

Science Notes

Applying community noise metrics in parks

By Kurt M. Fristrup

NOISE MANAGEMENT IS AN EMERGING

practice for the National Park Service (NPS), so evaluating community noise standards in the context of the NPS mission offers opportunities to recognize shared priorities as well as noise criteria that are inappropriate for park settings. Unfortunately, the United States has a checkered history of noise management (Holger 2003), which has hampered development of consistent standards and practices. The Noise Control Act of 1972 and the Quiet Communities Act of 1978 assigned coordination of national noise management efforts to the U.S. Environmental Protection Agency (EPA), but funding for the EPA Noise Control Division was eliminated in 1982 to shift responsibility of noise regulation to state and local governments. At the federal level, the U.S. Department of Transportation retained the paradoxical responsibility of managing transportation noise, even though their primary mission is expanding the capacity and coverage of transportation networks. Despite the paucity of useful developments in the past 30 years, three measures of noise impacts that emerged in the 1970s are applicable today: speech interference, classroom acoustical standards, and sleep interruption.

Virtually all community noise impact criteria use A-weighting to summarize the aggregate effects of sound energy across the entire audible spectrum. A-weighting, expressed in units of dB(A) (or dBA), discounts sounds below 1 kHz and above 5 kHz in accordance with decreased human hearing sensitivity at low and high fre-

Table D1. Steady A-weighted noise levels that allow communications with 95% sentence intelligibility over various distances outdoors for different voice levels

Voice level	Communication distance (meter)					
	0.5	1	2	3	4	5
Normal voice (dB)	72	66	60	56	54	52
Raised voice (dB)	78	72	66	62	60	58

Source: EPA 1974.

quencies. Aggregate noise level measures like dB(A) ignore the capacity of humans to selectively detect sounds at different frequencies. However, dB(A) provides a reasonable basis of comparison when the sounds have similar power spectra, or a similar distribution of energy of sounds across frequency. Transportation noise sources generate most of their sound energy in frequencies below 1 kHz, so dB(A) values for cars, trucks, motorcycles, boats, snowmobiles, and aircraft are comparable. However, dB(A) measurements from natural settings are often dominated by the sounds of birds, frogs, and insects. It is inappropriate to treat these sounds as “noise” in park units, and it is acoustically incorrect to interpret the resulting dB(A) levels as being comparable to—or likely to mask perception of—transportation noise. For these reasons, the NPS Natural Sounds Program recommends excluding sound energy above 1 kHz from environmental dB(A) measurements, and is working with national standards committees to codify this practice.

Speech interference criteria are relevant to all park management zones. Park staff and visitors should reasonably expect to com-

municate in most conversational settings without having to raise their voices. The EPA published guidelines to realize 95% sentence intelligibility for conversational speech as a function of vocal effort, distance, and noise level (EPA 1974, table D1):

These values can be extended to longer distances by subtracting a factor of $20 \cdot \log_{10}(R/R_{ref})$ from any cell’s associated decibel threshold (R represents the longer distance). For example, extending the italicized threshold of 66 dB at which people have to raise their voices to be understood at 2 m (6.6 ft) distance to 10 m (32.8 ft) distance results in a threshold of 52 dB: $66 - 20 \cdot \log_{10}(10/2)$. Desired conversational settings can be specified in terms of limited numbers or duration of interruptions, or desired intervals free from interruptions. Speech interference metrics are being utilized in ongoing air tour and soundscape management plans to assert that acute noise events that interrupt conversations should be rare.

Speech interference criteria can be applied to park ranger presentations because interruptions will compromise interpretive goals and the integrity of these settings.



NPS/NATURAL SOUNDS PROGRAM

Acoustical monitoring in urban settings helps park managers address various needs. At Fort Mason in Golden Gate National Recreation Area, California, staff is using data collected with this microphone in the preparation of a transportation plan for the rerouting of a cable car/trolley. Elsewhere monitoring documents and helps protect natural and cultural sounds amid urban noise.

Another relevant criterion is the ANSI (American National Standards Institute) standard for appropriate acoustical conditions in classrooms (ANSI S12.60). Empty classrooms should have sound levels below 35 dB(A) to provide good conditions for learning. This also acknowledges that children—especially those less than 8 years of age—have difficulty distinguishing speech in noise.

Noise also can disturb sleep. ANSI standard S12.9-2008 provides formulae for estimating awakenings from a sequence of noise events. Events louder than 45 dB(A) will waken some people; events louder than 35 dB(A) cause increases in heart rate and blood pressure (Haralabdis et al. 2008). These criteria were based on studies of people in familiar settings. In park lodging, and especially in campsites, visitors will be much more prone to awakening because the soundscape will be unfamiliar and they may feel less secure.

The National Park Service has a relatively protective noise regulation for all motorized equipment (including motor vehicles) and audio devices (36CFR2.12), which requires sound levels at a 50-foot distance to be below 60 dB(A) and reasonable for the activity in the park setting. Sound level meters are rare outside of the Natural Sounds Program, so the reasonableness criterion is the probable basis for enforcement. This protective regulation contrasts with two others (36CFR2.18, 36CFR3.7) that allow a snowmobile or boat to radiate as much noise as 63 or 446 automobiles, respectively, even though sound carries farther in the environments used by these vehicles. This inconsistency illustrates an important point: many principles and practices from community noise management can be applied in park settings, but it is crucial to carefully reevaluate each one in the context of the desired future conditions we intend to preserve or restore in park units.

References

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