

Ecological Networks Rethinking Sustainable linkages between nature and cities

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Abstract:

Nature is embedded within the city and in each one of us. Cities have evolved from nature and each city is a combined artifact of nature and culture. After the Industrial revolution cities have moved away from nature and adopted a modern outlook that nature exists only in the countryside. As said by Gregory Bateson, "When an organism destroys its environment, it destroys itself", cities that are moving away from nature are facing many challenges like urban floods, water crisis, pollution, climate change, etc. This paper aims to study various traditional and modern examples from Asian and European cities to know how nature and cities are interlinked and how they can sustain each other to get further benefits such as public health, urban aesthetics, etc. It tries to explain how cities form an ecosystem of their environment and people. Nature exists in different forms in the urban environment like urban parks, lakes, trees, etc. This paper tries to investigate how to integrate different forms of nature into urban development and learn nature-based solutions to fight the biggest challenges. One of the best ways to integrate nature into urban development is to identify and protect existing ecologically sensitive areas and corridors or by proposing linkages between fragmented ecologically sensitive areas. These ecological networks not only help to protect biodiversity in the urban environment but also provide health and recreation benefits to the public. These networks if defined and designed well, have aesthetical benefits to the city by becoming part of the urban landscape. Through various examples, case studies, and research, this paper tries to analyze the benefits of ecological networks and green corridors to the cities.

Keywords: Ecological balance, nature, green networks, urban landscape, sustainable.

I. INTRODUCTION

Cities are transforming from habitable places to overcrowded, polluted, chaotic, and unhealthy places to live in. This paper tries to investigate different ways to link nature and cities to resolve many urban issues. Cities have evolved from nature and are integrated with nature. Rapidly growing cities cannot ignore nature in

the name of development and growth. It is the most important aspect to maintain ecological balance in the cities and by every Urban Planner, Urban Designer, and Architects while designing for cities. The urban ecosystem connects the human community with nature. The objective of this paper is to identify and propose probable linkages between various natural and cultural elements of the city. By linking natural and cultural elements in the Urban Scenario contributes to the overall well-being of human health and helps to maintain environmental issues like air pollution, floods, groundwater depletion, etc. Nature exists in different forms in cities like Urban Parks, Lakes, Street Trees, rivers, coastal beaches, etc. Nature is integrated as cultural landscapes in terms of sacred trees, sacred grooves in cities and is well protected due to the faith people imbibe in them. In certain cities these spaces act as public spaces for people to meet, interact, and strengthen social activities as well as physical activities like walking, exercising which contribute to the overall well-being of citizens.

In most of the cities, a certain part of the natural spaces like parks and lakes are well protected and being used by the public. But certain natural spaces are still being abandoned and neglected by authorities and the public. By identifying potential natural spaces and linking those with the already active spaces will certainly enhance such spaces. This paper tries to study various best practices of national and international cities with the ecological approach in linking nature and cities which promote many cultural and environmental benefits.

Singapore being the smallest country is very well aware of the benefits of nature within the city and hence incorporating nature integrated development of the city. There are numerous ways in which Singapore is following best practices to integrate nature. Ecological networks or greenways are the most important component which plays a vital role in integrating nature into urban development. These greenways provide multiple benefits like habitat management, connectivity, health, and recreational benefits to the citizens.

The answer for what is an ecological network and what are the benefits you get from them are answered only



through thorough research. As per ecological literature “networks” are related to food webs and other natural connections. In the field of Urban Planning and Landscape, Architecture ecological networks relate to establishing physical, visual, and ecological connectivity between built areas of the city and the surrounding natural areas and green open spaces. Often these ecological networks form part of the Green Infrastructure of the city. In the historical context, several authors recognize the Boston Parkway (1860) network, designed by Olmsted, as a reference model of how to organize and manage nature for the enjoyment of people and the need for nature in urban regions by landscape connectivity.

II. HISTORICAL PERSPECTIVE

The Emerald Necklace is appreciated as the first masterpiece of landscape architecture principles, because of its connectivity and inherent multifunctionality (Fabos 1995, Forestier 1997, Burel&Baudry 1999, Ahern 2003).

A. EMERALD NECKLACE PARK SYSTEM- BOSTON:

The Emerald Necklace is a chain of the 1,100-acre area of parks connected by parkways and waterways in Boston, Brookline, and Massachusetts.

- It was conceptualized by F L Olmstead as Linear Park System.
- This park system derives its name from the way the planned chain appears to hang from the "neck" of the Boston peninsula
- Offers an opportunity for recreation and improves the air quality of the city.
- Ecologically important by providing nesting places for migratory birds.

The Emerald Necklace includes:

- Boston Common
- Public Garden
- Commonwealth Avenue Mall
- The Fens
- The Riverway
- Olmsted Park
- Jamaica Pond
- Jamaica way



Figure 1 Emerald Necklace Park System, Boston

B. INFERENCE:

Architect FL Olmsted has said that ‘no single park, no matter how large and well designed, would provide the citizens with the beneficial influences of nature’. Instead parks need to be linked to one another and

surrounding residential neighborhoods”. This idea of connecting parks for the benefit of people has evolved into the modern greenways movement. This historical park system provides ecological and recreational benefits to the city. Apart from being a major tourist hotspot, it has helped in improving urban aesthetics, it also gives a landmark identity to the city.

C. URBAN PLANNING HISTORY IN COPENHAGEN:

The UN Report on Urbanization says that “today 54% of the world population lives in urban areas, a proportion expected to rise to 66% in 2050.” (2014 UN Report). With the above statistics, there is a clear need for growth of the cities wherein density increase is inevitable. The future needs an urban development plan which promotes urban growth at the same time preserves nature within the city. A classic example that can be quoted here is Copenhagen five finger plan. Even though it was established in 1947, it is relevant to the present scenario. The reason for choosing to study the Copenhagen plan is to learn different ways to integrate nature in urban planning and development.

D. COPENHAGEN FIVE FINGER PLAN:

In 1947, a development plan for the city was established. It is called a finger plan since it was inspired by the hand with a palm and five fingers. It was conceptualized and developed by Danish Town Planning Institute. In this development plan, the palm is represented as the town, and fingers are represented as 5 transit routes. The main objective of this model was to expand the city while preserving nature. This five finger plan is relevant even in today’s context of rapid urban growth to integrate and preserve nature in the city.

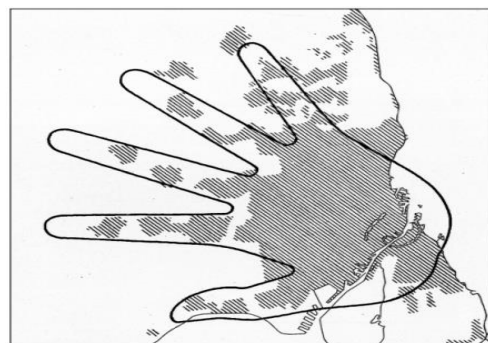


Figure 2 Five Finger Plan Concept (Image source: <https://danishbusinessauthority.dk>)

E. OBJECTIVES OF FINGER PLAN:

- 5 areas of mobility
- Connectivity to the center of the city
- Develop greener means of transport
- The green wedges (space between the fingers) are dedicated to providing land for urban farming and recreation purposes.
- These green wedges provide opportunities for bicycle paths, promenades, harbor

- Sidewalksetc which further leads to a well-distributed network of urban parks.

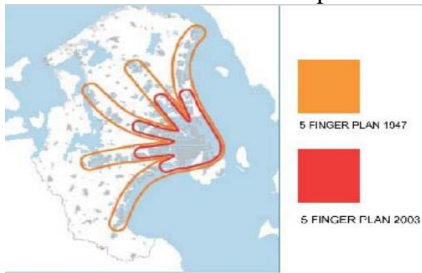


Figure 3 Evolution of the finger structure (source: Greater Copenhagen Authority Transport Plan 2003)

F. INFERENCE:

This historical Urban Planning model gives the city a direction in which the city can grow while preserving and integrating nature into it. Urban areas are developed along the corridor routes and in wedges the green areas and natural areas of the city are protected. The green areas are well connected by public transport and make it more accessible. Initiatives to integrate and preserve nature at the planning stage become extremely necessary.

G. THE GREATER LONDON PLAN

The Greater London Plan of 1944 was developed by Patrick Abercrombie. Patrick Abercrombie developed the plan based on Howard’s, Unwin’s and Olmsted’s ideas for the 1943-44 County of London Plan. He had the vision of ‘Open Spaces and Park System’ and proposed a Green Belt around London with a network of green links to connect it to central London.

The plan was based around five main issues facing London at the time:

1. Population Growth
2. Housing
3. Employment and industry
4. Recreation
5. Transport

Key features to enhance recreation:

A variety of open spaces was to be established like city squares and formal gardens, wild and picturesque parks. A series of parkways would be created, allowing residents to walk between the major open spaces unimpeded by traffic.

He explained that all forms of open spaces need to be considered as a whole and to be coordinated into a closely linked park system with parkways forming the links between larger parks.

H. INFERENCE:

The benefits of Greenways or connected park system were known to our great planners and they integrated it into their urban planning models. Many other urban planning models were practiced earlier like the garden city concept by Ebenezer Howard etc which insisted on integrating nature in the city. As the cities developed these connections are lost and open spaces are getting

more fragmented. They are failing in providing the required benefits to the citizens.

III. MODERN PRINCIPLES AND THEORIES ON ECOLOGICAL DESIGN

Ecological design is defined by Sim Van der Ryn and Stuart Cowan as "any form of design that minimizes environmentally destructive impacts by integrating itself with living processes." Ecological design is an integrative ecologically responsible design discipline. The book Ecological Design(Van der Ryn and Cowan,1996) is widely read in the field of ecological design and demonstrates **5 basic principles on Ecological Design.**

1. **Solutions grow from a place:** Ecological Design starts with responding and respecting local conditions and people. By being sensitive to the surrounding place, we can inhabit without destroying it.
2. **Make Nature Visible:** Making natural cycles and processes visible in the design help users to connect with nature.
3. **Design with Nature:** consider and integrate nature in every aspect of design by studying the existing patterns and processes of nature.
4. **Ecological accounting informs design:** by studying the environmental impacts of design, we can assure to develop environmentally sensitive design.
5. **Everyone is a designer:** Involving the local community and people is a great step towards ecological design.

The above-mentioned principles help us to design nature embedded cities and buildings which can encourage human and nature interactions within the city.

A. GREEN INFRASTRUCTURE:

Green infrastructure or Blue and green infrastructure are defined as an “interconnected network of green open spaces that conserves natural ecosystem values and functions and provides associated benefits to the human population”.

Green Infrastructure can convert urban blight into an urban destination with an appropriate network system and connectivity.

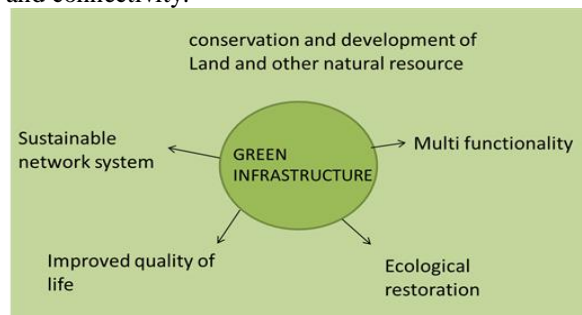


Figure 4 Green Infrastructure Concept in Ecological Design

Green infrastructure can enhance the interconnected network of Informal recreation spaces, community growing spaces, Playing fields, Sports areas, Urban parks and protected heritage and cultural sites, Ponds, Watercourses by providing recreation benefits as well as environmental benefits. it connects nature with the people. It addresses various environmental, socio-cultural, and physical issues of the city. Green infrastructure consists of various components like blue and green network, cultural network, etc. the connectivity of natural and cultural elements of the city enhances the quality of life. It also benefits biodiversity and enhances natural systems.

Table 1 Benefits of Green Infrastructure in Urban Area

<p>Environmental Benefits of green infrastructure</p>	<ul style="list-style-type: none"> • Protection and enhancement of natural resources. • linkages between major natural resources • enhances biodiversity • improving water quality • reduces flood risks • improving air quality
<p>Social Benefits</p>	<ul style="list-style-type: none"> • recreation opportunities • community involvement • sense of place and identity • improved health and wellbeing

B. CONNECTING URBAN OPEN SPACES

CASE STUDIES:

PARK CONNECTORS SINGAPORE:

The Park Connector Network (PCN) of Singapore is under the management of the National Parks Board (NParks). NParks is a national body responsible for managing and maintaining over 300 parks and the streetscape (or roadside greenery). There are a hierarchy and diversity of parks, ranging from large regional parks to neighborhood parks and playgrounds, where a spectrum of natural ecosystems co-exists with each other. In this system, the PCN serves as the network that connects these green spaces. The proposal to form a park connector network was approved in 1991 by The Garden City Action Committee. In 1995, The Kallang Park Connector became the first park connector to be implemented. Stretching over nine kilometers, the park connector links two regional parks -Bishan Park and Kallang Riverside Park. In December 2007, the Eastern Coastal PCN, a 42km loop was completed, providing a link from East Coast Park to Changi Beach Park. By January 2012, 200km of the PCN has been completed. (source:spcn.org)

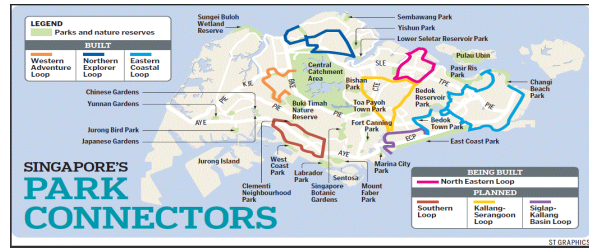


Figure 5 Map of Park Connectors Singapore, (source:spcn.org)

INFERENCE:

- Singapore has different loops connecting parks and nature reserves.
- These connectors are very successful as they encourage various activities.
- Some loops are connected and some are not.
- Each loop has different themes like adventure loop, coastal loop, and explorer loop.

C.GREENWAYS OF VANCOUVER:

Vancouver is a city that has implemented greenways successfully and still in the process of increasing the greenway systems. In Vancouver, Greenways provide beautiful urban connections to important destinations throughout the city for pedestrians and cyclists.

They have 2 types of Greenways:

- City greenways
- Neighborhood greenways

City Greenways:

City Greenway Network is a collection of greenways across Vancouver city.

City greenways are not more than a 25-minute walk or a 10-minute bike ride from every residential neighborhood in Vancouver.

Nature and Benefits of City Greenways:

- The city greenways try to cover the entire city connecting important destinations.
- They are continuous.
- They are integrated with transportation hubs and neighborhoods.
- Parking and other facilities are provided at the strategic locations which makes the greenways more functional.

Neighbourhood Greenways:

Neighborhood greenways are small-scale, local connections for pedestrians and cyclists linking **parks, natural areas, historic sites, amenities, and commercial streets.**

Community Participation:

Residents initiate neighborhood greenways, which are seen as partnerships between the City and communities. The City provides further assistance in the design, development, and construction of neighborhood greenways.

The community takes the lead to maintain the space once it is completed.

It is one of the best methods that community participation is involved in the urban development of Vancouver city.

IV. CONCLUSION

In the modern scenario, there may be various issues related to urbanization but if we adopt the ecological approach in urban planning and design, these issues can be tackled well and at the same time nature can be embedded into the cities. Due to urban growth, the loss of green open spaces is a cause for concern in every Indian city. Urbanization leads to the occupation and encroachment of green open spaces, directly contributing to a high level of fragmentation of urban green spaces. Protected urban green spaces are facing threats of encroachment. The standard designated parks and open spaces in the cities are restricted to certain functions like leisure and recreation activities and not contributing to the enhancement of biodiversity in a city or maintaining an eco-system.

From the above case studies, we can infer that a system of open spaces or connected network of green open spaces are multifunctional and enhance the image of the city. According to the World Health Organization (WHO), every city is recommended to provide a minimum of 9 – 12 square meters of urban green space for each person, provided that it should be accessible, safe, and functional. UDPFI Guidelines suggest 10-12 sqm of open space per person. The reality is

Metropolitan cities in India are having only 3 to 5 sqm of open space per person. Main goal of the above case studies on greenways and other strategies is to increase per capita open space which will be accessible, functional, and safe. Green infrastructure or Greenways in cities not only help to integrate nature in urban development but provide recreational, ecological benefits and contribute to the overall wellbeing of citizens.

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