

Soundscapes of Denali National Park and Preserve



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Soundscapes, the combined sounds from natural and non-natural sources, are recognized as an important resource in national parks. The natural soundscape is generally comprised of two main sound categories—those from biological or those from physical sources. Organisms such as

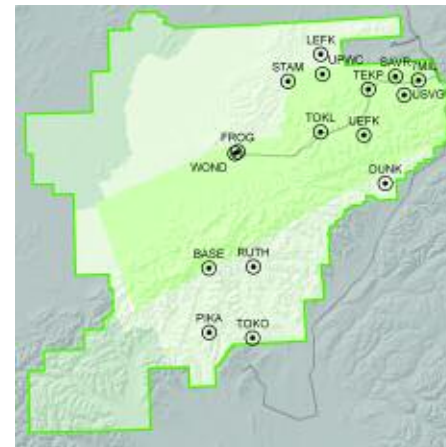


Figure 1. Sound monitoring locations in Denali National Park and Preserve, 2000-2005.

(Left) Sound station microphones at the Upper East Fork Toklat River location near Sable Pass, July 2004.

birds, frogs, and plants, create biological sounds, while forces such as wind, rock fall, and rivers, create physical sounds. These two types of sounds can be used to characterize different habitats. The specific soundscape characteristics are an important attribute of Denali National Park and Preserve's (Denali) natural systems, for non-natural sounds can obscure or disturb ecological functions, as well as adversely influence visitor experiences (NPS 1995).

Natural soundscapes are components of “the scenery and the natural and historic objects and the wildlife” as protected by the Organic Act (*Public Law 64-235*). They were specifically recognized and protected by the National Parks Overflights Act of 1987 (*Public Law 100-91*). Due to ongoing concern about aircraft overflight noise, the National Parks Air Tour Management Act was established, which requires the Federal Aviation Administration and the National Park Service to cooperatively develop air tour management plans for any park where commercial air tour operations exist or are proposed (*Public Law 106-181*). Although Alaska parks were excluded from the act, they were not excluded from aircraft noise and other influences on the natural soundscape and visitor experience.

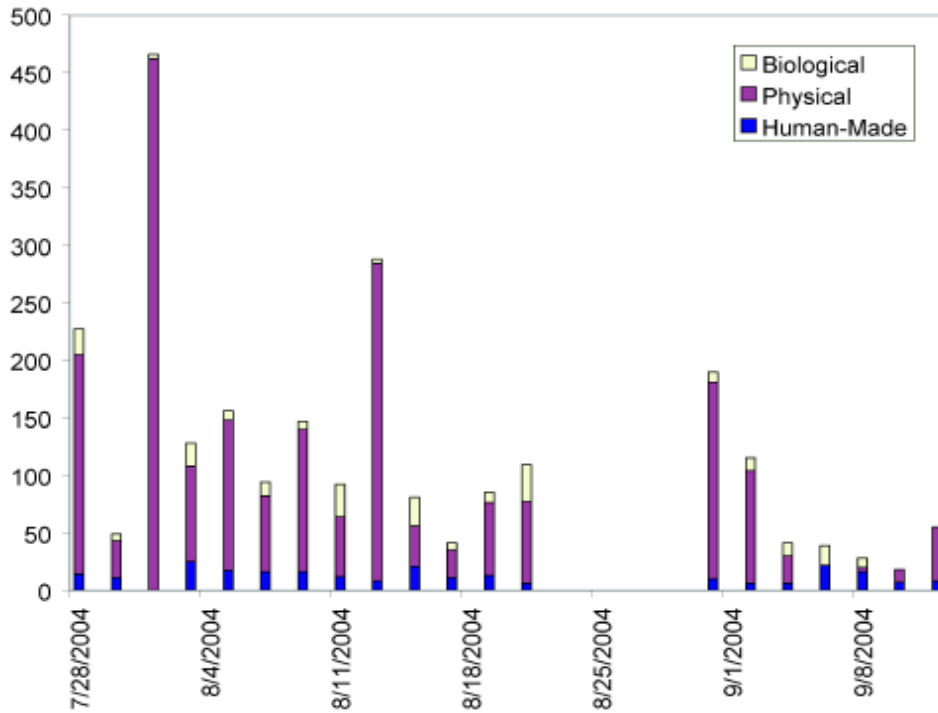


Figure 2. Quantity and types of sounds audible at the Upper East Fork Toklat River (UEFK in Figure 1) location, July-September 2004. Each bar represents the number of recording samples for each type of identified sound. Days without sounds were not analyzed.

By 2000, park managers recognized that the natural soundscape of Denali was increasingly affected by non-natural sounds. Because preserving the natural soundscape also helps preserve the associated wilderness values and visitor experiences, a soundscape program was initiated. The hope was to better understand, manage, and preserve the natural soundscape of Denali. In addition, soundscape measurements provide objective scientific data for future management decisions.

Systematic measurements of the current

acoustic conditions of all major habitats, air traffic corridors, and management zones in Denali have begun and a preliminary baseline study will be completed by 2008. Four automated sound stations collect data every summer, with fewer locations sampled during the winter. Soundscape data has been collected at 16 locations (Figure 1). Representative areas were chosen for sampling in the three major acoustical zones (alpine, alpine tundra, and boreal forest/scrub), and to compare areas of low and high motorized

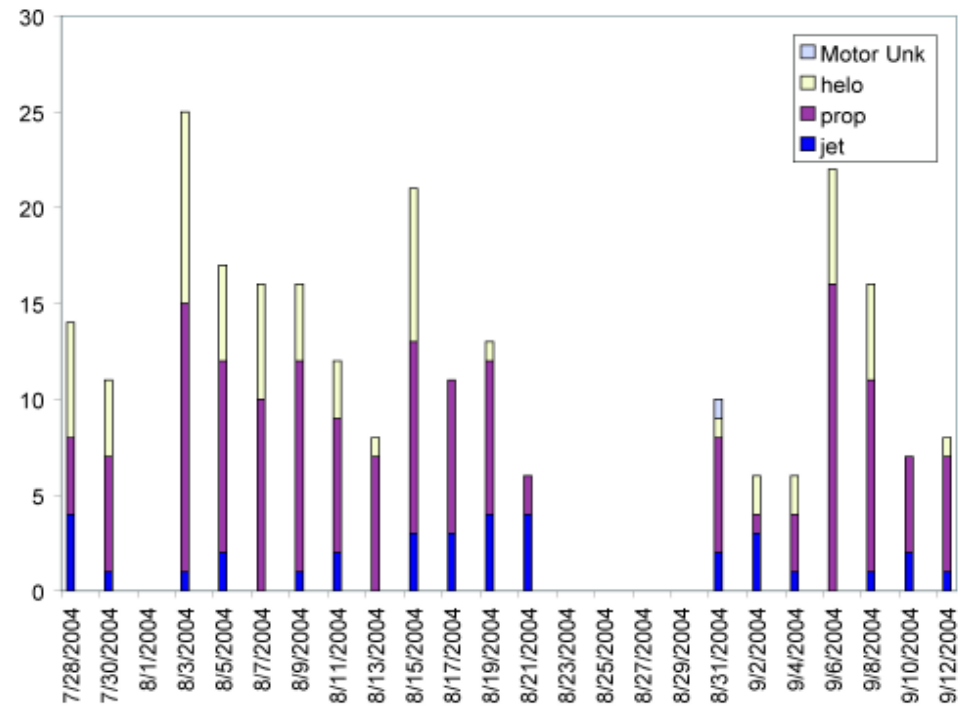


Figure 3. Quantity and type of non-natural sounds audible at the Upper East Fork Toklat River location, July-September 2004. Each bar represents the number of recording samples for each type of identified sound.

use. Each sound station records sound levels every second and collects five-second digital recordings every five minutes (288 samples per day). With this information we can identify the sound sources present at each sampling location, the sound levels of each sound source, and calculate the number of times per day each sound is audible. These data are used to compare the natural ambient sound levels to the sound levels of non-natural sounds. From the data analyzed to date, wind is the most widespread natural sound in all

areas, and aircraft overflights are the most common human-generated sound.

Soundscape data can be displayed in many ways. For example, Figure 2 illustrates the number and types of sounds audible at the Upper East Fork Toklat River location. The biological sounds at this site consist of bird song and insect sounds. The physical sounds consist primarily of wind, with some rain. The type and number of non-natural sounds recorded are shown in Figure 3. The Upper East Fork Toklat River sound station was placed

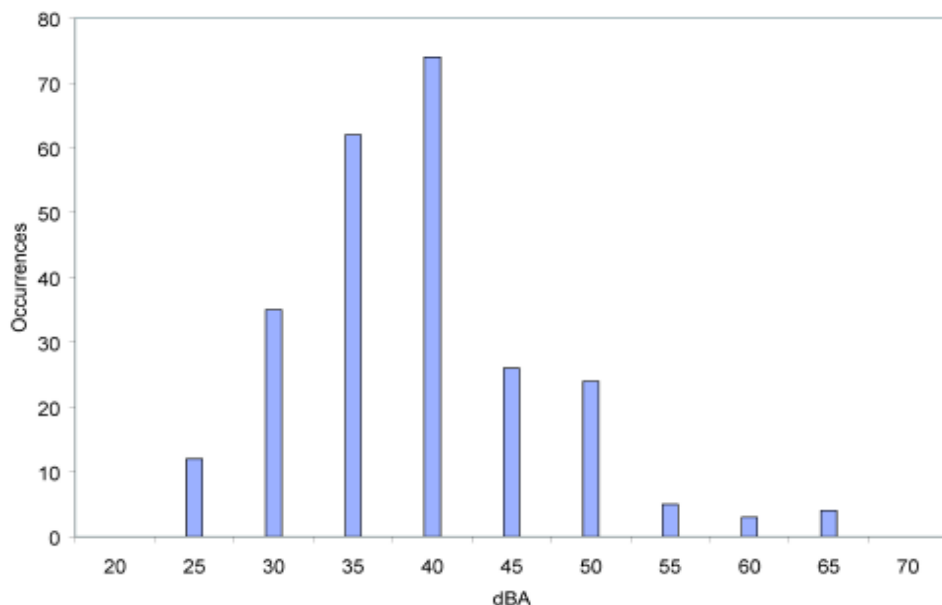


Figure 4. The sound levels of aircraft overflights audible at the Upper East Fork Toklat River location, July-September 2004. The sound level of most overflights were between 30 and 45 dBA, with a maximum of 65 dBA.

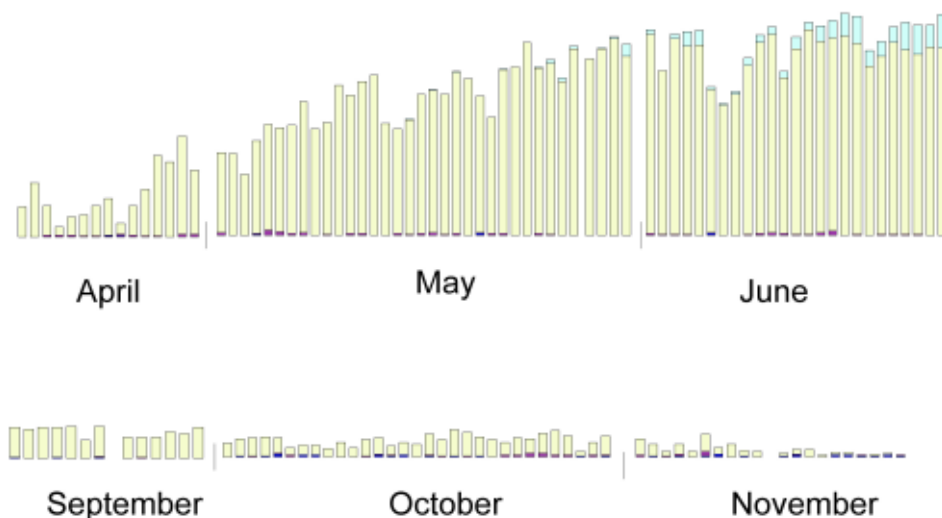


Figure 5. Daily number and type of animal sounds audible at the Stampede Airstrip (STAM in Figure 1) location. Red = squirrel, yellow = bird, blue = mosquito.

along a popular flightseeing corridor in 2004. Most days analyzed had at least five aircraft with a maximum of twenty-five aircraft recorded on August 3 (Figure 4). Weather also influences the number of motorized sounds heard. Strong wind can mask other sources of motorized sound, and aircraft often do not fly on days with inclement weather. For example, August 1 was windy and raining, and there were no aircraft audible. The highest number of audible aircraft was two days later on August 3, and the number of aircraft overflights remained high for the next two weeks.

The natural ambient sound level at the Upper East Fork Toklat River location is 30 dBA ±5 (dBA is the sound level, in decibels, weighted for human hearing), calculated using the median sound level after removing motorized sound levels. The natural ambient level at this site is higher than many other sites (typically around 25 dBA) because of a small steep creek nearby. Many sites have sound levels lower than the 18 dBA detection minimum

of the microphone, therefore we are not able to calculate the absolute minimum natural ambient levels presently.

Additional benefits of making audio recordings over long time periods include the capturing of animal sounds and estimating species presence/absence, distribution, and number of times audible per day (Figure 5). As expected, animal sounds gradually increase during the spring and are much less frequent during the fall. These soundscape recordings are supplementing ongoing bird surveys.

Soundscape studies are relatively new for the National Park Service. The Denali Soundscape Program is developing new techniques and important information about soundscapes in Alaska parks. As identified in a new draft management plan, soundscape measurements are an important indicator of the level of human influence on park resources (NPS 2005). Information provided through this program will help managers protect natural soundscapes and preserve high quality visitor experiences in Denali.

REFERENCES

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