Sustainable Linear Green Cover Development Plan for Gurugram City towards the Improvement of Urban Green-Spaces

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ABSTRACT

Roadside green is parameter that indicates the level of the beautification of the city. Towards sustainable achievement points this section is important point to certify and the total points earned for approved sustainable practices. Therefore, a detail analysis of roadside green of city Gurugram measured by using geospatial technology and integration with other ancillary datasets and documents. Primary survey for tree inventory will play an important role for demarcation of standing urban tree. Google-Earth satellite data with geo-tagged information will be helpful for decision support system and urban tree information system. Baseline for sustainable urban environment and greenbelt development by using geospatial technology will make it easier to use and will be helpful in creation of tree database management. Urban green cover works as a lung of the city and control the pollution emitting from various sources e.g. vehicle, industrial, waste water, institutional, e-garbage and medical waste and domestic bin improper dumping by slum residence and in the fringe zones of the city etc.

Keynotes: Geo-Tagging, Tree Cover, DSS, Urban Environment

INTRODUCTION

Green cover not only part of the beauty but it can also fruitful for biodiversity conservation, ground water retention, minimizing the temperature, controlling factors for pollution. Before starting any work related to environment conservation and environment development plan a baseline dataset is required. It was observed that roads, pedestrian and foot bridges are essential parts of local community of that city or region. It was believed that out of 168 hours in week, commuters spend 98 hours on the road. For the well being of people, livelihood and culture sustainability and natural law introduced (Green-roads Manual 1.5 US, 2011) and (Stephen T. M et. al.2010).

To achieve roadside green sustainability, green cover management and improvement of urban green a regular monitoring, tracking of green standing is required. Burden of pollution on the cities, eco friendly technologies are key factors to resolve global issues such as climate change, carbon emission, pollution increment, heat island etc. (P. Aruna & B. Rupini, 2021). 200 species recommended by CPCB (2000) according to bio-climatic regions of India for environmental cleaning through greening.

In a study, (J. Kumari & D. Mehta, 2021) five key areas of green highway introduces as storm water management, conservation and ecosystem management, energy emission reduction, recycle and reuse and overall societal benefits.

According to National Forest Policy of India at least 33 percent of green cover should be followed by any City. To achieve "The Green Highway Policy-2015" green practices such as plantation, beautification and maintenance, reduction in noise and air pollution (MoRT & H, 2019) code of Green highway is required. USDA defined various methods for urban forest management based on intent usages, planning and technologies such as remote sensing, forest type methods, surveying methods and regional planning (USDA, 2002). Urban trees can be three on side of the road left side, right side and central verge with its types.

Sarwadi et.al (2019) explained secondary arterial roads (SAR), secondary collector roads (SCR) and local street (LS) for productive landscape planning for urban environment. Ye Y et.al. (2018) studied on landscape and urban planning for better environment for human well being and sustainable urban planning strategy.

Interactive urban planning and green space studies are being done by using GIS and remote sensing (USDA 2002, Comber et.al. 2008). In a report (2000), CPCB defined some guideline for greenbelt development for combating air pollution along the roadsides.

Objective:

1. Green spaces monitoring and geodatabase creation
2. Green information system development

Study Area

Millennium city Gurugram previously known as Gurgaon is hub of multinational companies and revenue city of Haryana. It is part of National Capital Region and help to minimize the burden of Capital City Delhi. Gurugram Metropolitan Development Authority acquires an area of 274 sq km including municipal corporation areas of Gurugram and Manesar (as mentioned in Gurugram Manesar Urban Complex draft plan). It was constituted by Act 2018 of Town and country planning. Aravali and residual Aravali hills glimpse beautify its surrounding. Alluvial soil of Sahibi River and sandy loam soil makes fertile land in semi arid climatic condition. Major forest types of Gurugram is categorized under 5/DS1 Dry Deciduous Scrub, 5/E1Anogeissus Pendula Forest and 5/E1Anogeissus Pendula Scrub and major native species are Acacia nilotica, Dalbergia sisoo, Ficus spp., Accacia tortilis, Prosopis cinearia, Prosospis juliflora, Psidiue guava, Salvadora, Azadirchta indica etc (FSI, FTM, 2010). Transportation system of Gurugram is also well connected with entire country with road network NH-48 Northern Peripheral Road (NPR), Southern Peripheral Road (SPR), State highway (SH) and district roads etc. Railway and airways connectivity of the city is also well equipped having 16 km distance from international airport New Delhi.
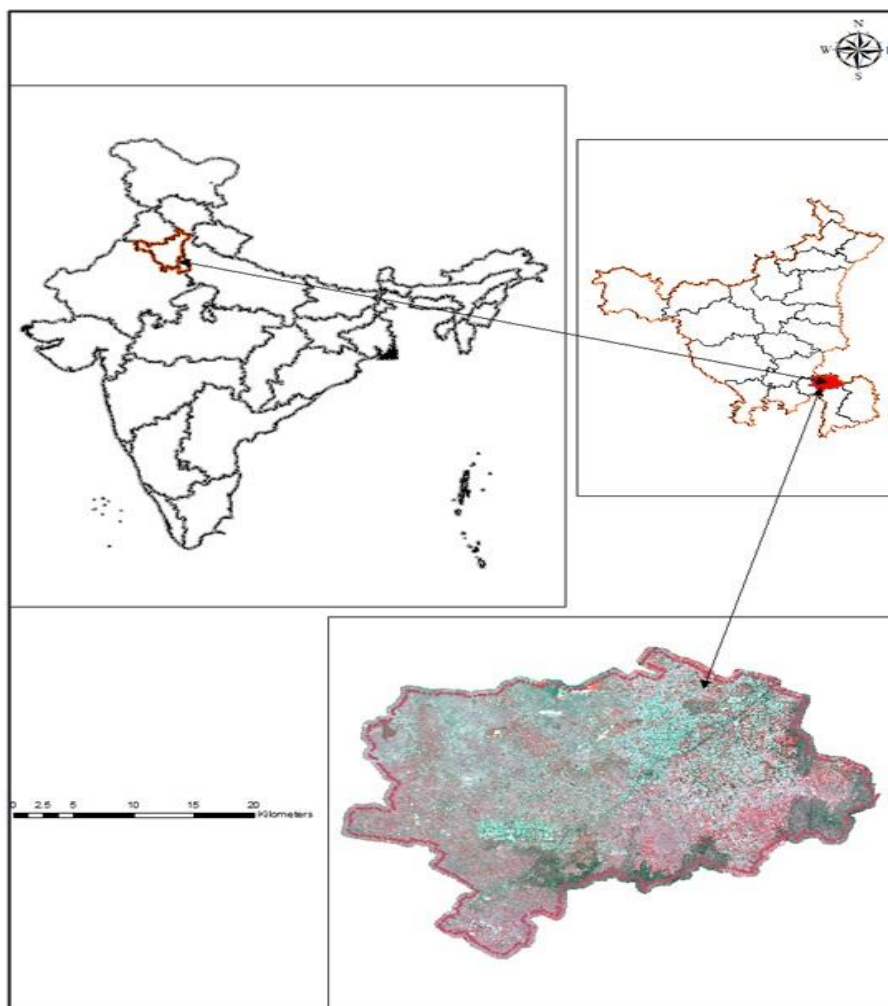
Figure 1: Location Map

DATA USED AND METHODOLOGY

Primary and secondary data used during the entire study. For mapping part Sentinel-2B and Google-earth were used. Ancillary datasets such as technical report, Town and country Planning Draft development plan of Gurugram,

Gurugram Manesar Urban complex document and related report, NCR draft plan 2041, technical reports of Forest Survey of India, etc. were also used with integration with spatial datasets.

RESULTS AND DISCUSSION

Land use and Land cover (LU/LC) Mapping

LU/LC based on Sentinel-2B December-2022 used for landuse classification. It was analyzed that highest coverage land is agriculture land which covered 38 percent area but proposed under Gurugram Metropolitan Development Authority area. Second highly concentrated landuse class is built-up which acquired 27 percent of total land as given in table 1. Water-bodies cover only 1 percent of the total geographical areas and 1 percent is covered under Bassai wetland areas. Green cover was 18 percent under GMDA control area boundary because of the Aravali Hills. During mapping the roads It was found that along the KMP (Kundli Manesar-Palwal) and Dawarka Expressway a large area can be developed as green corridor.

Table 1: Land use and land cover 2022

Classes	% Area
Built-up	28
Road	4
Agriculture Land	38
Tree Cover	1
Park/ Available Green Spaces	7
Proposed open Space	11
Aravali	10
Wetland/Wasteland	1
Water-body/ Drain/Pond/Canal	1

Source: Sentinel, 2-B datasets LU/LC, 2022
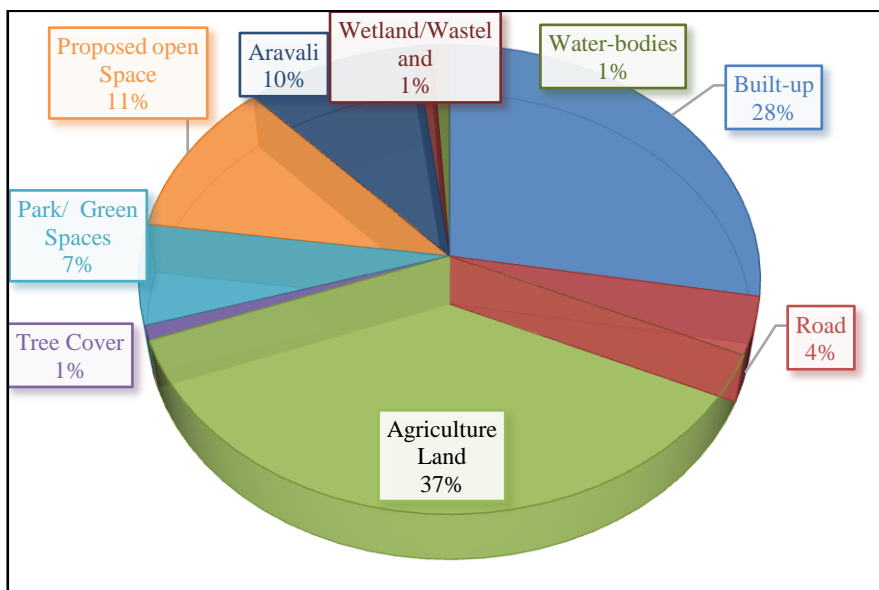
**Figure 1: Landuse and land cover percent in Gurugram city**

Road Assets zone Mapping

After calculation of total road some proposed suggestion of the city green cover enhancement for sustainable city development and to reduce carbon emission in the city. To reduce the impact of vehicle smoke emission in the city entire study was classified into two categories as following:

1. Mapping Part and
2. Decision making Part.
3. After ground truthing and quality check of the work authenticity.

Roads Types in the Gurugram City

There was multiple road, rail and metro corridors in the city including National highways, Expressway, state highways and district roads and city roads as given in figure 2. It was found that there was 199 km of the city roads were available in 2022 from which more than 20 roads were available having 60 meters and above right of way. Therefore a good roadside city green walk can be developed in the city. As per GIZ's study 9sqm per person green cover is require for good health.
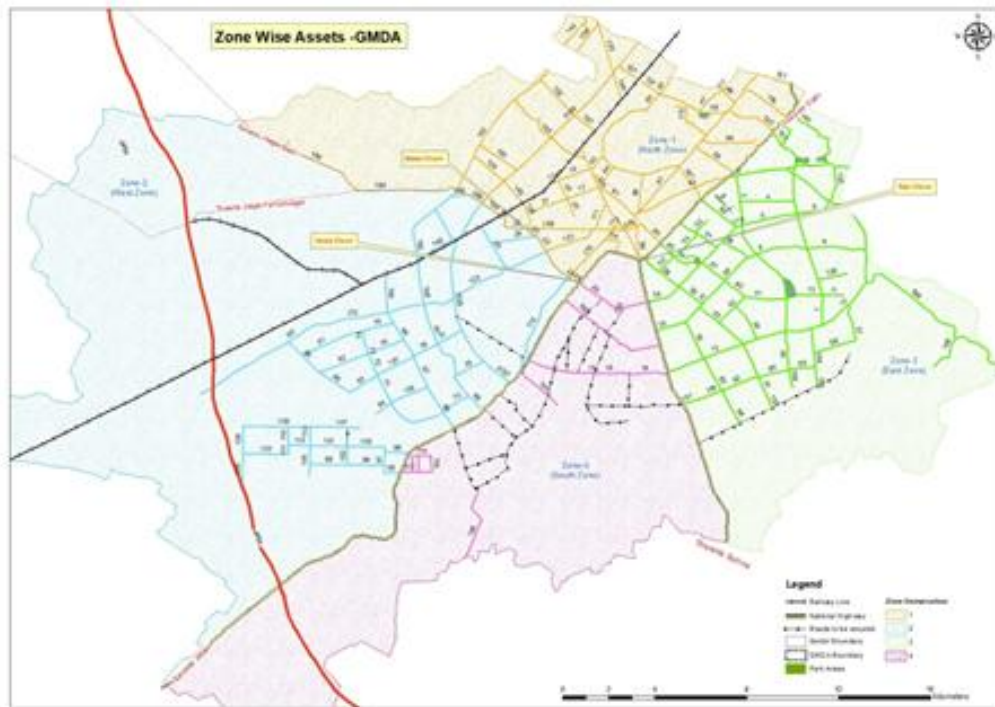
Source: GMDA Act-2018 (Town and Country Planning Department, Haryana) and onemapggm

Figure 3: Roads of the Gurugram City

Suggestions on the basis of Mapping

1. Green corridors establishment along expressways and highways
2. Roadside city green park development
3. Growing on the native species to combat with climatic adaptation.
4. Pollution absorption species plantation along the road to control the vehicle smoke emission as defined by Central Pollution Control Board of India.
5. Regular tree monitoring, beautification of the roads by obstacle free plants and shrubs
6. To control heat island large number of city plantation
7. To sustain and conservation of soil and rain water infiltration to ground aquifers
8. To conserve the biodiversity in the city area.

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