

Acoustic Environment and Soundscapes Resource Information

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
Natural Sounds & Night Skies Division



The Natural Sounds & Night Skies Division (NSNSD) provides the following information to assist park staff in considering the acoustic environment and soundscape in discussions of the park's foundation document. The acoustic environment in the national parks is managed under several policies and regulations. These include: NPS Organic Act of 1916, NPS Director's Order #47: Soundscape Preservation and Noise Management, National Parks Air Tour Management Act of 2000 and several sections of the Code of Federal Regulations regarding audio noise levels, snowmobiles, boats, and other motorized equipment. In addition, soundscapes are mentioned throughout NPS Management Policies including



Soundscape Management (4.9), Cultural Soundscapes (5.3.1.7), Recreational Activities (8.2.2), Use of Motorized Equipment (8.2.3), and Wilderness Protection and Management (6.3.4.3). Together, these provide guidance to NPS parks and programs for protecting and restoring the natural soundscapes to the greatest extent possible and in celebrating and conserving the cultural soundscapes at cultural and historic sites.

The quality of the acoustic environment is relevant to nearly every unit in the NPS System. The acoustic environment can be important as a natural resource, a cultural resource, or both. Natural sounds are important to component of wilderness character and play an important role in wildlife communication, behavior, and other ecological processes. In addition, results from multiple surveys indicate that hearing the sounds of nature is an important reason for visiting parks. Therefore, the importance of acoustic environments and soundscapes is related to an array of park resources and values and has broad implications for park management.

When developing the Foundation Document, park staff should consider the acoustic environment as a resource with inherent value that may be recognized when appropriate in the Fundamental Resource and Value, Other Important Resource and Value, or another section of the document. In addition, parks should consider soundscapes and acoustic resources as important factors that can have a profound effect on the quality of many other park resources and values such as visitor experience, wildlife, wilderness character, cultural landscapes and historic preservation. The following sections discuss the importance of natural sounds and the acoustic environment in relation to park resources and values.

Quality of the Resource in National Park Units

Sound levels in national parks can vary greatly, ranging from among the quietest ever monitored, to extremely loud. While, for example, the din of a typical suburban area fluctuates between 50 and 60 dBA, the crater of Haleakala National Park is intensely quiet, with levels around 10 dBA. Along some remote trails in Grand Canyon National Park, sound levels, at 20 dBA, are softer than a whisper (Bell, Mace, & Benfield, 2009). The noise levels standing near a snowcoach in Yellowstone National Park, however, can be compared to standing three feet from a churning garbage disposal (California Department of Transportation, 1982).

Decibels work on a logarithmic scale; an increase of 10 dB causes a doubling of perceived loudness and represents a ten-fold increase in sound level. Thus 20 dBA would be perceived as twice as loud as 10 dBA, 30 dBA would be perceived as 4 times louder than 10 dBA, 40 dBA would be perceived as 8 times louder than 10 dBA, etc. Below are some examples of sound pressure levels measured in national parks.

dBa	Sound
0	Threshold of human hearing
10	Volcano crater (Haleakala NP)
20	Leaves rustling (Canyonlands NP)
40	Crickets at 5 m (Zion NP)
60	Conversational speech at 5 m (Whitman Mission NHS)
80	Snowcoach at 30 m (Yellowstone NP)
100	Thunder (Arches NP)
120	Military jet at 100m AGL (Yukon-Charley Rivers NP)
126	Cannon fire at 150m (Vicksburg NMP)

Wildlife and Natural Resources

The importance of the acoustic environment should be considered when developing the Foundation Document both in terms of the intrinsic value of natural sounds and their importance to the protection of wildlife species and ecological integrity.

The acoustic environment is a natural resource that is integral to wildlife communication, behavior, and many other ecological processes. Exposure to relatively high noise levels that typically occur close to a source can produce potentially harmful physiological responses in humans and wildlife including hearing loss, elevated stress hormone levels and hypertension. Lower levels of noise can interfere with ecological processes in surprising and complex ways. Examples include reception of alarm calls, prey location, predator detection, mating behaviors, and threat avoidance.

Cultural Resources

Culturally-based sounds that are important to the purpose and significance of the park should be considered when developing the Foundation Document. Many culturally-based sounds are tangible symbols of a park's relevance. From culturally significant music, to sounds associated with notable events, to historic reenactments, relevant cultural sounds should be protected in national parks. Sounds as a cultural resource include both man-made sounds and natural sounds because of the impact that specific sounds can have on visitors' experience. Examples of meaningful soundscapes in our parks including jazz music in New Orleans, fog horn blasts at Golden Gate, and Civil War reenactments at Gettysburg.

Cultural sounds help reinforce a sense of pride in place, a connection to heritage and the awareness that humans, too, are integral to soundscape at many national parks. Many anthropogenic sounds have embedded themselves in the American psyche and echo significant movements in the country's development. The whistle of a train, the heavy rattle of a slave's chains and the crack of musket fire are all imbued with meaning about the American experience.

Visitor Experience

Visitors can be positively or negatively affected by the quality of the acoustic environment. The visitor who experiences the reverberating thud of male bighorn sheep butting heads or a chorus of bird songs in the evening often cherishes these memories for a lifetime. The sounds are potent reminders of the ancient rituals preserved in our natural spaces and serve as key examples of the richness of park acoustic environments. Natural sounds can promote understanding of the role of the acoustic environment in the ecosystem. Standing in the midst of the deafening trill of spring peepers, for example, is a riveting reminder that wetlands are critical habitat for amphibians.

Similarly, cultural sounds help form visitor's experiences in our parks. Memorial sites can better be revered in quiet solitude. Historic sites may be better understood with the sound of a horse-drawn vehicle on unpaved roadways. Battle reenactments are more impressive with the explosion of cannons or muskets. Seashores visits are enhanced by the clicking of cabling around sailboat masts or the deep tones of foghorns in the distance.

Interpretive Themes

The significance of the acoustic environment and soundscape on human experience and ecosystem health can be shared with park visitors in a variety of ways. Sounds can be included in displays at visitor centers and interpreted via pamphlets and website content. The content of soundscape themes will vary greatly from park to park. Natural sounds vary by ecosystem and by season. Cultural sounds vary by the purpose and location of each park. For a full discussion of ways to enhance the soundscape for visitors, please reference the NSNSD interpretive handbook, “The Power of Sound.”

NSNSD also developed the following pieces for use in parks:

- *Natural Sounds Program: Safeguarding the Sounds of Life* (brochure)
- *Ways to Enjoy Natural Sound* (flier)
- *Acoustic Resources are Essential to Functioning Ecosystems and to the Visitor Experience* (flier).

Planning and Data Needs

NSNSD staff records, measures and analyzes acoustic information for national parks. Information on sound levels, sounds sources, frequencies, intervals, and variations throughout the day or the year are measured.

If you would like acoustic monitoring and reporting for your park, please include acoustic environment and/or soundscape in planning documents and request study through a Technical Assistance Request (TAR). The Natural Sounds & Night Skies Division of the NPS is located in at the Washington Area Office in Fort Collins, CO and can be contacted via Frank Turina at frank_turina@nps.gov.