Annexure II

Eco-friendly development of new building: A case study of new terminal building construction of Vadodara airport

Each construction site has its own unique set of soil, tree species, and building process conditions. To understand these factors precisely a reconnaissance survey is required. Reconnaissance survey is the preliminary field inspection of the entire area to be covered and collection of relevant data. For vegetation specifically, initially quantitative floristic survey is done. These inventories provide useful information on the distribution and abundance of species and insights into processes that control tree diversity. It aids in determining the environmental effects of proposed projects that affect rare, threatened, and endangered trees and plant communities and to determine the presence/absence of invasive trees in that area. It also helps in discriminating the healthy and diseased or damaged trees which make the decision making easier. Information such as no. of trees, their species and their condition is gathered during this inventory. It also gathers information on the attributes of individual trees, like location, size, and health of tree.

Floristic inventory if supplemented with tree enumeration information become an important tool for studying the vegetation of an area. Tree enumeration data can be valuable source of information which can be used to develop efficient management system at the construction site. Hence, each tree was numbered for making the process of inventory accurate. Maintaining the details of inventory and enumeration of the trees for any area before construction is prerequisite as it helps in coordinating the different

activities of that site. Present study highlighted the details of floristic inventory that was carried out at construction site of new integrated building at Vadodara Airport.

The construction site was visited five times. The flora was inventoried by random walks that covered primarily the plain terrain. In the survey, density of the herbaceous ground cover and shrub layer was not characterized. The survey and enumeration analysis of the site showed the presence of total 237 species of trees at construction site. Many of these were non- native, exotic trees with the exception of *Azadirachta indica* A.Juss. Twenty-eight different woody species were found along transects during vegetation analysis **(Plate 54).** Many trees reported from the site were found commonly in Gujarat.

Use of computer and satellite aided technology of GIS (Geographic Information System)-GPS (Global Positioning System) helped in tree inventory at the site of construction. Both of these data collection systems provided a very comprehensive analysis for tree management. GPS was used to record the location of individual trees, and GIS to store and record all information related to the trees through graphical representation. In handling this data and generating the map GIS played a major role. It provided a means of organizing very large datasets spatially ensuring integrity, compatibility and accuracy of the data collected from the field. One of the most basic advantages of a GIS was to position trees on a local map in terms of their geographic coordinates. The spatial analysis using these tools improved understanding of how location affected health status of the tree, leading to more effective interventions.

Tree health assessment before initiation of construction activities is a means of establishing the relative usefulness of existing trees on potential construction sites. It is the matter of great concern for any construction site as it can prevent damage occurring to the trees. Damage may be so minor that the tree's value, growth, and probability of survival are not affected. Conversely, damage may be so severe that the tree's value has been destroyed, its growth potential reduced to a fraction of normal, or its survival chances severely reduced. It helps in saving money by determining which trees to preserve and which to remove. Trees marked for preservation should have a good chance to survive construction activities, adapt well to the new environment, and look good in the new landscape. Thus, the decision to regenerate requires sound judgments about individual trees. With this information, reasoned judgments can be made on which layout design will optimize the retention of the best trees. Therefore, proper inspection is required for the decision making. Hence for this study, extensive ground survey of trees of the study area using GPS was carried out and plant health was evaluated morphologically.

An initial walk-through survey of the construction area of the airport was carried out. It helped in the identifying valuable trees which should be saved. All the trees were examined visually for any disease and damage. Trees located more than 20 feet away from buildings, and not directly in driveways and sidewalks, were considered for saving. Trees located less than 20 feet from a new building were recommended for removal. Trees with very few leaves and many dead branches should be removed as early as possible. Large trees that lean or exhibit rot, deep trunk cracks, or extensive top dieback are potentially hazardous. These trees should be carefully removed by professionals so

as not to damage the remaining trees. Dead trees are excellent for wildlife, but dangerous to people and buildings and therefore should be removed.

Almost all the signs of deteriorating tree health were seen in most of the trees present in the study area except for the few healthy trees**. Plate 55** shows the photographs of trees with very poor, poor, moderate, good and excellent health condition. Overall health condition of the trees was found to be poor indicating stressful environmental conditions prevailed over there, causing adverse effect on tree structure. About 37 trees were having very poor health. About 84 trees were having poor health. About 21 trees were having moderate tree health. About 84 trees were having good health status. About 8 trees were found to have excellent type of health.

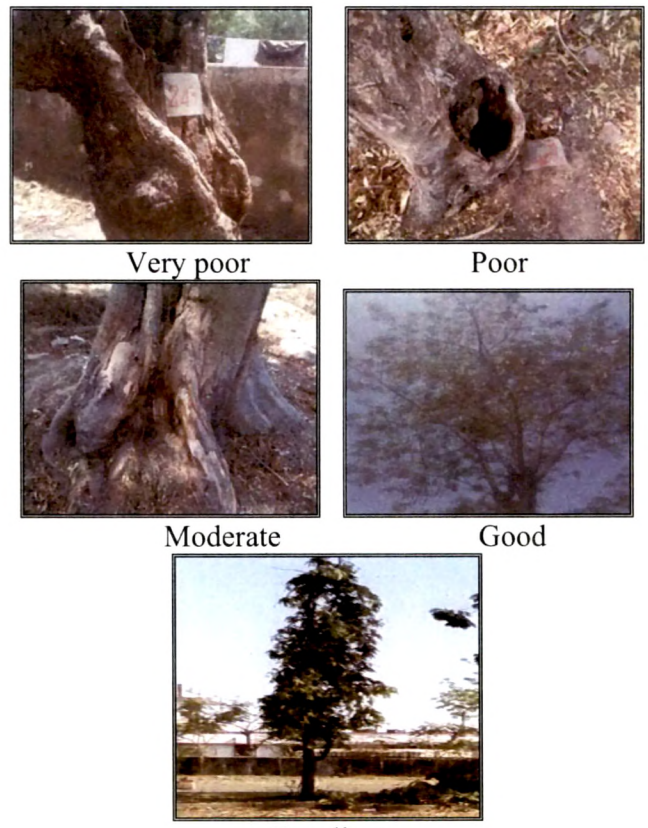

Plate 55. Photographs showing the health status of the trees

Based on the health status evaluation of trees decision can be made for the replantation of trees. Trees having the health status of very poor to moderate were not feasible for replantation and thus were not considered for replantation. Trees having good health condition can be considered for the replantation but they may face difficulties in survival. Trees with excellent health condition were considered for replantation as they were healthy. The study carried out for the construction site of the new integrated airport site revealed that out of 237 trees almost 139 trees were found in the status where they cannot be replanted while 93 trees were found to be in good condition **(Plate 56)**.

Plate 56: Photograph showing replantatation of some trees

Replantation of the trees is time consuming and expensive task and therefore, tree health assessment before initiation of construction activities becomes mandatory. It plays a major role in identifying the potential trees for replantation. Study of this construction site revealed that, many trees present in the campus were having poor health condition and must be removed. Few trees were having excellent health condition and should be replanted. Use of computer aided and satellite based tools of GIS and GPS made the study more efficient and effective. It helped in establishing the relative usefulness of existing trees on potential construction sites. Protection and the highest quality of care are the keys to preserving trees in construction sites.

Publications, Presentations and Award

Awards Received:

ICQESMS 2010 Excellence Award in Environment category

Publications:

1. **G.Sandhya K. and Usha Joshi , "*Urban Environment Quality Assessment using Satellite data and Geographical information system*", Proceedings of the 6th Indian Congress on Quality, Environment, Energy and Safety Management systems and 1st International Quality Congress, Dec. 20-21, 2010, Vadodara, Pp. 422-429, Oxford Publishing House, ISBN 81-86862-35-8**
2. **G.Sandhya K. and Usha Joshi, "*Eco-city planning: An Indian Perspective*",2009, 10th International Congress of APSA**
3. **G.Sandhya K. and Usha Joshi, "*Urban Planning: A Need of Hour*", WWF Journal, 2008**

Paper Accepted:

1. **Usha Joshi and G. Sandhya K., "*Plant Enumeration Studies Using Non-Conventional Approach*", Proceedings for National Seminar on Emerging areas of Plant Science, 2009**

Poster Participation:

1. **Poster presented in State Level Seminar on "Current Trends In Environmental Sciences" organized by Department of Biological and Environmental Sciences", N.V. Patel college of Pure and Applied Sciences, V.V.Nagar on Saturday, 20th September, 2008.**
   Ashwini Mudaliar, Usha Joshi and G.Sandhya Kiran

2. **Presented Poster on the topic "Geomatics: A way out to Environment Issues", In One day National Seminar on "Changing Environment and Degrading Natural Balance" organized by Indian Science Congress (Baroda Chapter), Vigyan Parishad (Baroda Chapter), Indian Society of Geomatics (Baroda Chapter), Central Control**

Board (west zone) and Department of Botany, Faculty of Science, The Maharaja Sayajirao University of Baroda on Saturday, 14th November 2009.
Ashwini Mudaliar, Usha Joshi and G.Sandhya Kiran

3. **Usha Joshi and G.Sandhya K., "*Plant Enumeration Studies Using Non-Conventional Approach*", Proceeding for National Seminar on Emerging areas of Plant Science, 2009**
4. **Usha Joshi and G.Sandhya K., "*Eco-city Plan Generation Using Geomatic Approach*", workshop organized on "Geoinformatics for Urban Planning" jointly organized by local chapters of ISRS, ISG, IMS and INCA at Space Applications Centre, ISRO, Ahmedabad, on January 07, 2012**

Paper Presentation:

1. **G.Sandhya K. and Usha Joshi, "*Eco-city planning: An Indian Perspective*", 24-27 November,2009,10th International Congress of APSA**

2. **Usha Joshi and G.Sandhya Kiran, "*Utility of GIS in Costing of Urban Green Spaces.*", 4-6 Feb., National Conference on Climate Change: Coastal Ecosystems, Geomatics 2010**

3. **Usha Joshi and G.Sandhya Kiran, " Correlation of Urban development and Cimate change",** National Seminar on " Climate change: Issues and Consequences" 22-23 Oct., 2010

4. **Joshi Usha B. and G. Sandhya Kiran, "Relationship between the Urban Green Space and environment for the planning of Eco city", National Symposium on "GIS and Remote Sensing In Infrastructure Development (GRID 2010)", 01-03 December 2010,** *Lonavala. (Organized by Indian Society of Remote Sensing)*

5. **Usha Joshi and G.Sandhya Kiran, "Satellite data in understanding the BaF and Ecosystem Function" National conference on "Impact of climate change with special emphasis on desertification." 3- 5 Feb.**

Workshop and Training attended:

1. **Workshop for Research Scholars of Science, UGC conducted Academic Staff college, Jay Narain Vyas University, Jodhpur, 12-17 July, 2010**
2. The NNRMS-ISRO sponsored Three Weeks Training Programme on "**Remote Sensing and GIS application for Environmental Monitoring**" held at **IRS, Anna University**, Chennai-25 during 18th May to 6th June,2009
3. Pre-Symposium tutorial on "**Microwave Signatures**" conducted at **SAC-ISRO, Ahmedabad** during December 16-17,2008
4. SVKM & GUJCOST sponsored Short Term Training Programme on "**Advanced Soft Modeling Techniques in Water-Shed Management**" organized by the General **Department of LDRP-ITR and Kadi Sarva Vishwavidyalaya, Gandhinagar** during December 1st to 5th,2008.

Seminar Participation:

1. State level Seminar on "**Importance of Trees in Conservation of Avian Diversity**" organized by the **Department of Zoology, Faculty of Science, The Maharaja Sayajirao University of Baroda** and Bird Conservation Society, Gujarat (BCSG) on 13th September, 2009 at The Maharaja Sayajirao University of Baroda, Vadodara.
2. Seminar cum Exhibition on "**Amla: An indigenous tree with enormous potentialities and IPS Symposium on Clinical Researches in Traditional Medicine**" sponsored by National Medicinal Plants Board, New Delhi and organized by **Department of Botany, Faculty of Science, The Maharaja Sayajirao University of Baroda** and Indian Pharmacological Society held on Tuesday, 4th August 2009.
3. National Seminar on "**Air Pollution Management in Changing Global Environment Scenario**"(Sponsored by CSIR, DRDO, GUJCOST and CPCB west zone) organized by Indian Association for Air Pollution Control, Indian Society of Geomatics(Vadodara chapter), Indian Environment Association, Indian Science Congress Association(Baroda Chapter), Environment Science and **Department of Botany, The Maharaja Sayajirao University of Baroda,** held on 7th Feb.,2010

4. National Seminar on " Climate change: Issues and Consequences" (Sponsored by MoES, GUJCOST, CSIR, NAGI, ISG and UGC) organized by Dept. of Geography and Botany, **The Maharaja Sayajirao University of Baroda,** held on 22-23 Oct.,2010

Symposium attended:

1. ISRS Symposium -2008 on "**Advances in Remote Sensing Technology and Applications with Special Emphasis on Microwave Remote Sensing.**" At NIRMA University, Ahmadabad during 18-20 Dec., 2008
2. **10th International Congress of APSA "Future of Asian Cities" held during November 24-26, 2009**
3. **Geomatics 2010 on National Conference on "Climate Change: Coastal Ecosystems." 4-6 Feb., Ahmadabad**
4. **ISRS Annual Convention & National Symposium on "GIS and Remote Sensing In Infrastructure Development (GRID 2010)", 01-03 December 2010,** *Lonavala. (Organized by Indian Society of Remote Sensing).*
5. **Geomatics 2011 on National conference on "Impact of climate change with special emphasis on desertification." 3- 5 Feb.**