University Susutainable Village: A Comprehensive Proposal for a New Compact Residential Community

BASHIR A. KAZIMEE and TOM J. BARTUSKA
Washington State University

Sustainable community development is an important national and international initiative which challenges and directs the design professions to create truly livable and sustainable environments. This mandate is particularly critical for university communities. They have a critical leadership responsibility in advancing and developing quality living and learning environments for their students — our future citizens and leaders of society. The "Secretariat of University Leaders for a Sustainable Future" is proactively fostering an enhanced university mission. ULSF has a membership of some 600 universities from over 60 countries throughout the world.

Our university community is at a critical pivotal point in its development. In the last 2-3 years, the community has held a series of public workshops on planning for the next Millenium. Parallel to these meetings, the University Village proposal was developed as part of an interdisciplinary research and design team who collectively worked on a National Affordable Family Housing program. The group received a grant from HUD to develop a proposal to study the feasibility of designing housing demonstration projects in several potential urban (not suburban) sites in the Pacific Northwestern region of the United States. The NAFH team focused its work on anti-sprawl measures and sustainable community development. The University Sustainable Village is a site specific, in-town study based upon the principles and processes of affordability and sustainability. Community sustainability directs ones focus to an urban regenerative process and incremental enhancement of both the ecology of a site and the existing traditional neighborhoods of the city. The proposal integrates the unique qualities of a compact and cohesive village with the dynamic ecological systems of the 67-acre university site. A strong sense of place is achieved through appropriate clustering of the developments, ensuring optimum density of human, social/cultural, economic and environmental factors and reducing the many ills of suburban sprawl.

Research, Design and Methods: Programming for Sustainable Development

Sustainable programming requires an integrated and holistic approach to understanding the unique human and environmental interrelationships and on-site resources. The first procedural issue was to develop a working definition of sustainability. Through research and prior studies, sustainability was defined as those strategies that look at a site's natural land, water, air and energy resources as integral aspects of the design (Vieria, 1993). It integrates natural systems with human patterns and celebrates continuity, uniqueness and placemaking (Early, 1993).

The University Sustainable Village program is based upon these directives and related ecological modeling techniques which carefully balance on-site interchanges between the unique human and environmental systems of the site. These interchanges were used as indicators of sustainable development and define the inherent qualities, carrying capacities, and required ecological footprint of this site (Wackernagel, 1996). This approach was used to model, measure and program a series of design strategies for the sustainable development as well as monitor the program's future regenerative process. The various sets of design strategies were organized under five primary variables for achieving sustainability: human ecology, energy, land, water and air quality. These variables are best understood as highly interrelated cycles expressed in the systems diagram (fig. 2). A summary of the implementing design guidelines is included at the conclusion of this paper.

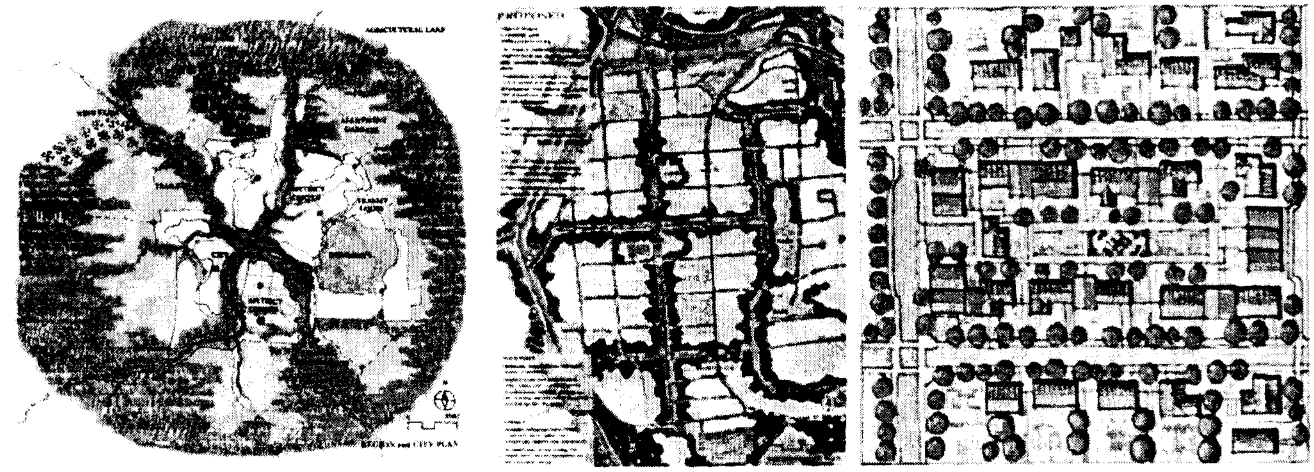
Data and Analysis Procedures: Ecological Modeling of On-Site Variables

The University site is a very important site which has close pedestrian proximity to the university and has a strong community context. The site is surrounded by a network of roads, residential housing (predominantly student population), commercial nodes and an industrial park.

As defined, sustainability mandates balancing the community's on-site ecological interchanges between human and environmental systems. In a separate study, the authors modeled the whole community's on-site ecological exchanges for a selected set of variables (air, water, land, and energy). This research and the resultant proposal was awarded a gold medal at the recent Habitat II conference in Istanbul, Turkey (IAA, 1996). The Pullman proposal is illustrated in figure 1 and can be reviewed @ www.arch.edu/~sustain.

In this earlier study, **air** exchanges were balanced by an extensive greenbelt and greenways program. It was estimated that the surrounding region and the city would require a massive tree planting program and the existing one million trees would have to be augmented by an additional four million trees in order to balance the carbon dioxide-oxygen exchange in the whole city. The required trees and proposed greenbelt would moderate the climate extremes, increase recreational opportunities and biological diversity. These green programs use indigenous landscaping which conserves water, reduces maintenance, and celebrates the uniqueness of the region. Currently, the community with university and public school students are planting some 30-50,000 trees per year.

For **water**, spring runoff would be impounded in balancing lakes and this would supplement the water needed in dry seasons, reduce spring flooding, filter eroded soil as well as improve water quality, fishing and recreation potential, and biodiversity. Within the context of this ecological model, strategies are also recommended for



Region and city. District and neighborhood. Housing densification/cluster.

Fig. 1. Pullman sustainable regenerative proposal.

land (food/fiber) and **energy**. Energy conservation of 40-60% by substantial reductions in auto use and in buildings were critical strategies for balancing the air (CO2 to O) exchange as well as the land and energy systems.

All the strategies are applied within an integrated set of scales, forming the **human ecology** or human-environmental patterns for the region, the overall city, the neighborhoods/districts, then the housing clusters and the individual units. Many of the concepts and design strategies are derived from the authors' research in proven sustainable principles used in vernacular and contemporary societies. By definition, vernacular developments have withstood the test of time and have celebrated substantial societal development without the use of non-renewable energies.

The analysis of the ecological variables and required conservation measures for the overall city study are illustrated in the following conceptual diagram and bar graph (Figures 2 and 3).

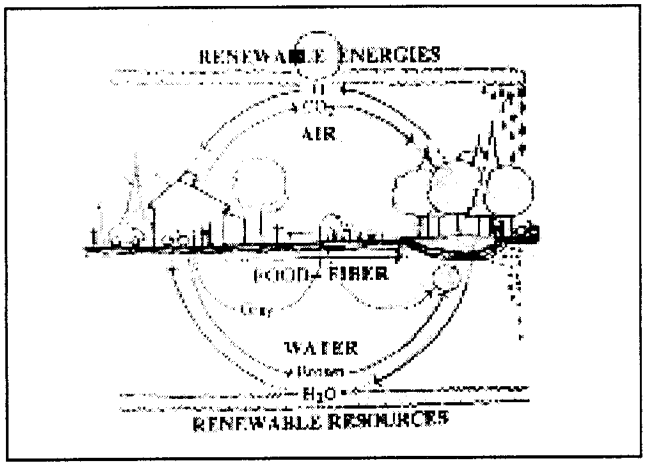


Fig. 2. Conceptual diagram of the ecological systems.

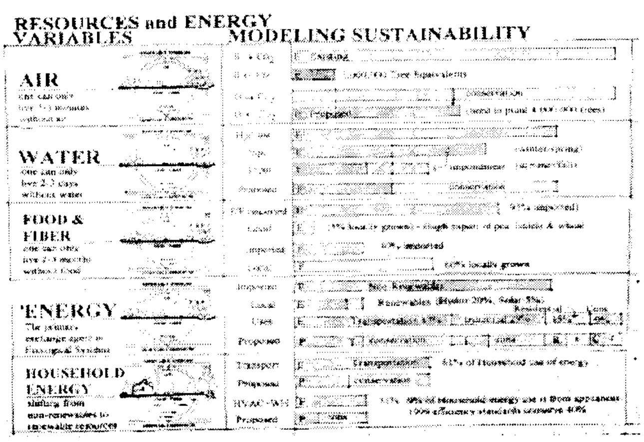


Fig. 3 Analysis of the community's human and environmental systems.

THE UNIVERSITY SUSTAINABLE VILLAGE

The University Sustainable Village (USV) applies this earlier city wide research to a specific site owned by the University. It focuses on integrating the concepts and strategies of this new development into an existing neighborhood, forming a cohesive village with defined greenways, diverse housing clusters, as well as, effective unit design to conserve resources and energy. The following is a summary of the USV proposal and implementing design guidelines.

Design Integration of Human and Natural Communities: The integration of the village with the natural systems of the site, the adjacent urban and university facilities were important design goals. The essential neighborhood functions and community facilities on adjacent sites were integrated with the general movement of the major pedestrian ways. Also, the design strategies enhance the indigenous qualities of the site (wetlands, natural habitats, view corridors, solar orientations, etc.).

The village contains a hierarchy of central places interconnected by an effective pedestrian focused infrastructure. This infrastructure is expressed in community greenways and the clustering of activities to promote enjoyment and accessibility. Internally, the pedestrian priority walk/bikeways and transit nodes foster accessible connections to neighborhood facilities, parks, transit shelter, daycare, recycling and compost centers, and most importantly to a neighborhood school and university. The neighborhood school becomes an active center and its central geographic location is critical to the pedestrian priority concept and community sustainability. Pedestrian enhancements are provided at every destination and several essential social spaces and facilities are located along the major walk/bikeways that conveniently provide for the community's daily needs.

Clearly defined greenways and the accessible transit system throughout the development will substantially reduce the automobile use and the consumption of non-renewable energy resources. Water conservation programs and gray water reuse would be imple-

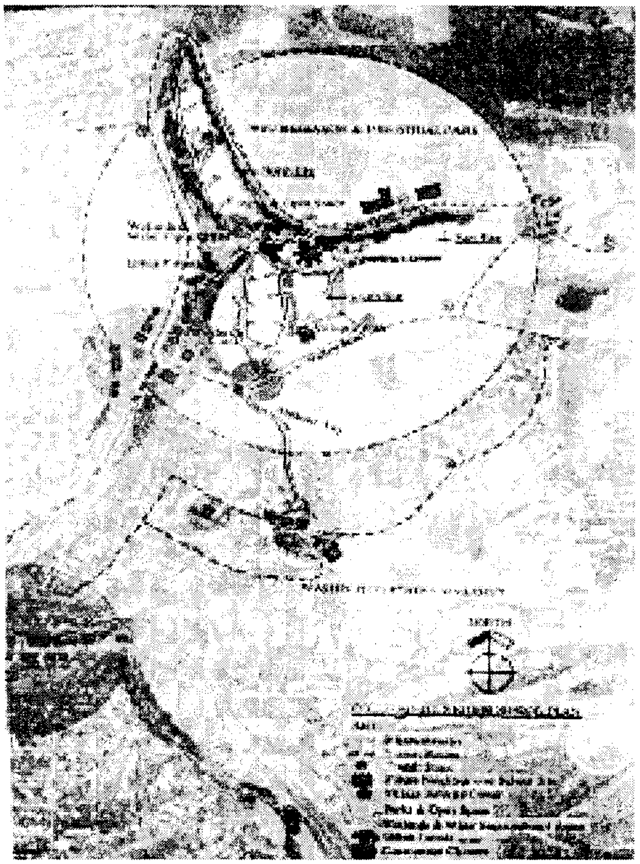


Fig. 4. Neighborhood land use plan and strategies.

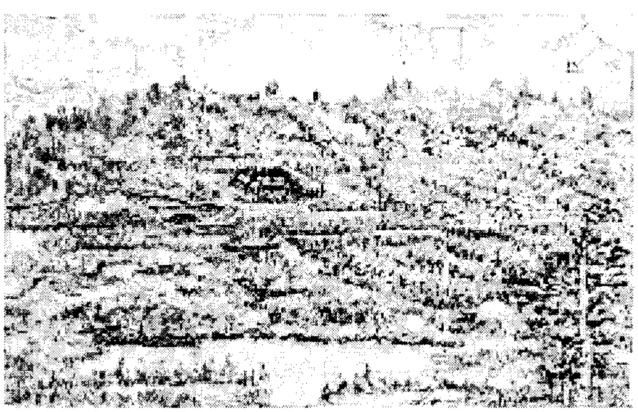


Fig. 5. Village panorama.

mented throughout the village. The successful resource management programs based on the 3R's (reduce, reuse and recycle) are integral parts of the community and their educational programs. The traditional garbage service is considered a community resource recovery process.

Housing Quality, Community and Privacy: In an urban environment where land prices and the cost of essential urban facilities and services are increasingly becoming unaffordable, higher density housing is needed to justify the economic use of community amenities. Clustering of housing with row houses and apartments around a semi-private garden is the prominent housing form in the village. This type of housing is economical and offers much higher densities without compromising the qualities associated with family living. When designed properly, clustering fosters a sense of place and

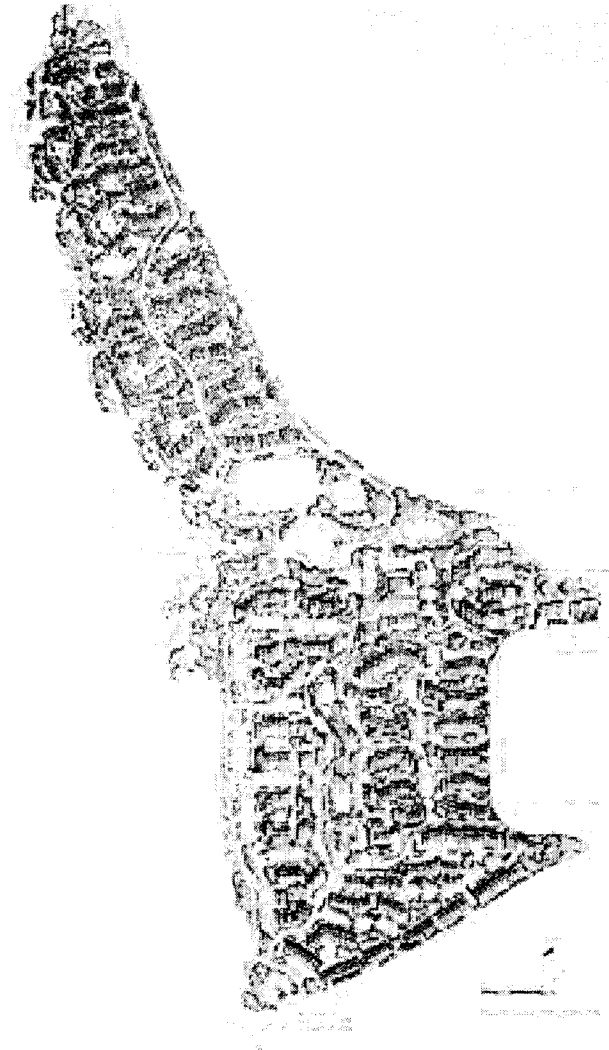


Fig. 6. Village plan with greenways and neighborhood school.

intimacy between the group of users and renders a manageable environment at residential scale.

A variety design strategies were used to increase the perception of territoriality by physical definition and a high degree of control by the inhabitants. These features are given priority in the design of clusters and units. The interior semi-private courtyards are defined by the housing units, creating a controlled space to protect the proper functioning of activities and encouraging social interaction. The entries to the courtyards are defined by means of gateways and level changes combined with indigenous landscaping to convey the message of territorial integrity.

The areas within the vicinity of the building entries, paths and front yards are assigned to the residents so they can have direct control and surveillance over these areas. Children play areas and parking are within these defined zones to assist the residents in adopting a proprietary attitude. Surveillance over public open spaces, the street and walkways are further improved through careful articulation of the building facades and varying architectural features such as ample front porches and bay windows. These design elements convey the message of user influence and control of the public realm at every level.

The units are designed to reach a high level of energy conservation, optimizing the use-reuse and recycle of renewable resources of sun, wind, water and food/fiber. Indigenous, low maintenance landscaping and permaculture are used instead of water consuming "lawns." Water is impounded in gardens and cisterns used for landscaping and gardening. All brown wastewater would be safely composted by the city and used for agriculture. Small family vegetable gardens would be encouraged adjacent to the homes within the residential clusters and in the green areas.

SIGNIFICANCE AND USE OF RESULTS: A SUSTAINABLE DESIGN PROTOTYPE AND PARADIGM

Prototype: The Sustainable Pullman Village and resultant Design Guidelines have been an effective prototype for demonstrating the theory, quality and application of sustianable design to the community. The proposal was presented numerous times to the University and Community. After three invited presentations to the University administration, a Request for Proposals (RFP) was developed which embodied many of the strategies of the USV. The University agreed to lease the land at a reduced cost if the design-build teams would develop their proposal with many of the qualities and strategies presented. Finally, the selected firms were brought to campus for a full day workshop. At the administration's request, the authors also presented their findings to teams of professionals who were selected to submit design-build proposals for the site. The RFP have been submitted but the estimated need for additional housing has temporarily diminished due to increased building in the private sector. The project awaits further university action.

Paradigm: The Sustainable Pullman Village is based upon a shift in thinking — a holistic ecological paradigm that identifies and calculates the human-environmental exchanges required for sustainability. From these ecological modeling techniques, design strategies were generated to celebrate and balance the ecological exchanges while providing opportunities for renewal and creation of truly affordable and livable environments. These integrated sustainable design strategies permeate various defining levels of the village integrating its natural amenities with its neighborhood context, residential clusters and dwelling units. **This design/planning approach "reverses the logic" of conventional design process used in the city**. **First**, rather than beginning with the layout of streets and lots, we started with the ecological modeling and selected an effective set of proven strategies to balance on-site human and environmental systems. **Secondly**, we identified the best and most sensitive land for parks, waterways, wetland and established greenways, view corridors and effective micro-climate optimization.

Third, connections were made to community amenities on and off the site with walkways, bikeways and transit nodes. The centrality of pedestrian and bike network and greenways interconnect activity centers, schools, and parks, reanimating place definition and activity nodes. These pedestrian priority strategies provide the fundamental links to the university, the surrounding neighborhood and its commercial nodes — diminishing reliance on the automobile and the magnitude of resources they consume.

Fourth, a diversity of housing types were clustered with the best solar orientation and views. The residential clustering achieves effective densification adjacent to amenities and greenways and enhances opportunities for interpersonal relationships and family privacy. **Fifth**, the dwelling units were proposed to reach a high level of energy conservation, optimizing passive strategies that enhance the users appreciation in natural qualities of the village. **Finally**, the design provided for landscaped auto access and parking within the clusters, lowering speed with traffic diverters and pedestrian priority crossings.

The study and resultant proposal verifies the initial thesis - that design based upon affordable and sustainable principles can enhance both human and environmental qualities of a site while celebrating uniqueness, quality of life and place making.

Fig. 7. Housing cluster.

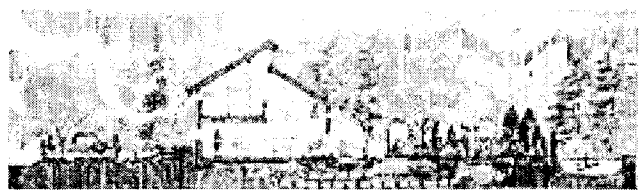


Fig. 8. Dwelling unit section with passive strategies.

DESIGN GUIDELINES FOR SUSTAINABLE AND AFFORDABLE RESIDENTIAL DEVELOPMENT

Twenty-five simple things one can do to achieve more quality, cost-effective and sustainable residential developments are discussed below. The guidelines are organized under five primary variables for achieving sustainability: **air, water, land (food/fiber), energy and human ecology**. These variables are best understood as highly interrelated cycles as expressed in the concept diagram (figure 2) discussed within this paper.

HUMAN ECOLOGY: The Way People Interrelate and Use the Environment:

(Community, Neighborhood or Village Scale)

1. Enhance a sense of community. A cohesive neighborhood is critical to a healthy, safe and sustainable community. Develop a cohesive village quality with convenient pedestrian access to neighborhood amenities and services. Neighborhood schools are a most important activity centroid to quality neighborhoods and their central location is critical to a walking environment. Save and restore all site characteristics and qualities (natural, cultural, historical, etc.). Enhanced wetlands and wildlife habitat, accessible parks, activity centers (indoor and outdoor) and services (shared governance, daycare, recycling, etc.) nurtures civility and community.

2. Provide for pedestrian priority connections between residential developments and neighborhood amenities and services. Bike and walkways enhance 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 and suburban sprawl. Provide convenient and ample bike parking. Reduce auto services to a minimum (18'-22' residential roadways). "Skinny" streets are a well-accepted traffic calming strategy.

3. Cluster, don't sprawl. Increased density and land use efficiency reduces infrastructure costs. Providing moderate densities of at least 12-16 dwelling units per acre encourages pedestrian focus and safety. **(Clusters and Subdivision Developments)**

4. **Develop defined residential clusters** of 15-25 dwellings with

cohesive cultural character, social amenities and shared open space for cluster activities. Oriented units to the South can enhance comfort and save energy.

5. Carefully define territoriality-public to private areas. Encourage user control and responsibility at least 60-70% of the property in the cluster. This allows users to personalize areas and decreases maintenance costs.

6. Minimize front setbacks and provide outdoor porches, bay windows, gardens, etc. to enhance human scale, socialization, surveillance and safety.

7. Minimize the impact of parking. Do not let large garages dominate the fronts of houses. When feasible, distribute parking in small, landscaped lots (8-12 cars). Parking areas are costly and require a lot of land, almost as large as some housing areas. Provide for 30-40% of parking for compact cars. 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. #2, Pedestrian Connections).

(Dwelling Units)

8. Think small and smart, not big and dumb. Size is generally proportional to costs. Small, efficient homes are far more affordable (both initial and operating costs). Townhouses are an excellent housing prototype for effective quality living. The common wall construction can conserve energy and maintenance costs.

9. Carefully zone housing to orient interior activities to exterior gardens, yards and clustered open space. Carefully designed public to private zoning can increase livability and efficiency of interior and exterior space.

ENERGY CONSERVATION: A Major Long-Term Cost to People and the Environment

10. Conserve energy by quality construction, good southern/ solar exposure, high levels of insulation, efficient lighting, equipment and appliances. The NW Energy Codes are excellent and the greatest savings can occur by optimizing all design decisions by the systems analysis path to code compliance. Provide for airlock entries. 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 2 or more times more energy than the dwelling and all its appliances (Ref. #2, Pedestrian Connections and #7, Impact of Parking).

11. Carefully orient each dwelling unit to sun and site. Take full advantage of passive solar strategies by providing increased windows, sun spaces/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. #15, Permaculture). Minimize window orientations to west and eastóvery uncomfortable in hot summers.

12. Increase use of renewable energies and passive and active solar strategies for heating, cooling and energy production. Place large spaces and windows on the south. Besides shading windows, consider passive cooling methods such as clearstories, (stacked) or attic ventilation, drawing replacement air from the cooler north side. Advancements in active systems are being made at exponential ratesóconsider active solar heating systems, especially water heating and photovoltaic systems now or in the future (Ref. #11, Orientation).

13. Select energy and resource conserving materials and construction methods. The embodied energy in building materials is substantial. Reuse/renovate existing structures and select materials for 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. Save and reuse all valuable top soils from excavations and grading. Reduce, reuse and/or recycle all materials during construction.

LAND & RESOURCE CONSERVATION: Critical Resources for a Sustainable Furture

14. Practice the 3 R's-First Reduce, then Reuse and Recycle. Provide incentives and facilities to conserve material and monetary resources. In the core of each unit, provide for a recycling center (1-2' closet area) and convenient shared recycling and composting bins in the cluster. Traditional garbage service can be eliminated by 100% precycling and recycling or disposal services can be minimized by common pick-up points. Precycling is an important strategy - encourage the purchase of products with recycled or recyclable content by individual, corporate or community preference or policy.

15. Design with permaculture while landscaping various open space and community areas. Permaculture is landscaping which is edible and perennial (fruit trees, grape vines, berry bushes, etc.). Permaculture provides beauty, low maintenance, shade and food that can be harvested by families or community groups, even sold locally for various site improvements or projects (Ref. #19, Xeriscape).

16. Provide for family gardening on the southern areas 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. #15, Permaculture).

17. Localize the economy. Encourage programs for neighborhood and community-wide sharing 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.

WATER CONSERVATION: A Fundamental Need for Human Health and Delight

18. Develop water impoundment areas and enhance wetlands. This allows water to percolate into the ground, water landscaping, reduce downstream flooding, and increase water quality and bio-diversity while enhancing recreation and education.

19. Xeriscape, don't just landscape. Xeriscape uses beautiful indigenous landscape which requires little maintenance and water. Minimize high maintenance grass areas and let them "go golden" in the dry seasons (Ref. #15 Permaculture).

20. Harvest rain and gray water from the house and other structures for use in landscaping and toilet flushing.

21. Use water conservation appliances throughout the garden areas and house. Water conservation fixtures and appliances can save up to 30-70% of water use. Use drip irrigation systems and avoid water wasters such as automatic sprinklers.

22. Develop artificial wetlands when feasible for brown/black water treatment. This strategy applies to large and small-scale developments and can be far more economical than traditional engineered water treatment facilities.

AIR QUALITY: A Critical Variable for Human and Environmental Health

23. Develop greenways and greenbelts. Trees are critical for human comfort and help balance the carbon to oxygen cycle. Green areas, saving wetlands and creating urban forest can enhance recreation, livability and sustainability.

24. 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.

25. Go green. Even though Kermit the Frog states "It's not easy being green," plants have many benefits to both the indoor and outdoor environments. They absorb toxins from the air, create oxygen, shade/cool the environment through evaporative transpiration, and add ambience and humidity of indoor and outdoor spaces. They produce visual and culinary delights to sustainable residential environments (Ref. #15, Permaculture and #19, Xeriscape).

REFERENCES

ACSA/AIA. "Educating Architects for a Sustainable Environment," AIA/ACSA Recommendations, Rosenman, Director, Ball State University, 1994.

AIA. "Building Connections," a three-part national teleconference and accompanying resource booklets. American Institute of Architects, Washington, DC, 1992.

AIAS. "Declaration on Sustainability," American Institute of Architecture Students, Resolution Passed at National Forum, November, 1992.

AIA. *The Environmental Resource Guide*, American Institute of Architects, Washington, DC, 1992-1996.

AIA & UIA. "A Call for Sustainable Community Solutions," American Institute of Architects, Washington, DC, 1993.

ALSA. "ASLA Declaration on Environment and Development," American Society of Landscape Architecture, Washington, DC, 1993.

Bartuska, T., Kazimee, B. and Owen, M. "Envisioning a Sustainable Community," *Universe*, Washington State University, Spring, 1995.

Bartuska, T. "Sustainability: The Emerging New Paradigm for Environmental Design," Association of Collegiate Schools of Architecture, International Conference and *Proceedings*, Rio de Janeiro, May, 1998.

Bartuska, T. and Kazimee, B. "Modeling Sustainability: Theory and Design," Associated Collegiate Schools of Architecture, National Conference and *Proceedings*, University of Michigan, January, 1994.

Benton, C. "Vital Signs," University of California, Berkeley, 1993.

BEPAC. *Building Environmental Performance Assessment Criteria*, Environmental Research Group, School of Architecture, University of British Columbia. 1993.

BREEM. "Building Research Establishments Environmental Assessment Method." Building Research Establishment, Watford, UK, 1990.

BSU. "Building to Save the Earth," a national conference on sustainability. Ball State University, 1992.

Capra, T. *The Turning Point: Science, Society and the Rising Culture*. Bantam Books, 1982.

CEM. "The Secretariat of University Presidents for a Sustainable Future" (International), Center for Environmental Management, Tuffs University, Medford, Mass., 1993.

Corson, W. "Measuring Urban Sustainability," Global Tomorrow Coalition, Washington, DC, 1993.

Early, D. "What is Sustainable Design," *The Urban Ecologist*, Society of Urban Ecology, Berkeley, Spring, 1993.

EcoTeam Workbook: Global Action Plan for Earth, Woodstock, NY, 1992.

Gershon, D. & Gilman, R. *Household Ecoteam Workbook*, Global Action Plan for the Earth, Woodstock, NY, 1992.

Hall, C. "Moving to an Age of Synthesis" in *The Built Environment: A Creative Inquiry Into Design and Planning*, T. Bartuska and G. Young, eds., Crisp Publications, 1994.

IAA. Gold Medal Award, Kazimee, Bartuska & Owen, "Community Sustainability: A Comprehensive Regenerative Proposal for Pullman Washington," International Academy of Architecture Forum, UN Habitat II Conference, Istanbul, Turkey, 1996.

Kazimee, B. "Places In-Between Dwellings: The Essentiality of Place Making in High Density Housing," International Conference on Urban Planning, Housing and Design, Singapore, 1997.

Kazimee, B. "Design Intervention and Cultural Diversity: An Interactive Approach," ACSA, London, 1994.

Kamizee, B. & Bartuska, T. "Constructing a Sustainable Urban Regenerative Proposal for Kyoto, Japan," ACSA, Rio de Janeiro, 1998.

McHarg. I. "Values, Process and Form" in *The Ecological Conscience-Values for Survival*. Disch (ed), Prentice Hall, 1970.

Mollison, B. *Permaculture: A Practical Guide for a Sustainable Future*. Washington, DC, 1990.

NSTC *Bridge to a Sustainable Future* and *Technology for a Sustainable*. National Science and Technology Council, Washington, DC, 1995.

RMI. *A Primer on Sustainable Buildings*. Rocky Mountain Institute, 1994.

Rosenbaum. "Sustainable Design Strategies," *Solar Today* (March/April, 1993).

Van Der Ryn, S. and Cowan, S. *Ecological Design*. Island Press, 1996.

Vieria. "A Checklist for Sustainable Developments" in a resource guide for *Building Connections: Livable, Sustainable Communities*, American Institute of Architects, Washington, DC, 1993.

Wackernagel, M. & Rees, W. *Our Ecological Footprint*. New Society Publishers, 1996.

Wann, D. *Deep Design: Pathways to a Livable Future*. Island Press, 1996.

Wann, D. *Biologic: Environmental Protection by Design*. Johnson Books, 1992.

WCED. *Our Common Future*. World Commission on Environment and Development, United Nations, Oxford University Press, 1987.