Acoustic Environment and Soundscape
National Parks of New York Harbor

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
Natural Sounds & Night Skies Division

The acoustic environment is a resource with intrinsic value. It is important as a natural resource, a cultural resource, or both. It is a critical component of wilderness character and plays an important role in wildlife communication, behavior, and other ecological processes. Results from multiple surveys of the American public indicate that hearing the sounds of nature is an important reason for visiting national parks. Therefore, the value of acoustic environments and soundscapes is related to an array of park resources and has broad implications for park management. The quality of the acoustic environment is relevant in nearly every unit in the NPS System. When developing the foundation document, park staff should consider the acoustic environment as a resource with inherent value. The topics herein discuss the importance of the soundscape and the acoustic environment in relation to park resources and values.

Acoustic resources protection and noise reduction may be related to the following park priorities:

- enhancing visitor experience
- conducting interpretive programs and events
- diversity of historic, commemorative, scenic, cultural and natural settings throughout the park units
- living history exhibits
- quality wildlife habitat

Potential Threats

- Noise from park facilities and operations
- Noise from nearby development
- Noise from transportation, watercraft and aircraft
- Noise from visitors such as visitor vehicles, music, shouting, electronics

Potential Opportunities

- Reduce noise from park operations (time activities to preserve quiet times, purchase quieter equipment)
- Outreach to visitors about reducing noise from sources such as electronics and idling vehicles
- Communicate with visitors about benefits of noise reduction to park experience and wildlife health
- Collaborate with partners and neighbors to manage noise sources that could affect park resources

Future data/planning:

- Collect acoustic data to measure baseline acoustic conditions
- Develop acoustic goals, indicators and standards in an acoustic resources plan or related park plans or strategies

NPS policy guidance:

- National Parks Overflight Act of 1987
- National Parks Air Tour Management Act of 2000
- Management Policies 2006: 4.9 Soundscape Management, 5.3.1.7 Cultural Soundscape Management, 8.2.2 Recreational Activities; 8.2.3 Use of Motorized Equipment, 8.4 Overflights and Aviation Uses
- Director's Order 47: Preservation of the Acoustic Environment and Noise Management

For management and planning purposes, it is important to distinguish and define certain key terms. *Acoustic resources* are physical sound sources, including both natural sounds (wind, water, wildlife, vegetation) and cultural and historic sounds (battle reenactments, tribal ceremonies, quiet reverence). The *acoustic environment* is the combination of all the acoustic

resources within a given area - natural sounds and human-caused sounds – as modified by the environment. The acoustic environment includes sound vibrations made by geological processes, biological activity, and even sounds that are inaudible to most humans, such as bat echolocation calls. *Soundscape* is the component of the acoustic environment that can be perceived and comprehended by the humans. The character and quality of the soundscape influence human perceptions of an area, providing a sense of place that differentiates it from other regions. *Noise* refers to sound which is unwanted, either because of its effects on humans and wildlife, or its interference with the perception or detection of other sounds. *Cultural soundscapes* include opportunities for appropriate transmission of cultural and historic sounds that are fundamental components of the purposes and values for which the parks were established.

The following topics in this document discuss the importance of the acoustic environment and soundscape in relation to park resources and values.

Human Health and Visitor Experience

Visitors can be positively or negatively affected by the quality of the acoustic environment. In relation to health and wellness, exposure to loud and continuous noises is known to cause hearing impairment, sleep disturbance, cognitive interruption, hypertension and other health detriments. Alternatively, hearing natural sounds is beneficial to human health and wellness by improving mood, cognitive performance, sleep quality and other benefits.

The visitor who experiences the reverberating thud of male bighorn sheep butting heads, the slap of a beaver tail on the water's surface, 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.

As was reported to the U.S. Congress in the *Report on the Effects of Aircraft Overflights on the National Park System* (NPS, 1995), a system-wide survey of park visitors revealed that nearly as many visitors come to national parks to enjoy the natural soundscape (91 percent) as come to view the scenery (93 percent). Noise can also distract visitors from the resources and purposes of cultural areas--the tranquility of historic settings and the solemnity of memorials, battlefields, prehistoric ruins, and sacred sites. For many visitors the ability to hear clearly the delicate and quieter intermittent sounds of nature, the ability to experience interludes of extreme quiet for their own sake, and the opportunity to do so for extended periods of time are important reasons for visiting national parks and one of the driving forces behind the development of this plan. These experiences are important reasons for preserving and visiting national parks.

Birding is one of the most popular outdoor recreational activities in the US with 48 million people participating in it each year (US Fish & Wildlife service, “Birding in the United States: A Demographic and Economic Analysis” amended, 2009). Most visitors identify a bird by hearing its call before the bird is ever seen. National Parks are uniquely poised to preserve natural soundscapes in proactive ways that protect this resource for the American public.

Wildlife and Other Natural Resources

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 other animals including hearing loss, elevated stress hormone levels and hypertension. Even low levels of noise can interfere with ecological processes in surprising and complex ways.

Some groups of animals (especially in social species) benefit by producing alarm calls to warn of approaching predators and contact calls to maintain group cohesion. A reduction in communication distance created by noise might decrease the effectiveness of these social

networks. Furthermore, many animals are known to eavesdrop on vocalizations from different species. For example, gray squirrels, listen in on the communication calls of blue jays to assess site-specific risks of cache pilfering; and nocturnally migrating songbirds and newts use the richness and complexity of biological sounds produced in local environments to make habitat decisions. Animals also use accidental sounds produced by potential prey to locate their next meal; other animals use sound to avoid predation. At least one study, in which African reed frogs were shown to flee from the sound of approaching wildfires, indicates that animals can use sound to avoid natural physical threats. It is likely that other ecological sounds are similarly important to animals.

These and other studies show that the animal communication and the interaction between wildlife and the acoustic environment is not a collection of private conversations between signaler and receiver but an interconnected landscape of information networks based on intentional and accidental sounds. 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.

Cultural Resources

Many culturally-based sounds are tangible symbols of a park's relevance. From culturally significant music, to sounds associated with notable events and historic reenactments, relevant cultural sounds are a protected resource in national parks. Examples of meaningful cultural soundscapes in our parks include 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. Culturally-based sounds that are important to the purpose and significance of the park should be considered when developing the foundation document.

In addition, listening to the sounds of nature like bird songs, a waterfall, or the surf has an important culural component. Natural sounds as a cultural resource should be considered because of the impact that site-specific sounds can have on visitors' experience.

Overflights

The noise from overhead aircraft is a pervasive intrusion in many national parks. All forms of aviation activities have increased in recent years over parks including: commercial passenger flights, park maintenance, scientific research, fire and emergency operations, and commercial air tours. Guided by the National Parks Overflight Act of 1987 (P.L. 100-91) and 2006 Management Policies sect. 8.4, the NPS works to manage flights over national park units.

In addition, the National Parks Air Tour Management Act of 2000 requires the cooperative management of air tours for parks where such tours operate. Identifying park soundscapes and the acoustic environment as fundamental or important in the foundation document assists in the development of overflights plans and helps articulate the importance of sounds in relation to the purpose and significance of the park. For more assistance on the Overflights Program, please contact Vicki Ward at vicki_ward@nps.gov.

Interpretive Themes

Interpretive programs with natural sounds or a focus on the soundscape are popular park activities. 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. A rattlesnake will shake its tail to alert intruders to its presence. Such examples help convey the significance of

preserving the integrity of the acoustic environment.

Similarly, cultural sounds help form visitor's experiences in our parks. Memorial sites can better be revered in quiet solitude. Historic sites are 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. Seashore visits are enhanced by the clicking of cabling around sailboat masts or the deep tones of foghorns in the distance.

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. Attention to sounds may be appropriate as a standalone subject or incorporated into other interpretive themes. 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. Many parks are visited with specific acoustic events in mind such as the fall elk rut in Rocky Mountain NP, the singing sands in Indiana Dunes NL, or concerts at Wolf Trap NP.

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 has developed an array of tools and services to help parks manage natural sounds and soundscapes. We record, measure and analyze acoustic information for national parks. From acoustical monitoring, information on sound levels, sound 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 a study through a Technical Assistance Request (TAR). In addition, we offer planning and compliance expertise by assisting parks with integration of soundscapes into planning documents, development of an Acoustic Resources Management Plan, and review of environmental documents. 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.