Protecting Park Resources within a Developing Landscape

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Parks, wilderness areas, and other protected natural areas across this country, and indeed throughout the developed world, are under increasing pressure from various types of land development. Human population growth continues to increase at an alarming rate. In the United States, emigration adds to an already pressing problem of accelerated resource consumption. When viewing the condition of the world natural resource base, added to economic pressure for continued intense resource use within this country, the mission of the U.S. National Park Service takes on herculean proportions.

The USNPS, charged with managing the world's first national park system, is faced with the challenging task of assuring that the natural, biological, and cultural integrity of the parks are perpetuated. The USNPS has always been faced with problems relating to that age-old balance between resource preservation and visitor use within the parks, but only within the last two decades have major threats from outside the parks began to be recognized. Today many of these perceived threats have become a reality and have developed into seemingly impossible problems to solve.

Increasing land use pressures resulting from the expansion of residential areas and the conversion of natural landscapes to agricultural and industrial purposes is becoming one of the most pervasive and widespread of these threats. One of the parks where many of today's pressing issues are coming to a head is Shenandoah National Park.

Located within 50 km of the greater Washington, D.C., metropolitan area, Shenandoah National Park is in a geographic region which is experiencing rapid population growth. Although rapid growth is occurring throughout the entire eastern section of Virginia, the greatest direct impact to the park results from the continual rapid outward expansion of the greater Washington area. Expanding growth has moved high-density populations closer to the park, resulting in changes in its use. Day-use visits now account for a greater proportion of total visitation than they did a decade ago. Highway improvements and the relocating of major businesses to the suburbs have reduced commuting time from the park to major job markets from two hours to a little over one hour. This

allows people with a wide range of occupations to reside next to the park while retaining their high-salaried urban jobs.

Rapid expansion of these metropolitan areas has had a dramatic effect on local economies. Real estate values have risen over 400% in the past decade. Land parcels that have common boundaries with the park have increased at an even greater rate. Much of the park boundary area is experiencing a land rush that continues to drive prices up. The effects of these price increases are already beginning to be seen. Farm and forested lands are being divided, and are either developed as residential subdivisions or sold as 10- to 20-acre farmettes. Opportunities for traditional uses such as hunting and other outdoor sports are being lost as more and more properties are posted "No Trespassing." Long-standing public access to park trails originating along the boundary are also being lost.

Coping with the economic and social issues brought about by rapid land-use changes is a growing concern for people residing in many areas of the country. The USNPS, however, has the unique responsibility of developing long-term strategies to preserve those delicate ecological balances that are the foundation of the biological significance of national parks. At particular risk is the ability of park ecosystems to function without constant human manipulation. A current and pressing example is the management of the larger species of mammals. Strip development along park boundaries decreases the opportunity for the larger mammals to move freely in or out, therefore having a negative effect on population dynamics and genetic transfer. At Shenandoah, reduction in harvest of species such as whitetailed deer and black bear during legal hunting seasons around the park may result in over-abundance of these species. Habitat destruction attributed to over-browsing by deer is already being seen in several areas of the park. Continued population growth will lead to increased incidents of property damage and livestock and crop depredation on nearby farms and residential areas.

Changes in land-use patterns near the park are also starting to have an adverse effect on visitor enjoyment, particularly as it relates to scenic quality. The Shenandoah National Park enabling legislation refers to the park and the world-famous Skyline Drive as an elevated viewing platform from which spectacular views of the Shenandoah Valley to the West and the Piedmont Plateau to the East can be enjoyed. The traditional view is a pleasing pattern of a rural landscape dominated by farms, woodlots, larger forested areas, and small communities. These pastoral scenes are being replaced by views of industry, housing subdivisions, and the pervasive influx of residential farmettes.

Increases in local industry and demands for additional electric power generation are adding to the degradation of air quality. Oncegrand views are already seriously impaired by air pollution. Visibility in the region has decreased by over 50% in the last two decades. Sulfur dioxide and nitrogen oxide emissions are causing an unprecedented increase in stream acidification that threatens the functioning of aquatic ecosystems.

Similar problems are shared by other parks throughout the U.S. National Park System. However, the situation at Shenandoah is unique.

Approximately 90 percent of the 352-mile park boundary is bordered by privately owned lands. Park issues and programs related to land and resource management must be communicated to thousands of landowners and scores of local governments. This is unlike most other large natural-area parks that are bordered by national forests or other public lands. These factors make the assessment and monitoring of lands related to the park and the development of any cooperative land-use planning programs very complex.

Now that the litany of woe and despair has been presented, we ask ourselves, What can we do? It is becoming increasingly clear that the USNPS must quickly learn how to integrate the values and needs of park protection with local socioeconomic needs and lifestyle values. The management of Shenandoah National Park has recognized this growing need for several years. In 1989, preliminary plans were made to initiate an intensive planning effort to address the growing problems associated with rapid local growth. Any further delay would result in a serious loss of opportunities to have a positive influence on land development along major sections of the park boundary area. A program, now commonly referred to as the "Related Lands Initiative," began to take form. A conceptual framework was established which contains several key elements that will be carried out in three phases.

Phase I consists of two primary elements: an inventory of the current status and conditions of those lands related to the park, and the implementation of a two-year research project referred as the "Related Lands Study."

Based on a conceptual framework of the desired results of the program, land-use data needs were identified that include: statistics on the contribution of the park to local economies, current land forms and use patterns in areas where the park borders private land, existence of critical habitats or resources that lie outside the park boundary, the relative visibility of private landscapes from key viewpoints inside the park, and current land-use zoning ordinances in the eight counties bordering on the park.

The objectives of the Related Lands Study are to: (1) identify values and concerns that are important to the residents of the eight counties that border the park; (2) identify values and concerns that USNPS believes are relevant to continued protection and perpetuation of the park; and (3) identify those values and concerns which are common to the citizens and USNPS, and then establish a cooperative framework for their long-term protection. An important component of the study will be public involvement, in which private landowners; city, county and state governments and agencies; and special interest groups will be asked to identify values and resources both within the park and on nearby lands that deserve special management or protection. These values will then be compared with USNPS values. Areas of agreement and potential conflicts will be identified.

Resolution of any areas of conflict will be carried out in a series of public meetings that are to be conducted by the Center for Environmental Negotiation, a portion of the University of Virginia study team.

The study team will seek to identify methods that can protect the agreed-upon set of values. One set

of methods that has been used in a similar process in Canada (Patter, et al., 1988) included an array of land protection possibilities, including (ranging from least to most restrictive): voluntary, verbal commitments from land owners to protect the designated resource; voluntary, written land protection agreements; enforceable county zoning; enforceable covenants or easements on identified lands purchased by local governments or environmental organizations; purchase and sellback with easements, and lastly, direct acquisition or donation of lands by private citizens to the park. All of these methods are strictly voluntary. No private landowner would be forced to enter into any form of agreement. Other methods of attaining the desired protection would also be explored.

Phase II is the creation of a set of interactive Geographic Information System (GIS) databases that will support the Related Lands Study and can be used analytically to assess values and to monitor changes in a wide array of themes. To quickly obtain data from large geographic areas, the park staff will use remote sensing technology such as SPOT satellite scenes and color infrared photography. These new themes will be used in conjunction with existing themes to inventory land uses and sensitive resources, record land ownership, and perform analytical functions such as viewshed determinations.

The basic GIS land themes developed for the park GIS since 1986 were configured for use with SAGIS software. The park's new Related Lands Initiative accelerated the planned change from this vector system to the more widely used raster-based GRASS software. GRASS is now operated on a new SUN SPARKS computer station and 1.2-gigabyte tape drive. Existing SAGIS themes being converted to GRASS include: topography (DMA), streams, forest cover types, geology, soils, fire history, critical habitats, locations of threatened and endangered species, Long-Term Ecological Monitoring System (LTEMS) plot locations, cultural sites, and the human-related themes of park and county boundaries, developed areas, roads, trails, utility rights-of-way, and special park uses. Major new themes under development for non-park lands include: land classification along the park boundary (forest, agricultural, low-density residential, high-density residential and industrial); land ownership of all parcels adjoining the park; viewsheds (analyzed from 76 different viewpoints along the Skyline Drive and four mountain peaks); significant habitats, such as winter range, threatened and endangered species outside the park, etc.; wildlife travel corridors; critical access lands (parcels that include trail access, etc.); protected private lands (those with restrictive easements currently in existence); and unprotected cultural resources.

Phase III will be the evaluation of alternative methods for the USNPS and local governments and citizens to work cooperatively toward the protection of the values and concerns identified in Phase I. One such alternative which will be evaluated is the creation of a Central Appalachian Biosphere Reserve. The park and the neighboring two national forests were identified as a high-priority site for biosphere reserve designation by the Man and the Biosphere Program's eastern deciduous forest biome study team in 1985. A highly

active biosphere reserve could well be the ideal interactive medium to bring the private sector and the various federal and state agencies together in a truly common sense of purpose for the good of all.

The Shenandoah National Park Related Lands Initiative is still in the formative stages and continued fine tuning is expected. It is obvious from this program overview that it could not be done without the land-based data acquisition, storage, and analytical capabilities of advanced GIS technology. Critical management programs such as this provide vivid illustrations of the importance of resource management technology that is firmly rooted in the sciences. Disciplines that are needed to provide critical input into the various GIS themes include forest ecology, wildlife biology, aquatic ecology, fisheries, hydrology, soil science, geology, entomology, archeology, sociology, and economics.

The critical management needs of Shenandoah National Park are amply depicted in this new management initiative. They highlight the importance of research and scientifically based professional resource management programs to the continued existence of parks and the U.S. National Park System.

Literature Cited

Patter, M.V., H. Gerts, and S. Hilts. 1988. "Enhancing Private Land Stewardship." *Natural Areas Journal*, Vol. 10, Number 3.

This paper was presented at the Society's Sixth Conference on Research and Resource Management in National Parks and Equivalent Reserves, held in November 1990 in El Paso, Texas.

The date and venue of the 1992 GWS Conference have been set. Instead of the first week of November 1992 (as we tentatively said in the last issue), we will meet during the third week. The site will be the Marina Hotel at St. John's Place in Jacksonville, Florida. Full details and a call for papers will be mailed to all GWS members soon, and will also appear in the next Forum.

NOVEMBER 1992

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22/29	23/30	24	25	26	27	28

THIRD WEEK IN NOVEMBER 1992–GWS SEVENTH CONFERENCE–JACKSONVILLE, FLORIDA

Thanksgiving