Greenway Patterns and City Planning

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Abstract

Greenway lies at the intesection of citified nature and naturalized city, which is a powerful performative position to occupy. Yet the current discourse, largely approaches Greenway as a program that is inserted in the urban fabric to form a micro-scale connective between homogenous or heterogenous landscape. This article is motivated by the nostalgic reality of agricultural times when the urban pattern was guided by rivers and floodplains, and explores the counter programming position on cities which is inserting urban fabric into the greenway or landscape matrix. The design with nature and for all biotic species theses of Ian McHarg and Richard Forman has already laid the foundation for further discussion on landscape patterns and city planning. Yet, current discussion on the topic is not voluminous or critical enough. This article addresses the gap by explicitly investigating greenways patterns and its position in informing future design/ planning of cities. In conclusion, Greenways patterns are diagrammed and synthesized as a template to study urban landscape patterns. Green Network Oriented Zoning -GNOZO map, a combination of greenway pattern, land valuation economics, land suitability analyses, and eco-civic optimization, is put forth as a potential framework for designing and planning future city development.

Keywords: Greenway network, landscape pattern, city and urban planning, design syntax

1. Introduction

Greenway has been traditionally understood as a multi-functional, multi-objective linear landscape with potential to address socio-cultural, recreational, tourism and ecological concerns. A range of positive values such as environmental, psychological, safety and aesthetic enhancements due to parks, greenways and open areas have been projected through multitude of contemporary research. Yet, each city and suburb is not infused with well planned and internally connected open space and green networks since the final manifestation of these plans requires many complex factors to align such as community engagement, costs of land acquisitions, political will, design sensibilities and other contextual variables. Considering that the traditional approach of preservation and conservation oriented Greenways, applicable at regional scales, has now filtered into urban constructs and city planning meetings, it is reasonable to assume that the multiple complex factors could align if so desired by each involved stakeholder. The question is that once that happens, do we have guiding frameworks to implement these, city wide, city-country, or city-city and country-country green networks. This article inquires into this question, unravels current greenway patterns in the process, and in conclusion, offers, another mapping based framework of GNOZO Map for consideration in future city planning. The underlying intention s GNOZO Map is to advocate and facilitate integration green network as a key component of inhabitable urban constructs.

2. Method

This article critically examines recent theories and practice of greenways design and planning with specific attention to emerging patterns. The scholastic publications, design proposals, reports by government and other participating agencies are critically reviewed. A critical, constructive and interpretative approach is employed to examine theory and practice of Greenways and emerging patterns. As Christopher Alexander noted in explaining the logic for his book -*A Pattern Language,* the patterns need to be revealed before they can be improved. This article mimics Alexandrian logic in that sense and reveals contemporary greenways pattern to further assess implications to future city planning. Diagramming is therefore critical to research methodology.

3. Greenway Patterns and Theory

Ian McHarg and Richard Forman examined and advocated for designing landscape patterns with conscientiousness towards ecology and biodiversity through their respective books on Design with Nature (1969) and Land Mosaic (1995). The suggestion on greenway systems as purveyors of fertilizers (Fabos, 1995, 9) indicates leaning towards linear corridor or conduit kind of a pattern, also favored by policy planners of alternative transportation mode (Shafer, Lee and Turner, 2000, 164). Greenway as a promising strategy, incorporating wetland filtering and buffering functions (Ahern, 1995), re-appears in articulation of green infrastructure as connected landscape including ecological hubs and critical landscape linkages (Benedict and McMahon, 2006, 35).

In Beijing, a heterogeneous green network is proposed for different scales of region, city, and neighborhood to address urban sprawl (Li, Wang et al et al, 2005). A large forested corridor in the northwest and the southeast periphery of the regions was proposed as means of protecting environmental quality and providing habitats for wildlife, at the regional level. At the city level, a system of green wedges, parks and green corridors was recommended, primarily, towards limiting the future urban expansion. Gridiron green extensions along the rivers and streets linking existing and new green spaces were suggested for neighborhood scale. The breach of rigid greenbelt is observed in Nanjing as well, thus leading to the proposal of hierarchically scaled interventions, similar to Beijing, through city-circuiting greenway, green wedges in median strip to guide sprawl and inner city riparian and roadside greenways for connectivity (Jim and Chen, 2003). The formal pattern of green wedge, urban fingers and greenway network Nanjing and Beijing cities in China resonate with Forman's Patch-corridor-matrix approach (Jim and Chen, 2003, 106,107; Li,Wang et al 2005). The existing green patterns are concentric radial and are envisioned to shift to dispersive radial over time.

A dissipative dispersive pattern shows up in yet another Asian example from Japan. The green networks proposed in 1960s and more recently were assessed in relation to the corresponding statutory mandates through the cases of Tsukuba and Kohaku (Yokohari, et al, 2006). The Tsukuba New Town greenway plan was guided by Urban Park act and called for a series of block parks having their own catchment areas catchment radius of 250 m to 1000 m, connected by a web of greenways connecting the block parks and other green spaces. The grid of dissipative green network pattern has a strong central spine with nodes of green patches. The

development in Kohaku, Japan guided by Green Matrix system –a land conservation tool, embraced a more organic radii pattern, best described as two facing green arcs with green patches organized in dissipative pattern (Yokohari et al, 2006, 215, 216).

For greenways planning oriented to nature tourism, education and culture in urban areas, Pena et al recommend that the unique landscape elements and characteristics are highlighted; unstable areas are recovered and cultural elements integrated (2010, 982). For rural areas, the authors recommend critical thinking n greenways to address socio-economic and health problems of the area. A greenway network planned for the UNESCO world Heritage site in Sintra was approached greenway as a critical infrastructure contributing towards sustainable development and equally significant as conventional infrastructure systems of water, sewerage, transportation and energy (Ribeiro and Baroa, 2005, 7). A greenway network connecting valuable resources delineated as Corridors of Outstanding landscape Quality was proposed as a strategy to conserve cultural, historic quality of the place while allowing for new development. The formal design decision favored by a local firm comprised of topography and hydrology guided organic patch shape and curvilinear corridors (Ribeiro and Baroa, 2005, 8). Another study from Europe by Brunckhorst, Coop, and Reeve (2006) suggest resource governance as sustainable regional development and the approach of eco-civic optimization. The authors assert that judicious selection of the conservation areas need to be critically reviewed if the ecological conservation is to be effective. The areas of ecological and political concerns should be identified and the areas of high civic attachment should be mapped; land area lying at the intersection of eco-political-civic concerns should be then selected for conservation (Brunckhorst, Coop, and Reeve, 2006).. The closest reference to design patterns is in terms of demarcation of boundaries and thresholds.

Kuhn inquired into the greenways patterns through studies on urbanization patterns in Berlin, Germany and Randstad, Holland (Kuhn, 2003). The study attempted to address the contentious question of which of the Green-belts or Green hearts typology is better, one that acts as a connector or a *separator* for urban and suburban regions (Kuhn, 2003, 19-27). In the process, the article brings out the two broadly debated approaches of one large patch over a concentric ring of small multiple patches, in context of urban spatial organization design, more popular in landscape ecology as Forman's SLOSS (single-large or several-small patches/ ecosystem) concept. The verdict seems to be favoring a combinatory pattern. A reiteration on grid pattern comes from another study on urbanization patterns in Holland (Schrijnen, 2000). The study advocates a dynamic grid pattern connecting the local infrastructure with the green network where the dynamic grid is based in landscape ecology principle that the survival of a species often depends on the access to larger areas since that allows flexibility to cope with variations in conditions. The grid pattern allows multiple mutual crossings or interfaces between infrastructure and green networks. Essential design principles embedded in this pattern are polarity, de-centrality, equality, continuity and formality.

4. Greenway Patterns and Practice

Patch-Corridor-Matrix theory of Richard Forman was an inspiration world over even if the translation to practice is more of a progressive education. To cite an example, the city country of Singapore's park connector network is designed as a multipurpose, multifunctional, socially and environmentally responsible landscape system with patches of fragile ecosystems connected by

multipurpose corridors (Tan, 2004, 5). Another example is of a riparian greenway from Australian city of Adelaide (Mugavin, 2004). The key goals of the River Torrens Landscape plan, were listed as eco-system conservation, protection of cultural landscape values, restoration of river and recreation. The Torrens river greenways as re-presented by Mugavin has a linear, connective form (Mugavin, 2004, 232-233).

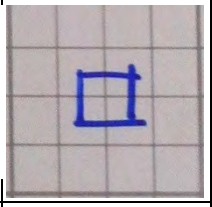
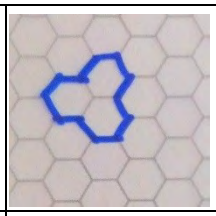
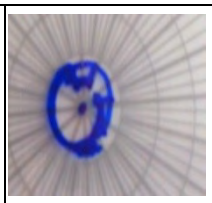
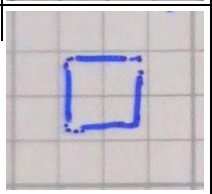
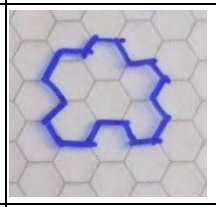
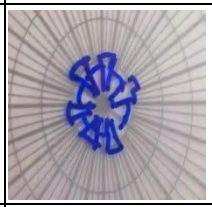
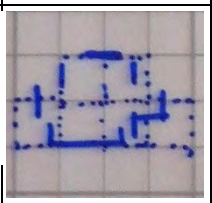
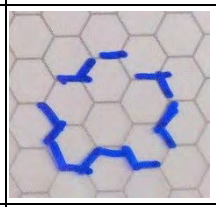
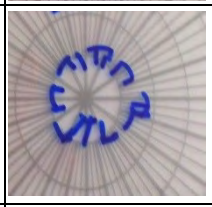
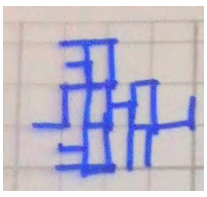
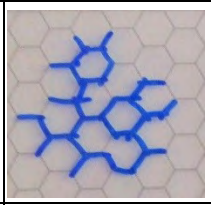
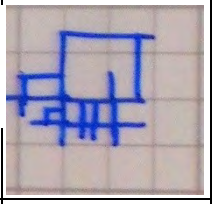
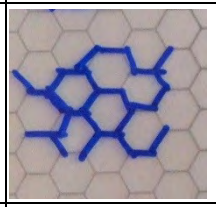
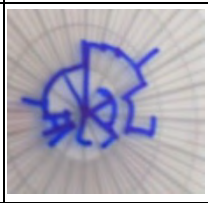
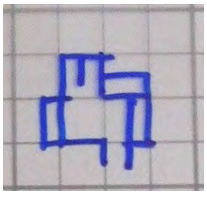
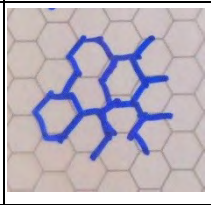
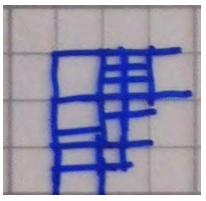
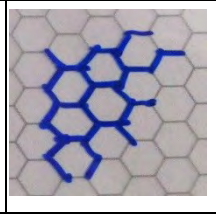
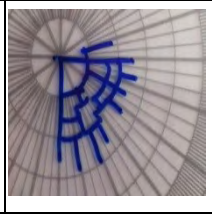
To review greenway practice at home ground in America, some projects from Appalachian corridor are examined. The Knoxville, Knox County Greenway plan is said to be a culmination of Knoxville Greenways and Community Trails Commission Report, 1992, the Knox County Greenways Plan, 1994, Knox County Park and Recreation Facility Plan, 1998, and Knoxville Parks, Greenways and Open Space Resource Inventory, 1999. The Greenway aims to provide a connected and cohesive system of parks and recreation facilities while facilitating the preservation of important natural resources (Knoxville Metropolitan Planning Commission-KMPC, 2009, 7,10). The greenways plan thus focuses on connecting parks, recreational areas and water bodies so as to protect open space systems, reinforce the pedestrian transportation network, and facilitate avenues of economic vitality.

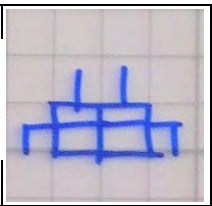
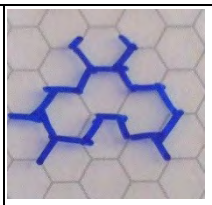
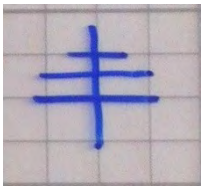
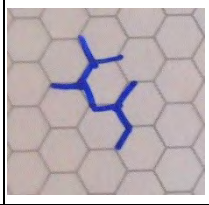
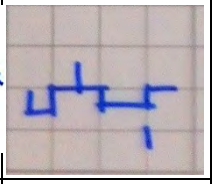
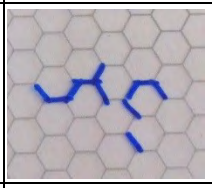
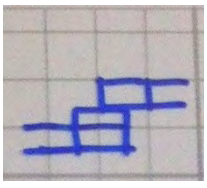
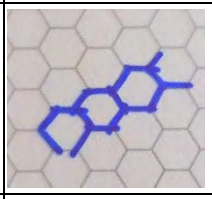
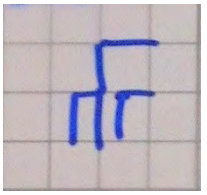
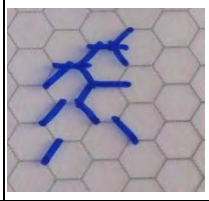
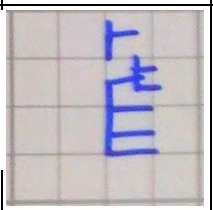
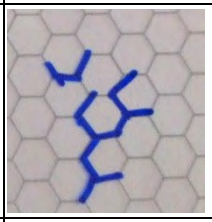
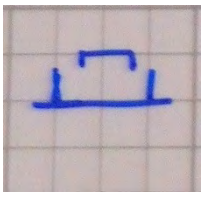
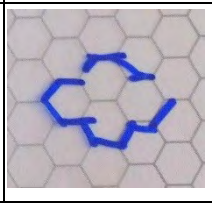
Greenways in Nashville, middle Tennessee are primarily designed to connect the places of natural beauty with the neighborhoods. The fundamental belief that guides the plan is that Greenway should provide all citizens with barrier-free access to natural resources and recreational opportunities (Metropolitan Government of Nashville and Davidson County, 2010). Mecklenburg County's Greenway System in North Carolina, initially proposed in 1980 as an aesthetics and access to nature based "green necklace" along the creeks and streams of the County was updated in 1998 to include floodplain management objectives. The idea was to protect stream corridors and floodplains from degradation due to poor land management practices, which in turn, caused flooding through the city. Provision of walking and biking as an alternative transportation mode were additional motives of the plan (Haden and Stanziale, 1999, 2010).

5. Discussion: Greenway patterns and implications for city planning

The Greenway patterns are essentially design manifestations of desired objectives such as connectivity or containment (Sharma, 2010), patterns presented in first column of Table 1indicates that most patterns lean towards connectivity, with some greenway plan employing containment employed only in parts, as a sub-set of the connective pattern, only rarely did patterns such as the ones from Randstad, Holland and Beijing, China come close in practice of containment, when looked at exclusively through pattern based view as used in this article. Superimposing the greenway patterns on a range of geometric grids such as cartesian, hexagonal and polar, helps extrapolate the reductive patterns, thus transforming them from specific to generic diagrams, which are ideally and hypothetically more amenable to replication. The variation based on underlying geometric grid to synthesize reductive patterns is shown in Table 1.

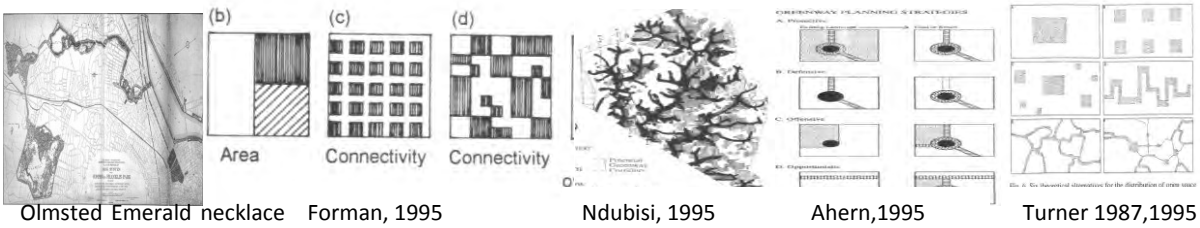
Table 1. Exploring reductive pattern for Greenways

Location	Greenway patterns	Greenway patterns on geometric grids which are popular as underlays for city design			Objectives Pattern types	
Randstand, Holland					Contain-ment	Radial Concentric
Beijing, China						
Berlin,Germany					Contain-ment + Connective	
Singapore					Connective	Poly-Centric Radial Dispersive
Knoxville, TN, USA						
Sintra, Portugal						
Holland						Poly-Centric Grid Dispersive

Nanjing, China						
Tsukuba, Japan						Axially Dispersive
Nashville, TN, USA						
Adelaide, Australia						
Lisbon, Portugal						Poly-Axes Dispersive
Mecklenburg county, NC, USA						
Kohaku, Japan						

The most iconic theorizations on greenway patterns to date are Olmsted's Emerald necklace, Richard Forman's PCM: Patch-Corridor-Matrix , Ndubisi's ESA:Environmentally sensitive areas, Jack Ahern's PODO: Protective, Offesnive, Defensive, Opportunistic approach, and Tom Turner's Open Space Network alternatives; see Figure 1. Besides Olmsted's Emerald necklace drawing which despite being descriptive serves as a genesis, other diagrams were used as means of theorizing approaches to spatial planning. These are significant advance in fractal pattern based study in landscape. The approaches attempt to negotiate a safe ground between planning,

politics and design but come across as more reliant on the planning intent and objectives to guide decisions on spatial connections or emergent greenway patterns. The reason probably these approaches have not been popularly embraced in the realm of city planning could be the position rooted in landscape and biodiversity conservation, which may not be highest priority for city planners.



Olmsted Emerald necklace as in Fabos, 1995,2004 | Forman, 1995 | Ndubisi, 1995 | Ahern,1995 | Turner 1987,1995

Figure 1. Iconic theorizations and diagrams on greenway patterns

Greenway, like most other public open spaces or commons, is generally perceived as a liability in city planning practice, rather than an opportunity. One of the reasons for this perception could be the widespread impression of Greenway as a fragile instrument requiring continuous maintenance. Benefits of greenway on health, an area under exploration might give a push to the acceptance of idea of greenway as a key instrument of city planning. The idea that currently resonates most with city planning officials is of Greenway as a scenic byway or alternative transportation mode, for the associated revenue generating potential (Shafer and Lee, 2000). There must be other ways to present greenways as appealing to this economics oriented mindset. Statistics on increase in real estate value of properties in proximity to greenways serve most appropriately in building dollar based reasoning. Research shows that proximity to a greenway increases property values, for instance home prices up-surged in the range of $230 to $3,200 within the 5,000 feet or roughly a mile of a distance of the greenway in Mecklenburg County, North Carolina (Harrison and Munroe, 2007, 134). This is an attractive incentive to developers despite the high construction and maintenance costs ranging from $50,000 to $120,000 per mile (Rails to Trails Conservancy, 2012; Chalkey, 2005).

Superimposing the greenways pattern templates in Table 2 with classic McHargian land suitability analysis maps and the enhanced land valuation for 1 mile zone next to greenways, provides a zoning map that takes into account both the land based and the economic criteria. The approach of eco-civic optimization suggested by Coop and Reeve (2005) is applied as an overlay to account for social concern. This approach negotiates three critical stakeholders to increase chances of accomplishing the objectives of resource conservation over a long term. Three different sets of information datasets favoring three empathies of ecological conservation, political governance and social / emotional care or attachment values are mapped and overlapping areas are marked as an agreeable conservation zone. Combining these maps generates a complex pattern that serves as the fundamental zoning generator map, see Figure 2. The emergent complex pattern could be most aptly termed as Green Network Oriented Zoning - GNOZO map.

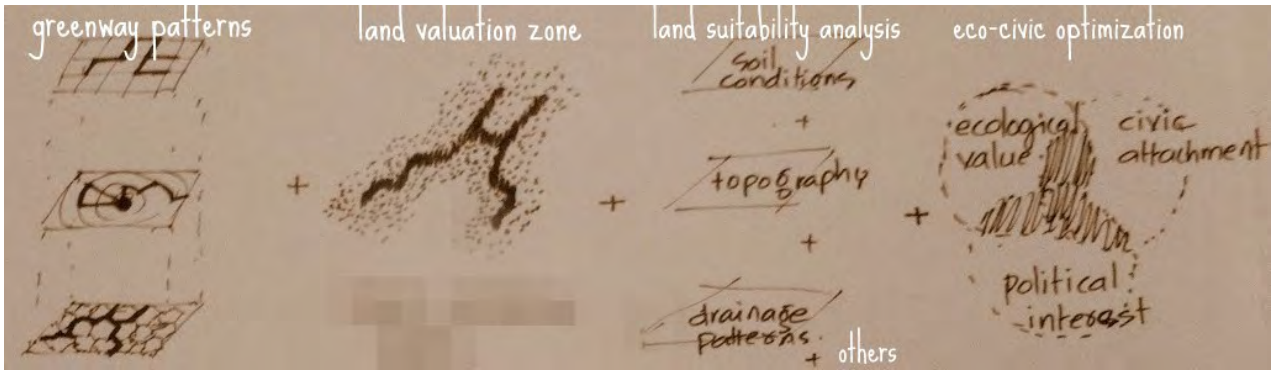


Figure 2. Process of generating a Green Network Oriented Zoning -GNOZO map

The GNOZO map offers city planning authorities, a basis to generate land use zoning maps to plan a complex *green network*, comprised of sub-networks of complete streets, greenways and green trails.

Conclusion

Critical review of greenways design and planning showed that the explicit discussion on greenway patterns and morphology is noticeably weak. The article addressed the gap through fundamental inventorying and creative analysis of greenways patterns. Greenway patterns are mostly a variation on a rectangular grid, convergent circles or dispersive radii. The article also points to greenways pattern based zoning maps for city planning thus opening ground for further discussion on city planning and design syntax. The *GNOZO map* could be strategically employed to enhance the dollar based land values in the economically underprivileged neighborhoods. The zoning map could also be used as a guide for land acquisition by Land trusts. The conceptual framework presented in this article provides two tangential directions for future research, which include: a critical review of city scale zoning policies and, refinement of understanding on citywide greenway patterns through software programs.

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