"GREEN BELT DESIGN FOR SEMI-ARID AREA, STUDY AREA: BHIWADI, RAJASTHAN"

Introduction

Green Belts, unlike the popular impression, are not merely for beautification purposes. 'Green vegetal cover is not only pleasing to the eyes but also beneficial in many ways such as conservation of bio- diversity, retention of soil moisture, recharge of groundwater and moderation of micro-climate. Yet another important role of vegetal cover, which is not well recognised, relates to containment of pollution.'[1] Green belt is an important component of any development project. Being a mandatory provision in most cases, it needs to be handled sensitively and with precision to make it work successfully.

The ever-increasing air and noise pollution levels have affected lakhs of people in urban areas with diseases such as asthma, bronchitis, lung cancer, respiratory problems and hearing deficiencies. Euro II engines or CNG fuel are a step towards saving the urban environment, but keeping in mind the rising trend in vehicle ownership, it becomes imperative that vehicular air pollution, a major source of pollution in urban areas, be combated through other measures also. Another problem associated with vehicle plying is the high noise levels making areas adjoining to major roads unfit for environmentally sound living. Industrial towns have added to the pollution through stack emissions, operational odours and noises, effluents and toxic or hazardous solid waste.

While planning of urban or industrial areas, it has become a tendency to leave open spaces for plantations. Usually they are for the purpose of beautification in urban areas or to act as a buffer around industries. Sir Ebenzer Howard had used an agriculturally productive green belt for the purpose of containing urban expansion in his concept of "Garden Cities". Since time immemorial, the knowledge that plants inhale what we exhale i.e. carbon dioxide, has been there. But over the last few decades it has also come to light that plants have the ability to tolerate and assimilate a variety of air pollutants. They also have been proved to absorb noise, thus attenuating it.

With rise in pollutant levels in not just urban areas but the hinterland as well, it has become imperative that the green belt planning and designing to be done in future, is not merely for ornamental purposes. Providing minimal width of green belts is no more enough. A green belt should be able to abate air and noise pollution and act as a pollutant sink. For this purpose, the basis for green belt planning and designing has to be a scientific one, only then will the green belt be efficient. The layout, width, height, cross sectional variation in height, species and other green belt parameters should be decided for different areas on the basis of climate, soil type, water availability, pollutant to be combated, aesthetics, ground water recharging capacity, growth rate, economic benefits and other factors.

Hence, a scientific approach towards the choice of plants, trees and formation of appropriate green belts will lead to not only cleaner but also greener towns and cities with open green lungs to sustain them into the coming millennia.

Title
Greenbelt Design for Semi- Arid Area

Study Area
Bhiwadi, District Alwar, Rajasthan.

Aim
To plan and design a green belt model for pollution abatement in an industrial town in semi- arid area

Objective and Scope
1. To create a replicable green belt model for industrial towns in the semi-arid agro-climatic zone with similar industrial, residential and traffic characteristics.
2. To create a green belt model for environmental improvement which may include one or more of the following:
   (i)   air pollution abatement,
   (ii)   noise pollution abatement,
   (iii)   ground water recharge,
   (iv)   waste water treatment,
   (v)   wasteland reclamation,
   (vi)   preventing soil erosion,
   (vii) combating desertification,
   (viii) improving biological diversity,
   (ix)   economic returns,

1. Biswas, Dilip, March 2000, 'Guidelines for Developing Greenbelts', PROBES/75/1999-2000

    (x)   modification of micro- climate,
    (xi)   aesthetics and recreation
    (xii)   containment of urban growth
3. To apply the Green Belt model on Bhiwadi, Distt. Alwar, Rajasthan.
4. To work out Finances, Organisation and Management of proposed green belt in Bhiwadi
5. To formulate guidelines and policies for green belt development for industrial areas

Selection of case study area

Due to rapid urbanisation in the city of Delhi, the population has exceeded over 100 lakhs. In spite of it's already massive extent, Delhi continues to attract more people due to its employment potential in the industrial, tertiary and informal sectors. In order to support Delhi population, correspondingly the vehicles, both public and private, have increased drastically. Air and noise pollution from vehicles, slums, and several other sources has increased to such an extent that Delhi is considered the third most polluted city in the world according to W.H.O. The inadequate infrastructure further leads to environmental problems such as water pollution, diseases and unhealthy living environment.

Considering the increasing congestion in the National Capital, an effort was made by the government in the form of enacting a 'National Capital Region (NCR) Planning Board Act, 1985' covering National Capital Territory(NCT) of Delhi, parts of Haryana, U.P. and Rajasthan. NCR provided counter magnates to release pressure on Delhi and to precipitate a balanced development in the region.

Rapid urbanisation in this region might gradually lead to Delhi like situations at the growth centers. Hence, the quest for a new town for green belt modeling led to the new towns in NCR.
As per plan proposals Bhiwadi is identified as Regional Centre or Priority Town of Rajasthan sub region. This designation led to rapid urbanisation of the already industrialised town leading to rising air, noise, water pollution levels. With a resident population of less than thirty five thousand, and an urban area of 2000 hectares (20 sq.km.), it seems a suitable town size for micro[2] and meso[3] scale studies. The precedence of Delhi's deteriorating environment warns of the environmental dangers of the rapid growth in a Priority Town. Hence, it seems the ideal town for and ideal green belt model.

Brief Description of case study area

Bhiwadi is situated in the north eastern border of Rajasthan. It lies at the intersection of 28o13' North latitude and 76o15' East latitude. It is located at the junction of Rewari-Sohna- Palwal State Highway No. 28 of Haryana State and Gangapur-Alwar-Bhiwadi State Highway No. 25 of Rajasthan State. Bhiwadi is about 70 kms away from Delhi, 90 kms from Alwar and 190 km from Jaipur. It is only 4 km away from Dharuhera which is situated on NH 8.Bhiwadi lies in Tehsil Tijara in District Alwar of Rajasthan.

Bhiwadi was a small rural settlement till the 1970's. The realignment of NH8 via Dharuhera improved it's linkage. By 1975, Bhiwadi was declared an industrial area and the population grew from 1624 persons in 1971 to 15000 persons in 1991. The policy of the Government to develop Bhiwadi as a Regional Centre of Rajasthan Sub Region has also accelerated the growth and the residential population is estimated to be over 30,000 persons in 2000.

Study Methodology

The study is carried out in six stages as shown in Figure 1. These stages are
- Conceptualisation of Study;
- Concept of Green Belt;
- Environmental Status;
- Greenbelt Plan for Bhiwadi;
- Project Formulation; and
- Methodology for Greenbelt Development in Semi- Arid Areas

Conceptualisation of Study

The conceptualisation of the study area includes the fixing of the scope of the study and the finalising of the aims and objectives of the study. The Scope and limitation of the

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2. length scale $\leq$ 1 km, "Monitoring Ambient Air Quality For Health Impact Assessment", WHO Regional Publications, European Series, No.85
3. 1 km $\leq$ length scale $\leq$ 1000 km, "Monitoring Ambient Air Quality For Health Impact Assessment", WHO Regional Publications, European Series, No.85

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study were identified on the basis of the need for a model as well as need for a green belt in the study area. The database used for the purpose of the analysis is from both primary and secondary sources. The data from the primary source includes Sample survey of the Villagers with regard to acceptance of species. The secondary data utilised is mainly in the form of industrial inventory and various other reports including the Master Plan of Bhiwadi.

Concept of Green Belt

This is the one of the most important task towards achieving the objectives of the study. Understanding the concept of Greenbelt is a prerequisite for model building. The concept of Green belt has been understood through compilation of available literature on the subject. This includes a description of the types of the Greenbelt, its functions, Its components, and most importantly the approaches and the models for Greenbelt development.

Environmental Status

The study area characteristics have been analysed in detail to understand the environmental characteristics of the area. Only status evaluation of the study area would give further credence to the need for Greenbelt development and choice of the appropriate type of Greenbelt and appropriate species of plants for the area. This analysis includes industrial analysis and land analysis to give the status of the environmental parameters, namely, air, water, soil, land, flora and human resource.

Greenbelt Plan for Bhiwadi

The development of the Green Belt follows the understanding the characteristics of the study area. It is the formulation of the best applicable greenbelt area by taking inputs from the present land use, proposed land use, land availability, conceptual greenbelt and greenbelt by numerical method. The greenbelt is then divided into two types i.e. polluter oriented and the local community oriented. Further division is done on the basis of the function that will be performed by each of the greenbelt. For example, the polluter oriented oriented greenbelt will be for the industrial estate. However, further subdivision

can be done in the form of greenbelt along industrial estate periphery which is for the sole purpose of air pollution abatement. Strip plantation along the roads will have a dual purpose of aesthetics and comfort as well. The open spaces and parks will be for recreation. But they all will be contributing to improvement of the environment of the industrial estate.

Project Formulation

Project formulation has been done to detail out the various types of greenbelt in the form of projects for implementation. These projects include are:

- **Industrial Estate Greenbelt** around the estate to reduce the impact of fugitive emmissions as well as accidental releases;
- **Strip plantation** along roadsides in the industrial estate, the residential areas and along the state highway;
- **Wasteland Development** involves the development of the degraded protected forest areas as well as the areas adjacent to gullies to reduce soil erosion;
- **Agro-forestry** is to be carried out in the rural areas for the purpose of not only planting pollution resistant species beyond the greenbelt but also to augment the need for firewood, fruit and fodder; and
- **Development of open spaces** in the industrial as well as the residential areas to serve as "lungs" for the township. They will also be attractive recreational spaces for the people.

The need for the formulation of such projects is due to the fact that land required for each of these purposes is different and they are to be acquired from various sources. Therefore, it is essential to detail out these projects. The Cost benefit ratio for the development of the Greenbelt has been worked out to evaluate the economic feasibility of the project.

Methodology for Greenbelt Development in semi- Arid Areas

The final product of the study is development of a methodology for Greenbelt development in the semi-arid areas.

Methodology

1. Survey of current green belts, green areas, parks, open spaces, etc. in Delhi by subdivision into five zones namely north, east, south, west and central.

2. Identification of critical areas based on air and noise pollution levels.

3. Identification of areas with potential for plantation of green belts.

4. Research along scientific lines to determine the best theoretical green belt model for Delhi's climatic condition, soil, hydrological regime and type of pollutant to be abated.

5. Using the green belt model for determining the most suitable size, height and species of trees in critical as well as non- critical areas by applying the model in various parts of the city.

6. Giving the output in the form of a document (manual) containing guidelines and methodologies of tree and green belt plantation for air and noise pollution abatement in Delhi region, with secondary uses such as waste water use, ground water recharge, biodegradable waste use and economic return.