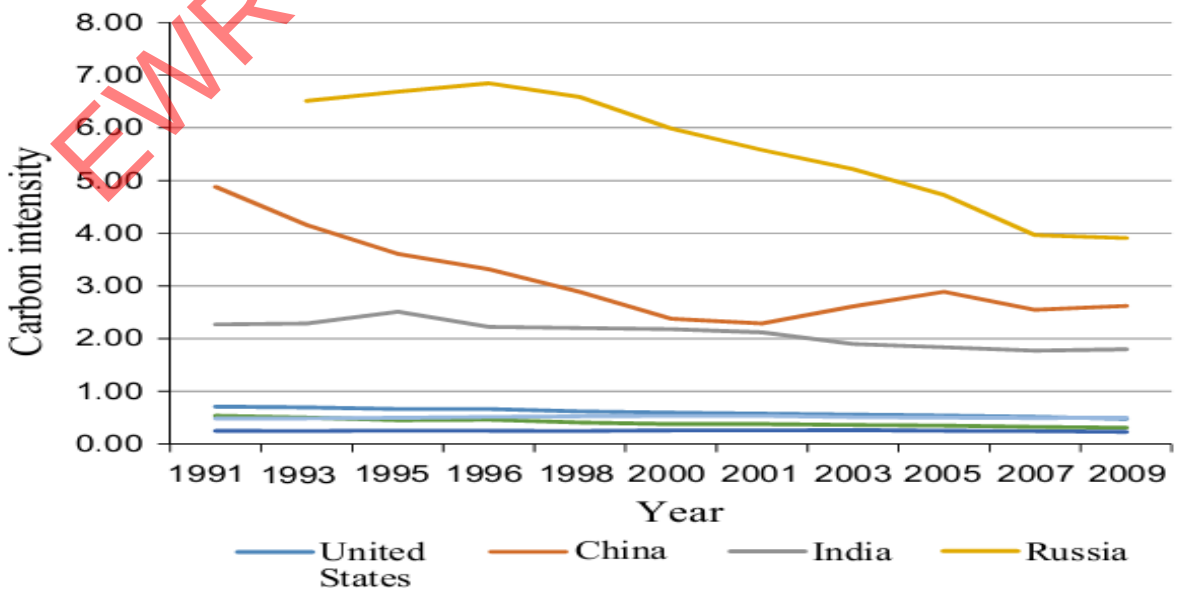

Fig. 1. Carbon intensity across the countries (kg CO_2/constant US $).

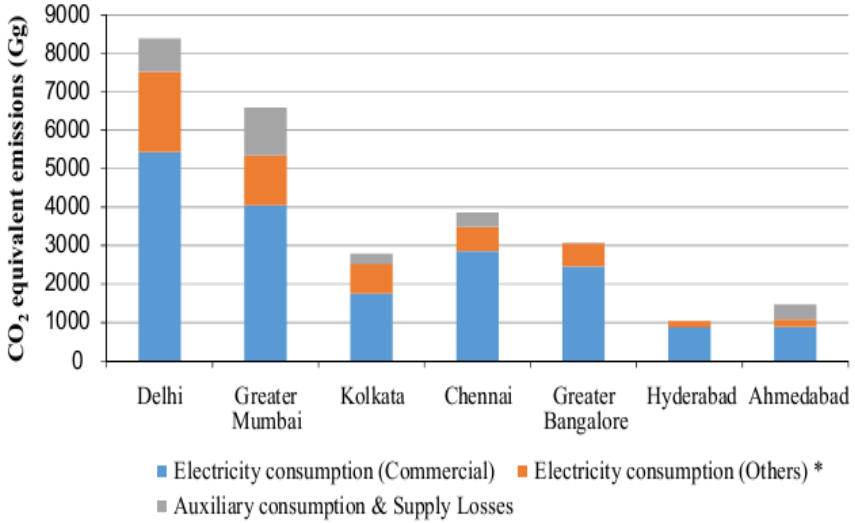

Fig. 3. GHG emissions (carbon dioxide equivalent, CO_2 eq.) from electricity consumption.

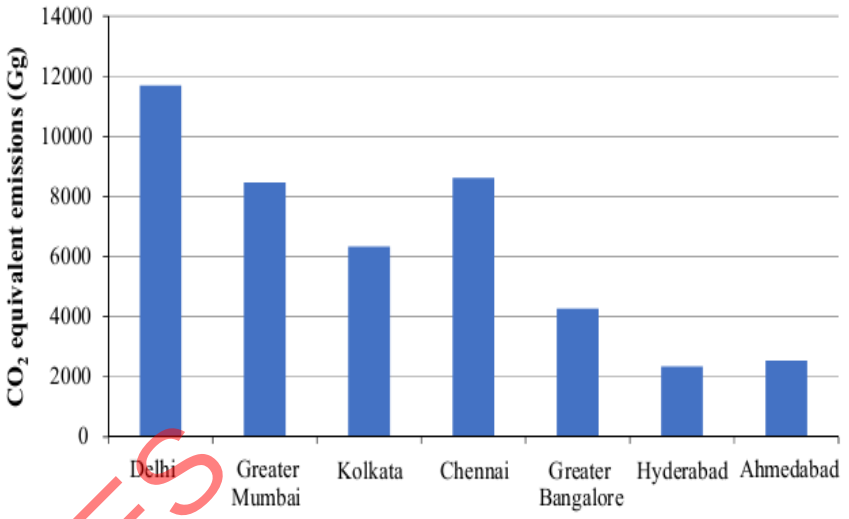

Fig. 4. GHG emissions (carbon dioxide equivalent, CO_2 eq.) from domestic sector.

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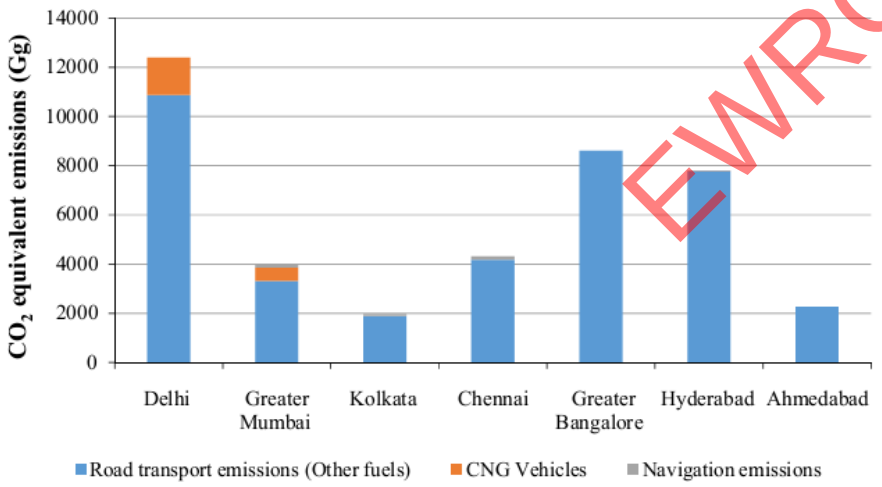

Fig. 5. GHG emissions (carbon dioxide equivalent, CO_2 eq.) from transportation sector.

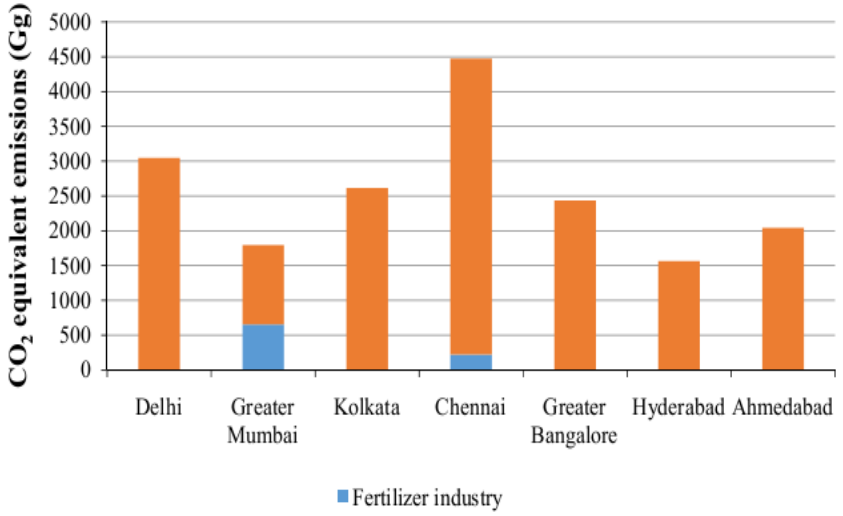

Fig. 6. GHG emissions (carbon dioxide equivalent, CO_2 eq.) from industrial sector.

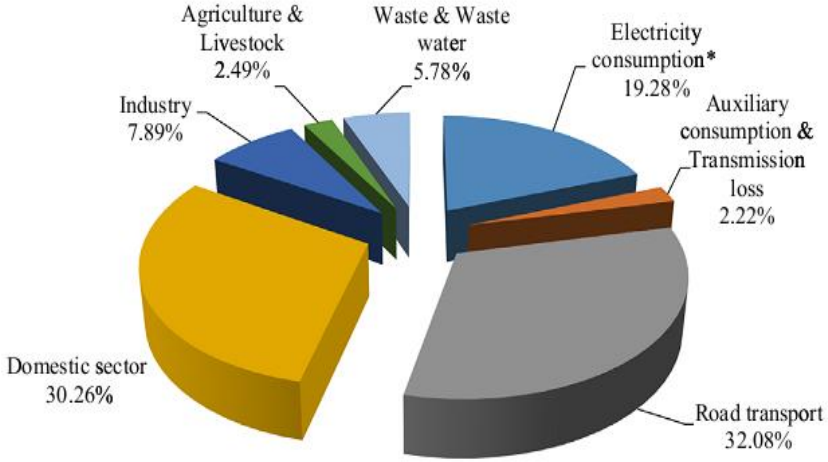

Fig. 12. GHG footprint (carbon dioxide equivalent emissions, Gg) of Delhi.

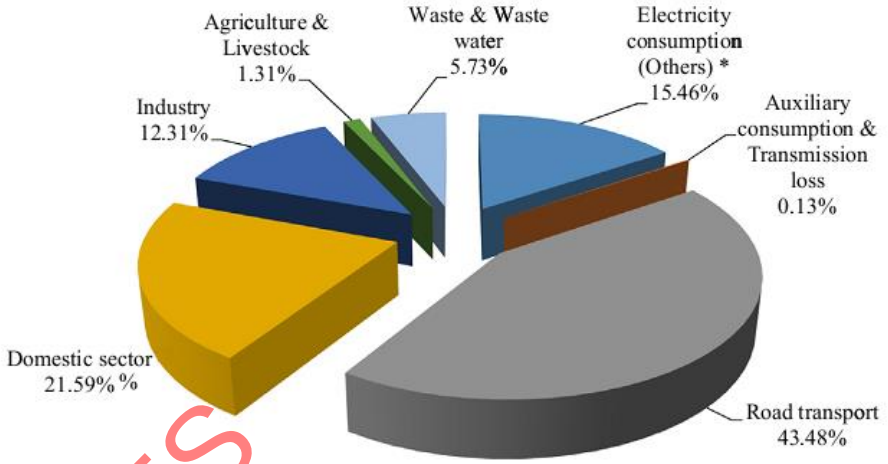

Fig. 16. GHG footprint (carbon dioxide equivalent emissions, Gg) of Greater Bangalore.

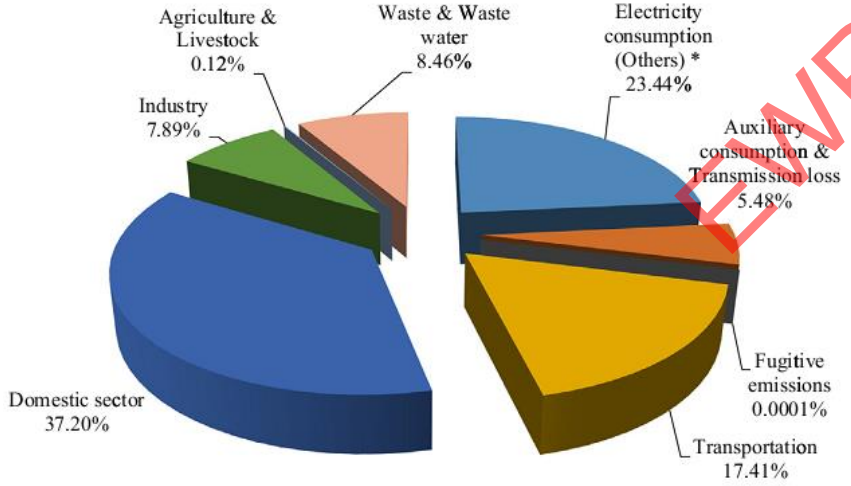

Fig. 13. GHG footprint (carbon dioxide equivalent emissions, Gg) of Greater Mumbai.

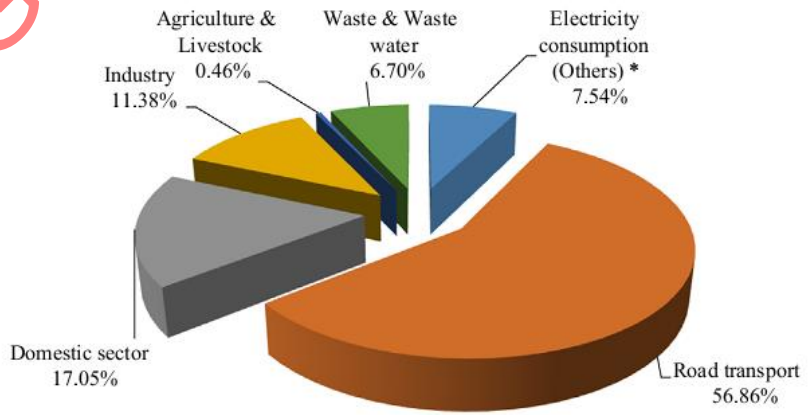

Fig. 17. GHG footprint (carbon dioxide equivalent emissions, Gg) of Hyderabad.

Waste & Waste Electricity

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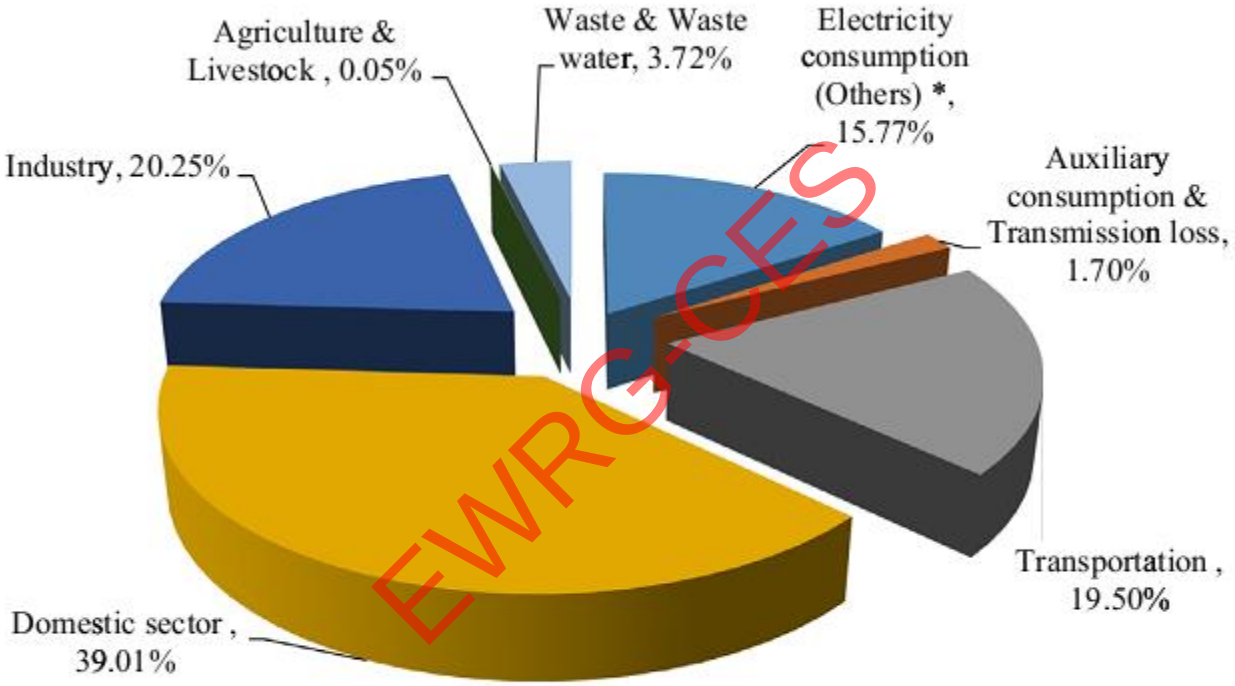

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Fig. 15. GHG footprint (carbon dioxide equivalent emissions, Gg) of Chennai in 2009–2010.

Waste mismanagement

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Waste composition

Waste type	Composition (% by weight)			
	Year 2000 (all over Bangalore)	Year 2004-05 (all over Bangalore)	Year 2001 (IISc)	Year 2010 (IISc residential area)
Fermentable	72	52	73	69
Paper and cardboard	11.6		18	8
Cloth, rubber, PVC, leather	1.01			2.32
Glass	1.43			8
Polythene/plastics	6.23		9.5	7
Metals	0.23			1.33
Dust and sweeping	6.53			
Source/Reference	TIDE, 2000	TEDDY, 2009	Sathiskumar et al., 2001	Based on study conducted in residential area

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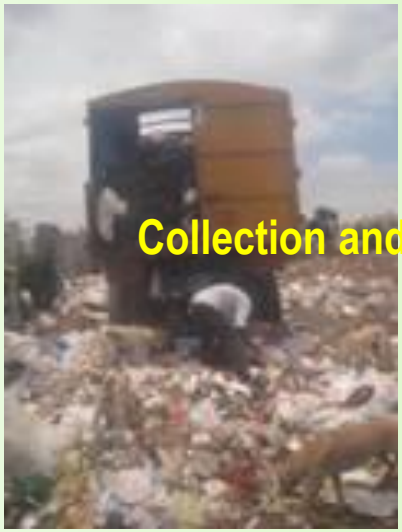
Components of Municipal solid waste management



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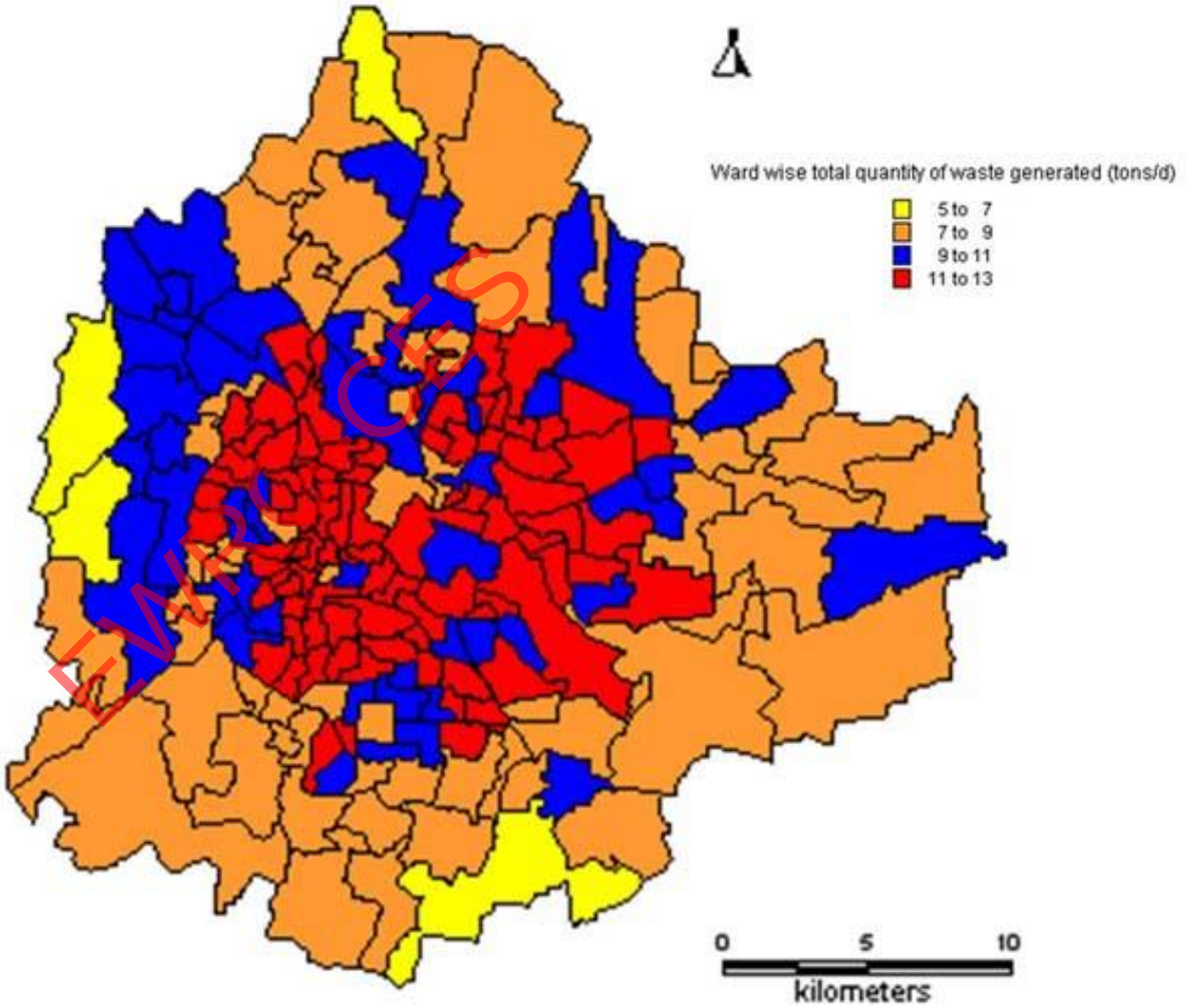
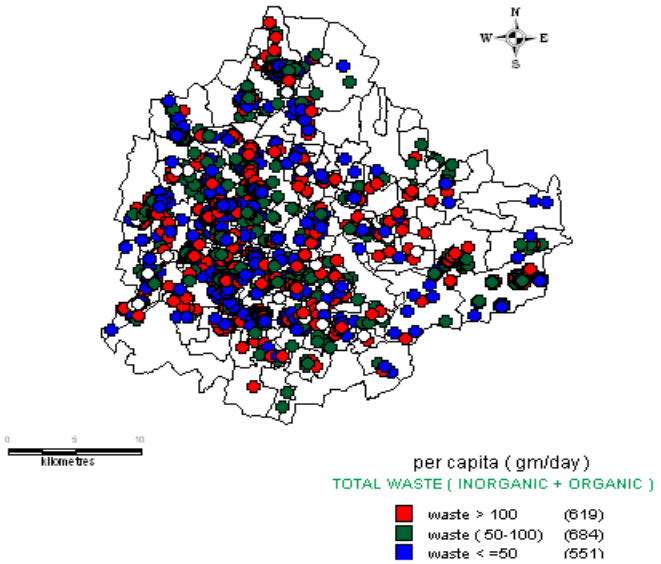
Ward wise MSW generated in Bangalore

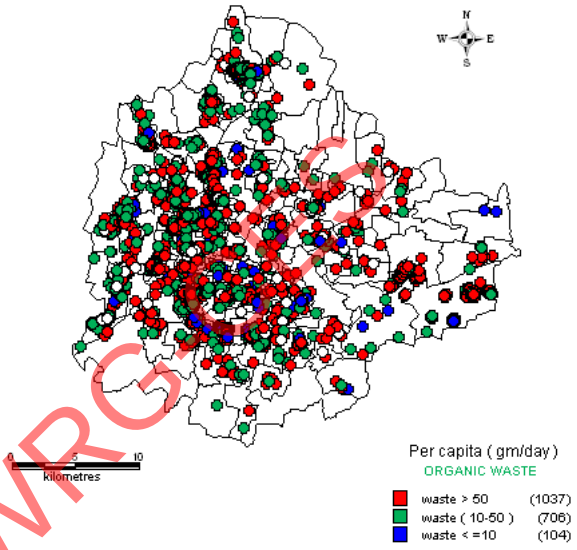


E-WRC CES

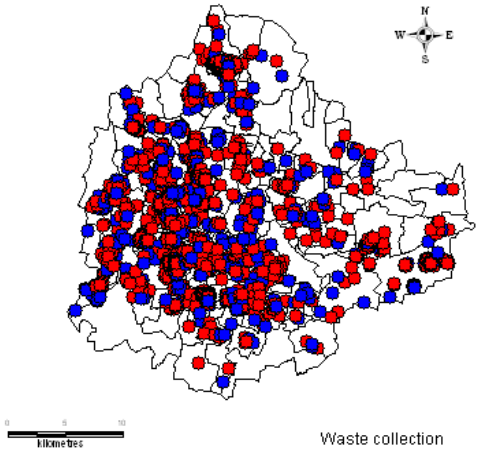
- Population: 7.8 million
- Area: 741 km^2
- Per capita waste generation: 0.35 kg/d in year 2009

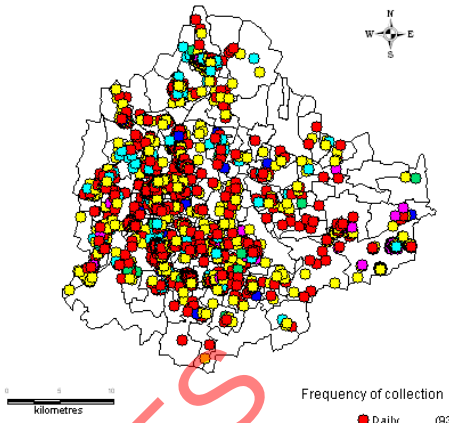
Solid Waste: composition





EWRG-CEE


N
W
E
S
0 5 10
kilometres
Waste collection
Door to door collection (1270)
Provision of storage bin (697)


N
W
E
S
0 5 10
kilometres
Frequency of collection (WEEKLY)
Daily (930)
Four times (234)
Thrice (39)
Twice (29)
Once (52)
Bin (683)

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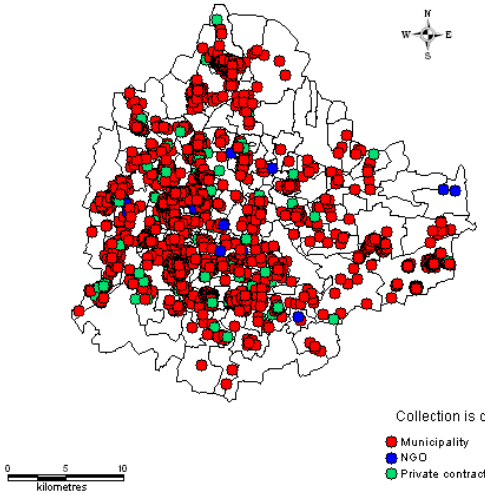
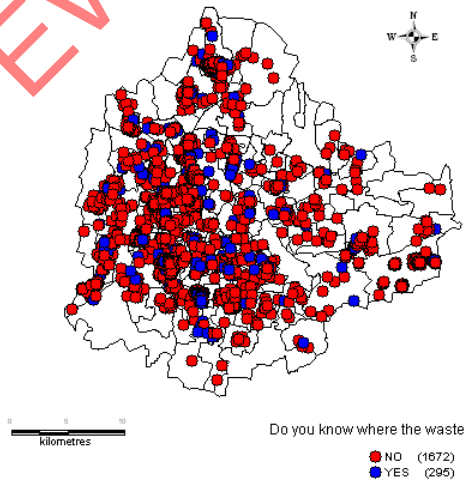
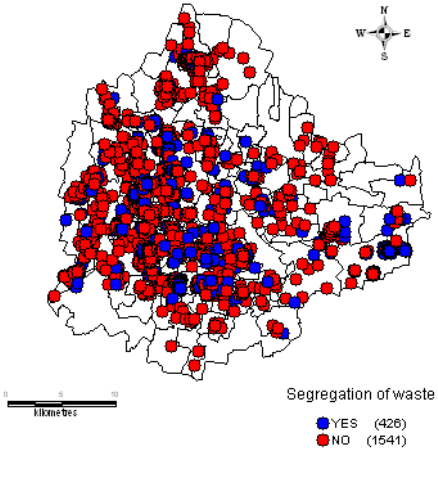
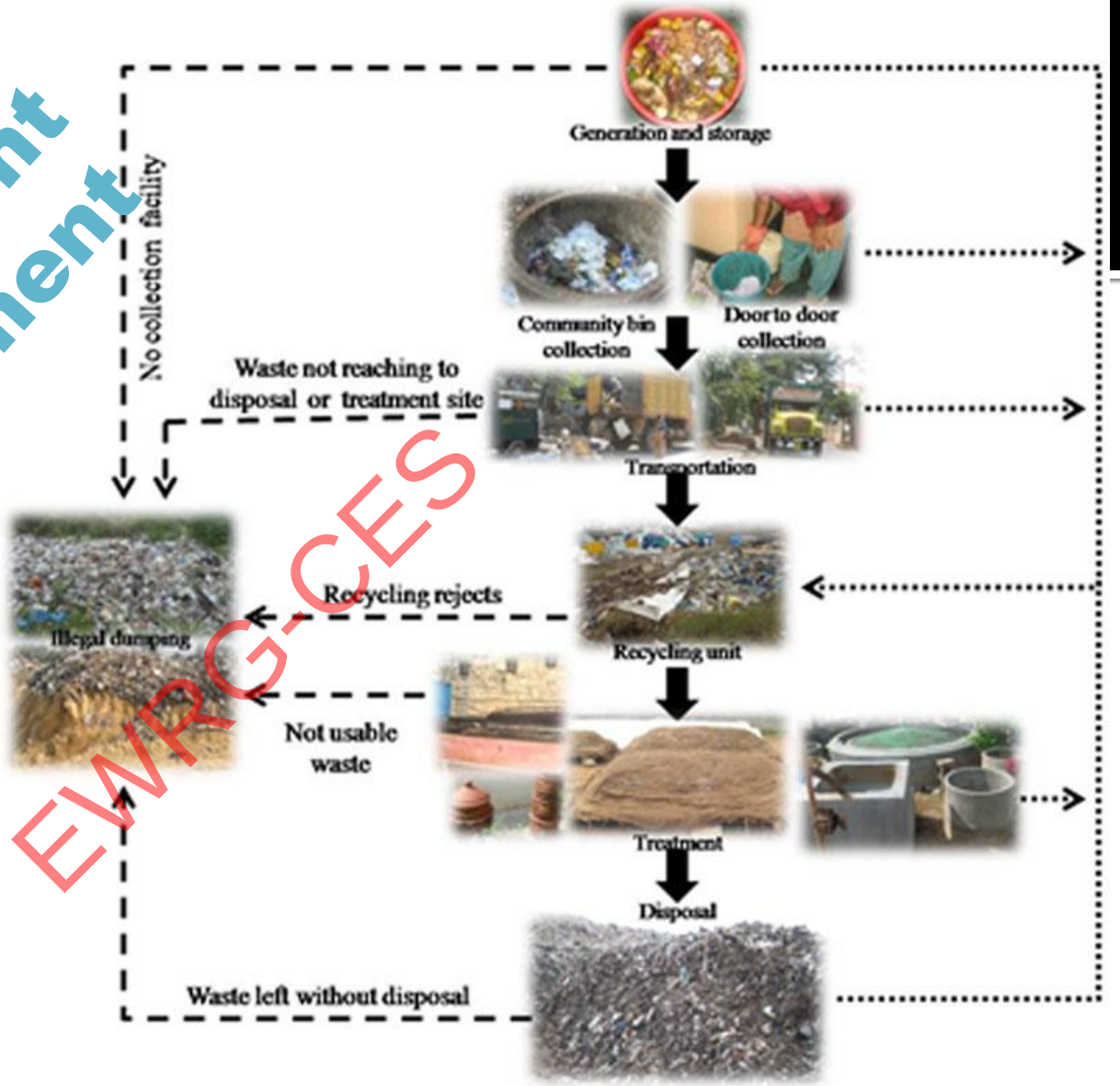

N
W
E
S
0 5 10
kilometres
Collection is done by
Municipality (1777)
NGO (29)
Private contractor (161)


N
W
E
S
0 5 10
kilometres
Do you know where the waste is transported
NO (1672)
YES (295)


N
W
E
S
0 5 10
kilometres
Segregation of waste
YES (426)
NO (1541)

Overview of current waste management



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Mavallipura
- CH_4 emission (tons)= 0.76
- CO_2 emission (tons)= 93.58

Mandur
- CH_4 emission (tons)= 5.13
- CO_2 emission (tons)=632.62

KCDC
- CH_4 emission (tons)= 1.79
- CO_2 emission (tons)=221.5

Chennasandra
- CH_4 emission (tons)= 0.92
- CO_2 emission (tons)=

Authorized treatment and disposal places

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Current treatment practices

Windrow composting

Mavallipura

Mandur

Centralized treatment facility

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Small scale treatment facility

- Mavallipura and Mandir have capacity to treat 600t/d and 1000t/d of waste[1]

1 BBMP report, 2009

Flaws in Waste Management

- Illegal dumping in roadside area and in peripheral city area creates nuisance and cause damage in the environment
- The core city area is highly populated and availability of open space is very limited
- Planning and management of existing landfill sites
- Lack of awareness and insufficient segregation

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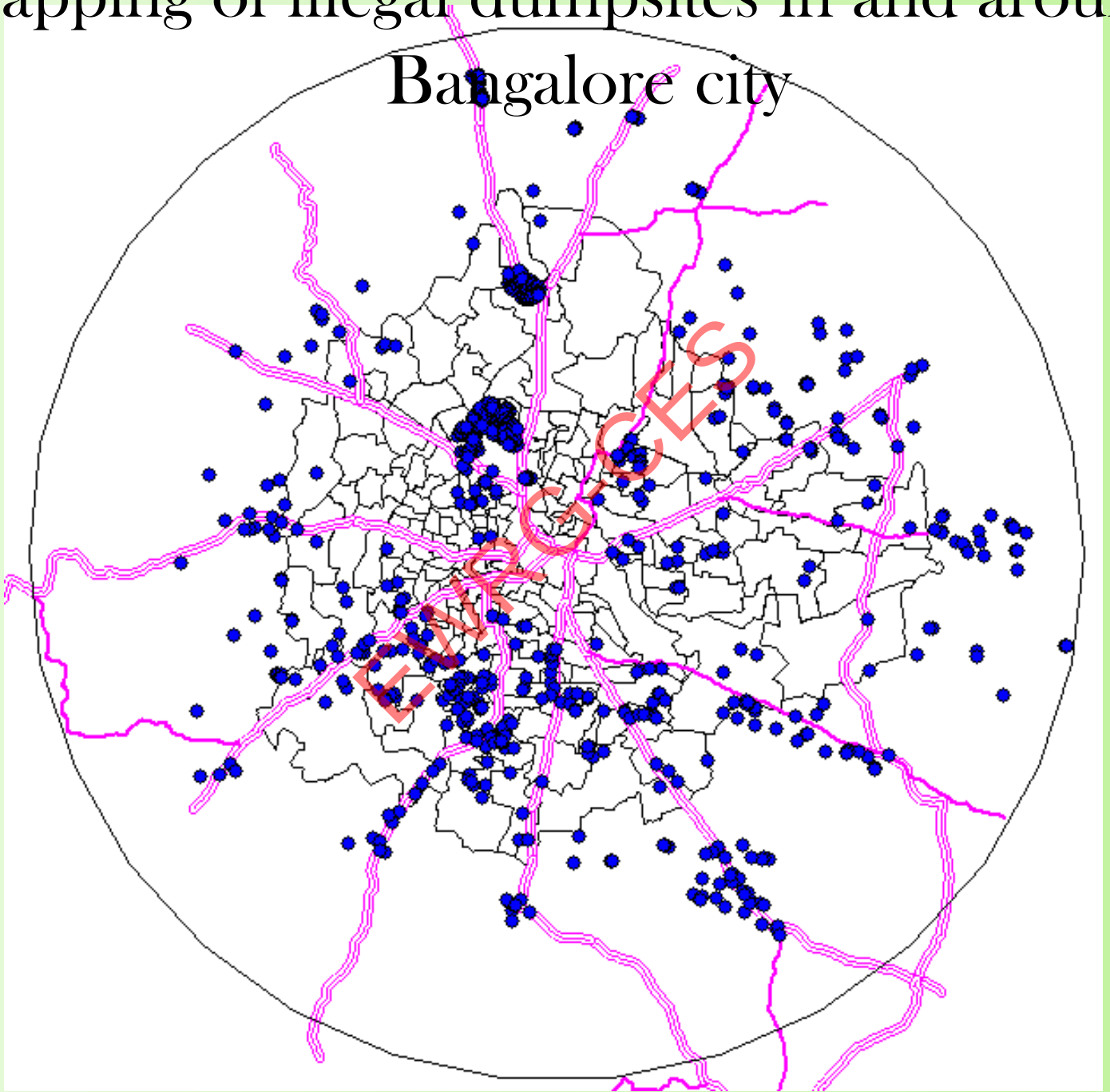
Mapping of illegal dumpsites in and around Bangalore city



Waste sectors contributing to carbon emission

- Open dumping/ Unauthorized dumping
- Unscientific disposal
- Collection and transportation

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Waste and water bodies

- Open waste disposal: open area, quarry pit or water bodies.
- Fermentable get degraded and left behind a predominantly non biodegradable wastes.
- Direct discharge of sewage and wastewater into storm water drains that ultimately link to water bodies[2].

Indian Institute of Science, Bangalore
EWRG-CES

2. Mahapatra et al., 2011


??
!!


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Leachate??

South Bangalore (near Bettadasanapura)

Environment Education & 3S

- Enhance Environment Literacy – General Public
- EE at all levels – School to College
- 3 S's
- Sense of Belonging - **Public**
- Sincerity – **Bureaucracy, Custodians**
- Spinal card – **Regulatory Agencies**

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What can be done??

- Reduce Waste
- Reuse Waste
- Recycle Waste
- Resource Recovery
- Create Awareness:
  - Waste reduction
  - Segregation at source
- Decentralized waste management
- Remove nexus (contractors, engineers, budding politicians, ...

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Environmental Impacts

- Contaminated leachate and surface run-off from land disposal facilities affects ground and surface water quality.
- Volatile organic compounds and dioxins in air-emissions are attributed to increasing cancer incidence and psychological stress.
- Drain clogging due to uncollected wastes leading to stagnant waters and subsequent mosquito vector breeding.

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Summary

We discussed waste characteristics, which decide various elements of management and disposal option.

Subsequently we have seen consequences of improper disposal of solid waste on public health and environment.

Finally, these aspects were illustrated with an example of solid waste management in Bangalore city.

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What needs to be done?

- Decentralized waste management
- Remove waste mafia – contractors+BBMP engineers
- Segregation at source level / Segregation at ward level
- Reuse and recycling
- Availability of waste treatment for organic waste
- Enhance Awareness.

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ENVIRONMENT EDUCATIION

EEC2016 (23-26 Jan 2015)

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