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BEAUTY FOLLOWS COMPLEXITY

Designers must heed Sullivan's "form follows function" to avoid beauty over function. Following nature in landscape design enhances ecological productivity while promoting sustainability with principles of use of native species, biodiversity, and conservation of natural resources.

Which architect worth her salt has not heard of Sullivan's cardinal rule *'form follows function'*? And yet, every city has its share of structures that are good to behold, but miserably fail in functionality. Unfortunately, knowing what matters is not the same as doing what matters. This anomaly is evident even in landscape projects. While manicured landscapes can be spectacular, they stand alienated from the surrounding natural landscape. Designing for beauty often disregards vital biophysical characteristics of the land. Such designs are ecologically cut off from the larger natural ecosystems.

Eugene Viollet-le-Duc, the French restoration architect conceptualized excellence in architecture on how its structure is designed. He believed that each element should be joined to the next and the whole in a manner analogous to the composition of an organic body. Ecologists couldn't agree more. This is how ecosystems are built, and that is why they support us with indispensable life-sustaining services. Carbon sequestration and atmospheric gas balance, hydrological cycle, decomposition and nutrient cycling, groundwater recharge, seed dispersal, and germination are just some of the services that ecosystems generate. The health of natural ecosystems is influenced by species composition, structure, and complexity within the food chain. Natural forests are not designed for beauty, but you don't hear anyone call them ugly! Their appeal comes from the complexity of their composition and structure. The central argument of this article is that by mimicking nature, landscape architects can recreate the charm of natural ecosystems while supporting the ecological productivity of the larger landscape.

ABOVE |
Diversity, stratification and complexity are clearly visible in a natural forest. Every drop of sunlight is taken up by herbs, shrubs, trees and climbers.
PHOTO CREDIT | ***Gurudas Nulkar***

Demystifying Natural Ecosystems

Ecosystems are an assemblage of biological and physical elements that interact with each other. Between them, there is a continuous exchange of matter and energy. In an ecosystem, solar energy is transformed into biomass by photosynthetic organisms. The other creatures in the food chain consume this biomass to get their energy. The health of an ecosystem is measured by its ecological productivity – the rate at which it produces biomass and transforms energy by natural processes. A robust natural ecosystem has a high primary productivity, where autotrophs (organisms that make their food) use photosynthesis to produce biomass. From primary productivity, humans derive two 'goods' – oxygen and food. Forests, wetlands, and coral reefs are some of the most productive ecosystems on the planet.

Composition and complexity influence productivity. Ecosystem composition refers to the specific combination and relative abundance of different species within that ecosystem. Composition is characterized by species richness, that is the count of different species, and species abundance which is the number of individuals in each species. A productive ecosystem has a diversity of plants, animals, insects, and micro-organisms, and this food web keeps a check on individual populations.

ABOVE |
Species selected only on the basis of their beauty, and hardly any physical diversity can turn a very appealing garden into an ecologically isolated portion in the surrounding landscape.
PHOTO CREDIT | ***Mukul Jindal***

Ecosystem complexity constitutes the web of interactions, processes, and interdependence that exists within the ecosystem. Complexity depends on the species composition, physical diversity, stratification of vegetative layers, topographic variations, soil types, precipitation, and micro-climatic conditions. The greater the structural complexity, the greater the resilience of the ecosystem.

A Wilderness and a Garden

Imagine a beautifully designed garden that is adjoined by a protected patch of natural wilderness. Our garden has a carefully selected floral diversity. There are herbs, shrubs, trees, and climbers. Most of them are not native to this region but find a place here because of their beautiful flowers or perhaps their leaves. The garden has some aesthetic undulations but is largely flat. There is hardly any physical diversity, uniformly enriched soil, and no variety in habitats. It is designed for beauty and scores high on this count. The selected flowers and fruits attract certain birds and insects, but not everyone is welcome here. The vegetation is new to the region and is not palatable to many species. The plants need specific nutrients that must be replenished in the soil. Our garden needs protection and irrigation.

ABOVE |
Plantations sequester carbon and reduce erosion, but they are monocultures that do not promote biodiversity and robust food webs.
PHOTO CREDIT | ***Lena Bauermeister on Unsplash***

On the other hand, the wild patch adjoining this garden has physical and floral diversity. The different habitats and variety of food attract diverse fauna. This patch is 'natural' which means it is managed by nature, not man. The diversity is not selected by humans but has evolved. Nature does not encourage any one species to maximize its yield, but offers a competitive playing field where each individual must survive or make way for a fitter individual. This makes our wild patch ecologically more productive. The fauna here is functionally diverse – there are producers, herbivores, carnivores, detritivores, and decomposers, each one competing for resources. This leads to increased interactions – there is predation, competition, commensalism, mutualism, and parasitism. These are exchanges of matter and energy and create complexity that makes this wilderness resilient to external shocks. It neither needs irrigation nor fertilization. The species change naturally over time, but the ecological productivity of this wilderness hardly diminishes.

There is no display of flowers *'tossing their heads in sprightly dance* [1]' nor does it yield a ton of fruit. What the wilderness lacks in charm for humans is compensated with ecological services for humanity. This wilderness conserves a genetic pool, recharges groundwater, recycles its nutrients, fixes nitrogen in the soil, disperses seeds, regulates the micro-climate, maintains soil moisture, and provides food and shelter to non-human beings, beating our manicured garden on existential value. Our garden scores on beauty, but a variety of organisms find the wilderness more attractive.

Sustainable Landscapes

Located in the tropics, India has what it needs for a good vegetation cover – sunlight, rainfall soil. However, economic aspirations have driven changes in land use that have left us with over 90 million hectares of degraded lands [2]. Degraded landscapes threaten the life-sustaining ecological services that emanate from natural ecosystems. Atmospheric gas balance, carbon sequestration, soil conservation, and groundwater recharge, are some of the gifts of healthy ecosystems. Most of them are impossible to replicate with current technologies, and those that can be are prohibitively expensive. There is an urgent need for ecosystem restoration and design imperative for India.

Hundreds of organizations across the country are engaged in tree plantations. However, plantations are not the same as forest ecosystems. Some are detrimental to the landscape. Plantations of Su-babul *(Leucaena leucocephala)*, a non-native species, have turned invasive. They are prolific breeders and spread rapidly. There are hardly any organisms that depend on them for food and shelter. They do sequester carbon, reduce soil erosion, and provide shade, but stand alienated in the food chain, and hardly contribute to other ecosystem services. Su-babul plantations are green deserts. Ecological restoration, saving wild patches, and designing a wilderness are small but important steps in land restoration. This is where landscape architects come in.

ABOVE |
Himalayan villages depend significantly on natural ecosystems for their livelihood and survival
PHOTO CREDIT | ***Gurudas Nulkar***

Lessons from Nature

Understandably, this is not only about landscape architecture. But there is a great potential for landscape designers to contribute here. Strengthening urban biodiversity, integrating rural projects in surrounding landscapes, creating habitats and niches for fauna, and conserving rare and threatened flora are just some of the ways architects can contribute to sustainable landscapes. By applying principles of ecosystem structure, composition, and diversity, landscape architects can craft aesthetically beautiful yet highly functional spaces that are in harmony with nature. Such landscapes provide diverse habitats, support nutrient cycling, regulate water and air quality, and contribute to the overall environmental health of the region.

On the other hand, disregarding ecosystem dynamics can lead to excessive resource inputs, suffering from pest and pathogen outbreaks, or a lack of resilience to stresses.

This does not mean that the client brief should be ditched for conservation measures. But I do propose that planners must consider the ecological loss brought about by designing for beauty. Convincing clients is not easy, but not impossible. Everyone stands to gain from productive ecosystems. It is possible to create or retain wild patches in landscape projects and have gardens, conferring a unique value to the project.

Aldo Leopold's philosophy of land ethic [3] calls for ethical conduct with the natural world. He urges humans to see land not just as a commodity to be exploited, but as a community to which we belong and for which we are responsible. Such a landscape exudes enduring beauty for all life forms.

[1] From the poem 'Daffodils' by William Wordsworth

[2] Desertification and Land Degradation Atlas of India, ISRO. 2021. Available at https://vedas.sac.gov.in/en/Desertification_Status_Mapping_(DSM)_Atlas.html

[3] Leopold, Aldo. A Sand County Almanac. Oxford University Press. 1949. https://www.aldoleopold.org/about/the-land-ethic

What could be some of the key principles to follow in this journey? Here are some, and you could add more:

- Use of native species appropriate to the bio-geography and local conditions.
- Building species diversity and stratification.
- Designing for physical diversity by creating habitats and niches, retaining topography and natural drainage.
- Designing for ecosystem structure and complexity.
- In-situ soil improvement by composting leaf litter and making biochar.
- Creating measures for water conservation with open areas and minimum hardscapes for percolation, effective mulching, and efficient irrigation.
- Controlling invasive species of flora and fauna.
- Considering corridors as vital connections for fauna movement. In ecological restoration, the SLOSS question (single large or several small) is debated and yet small landscapes can contribute to biodiversity with a corridor approach.
- Designing for minimum external inputs like electricity, fertilizers, soil, or water.