

Towards a sustainable urban space: attributes and interaction

Khalid S. Al-Hagla

Dept. of Architecture, Faculty of Engineering, Alexandria University, Alexandria, Egypt
E-mail: khagla@hotmail.com

The neighborhood is a basic planning entity in the modern residential planning theories. Both social and ecological dimensions are among the main features that formulate its identity and consequently influence its performance. In spite of the uniqueness of each neighborhood, in regards to its local micro ecological perspective and the social relations, it develops, the typical spatial structure of these neighborhoods could be tackled as an approach for studying their sustainability potentials. Open spaces, as a vital constituent of the neighborhood physical spatial structure, have an important role to play. They are the arena of both, neighbors' outdoor interactions –consequently building the neighborhood's sense of community-; and the micro ecological sphere-setting its parameters and configuring its fundamentals. The paper draws on the dual role that open spaces play at the neighborhoods' spatial structure. It focuses on the typical open spaces' structure of the neighborhood as the media of different social and ecological interactions. It highlights their potentials as an approach towards achieving sustainable neighborhoods. However, it differentiates between two main categories; "greenspace" and "greyspace". Moreover, it studies a number of subdivisions of these two main categories and their related qualities, role in the community, and their physical interconnections and networks. At its final part, the paper shows a three dimension matrix that correlates different types of neighborhood open space with sustainability goals and strategies applied to neighborhoods.

تعتبر "المجاورة السكنية" وحدة البناء الأولى للتجمعات السكنية، ويمثل البعد الاجتماعي أحد أهم الجوانب التي تؤثر في رسم ملامح شخصيتها، كما تكون الظروف الإيكولوجية الخاصة بموقع هذه المجاورات السكنية محدداً أساسياً لمدى تفرد هذه الشخصيات، ويأتي هذا كنيحة للتفاعل المستمر بين هذه التجمعات ومحيطها الإيكولوجي. وتلعب الفراغات المفتوحة بالمجاورات السكنية دوراً أساسياً مزدوجاً في هذا المجال حيث تعتبر مسرحاً للتفاعلات السلوكية البيئية بما يسمح بتدعيم الإحساس بالانتماء للمكان وبناء شخصيته الاجتماعية كما تؤثر عن طريق التحكم في متغيرات البيئة الإيكولوجية الدقيقة في التأكيد على قيم التفرد الخاصة بها. تهدف الورقة البحثية إلى دراسة إمكانيات الفراغات المفتوحة بالمجاورات السكنية لتطوير أداء التنمية المستدامة بها عن طريق الدور المزدوج الذي يمكنها القيام به من خلال البعدين "الاجتماعي" و "الإيكولوجي". ولتحقيق هذا الهدف تتبع الورقة البحثية منهجاً يعتمد على دراسة الهيكل الفراغة النمطية للمجاورات السكنية والتي تعتبر مسرحاً للتفاعلات السلوكية والإيكولوجية بها، وفي هذا السياق يقوم البحث بتصنيف الفراغات إلى مجموعتين أساسيتين "Greenspace" – "Greyspace" حيث يقوم بداسة مقومات هذه الفراغات التي تؤثر على مدى كفاءتها في لعب الفراغات المفتوحة بالمجاورة السكنية لتحقيق أهداف الإستدامة التي يجب تحقيقها من خلالها.

Keywords: Sustainability Goals, Ecological Sustainability, Social Sustainability, Neighborhood, Greenspace, Greyspace

1. Introduction

The rapid growth of towns and cities in the nineteenth century led to calls for parks to be provided for the health of factory workers and consequently it benefited society as well. This could be seen as an early precedent to what we now call sustainable development, with benefits to social life (people relaxing and meeting in the parks) and the environment (as

open spaces were created amongst the streets, mines and factories) Shirley [1].

The guide to Sustainable Settlements, published at the beginning of the 21st century, briefed an understanding of the sustainable development concept based on a clear definition of its two terms. 'Sustainability' is taken as referring to global ecology and 'development' is recognized as being much broader than economic growth Barton [2]. Sustainable development is, therefore, about

"maintaining and enhancing the quality of human life - social, economic and environment - while living within the carrying capacity of supporting ecosystems and the resource base". The two key principles that emerge from this definition are first, satisfying human needs, recognizing the obligation for inter-generational as well as intra-generational equity; and second, increasing the level of self-sufficiency at different scales: building, locality, neighborhood, town, and region. However, that determines the sustainability goals that are to be achieved at all society levels.

On the other hand, the neighborhood is the first structural element of society. Its conventional image is that of a local catchment's area, with residential areas grouped around a local service center or primary school. These catchments are identified empirically by pedestrian surveys and time/distance mapping. Davies [3]. The neighborhood's physical reference to its central services' area creates both physically and socially coherent community. This characteristic could be used as a potential in creating a micro sustainable community. This is to meet sustainability needs of achieving self-sufficiency at the neighborhood scale.

However, the paper highlights the neighborhoods' role to realize the requirements of sustainability principles at its level. It identifies sustainability goals and objectives that have to be achieved at the neighborhood based on the overlapping area of its social and ecological perspectives. It makes special emphasize on the role of controlling the configurations of different open spaces' typologies in neighborhoods.

2. Neighborhood: an ecological community

Sustainability application to neighborhoods has to cover two different but integrated perspectives. The first is 'social' that highlights the importance of understanding the neighborhood as a 'community'. Meanwhile, the second is 'ecological' that sees the 'ecological perspective' as much more appropriate to be applied to a neighborhood regarding its unique site qualities.

2.1. Neighborhood as a community

The two terms, 'Neighborhood' and 'Community', are not interchangeable as they express different areas of interest. Meanwhile, the former is about a place and the latter about people. However, the locality provides the focus for a number of overlapping interests Barton [4].

On the other hand, the neighborhood, in terms of its streets, houses, facilities and green spaces, may be consciously planned. Meanwhile communities – in the sense of networks of mutual support and friendship – cannot be planned in the same way, but occur as a consequence of people's choices and interactions with their surroundings.

The overlapping area of both the terms 'neighborhood' and 'community' could be used to understand the definition that the Egan Review report 'Skills for Sustainable Communities', develops [5]. It highlights sustainable communities as those which "meet the diverse needs of existing and future residents, their children and other users, contribute to a high quality of life and provide opportunity and choice. They achieve this in ways that make effective use of natural resources, enhance the environment, promote social cohesion and inclusion and strengthen economic prosperity". It concludes that there are seven components of sustainable communities drawn from this definition

- *Governance*; Effective and inclusive participation, representation and leadership
- *Transport and connectivity*; Good transport services and communication linking people to jobs, schools, health and other services
- *Services*; A full range of appropriate, accessible, public, private, community and voluntary services
- *Environment*; Providing places to live in an environmentally-friendly way
- *Economy*; A flourishing and diverse local economy
- *Housing and the built environment*; A quality built and natural environment
- *Sociology and culture*; Vibrant, harmonious and inclusive communities

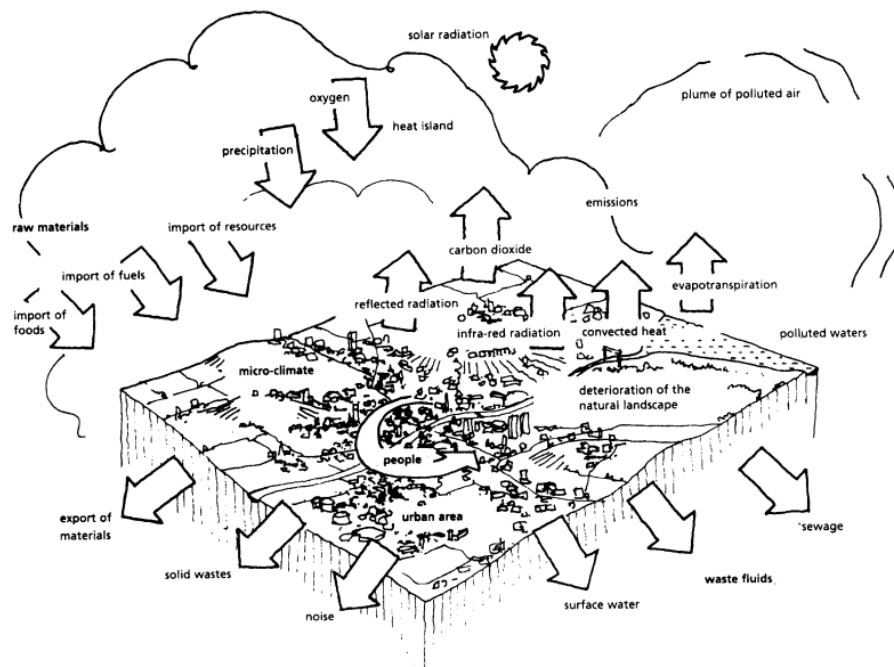


Fig.1. Neighborhood as an eco-system. Source: Barton [2].

From another stand point, Barton [2] gives a different approach based on 'Ecological Perspective'. He asserts that "One way of approaching the problem of sustainable design is to see each development as an organism or a mini ecosystem in its own right". Regarding this point of view, a neighborhood is an ecosystem in the sense that it provides the essential local habitat for humans, creating its own microclimatic conditions, and should provide as far as possible for their comfort and sustenance. He highlights that "a settlement is like a living organism in that it has the capacity to reproduce or renew itself (both the people and the built environment); it ingests quantities of food, fuel, water, oxygen and other raw materials; it ejects waste fuels, solids and atmospheric emissions". The concept is relevant at a range of scales, from individual home or building, up to a region Barton [2].

Barton [2] confines the indicators reflecting the increase of local autonomy, hence; formulating local ecological personality, at the level of the neighborhood in three main categories; -social aspects, energy and water management, and recycling practices-, and their correlated aspects. *The first category*

contains: clustering of local jobs and facilities at the heart of the area, and the provision of a wide range of housing types. *The second category* contains: building energy demand management, use of local energy sources where possible, reduction of water demand and use of local water sources. *And the third category* contains: local treatment of foul and surface water, and recycling of nutrients locally.

Each of the two shown approaches (community, and ecology); covers a different perspective of sustainability application to the neighborhood scale. The paper develops an integrated approach that appreciates the fact that social and environmental goals are often mutually reinforcing, thus providing a broad constituency of support for policy. Moreover, they come to the heart of the dual role that open spaces play in the structure of neighborhoods. For example an attractive, safe and well supervised pedestrian environment can also help towards social stability and the creation of a sense of community. However, this approach aims to: improve the local environment, reduce traffic and make walking

more pleasant, enhance health and aesthetic enjoyment as well as reduce emissions.

Table 1 sets sustainability dimensions, applied to neighborhoods regarding both community and ecological perspectives Shirley [1].

3. Open space morphology of neighborhoods

Open spaces take up more than one third of total neighborhood areas. They are active contributors to achieving sustainability goals. The resources needed to manage them are compensated for by the economic and social values they provide Shirley [1]. The resources are offset to a greater or lesser extent by the free ecosystem functions provided, especially by informal, semi-natural and natural green space. The matrix of open spaces performs many such functions for both people and wildlife with its vegetation, permeability and varying degrees of connectedness and isolation within the neighborhood, and between the neighborhood and the surrounding open countryside. These functions covers both social and ecological domains as they include improving air quality, improving shelter and shade, places for recreation and wildlife habitats, promoting social interactions, and enhancing property values, ...etc. Shirley [1].

Open spaces in neighborhoods are defined as 'any unbuilt land within the boundary or designated envelope of a neighborhood which provides, or has the potential to provide, environmental, social and/or economic

benefits to communities, whether direct or indirect.' Campbell [6]. They could be classified according to a number of criteria. This paper differentiates vegetated from non-vegetated areas and this leads to the following typology classification.

- *Greenspace*: a sub-set of open space, consisting of any vegetated land or structure, water or geological feature within urban areas.
- *Greyspace* (sometimes referred to as "civic space"): a sub-set of open space, consisting of urban squares, market places and other paved or hard landscaped areas with a civic function.

"Greenspace" is being used more often and evokes much more positive connotations of attractiveness and sustainability than "open space", a term which conjures up images of SLOAP (usually Space Left Over After Planning, but sometimes Planting) Campbell [6].

One way of classifying greenspaces is shown in fig. 2. This simple typology recognizes four landscape types. In two, natural processes predominate; while in the other two, human activities predominate Shirley [1].

Moreover, there are seven distinct sub-sets of publicly accessible greenspace, each with a specific and distinct primary function Campbell [6]:

- *Parks and gardens*: Parks can therefore be considered as being areas of land, normally enclosed, designed, constructed, managed and maintained as a public park or garden. They can be either urban parks or country parks

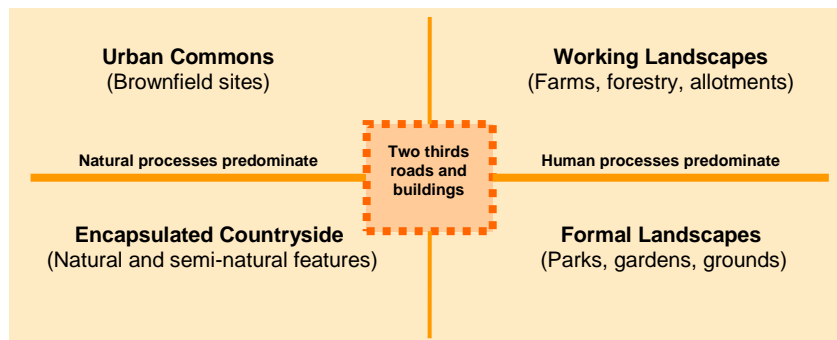


Fig. 2. Green space classification. source: The researcher based on Shirley [1].

Table 1
Sustainability dimensions, applied to neighborhoods. Source: Shirley [1]

Ecological Perspective	- Global Ecology Climate Stability	
	Energy in transport	<ul style="list-style-type: none"> • Locations that minimize trip length, and are well served by public transport • Design that fosters walking and cycling and discourages car reliance
	Energy in buildings	<ul style="list-style-type: none"> • Energy-efficient built form and layout • Development of community renewable energy
	Biodiversity	<ul style="list-style-type: none"> • Wildlife refuges and corridors
	- Natural Resources	
	Air quality	<ul style="list-style-type: none"> • Traffic reduction and air quality management
	Water	<ul style="list-style-type: none"> • Local sourcing and demand management • Local surface water/sewage treatment, aquifer recharge
	Land and soils	<ul style="list-style-type: none"> • Higher densities to reduce urban land take • Local composting/organic recycling schemes
	Minerals	<ul style="list-style-type: none"> • Locally-sourced and recycled building materials
	- Local Environment	
Aesthetic quality	<ul style="list-style-type: none"> • Attractive pedestrian-scale local environment 	
Image and heritage	<ul style="list-style-type: none"> • Legible environment with a sense of place • Design reflecting distinctive landscape and cultural heritage 	
Community Perspective	- Social Provision	
	Access to facilities	<ul style="list-style-type: none"> • Accessible, good quality health, educational retailing and leisure facilities
	Built space	<ul style="list-style-type: none"> • Diverse, affordable good quality housing stock • Adaptable, good quality commercial/institutional space
	Open space	<ul style="list-style-type: none"> • Accessible, well run parks/playgrounds/playing fields/allotments
	Infrastructure	<ul style="list-style-type: none"> • Adaptable, easily maintained road and utility networks
	- Economic Sustainability	
	Job opportunities	<ul style="list-style-type: none"> • Diverse and accessible job opportunities with good local training services
	Economic buoyancy	<ul style="list-style-type: none"> • Encouragement for local offices/workshops, home-working and tele-centers
	- Social Sustainability	
	Health	<ul style="list-style-type: none"> • Pollution-free environment facilitating healthy exercise, local food production and mental wellbeing
Community safety	<ul style="list-style-type: none"> • Safe traffic-calmed streets with good visual surveillance • Neighborhood social balance and continuity 	
Equity and choice	<ul style="list-style-type: none"> • Access to housing for all social groups • All facilities easily accessed by foot or public transport, with special attention to needs of children and the disabled 	

depending primarily on their location, although urban parks will tend to be more “manicured” and country parks more “natural”. Parks and gardens often incorporate other types of greenspace, such as children’s play areas and sports facilities, but their primary function is for informal activity or relaxation, social and community purposes, such as kicking a ball about, jogging, events and festivals, and horticultural or arboricultural displays. Some parks and gardens may also be designed landscapes of historical importance, where they are of national significance.

- *Amenity greenspace*: Managed and maintained landscaped areas with no designated specific use by people, but providing visual amenity or separating different buildings or land uses for environmental, visual or safety reasons (for example, road verges). Amenity greenspaces may also be used, incidentally, as wildlife habitats.

- *Children’s play areas*: Designated and maintained areas providing safe and accessible opportunities for children’s play, usually linked to housing areas and therefore normally set within a wider green environment

of amenity open space. The primary function of these areas is to provide safe facilities for children to play, usually close to home and under informal supervision from nearby houses. Many play areas may have equipment such as slides, swings and climbing frames; all should have some form of surfacing which absorbs impact.

- *Sports facilities:* Designed, constructed, managed and maintained large and generally (although not always) flat areas of grassland or specially-designed artificial surfaces, used primarily for designated sports; if in public ownership they are generally bookable. The primary function of these areas is to accommodate practice, training and competition for recognized outdoor sports such as athletics. If required, sports facilities can be sub-divided into various categories according to either ownership, for example public (local authority), institutional (schools and higher education institutions) or the voluntary sector; or by the degree of public access.

- *Green corridors:* Routes linking different areas within a town or city as part of a designated and managed network and used for walking, cycling or horse riding or linking towns and cities to their surrounding countryside or country parks. The primary function of green corridors is to allow safe, environment-friendly movement within urban areas. Moreover, they support wildlife colonization and therefore habitat creation.

- *Natural/semi-natural greenspaces:* It is better for natural greenspace to be defined more simply as areas of undeveloped land with little or only limited maintenance which have been planted with wild flowers or colonized by vegetation and wildlife. Natural greenspace therefore also includes woodland, railway embankments, river and canal banks and derelict land, which may in some cases be thought of as temporary natural greenspace. The primary function of natural greenspaces is to promote bio-diversity and nature conservation.

- *Other functional greenspaces:* Essentially allotments, the yards of religious buildings and cemeteries.

Some classifications add an eighth type of greenspace – school grounds. However,

regarding the approach of this paper, they could be included within the above typology, even if they normally include more than one type of greenspace.

There are also various types of Greenspace (civic space), including:

- *Civic squares and plazas,* often containing statues or fountains and primarily paved, sometimes providing a setting for important public buildings.

- *Market places,* usually with historic connotations.

- *Pedestrian streets,* usually former roads which have been paved over and provided with seats and planters.

- *Promenades and sea fronts.*

Table 2 shows different typologies of open spaces within the neighborhood structure and their detailed classifications.

4. Open spaces network of neighborhoods

Open space is traditionally seen in terms of the provision of separate spaces for different interests. Now, due to the complexity of both ecological and communal systems, there are compelling reasons to plan open space networks serving a number of interrelated purposes concerning managing sustainability issues such as: pollution, wildlife, energy, water and sewage as well as enhancing the local provision of greenspace.

They serve mainly as accessible routes that support a number of sustainable accessibility alternatives, such as footpaths and cycling links. Moreover, they ensure local provision of parks, play areas, sports fields, allotments, wildlife refuges and corridors. Moreover, they play an important role in shaping the macro ecological perspective of the neighborhoods as they proceed local treatment of foul and surface water, provide shelter belts and coppicing, and absorb pollution and sound attenuation Barton [2].

4.1. Urban greenway

Jack Ahern [7], in his paper entitled "Greenways as a Planning Strategy" defines Greenways as "networks of land containing

linear elements that are planned, designed, and managed for multiple purposes including ecological, recreational, cultural, aesthetic, and other purposes compatible with the concept of sustainable land use". The 'linkage' concept is clear in this definition. That highlights the network typology of the

greenways as they provide a path from one destination to another. They can be recreation oriented with trails and sporting facilities, preserve natural habitats, buffer new development, or preserve the unique culture or history of a place Searns [8]. However,

Table 2
Urban open space and green space typology. Source: Barton [4].

Open space typologies	Detailed classification for open space typologies
<i>- Greenspaces</i>	
Parks and gardens	Urban parks Country parks Formal gardens (including designed landscapes)
Amenity green space (most commonly, but not necessarily, in housing areas)	Informal recreation spaces Housing green spaces Domestic gardens Village greens Other incidental space
Allotments, community gardens, and urban farms	Allotments Community gardens City (urban) farms
Natural and semi-natural urban green spaces, including woodland and urban forestry	Woodland (coniferous, deciduous, mixed) and scrub Grassland (e.g. downland and meadow) Heath or moor Wetlands (e.g. marsh, fen) Open and running water Wastelands (including disturbed ground) Bare rock habitats (e.g. cliffs, quarries, pits)
Green corridors	River and canal banks Road and rail corridor Cycling routes within towns and cities Pedestrian paths within towns and cities Rights of way and permissive paths
<i>- Greyspaces</i>	
Civic space 'hard landscaped areas'	Civic squares and plazas Market places Road and rail corridor Pedestrian paths within towns and cities Promenades and water fronts

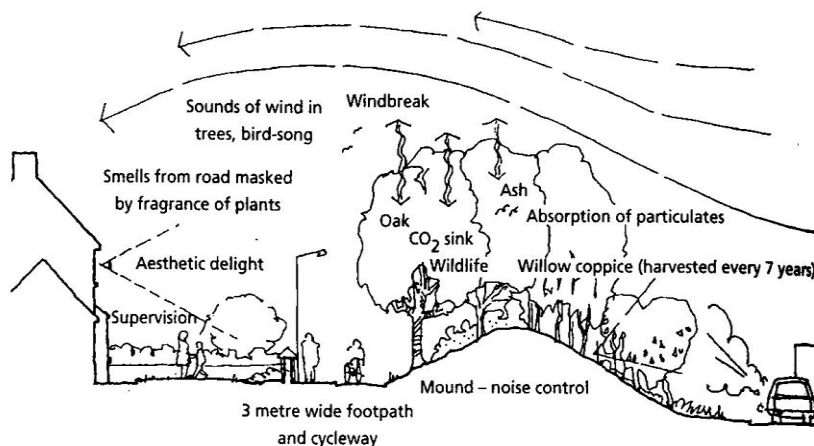


Fig. 3. The interrelated functions of urban greenway. Source: barton [10].

Fabos [9] describes three primary types of greenways: ecologically significant corridors and natural systems; recreational greenways; and greenways with historical and cultural values. Leicester city is a good example of the first type. The city council developed a strategy that utilizes the extensive network of rivers, canals and wetlands, and incorporates woodlands, farmland, and formal recreation space. It develops a multi functional system of strategic green routes for walkers and cyclists Barton [10]. However, this example reflects the clear interaction qualities between landscape, the neighborhood, and human activities. The landscape is recognized as providing the form within which a neighborhood may lie. Human activity responds to and reflects the landscape that nurtures and in its turn shapes the landscape itself.

Greenways could be seen as a complex and variable strategic approach to planning a spatial network of natural landscape that neighborhoods could be fit within. This vision is based on greenways' planning typology as a multi-functional that to achieve a complimentary between nature protection, social interaction, and economic development. However, this needs to identify the ecological, cultural, social, and aesthetic goals for each site. Moreover, to manipulate the way such greenways link together with formal and informal open space to create a network accessible to all residents. According to Barton et al. [11] elements of this network should be within about 800 meters of all dwellings, with some playgrounds, parks and allotments closer, within the residential area. On the other hand, a study by Gobster and Westphal [12] describe six foundational characteristics that mainly influence greenway users' perceptions of trail space: cleanliness, naturalness, aesthetics, safety, access, and appropriate development.

Fig. 3 shows the interactive typology between different spatial functions which gives an example for the transition between housing area in a neighborhood and a narrow greenway alongside a main road. The figure illustrates the multi-functional role of the open space: windbreak, noise baffle; particulate absorber, CO₂ sink, energy source, wildlife haven, aesthetic pleasure, movement and recreation Barton [10].

5. Open space's sustainability attributes

Table 3 determines sustainability goals and objectives that have to be achieved at neighborhood level. They are driven from the sustainability dimensions applied to the neighborhoods table [1].

The role that open spaces ('greenspace' and 'greyspace') have to play within the neighborhood's structure, to achieve these goals and objectives, is formulated in three key issues [*space management, circulation of people, and Sustainable Residential Greenspace*] as shown in [fig. 4]

- First: *The Management* is a key issue to be taken into consideration. Campbell [6] asserts that, '*sustainability is a function of the inter-relationship between design and management*'. He clarifies that it is not a cost issue, although whole life costs are obviously extremely important, however, it includes: Ironside [14]
 - Encouraging sustainable lifestyles, for example by providing paths and cycle routes
 - Making maximum use of existing features and assets.
 - Strengthening the sense of place.
 - Incorporating local or recycled materials.
 - Encouraging community participation and involvement.
 - Reducing inputs of non-renewable resources during construction and subsequent maintenance.
 - Eliminating or reducing the use of herbicides and resources that affect other ecosystems.
- Encouraging habitat creation and native planting.
- Managing resources carefully – for example, cutting grass when needed and in appropriate weather conditions, not in accordance with a standard contract Campbell [6].
- Second: while most modern development planning uses the road network as the key structural element, a sustainable design takes the *circulation of people on foot and bike* and the effectiveness of public transport as starting points Barton [2]. The objectives are to reduce the level of car reliance and to reduce the need to travel - with the social benefits of increasing transport choice for all groups in the population, and enhancing local security and community.

Table 3
Sustainability goals and objectives. source: the author based on barton [13].

Sus. dimensions	Goals	Objectives
Global ecology	Cutting greenhouse gas emissions and energy	Reduce the need to travel Reduce car reliance Increase energy efficiency in buildings
	Closing local resource loops	Reduce demand for non-renewable resources Reuse and recycling of resources locally Local water sourcing, treatment and aquifer recharge Local low-input food production
Natural resources	Enhancing local environmental quality	Promote local distinctiveness and heritage Create an attractive public realm Enhance local habitat diversity
Local environment	Creating a healthy environment	Improve local air quality Promote an active life-style (especially walking) Encourage consumption of fresh fruit and vegetables
Social sustainability	Increasing street safety	Reduce the chance of vehicle/pedestrian accidents Reduce the fear of violence
	Equity and social inclusion	Choice of facilities within easy walking distance Viability of public transport
	Increasing local self-determination	Increase user/citizen control Management of decentralized systems
Social provision	Increasing accessibility and freedom of choice	Choice of transport mode for trips More facilities accessible locally
	Value of local community	Facilitate accessible social networks Promote mental health
Economic sustainability	Local work opportunities	Accessible jobs for those tied to the locality Reduce transport emissions

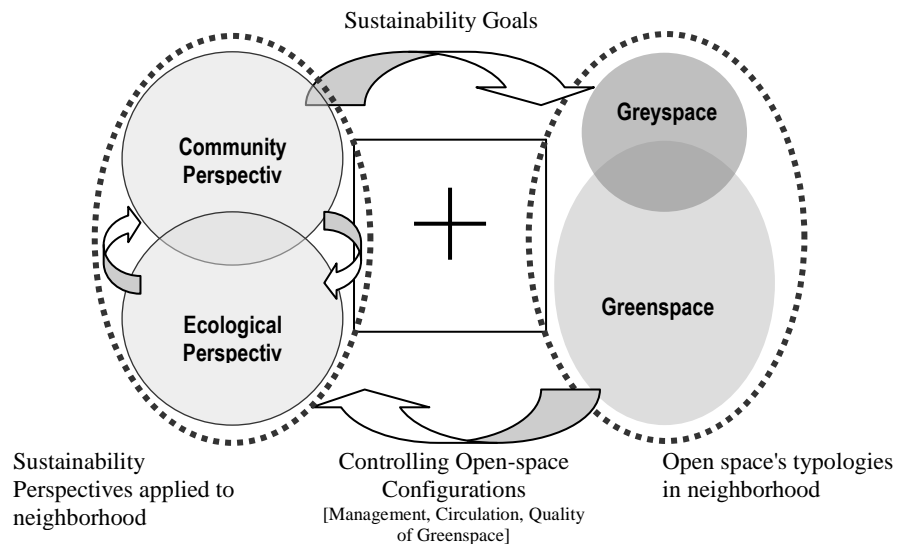


Fig. 4. Neighborhood's sustainability mechanism. Source: The author.

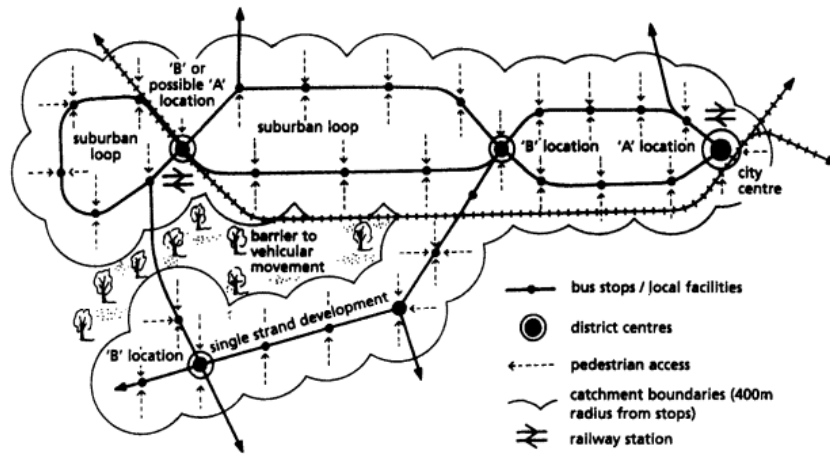


Fig. 5. Principles of public transport planning source: Barton [2].

• Third: 'Quality Greenspace in Residential Areas' Ironside [14] defines *sustainable residential greenspace* as: "Greenspace fit for its purpose, responsive to evolving needs and changes over an extended period of time, not requiring an excessive input of resources."

In more detail, for Greenspace to be sustainable it should:

- meet the varied recreation and leisure needs of users.
- create a pleasant environment.
- improve a neighbourhood's image.
- ameliorate microclimate and pollution and increase bio-diversity.
- be designed with flexibility in mind for varied contemporary usage and functions and with a view to future maturation, development and change.

- be located and designed with full consideration of the practical and financial implications of future maintenance and usage
- involve local communities.
- promote bio-diversity and urban wildlife habitats.
- use local materials and craft skills reduce inputs of energy, water and chemicals in maintenance operations.

6. Sustainable neighborhood's space articulation

Based on the above-mentioned literature review, the paper proposes a three dimension matrix that correlates different types of open

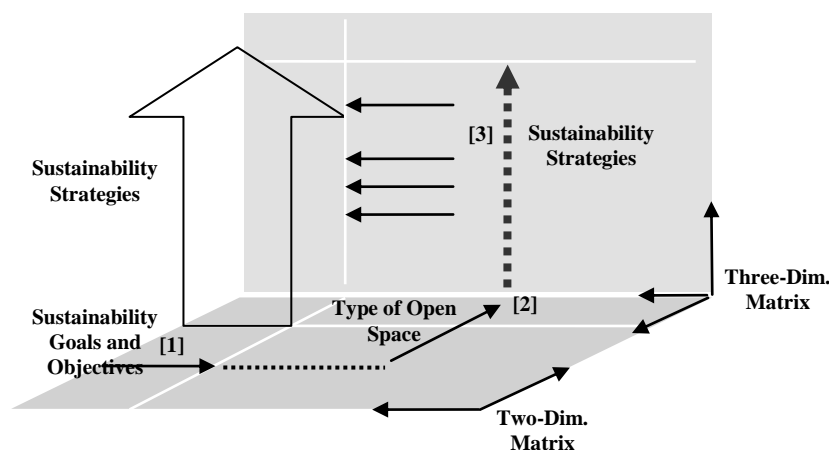


Fig. 6. Three dimension matrix correlates types of open space to sustainability attributes source: The author.

spaces in neighborhoods to the sustainability attributes. This matrix consists of two main parts.

The first is a two dimension matrix that investigates the potentials of neighborhoods' open spaces in achieving sustainability goals and objectives. It shows the role and responsibilities that each of these types has to play –divided mainly into two categories: 'greenspaces' and 'greyspaces'.

The second, is a two dimension matrix that correlates the assigned sustainability strategies –driven out of the study of, (management, circulation, and residential greenspace) sustainability issues – with, 'greenspaces' and 'greyspaces'.

The three dimension matrix shows the overlapping area of practices that different types of open spaces have to play all together to fulfill their sustainability responsibilities. However, it draws a space articulation perspective that supports sustainability practices in neighborhoods; depending on their integrated; physical and non-physical dimensions.

The first two-dimension matrix answers the question about 'What' are the goals and objectives that the open spaces in a neighborhood have to achieve. And the second is about 'How' do these goals and objectives could be achieved? The overlapping answers of these two questions draw the dimensions of the developed three dimensional matrix. However this matrix could be used to develop a further checklist for evaluating the open spaces performance in neighborhoods. This could be achieved in three consequent steps.

- The first is to determine what sustainability goals and objectives have to be achieved in the neighborhood table 3.
- The second is to determine which type of open space the study wants to investigate table 4.
- The third is to develop a checklist of the sustainability strategies assigned to this type of open space table 5.

Within this understanding the paper discusses three main issues which constitute open space's articulation parameters that reflect the sustainability vision: space form, space function, and objects within space [landscaping elements].

6.1. Space form [linear concentration]

While it is generally settled that compactness is a desirable attribute for sustainable settlements, especially when these settlements are human-scaled (less than 5 km radius, easy cycling distance), there are obvious disadvantages if gross densities become too high Barton [2]. This happens at the moment in well defined neighborhoods with no physical extension prospects.

Hugh Barton describes the possible problems using the expression "town cramming", implying loss of open space, reduced choice and flexibility, less room to breathe. However, the implication of planning for public transport and for open space corridors is linearity rather than compactness.

This research appreciates the linear concentration of varied retail, social, cultural and commercial activities, fig. 5 plus flats and town houses, along a 'high street' as one that provides varied benefits by comparison with compact centers:

- better access from homes to local facilities.
- flexibility of hinterland size for facilities. over time and at any time.
- a wide range of property values, permitting marginal users frontage space.
- a common focus for main pedestrian, bus and bike routes.
- a linear, mixed use focus for possible district heating mains.

6.2. Space function [pedestrian permeability and access]

There is a tension between the conventions of cul-de-sac housing layouts, with alley links often blocked to reduce danger and escape routes, and the need for a dense network of routes giving good 'permeability' and maximum access from any given place to another. However, creating neighborhoods where walking is the natural and pleasurable means of access between activities could solve this conflict. Moreover, it becomes a social activity in its own right. Thus the number of

people on the streets and paths itself provides security. Studies find that the quality of the walking routes is a significant factor influencing usage Barton [2].

Furthermore, organizations which promote *Smart Growth, New Urbanism and Neo-traditional Development* [15] define areas of overlap and alignment between Smart Growth and Active Living strategies as ones that include:

- *Multiple Modes of Transportation* — "A key smart growth feature is the availability of alternative modes of transportation. Accessible pedestrian and bicycle facilities such as sidewalks, trails and bikeways provide opportunities for physical activity for leisure or transportation".
- *Mixed Land Use* — "Communities can support walking and cycling if they are developed with meaningful destinations in close proximity to each other, such as shopping, school and employment".

These movements strive for well-designed communities that provide safe and abundant opportunities for routine physical activity in addition to some issues such as *Quality of Life*-health economics of communities, and *Community Participation*.

6.3. Objects within space [sustainable landscape design]

Landscaping elements are the basic constituent of any open space's structure. Whatever its type- greenspace or greyspace-their landscaping elements should be utilized to achieve sustainability goals at a micro level. Janis Birkeland [16] draws a framework that consists of a number of sustainable ecological principles that can extend the designer's scope well beyond the boundaries of the conventional and banal.

- *Return to original sources of inspiration*, whether nature or culture, is regarded as a fundamental concept of eco-design, avoiding introspective and self-referential perspectives which ignore reality Papnek [17].
- *Respond to the site*, designing in harmony with its distinctive character to enable the unfolding of the landscape's ecological potential over time. This may involve:

- creating connections and themes (functional and perceptual as well as spatial) within and across sites while defining and delineating boundaries;
- transforming site constraints into environmental opportunities;
- minimizing negative environmental impacts (including sensory as well as physical pollution);
- maximizing positive impacts, off-site as well as internally.

Landscape design has a key role here in enhancing the sustainability of building design by modifying microclimate and reducing heating/cooling demand).

- *Minimize inputs* of materials and energy and maximize outputs of renewable and reusable resources - from initial concept to final construction. This includes design for long life, durability, energy efficiency and recyclability of hard landscape elements, and represents a way in which landscape design can catalyze ecological advances in other design areas.

- *Maximize resilience* and dynamic stability in the landscape in such a way that each element fulfils several functions and each function is undertaken by several elements. Two additional principles adapted from permaculture are:

- maximizing the diversity of landscape elements and the diversity of relationships between elements;
- creating opportunities for the emergence of self- sustaining and self-regulating systems in the landscape.
- *Create 'place'* as distinct from merely manipulating space, in such a way that the design maximizes the potential for user interaction with the environment. This involves designing for all the senses - touch, taste, smell, hearing and movement - not just vision.
- *Make systems visible*, which means making environmental processes apparent and celebrating them - a specific application of the broader principle of featuring contrasting processes (dynamic contrast) as well as the use of contrasting static elements in a synthesis of art and ecology.
- *Minimize maintenance* and maintain to enable full expression of design,

acknowledging that ongoing management is itself an aspect of design, to ensure the continuity of sustainable outcomes.

7. Conclusions

The paper investigates open spaces' ability to achieve sustainability goals and objectives at residential neighborhoods. It tackles an approach that uses the intersection area of both social and ecological dimensions applied to neighborhoods. Such an approach is chiefly based on the dual role that open spaces play in formulating the neighborhood's character. They are the arena for different social interactions and shared community activities, and the field of micro-ecological features to express their interactions as well.

The paper classifies urban open spaces in neighborhoods into two main categories; 'greenspace' and 'greyspace'. It uses this typology classification as an appropriate to its approach. Moreover, it shows detailed subdivision of all types of open spaces classified under these two main categories. However, it places special emphasis on 'greenspace' as more relevant to achieving sustainability prospects at neighborhood level. On the other hand, the paper discusses the added value that open spaces' networks present—concerning-sustainability performance—when they are arranged in a complementary order.

The paper reviews three sustainability attributes that are closely related to the open spaces' performance at residential neighborhoods. These attributes are: space management, public transport planning, and the quality of 'greenspace'. They are determined as to meet sustainability goals and objectives that have to be achieved at the neighborhood's level. Based on this vision, the paper develops a three dimensional matrix investigating the relationship between these goals and objectives and the neighborhood's different types of open spaces. This matrix consists of two detailed matrixes; the first is to answer the question about 'What' are the goals and objectives that different types of open spaces in a neighborhood have to achieve? And the second is about 'How' do these goals and objectives could be achieved?

The paper in its final part utilizes the understandings of its proposed three dimensional matrix's to draw the articulation features of the typical open spaces' structure in neighborhood. This covers three domains: *space form, space function, and objects within space.*

Regarding these dimensions, the paper concludes that:

Space form: the linear concentration of varied cultural, commercial and residential activities, along a 'high street' is one that provides varied benefits by comparison with compact centers.

Space function: creating neighborhoods where walking is the natural and pleasurable means of access between activities could solve the conflict between cul-de-sac housing layouts, with blocked alleys to reduce danger, and the maximum accessibility needed.

Objects within space have to be organized and configured according, to a number of sustainable ecological principles that help maintaining sustainability responsibilities at landscape design level. This includes returning to original sources of inspiration, responding to the site, minimizing inputs, maximizing resilience, creating 'place', making systems visible, and minimizing maintenance.

References

- [1] Shirley Peter, "The Urban Park", (Chapter 5). Urban Design: Green Dimensions, Ed. Moughtin Cliff, Elsevier, Architectural Press, Oxford, UK, pp. 77-92 (2005).
- [2] Barton Hugh, Daniels Isobel, Davis Geoff and Guise Richard, "Going Green by Design", Sustainable Urban Design, Vol. 1 (57) (1996).
- [3] Llewellyn Davies, "Sustainable Residential Quality: New Approaches to Urban Living", LPAC: London (1998).
- [4] Barton Hugh, "Setting the Scene: Conflicting Perception of Neighborhood", (Chapter 1). Sustainable Communities: The Potential for Eco-Neighborhoods, Earthscan Publications Ltd, London, UK, pp. 4-18 (2002).
- [5] Review Egan, "Skills for Sustainable Communities", The Office of the

- Deputy Prime Minister in Sustainable communities: Quality with quantity, RIBA, London, Great Britain (2004). On web www.architecture.com
- [6] Campbell Kit, "Rethinking Open Space, Open space Provision and Management: A Way Forward", Report presented by Scottish Executive Central Research Unit. Edinburgh, Scotland (2001).
- [7] Ahern Jack, "Greenways as a Planning Strategy", *Landscape and Urban Planning*, Vol. 33 (1995).
- [8] R.M. Searns, "The Evolution of Greenways as an Adaptive Urban Landscape Form", *Landscape and Urban Planning*, Vol. 33, pp. 65-80 (1995).
- [9] J. Fabos and J. Ahern, (eds), "Greenways: The beginning of an International Movement", Elsevier: New York (1995).
- [10] Barton Hugh, "Rethinking of Neighborhood Option: The Design of Neighborhood", (Chapter 8). *Sustainable Communities: The Potential for Eco-neighborhoods*, Earthscan Publications Ltd, London, UK, pp. 123-143 (2002).
- [11] Barton Hugh, Davis Geoff and Guise Richard, "Sustainable Settlements – A guide for Planners, Designers and Developers", University of the West of England and Local Government Management Board: Luton (1995).
- [12] P.H. Gobster, "Perception and use of a Metropolitan Greenway System for Recreation", *Landscape and Urban Planning*, Vol. 33, pp. 401-413 (1995).
- [13] Barton Hugh, "Do Neighborhoods Matter", (Chapter 2). *Sustainable Communities: The Potential for Eco-Neighborhoods*, Earthscan Publications Ltd, London, UK, pp. 49-65 (2002).
- [14] Ironside Farrar, "Quality Greenspace for Residential Areas", Perth: SNH, (1999).
- [15] National Neighborhood Coalition, "Neighborhoods, Regions and Smart Growth Toolkit: The Smart Growth, Better Neighborhoods Action Guide", National Neighborhood Coalition: Washington DC (2005). On web www.neighborhoodcoalition.org
- [16] Birkeland Janis, "Design for Sustainability, a Sourcebook of Integrated Eco-logical Solutions", Earthscan Publications Ltd: London, UK (2004).
- [17] V. Papnek, "Design for the Real World", Thames and Hudson: London (1984).
- [18] Philadelphia City Planning Commission, "Neighborhood Design Guidelines: for all of Philadelphia's Neighborhoods", Philadelphia. USA (2005).

Received September 5, 2007
Accepted February 24, 2009