Sustainable urban design paradigm: twenty five simple things to do to make an urban neighborhood sustainable

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Abstract

Sustainable design celebrates and creates the ability of communities and wider urban systems to minimize their impact on the environment, in an effort to create places that endure. Central to this paradigm is an ecological approach that take into consideration not only the nature but human element as well, locally and globally.

The paper presents twenty five design strategies and explores processes that point to a rediscovery of the art and science of designing sustainable neighborhoods. It seeks to synthesize these principles into an agenda for the design of towns and cities with the intention of reversing many of the ills and destructive tendencies of past practices. These strategies serve as indicators to sustainable development; they are used to define inherent qualities, carrying capacities and required ecological footprints to illustrate the place of exemplary communities. Furthermore, they are established to allow designers to model, measure and program sustainable standards as well as monitor the regenerative process of cities.

The guidelines are organized under five primary variables for achieving sustainability: human ecology, energy conservation, land and resource conservation (food and fiber,) air and water quality. These variables are presented as highly interactive cycles and are based upon the theory and principles/processes of place making, affordability and sustainability.

The ecological strategies are extensions of the author's earlier collaborative work with two other colleagues; Tom Bartuska and Micheal Owen at Washington State University, which was awarded a gold medal for their
proposal for Pullman, Washington, USA, at the UN Habitat II conference in Istanbul in 1996.

Introduction

In light of diminishing global resources and much environmental degradation, the prospect of a new century raises serious questions about the health and livability of future cities. In the last century our cities and towns were transformed significantly from an efficient fabric to a sprawling low density suburbia. This process not only impacted adversely our natural habitat, but also exhausted the vitality of traditional urban places. The effluent suburban culture created its own self contained communities with employment centers, shopping malls and office parks, abandoning the center and yielding to much decay and human blight [1].

Most traditional cities and building practices evolved out of necessity and not a supply-driven ideology. Their sense of sustainability emerged from having found resonance with nature, its pace and cyclical progression. They have withstood the test of time and appealed to a variety of functional needs. Much of their charm was a product of the way they related to the character of the neighborhood and allowed for democratic expressions. It was not until the past century that their worth began to subside and this was so due to the way of modern building practices that ignored the limitations of the human condition and began to use excessive technology to solve situations wholesale. Standardization along with the introduction of mass-produced cheap materials and energy resources, both contributed to the further marginalization of traditional practices.

The emergence of sustainable design offers tangible promises; its holistic approach to the crises of the environment makes for a reliable connection between nature and culture. Its importance to our search for ecologically balanced urban environments lies in its ability to optimize our vital human-environmental support systems, while providing sustainable promise to future generations. Also as part of its appeal, sustainable design offers city planners and architects the insights with which to create livable places that emphasize continuity in human habitation and interconnectedness between people and places.

Society and the design professions must continue to determine and agree upon definitive ways to define, model and achieve sustainability. Sustainable programs require a comprehensive and integrated understanding of a city's unique human and environmental resources. By definition, sustainability identifies strategies that look at a community's on site natural resources as integral aspects of the design [2]. It integrates natural systems with human patterns and celebrates continuity, uniqueness and place making [3].

Sustainable guidelines are based upon an integrated ecological or biological modeling techniques which carefully work to balance relationships between human artifacts and environmental systems. The amount or percentage a development uses renewable human and environmental resources is a useful
"indicator" or measurement of the degree to which sustainability is successful. The basic ecological or biological variables are: air, water, energy and human ecology. These fundamental human-environmental exchanges within a city are then used in developing critical "input-output" modeling techniques to program, measure and achieve sustainability. Sustainable indicators are commonly generated and agreed upon by a city and its citizens. To implement this vision successfully we must work with local communities to achieve the goals of sustainability.

The design guidelines for sustainable and affordable development discussed below are organized under five primary variables. They are: (I) human ecology, (II) energy conservation, (III) land & resource conservation, (IV) water quality and (V) air quality.

(I) Human ecology: the way people interrelate & use the environment

Regional design strategies: It is necessary to provide an opportunity to balance the critical and selected human-environmental interchanges in the region by providing and enhancing greenbelt and water impoundment systems to improve and balance air exchanges (O=CO2); water cycles (precipitation + H2O use); land and it's food/fiber processes (gardens, urban forests and reducing/reusing/recycling of resources); energy use (conservation and use of renewable resources).

1. The greenbelt moderates climate extremes, increases recreational opportunities and bio-diversity. These green programs should use primarily indigenous landscaping which conserve water, reduces maintenance and celebrates the unique qualities of region. Family farming should also be encouraged in allotment gardens in the green belt.

2. Spring water runoff should be retained in balancing lakes which supplements dry seasons, reduces spring flooding, filters eroded soils, improves water quality, fishing and recreation potential.

3. The increased cost of non-renewable energy in 21st century will continue to create a positive shift to conservation and renewable resources. The sustainable energy budget should emphasize the use of regional hydro electric power, solar and photovoltaics and wind farms in the greenbelt.

City design strategies: Provide for a nested hierarchy of central places (city, districts and neighborhoods) supported by an effective infrastructure emphasizing public transit and pedestrianization. This infrastructure should be expressed in community greenways and the clustering of activities which will increase pedestrian enjoyment and accessibility. The critical city design strategies are summarized below

4. The city center and its historic character should be reanimated to facilitate an ideal, centralized geographic position. The clustered restructuring of central city will foster incentives for economic growth and establishes a dynamic central focus for the city.
5. Design priorities should be given to pedestrian and public transit systems. Clearly defined greenways and transport systems throughout the city make a substantial reduction in auto consumption of non-renewable energy. This is the single most important strategy in balancing the CO₂ to O cycle and improving the air quality in the community.

6. Resource management (traditionally waste disposal) should become self-sufficient by adopting priorities to first reduce, then reuse and recycle. This model fosters community enterprises based on sustainable resource use, reuse and recycling.

Community, neighborhood or village scale:

7. Enhance a sense of community. All site characteristics and qualities (natural, cultural, historical, etc.) should be saved and restored. A cohesive urban village quality with convenient access to neighborhood amenities and services should be developed. A cohesive neighborhood is critical to a healthy, safe and sustainable community. Emphasize convenient pedestrian accessibility to:
   - Neighborhood schools (A most important activity centroid to quality neighborhoods. The central location is critical to a walking environment.)
   - Greenways, wetlands and wildlife habitat, parks, views, etc.
   - Activity centers (indoor and outdoor) and services (shared governance, daycare, shopping, recycling, etc.)

![Figure 1: Urban village connected to central neighborhood school, parks & wetland.](image1)

![Figure 2: Residential areas with pedestrians & bikeway corridors.](image2)

8. Provide for pedestrian priority connections (between residential developments and neighborhood amenities and services). Bike and walkways are critical to enhancing a more personal/pedestrian sense of community. These walkways should connect to convenient transit stops and should have continuous pavement patterns across driveways and streets. Pedestrian/bike connections are far more energy- and cost-efficient than auto dependent access. Provide ample bike parking. Reduce auto services to a minimum (18'-22'
residential roadways). "Skinny" streets are a well-accepted traffic calming strategy.

9. **Cluster, don’t sprawl.** Design for effective land use and density. Increased land use efficiency reduces infrastructure costs. Providing moderate densities of at least 12-16 dwelling units per acre encourages pedestrian focus and safety. Clustering is also an important strategy for commercial and industrial areas.

![Figure 3: Clustered townhouses achieve quality, efficiency & affordable housing.](image)

**Cluster/subdivision development:**

10. **Develop defined residential clusters.** 25-35 dwellings with similar cultural character and life styles, shared social amenities and open spaces, form a cohesive cluster. Orienting dwelling units to the South can enhance comfort and save energy.

11. **Carefully define land territoriality - public to private areas.** Define for user control and responsibility at least 60-70% of the property in the cluster. This allows users to personalize residential areas and decreases maintenance costs.

![Figure 4: Friendly & safer housing areas with personalized public & private areas.](image)

![Figure 5: Clustered housing enhances neighborhood Social interaction.](image)

12. **Minimize front setbacks.** Provide for outdoor porches, gardens, etc. to enhance human scale, social activities, surveillance and safety.

13. **Minimize the impact of parking.** Do not let large garages dominate the fronts of houses. When feasible, distribute parking behind housing or in small, landscaped lots (8-12 cars). Parking areas are costly (300 sq. ft. per car) and require a lot of land, almost as large as some housing areas. Provide for 30-40% of parking for compact cars (8’ x 14’) to help reduce the impact of parking on the landscape. When feasible, slope land so housing is 2-3 feet above parking areas. Shade parking with canopies of trees. For rental units, lease parking
spaces so households with one or no cars do not subsidize the parking for others (Ref. #8, Pedestrian Connections).

![avoid garagescape]

Figure 6: Enhance neighborhood qualities by recessing parking areas & avoiding garagescape.

**Dwelling units:**

14. **Think small and smart, not big and dumb.** Size is generally proportional to costs. Small, efficient homes are far more affordable (both initial and long-term operating costs). Townhouses are an excellent housing prototype for effective quality living. The common wall construction can conserve up to 50% of energy and maintenance costs of a single, detached house. Carefully zone housing to orient interior activities to exterior gardens, yards and clustered open space. Interior public to private zone can increase livability and efficiency in space utilization.

![SIZE = $]  
**efficiency = affordability**

| 2 bedroom units @ 1000 sf | 3 bedroom units @ 1200 sf | 4 bedroom units @ 1400 sf |

Figure 7: Efficient townhouse units are more affordable minimizing initial & operating costs.

![Figure 8: Carefully zoned public to private areas.]

**(II) Energy conservation: A major long-term cost to people & environment**

15. **Conserve energy.** Quality construction, good southern/solar exposure and efficient lighting equipment and appliances are important facts for conserving energy. Many Energy Codes are effective, but saving through good design can surpass its minimum standards by an additional 30-80%. Greatest savings can occur by optimizing all design decisions by the systems analysis path to code...
compliance. Meter each unit separately to provide the means for each user to monitor and save monetary and material resources. Although significant savings can be achieved by careful design of the dwellings, autos consume 1.5 x 2.0 times more energy in a typical household budget than the dwelling and all its appliances (Ref. #8, Pedestrian Connections and #13, Parking).

16. Carefully orient each dwelling unit to sun and site. Take full advantage of passive solar strategies by providing increased windows, sun space/greenhouses and gardens on the south side of dwellings. Shade them to increase summer comfort by overhangs, trellises and or deciduous plants. Plants not only provide shade, but also increase cooling by evaporative processes and can provide for enjoyment and food (grapes, apples, plums, etc., Ref., Permaculture). Minimize window orientations to west and east – very uncomfortable in hot summers.

![Figure 9: Design with climate & winter sun.](image1)

![Figure 10: Design for summer shade and natural ventilation.](image2)

17. Increase use of renewable energies and passive and active solar strategies. Reference orientation (Ref. #17, dwelling orientation) and place large spaces on the south. Besides shading window, consider passive cooling methods such as clerestory (stacked) or attic ventilation drawing replacement air from the cooler north side. Advancements in active systems are being made at exponential rates – consider active solar heating systems, especially water heating and photovoltaic systems now or in the future.

![Figure 11: Use solar water & space heating & photo-voltaics.](image3)
18. Select energy and resource conserving materials and construction methods. The embodied energy in building is substantial. Reuse/renovate existing structures and select materials for a new construction which have low embodied energies, come from renewable/sustainable resources and have the highest recycled content (50-80%). Consult various green guides for minimizing toxic materials, adhesives and production methods. Reduce, reuse and/or recycle all materials during construction. Save and reuse all valuable topsoil from excavations and grading.

(III) Land & resource conservation: Critical resources for a sustainable future

19. Practice the 3 R’s – Reduce, Reuse and Recycle. Provide incentives and facilities to conserve material and monetary resources. In the core of each unit, provide for a recycling center (2 – 3’ closet) and convenient recycling and composting bins in the cluster. Traditional garbage service can be eliminated by 100% recycling and common pick-up points can minimize recycling or disposal services. Recycling is an important strategy for reducing our consumption. Encourage only the purchase of products with recycled or recyclable content by individual, corporate or community preference or policy.

20. Design with permaculture for landscaping various open spaces and community areas. Permaculture is landscaping which is edible and perennial (fruit trees, grapevines, berry bushes, etc.). Permaculture provided beauty, low maintenance, shade and food, which can be harvested by families or community groups and sold, locally for various site improvements or projects. Use Xeriscape, don’t just landscape. Xeriscape uses indigenous landscape which requires little, if any, additional water. Xeriscape requires less maintenance and resources. Minimize high maintenance grass areas and let them “go golden” in the dry falls.

21. Localize the economy. Encourage programs for neighborhood and community-wide sharing or exchanges of resources and talents. Craft/yard sales, produce/farmer’s markets, etc. foster community pride, the reuse/recycle of resources and stop economic leakage to non-community sources. Provide for family gardening adjacent to the units as well as allotment gardens in various greenways. Encourage workshops to foster interest and awareness in the benefits of family gardening (Ref. 21, Permaculture).

Figure 12: Celebrate local crafts, produce & products. Figure 13: Edible permaculture & family gardening.
(IV) Water conservation: A fundamental need for human health

22. Develop water impoundment areas and enhance wetlands throughout the site. Retain all water on the site as long as possible. This allows water to percolate into the ground, water landscaping, reduce downstream flooding, and increase water quality and bio-diversity. This can enhance the unique qualities of each site and provide for recreation and education.

Figure 14: Landscape with indigenous, low maintenance plants.

Figure 15: Water impoundment areas enhance human & natural habitat (biodiversity).

23. Use water conservation appliances. Water conservation fixtures and appliances in the home can save up to 30 – 70% of water use (low flush toilets, low flow faucets, water and energy efficient appliances, etc.) Avoid automatic water wasters such as automatic, above ground sprinklers. Use drip irrigation systems; they are many times more efficient than spray sprinklers. Harvest the rain and gray water from the house and other structures. Develop a gray water storage cistern for use in landscaping and toilet flushing. Provide artificial wetland in the site. Wetlands are economical for brown/black water treatment. This strategy applies to large and small-scale developments and is far more economical than traditional engineered water treatment facilities.

Figure 16: Use water conservation fixtures & gray water systems.
(V) Air quality: A critical variable for human & environmental health

24. **Develop greenways and greenbelts.** Trees are critical for human comfort and balancing the carbon to oxygen cycle ($\text{CO}_2 \leftrightarrow \text{O}_2$). Cities need to balance this critical oxygen producing cycle by planting more trees – do your part. Green areas increase the desirability of residential areas. Saving wetlands and creating urban forest, can enhance recreation, livability and sustainability. Trees absorb toxins from the air, create oxygen, shade and cool the environment through evaporative transpiration, and add to the ambient humidity of indoor and outdoor spaces. They produce visual and culinary delights to sustainable residential environments (Ref. #21, Permaculture).

![Figure 17: Plants enhance the local & global environments.](image)

![Figure 18: Planting trees to balance CO$_2$ - O exchange.](image)

25. **Build with green materials.** Indoor air quality and human health are greatly improved by the use of green (non-toxic) materials. Consult various green guides for materials, which are non-toxic, contain high percentages of recycled content and are produced from sustainable resources.

**Conclusion**

The sustainable design guidelines are an effective tool for demonstrating the theory, quality and application of sustainable design to an urban community. These integrated design strategies permeate various defining levels of a community, integrating its natural amenities with its neighborhood context, residential, cluster and dwelling units.

The strategies are inherently a powerful research, educational and marketing tool for sustainable community planning and development. They can be used by any city as a guide for developing a comprehensive sustainable urban program. Specific policies and strategies will vary with local conditions, but the methods for demonstrating human-environmental interchanges and benefits are universally applicable.
Adopting these recommendations in a systematic manner will provide significant long term resource and monetary savings for each household, the community and the city. These savings can be retained in the city instead of exporting to pay for imported resources and energy. This fosters a sustainable economy.

The implementation of sustainable program will require collaboration with government, civic organizations and private individuals. The process should be enhanced by grass root effort, demonstration projects and presenting and lobbying of governmental and community leaders.

References

[10] In Context: A Quarterly of Human Sustainable Culture, Bainbridge Island, WA.