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Urban ecosystem, National park, Buffer zones, Planning & design

Urban Fringe Development around Bannerghatta National Park, Bangalore

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ABSTRACT

The premise of this paper is to explore relationship between natural processes and development dynamics in an urban context based on Ian McHarg's ideology of 'Design with Nature'. It investigates the expansion of a city along the fringes of an ecological protected zone—a National Park and impact of urbanization on its ecosystem. Bannerghatta National Park (BNP) in Bangalore city (also Bengaluru), about 22 km to the South of the city is witnessing the stress of urban expansion in various ways. Development around protected areas must be understood and managed in the context of its ecological and cultural landscapes. Aim of this study is to streamline such an urban expansion with a holistic planning approach. Analysis of the issues and impacting factors outline the reasons for conflicts between people-park and people-animals. Many factors dictate the fringe planning and design— ecology, topography, hydrology, drainage & vegetation. Additionally culture, socio-economic status and circulation patterns impact the region as well. Results of the study of BNP and its fringe development indicate these multiple factors of influence and demand an integrated approach towards sustenance of the bio-diversity while creating urban expansions that are intrinsically liveable in nature.

Introduction

This study essentially investigates the urban expansion around an ecological sensitive zone – Bannerghatta National Park (BNP) in Bangalore city, capital of the state of Karnataka in South India. Understanding is sought in terms of factors of influence that define the relationship between the National Park and the city with its people. The International Union for Conservation of Nature, which is an international organization working towards conservation of natural resources, defines National parks as category II in the Indian context, which is meant for ecosystem protection and recreation. Protected areas provide many significant benefits to cities ranging from education and healthy recreation to biodiversity conservation & income from tourism. As gateways to the conservation effort, these green spaces can no longer be viewed as isolated entities. The fringes of National parks when located within or near urban areas are zones of people-park conflict. Is man invading the animal territory? Question lingers on, but interestingly there have been many tribal communities who have lived harmoniously in cohesion with the forests. As urbanization and its side effects took over, many aspects changed. The local inhabitants whose livelihood depends on the forest are normally displaced as per the norms governing the 'protected area' status of the precinct (National Parks are notified by State Governments and protected by the Forest Departments under the provisions of the Wildlife Protection Act of 1972, Indian Forest Act of 1927 & Forest Protection Act of 1980). There is a constant pressure of human encroachment over the natural habitat for various resources. To achieve a sensible fringe development pattern, planning decisions need to consider the natural ecosystem and socio-cultural setup while aiming to sustain eco-tourism as well.

In the following sections, first part gives an introduction to the locational attributes of the National park, objectives of the research and methodology adopted. Second section derives learnings from literature and case studies. The third section introduces context of the study area at three scales – macro, meso and minor, discussing the various layers involved, the concerning issues and proposals of possible mitigation measures in terms of urban planning and design strategies.

Bannerghatta National Park

Bannerghatta was declared as a National Park under the forest department in the year 1974. The total area of the National Park is 260 sq km. It comprises of 12 reserved forests lying contiguous to each other. BNP is about 22 km. to the South of the city of Bangalore The publications by Mr. B. M. T. Rajeev (2002) who served as Deputy Conservator of Forests previously and was in-charge of BNP have lent insights into the salient aspects of the National Park and its ecosystem in this study.

BNP is the largest available natural systems in Bangalore comprising of dry deciduous forests and abundant variety of flora like Eucalyptus, Neem, Sandal & Tamarind, which have immense medicinal and commercial value. It is inhabited by the Asian Elephants, leopards, Sloth Bears, Chital, Sambar, Monitor Lizards, Pangolin, Vipers, Cobras, Macaques, Porcupines, Mongoose and rare bird species, reptiles, insects and fish. There are large

number of items of archaeological interest and geological formations as well. The main aim of starting the park by the government was bio-conservation, bio-recreation and bio-education facilities for students and researchers (Zoo Authority of Karnataka, 2014). History shows that during the16th century, there are traces seen on the clearing of these forests by human encroachment.

In 2002 a portion of the park was designated a biological reserve now a popular tourist destination with a zoo and a safari ride. The park is part of Elephant Reserve Number-7, containing the single largest population of Asian Elephants 'Elephas maximus' in Asia with 8572 elephants in the 15338 Sq km forest area (Envis, 2016). The Asian Elephant is a flagship species for most of the countries in which it is found.

Objectives of the Study

- To explore the relationship between natural processes and development dynamics of the growth of a city on the fringes of an ecological reserve zone.
  Bangalore with an unprecedented population of 10 million is constantly under pressure to expand beyond its stipulated green belt into the forest zone.
- To outline issues & conflicts pertaining to unplanned urbanization near a protected zone.
  BNP is seeing a spurt in land conversions for industrial, residential, tourism and institutional development negating the natural rhythm of the land. This has resulted in people-park conflicts of various degrees and fragmentation of the ecological corridor by land cover changes (Ashoka Trust for Research in Ecology and the Environment- ATREE, 2007).
- To deduce a strategic proposal plan for a rational urban expansion and development.
  A strong institutional framework is needed for a well-coordinated zoning along the National Park boundary and a definitive approach to the character of the built.

Methodology

The study largely needed to perceive two main aspects: Bannerghatta National Park with its integral ecological system and the urban development around it. Natural ecosystems are part of larger systems and never isolated, occurrence at one edge of the National Park may impact a much larger ecological process. The methodology of the study aims at understanding the context at three levels: macro (Regional), meso (precinct) and micro (local) scales in terms of the larger natural linkages, character of the land- vegetation, hydrology, topography and settlements around. The study is towards the Northern part of national park adjunct Bangalore city, now called as Bannerghatta Biological Park (BBP). The urban development study encompassed aspects of land uses and its impact on the ecosystem while also the various temporal urbanism aspects owing to the cultural landscapes and resulting load on infrastructure. Under each scale of study, understanding of the salient features of land leading to the critical issues and resolutions thereupon shall be outlined. Literature and case studies on similar contextual scenarios shed light on mitigation

measures and human-nature co-existence. Writings of Ian McHarg and B M T Rajeev contributed largely to the understanding of the premise in this study, while survey maps and Comprehensive Development Plan documents guided towards creation of analytical maps.

Theoretical Outlook

The term ecosystem refers to the combined physical and biological components of an environment. Prof McGlade says rethinking urban design, architecture, transport planning and urban landscapes could be turned into 'urban ecosystems' at the forefront of climate change mitigation (better transport, clean energy) and adaptation (floating houses, vertical gardening). A report by UNESCO on the research conducted under the 'Man and biosphere program in 2003' described the general principles of the different analytical approaches of urban ecosystems using a bio-based analysis (systems approach, biological analysis, material flow analysis) in addition to spatial analysis and social analysis. Ian McHarg (1992), pioneer of ecological planning to integrate and aid co-existence of people and nature, worked with nature rather than trying to conquer it and proposed a holistic theory in his book 'Design with nature'. Breaking down a region into its appropriate functions opened new ideologies on nature sensitive design.

Bradley (1984) described the various perceptions of urban-forest interface using the metaphor of a line under five main criteria (Fig. 1). Economic criteria points at the line where the marginal value of land for urbanization is approximately equal to the marginal value of the forest land. Aesthetic perspective is rather fuzzy and mostly evident by the presence or absence of trees. Jurisdictional perspective refers to transition between public and private land or where parcel sizes start varying to larger lots. As structures start appearing on the landscape, the interface is a line drawn between built and unbuilt environments as a developmental criterion. Finally, under the physical & biological criteria, the line distinguishes highly productive lands from lesser ones.

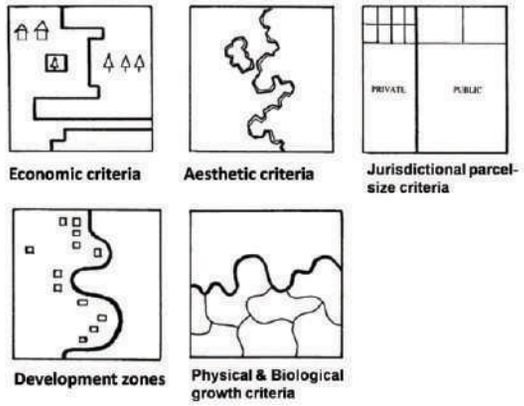

Figure 1: Urban-Forest interface criteria (Bradley, 1984, pg 11-13)

Based on the above propositions, perceiving the National Park fringe zones w.r.t the natural setting, land character, bio-diversity and human development criteria in order to achieve the right balance of growth seems pertinent.

Perspectives and Case Studies

Urban zones around Banff National Park (Calgary, Canada), Nairobi National Park (Kenya, Africa), Sanjay Gandhi National Park (Mumbai, India) and Kalesar National Park (Haryana, India) have displayed different approaches by respective cities to address the concerns specific to the context. Banff National Park, established 1885 with an area of 6000 sq km. is a strong ecological link within the Rocky

Mountains ecosystem in Canada. The main motto of city development was ecological integrity while allowing development. Main issues faced were related to fragmentation of natural landscape, loss of habitats due to human development and expansion & increase in human- wildlife conflicts. To resolve these, the strategy plan adopted by the Banff city municipal (Parks Canada, 2008) suggested:

- Creation of unique Land use planning in purview of the behavior of the land
- Creating environmental sensitive sites towards reduction in impact of transport corridors. 'Bow corridor regional mobility strategy' was evolved with the aim to move people and animals with an integrated approach to transport planning. Construction of underpasses and overpasses for easing wildlife movement across ecological corridors .
- Improved waste management and reclamation of disturbed sites.

In Kalesar National Park in Haryana, mitigation measures as proposed by Ministry of Environment & Forest in lieu with the Government Notification of 3rd June 2009 to reduce human- forest conflicts include:

- Eco sensitive zone is identified up to 5kms from boundary which includes over 20 villages with limited conversion of land allowed for residential expansion of the settlements.
- No polluting industries in this zone, no construction up to 500 m from the national park boundary, mining activity & crushing activity not allowed in the 500 m and 2 km respectively.
- Felling of trees, water extraction or contamination, noise pollution and solid waste disposal to be monitored by the Forest department.

In Nairobi National Park, Kenya, strategies adopted by the Nairobi City Council Report, 2008 to mitigate conflicts include:

- Wildlife conservation lease program- Land owners are given incentives to lease out land and keep the land fence free
- Regulations for the built massing and location of the built
- Socially and economically strengthening the tribal communities by creating land use that compliments the local talent and needs such as their handicrafts.

Sanjay Gandhi National Park, Mumbai is a major National Park located within a highly dense and urbanized Metropolitan city of Mumbai and experiences threats in the form of poaching, encroachment, major roads through the National Park and residential colonies right up to the National Park edge with poor fencing resulting leopards entering the city and occurrence of forest fires. Mumbai Metropolitan Region Development authority has outlined specific zoning and development controls to limit and mitigate further growth into the National Park. Development is designated in layers at certain radius from the National Park edge such as industries beyond 5 km radius.

It is observed that National Park fringe zones have been mainly addressed with the habitat concerns and the human settlements at varied scales of urban interventions likewise substantiating the theoretical propositions. In the following section, issues are discussed under three scales and related strategies are proposed.

Study Area Analysis and Proposals

The study was conducted at three scales- macro, meso and micro levels as there is a hierarchical cascading of issues from the regional level to the National Park and its immediate edges. The analysis aids in understanding & identifying the issues at each scale which shall further lead to strategic proposals as derivatives to guide a suitable urban development around the National Park (**Fig. 2**).

Scale: Macro (Regional) Scale:

BNP is a part of the link between the Eastern and Western Ghats in South India and this link is a part of a much larger natural ecological system (**Fig. 3A**). It is a part of the migratory corridor for Asian elephants (**Fig. 3B**) from Kerala through the contiguous forests of Tamil Nadu, passing through BNP to go towards Savanadurga and finally forests of Hassan in Karnataka. This route is taken every year by the elephants.

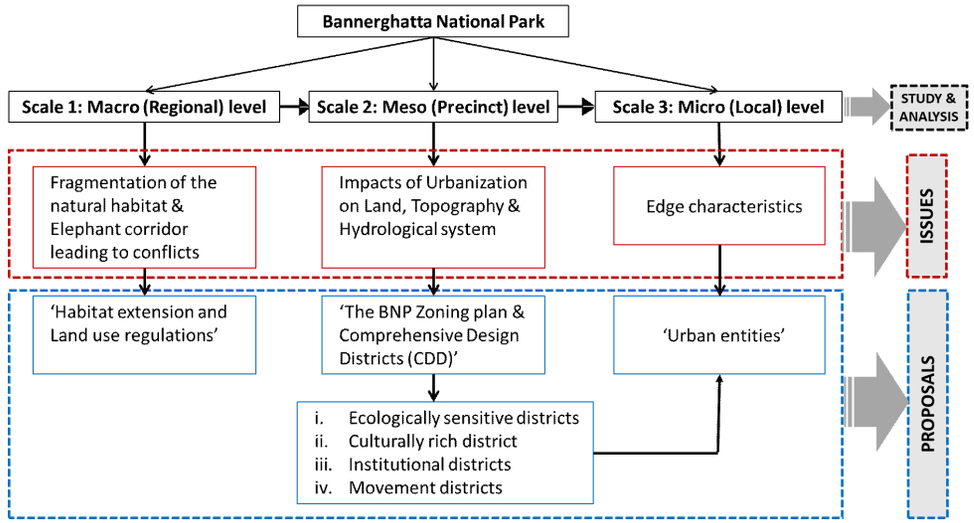

Figure 2: Three scales of study, analysis and proposals for Bannerghatta National Park

Figure 3B: Asian Elephants

Figure 3A : Link in the larger ecosystem and the Elephant migratory path from Kerala to Karnataka (Wayanad-Bandipur-Bannerghatta-Savandurga-Hassan; nearly 700 km)

Issue at Macro Scale: Fragmentation of the Natural Habitat and Elephant Corridor Leading to Conflicts

Urban expansion has led to fragmentation, degradation and isolation of the natural habitats affecting the bio-diversity and occurrence of Human-Elephant Conflict (HEC) along the fringes. Due to unplanned urbanization, land encroachments and roadways cutting across the forests at frequent intervals, elephants tend to get dis-oriented and stray from their path. Frequent human-elephant conflicts at the fringes occur at weak points such as narrow strips of forest area, water bodies, waste disposal points and roads. Facilities at the fringes attracting elephants include distilleries which dispose molasses or any other food sources & the farms around. This results in harm and loss to animals and humans as well. As per Elephant census, the population density of elephants within Bannerghatta is considered relatively high at 0.63 per square km (Ministry of Environment & Forest, 2017). This density, combined with the narrow dimensions of the park and the close proximity of 120 villages and farmland, has led to serious HEC problems on the margins of the park (**Fig. 4**).

Proposal at Macro Scale: Habitat Extension and Land Use Regulations

The objective of the proposal is basically to conserve the natural ecosystem for three reasons- continuity of the natural habitat/ corridor, avoid human elephant conflict and rehabilitation of communities facing evacuation in the protected zones.

Hence firstly, the point of address shall be to extend the forest habitats at the critical conflict

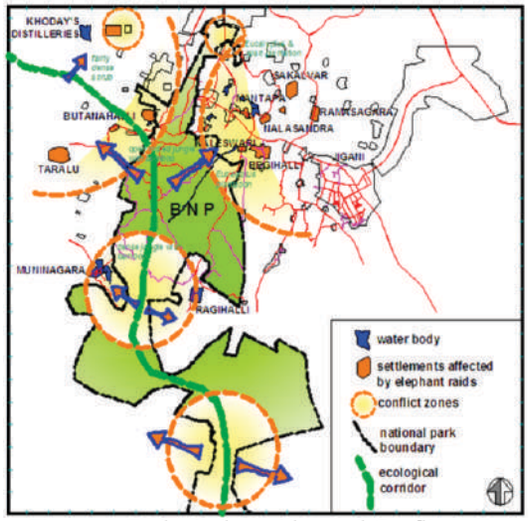

Figure 4: Ecological corridor and Conflict points (Mapped based on Forest Department statistics on Human-Elephant conflicts, 2018)

(forest depletion) zones by afforestation measures by the Forest department. This shall need to be all along the habitat corridor as a regional master plan. Secondly, designation of buffer zones and regulations within the ambit of an appropriate land use regulations at the fringes by the planning authorities shall be essential. In such instances, phased relocation of communities by means of socio-economic stabilization needs to be carried out along with re-orientation/ disposition of infrastructure. Siting activities such as breweries or such non-conducive uses that attract elephants need to be avoided.

Scale: Meso (Precinct) Scale

Study at this scale aims at in-depth understanding of the natural system in & around the national park and the concerning issues. BNP comes partly under Bangalore Urban & Rural districts and Anekal taluk. Jurisdictionally as per Bangalore CDP, BNP

comes in the 'Bannerghatta Planning District', which could be spatially and geographically divided into three zones.

1) BNP consisting of a system of granite hills, forests and valleys
2) Western side of BNP with its forests and low-lying areas
3) Eastern side of BNP with undulating topography, a micro system of valleys and lakes and several granite formations prone to quarrying.

The BNP national park is managed by the Forest Department of Karnataka. The region from the forest boundary at the North of national park comes under Bangalore North and partly Bangalore South, they are hence under Bangalore Development Authority (BDA) and Bangalore Metropolitan Regional Development Authority (BMRDA) while the Eastern side is under Anekal Taluk and Western side is under Kanakapura Taluk, each with its Local Planning Authority. Multiple regulatory bodies are governing the National Park edge areas; each body has its own set of policies and regulations leading to conflicting managements. A consensus amongst these bodies is much required to intelligently resolve responsibilities towards efficient management of the urban growth.

Issue at Meso Scale: Impacts of Urbanization on Topography & Hydrological System

Bannerghatta road which is the access spine from Bangalore city, has witnessed rapid urbanization in the past 10 years reaching almost to the boundary of the national park. To the West is Kanakapura town with mainly agricultural lands and the fast-growing National Highway, NH 209 lined with Resorts, Gated residential enclaves and institutional developments. To the East there has been a spurt in development from NH 7- Hosur road with the booming Electronic city, Bommanahalli and Jigani Industrial areas. Anekal to the down East is a fast-developing town into mini-city (**Fig. 5**).

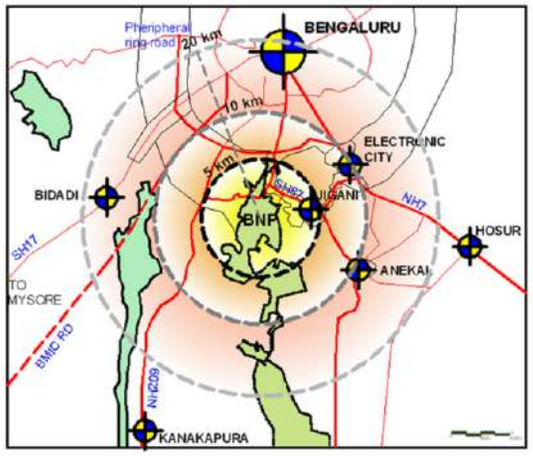

Figure 5: Zones of influence around BNP (By authors)

BNP fringes have many settlements within the defined zone of impact. Hundred and seventeen hamlets are found within the 5 km from the edge of the national park and 5 hamlets within the national park with forest-dependent communities (Gopalkrishna et al., 2010). Jigani town falls within 5 km zone which has many quarrying industries. Additionally, few major roads cut across the National Park with increased traffic in recent times connecting to Kanakapura town & Tamil Nadu state to the South and few local thoroughfares.

Topography: BNP and its surrounding terrain are undulating and sometimes steep and rocky as mapped in the study (**Fig. 6**). There are a number of hills; altitudes ranging from 700 m to 1035 m above Mean Sea Level. At

Bannerghatta circle (point of entry from city) is the large Suvarnamukhi hillock in the Kalkere State Forest. It is an important cultural, mythological (existing since three yugas- Hindu eras) and historical landmark with the Champakadha- maswamy Temple, popular pilgrim center built in Dravidian style over 800 years ago. The Western side of the national park has undulating topography and an evident micro system of valleys & lakes. A major concern is that the landform reveals several granite formations which are prone to quarrying, mostly illegal in the designated eco-sensitive zones. (Deccan Herald- Bengaluru, 2018)

Hole (stream) and Rayathmala Hole and finally joining the River Cauvery, one of the major rivers in South India.

There is a distinct system of valleys and drainages around the national park (**Fig. 6 & 7**). A network of water sources both perennial and semi-perennial streams, tanks and lakes are seen. The important lakes in the valley are Mantapa, Amanibidarikere, Jigani and Hennagara. They are all connected, semi-perennial and never go entirely dry. But this is fast changing because of the lake beds and drains been cut-off by construction activities and land conversions.

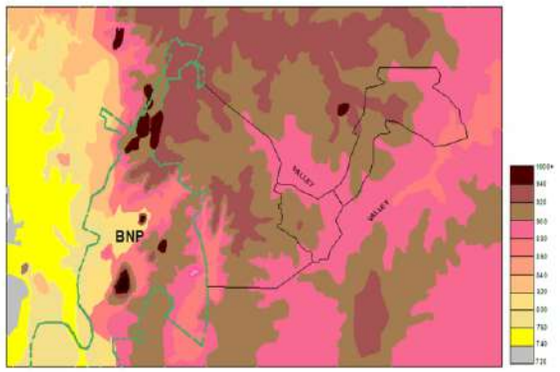

Figure 6: BNP Topography map (Map by authors)

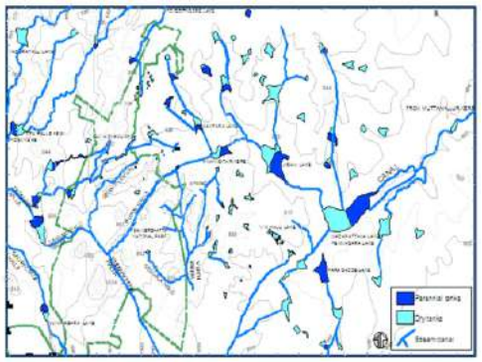

Figure 7: Water network (Map by the Authors)

Hydrological system: Water sources, network and drainage form important criteria for the national park and its habitat to sustain. When this system is disturbed by the unplanned development and tampering of the wetlands/channels, there is a definite threat to water levels and existence of bio-diversity. Study of the natural water system is necessary to guide any form of holistic urban expansion. The water from the area of the national park drains into the river Arkavati through its tributaries like Suvarnamukhi, Antharagange

Additionally, this main network allows for a system of streams or 'hallas' (wells) which caters to the wild animals and crucial to keep them within the park premises. Recent bouts of drying up of these water sources had let the animals into the park peripheries in search of water giving. There is a distinct contamination of water in the region because of uncontrolled urban activity, usage of chemical fertilizers in farming and industrial waste being disposed into the lakes. As per a report by Integrated Management Information System for the

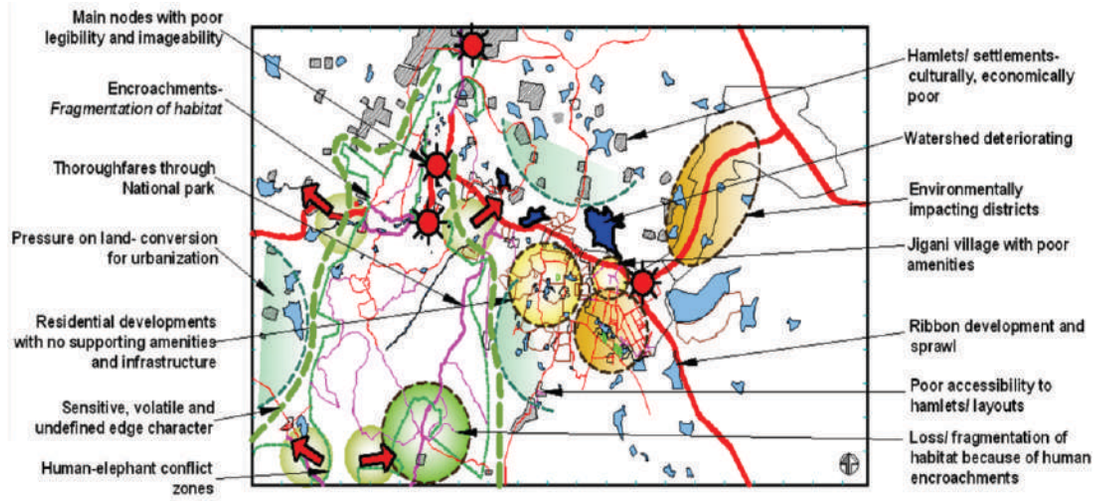

Figure 8: Issues Mapping

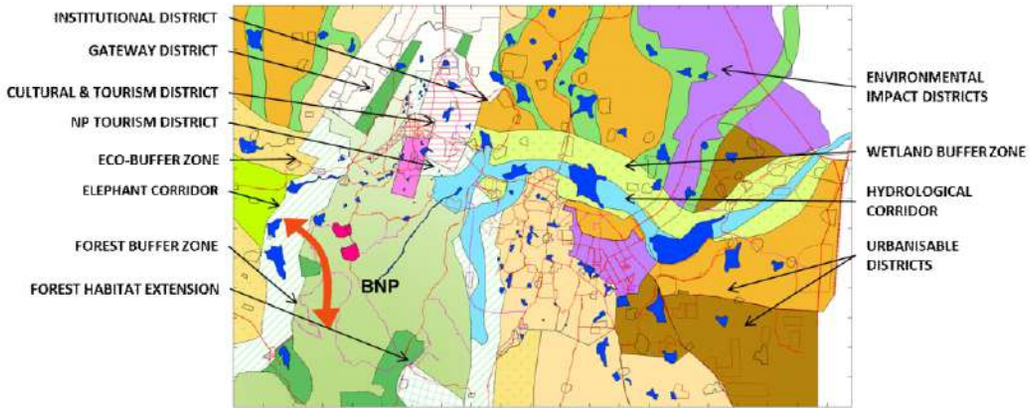

Figure 9: Proposed BNP Zoning Plan with the Comprehensive Design Districts (By Authors)

Department of Drinking Water Supply, Fluoride levels in ground water in adjoining towns such as Jigani, Chandapura was high over 5 mg/l, while water safety limit is less than 1.0 mg/l (Government of India, 2009).

Upon overlay of the observations at the above two scales of study, the summary of issues is mapped as below (**Fig. 8**).

Proposals at Meso Scale: The BNP Zoning Plan & Comprehensive Design Districts

The aim of proposals here is to protect the natural ecosystem while tapping resources to award the urban dweller with access to nature and aid appropriate balanced development. Hence, the Zoning plan (**Fig. 9**) is proposed in this research which encompasses concepts of 'Comprehensive Design Districts' (CDD) and the 'Green plan'. The objectives are:

- Protecting and conserving the natural green network and water system.
- Maintaining the open land uses for farming or groves/woods suitably to continue the bio-diversity.
- Defining and enhancing the urban structure of the city as a whole.
- Demarcating green wedges mapped around wetlands and greens penetrating the urban tissue aiding as links to the countryside & natural reserve forests to the urban dweller.
- Awarding 'Sense of place' to neighborhoods by appropriate design of public open spaces.

The concept of *Comprehensive Design Districts (CDD)* in the proposed plan will include strategy for the zoning around the national park and formulation of development guidelines for each delineated zone. The development has to happen in layers around the national park from low intensity to high intensity. Following are largely the identified CDD's including four districts viz.,
i) Ecologically-Sensitive District,
ii) Culturally-Rich District,
iii) Institutional District,
iv) Movement Districts.
Emphasis shall be on community based activities, sufficient open spaces and livable institutional and commercial zones. To regulate urban expansion, use and density restrictions are proposed where developers can gain higher densities if their projects provide additional benefits for the public. These benefits include affordable housing, public facilities and environmental protection initiatives. There is a need to encourage the optional and imaginative utilization of land contemplated by CDD in order to improve the total environment and lessen the public costs associated with infrastructure development. CDD hence promotes economic development, protects the environment and streamlines the development process.

I. *Ecologically Sensitive Districts*: These are basically to curtail the urban expansion as they include forest habitat extension, buffer forests, elephant corridors and hydrological corridor. Eco-buffer zones shall be addressed with a conservation approach, minimal building activity, introduction of nature trails, upliftment of tribal communities, harnessing non -timber forest products such as Bamboo, fruits, nuts, palm, resins, honey, medicinal plants & traditional items such as incense etc.

ii. *Culturally Rich District:* Aims at tourism based economy employing local residents, local handicrafts /talents, materials and vernacular architectural styles to harness the backdrop of nature. Views and vistas to hills, forests and temple to be maintained by relevant height and massing restrictions. Regulatory mechanism to be enforced for nature safeguard such as eco-tourism (plastic free) and vehicle control **(Fig. 10A & 10B)**. A Gateway node is designed to frame the approach to the National Park from Bangalore city end and host tourism-based economy, land uses and design controls are suggested in terms of aesthetic specifications, tree-lined avenues, enhanced water bodies, green vistas, improved legibility, appropriate parking and other amenities.

iii. *Institutional Districts:* Aims to elevate the trend of locating educational institutions, environmental research labs, nature retreats etc. as large plotted developments with regulated built and aiding in bio-diversity continuity in the region.

iv. *Movement Districts:* Main movement corridors affecting the National Park are redefined to alternate locations or time -controlled management to mitigate any interference with the National Park habitat. The connector from Muninagara to Shivanahalli and Anekal is proposed to be elevated as it cuts across the core forest.

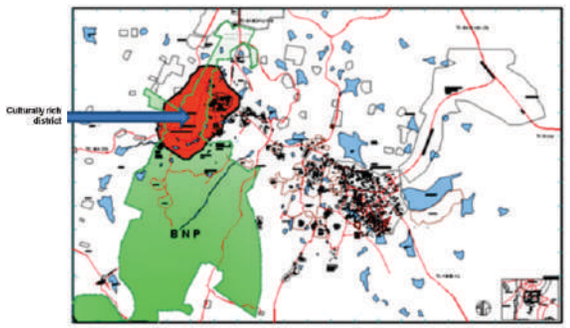

Figure 10A: Culturally rich district with a Gateway node

Figure 10B: Historical Temple in the district and the entry point to BNP from the City side

Bannerghatta Road across Kalkere reserve forest shall be realigned around the forest to reach the National Park & pilgrim center. Also, secondary connectors to be strengthened to improve accessibility to the various settlements and removing pressure from main connectors. (**Fig. 11 A & 11 B**)

The concept of Green Plan in the zoning plan included mapping precisely the existing green areas and water networks following the land profile to safeguard these systems from further deterioration and form a continuous linkage loop to sustain the system **(Fig. 12)**. This aids in bio-diversity continuity while also providing access to nature enhancing livability as suggested by World Health Organization. These wedges are open green or water ways as farms or woods or parks. A suitable landscape strategy on vegetation native to the region that helps in water retention is ideally suggested. By this, water bodies are kept intact within the habitat zone, catering to animal needs and avoid straying into human realms.

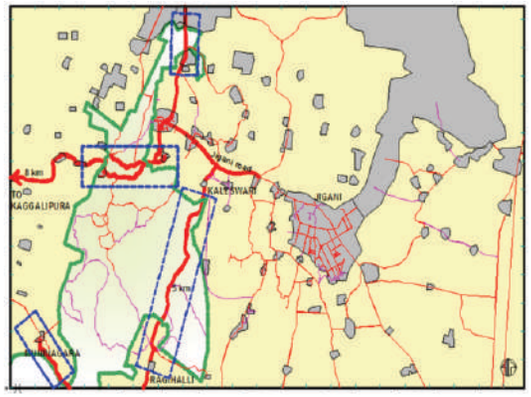

Figure 11A Existing Movement District

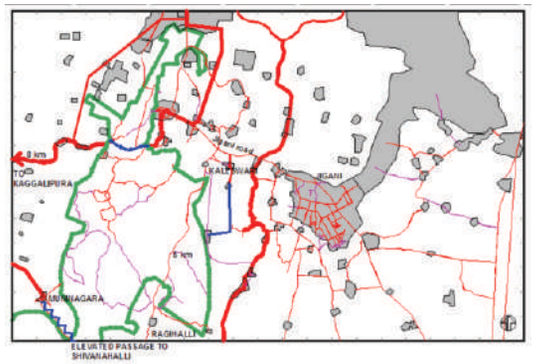

Figure 11B Proposed Movement District

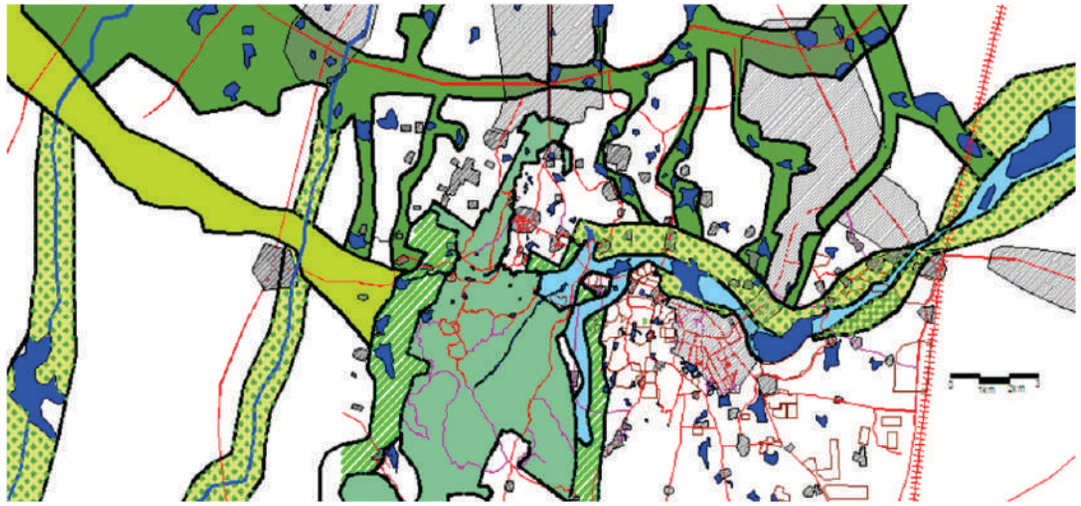

Figure 12: 'The Green Plan'- Proposed Green wedges

Micro (Local) Scale

This scale refers to the immediate national park edges responding to the impact of prior two scales addressed above. The districts adjacent to the edges are unique in characteristics and hence may be perceived specifically to address 'vision' for each corresponding edge precinct as follows (**Fig.13**):

- *'City Edge'* towards Bangalore city. This is a hard edge and further encroachment into forest zone has to be controlled.

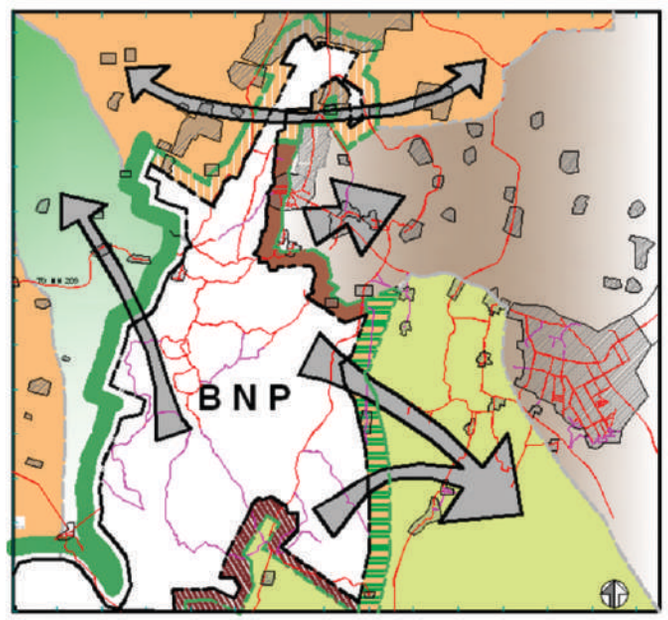

Figure 13: BNP Edge character classification in this study

- *'Green Edge'* is the elephant corridor linking to Savandurga to the West. This has to be a conserved and habitat expanded.

- *'Preservation Edge'* is the Ragihalli side to the South of BNP which is facing higher degree of shrinkage and depletion. A strong preservation approach to forest is implied.

- *'Soft Edge'* towards Eastern side of BNP, which is seeing a spurt of growth around Jigani and Bommasandra to Hosur road, needs to moderate the degree of urbanization.

- *'Infra Edge'* in the direction of Electronic City has potential for urban expansion with the aid of specific policies and regulations for the built and open spaces. Development along the edge is permitted with strict restrictions on density and land uses.

Hence, the principles of development that shall guide the strategic proposals are corresponding to the edge characteristics:

1. Sensitive areas need to be protected and expanded at critical points by forest expansion or buffers zones
2. Development need to be aptly concentrated in suitable areas that can bear the expansion without adverse implications
3. Growth shall be directed to existing settlements with balanced resource management.

Proposals for Micro Scale: 'Urban Entities- Specific Design Guidelines'

Proposals at micro scale comprise of design interventions to complete the loop of achieving a wholesome sustainable system of growth around the BNP in compliance with the macro & meso scale strategies, while protecting the integrity of the NP itself.

Under the ambit of the CDD concept at meso scale, each district shall have modules of zones of typically smaller sizes with specific intent or point of relevance towards design and development. Such a system of subjective design modules shall be individually termed as 'Urban entities' within each district. The urban entities may be strewn or identified around the NP in any given location but they shall correspond to the edge conditions of the BNP as discussed above and shall be designed responding to the characteristics outlined for the edge. Hence, each urban entity shall have guidelines subjective to the proposals at the preceding two scales and corresponding edge characteristics. Likewise, the principles of urban design for any given urban entity shall be guided largely by:

- Proposals at Macro and Meso scale
- Edge characteristics along the National Park edges

An urban entity may manifest as: a block, street, node or an identified zone in the CDD with a specific point of interest. These urban design proposals shall weave together and enable a wholesome addressal of growth around the National Park.

Demonstration of Design Guidelines for the Urban Entity Pilgrim & Tourism Node identified in the CDD Culturally Rich District

One example of design is demonstrated at the urban entity of Pilgrim and Tourism node at

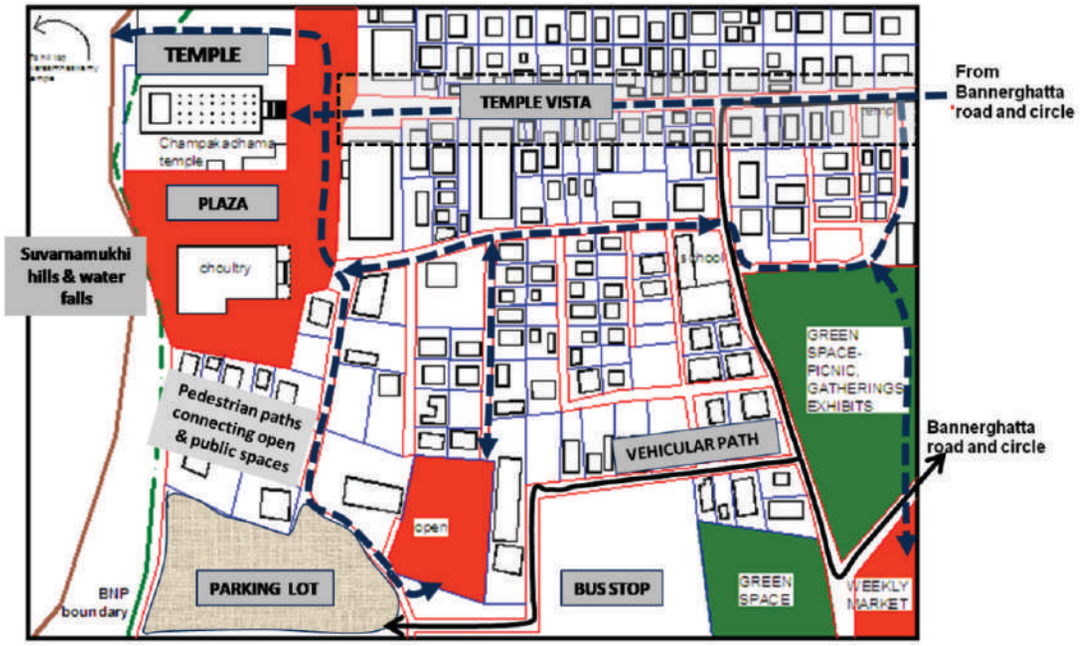

Figure 14: Proposed 'Gateway district'- Pilgrim and tourism node at Bannerghatta circle (red, green, greys are proposed spaces in the design scheme along with the pedestrian loop)

Bannerghatta circle under the CDD of Culturally Rich Districts as broadly outlined in the Proposal for Meso Scale in the preceding section.

One example of design is demonstrated at the 'Culturally Rich District- Pilgrim and Tourism Node at Bannerghatta Circle'. Each district shall have specific design guidelines subjective to the proposals applied at all scales.

The Bannerghatta junction is the main point of entry from the city side with three deviations occurring to BNP on South, to Champakadhama temple on Suvarnamukhi hills on the West and towards Jigani town on the East. A 'Gateway District' is proposed to define a befitting approach to the National Park on one side and the pilgrim center on the other side. This node falls under 'city edge' and partly 'green edge'. Accordingly, there is no further encroachment of the hill and apt design for the urban settlement around the junction and Temple.

The cultural and tourism district is one of the main zones with local and floating population. There are different factors of influence - reserve forest area, hilly areas, pilgrim center, tourist destination, commercial and residential land uses. Development degree is high, which has to be defined and a 'sense of place' and 'identity to place' achieved by designing the precinct to cater to the community and cultural aura of the place. Conservation and development have to happen simultaneously.

The main design strategies include (**Fig. 14**):

- Mixed land use- residential and commercial involving local community to encourage local crafts such as bamboo, cane & jute handicrafts. This generates employment, boosts the disappearing crafts, introduces eco-tourism related retail and aptly enhances the entrance node.
- Bifurcation of vehicular and pedestrian traffic. Creation of walkable precincts with efficient network of public transit nodes & connectivity to the area and National Park.
- Strengthening secondary connectors within & outside the district.
- A network of open and green spaces: as community spaces and cultural nodes with facilities for exhibition, gathering, celebration and trails amidst natural setting. A plaza proposed at the entry to the temple with amenities for visitors.
- Building design- mass, scale and height controls to upkeep the views and vistas to temple gopuram and the hills behind.
- Defining the axis of approach street to the temple and hills behind, envisioned as a green vista avenue with guidelines for building height restrictions and character of the architecture.
- Defining the chariot path loop during the annual festival which is conducted every summer in the temple and sees pilgrims from all around the state gathering to offer prayers. The chariot path is mainly on the main temple path and along the main streets in the zone.

Conclusion

The analytical study at three levels of the National Park fringes has revealed that ecologically sensitive zones need a larger regional plan and land-specific design guidelines that will shape the development. As Urban planners and designers, interventions to direct an amiable physical expansion that the land can hold needs to be identified with zone-specific policies as proposed in this study. Built forms can control the density of population, the aesthetics and environmental impacts with the backdrop of nature. Better liveable places may be created tied with walkable urban spaces with a 'Sense of Place', better community-cohesive structure and ecologically sensitive development.

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