

Case Studies

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Soundscape monitoring and an overflights advisory council:

Informing real-time management decisions at Denali National Park and Preserve



By Jared Withers and Guy Adema

DENALI NATIONAL PARK AND PRESERVE

is a six million acre (2.4 million ha) land in central Alaska, most of which is either designated as or suitable for wilderness. It features North America's highest mountain, 20,320-foot tall Mount McKinley and also includes countless other spectacular mountains and many large glaciers. Denali's ecosystems span over 17,000 vertical feet (5,185 m) and encompass a complete set of subarctic ecosystems that include boreal lowlands, expansive subalpine tundra, and alpine and mountain areas. The park was established as Mount McKinley National Park on 26 February 1917. The

original park was designated a wilderness area and incorporated into Denali National Park and Preserve in 1980. The park was designated an international biosphere reserve in 1976.

In order to properly manage this vast wilderness, the park completed a major amendment to its general management plan in 2006, a comprehensive backcountry management plan and environmental impact statement (BCMP). The backcountry management plan is the result of a public process that took eight years and included specific management goals for Denali's variety of backcountry lands: designated wilderness, suitable wilderness,

A National Park Service high-elevation rescue helicopter flies over an automated sound station on Mount McKinley's West Buttress climbing route, elevation 10,500 feet.

national preserve, national park, and other undeveloped park lands. The plan created management zones to accommodate a range of backcountry users accessing the park in a variety of ways, such as day hikers, backpackers, mountain climbers, snow machiners, and hunters. Soundscape is a critical resource specifically addressed in the backcountry management plan. Three acoustic indicators were established with standards defined for each of the

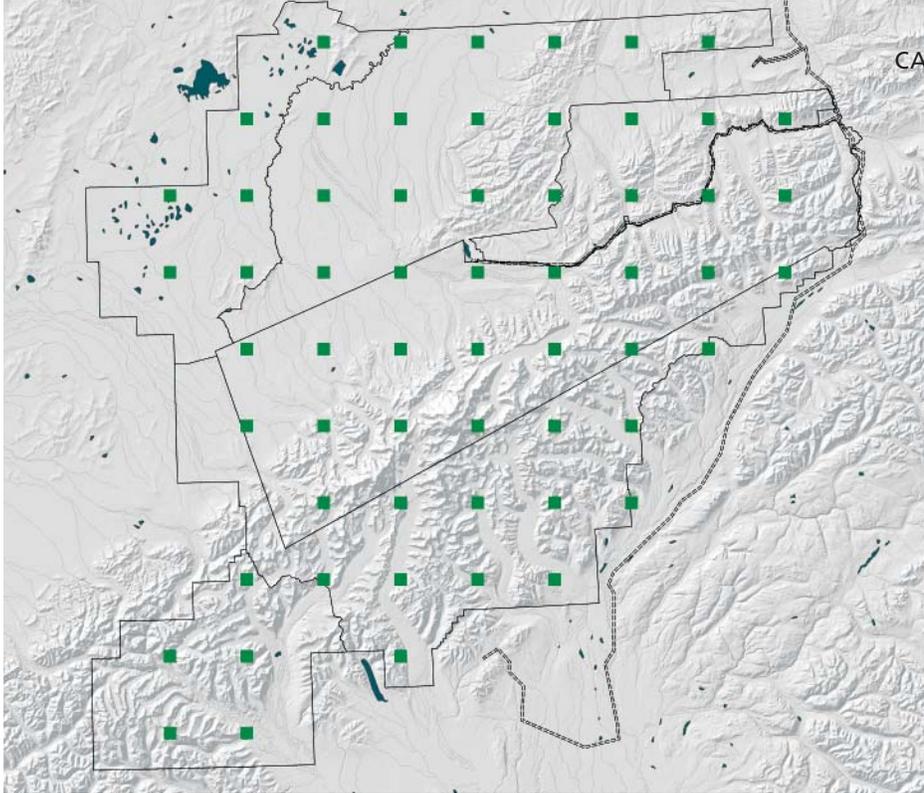


Figure 1. This map illustrates the grid locations to be sampled for a parkwide inventory of natural and human-made sounds.

various management zones created by the plan.

1. Percentage of any hour when motorized noise is audible
2. Number of motorized noise intrusions per day that exceed natural ambient sound
3. Maximum motorized noise level

Denali initiated soundscape measurements in 2000 in order to establish acoustic standards for the forthcoming backcountry management plan and in response to Director's Order 47, which articulates

operation policies for protection, maintenance, and restoration of the natural soundscape resource. Upon completion of the plan, this pilot program developed into a protocol designed systematically to sample the soundscape of the entire park at a landscape scale, with the objectives of inventorying current conditions, long-term trend analysis, and informing park management's implementation of the plan.

To achieve these goals, automated monitoring stations are temporarily deployed to six grid locations per year, measuring all

60 points over a 10-year period (fig. 1). Two additional non-grid sites are monitored each year at locations where data necessary for management on a shorter-term return cycle are required or where focused local data are desired. Remote stations collect interval audio recordings and spectral sound pressure level (i.e., loudness) data for at least one month per site during the operational season (May–September). The interval recordings are a five second audio clip recorded every five minutes, and spectral data are calibrated one-third-octave band sound pressure levels sampled once a second. Winter conditions are also monitored through an alternate scheme that aims to track acoustic conditions in areas of traditional winter use.

The methods and analyses are designed to inform progress directly toward the standards identified in the backcountry management plan, as well as to provide an accurate profile of the natural soundscape at each sample location. For example, data from near the terminus of Tokositna Glacier demonstrate observed conditions relative to BCMP indicators and standards and are shown in figs. 2, 3, and 4. These data reveal that there is significant overflight activity at this location, but it is largely within the desired future conditions

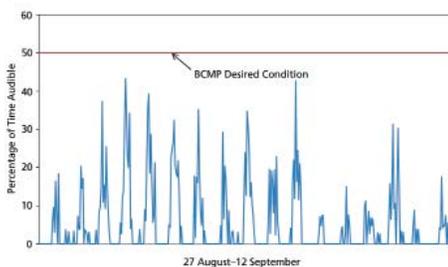


Figure 2. The graph shows the percentage of time motorized aircraft sound is audible, by hour, at the Tokositna Glacier in 2008.

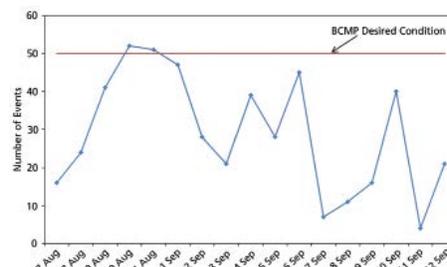


Figure 3. The graph shows the number of aircraft overflight events per day at the Tokositna Glacier in 2008.

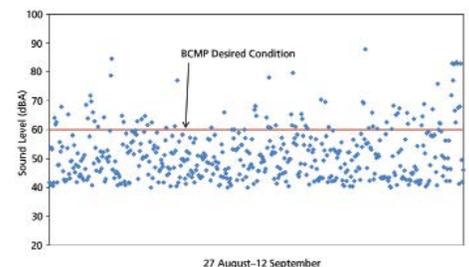


Figure 4. The graph shows maximum A-weighted sound pressure levels of each aircraft overflight at the Tokositna Glacier during the 2008 measurement period. A-weighting is a correction curve that attenuates certain frequency bands in the same way the human ear does, yielding sound pressure levels that are representative of what a human would perceive.

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Tokositna Glacier—Natural Soundscape Audibility

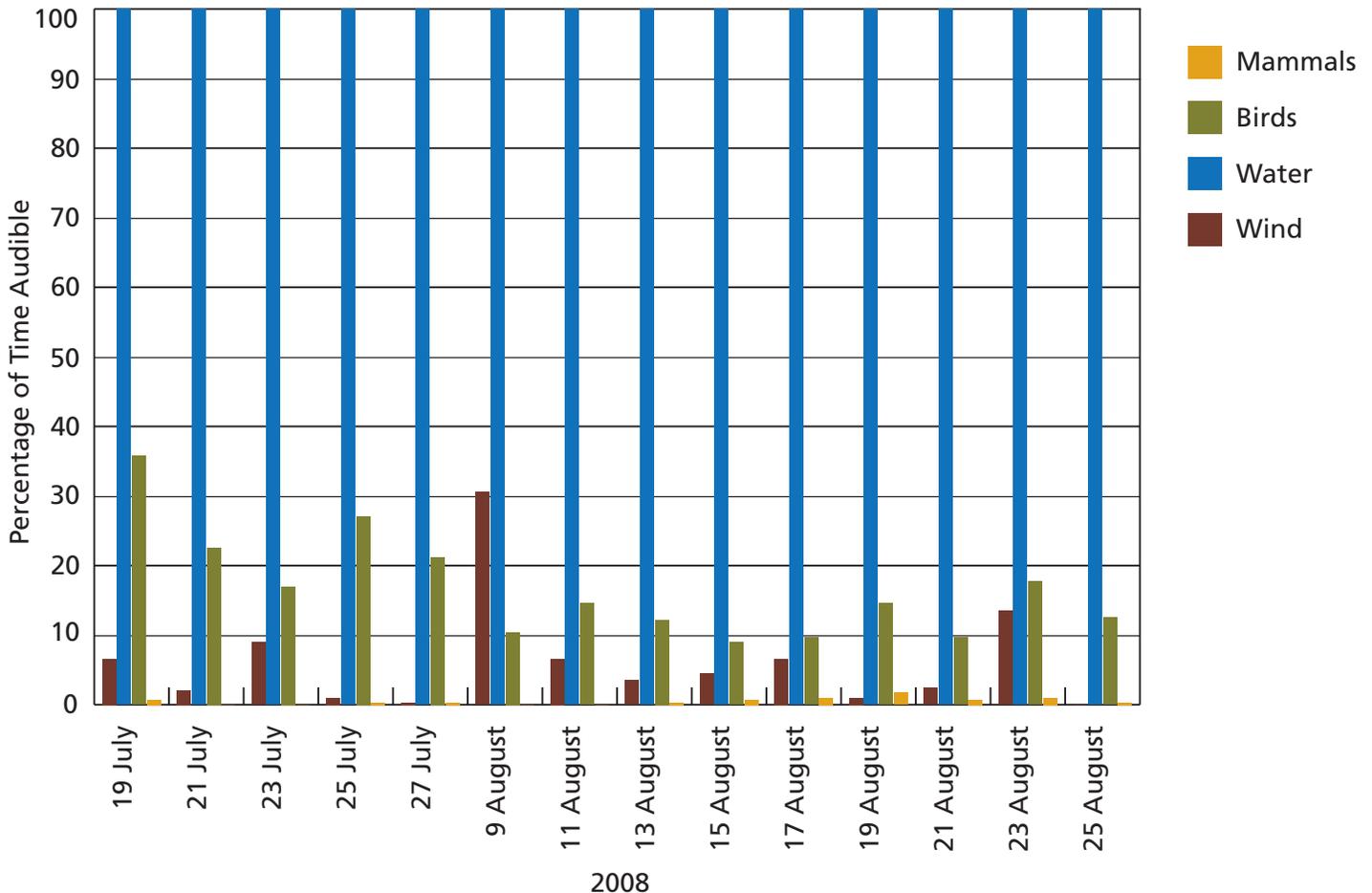


Figure 5. The graph shows the percentage of time a range of natural sounds measured at the Tokositna Glacier in 2008 were audible.

identified for this zone. Figure 5 shows the distribution of the natural sounds at the same location. This site is located at a glacial terminus, and the sound of flowing water is audible 100% of the time; birdcalls are often audible and mammal sounds are occasionally heard.

In addition to the inventory and monitoring of the soundscape, the backcountry management plan calls for the establishment of a formal Aircraft Overflights Advisory Council. Although Alaska is exempt from the National Parks Air Tour Management Act of 2000 and does not have an air tour management plan requirement, the Aircraft Overflights Advisory Council is chartered under the Federal Advisory Committee Act and has a diverse

membership representing interests of the Federal Aviation Administration, State of Alaska, mountaineers, backcountry users, general aviation, local businesses, private property owners, air taxi operators, sightseeing flight operators, local and national environmental groups, and military flight operations. The advisory council's task is to advise the Secretary of the Interior about voluntary measures to reduce the impacts of overflight noise on the natural soundscape and increase safety for passengers, pilots, mountaineers, and other backcountry users. These measures would help the park achieve the desired future resource conditions identified in the backcountry management plan.

Since the creation of the Aircraft Overflights Advisory Council, Denali's sound program has worked intensively to collect and interpret acoustic data so that the council can make recommendations based on objective and accurate measurements of soundscape conditions. Data have been synthesized to highlight areas of the park that both meet and exceed desired future conditions. Figure 6 shows which areas of the park meet or exceed the BCMP "number of events per day" desired future condition based on field measurements to date. In this instance, the data indicate that the low disturbance zone in the central area of the park, federally designated as wilderness, is most in need of attention to meet desired conditions.

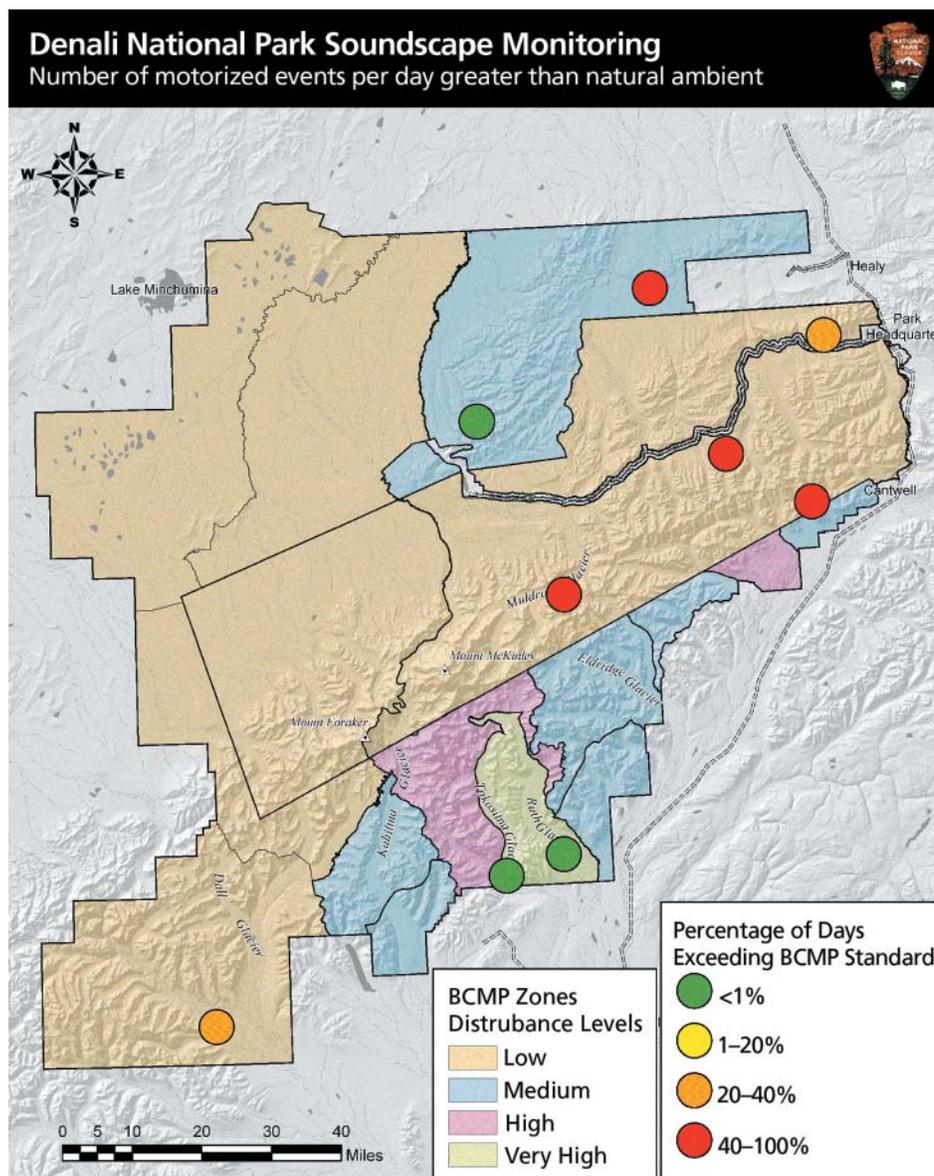


Figure 6. This map illustrates the percentage of samples exceeding the backcountry management plan “number of events per day” desired future condition at nine locations within Denali.

The Aircraft Overflights Advisory Council has worked closely with the park soundscape program to understand the acoustic environment, monitoring results, data strengths and limitations, and established standards. Through listening sessions, annual data review, and technical presentations, the members not only have a working knowledge of soundscape management but also use monitoring results to seek options for improving Denali’s backcountry experience for visitors. In

2010, NPS scientists will be working with the Aircraft Overflights Advisory Council and local air touring companies to test and evaluate the effects of actions aviators could take to reduce impact on a popular wilderness day-hiking area, and at the West Buttress climbing route on Mount McKinley.

This cooperative effort is moving Denali National Park and Preserve toward its goal of reducing the noise impact of aircraft

The central area of the park, federally designated as wilderness, is most in need of attention to meet desired conditions.

overflights to meet management standards and improve visitor safety through expanded communication. The close interaction of a holistic soundscape monitoring program and the Aircraft Overflights Advisory Council is proving to be a constructive solution to achieve Denali National Park’s management objectives and could serve as a model for other Alaskan parks.

References

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About the authors

Jared Withers and Guy Adema are physical scientists at Denali National Park. They can be reached at jared_withers@nps.gov and 907-683-5760, and guy_adema@nps.gov and 907-683-6356, respectively.