

CASE STUDY

Using acoustical data to manage for solitude in wilderness areas

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WILDERNESS PLAYS A SIGNIFICANT ROLE IN THE LIVES OF

wildlife and people, whose activities in wilderness may benefit from its solitude and associated quiet. For example, sounds can have a profound effect on the perceived quality of an image or visual landscape (Benfield et al. 2010). Lake Mead National Recreation Area (NRA), particularly its nine designated wilderness areas, is home to many animals of special concern. Most animal species rely on a quiet environment for life-sustaining activities such as locating prey, finding mates, predator detection, and basic communication. Animals such as the Sonoran pronghorn (*Antilocapra americana sonoriensis*) avoid loud areas, which reduces their range and often fragments their habitat (Landon et al. 2003). Increased human activity is reducing suitable habitat for animals throughout the United States therefore it is important to preserve and protect wilderness resources.

Beyond providing habitat for wildlife, wilderness areas also contain many cultural resources and meanings important to people. The Spirit Mountain Wilderness in Nevada is significant and sacred to the Yuman-speaking tribes, used in ways according to their traditions. Modern sounds can have an impact on the traditional ceremonies and aesthetics of what is considered sacred land.

Lake Mead NRA, on the Nevada-Arizona border, comprises 607,028 ha (1,499,966 ac), including nine wilderness areas totaling approximately 75,187 ha (185,787 ac). Adjacent and potential wilderness-designated lands bring the total wilderness to more than 291,575 ha (720,482 ac) in size. Despite these designations, the western border of Lake Mead NRA lies only 9.7 km (6.0 mi) from Las Vegas, and its eastern boundary abuts Grand Canyon National Park.

Acoustical monitoring

To protect the acoustical environment of Lake Mead NRA wilderness, these areas first had to be characterized. Park personnel set up three acoustical monitoring sites in wilderness areas (LAME009, LAME010, and LAME011) between June 2007 and May 2009 to obtain baseline acoustical data (figs. 1 and 2, pages 82 and 83). Data from a nonwilderness control site (LAME007) were also included for comparison (see fig. 2). Monitoring equipment

Abstract

The preservation of natural sounds and quiet is essential for protecting wilderness quality and character. Incorporating soundscape management into wilderness management plans is vital for maintaining the solitude and primitive character of wilderness areas. As development outside park areas increases, so does the potential of human-caused noise to impact wilderness areas within the parks. Lake Mead National Recreation Area is one of the first national parks to incorporate acoustical data into a wilderness management plan. Monitoring sites were set up in three wilderness areas over a two-year period to collect audio recordings, sound levels, and meteorological data. On-site listening was conducted to identify sound sources at the monitoring sites. Park personnel found that the monitored wilderness areas were quieter than other areas in the park, but there was still noticeable human-caused noise, primarily aircraft overflights. By including acoustical data in the wilderness management plan, the park has been able to reference the quietness of the wilderness areas while working with other agencies concerning potential noise-producing projects adjacent to park wilderness. The baseline data collected in the wilderness units will also assist in developing a soundscape management plan. A characterization of the natural acoustical environment will enable park management to improve overall ecosystem health and visitor experience by incorporating acoustical data into management plans and educating park visitors.

Key words

human-caused noise, Lake Mead National Recreation Area, natural sounds, soundscape, wilderness management plan

continuously collected readings of sound pressure level (intensity), recorded in decibels (dB), and frequency, or pitch, recorded in hertz (Hz). Audio recordings and meteorological data were collected, and each site was monitored for 30 days. On-site listening was also conducted to identify sound sources at each site. Sound levels are often adjusted, or “weighted,” to match human hearing and are expressed as dBA. Existing ambient sound level, a median composite sound level of all sounds both natural and human-caused, was measured at each site in dBA. Natural ambient, an estimate of what the acoustical environment would be without the contribution of anthropogenic sounds, is also measured. However, only existing ambient is reported here.



Figure 1. Technicians deployed acoustical monitoring equipment at Lake Mead National Recreation Area, this setup at site LAME009. The anemometer on the left is used to determine wind speeds. The microphone on the right is topped with a metal spike to prevent birds from landing on the foam windscreen. This equipment was used to document the extraordinary quiet of the wilderness areas at Lake Mead.

All three wilderness sites had median existing ambient levels lower than that of the nonwilderness site. For reference, 10 dBA is typical of a human breathing at 3 m (9.8 ft), 20 dBA is the volume of a human whispering at 5 m (16.4 ft), 35 dBA is a quiet residential area at night, and 60 dBA is conversational speech at 5 m (16.4 ft). Due to its proximity to Las Vegas, LAME009 was the loudest wilderness site, with a daytime existing ambient level of 30.7 dBA. LAME010 and LAME011 had daytime existing ambient levels of 13.4 dBA and 16.2 dBA, respectively. The two latter sites were found to be quieter than other sites at Lake Mead NRA. During the early morning hours, the sound levels recorded were extraordinarily low and often approached the equipment noise floor. The nonwilderness site, LAME007, was the loudest site, with a daytime existing ambient level of 33.5 dBA during the day (fig. 3).

Discussion

The quiet documented at Lake Mead NRA has become exceedingly rare as the world continues to get louder. As the U.S. population increases, so do transportation networks and development (U.S. Federal Highway Administration 2008). Since the wilderness areas are the quietest places in the park, they are more susceptible

to the intrusion of human-caused noise, which is still present throughout the day.

The main source of human-caused noise was flights over the park. Aircraft can be heard throughout the park during all daylight hours. As would be expected for any park near a metropolitan area, multiple commercial and private flights pass overhead each day. Even more noticeable are the helicopter overflights associated with scenic tours, offered from dawn to dusk, exposing visitors to the beauty of Lake Mead, Hoover Dam, and Grand Canyon. Previous monitoring efforts have recorded an estimated 15–20 helicopter overflights per hour at some locations. The impact of overflights on the acoustical environment is much more noticeable at LAME007 and LAME009 (fig. 3).

Lake Mead NRA is one of the first parks to incorporate acoustical data into a wilderness management plan. Although the acoustical data will not be used to set standards and thresholds in the plan, park personnel will be able to reference the quiet of the wilderness areas while working with other agencies trying to develop land adjacent to these. In addition, this will help the park maintain or work toward desired acoustical conditions and develop a soundscape management plan. The final wilderness management

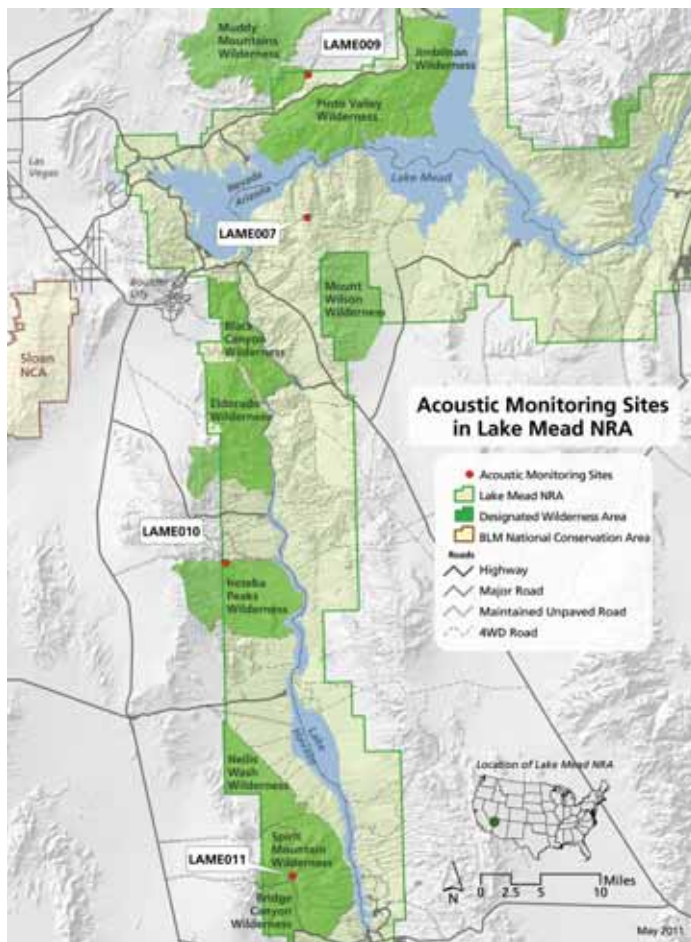


Figure 2. Locations of the three wilderness acoustical monitoring sites (LAME009, 010, 011) and the nonwilderness control site (LAME007) at Lake Mead National Recreation Area.

plan draft may include more acoustical monitoring sites for a more robust description of the acoustical environment of wilderness at Lake Mead NRA.

Conclusion

Wilderness area management includes the protection of solitude and primitive character of these natural areas. Protecting the natural sounds and quiet is vital to maintaining the solitude and overall ecosystem health of wilderness areas. By incorporating acoustical data into a wilderness management plan, Lake Mead NRA will be able to work on protecting the solitude that wilderness areas are created to preserve.

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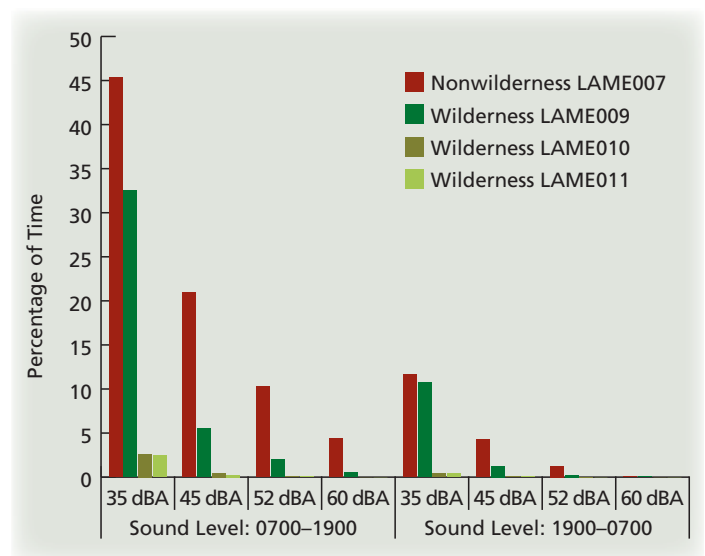


Figure 3. Percentage of time that measured sound levels were above four key thresholds: 35 dBA—this sound level causes an increase in blood pressure and heart rate in a sleeping human (Haralabidis et al. 2008), 45 dBA—the World Health Organization's recommendation for maximum noise levels inside bedrooms (Berglund et al. 1999), 52 dBA—the threshold for speech interference during park interpretive programs, and 60 dBA—the threshold for speech interruption for normal conversations (U.S. Environmental Protection Agency 1974).

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