



## **ANNEXURE 1**

### **BIODIVERSITY CONSERVATION IN ECO-HOUSING**

#### **Eco-housing Assessment Criteria - Version II**

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## **1 INTRODUCTION**

Biodiversity is defined as ‘the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems’.

‘India is one of the 12 mega diversity countries of the world. The innumerable life forms harboured by the forests, deserts, mountains, other land, air and oceans provide food, fodder, fuel, medicine, textiles etc. There are innumerable species, the potential of which is not yet known.’<sup>1</sup>

Conversion, destruction and fragmentation of habitat are the greatest threats to biodiversity. Humans have dramatically transformed landscapes to accommodate our needs for housing, transportation, food, fiber, recreation, and a host of other uses. Even places that provide open space, like public parks, hills and water bodies, may have diminished habitat value because of inadequate management, over-use, invasion by harmful exotic species, or contamination from external sources.

## **2 BIO-GEOGRAPHIC ZONES AND VEGETATION TYPES IN INDIA**

### **2.1 Bio-Geographic Zones**

There are 10 Bio-Geographic Zones in India, which are classified as shown in Table 1

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<sup>1</sup> *State of the Environment, 2001, Ministry of Environment and Forests, GOI*

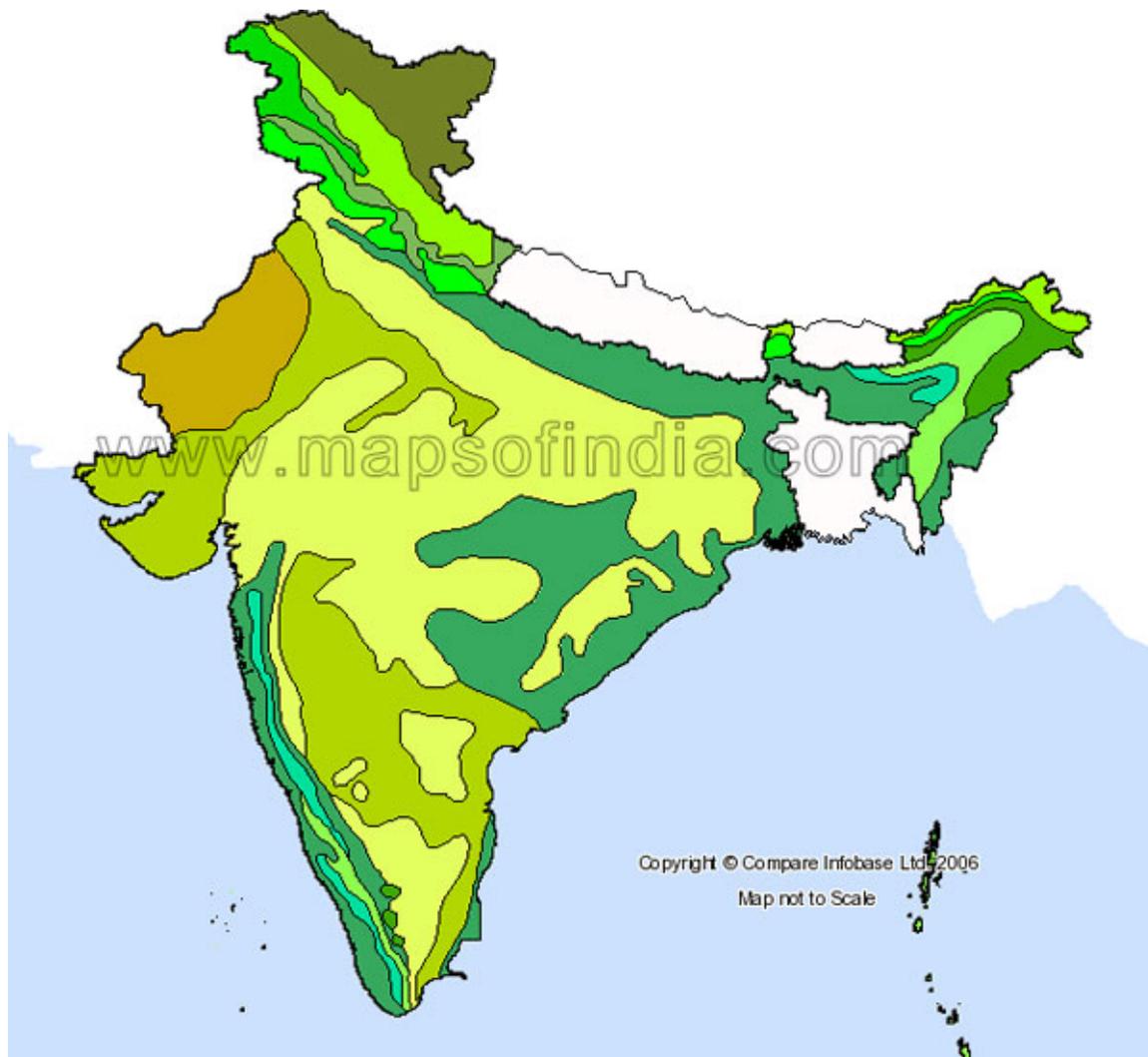
**Table 1. Bio-Geographic Zones in India (Rodgers and Pawar 1990)<sup>2</sup>**

Biogeographic Zone	Percentage of land mass of the country	Location and description
<b>Trans-Himalayas</b>	5.7	An extension of the Tibetan plateau, harboring high-altitude cold desert in Laddakh (J&K) and Lahaul Spiti (H.P).
<b>Himalayas</b>	7.2	The entire mountain chain running from north west to north eastern India, comprising a diverse range of biotic provinces and biomes.
<b>Desert</b>	6.9	The extremely arid area, west of the Aravalli hill range, comprising of both the salty desert of Gujarat and the sand desert of Rajasthan.
<b>Semi-arid</b>	15.6	The zone between the desert and the Deccan plateau, including the Aravalli hill range.
<b>Western Ghats</b>	5.8	The hill ranges and plains running along the western coastline, south of the Tapti river, covering an extremely diverse range of biotic provinces and biomes.
<b>Deccan Peninsula</b>	43	The largest of the zones, covering much of the southern and south-central plateau with predominantly deciduous vegetation.
<b>Gangetic plain</b>	11	Defined by the Ganges river system, these plains are relatively homogenous.
<b>North-East India</b>	5.2	The plains and non- Himalayan hill ranges of north eastern India, with a wide variation of vegetation.
<b>Islands</b>	0.03	The Andaman and Nicobar Islands in the Bay of Bengal and Lakshadweep islands with a highly diverse set of biomes.
<b>Coasts</b>	Negligible	A large coastline distributed both to the west and east, with distinct differences between the two.

<sup>2</sup>-State of the Environment, 2001, Ministry of Environment and Forests, GOI

### Vegetation Types

The Map below indicates the distribution of natural vegetation types in India



#### LEGEND

	Alpine & Sub Alpine		Cold Desert		Desert Soil
	Himalayan dry temperate		Himalayan moist temperate		Hot desert
	Montane wet temperate		Sub tropical coniferous		Tropical dry deciduous
	Tropical moist deciduous		Tropical semi evergreen		Tropical thorny vegetation
	Tropical wet evergreen				

**Figure 1** Natural vegetation types in India, Source <http://mapxl.com/indiamaps/natural-vegetation.html>

### **3 RELEVANCE OF BIODIVERSITY CONSERVATION TO ECO - HOUSING**

Just as housing is an essential human need, so is biodiversity conservation the need for sustainable development. It is often, that places with gentle topography, water, mild climates and other features so attractive to people are also important for wildlife. Construction, especially through the building of structures, impervious surfaces and roads, destroys and fragments habitat and disrupts ecological processes. Invasive species thrive and pollution increases in these disturbed environments, causing numerous problems for native species and their habitat.

A building can be truly eco-friendly, only when constructed with the least impact on biodiversity. The impacts of construction activity are not restricted only to the actual building site but also affect the biodiversity at the site of disposal of construction waste and excavated material, at the burrowing sites for aggregate, sand, soil for bricks etc. Most of these areas are within the fringes of a city and therefore these secondary impacts also need specific consideration and mitigation measures.

Ecological needs are most appropriately addressed at regional or state levels. At this scale, it is possible to identify large blocks of relatively undisturbed land that provide good habitat for a wide range of species.

At the macro level, to address biodiversity conservation in relevance to Eco-housing, we consider it at two levels - the city level and at the site level.

### **4 BIODIVERSITY CONSERVATION AT CITY LEVEL**

Following are the recommendations for conservation at city levels

1. The relevant Municipal or Planning Authority should identify areas rich in biodiversity and have a detailed list of sensitive habitats such as water bodies, undisturbed woodlands, bird nesting sites, wildlife corridors, protected and reserved forests, etc. This will help developers check if their site is close to or falls in a biodiversity sensitive area.
2. In the case of coastal cities and towns, the regulations pertaining to the latest amended CRZ Notification 1991 of the MoEF<sup>3</sup>, should be adhered to.
3. If the potential adverse impacts on biodiversity due to the construction activity are significant and immitigable, then the developer should reconsider selection of the site for construction activity.
4. Plantation along public roadways and nallahs should be done with native vegetation with the intent to conserve the biodiversity of the city. It has been found that areas that have experienced a loss of biodiversity can be restored with proper planning.
5. It is important to strategically conserve undeveloped lands in urbanizing areas to provide important connectivity between surrounding less developed landscapes.

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<sup>3</sup> MoEF – Ministry of Environment and Forests, Government of India

6. Development of urban forests and urban farmlands as a part of cities will provide breathing areas for the city as well as maintain the biodiversity of the city. (Refer to box below).
7. The impacts of activities such as excavation of soil for bricks and aggregate, digging of sand from dry riverbeds and sea beds should be monitored and appropriate measures taken to mitigate them. Strict enforcement of laws which regulates dredging of sand, such as the CRZ Notification 1991 of the MoEF, is required.

*Urban forests can be defined as tracts of land reserved or developed as green spaces, with a variety of native vegetation. Examples of these are the Hyde Park in London, Central Park in New York, Lalbaugh in Bangalore and Botanical Garden in Howrah. Urban forests provide shade, beauty, and habitat for urban wildlife. Properly planted trees and other urban vegetation can reduce heating and cooling costs, intercept and store rainwater, improve air quality, and increase property values and local tax bases. Properly cared for and well-managed urban forests can provide benefits that far exceed their management costs. Urban forests can also bring communities of people together and form connections between humans and the urban flora and fauna.*

*Urban Farmlands – Similar to Urban forest, it would be beneficial to have areas as urban farmlands within the city as green spaces. Very often, peri-urban areas have existing farmlands which mostly get converted to non agricultural land in the process of urbanization. It is important to preserve some of these farmlands by providing incentives to the owner to maintain the farms and develop the area as an eco-tourism and agricultural tourism spot. This would help to create open breathing spaces in the city and enrich the biodiversity of the area.*

## 5 SITE SPECIFIC CONSERVATION

Changes of land use from non-residential to residential use or even low-density use to high-density use impacts the ecology of the area. Biodiversity conservation is site specific and the needs for conservation on each site would be different. Biodiversity conservation measures for Eco-housing should be implemented before the site is built upon and not as a remedial action after the natural system has been destroyed. Thus, site-specific conservation should be considered with a two-pronged approach.

- a) Conservation of the existing natural habitats
- b) Remedial measures to restore and promote the natural biodiversity of the area.

## 5.1 Conservation of the existing natural habitats

The following measures are recommended

1. Prior to development, the builder should check if any biodiversity sensitive sites are in the near proximity of the proposed construction site. In order to qualify for Eco-housing certification the proposed construction site should not be a part of or fall in an area listed as ecologically sensitive by the relevant local/ national/ international authority (e.g. Urban local body, MoEF, IUCN).
2. The first step is to document the naturally occurring flora and fauna on the site with the involvement of taxonomy experts and other experts. Conduct a detailed ecological survey of the site to identify species of trees, shrubs and even weeds. Identify the faunal species present and survey their habits in the area.
3. The natural drainage pattern on the site, its topography and slopes are also an important component of the site biodiversity. These should be studied and taken into consideration during the design stage. The first, second and third order streams should be maintained and not filled for leveling.<sup>4</sup>
4. Based on the site inventory report, identify pockets of microhabitats that need to be left undisturbed. The building layout should be designed with the aim of conserving these areas.
5. It is important to do a study of the movements of fauna in the area. A corridor study of the site and immediate surrounding area to understand the movements of fauna and the impact of construction activity on the path should be conducted, especially for those sites closer to hills, forest patches.
6. Destruction of natural habitat may result because of absence of co-ordination between the various activities in the construction process. Developing a logical framework that provides a sequence of activities that ensures protection of site biodiversity should be prepared. Measures should be identified to conserve the biodiversity at every stage of the design and construction activity. Based on the site inventory, trees that need to be conserved at their present location and trees that can be transplanted should be prioritized.
7. An effort should be made to save as many trees as possible either by retaining them on site or by transplanting them. In may not be possible to transplant all trees that are not being retained. Sometimes the cost of transplantation may be exorbitant compared to the cost of planting a sapling of the same species.

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<sup>4</sup> First order stream – A stream that has no permanent tributaries

Second order stream - a stream formed by the confluence of two first order streams, or of a first order stream and a second order stream

Third order stream - A stream formed by the confluence of two second order streams, or of a second order stream and a third order stream

8. It should be noted that although the emphasis is on conserving and promoting native species of vegetation, if existing non-native trees/exotic species exist on the site; these should not be cut, to be replaced by native species.

## **5.2 Remedial measures to restore and promote the natural biodiversity of the area**

The following remedial measures should be adopted

1. Once the site is altered, it is impossible to regain the original natural biodiversity of the area. Remedial actions are therefore focused towards creating a conducive urban niche for the flora and fauna that have been displaced from the site.
2. Plant only native species in the landscaped area. Plant trees of species that existed naturally on the site before development. Alternate paths should be identified and developed for faunal movement wherever old paths have been altered.
3. Landscape for the building should be designed to integrate the conserved pockets of microhabitats.
4. Create urban niches to form environments conducive for fauna.
5. Landscape of the building should be designed to recreate the natural connections of the site with the surrounding area and not in isolation.
6. Provide for areas of natural growth in the landscape design that would allow weeds and seasonal plants to grow, as these would attract insects and consequently other fauna.
7. Landscape planning should- “Adopt the principle of natural succession, which is speeded up and assisted by mangement. It follows three general phases-
  - a. An initail planting of fast growing , light demanding pioneer species that quickly provide vegetative cover, ameliorate soil drainage, fix nitrogen and stimulate soil micro organisms, and create favourable micro-climate conditions fo more long lived species
  - b. An intermediate phase of plants that ultimately replace the pioneers
  - c. A climax phase of slow growing, shade tolerant species that are long lived plants.

In practice the planting of these species may be done all at one time, or introduced at intervals.”<sup>5</sup>

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<sup>5</sup> Cities and Natural Process, 1995,Michael Houge

## **6 REFERENCES**

1. State of the Environment, 2001, Ministry of Environment and Forests, GOI
2. <http://mapxl.com/indiamaps/natural-vegetation.html>
3. Cities and Natural Process, 1995, Michael Houge