THE CONCEPT AND PRINCIPLES OF SUSTAINABLE ARCHITECTURAL DESIGN FOR NATIONAL PARKS IN SERBIA

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The paper elaborates the concept of sustainable architectural design that has come to the forefront in the last 20 years, and in the light of the National Park. This concept recognizes that human civilization is an integral part of the natural world and that nature must be preserved and perpetuated if the human community itself is to survive. Sustainable design articulates this idea through developments that exemplify the principles of conservation and encourage the application of those principles in our daily lives.

A corollary concept, and one that supports sustainable design, is that of bio-regionalism - the idea that all life is established and maintained on a functional community basis and that all of these distinctive communities (bio-regions) have mutually supporting life systems that are generally self-sustaining. The concept of sustainable design holds that future technologies must function primarily within bioregional patterns and scales. They must maintain biological diversity and environmental integrity contribute to the health of air, water, and soils, incorporate design and construction that reflect bio-regional conditions, and reduce the impacts of human use.

Sustainable design, sustainable development, design with nature, environmentally sensitive design, holistic resource management - regardless of what it's called, "sustainability," the capability of natural and cultural systems being continued over time, is the key. Sustainable design must use an alternative approach to traditional design and the new design approach must recognize the impacts of every design choice on the natural and cultural resources of the local, regional, and global environments.

Sustainable park and recreation development will succeed to the degree that it anticipates and manages human experiences. Interpretation provides the best single tool for shaping experiences and sharing values. By providing an awareness of the environment, values are taught that are necessary for the protection of the environment. Sustainable design will seek to affect not only immediate behaviors but also the long-term beliefs and attitudes of the visitors.

Key words: concept, principles, sustainable, architectural design, national park, development, and environment.

INTRODUCTION

How do we define sustainable architecture? And what the National Park has to do with it?

Prior to the use of the term "sustainable architecture," the term "solar architecture" expressed the architectural concept of the reduction of the consumption of natural resources and fuels. The intent was that we could conserve our fuel resources through the immediate capture of the available solar energy through appropriate building design. The evolution of the development of this design approach has brought us to the current and broader concept of "sustainable architecture." This term describes those who take up the banner for an energy and ecologically conscious approach to the design of the built environment. In doing so, it has broadened the scope of issues involved. Unfortunately, because of the confusion of the literal meaning of the term, it has also hampered the communication about this approach to architecture.

The literal interpretation of the words "sustainable environment" is the creation of an environment for human occupation, performance and the support of life to which sustenance or nourishment is continuously given. That is the definition used in this paper. The term "sustainable" does not express the minimization of the expenditure of those resources necessary for the prolongation of the life of the National Park. The term defines the fact that no humanly created environment can survive without the contributions of the larger natural

environment or ecological systems what National Parks normally are.

We cannot create environmental order as architecture without ultimately extracting energy and resources from other systems. The end product is a closed system of increased order but only at the expense of other systems within the universe. The net result is a decrease in order or an increase in entropy. A sustainable environment is an entity that owes its existence to the consumption of the natural resources and order that surround it. If an environment physically exists, it is being sustained. It is impossible to have a non-sustainable environment (1). That of course applies to National Parks too, probably even much more than to any other environment.

The term “sustainable architecture”, used to describe the movement associated with environmentally conscious architectural design, still creates ambivalence and confusion, even more than twenty years ago when it was introduced (2). A brief examination of the meaning of “sustainable” identifies why this occurs. The popular interpretation describes an approach to design that minimizes sustenance of resource consumption so as to prolong the availability of natural resources. And that directly applies to the National Park. However, the definition of “sustainable” does not imply a minimization of sustenance. “Sustainable” simply expresses the fact that resources do maintain our environment. Depletion of resources is inevitable in maintaining any environment. Sustainable architecture describes the fact that we receive what we need from the universe. This realization compels us to respond with care or stewardship in the use of those resources around us. Sustainable architecture, then, is a response to awareness and not a prescriptive formula for survival, let alone fashion.

Sustainability might be understood as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (3). We will most probably run out of resources at some point in time but we seek to delay that point for as long as possible. Implicit in this definition is the hope that if we delay long enough, we may be able to see how new technologies will reverse what now appears to be a continual process to an inevitable end. A similar interpretation is that we treat the natural resources available to us as capital and seek to leave off only the interest or produced resources of nature. It would mean that we would consume less through the products of our creative efforts than nature produces through the natural cycles. The reality is that we are beholding to the universe that surrounds us for our survival, the existence of life and the opportunity to express ourselves creatively. We do create order and an increase in resources for human fulfillment through our architecture (4).

Sustainable architecture describes the fact that we can only exist and create with the availability of natural resources. Those resources are the foundation of our world. Sustainable architecture proclaims this fact to the world. It is a celebration that we are that we create and that resources are available to do this. And that is probably the most appropriate understanding of the term (5).

“Sustainability” is a term that represents the social and cultural shift in the world order, patterns and styles of living (6). It is another step in the process wherein society has moved from a nomadic hunting order, to an agricultural order, to an industrial order and is currently moving fast to an information-based order. “Sustainability” has become a buzzword or symbol describing this inevitable, ongoing transition. As such, the term “sustainability” is actually not the first one that has little to do with the dictionary, literal definition of the word, but is the name for a new attitude and way of looking at the world.

The artists, including architects, state that our priority as human beings is to express ourselves and continually say things in new and different ways. Resources are for consumption. Sustainability refers to the adjustments that we must make as we exhaust one form and use another in its place. On the other hand the priority of life for materialists is economic productivity and physical comfort and welfare. This is the argument of Capitalism and Communism alike. Consumption is what motivates us. The earth's resources exist for our consumption, including National Parks. Based upon the laws of supply and demand adaptation occurs.

Both of these approaches offer opportunities to contribute to the goals of the popular understanding of sustainable architecture. The artistic, should we say architectural approach contribution is based on the concept of continually seeking new forms and means of expression. In a time of social and cultural change, the artist, namely architect is in the forefront. After all, the new architecture, if it tends to be really new, is about sustainability (7).

Related to the nebulous quality of the term "sustainable" in this context is that some proponents of sustainability feel that we really can create environments that consume less than they produce, and I am definitely one of those. Some even say the term is intellectually dishonest, and we, as a society, do not know how to build sustainable architecture.

So the term "sustainable," as popularly understood, is inadequate and, consequently, it is a negative influence toward the real goals of the sustainable architecture movement. First and foremost, it is a negative concept. The aim of architecture is to improve our quality of life and environment. The intention of architecture is not to save resources preventing their use but to reorder them to better serve the people. In the context of that priority, the issue is how do we achieve it.

The reality of the finites of energy and resources and the resulting deterioration and destruction of our natural environment, including National Parks, clearly has significant impact upon our cultures and lifestyles. The logical conclusion is that we must address the issues of sustainability in our architecture everywhere, and of course especially to National Parks. We need a long-term view, not the fulfillment of immediate physical satisfaction. Both artistic and economic points of view have significant roles to play in the development of sustainable architecture.

SUSTAINABLE NATIONAL PARK

In order to propose meaningful developments that are sustainable and environmentally sound in the National Park, then a number of environmental aspects that promote sustainable design need to be looked at. Therefore, next is the study that looks at the environmental guidelines of the National Park.

All the proposed interventions and develop-

ments at the National Park need to be sustainable so as to maintain the existing ecosystem (8). The concept of sustainable design has come to the forefront in the last twenty years. It is a concept that recognizes that human civilization is an integral part of the natural world and that nature must be preserved and perpetuated if the human community itself is to survive. Sustainable design articulates this idea through developments that exemplify the principles of conservation and encourage the application of those principles in our daily lives.

A corollary concept, and one that supports sustainable design, is that of bio-regionalism - the idea that all life is established and maintained on a functional community basis and that all of these distinctive communities (bio-regions) have mutually supporting life systems that are generally self-sustaining. The concept of sustainable design holds that future technologies must function primarily within bioregional patterns and scales. They must maintain biological diversity and environmental integrity contributing to the health of air, water, and soils, incorporating design and construction that reflect bio-regional conditions, and reducing the impacts of human use (9).

Design principles

Sustainable design, sustainable development, design with nature, environmentally sensitive design, holistic resource management - regardless of what it's called, "sustainability," the capability of natural and cultural systems being continued over time, is the key (10).

In order to have sustainable design in the National Park, an alternative approach to traditional design and the new design approach must recognize the impacts of every design choice on the natural and cultural resources of the local, regional, and global environments.

A model of the new design principles necessary for sustainability is exemplified by the "Hanover Principles" or "Bill of Rights for the Planet," developed by William McDonough Architects for EXPO 2000 held in Hanover, Germany.

1. Insist on the right of humanity and nature to co-exist in a healthy, supportive, diverse, and sustainable condition.

2. Recognize interdependence. The elements of human design interact with and depend on the natural world, with broad and diverse implications at every scale. Expand design considerations to recognizing even distant effects.

3. Respect relationships between spirit and matter. Consider all aspects of human settlement including community, dwelling, industry, and trade in terms of existing and evolving connections between spiritual and material consciousness.

4. Accept responsibility for the consequences of design decisions upon human well being, the viability of natural systems, and their right to co-exist.

5. Create safe objects to long-term value. Do not burden future generations with requirements for maintenance or vigilant administration of potential danger due to the careless creations of products, processes, or standards.

6. Eliminate the concept of waste. Evaluate and optimize the full life cycle of products and processes, to approach the state of natural systems in which there is no waste.

7. Rely on natural energy flows. Human designs should, like the living world, derive their creative forces from perpetual solar income. Incorporate this energy efficiently and safely for responsible use.

8. Understand the limitations of design. No human creation lasts forever and design does solve all problems. Those who create and plan should practice humility in the face of nature. Treat nature as a model and mentor, not an inconvenience to be evaded or controlled.

9. Seek constant improvements by sharing knowledge. Encourage direct and open communication between colleagues, patrons, manufacturers, and users to link long-term sustainable considerations with ethical responsibility, and reestablish the integral relationship between natural processes and human activity.

Role of interpretation

For any National Park to be sustainable, it will only succeed to the degree that it anticipates and manages human experiences (11). Interpretation provides the best single tool for shaping experiences and sharing values. By providing an awareness of the environment, values are taught that are necessary for the protection of the environment. Sustainable design will seek to affect not only immediate behaviors but also the long-term beliefs and attitudes of the visitors.

To achieve a sustainable park:

- Visitor experiences should be based on intimate and sensory involvement with actual natural and cultural resources. The local culture should be included. The experiences should be environmentally and culturally compatible and should encourage the protection of those resources
- Educational opportunities should include interpretation of the systems that sustain the development as well as programs about natural and cultural resource values of the setting.
- Site and facility design should contribute to the understanding and interpretation of the local natural and cultural environments.

Interpretation should make the values of sustainability apparent to visitors in all daily aspects of operation, including services, retail operations, maintenance, utilities, and waste handling. A good example should be set in all facets of operation

Opportunities for Interpretation

A value-based visitor experience requires interpretation as an essential part of the planning and design process (12). The primary interpretive resources of the park can usually be identified in the planning stages of the development by answering the following questions:

- What is special or unusual about a particular National Park?
- What is particularly interesting, scenic, or photogenic about the park?
- What do visitors come to see?
- What is fun to do?
- What can be done to the park that is both environmentally sustainable and challenging?
- What resources provide particularly strong opportunities to demonstrate the underlying value system of sustainable development?
- What significant environmental controversies might be illustrated using local resources?
- What experiences are currently fashionable?
- What knowledge do visitors already have about the area?

- What knowledge and attitudes do neighboring residents have about the park and its resources?
- What messages can be offered about sustainability that visitors can use in their everyday lives?

In addition, interpretation must be reinforced in all visitor experiences and inherent in management's thinking and in the relationship of the proposed development to the larger cultural context. The value system that interpretation communicates must pervade the entire cycle of planning, design, construction, operations, and maintenance.

Integration of Interpretation into Sustainable Development

Visitor experiences must be based on actual knowledge of resources that are environmentally sustainable and influence human values, thus protecting the overall environment. The table below provides a list of general goals and specific examples to facilitate the integration of interpretation into sustainable development of the park.

Design considerations

The National Park depends on close and intimate associations with the ecosystems around it. Park visitors and ecotourists seek to participate, to join in, to experience, and to gain a better awareness, appreciation, and understanding of the ecological system.

The following are essential considerations for the integration of the park's development with natural resources (13).

1. Natural Behavior within an Ecosystem - A basic understanding of the natural behavior of an ecosystem is required before designing facilities for sustainable functioning within it. It is crucial to identify key resources on which ecotourism will be focused and to understand how these resources are linked. Geographic information system inventories of soils, hydrology, and plant and animal communities can aid to this understanding.

2. Links between Ecosystems - There are links between ecosystems that may be geographically separate, and changes in one ecosystem may have consequences in another, therefore long-term resource protection involves plan-

Visitor Experiences

Interpretive Goals	Examples
Visitors must	Visitors would benefit by
- have the opportunity to see that the local natural and cultural worlds are interrelated.	- participating in organized cultural activities and demonstrations that allow local residents to share their values and skills with visitors. - being served meals that feature local foods and products and by seeing heal food plants being cultivated within the park.
- learn that the resources that surround them are important, interesting, and worthy of respect.	- attending evening programs featuring site specific interpretive themes. - having plants and other features of the site identified by labels or in guidebooks. - ensuring that the beauty of the natural and cultural environments are preserved and revealed in the park.
- have the opportunity to interact with the environment at every possible moment.	- participating in guided activities that focus on significant natural and cultural features found onsite or nearby. - participating in environmental education programs that include members of the community and local schools. - ensuring that the physical development is designed to grasp every opportunity to bring the visitor in close sensory contact with the environment. - ensuring that preservation of the environment takes precedence in all aspects of the park and that this goal is made visible.
- have opportunities for learning through exhibits and literature as well as through guided activities.	- participating in organized volunteer activities that allow visitors to work on the enhancement of the environment after appropriate training. - using the National Park's resource library - providing sensory experiences using interpretive messages whenever possible as part of the design.
- share in the responsibilities of caring for the natural and cultural environments.	- taking part in active programs that are planned for preserving and restoring the environment. - participating in routine operations of the park, such as recycling, energy conservation and so on.

Facility Planning/Design/Construction

Interpretive Goals	Examples
Sustainable design must	Sustainable design would
- include a professional understanding of the natural and cultural resources involved and clearly state that people must be subordinate to (or in harmony with) nature.	- ensure that the site plan, design, and construction preserve and emphasize key elements of the natural and cultural environments.
- give the park a special sense of place based on the resources of the site.	- feature architectural materials that are native to the site or region and that are renewable and environmentally sensitive. - encourage opportunities for sensing, experiencing, and/or understanding resources in the architecture and site design.
- provide education about the natural and cultural environments and the support systems that sustain the park while bringing visitors and resources together whenever possible.	- place interpretive exhibits within the development, allowing visitors to be aware of immediate resource protection concerns associated with the environment. - provide information in visitor facilities about the resource, using printed or electronic media as appropriate. - provide access to the support systems of the park through cutaway walls or other methods.
- allow visitors to experience nature in an intimate sensory fashion, providing opportunities for private moments in natural settings.	- limit outdoor night lighting to low wattage, directional lighting, with consideration of photovoltaic power and control. - provide passive, quiet areas where visitors can reflect on the natural scene. - assist interpretive programming to set the stage for private moments in natural settings.
- incorporate the living culture as a significant part of the visitor experience and encourage opportunities for visitors and local residents to interact and share their values and experiences.	- incorporate architectural traditions, names, and images into facility design.

ning and government controls on a wide geographical basis.

3. Fragmentation of Habitats - Whether due to a specific facility or throughout an ecosystem, habitat fragmentation causes loss of biological diversity and must be minimized.

4. Energy Subsidies for Ecosystems - Sustainable planning and design can keep energy subsidies in the park at a minimum by taking advantage of renewable energy resources within the local ecosystem. Questioning how the park can function if the energy subsidy were unavailable will keep development more in harmony with existing resources and minimize the environmental impact of importing energy.

5. Human Demands on Ecosystems - The demands of human use on an ecosystem are cumulative. New proposals must account for the previous use of resources so that the effects of the activity, proposed development, and increased use do not exceed the ecosystem's capability. Change in the system is inevitable, but limits of acceptable environmental change should be established before development begins. Unpredictable events such as floods and droughts, which could cause the whole system to collapse, should be considered.

6. Ecosystem Monitoring - The effects on surrounding resources of developing and operating facilities should be routinely monitored and evaluated, and actions to correct problems should be taken immediately. This will ensure that the limits of acceptable change are not exceeded and will provide information about the behavior of the system. This information can be used for improved designs.

7. Management of Cultural Resources - Cultural resources are reflections of past cultural, historical, and environmental influences. Any development in areas containing cultural resources like the National Park should pursue appropriate methods during planning, design, construction, and throughout subsequent operation to ensure that these nonrenewable, environmentally sensitive resources are protected, conserved, interpreted, and left unimpaired for future generations.

The following general recommendations should be included in the park's sustainable

Operations and Maintenance

Interpretive Goals	Examples
The values of a sustainable park development must be	The values of a sustainable park development are shown by
- communicated by the manager who serves as the chief interpreter of a sustainable park.	- providing all staff with regular training regarding local natural and cultural features and resources. - organizing work / study programs that emphasize resources and sustainable design techniques. - organising volunteer activities that allow visitors to work on restoration or enhancement of the environment after appropriate training. - developing volunteer programs that allow visitors to operate site support systems.
- understood and appreciated by the entire staff, who should demonstrate understanding and respect for the local environment and share their knowledge with visitors.	- providing tours that present the sustainability goals of the park as shown in the operation and maintenance functions such as utility and support systems. - providing visitors the opportunity to understand the relationships of local water, wastewater, solid waste, and electrical systems to local, regional and global environments.
- shared with those who live in the surrounding areas; the local culture should have a significant role to play in the operation of the park.	- including representatives of the local culture in significant staff positions. - organising cultural activities and demonstrations that allow local residents to share their values and skills with visitors. - organising environmental education programs that include members of the local community and schools.
- visible in all daily aspects of operation, including energy use, food handling, waste handling, maintenance activities, retail operations, and visitor services.	- providing a central staffed location for resource and activity information. - serving meals that feature local foods and products and by cultivating local foods within the park. - recycling all possible waste. - selling appropriate informational materials and quality items crafted by local people.

design that affects cultural resources:

- All the proposed development sites within the park should be surveyed for cultural resources, and the significance, integrity, and tangible and intangible qualities of those resources determined.
- All site and facility designs should incorporate methods for protecting and preserving significant cultural resources over the long term.
- The architectural style, landscape design, and construction materials of new developments within the park should reflect the cultural heritage of the locality or region.
- Cultural resource treatment and maintenance methods should be both environmentally and culturally sensitive and sustainable over the long term.
- When opportunities arise, cultural resources should be interpreted to include lessons about the environmental exploitations or sustainable, environmental successes of the past.
- Any proposed development plan associated with the park must take into account the total impacts of development in the widest possible context, and it must seek and implement effective mitigation for those impacts.

The conservation and management of cultural resources in an environmentally sensitive manner requires detailed planning; knowledge of materials and their interactions; knowledge of construction, craft techniques, skilled technicians, and available resources; and an ongoing commitment to resource conservation. Successful preservation must also address construction and operations associated with the park's proposed development.

Site design

Site design is a process of intervention involving the location of circulation, structures, and utilities, and making natural and cultural values available to visitors. The process encompasses many steps from planning to

construction, including initial inventory, assessment, detailed design, and construction procedures and services (14).

Sustainable Site Design Philosophy

Sustainable site design of the park requires holistic, ecologically based strategies to create projects that do not alter or impair but instead help repair and restore existing site systems. Site systems such as plant and animal communities, soils, and hydrology must be respected as patterns and processes of the living world (15).

Useful in understanding sustainable ecologically based site design is the "Valdez Principles for Site Design" developed by Andropogon Associates, Ltd. These strategies are precedent setting regarding their application and especially important to rightfully integrate the built environment into the park.

1. Recognition of Context - This site can not be understood and evaluated without looking outward to the site context. Before planning and designing for the park, fundamental questions must be asked in light of its impact on the larger community.

2. Treatment of Landscapes as Interdependent and Interconnected - Conventional development often increases fragmentation of the landscape. A fabric of development that diminishes their ability to support a variety of plant communities and habitats typically surrounds the small remaining islands of natural landscape. This situation must be reversed. Larger whole systems must be created by reconnecting fragmented landscapes and establishing contiguous networks with other natural systems both within the park and beyond its boundaries.

3. Integration of the Native Landscape with Development - Even the most developed landscapes, where every trace of nature seems to have been obliterated, is not self-contained. These areas should be redesigned to support some component of the natural landscape to provide critical connections to adjacent habitats.

4. Promotion of Biodiversity - The environment is experiencing extinction of both plant and animal species. Sustaining even a fraction of the diversity known today will be very difficult. Development itself affords a tremendous opportunity to emphasize the establishment of biodiversity on the site. Site design must be directed to protect local plant and animal communities, and new landscape plantings must deliberately reestablish diverse natural habitats in organic patterns that reflect the processes of the site.

5. Reuse of Already Disturbed Areas - Despite the declining availability of relatively unspoiled land and the wasteful way sites are conventionally developed, existing built areas are being abandoned and new development located on remaining rural and natural areas, which is something that must not occur in the development of this park.

6. Making a Habit of Restoration - Where the landscape fabric is damaged, it must be repaired and/or restored. As most of the ecosystems are increasingly disturbed, every development project should have a restoration component.

When site disturbance is uncontrolled, ecological deterioration accelerates, and natural systems diminish in diversity and complexity. Effective restoration requires recognition of the interdependence of all site factors and must include repair of all site systems - soil, water, vegetation, and wildlife.

General Site Design Considerations

The following considerations apply to the sustainable site design of the park:

- Promote spiritual harmony with, and embody an ethical responsibility to, the native landscape and its resources.
- Plan landscape development according to the surrounding context rather than by overlaying familiar patterns and solutions.
- Do not sacrifice ecological integrity or economic viability in a sustainable development; both are equally important factors in the development process.
- Understand the site as an integrated ecosystem with changes occurring over time in dynamic balance; the impacts of development must be confined within these natural changes.
- Allow simplicity of functions to prevail, while respecting basic human needs of comfort and safety.
- Recognize there is no such thing as waste, only resources out of place.
- Assess feasibility of development in long-term social and environmental costs, not just short-term construction costs.
- Minimize areas of vegetation disturbance, earth grading, and water channel alternation.
- Locate structures to take maximum advantage of passive energy technologies to provide for human comfort.
- Provide space for processing all wastes created onsite (collection/recycling facilities) so that no hazardous or destructive wastes will be released into the environment.
- Determine environmentally safe means of onsite energy production and storage in the early stages of the park's sites planning.
- Phase development to allow for the monitoring of cumulative environmental impacts of development.
- Allow the natural ecosystem to be self-maintaining to the greatest extent possible.
- Develop facilities to integrate selected maintenance functions such as energy conservation, waste reduction, recycling, and resource conservation into the visitor experience.
- Incorporate indigenous materials and crafts into structures, native plants into landscaping, and local customs into programs and operations.

Specific Site Design Considerations

Site Selection

The requirements and environmental characteristics of a sustainable National Park will vary greatly, but the following factors should be considered in site selection:

- *Capacity* - As difficult as it can be to determine, every site has a carrying capacity for structures and human activity. A detailed site analysis should determine this capacity based on the sensitivity of site resources and the ability of the land to regenerate.

- *Density* - Siting of facilities should carefully weigh the relative merits of concentration versus dispersal. Natural landscape values may be easier to maintain if facilities are carefully dispersed. Conversely, concentration of structure leaves more undisturbed natural areas.

- *Climate* - The characteristics of the park's climate should be considered when locating facilities so that human comfort can be maximized while protecting the facility from climatic forces such as violent storms and other extremes.

- *Slopes* - In certain parts of the park where the steep slopes predominate, special sitting of structures and costly construction practices are required. Building on slopes considered too steep can lead to soil erosion, loss of hillside vegetation. Appropriate site selection should generally locate more intensive development on gentle slopes, dispersed development on moderate slopes, and no development on steep slopes.

- *Vegetation* - It is important to retain as much existing native vegetation as possible to secure the integrity of the park. Natural vegetation is often an essential aspect of the visitor experience and should be preserved. Site selection should maintain large habitat areas and avoid habitat fragmentation and canopy loss. In some areas, most nutrients are held in the forest canopy, not in the soil - loss of canopy therefore causes nutrient loss as well. Plants occur in natural associations (plant communities) and should remain as established naturally.

- *Views* - Are critical and reinforce visitor's experience. Site location should maximize views of natural features and minimize views of visitor and support facilities.

- *Natural Hazards* - Sustainable development should be located with consideration of natural hazards such as dangerous animals and plants, if any. Site layout should allow controlled access to these features.

- *Access to Natural and Cultural Features* - Good siting practices can maximize pedestrian access to the wide variety of onsite and offsite resources and recreational activities. Low impact development is the key to protecting vital resource areas.

- *Traditional Activities* - Siting should be compatible with traditional agricultural and hunting activities. Some forms of recreational development that supplant traditional land uses may not be responsive to the local economy.

- *Energy and Utilities* - Conventional energy and utility systems are often minimal or nonexistent in potential ecotourism areas. Siting should consider possible connections to offsite utilities, or more likely, spatial needs for onsite utilities. The potential exists for alternative energy use in many places, particularly solar and wind based energy systems. Good sustainable siting considers these opportunities.

- *Separation of Support Facilities from Public Use Areas* - Safety, visual quality, noise, and odor are all factors that need to be considered when siting support services and facilities. These areas need to be separated from public use and circulation areas. In certain circumstances, utilities, energy systems, and waste recycling areas can be a positive part of the visitor experience.

- *Proximity of Goods, Services, and Housing* - This development often requires the input of a variety of goods and services and the large operational staff. Sitting should consider the availability of these elements and the costs involved in providing them.

Site Access

Site access refers not only to the means of physically entering the park but also to the en route experience. For example, the en route experience could include transitions between origin and destination with sequential gateways, or it could provide an interpretive and/or educational experience. Other considerations for enhancing the experience of accessing the developed area include:

- Select corridors to limit environmental impacts and control development along the corridor leading to the facility.
- Provide anticipation and drama by framing views or directing attention to landscape features along the access route.
- Provide a sense of arrival at the destination.

Site access can be achieved by various means of travel including pedestrian, transit systems, private vehicles and aircraft. These transportation means impose limitations on users based on the capabilities of the traveler or the capacity of the particular transportation mode. Transportation means that are the least polluting, quiet, and least intrusive in the natural environment may be the most appropriate for this recreational development. Where environmental or other constraints make physical access impossible (just like accessing some particular areas during the snow or rainy season), remote video presentation may be the only way for people to access the site. The need to construct a road into a site is the first critical decision to be made. Building a road into a pristine site should be considered a serious intervention that will change the site forever. Roads tend to create irreversible impacts.

Road Design and Construction - Crossing unstable slopes should be avoided and retaining walls should be included on cut slopes to ensure long-term slope stability. The road should have low design speeds (with more and tighter curves) and a narrower width to minimize cut-and-fill disturbance. Over engineering of park roads should be avoided.

Access corridors should be provided for multiple purposes - e.g., visitors, maintenance, security, emergency vehicles, underground utilities. Secondary access (road, dock, or helicopter landing site) should always be provided to permit emergency entry and evacuation in the event of a natural disaster. Multi use corridors can be effective and using the same road during construction can limit site degradation and re-landscaping.

Many soils are highly susceptible to erosion. Vegetation clearing on the road shoulders should be minimized to limit erosion impacts and retain the benefits of greenery. Exposed soils should be immediately replanted and mulched. Paved ditches are frequently used to stem erosion along steep road gradients. In the design of park roads, landscape solutions are preferred to render a softer appearance.

Unpaved surfaces are appropriate in areas of stable soils, lower slopes, and low traffic loads, but they require more maintenance. Permeable paved surfaces allow limited percolation of precipitation while providing better wear than unpaved surfaces. Impermeable paved surfaces are needed for roads with the highest load and traffic requirements. Whenever possible, recycled materials should be used in the construction of the surfacing, e.g., recycled aggregate. The surfacing material should blend with predominant landscape tones. Contractual arrangements should be developed with local businesses for the reuse/recycling of any construction waste.

Other Access Improvements - Airstrips should not disturb the other recreation facilities because of visual and noise impacts of airplanes. Permeable pavements should be used to increase water recharge and reduce runoff.

Core Site Access - While all visitor facilities should be accessible to visitors with disabilities, some natural features and site opportunities may by their very nature limit total accessibility. Rather than forcing unacceptable physical disturbance to make these areas accessible to all visitors with disabilities, the concept of challenge levels should be used. The degree of difficulty is determined and made known to visitors in advance, much in the same way as ski slopes are classified for beginners, intermediates, or experts. Challenge levels assume that while key facilities will be readily accessible to all visitors, some other sections of the park will be more difficult to access, and will involve some sense of adventure and accomplishment.

Utilities and Waste Systems

Utility Systems - Substantial impacts usually occur in order to provide electricity, gas, heating, cooling, ventilation, and storm drainage, on the landscape and the functioning of the natural ecosystem. Sustainable site planning and design principles must be applied early in the planning process to assist in selecting systems that will not adversely affect the environment and will work within established natural systems. After the appropriate systems are selected, careful planning and design is required to address secondary impacts such as soil disturbance and intrusion on the visual setting.

Utility Corridors - Due to environmental impacts of utility transmission lines, onsite generation and wireless microwave receivers are preferred. When utility lines are necessary they should be buried near other corridor areas that are already disturbed, such as roads and pedestrian paths. Overhead lines should not be located in desirable view sheds or over landform crests. Low impact alternatives for utility lines such as shielded conduit placed on the ground should be considered.

Utility System Facility Siting - Sustainable development of the infrastructure embodies the principles of reducing scale, dispersal of facilities, and the use of terrain or vegetative features to visually screen intrusive structures. Odor and noise are strong nuisance factors that are addressed by location and buffering. Also, the insulation of mechanical equipment that can have acoustical impacts has been considered. The exception to this rule may be to feature alternative utility systems for the purposes of interpretation for the environmentally conscious visitor.

Night Lighting - Care is required to limit night lighting to the minimum necessary for safety. Low voltage lighting with photovoltaic collectors has been considered as an efficient alternative energy.

Storm Drainage - The main principles in storm drainage control are to regulate runoff, to provide protection from soil erosion and avoid directing water into unmanageable volumes. Removal of natural vegetation, topsoil, and natural channels that provide natural drainage control should always be avoided. One alternative that has been considered is to try and stabilize soils, capture runoff in depressions (to help recharge groundwater supply), and re-vegetate areas to replicate natural drainage systems.

Irrigation Systems - Low volume irrigation systems are appropriate as a temporary method in most areas, to help restore previously disturbed areas or as a means to support local agriculture and native traditions. Irrigation piping can be reused on other restoration areas or incorporated into future domestic hydraulic systems. Captured rainwater recycled gray water, or treated effluent should be used as irrigation water.

Waste Treatment - It is important to use treatment technologies that are biological, non-mechanical, and do not involve soil leaching or land disposal that causes soil disturbance. While a septic system can be considered, treatment methods that result in useful products such as fertilizer and fuels are preferred. Constructed biological systems are increasingly in use to purify wastewater. They offer the benefits of being environmentally responsive, nonpolluting, and cost-effective.

Site-Adaptive Design Considerations

The concept of sustainability suggests an approach in terms of site components that is somewhat different from conventional site design. With a sustainable approach, site components refer to the character of the landscape they occupy, in this case the park, so that the experience of the landscape will be paramount. Instead of human functional needs driving the site design, site components respond to the indigenous spatial character, climate, topography, soils, and vegetation as well as compatibility with the existing cultural context. For example, all facilities would conform to constraints of existing landforms and tree locations, and the character of existing landscape will be largely maintained.

Natural buffers and openings for privacy are used more than artificially produced through planting and clearing. Hilly topography and dense vegetation are natural ways of separating site components.

Natural Characteristics - When nature is incorporated into designs, spaces can be more comfortable, interesting, and efficient. It is important to understand natural systems and the way they interrelate in order to work within these constraints with the least amount of environmental impact.

- Wind - The major advantage of wind in the park is its warming/cooling aspect. For example, as the southerly winds prevail, orientation of structures, and outdoor gathering places need to take advantage of this warming wind movement, or "natural" air conditioning.
- Sun - Where the sun is abundant, shading for human comfort and safety in activity areas is to be provided. The most economical and practical way is to use natural vegetation, slope aspects, or introduced shade structures.
- Rainfall - Is to be captured for a variety of uses (e.g., drinking and bathing) and this water reused for secondary purposes (e.g., flushing toilets, washing clothes). Wastewater or excess runoff from developed areas is to be channeled and discharged in ways that allow for groundwater recharge instead of soil erosion. Minimizing disturbance to soils and vegetation and keeping development away from natural drainage ways protect the environment as well as the structure.
- Topography - Potentially can provide vertical separation and more privacy for individual

structures. Changes in topography can also enhance and vary the way a visitor experiences the site by changing intimacy or familiarity. Again, protection of native soil and vegetation are critical concerns in high slope areas.

- Geology and Soils - Designing with geologic features such as rock outcrops can enhance the sense of place. Soil disturbances should be kept to a minimum to avoid erosion of fragile soils and discourage growth of plants. If limited soil disturbance must take place, a continuous over cover of disturbed soils with erosion control netting will need to be maintained.

- Vegetation - Sensitive native plant species need to be identified and protected. Existing vegetation is to be maintained to encourage biodiversity and to protect the nutrients held in the biomass of native vegetation. Native planting is to be incorporated into all new developments in such a way that every removed plant is replaced by two new ones. Vegetation can enhance privacy, be used to create "natural rooms," and be a primary source of shade. Plants also contribute to the visual integrity or natural fit of a new development in a natural setting.

- Wildlife - Sensitive habitat areas will always be avoided. Encouraging wildlife to remain close to human activity centers enhances the visitor experience. This can be achieved by maintaining as much original habitat as possible.

- Visual Character - Creating onsite visual intrusions (road cuts, utilities, etc.) will be avoided, and views of offsite intrusions carefully controlled. Using native building material, hiding structures within the vegetation, and working with the topography can maintain a natural look. It is easier to minimize the building footprint initially than to heal a visual scar at the end of construction.

- Cultural Context - Local archeology, history, and people are the existing components into which visitation must fit. Sustainable principles seek balance between existing cultural patterns with new developments like this one. Developing an understanding of local culture and seeking their input in the development processes can make the difference between acceptance and failure.

- Archeology - A complete archeological survey prior to development is imperative to preserving resources as some archeological discoveries have been made before in this area. Once resources are located, they can be incorporated into the final designs as an educational or interpretive tool. If discovered during construction activities, work should be stopped and the site reevaluated. Sacred sites will be respected and protected.

- History - Cultural history bas been reinforced through design by investigating and then interpreting vernacular design vocabulary. Local design elements and architectural character have been analyzed and employed to establish an architectural theme for the new developments at the park.

- Indigenous Living Cultures - Cultural traditions need to be encouraged and nurtured. Hence a forum should be provided for local foods, music, art and crafts, lifestyles, dress, and architecture, as well as means to supplement local incomes. Traditional harvesting of resource products will be permitted to reinforce the value of maintaining the resource.

Construction Methods and Materials

If a project is to be successful, there should be no residual signs of construction, and environmental damage should not be permitted. Certain site design strategies should be discouraged based on the probable environmental impacts of the construction methods necessary to build them.

Construction Process Program. A careful organization and sequencing of construction is emphasized. Examples include building of walkways first, and then their use as access to the site. Also it is important to plan material staging for areas in conjunction with future facilities.

Construction Limits and Landscape Features. All undisturbed soil and vegetation located outside specifically designated construction limits will be protected. Where disturbance occurs, the site needs to be restored as soon as possible and all the topsoil from a construction area will be collected for use in site restoration. Flexibility in revising construction plans should be allowed to change materials and construction methods based on actual site impacts. Throughout construction, resource indicators will be monitored to ensure that resources are not being adversely affected.

Native Landscape Preservation / Restoration

Preservation of the natural landscape is of great importance during construction because it is much less expensive and more ecologically sound than subsequent restoration. Restoration of native planting patterns should be used when site disturbances are unavoidable (16). The site should be replanted with native materials in a mix consistent with that found in a natural ecosystem. In some instances, native materials will be used compositionally to achieve drama and visual interest for human benefit.

Interpretation of the restoration areas will inform and educate the public on the value of native landscape restoration. Protection of existing resources in the ecosystem is the fundamental purpose of sustainable design (17).

Visitor Safety and Security

Written and personal briefings by staff could help foster awareness of safety risks and allow visitors to take responsibility for their own safety and security.

Some important design considerations are as follows:

- Visitors must have a sense of personal safety and security to be attracted to recreation areas. The facility will have reasonable provisions to protect visitors from natural and manmade hazards. Location of walks and lodging are designed to discourage visitor of contacts with dangerous plants or animals.

- The design considers safety from climate extremes; visitors may be unaware of natural hazards, including intense sun, high wind, heavy rainfall or snow, and extreme humidity.

- Ecological integrity will be balanced with safety concerns in this development where adventure and challenge are important for the experience. Various challenge levels in site facilities will be provided to accommodate all visitors, including visitors with disabilities.

- The use of artificial lighting are to be limited to retain natural ambient light levels - using ground-mounted light fixtures to limit light impacts while providing a basic sense of security.

- Remote location and controlled access can enhance appropriate atmosphere and security to the facilities - incorporating natural barriers into facility design to minimize the need for security fencing or barriers has to be done.
- An alternate means of access will be available to provide essential emergency provisions of water, food, and medicine and a reliable communication system.

SENSE OF PLACE

In meeting the needs of the human community, development needs to be designed and built with an awareness of the interrelationships between natural, cultural, social, and economic resources both locally and globally (18). In order to make this development sustainable is aimed at an absolute minimal impact on the local, regional, and global environments. In providing facilities and activities for visitors a special care should be taken in preventing them to destroy the very resources or qualities they have come to experience (19) .

Sustainable Building Design Philosophy

Sustainable design balances human needs (rather than human wants) with the carrying capacity of the natural and cultural environments. It minimizes environmental impacts; it minimizes importation of goods and energy as well as the generation of waste. The ideal situation is that since this development is necessary, it will be constructed from natural sustainable materials collected onsite, generate its own energy from renewable sources such as solar or wind, and manage its own waste.

The use of immediate and locally available materials for construction will be made and hence done with economy and efficiency. The same strategies when used in development can minimize global and local impacts on resources. This ecologically sensitive design adjusts demands, lifestyles, and technologies to evolve a compatible balance with the natural and cultural systems within its environment (20).

Understanding Resource Sensitive Design

One method of describing sustainable building design is to compare it to other forms of resource based developments. Metaphorical interpretation of traditional forms of tourist resorts provides insight into the relationship that the facilities and visitors have with the resources upon which they are based.

Plantation

The plantation represents a significant piece of history of many not only tropical and subtropical, but also temperate areas. Characteristics of the traditional plantation include:

- a strong hierarchical organization of building forms (i.e., large main buildings for owners and visitors, small outbuildings for laborers, animals, agricultural processes, and storage)
- exploitation / importation of energy
- environmental degradation through the removal of native plant material and the introduction of cash crops with an emphasis on profit rather than the environment
- import and export as a primary operational mode, including export of capital to some extent, and import of building forms and technologies

The plantation model carries many negative connotations as a result of these very characteristics. Although representational of a harsh disregard for local natural and cultural resources, the plantation model can be seen in design and operation of numerous tourist resorts around the world. All too often, tourist-related development is conceived as a resource in and of itself. This type of plantation approach to tourism development satisfies its own needs through exploitation and importation, rather than through harmonic integration with its host environment.

Community

The community metaphor depicts resorts focused on activity more than the built environment (21). Characteristics of the activity-related resort include:

dispersion of building units in a functional but nonhierarchical pattern, often the resorts are conceptualized as "villages"

strong interaction of staff and visitors in a more democratic manner than the plantation model

integration of maintenance and operational staff into the life of the resort as a necessary element to sustain its operation

Resource based activities override concern for the local ecology or interest in interaction with native culture while the community model recognizes a dependency on the resources for its activities; it makes marginal investment in sustaining the health of those resources and typically operates in isolation from the local community. (22)

Aesculapia

A more appropriate metaphor for resource related design might be aesculapia, the Greek “place of healing”. In this model, nature is respected for its restorative qualities.

The human experience is set in harmony with the environment and an opportunity is created to allow a reconnection of human needs to the natural systems upon which all life is based. Applying these objectives to the national park would embrace the following characteristics:

- the primary senses - sight, hearing, smell, taste, and touch - are incorporated into the visitor experience to enhance understanding of the environment's uniqueness
- to be healing, visitors must experience an obvious organic connection with the natural and cultural context of the surroundings so as to appreciate their value and to seek ways to minimize biological disturbances

Sustainable Park Development

Today's increasing demand for ecologically oriented tourism provides a prime opportunity for applying the attributes of aesculapia to the National Park. (23). Following are criteria or standards that park intends to meet:

- Provide education for visitors on wildlife, native cultural resources, historic features, or natural features.
- Involve indigenous populations in operations and interpretation to foster local pride and visitor exposure to traditional values and techniques.
- Accomplish environmental restoration.
- Provide research and development for and/or demonstration projects of ways to minimize human impacts on the environment.
- Provide spiritual or emotional recuperation.
- Provide relaxation and recreation.
- Educate visitors that knowledge of our local and global environment is valuable and will

empower their ability to make informed decisions.

Sustainable Building Design Objectives

The long-term objective of sustainable design is to minimize resource degradation and consumption on a global scale (24). Therefore sustainable building design within the park seeks to:

- use the building as an educational tool to demonstrate the importance of the environment in sustaining human life
- reconnect humans with their environment for the spiritual, emotional, and therapeutic benefits that nature provides
- promote new human values and lifestyles to achieve a more harmonious relationship with local, regional and global resources and environments
- increase public awareness about appropriate technologies and the cradle-to-grave energy and waste implications of various building and consumer materials
- nurture living cultures to perpetuate indigenous responsiveness to and harmony with, local environmental factors
- relay cultural and historical understandings of the site with local, regional, and global relationships

Checklist for Sustainable Building Design of the Park's Infrastructure

General

The design (25) is meant to:

- be subordinate to the ecosystem and cultural context
- respect the natural and cultural resources of the site and absolutely minimize the impacts of any development
- reinforce/exemplify appropriate environmental responsiveness
- educate visitors/users about the resource and appropriate built responses to that environment.
- interpret how development works within natural systems to effect resource protection and human comfort and foster less consumptive lifestyles
- use the resource as the primary experience of the site and as the primary design determinant
- enhance appreciation of the natural environment and encourage/establish rules of conduct
- use the simplest technology appropriate to the functional need and incorporate passive energy conserving strategies responsive to the local climate
- use renewable indigenous building materials to the greatest extent possible
- avoid use of energy intensive, environmentally damaging, waste producing, and/or hazardous materials
- strive for "smaller is better", optimizing use and flexibility of spaces so overall building size and the resources necessary for construction and operation are minimized
- strive for minimal environmental disruption, resource consumption, and material waste, and identify opportunities for reuse/recycling of construction debris
- provide equal access to the full spectrum of people with physical and sensory impairments while minimizing impacts on natural and cultural resources

Also, the design's aim is to

- consider phasing the development to allow monitoring of resource impacts and adjustments in subsequent phases
- allow for future expansion and/or adaptive uses with a minimum of demolition and waste
- materials and components should be chosen that can be easily reused or recycled
- make it easy for the occupants/operators to recycle waste

Natural Factors

By definition, sustainable design seeks harmony with its environment just like facilities relate to their context. It should be obvious as to provide environmental education for its users. The following information serves as a checklist of basic considerations that have been adopted for the sustainable development of any National Park.

Climate

The development proposes to:

- apply natural conditioning techniques to effect appropriate comfort levels for human activities - do not isolate human needs from the environment
- avoid over dependence on mechanical systems to alter the climate (such dependency signifies inappropriate design, disassociation from the environment, and non sustainable use of resources)
- analyze whether the climate is comfortable for the anticipated activities, and then which of the primary climatic components of temperature, sun, wind and moisture can improve the comfort levels.

Temperature

- temperature is a liability in climates where it is occasionally too hot or too cold
- areas that are very dry or at high elevation typically have the asset of large temperature swings from daytime heating to nighttime cooling, which can be flattened through heavy/massive construction to yield relatively constant indoor temperatures
- when climate is predominantly too hot for comfort:
- minimize solid enclosure and thermal mass
- maximize roof ventilation
- use elongated or fractured floor plans to minimize internal heat gain and maximize exposure for ventilation
- separate rooms and functions with covered breezeways to maximize wall shading and induce ventilation
- isolate heat generating functions such as kitchens and laundries from living areas
- provide shaded outdoor living areas such as porches and decks
- capitalize on cool nighttime temperatures, breezes or ground temperatures
- when climate is predominantly too cool for comfort
- consolidate functions into most compact configuration
- insulate thoroughly to minimize heat loss
- minimize air infiltration with barrier sheeting, weather stripping, sealant and airlock entries
- minimize openings not oriented toward sun exposure

Sun

- sun can be a significant liability in hot climates, but is rarely a liability in cold climates
- sun can be an asset in cool and cold climates to provide passive heating
- design must reflect seasonal variations in solar intensity, incidence angle, cloud cover, and storm influences
- when solar gain causes conditions too hot for comfort
- use overhangs to shade walls and openings
- use site features and vegetation to provide shading to walls with eastern and western exposure
- use shading devices such as louvers, cove-

red porches and trellises with natural vines to block sun without blocking out breezes and natural light
- orient broad building surfaces away from the hot late-day western sun (only northern and southern exposures are easily shaded)
- use lighter-colored wall and roofing material to reflect solar radiation (be sensitive to resulting glare and impact on natural/cultural setting)
- when solar gain is to be used to offset conditions that are too cool for comfort
- maximize building exposure and openings facing south
- increase thermal mass and envelope insulation
- use darker colored building exteriors to absorb solar radiation and promote heat gain

Wind
- wind is a liability in cold climates because it strips heat away quicker than normal; wind can also be a liability to comfort in hot dry climates when it causes the human body to dehydrate and then overheat
- wind can be an asset in hot, humid climates to provide natural ventilation
- use natural ventilation wherever feasible; limit air-conditioning to areas requiring special humidity or temperature control such as artifact storage and computer rooms
- maximize/minimize exposure to wind through plan orientation and configuration, number and position of wall and roof openings and relation to grade and vegetation
- use wind scoops, thermal chimneys or wind turbines to induce ventilation on sites with limited wind.

Moisture
- moisture can be a liability if it comes in the form of humidity, causing such stickiness that one cannot cool by perspiring in summer
- strategies to reduce the discomfort of high humidity include maximizing ventilation, inducing air flow around facilities and venting or moving moisture producing functions such as kitchens and shower rooms in outside areas
- nature can be an asset by evaporating in hot, dry climates to cool and humidify the air
- techniques for evaporative cooling include placing facilities where breezes will pass over water features before reaching the facility, and providing fountains, pools, and plants

Other Climatic Considerations
- rainfall can be a liability if any concentrated runoff from developed surfaces is not managed to avoid erosion
- rainfall can be an asset if it is collected off roofs for use as drinking water
- storms / cyclones
- provide or make arrangements for emergency storm shelters
- avoid development in floodplain and storm surge areas
- consider wind effects on walls and roofs
- provide storm shutters for openings
- use appropriate wind bracing and tie downs
- design facilities to be light enough and of readily available and renewable materials to be safely sacrificial to large storms or of sufficient mass and detail to prevent loss of life and material

Vegetation

The development shall propose to:
- locate and size facilities to avoid cutting mature vegetation and to minimize disruption to or disassociation with, other natural features
- use natural vegetation and adjustments in building plan to diminish the visual impact of facilities and to minimize imposition on environmental context
- in warmer climates, strengthen interplay of facilities with their site environment through minimizing solid walls, creating outdoor activity spaces, etc.

Topography

The development shall propose to:
- consider building to minimize disturbance to site character, skyline, vegetation, hydrology and soils
- consolidate functions or segment facilities to reduce footprint of individual structures to allow sensitive placement within existing landforms
- use landforms and the sensitive arrangement of buildings to
- help diminish the visual impact of facilities
- enhance visual quality by creating a rhythm of open spaces and framed views
- orient visitors to building entrances
- accentuate key landmarks, vistas and facilities

Hydrology

The development shall propose to:
- locate and design facilities to minimize erosion and impacts on natural hydrological systems
- safeguard hydrological system from contamination by development / activities
- allow precipitation to natural recharge groundwater, wherever possible

Geology / Soils

The development shall propose to:
- minimize excavation and disturbance to groundcover
- minimize erosion by avoiding large impervious surface areas and building footprints that collect rain and create concentrate runoff onto site

Pests

The development shall propose to:
- design facilities to minimize intrusion by noxious insects, reptiles and rodents
- ensure that facility operators use natural means for pest control

Wildlife

The development shall propose to:
- respect importance of biodiversity and the humble role of humans in design
- avoid disruption of wildlife travel or nesting patterns by sensitive sitting of development and by limits set on construction activity and facility operation.
- allow opportunities for users to be aware of indigenous wildlife by observing and not disturbing

Human Factors and Cultural Resources

Archeological resources – it is proposed to:
- use preservation and interpretation of archeological features to provide insight to previous cultural responses to the environment, their successes as well as failures

Vernacular architecture – it is proposed to
- analyze local historic building styles, systems and materials usually for time tested approaches in harmony with natural systems
- use local building material, craftsmen and techniques to practically greatest extent in the development of new facilities

Sociology – it is proposed to:
- understand the local culture and peoples needs to avoid introduction of socially unacceptable or morally offensive practices
- consult with local indigenous population about design input and foster their sense of ownership and acceptance

- include local construction techniques, materials and cultural considerations (that are environmentally sound) in the development of new facilities

Arts and crafts – it is proposed to:
- incorporate local expressions of art, handiwork, detailing and, when appropriate, technology into new facility design and interior design
- provide opportunities and space for demonstration of local crafts and performing arts

Sensory Experience

Visual – it is proposed to:
- provide visitors with ready access to educational materials to enhance their understanding and appreciation of the local environment and threats to it
- incorporate views of natural and cultural resources into even routine activities to provide opportunities for contemplation, relaxation and appreciation
- use design principles of scale, rhythm, proportion, balance and composition to enhance the complementary integration of facilities into environmental context
- provide visual surprises within design of facilities to stimulate the educational experience
- use colors to blend facilities with natural context, unless contradictory to other environmental considerations or cultural values

Sounds - it is proposed to:
- Locate service and maintenance functions away from public areas
- space lodging units and interpretive stops so that natural, not human, sounds dominate
- use vegetation to create sound baffle between public and private activities
- orient openings toward natural sounds such the lapping of waves, babbling of streams and rustling of leaves by the wind
- restrict the use or audio level of unnatural sounds such as radios and televisions

Touch - it is proposed to:
- allow visitors to touch and be in touch with the natural and cultural resources of the site
- vary walking surfaces to identify or give different quality to different spaces
- use contrasting textures to direct attention to interpretive opportunities

Smell - it is proposed to:
- allow natural fragrances of vegetation to be enjoyed
- direct air exhausted from utility areas away from public areas

Taste - it is proposed to
- provide opportunities to sample local products and cuisine

Environmentally Sensitive Building Materials Selection Priorities

(Used to Determine Appropriate Building Materials for the Park's Infrastructure) (26)

When their source is sustainable:
- Natural materials are less energy intensive and polluting to produce and contribute less to indoor air pollution.
- Local materials have a reduced level of energy cost and air pollution associated with their transportation and can help sustain the local economy.
- Durable materials can save on energy costs for maintenance as well as for the production and installation of replacement products.

In selecting building materials, prioritizing them by origin and avoiding materials from nonrenewable sources was done. The following guidelines should be used.

Primary - materials found in nature such as stone, soil, reed, wool, cotton, and wood
- ensure new lumber is from certified sustainable managed forests or certified naturally felled trees
- use caution that any associated treatments, additives or adhesives do not contain toxins or off-gas volatile organic compounds that contribute to indoor air/atmospheric pollution

Secondary Materials - materials made from recycled products such as wood, aluminum, cellulose and plastics
- verify that production of material does not involve high levels of energy, pollution, or waste
- verify functional efficiency and environmental safeness of recycled materials and products from old buildings
- look closely at the composition of recycled products; toxins may still be present
- consider cellulose insulation; it is fireproof
- specify aluminum from recycled material; it uses 80% less energy to produce over initial

Tertiary - man made materials (artificial, synthetic, non renewable) materials having varying degrees of environmental impact such as plywood, plastics, and aluminum
- avoid use of materials and products containing or produced with chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs) that deteriorate the ozone layer
- avoid materials that give off gas volatile organic compounds, contributing to indoor air/atmospheric pollution
- minimize use of products made from new aluminum or other materials that are resource disruptive during extraction and a high energy consumer during refinement

CONCLUSION

Sustainability refers to a process and an attitude or viewpoint. It is a process wherein responsible consumption is practiced, so as to minimize waste and interact in balanced ways with natural environments and cycles. (27) In terms of process, the task is to formulate a program and a process where comprehensive nature would balance the desires and activities of human kind within the integrity and carry the capacity of nature, instead of a defined wish list of idealized conditions, principles and processes. That is what we should adopt to achieve a stable, long-term relationship within the limits of our local and global environment. It represents a process document. It presents a complete and coherent theory for the realization of the sustainable environment. It also describes a politically workable, economically feasible process through which the balance-seeking process of sustainability may be actualized. (28) The accomplishments are not so much in achievement of perfect environments as they are in raising consciousness and defining appropriate, effective steps and actions. The same if not much more applies to the National Parks..

Sustainable architecture is also a response and an expression of gratitude for our existence and respect for the world around us. The human environment is what the resources of the natural universe are sustaining. We recognize that we cannot create, we cannot live or survive without the use of the resources of the universe and we are filled with awe and respect. (29) A sense of sacredness attaches itself to those

resources. In response the concept is best expressed in the term "stewardship." When we do these things, and say these things with understanding, we cross into another realm - leaving behind the simple innocence of ignorance. We can see our allies, ourselves and the world more clearly now. We have formulated a rudimentary value system and we are further on the path to the formulation of a workman's code, the view of the good steward of our National Parks too (30).

Although the term "Sustainable Architecture" transmits slightly different meanings to different audiences, nevertheless it serves as a rallying point for creating greater concern about the built environment and its long-term viability. Rather than signaling a return to subsistence living, sustainability means an increase in quality and standard of living, using and enjoying our National Parks too.

The key to sustainable architecture is in recognizing our position as temporary stewards of our environment everywhere. The better we as architects understand and implement our stewardship of the built environment, the greater the quality life of future generations which we will enjoy (31). Within the borders of our National Parks too.

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