

The Importance of Natural Soundscapes in National Parks

-- Overview: Soundscape Preservation and Noise Management Planning--

Introduction

The various purposes for national parks are described in the National Park Service Organic Act. They include conservation of scenery and natural and historic objects and wildlife, which are to be left unimpaired for enjoyment by this and future generations. One might ask how it is possible to enjoy scenic quality, wildlife viewing, wilderness solitude, or a myriad of natural and cultural values found in national parks, when the whole is overlain by modern human-caused noise. Natural sounds accompany a natural setting. The soundscape is a resource and an inherent value associated with a park. Why manage for a natural soundscape? The answer to that question is the same as the answer to: Why manage for any other natural value in a park?

To explore this topic, several areas of discussion are presented: sound as a natural resource; sources of noise in national parks; and soundscape management planning. The final section presents a summary of laws, regulations and policies relevant to soundscape management.

Natural Sound as a Resource or Value in National Parks

NPS recognizes that natural sound is a resource and a value to be appreciated— concurrent with all other natural values that are specified in laws, regulations, and executive orders. It has established policy for protection and restoration of the natural soundscape. Although sound is not tangible in the sense that it can be touched or seen, it is very real. Sound is part of the context of existence for animals that have a full complement of sensory organs. A “natural” setting for humans is not complete unless the soundscape is also natural. Human presence in a natural setting, often evident because of the sounds humans produce, has real impacts that can be seen.

At times, it is necessary to distinguish between the inherent value of a resource by virtue of its existence, and its value as an object or phenomenon to be enjoyed by people. In terms of protection or conservation by NPS, both are critical. Unless the resource is protected or conserved and valued in its own right, it may over time become unavailable, degraded, or altered – impaired – reducing its value as a natural wonder to be enjoyed.

The soundscape as an inherent value may be difficult to grasp. To paraphrase a Zen question: if a tree falls in the forest, does it make a sound? Among the many possible answers: no, not if there is no one to hear it. Or, yes – a sound is what it is. Also, what about squirrels and deer – they hear it or feel it and are affected by it, even if people are not present. What about the impact on the ground? The point is that there are subtle and not so subtle changes in habitats when human sounds are imposed on a natural setting. There are relationships among occupants of habitats that are strongly keyed to types and levels of sound intrusion. These are just being investigated as sophisticated ways of monitoring both animals and sound concurrently are being developed.

There are many examples of natural sounds that characterize unique park resources – why people visit and enjoy the park. Among the most notable are the sounds of wolves, elk, geysers, and hot springs in Yellowstone National Park. But, for many people it is merely the birds, bees, and wind in the trees - mountain music – that is most enjoyable. Or, stated another way, what people enjoy is the absence of other human-caused sound that is so prevalent in daily life.

It is not only natural sounds, as such, that need to be conserved. Natural sounds are important in the context of enjoying the natural environment. Alternately, many parks contain unique cultural resources: battlefields, historic cabins or homes, preserved evidence of a people or an early lifestyle. These are offered for the appreciation of visitors, and it is important that the acoustic environment is as consistent with the preserved cultural environment as it can be. National memorials, while not emphasizing “naturalness” qualities or cultural qualities, per se, are established to provide a reverent and contemplative environment. Such terms, in addition to “solitude” or “wilderness” clearly evoke some interpretation of the soundscape as “quiet” or lacking significant intrusions by human-caused sound.

Apart from today’s legal necessities in both conserving park resources and enjoying them, it is illuminating to review history leading up to establishment of the National Park System. There is much testimony, long before the advent of snowmobiles and commercial air travel, about preserving places to get away from the rigors of daily life; about the need for a refuge in which to obtain solitude and rejuvenate one’s spirit; about the need for immersing oneself in nature. It was in this spirit that the National Parks Organic Act was written. The Wilderness Act, under whose authority lands in a number of federal jurisdictions are preserved, invokes the same spirit.

Sources of Inappropriate Sound in National Parks

Since parks were created in part for enjoyment by people, present and future generations, the element of human sound is necessarily present. Roads, trails, modes of access, facilities, facility maintenance, et al, represent sources of sound. The irony, which represents the crux of many soundscape issues in national parks, is that people who wish to enjoy the natural values are by this act directly or indirectly affecting the quality of the resource itself.

Some who enjoy national parks using certain modes of access at the same time create sounds that impacts the experience of other visitors. While one is viewing the park via an air tour, an auto, a snowmobile or snowcoach, personal water craft, motorcycle, or a bus, sounds are created for other people who have an expectation of quiet, solitude, or appreciation of natural sounds. Adding to the difficulty, people who use these modes of access are not often aware of the impact on other people. Perhaps the most extreme example of this is in the use of air tours to view parks or significant park features from above.

The existence of human infrastructure in and near a park is an index to the type, level and amount of “created” sound present in a park. Some parks contain through roads or highways. Most parks have roaded access. Many parks have nearby airports. Nearly all parks have visitor facilities such as lodges, visitor centers, trail heads, information kiosks, or other areas that people access and congregate around. Use and maintenance of these facilities are sources of “created” sound. The more development there is of this nature, the higher is the level of sound – generally – and the greater is the period during which human-caused sound may be audible over a large percentage of the time.

Other sources of non-natural sound originate from beyond the park boundaries, and beyond the regulatory authority of NPS. These include aircraft overflights of a commercial or military nature, at higher elevations, depending on the proximity of the park to a commercial airport or military installation. Air tours, originating from nearby airstrips or airports, are designed specifically for flying over a park at close range with fixed wing and helicopter conveyances. Distant highway traffic and motorized vehicles using adjacent public lands are other common sources of sound affecting a park.

Individual sources of sound may not be loud, frequent, or otherwise dominant. However, the total impact of non-natural sound involves all sources cumulatively as they affect the natural soundscape. It is the combination of sounds, their loudness, their frequency (in terms of sound spectra), their frequency and duration (in terms of time), and the physical character of the landscape that determine the impact. The

total impact may cover large areas in the park, where human sound is audible beyond its various sources. And, it may be audible through a large percentage of the day, each day. In many parks today, this cumulative impact of sound is to be reckoned with as potentially impairing park resources and values or their enjoyment.

Regarding both individual types of sound sources and their cumulative effect, the key analysis issue is in determining what levels and types of sound are appropriate or acceptable for different management areas throughout a park. Various terms presented in this discussion, such as human-caused sound, non-natural sound, created sound, and the like all lead to the idea that some sounds and sound conditions are not appropriate upon considering the purposes for which a park unit may have been established. Hence, we distinguish between appropriate and inappropriate sounds or sound conditions.

Soundscape Management Planning

Park Service Policy

NPS Director's Order #47, December of 2000, references mandates and policies to set into motion requirements for addressing problems of inappropriate sound affecting national park units. The vehicle whereby these requirements are met is in performing a planning and compliance process, and implementing resultant measures designed to eliminate, mitigate or minimize inappropriate sound.

Where the need exists, parks are to:

- Describe desired future conditions for soundscapes
- Describe ambient natural sound environments (baseline)
- Identify the level, nature, and origin of sound sources affecting the park
- Identify sound sources and conditions consistent with park purposes
- Articulate measures that will move the park toward desired soundscape condition

The order reminds parks of the planning process to be followed – provided in DO #2 (Park Planning). Also, park planning is necessarily conducted to meet the requirements of the National Environmental Policy Act, with further guidance in DO #12. The requirements conveyed generally under all three director's orders are referred to as Soundscape Management Planning.

Soundscape Management Objectives

Management zone objectives for the natural soundscape, if not articulated in a General Management Plan, can easily be inferred from other objectives using key words and phrases like 'solitude,' 'undisturbed,' or 'natural.' Some planning documents contain suitable objectives, or desired conditions, for sound in the objectives for visitor experience. Objectives should be specific to the soundscape resource because they relate to more than just visitor experience. The soundscape is best viewed as a resource, which, when impacted, further impacts visitors, wildlife, cultural resources, or othersound-sensitive resource.

Suitable indicators, such as "distance and time human-caused sound is audible," should be provided as representative measures of the objective. Specific (quantified) desired conditions for these indicators, such as "not audible more than 10% of the time" should be presented. The methods and assumptions section for soundscape should explain the analysis parameters and their relationship to indicators, if they are different. The analysis should be quantified to the extent that allows a reasonable person to be able to track the stated impact to the defined impact threshold. After all is said and done, the desired conditions should become quantified standards by which a plan is implemented and monitored. For more details and examples of each of these tasks, please see the paper in this series that provides details on Soundscape Management Planning.

Soundscape Impact Analysis: Impact Thresholds

The development of impact thresholds that are effective in the analysis of proposed actions is dependent upon several things. First, suitable and specific guidance/objectives must be articulated in a current management plan. Second, within the hierarchy of objectives, indicators and standards must be provided. For each management zone there must be one or more indicators described whose measurement is an index to performance in meeting the objective. Then, for each indicator, there must be a standard (threshold) by which performance is actually measured. Third, there must be a viable and acceptable tool (or method) for actually measuring the indicator and for modeling it in an effects analysis. The applicability and results of a model should be field checked and calibrated. This can only happen if the same indicator is being used/measured for both. With this basis, impact thresholds can be developed to tie the impacts analysis to park objectives for an effective comparison. In short, the basis for determination of adverse impact – and later for impairment – is the degree to which anticipated alternatives depart from objectives located in the management plan.

Some indicators for impact/threshold analysis are: area of audibility, sound pressure level, and sound frequency. These indicators must be viewed in the context of where and when impacts occur. Thresholds must integrate all these concerns. Context, time factors (e.g., duration, frequency of occurrence, and sensitive time periods), location and intensity interact in a complex manner to determine the degree of impact for an activity. For example, a certain duration and intensity of sound would have greater impact in a highly sensitive land use or resource context. Also, a given intensity would have greater impact if it occurred more often, for longer duration, or over a greater area. The time of day or time of year a given noise occurs can also have a significant influence on the impact it will have. Management judgment, based upon a well supported and documented rationale, must be used to determine what degree of impact best applies in individual parks.

Example definitions of the various thresholds that might be applied in describing effects on soundscapes are presented in another paper in this series relating to soundscape impact assessment. These definitions are provided as general guidance and should not be adopted as the park-specific thresholds without sufficient preparation as described above. Directions for management of various park units differ, sometimes dramatically, and therefore the thresholds must be set park by park and management zone by management zone. For example, a national recreation area by its nature is required to allow recreational boating uses which will produce noise and therefore the thresholds for an NRA could be significantly different than for a park containing mostly designated or recommended wilderness. However, standards for restoring and maintaining soundscapes should be relatively consistent from park to park where similar zone types exist.

The level and type of impact, as it may vary from park to park, could result in different levels of mitigation needed to achieve the same standard. Impact thresholds (or levels) may be used as a guideline to make conclusions about impacts from a proposed action or alternatives to it. It is appropriate to consider impacts across the range of management zone types that are affected by an action, so wording is provided for the natural or wilderness end of the spectrum and for the developed end. Note that the impacts of a proposed action (and its noise) on wildlife, cultural resources, or visitor experience would be defined specifically in those sections of an environmental document.

Any decision that may result from a proposal and an analysis of impacts should be accompanied by criteria to be used in monitoring the actual results of implementation. Monitoring should include a program to assure the provisions of the decision (including mitigation) are implemented, to evaluate performance in light of the objectives the action is intended to reach,

and to assess the ability of mitigation measures to reduce impacts acceptably. Monitoring standards are easily designed along the lines of well-considered objectives. Details and examples are provided in another paper in this series on monitoring and inventory.

Guiding Regulations and Policies:

The management of the national park system is guided by the Constitution, public laws, treaties, proclamations, Executive orders, regulations, and directives of the Secretary of the Interior and the Assistant Secretary of Fish Wildlife and Parks. All NPS policies must be consistent with these higher authorities, and with appropriate delegations of authority. Published NPS policies are mandatory, except that they may be waived by the Park Service Director under certain conditions.

Legislation

Organic Act and the General Authorities Act

The NPS and its basic mandate are authorized under the NPS Organic Act (16 USC 1, 2-4) and the General Authorities Act (16 USC 1a-1 through 1a-8):

The Service thus established shall promote and regulate the use of Federal areas known as National Parks...by such a means and measures as to conform to the fundamental purposes of the said Parks...which purpose it is to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.”

The Redwood Act

The Redwood Act (March 27, 1978, P.L. 95-250, 92 Stat. 163, 16 U.S.C. 1a-1) affirms the basic tenets of the Organic Act and provides additional guidance on national park system management:

“the authorization of activities shall be construed and the protection management and administration of these areas shall be conducted in light of the high public value and integrity of the national park system and shall not be exercised in derogation of the values and purposes for which these various areas have been established...”

The restatement of the principles of park management is intended to serve as the basis for any judicial resolution of competing private and public values and interests in the national park system (Senate Report No. 95-528 on S. 1976 pg.7). The establishment legislation of each park area provides the authority and direction for management of each park area within the national park system. Purposes stated in the parks establishing legislation or proclamation as the resources and values of a park whose conservation is essential to the purposes for which the area was included in the national park system.

The Federal Aviation Act of 1958

This law gives the authority for managing the airspace of the United States to the Administrator of the Federal Aviation Authority (FAA). The FAA has the authority and mandate to prescribe rules and regulations governing the flight of aircraft, including rules as to the safe altitude of flight, for the purposes of 1) navigation, protection and identification of aircraft, 2) the protection of persons and property on the ground, 3) the efficient utilization of navigable airspace, and 4) protection to the public health and welfare from aircraft noise and sonic boom.

Airport and Airway Development Act of 1970 (P.L. 91-258, 84 Stat. 226, 49 U.S.C. §2208)

Requires airport development projects to provide for the protection and enhancement of the natural resources and environmental quality and limits the secretary of transportation in circumventing this purpose. No airports can be authorized with adverse environmental impacts unless it is determined in writing that no feasible and prudent alternatives exist and steps have

been taken to minimize adverse effects. Relationship is identical to §4(f) of Department of Transportation Act.

Noise Control Act of 1972, as amended (P.L. 92-574, 42 U.S.C. §4901 et seq.)

Sets standards and procedures for limiting noise that jeopardizes Americans health and welfare. Requires publication of information on limits of noise required to protect public health and welfare. Authorizes the Office of Noise Abatement within the Environmental Protection Agency to specify noise limits for products distributed in commerce.

Grand Canyon National Park Enlargement Act (P.L. 93-620 §8)

Section 8 recognized “natural quiet as a value or resource in its own right to be protected from significant adverse effect. In addition, it specifically addressed the potential for helicopter operations to cause a significant adverse effect on natural quiet and experience of the park.

National Parks Overflight Act (1987) (P.L. 100-91)

The National Parks Overflight Act directed the NPS and the US Forest Service (USFS) to study the effects of aircraft overflights and report to Congress on the results. *The Report on the Effects of Aircraft Overflights on the National Park System* was submitted to Congress in 1994 and made available to the public by the NPS in 1995.

National Parks Air Tour Management Act of 2000 (P.L. 106-181)

This act prohibits a commercial air tour operator from conducting commercial air tours operations over a national park or tribal lands, except in accordance with the act, conditions prescribed for that operator by the FAA Administrator and any commercial air tour management plan for the park or tribal lands. The act sets forth specifies requirements with respect to: 1) the granting of authority to commercial air tour operators to conduct air tour operations over national parks or abutting tribal lands with specified exceptions; and 2) establishment of commercial air tour management plans.

Executive Orders

Executive Order 11644 Off-Road Vehicles on Public Lands

Executive Order 11644, as amended by Executive order 11898, promulgates guidelines for controlled use of off road vehicles on public lands. The executive orders define off-road vehicles as:

“ any motorized vehicle that is capable of cross country travel over snow, ice of other natural terrain ...the widespread use of such vehicles has demonstrated the need for a unified federal policy...that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of these lands, to promote the safety of all users and to minimize the conflicts among the various users of those lands.”

Regulations:

The following are provisions in park service regulation that address issues of noise management.

Audio Disturbances

36 CFR Section 2.12 Audio Disturbances

The following are prohibited:

- 1. Operating motorized equipment or machinery such as an electric generating plant, motor vehicle, motorized toy, or and audio device such as a radio, television set, tape deck or musical instrument in a manner: (i) That exceeds a noise level of 60 decibels measured on the A-weighted scale at 50 feet or, if below that level, nevertheless, (ii) makes noise which is unreasonable, considering the nature and purpose of the actors conduct location time of day or night, purpose for which the area was established, impact on park users, and other factors that should govern the conduct of a reasonably prudent person under the circumstances.*
- 2. In developed areas, operating a power saw, except pursuant to the terms and conditions of a permit.*
- 3. In nondeveloped areas, operating any type of portable motor or engine, except pursuant to the terms and conditions of a permit. This paragraph does not apply to vessels in areas where motor boating is allowed.*

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4. Operating a public address system, except in connection with a public gathering or special event for which a permit has been issued pursuant to §2.50 or §2.51.

Snowmobiles

36 CFR Chapter 1, 2.18 Snowmobiles

Notwithstanding the definitions of vehicles set forth in §1.4 of this chapter, the provisions of §§ 4.4, 4.12, 4.13, 4.20, 4.21, 4.22 and 4.23 of this chapter apply to the operation of a snowmobile.

The following are prohibited: Operating a snowmobile that makes excessive noise. Excessive noise for snowmobiles manufactured after July 1, 1975 is a level of total snowmobile noise that exceeds 78 decibels measured on the A-weighted scale at 50 feet. Snowmobiles manufactured between July 1, 1973 and July 1, 1975 shall not register more than 82 decibels on the A-weighted scale at 50 feet. All decibel measurements shall be based on snowmobile operation at or near full throttle.

Noise Abatement

36 CFR Chapter 1, § 3.7: Noise Abatement

(1) Operating a vessel in or upon inland water so as to exceed a noise level of 82 decibels measured at a distance of 82 feet (25 meters) from the vessel is prohibited. Testing procedures employed to determine such noise levels shall be in accordance with or equal to the Exterior Sound Level Measurement Procedure for Vessels recommended by the Society of Automotive Engineers SAE-J34a (Revised April, 1977).

National Park Service Policies Relating to Soundscape or Noise Management

Basic service wide policy is published in *NPS Management Policies (2001)*. There are a number of policy statements that address or, in significant ways, relate to soundscape management. The following table lists those policies, followed by the presentation of the policy on soundscape management, per se.

List of Policies Relating to Noise Management

1.4 Park Management	6.2 Identification and Designation of the Wilderness Resource
1.4.1 The Laws Generally Governing Park Management	6.2.1 Assessment of Wilderness Suitability or Non-suitability
1.4.2 "Impairment" and "Derogation": One Standard	6.2.1.1 Primary Suitability Criteria
1.4.3 The NPS Obligation to Conserve and Provide for Enjoyment of Park Resources/Values	6.2.1.2 Additional Considerations in Determining Suitability
1.4.4 The Prohibition on Impairment of Park Resources and Values	6.3.4.1 Zoning for Wilderness
1.4.5 What Constitutes Impairment of Park Resources and Values	6.4.3 Recreational Use Management in Wilderness
1.4.6 What Constitutes Park Resources and Values	8. Use of the Parks
1.4.7 Decision- making Requirements to Avoid Impairments	8.1 General
1.5 External Threats and Opportunities	8.2 Visitor Use
1.6 Environmental Leadership	8.2.3 Use of Motorized Equipment
3. Land Protection	8.2.3.1 Off- road Vehicle Use
3.1 General	8.2.3.2 Snowmobiles
3.4 Addressing Threats from External Sources	8.2.3.3 Personal Watercraft
4. Natural Resource Management	8.4 Overflights and Aviation Uses
4.1.3 Evaluating Impacts on Natural Resources	8.4.1 Alaska and Remote Areas
4.1.5 Restoration of Natural Systems	8.4.1 Alaska and Remote Areas
4.4.1 General Principles for Managing Biological Resources	8.4.2 Education
4.9 Soundscape Management	8.4.3 General Aviation
	8.4.4 Administrative Use
	8.4.5 Military Aviation
	8.4.6 Commercial Air Tour Management
	8.4.7 Permitted Overflights
	8.4.8 Airports and Landing Sites

Soundscape Management Policy

4.9 Soundscape Management

The National Park Service will preserve, to the greatest extent possible, the natural soundscapes of parks. Natural soundscapes exist in the absence of human- caused sound. The natural soundscape is the aggregate of all the natural sounds that occur in parks, together with the physical capacity for transmitting natural sounds. Natural sounds occur within and beyond the range of sounds that humans can perceive, and can be transmitted through air, water, or solid materials.

Some natural sounds in the natural soundscape are also part of the biological or other physical resource components of the park. Examples of such natural sounds include:

- Sounds produced by birds, frogs, or katydids to define territories or aid in attracting mates;*
- Sounds produced by bats or porpoises to locate prey or navigate;*
- Sounds received by mice or deer to detect and avoid predators or other danger; and*
- Sounds produced by physical processes, such as wind in the trees, claps of thunder, or falling water.*

The Service will restore degraded soundscapes to the natural condition wherever possible, and will protect natural soundscapes from degradation due to noise (undesirable human-caused sound).

Using appropriate management planning, superintendents will identify what levels of human- caused sound can be accepted within the management purposes of parks. The frequencies, magnitudes, and durations of human- caused sound considered acceptable will vary throughout the park, being generally greater in developed areas and generally lesser in undeveloped areas. In and adjacent to parks, the Service will monitor human activities that generate noise that adversely affects park soundscapes, including noise caused by mechanical or electronic devices. The Service will take action to prevent or minimize all noise that, through frequency, magnitude, or duration, adversely affects the natural soundscape or other park resources or values, or that exceeds levels that have been identified as being acceptable to, or appropriate for, visitor uses at the sites being monitored.

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