KEY WORDS:
Water, Hampi, Sustainable Resource Management, Urbanisation, Landscape Urbanism

The Water Conserving Syntax: A Rationale for Sustainable Urban Performance

Rahul Paul and Mohan Rao

Tekton
Volume 3, Issue 2, September 2016
pp. 08 - 21

Rahul Paul, a graduate from Architectural Association, London, MA (Landscape Urbanism), is a Senior Associate with Integrated Design (INDÉ), Bangalore, where he is involved in developing landscape infrastructure strategies for large scale urban projects. Rahul has participated in several international and national design workshops and has presented research papers and articles at national and international conferences. He also works in editorial capacity for journals on issues of Landscape Urbanism, Infrastructure Urbanism and Urban Planning.

✉paulrahul@hotmail.co.uk

Mohan S. Rao, an Environmental Designer and Landscape Architect, is the principal designer of the leading multi-disciplinary consultancy practice, Integrated Design (INDÉ), Bangalore. He is involved in research and design programs in several countries, and done notable work in passive water management and conservation strategies in South East Asia. He is the recipient of 2010 IFLA- President's Award for the Asia Pacific Region, and the Award of Distinction in the UNESCO Asia-Pacific Awards for Cultural Heritage Conservation programme for his work in Hampi.

✉mohaninde@gmail.com/ indeinde@gmail.com

ABSTRACT

The notion of water in its tangible forms – rivers, lakes, coastlines – as a primary structuring element of urban patterns has been well established. This paper investigates the role of water derived from ecological sensitivity as the primary structure governing urban and city systems. The paper investigates the structuring of the ancient city of Vijayanagar (present day Hampi) in India and a few other traditional examples, based on the parameters and understanding of the principles of water resource management. Through this diagram of study, the concept of Landscape Urbanism - integrating the modes and operations of landscape design into the domain of urbanism, is discussed as an indigenous process in time and not merely as a new idea developed in the late 20th century, a better understanding of which is essential for survival strategy in a rapidly urbanising condition.

Water - Beyond its Tangible Notions

"Water equals power." (Shanon and Manawadu, 2007). Water in its tangible forms, what we usually refer to as 'water bodies' and its association and dependency with the human habitat has been a long standing tradition across geographies and over time. From the very beginning of the human civilization, man has been dependant on water to structure its growth and necessities. The influence of water bodies – whether streams, rivers, lake systems or sea fronts – on the settlement pattern have been strongly expressed in visual terms, both in traditional settlements as well as in latter-day developments. The dependency on these water bodies in the agrarian society, for their basic needs and to irrigate lands was a very common practice that continues to be reflected in contemporary times. Construction of canals

> **The water management methodology, as a model of study, borne out of any responsive cause, has the ability to not only transform the existing landscape into a more performative field, but also address the urban lines of action in a socially cohesive and sustainable manner.**

to divert the flow of water toward drier regions of the state or construction of dams and water tanks along the riverbed to store water are themes that have for long served as models of utilising natural resources to benefit the human civilization.

What remains least explored in studies of human settlements and their relation to water is the phenomenon of water resource management 'at the territorial level and implications of the resultant landscape on the attendant urbanization. This practice of integrated water management, not particularly widespread in many parts of the world over millennia, still found traces of implementation in certain parts of the Asian sub-continent as illustrated by Fred Pearce.

> "*In India, you can still see abandoned ponds and lakes dotted through the country side [...] much of India was irrigated from shallow mud- walled reservoirs in valley bottoms that captures the monsoon rain each summer.*" (Pearce, 2006, p.303).

The reason for it being so sparsely used as a technique to define human civilizations is understandable. The process of water resource management transcends far beyond the mere engineering skills developed to supply water to a community. Rather, it is more related to a holistic understanding of the environment, the water cycle, human needs, the landscape character and topography of the region, amongst others.

Application of this methodology (of integrated water management) not only provides a sustainable solution to the city as a whole by effective and economic use of water, but also adds new dimensions and definitions to the existing landscape, which in turn indexes different urban patterns, associations and forms with it. In a few cases, this system has transcended beyond just a survival tactic and has developed an intrinsic social dimension to it as well. As quoted by Hadeja, a retired Indian Police Officer, in Pearce's book "*I saw the people leaving the village and I wanted them to stay. That meant finding more water. So I tried catching*

Figure 1: *Overview of the Hampi Landscape*

the rain" (Pearce, 2006, p. 308). A thought that transformed a small village of Rajsamadhiya, Gujarat, India into a metaphor of integrated sustainable living and urban performance. The water management methodology, as a model of study, borne out of any responsive cause, has the ability to not only transform the existing landscape into a more performative field, but also address the urban lines of action in a socially cohesive and sustainable manner. A tradition yet not comprehensively explored, but one that has the potential to comprehensively address current development challenges.

In this paper, we discuss three case studies from past traditions which display such integrated water management methodology. Thereafter, we examine the concept of 'Landscape Urbanism' and trace their precedents in the traditional systems.

Case Study 1: Hampi, Vijayanagar – The Forgotten Empire

Hampi, in the southern Indian state of Karnataka, the ruins of erstwhile Vijayanagara is a World Heritage Site, marks the remains of a 15th century capital city. The city of Vijayanagara, founded over existing ancient settlements during the 13th century, peaked in terms of scale & maturity during the 15th -16th century before being ransacked by an invading army. The region was abandoned following the attack and is now a prime archaeological site, with buried structures and settlements spread over 130 Sq. km.

At its peak, Vijayanagara was the largest urban agglomeration of its day in the world (Swell, 1900) with a population of over 600,000. Contrary to prevailing trends of the period, Vijayanagara was 'not a uni-centered capital city'. It was intentionally developed as a multi-polar urban settlement, where each settlement – or '*pura*' (town) – had a centrality of its own. Each settlement was defined and dominated by a temple complex dedicated to the presiding deity with a large bazaar street axial to the temple. All other components of the town – housing, workspace and markets – stretched along and behind the axial bazaar which formed the main spine of the *pura*. This approach to settlement planning was not merely a passing thought, but borne out in response to the topography and site surroundings. The landscape of the region possessed its own visual delight and with it, engaged new possibilities to the making of the Vijayanagar citadel (**Figure 1**). Such an

Figure 2: *Pushkarni- the stepped water tanks in Hampi*

intense level of engagement with the regional landscape in the planning of a city remains unparalleled in the ancient world. What was more common to our knowledge was the establishment of towns along the natural resources or 'placing' of 'diagrammed towns' amidst the serenity of natural landscapes. Never was the issue of engagement of town planning with site conditions rendered as an idea to shape and define the territory.

The multiple nodes nestling in the valleys are visually isolated from the larger fabric. This distinctive settlement pattern has been traditionally interpreted as a security need – "a marital response with the surrounding hills forming a protective enclosure" (Longhurst, 1917). This statement, though, is only partially true. A closer examination and further excavations in the site reveals an intimate relationship between the settlement pattern and the watershed characteristic of the region. Vijayanagara was strongly identified with the river Tungabhadra, one of the larger river systems of peninsular India. As Dr. Halkatti and C.S. Patil (2006) emphasise, "The point of interest is the fact that the city did not use the river as a source for its domestic water needs." This is exceptional in a region that receives a mere 560 mm of rainfall annually. Barring irrigational requirements, the river remained untouched as a source of water. This finding, along with the latter day excavations of the *pushkarani* (water tanks), which harvested and stored rain water and the surface run off of the terrain, highlight the relation that the citadel possessed with its surrounding topography and the idea of water resource management that was incorporated in the planning of the city.

> **The Pushkarni served more than ceremonial and recreational identities for the settlement, they were designed to perform functions of effectively harvesting, routing and storage of the run- off water, as the entire population of the day was dependant on effective management of rainwater.**

The Pushkarani – an Environmental and Urban Performer in Hampi

The *Pushkarani*, are stepped water tanks, which were built of stone as a series of stepped tanks are found dotted throughout the extant of the landscape in relation to the valley system and the watershed characteristics of the region (**Figure 2**). The Pushkarni served more than ceremonial and recreational identities for the

Figure 3: *Relationship of the detention pond and the bazaar*

settlement, they were designed to perform functions of effectively harvesting, routing and storage of the run- off water, as the entire population of the day was dependant on effective management of rainwater. The system of diverting water to these tanks was based on careful analysis of the topography and the terrain, which was in itself based on sustainable design solutions.

The water from the surrounding steep hills was diverted by means of creating swales constructed along the main catchment zones in the watershed region. As these were the main channels to carry water to the lower terrain, built forms were avoided along these valley lines, which prevented any diversion or hindrance to the natural flow of water. These swales were led into smaller tanks (detention ponds) placed closer to the main water tank, to perform the primary function of de-silting the water (**Figure 3**). The water then overflowed from this tank through a system of swales shallow wells, to be finally stored in the *pushkarni*. In most cases, the water from one *pushkarni* was also made to overflow into another, creating a series of water tanks that were dependant on the overflow of the tank at its immediate higher terrain.

In addition to this, the landscape was also dotted by a number of percolation pits, which helped in maintaining the ground water table. This territorial level understanding of the landscape and the reading of the terrain led to

> **This still leaves out the local municipalities who are generally not included in the final decision making and are not empowered to fund the operation and maintenance of these facilities through local revenue and tax collection.**

the establishment of an effective system for the city and rendered a sustainable network to the city's performance by reducing its dependency on its more obvious source, the Tungabhadra River and increasing its efficiency by 'catching the rain', (Pearce, 2006).

These water tanks though, did not just possess a singular dimension of environmental response but were performative to engage the productive (agricultural), reflective (religious) and engineering (flood/drought control) aspects as a cohesive and integrated set of relations (Shanon and Manawadu, 2007). The water stored in these tanks were utilised by the population to satisfy their daily needs. For

Figure 4: View of a Revived Pushkarni

the residents, they were the source of potable water as well as supply to carry out domestic activities. In relation to the religious domain, they were consecrated as sacred tanks, which served water to the temples and sufficed to all the water related rituals that the religious traditions demanded. In some cases, they were also used as recreational features of the royal population, where as in the agrarian community, they were beneficial to supply water to their crops. These water tanks transcended beyond their usual behaviour of just water storage structures and were extended as an epicentre for social and cultural activities.

These tanks were social urban performers that created a more cohesive society as their existence; construction and relevance did not aim towards to any specific community per se, but was a responsive endeavour that was to serve the entire population holistically.

Though these *pushkarani* were not the only institutions that engaged with the social dimension of the citadel, they were more an undefined physical entity that performed at metaphysical level to weave the society together (**Figure 4**). They contributed to encourage social relationships in more informal mannerisms, create opportunities to define new set of cultural values and more so to reform itself as a platform to accentuate public participation beyond the divisions of caste, sex and religion. These tanks were social urban performers that created a more cohesive society as their existence; construction and relevance did not aim towards any specific community per se, but was a responsive endeavour that was to serve the entire population holistically. Thus, it reciprocated a sense of common belonging among the entire population.

In terms of its physical form and existence, it related and governed the spatial planning of the individual *puras* that were nestled amidst the terrain of the region. These *pushkarni* though were not the geometrical centres of these towns, but were more epicentres around which the different institutions were arranged and planned. The temple, the bazaar (market) street, the dwellings and the workspaces were all developed in an accretive manner with respect to these stepped tanks and their spatial characteristics were defined in relation to these tanks. Thus, the *pushkarni* in its day was

an entity that had far reaching effects from the micro to the macro scale – from defining the landscape territory at the larger scale, to establishing the urban pattern and finally to present itself as body to regulate the 'way of life' – urbanism (Writh, 1938).

Such was the importance of these water tanks, derived from water resource management principles to the city of Vijayanagara, that during the restoration of this archaeological site by the Archaeological Survey of India (ASI), a special impetus was undertaken to revive this entire water system and store water in these pushkarnis. This effort jointly undertaken by our environmental design firm Integrated Design (InDe), based in Bangalore, India, has already been successful in reactivating these pushkarni to their original intent. After only one season, the pushkarani now holds water throughout the year in an area that is perpetually drought prone. Though this effort of storing the water does not serve any habitable population now, its resurgence has certainly bought back the cultural identity to this archaeological site and served as an impetus towards improving visitor experience.

Case Study 2: Waterscapes in Sri Lanka

This model of study has also found traces in Sri Lanka where relation between landscape and urbanisation has had long standing tradition. The earliest Singhalese settlements in the so-called Dry Zone of the flat coastal lowlands surrounding the central highlands were structured in conjunction with an ingenious tank (man-made reservoir) and irrigation system, linking habitation to cultivation and sacred spaces to topography. The historical geography of urban water control in South and Southeast Asia reveals highly structured rural and urban systems that are physically and symbolically linked to both irrigation techniques and cultural/ religious relationships with water bodies. The region boasts numerous waterscapes, man-made landscapes that operate on a territorial scale. Waterworks were huge infrastructure projects that supported innovative and thriving civilizations. Their history became etched into the technical, socio-cultural and ecological structures of the water system. The South / Southeast Asian monsoon belt became synonymous with the rice belt due to the inhabitants' hydraulic ingenuity (Shanon and Manawadu , 2007).

Case Study 3: Bangalore's Traditional water Management Syntax

A pattern also witnessed in classical cultures of India, in particular, where a number of such cities were developed based on the principle of indigenous landscape urbanism. As Anuradha Mathur and Dilip Da Cunha have stated about the making of the city of Bangalore in India- *"landscape was an initiator of the settlement."* The lower Deccan Plateau, a triangle of the South Indian peninsula, was structured by a system of tanks that exploited the territory's dendritic drainage pattern. The tanks were man-made lakes that served as water reservoirs during dry seasons. 'The land of a thousand tanks', a land where the Great Trigonometric Survey of India was initiated, made a strong link between urbanization and water management. The interdependent system was begun by King Kempegowda I and included a number of traditional structures including the pettah (indigenous mud and bamboo walled city), agrahara (school for priests) and tota (gardens with strong social hierarchies) – all in relation

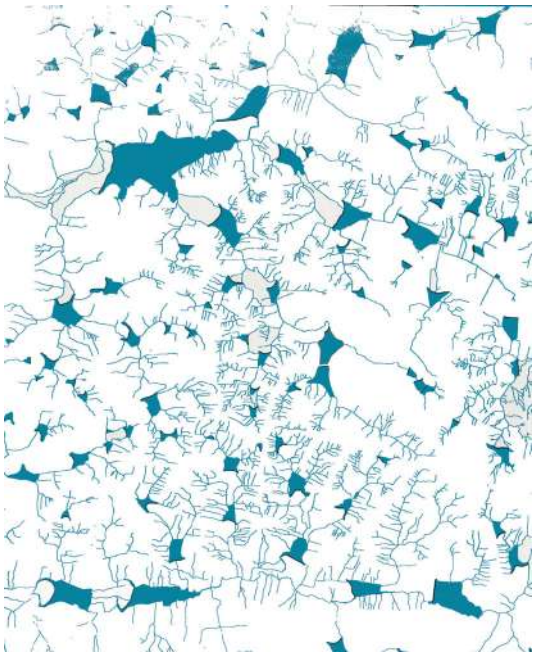

Figure 5: Bangalore- The land of the thousand tanks Image Credit: Mathur and Da Cunha (2005).

to bunds, tanks and sluices (Mathur and Da Cunha, 2005).

"Contrary to the engineer's view, there is no dominant watercourse in the 'land of a thousand tanks' (**Figure 5**). Instead, there are many possible series reaching back to the 'thousandth tank' on the tableland via tenacious connections that are more political than physical, dependent on managed sluices more than natural sources." (Mathur and Da Cunha, 2005, p. 155).The growth of the city of Bangalore based on such principles of water management syntax points to a close resemblance to the city of Vijayanagara. It can be argued that this growth pattern was directly influenced by the ancient civilization as both these settlement patterns belong to the same hydrological, topographical and geographical conditions and lie in close proximity of 350 Km from each other. It was a process of city development, which in time turned into a traditional pattern of territorial engagement.

Landscape Urbanism- A New Concept or Indegenous Process?

The application of these principles of water resource management, as early as in the 13th century Hampi and elsewhere, introduces us to a new approach towards planning- where the modes and operations of landscape design are integrated into the domain of urbanism to create new sets of urban materials based on intensive coexistence – an idea that in the 20th century has been described as 'Landscape Urbanism'.

As Gareth Doherty (n.d.) states, "Two overarching themes bind landscape urbanism together. Firstly, landscape urbanism is a synthetic and multi-scalar discipline leading a range of other disciplines and interests. Secondly, the recognition of landscape infrastructure as the primary ordering device of the city." These principles, if studied through the model of approach undertaken in the 13th century city of Hampi, Vijayanagar - where the water tanks derived from ecological understanding attended the immediate urban surroundings –reflects a close relation to the domain of landscape urbanism. The term 'Landscape Urbanism' was first articulated in the late 1990s by Charles Waldheim. However, the study of the ancient civilizations in most parts of South and South East Asia reveal that the generic idea of landscape urbanism – understood as a structuring of landscapes to guide their occupation, use and urbanization– is not new, but has indeed been in practice for several millennia (Shanon and Manawadu , 2007). It can

be argued that the term might be coined in the contemporary times in response to present day situations but the thought was in practice since ancient times.

> *"Much of the contemporary discourse on landscape urbanism – and the projects aligned with this emerging field – focus upon the challenges posed by post-industrial urban voids, the recovery of Brownfield sites and the reintroduction of natural processes and habitats but an investigation on territories structured by water resource management and the relationship of such landscapes to urbanization argues that there is an ancient, indigenous landscape urbanism whereby an integral system of urbanization is tied to the logics of landscapes."*
>
> (Shanon and Manawadu , 2007)

Landscape Urbanism- Reformation of the traditional

The condition and growth of these civilizations is a testimony to the emergence of a process and a body of study called 'Landscape Urbanism'. It is often heralded as the saviour of the built professions, as a new 'ism' with concerns that are congruent with the politically correct ecological biases and priorities of the developed, Western World. It is of importance to note here that this domain of study traces the least explored facet of human civilization and its relation to water – the one derived from ecological principles and not just the relationship of human civilizations with the tangible notions of water as either supply and/ or a visual feature, or a natural form of existence to shape the fringes of the settlement. But in all these cases it was never understood as integrated holistically with the process of city making, to address the extent of landscape or to shape the socio- spatial relationships – as seen in traditional urbanism of aforementioned examples. Since such a water management system is least explored, the discourse of Landscape Urbanism was probably heralded as a new emerging school of thought and not defined as a resurgence of an age old tradition to comply with the contemporary post - industrialisation times as a performative-ism.

We argue that this domain of water management syntax was indigenous in nature and had relevance in the ancient and medieval world, its advent in the contemporary times has brought with itself new sets of emerging engagements such as uprising urbanisation, the concepts of pollution, new social and political strands of living and also new emerging spatial land use patterns. The absorption of these elements in the discourse of Landscape Urbanism has transformed this ancient process into a more complex body of organisation by redefining it with new operative capacities of multiscalarity, cross-scalarity and pre-physicality. This reformation of the domain is aptly defined by James Corner (2003), where he addresses this discipline as, "The combination of biology and technology to spawn biotech, or of evolutionary science with business management to produce organizational dynamics."

Misguided Environmentalism

There has been no doubt that water resource management system has been an effective scheme not only from the environmental viewpoint but also as a poignant tool for urbanism. But with the advent of urbanisation, this scheme of water system has been encountered to new set of issues that it had

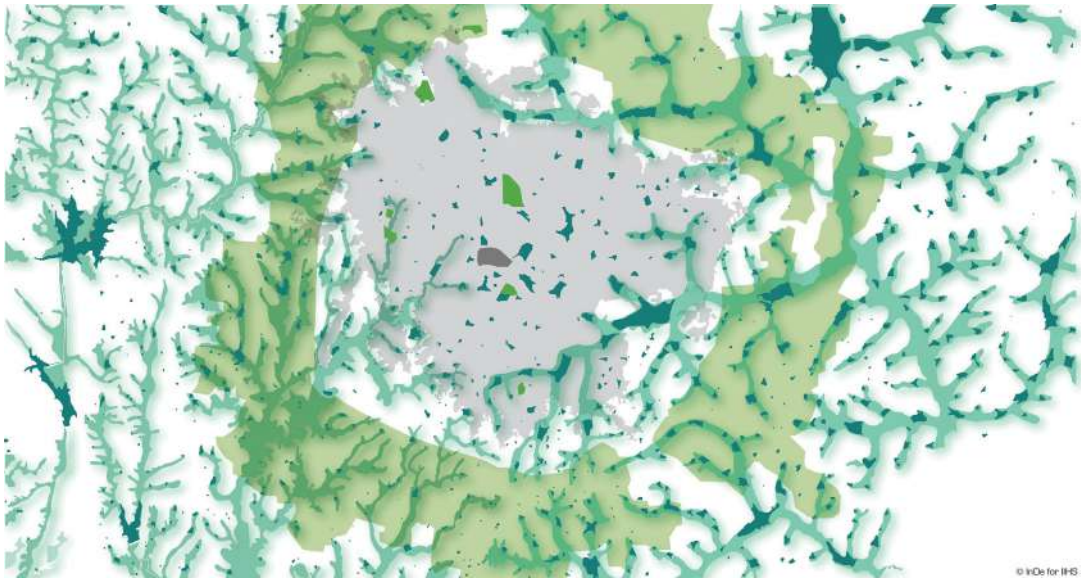

Figure 6: *Proposed green belt for the Bangalore Region. Image Credit: Groupe SCE (India) Ltd*

not been exposed to in the earlier times. Issues such as – increase in population, increase in demands of water, the rise in pollution levels, the growth of new social relations, and the political demands – have already raised questions of effective functioning of this system. Not only have they raised new set of questions and concerns but in some cases, the inefficiency of these water systems to engage with contemporary times has already led them into disrepair. Pearce states with reference to the *qanats* of medieval Iran, "The *qanat* is a classical technology for the communal management of water. It has fallen by the way side not through any hydrological failing, but because it does not fit easily with the modern vogue for private ownership of resources." (Pearce, 2006, p. 348).

Though the linkage between natural system, resource and urbanisation has long been understood, even the most progressive planning processes have been unable to integrate them in a holistic and active manner. This is evident in the Bangalore Revised Master Plan 2015.

The most striking of this failure of the water management schemes in cities, (We emphasise on the scale of cities because on smaller scales of residential or individual institutional buildings this system of "catching the rain" still works effectively) has been the city of Bangalore, India. The city has probably witnessed a process over time to see its effective ancient system slowly engulfed by the forces of rapid urbanisation and regressive planning strategies. Though the linkage between natural system, resource and urbanisation has long been understood, even the most progressive planning processes have been unable to integrate them in a holistic and active manner. This is evident in the Bangalore Revised Master Plan 2015, which proclaims that the "green belt (composed of agricultural

zone) plays a very useful role in limiting urban sprawl" (**Figure 6**). By confining the "green belt" as the physical boundary of the city, Bangalore has been allowed to develop in a radial urban form, completely ignoring millennium-old natural history of the region. Derived from out-dated and non-contextual planning theories, the 'green belt' ideas has ended up severely undermining the performance and connectivity of natural systems in the region.

Urban planning and design discourses have, of late, attempted to promote a conscious engagement with the natural environment, largely driven by external rating systems. The results are far from desirable.

This ecological framework, referred to as "bourgeois environmentalism" by some, has caused immense damage to the natural ecology of the region. It is estimated that, of the 262 lakes identified in the Bangalore region in 1960, only 81 exist today—of these, only 34 are recognized as "live" lakes. While highlighting the plight of lakes, what the numbers do not reveal is the massive and irreversible destruction of valley networks as described earlier, the very lifelines of the regional landscape. The valleys feed the lake system, regulate surface run-off, mitigate flooding, and sustain aquifers and wetland ecosystems. Bangalore's planning paradigms, which have effectively turned their back on this natural framework, have resulted in, amongst other things, the severe depletion of ground water, increased flooding, loss of biodiversity, and increased urban heat islands. A similar pattern of change, destruction and disappearance is visible in the eri systems of Chennai, in Tamil Nadu Region (Coelho and Raman, 2013, p.146).

Urban planning and design discourses have, of late, attempted to promote a conscious engagement with the natural environment, largely driven by external rating systems. The results are far from desirable. This could be attributed to first order political-economic demands, although it chiefly emerges out of the understanding of capacities and performances that these landscape systems are embedded with, and the relations that they can nurture. Often, these systems are studied in isolation to their larger ecological and social-urban contexts, resulting in these systems being either objectified as mere protected corridors, or worse, as beautified recreation pockets dotting the city fabric.

Conceptual Shift Towards Water Management – New Parameters of Engagement

A conceptual shift is necessary, one that recognises and positions these landscape systems as networks and infrastructure critical to the larger ecological establishment. If one wants to successfully position natural landscapes and environmental systems within the seemingly improbable demands of contemporary urbanization, a regimental shift is required, one that recognises that these landscapes must be evaluated not by their physical extent, but by their capacities and embedded performance. Understanding the notion of ecosystems hence becomes an important tool in this paradigm shift to position landscape and environmental systems within the demands of contemporary urbanization. Ecosystem Services by definition are the "goods, functions and processes that are

derived from the Biosphere". The system broadly functions as a four-feedback loop that can be generically categorized as *Regulating* – storm water, water treatment, erosion control etc., *Provisioning* – food and access to fresh water etc., *Supporting* – nutrient cycle, soil formation, etc., and *Contributing* – towards cultural associations, recreational values, etc. By exercising the benefits and potentials of this system, the idea is to derive malleable urban systems that function in tandem with the natural ecosystem to provide long-term solutions for urban development, contributing both environmentally and socially in a single feedback loop.

> **If one wants to successfully position natural landscapes and environmental systems within the seemingly improbable demands of contemporary urbanization, a regimental shift is required, one that recognises that these landscapes must be evaluated not by their physical extent, but by their capacities and embedded performance.**

Closely related to this conceptualization are the notions of *land capacity* and land *potential*, both of which represent a critical departure from the dynamics of theorizing the value of land based on the logic of capital and real estate. Land capacity, in its essence, is the assessment of land potential, both tangible and intangible. This may include an inter-relationship study and analysis of topographical conditions, hydrogeology patterns, watershed systems, visual qualities, and natural features. Such studies often help in revealing the land's inherent demands for conservation, suitability for development, judicious exploitation. It contextualises the inherent usability of land within the regional landscape. An evaluation of natural capital includes its capacity to produce food, sequester water, moderate microclimate and as a habitat for biodiversity and importantly linkage to livelihood - a traditional relation between human habitation and landscape systems established over millennia.

Conclusion: Water Ethics – Towards a Sustainable Future

Water resource management as an effective management process has often been less explored and less documented in relation to human civilization, now has transgressed as a potent global phenomenon that probably holds the key to ensure the availability of the world's greatest renewable source – water and the efficient survival of future human habitats. The city of Hampi, Vijayanagara in this context serves as model of this engagement and addresses the potentials and possibilities of integration of this water resource management from both the domains of landscape and urbanism. The model of study not only serves to address the sensitivity of approach that needs to be undertaken in contemporary times but also the arrangement of the city infrastructure for performing in a cohesive manner beyond contemporary models and notions of urban planning – which tend to be far more program driven rather than potentially achieved.

The model of water harvesting, management, supply and subsequent reuse directs the urban form towards a decentralized, multi-polar settlement pattern. Further, integration of the agricultural systems based on terrain and

water needs can potentially create a pattern of development that effectively integrates the built and unbuilt and creates a diversity that is rich in land use patterns and the visual landscape. Each aspect of the urban landscape can be defined, directed and formed by the interaction of the ecological framework set out at the broad scale and the dynamic engagement of urban, farm lands and protected greens.

A deeper understanding of the conceptual framework of traditional landscape systems helps clarify the integral nature of sustainable settlement planning. The learning from an ancient settlement can be judiciously applied in contemporary settings to address present day needs for a sustainable and equitable development. A holistic approach determined by the frameworks of landscape urbanism encourages an ongoing discussion on the process of effectively structuring space and ordering land based on perceived urban needs, visual characteristics, demands of the end user and the territorial landscape.

A holistic approach determined by the frameworks of landscape urbanism encourages an ongoing discussion on the process of effectively structuring space and ordering land based on perceived urban needs, visual characteristics, demands of the end user and the territorial landscape.

The model of study not only serves us to address the sensitivity of approach that needs to be undertaken in contemporary times but also the arrangement of the city infrastructure for performing in a cohesive manner beyond contemporary models and notions of urban planning, which tend to be far more program-driven rather than potentially achieved through terrain intelligence.

Cities can become more sustainable by modelling urban processes on ecological principles of form and function by which natural ecosystems operate. The characteristics of ecosystems include diversity, adaptiveness, interconnectedness, resilience, regenerative capacity and symbiosis. These characteristics can be incorporated in the development of strategies to make them more productive and regenerative, resulting in ecological, social and economic benefits.

In the modern times, the domain of 'Landscape Urbanism' as stated by Kenneth Frampton, "*offers remedial agent within urban areas, in the developing as well as the developed world*" (Doherty, n.d.), as it focuses on the establishment of operative systems of abstract relationships: artificial ecologies that can traverse disparate scales and areas of knowledge. The domain of Landscape Urbanism engages with these new sets of issues of today's time and "uses 'territories' and 'potential' instead of 'program', adaptable 'systems' instead of rigid 'structures' as a better way to organize space" (Corner, 2003), holds the key to the resurgence of this ancient system of effective water management with current global trends. This thus confronts us with an unusual situation where this ancient process of water system which traces the roots of the process of Landscape Urbanism, now needs to be readdressed through the contemporary engagements of the domain, to redefine itself for its effective participation within the larger context. In this contemporary situation of flux, where

the need of water resource management is essentially vital and so is the need for re-establishing its notions with current patterns of urbanization, Landscape Urbanism serves as the most critical and potential domain to interpret the water resource management system not only to initiate a mutual co-existence between territorial landscape and attendant urbanization for a performative city growth but also for its global implication of effectively functioning as a primary water source potential to the present and future generations before we consume all the available water and let the rivers run dry. ■

Photo Credits: All other images, unless otherwise mentioned, are credited to Integrated Design (InDe), Bangalore.

References:

Coelho, K.; Raman, N. V. (2013). From the Frying Pan to the Flood Plain: Negotiating Land, Water and Fore, in Chennai's Development, in Rademacher, A. M., Sivaramakrishnan, K. (eds). *Ecologies of urbanism in India: metropolitan civility and sustainability (Vol. 1)* (pp.145-163). Hong Kong University Press.

Corner, James. (2003). Terra Fluxus. In Mostafavi, Mohsen; Najle, Ciro. (Eds.). *Landscape Urbanism: the machinic landscape.* Architectural Association Publications.

Gareth Doherty (n.d.). *Landscape as Urbanism.* Harvard University, Cambridge USA
Retrieved 20 May, 2016, from: http://www.rali.boku.ac.at/ila/veranstaltungen/konferenzen/x-larch-2-2006/lectures/gareth-doherty-landscape-as-urbanism/

Halkatti; Patil, C.S. (2006). *Water systems in ancient Vijayanagara*, Journal of Archaeology for Asia and the Pacific, June, 2006.

Longhurst, Albert Henry. (1917). *Hampi ruins described and illustrated.* Superintendent, Govt.Press, Madras

Mathur, Anuradha; Da Cunha, Dilip. (2006). *Deccan Traverses: The Making of Bangalore's Terrain.* Rupa.

Mostafavi, Mohsen; Najle, Ciro. (Eds.). (2003). *Landscape Urbanism: A Manual for the Machinic Landscape.* Architectural Association Publications.

Pearce, Fred. (2006). *When the Rivers Run Dry*. Eden project Books.

Sewell, Robert . (1900) *A forgotten empire, Vijayanagar, Forgotten Books,ISBN 1606209590, 9781606209592*

Shannon, Kelly; Manawadu, Samitha. (2007). Indigenous Landscape Urbanism: Sri Lanka's Reservoir and Tank System. *Journal of Landscape Architecture*, Autumn 2007, 6-17

Wirth, Louis. (1938). Urbanism As a Way of Life. *The American Journal of Sociology*, 44(1), July pp. 1-24.