

Acoustic Environment and Soundscape Resource Summary Chaco Culture National Historical Park

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.

At **Chaco Culture NHP**, protecting acoustic resources may be related to the park's ability to enhance visitor experience, and conduct interpretive programs and interpret Ancient Puebloan Culture. The remote setting throughout the park as well as the diversity of related resources benefit from preservation of intrinsic park sounds and noise reduction. The topics in Attachment 1 discuss the importance of the soundscape and the acoustic environment in relation to park resources and values. Future data and planning needs could include final reporting on the 2014 acoustic monitoring, future follow up on acoustic monitoring to track trends, and development of acoustic goals, indicators and standards in planning documents.

Quality of the Resource at Chaco Culture National Historical Site

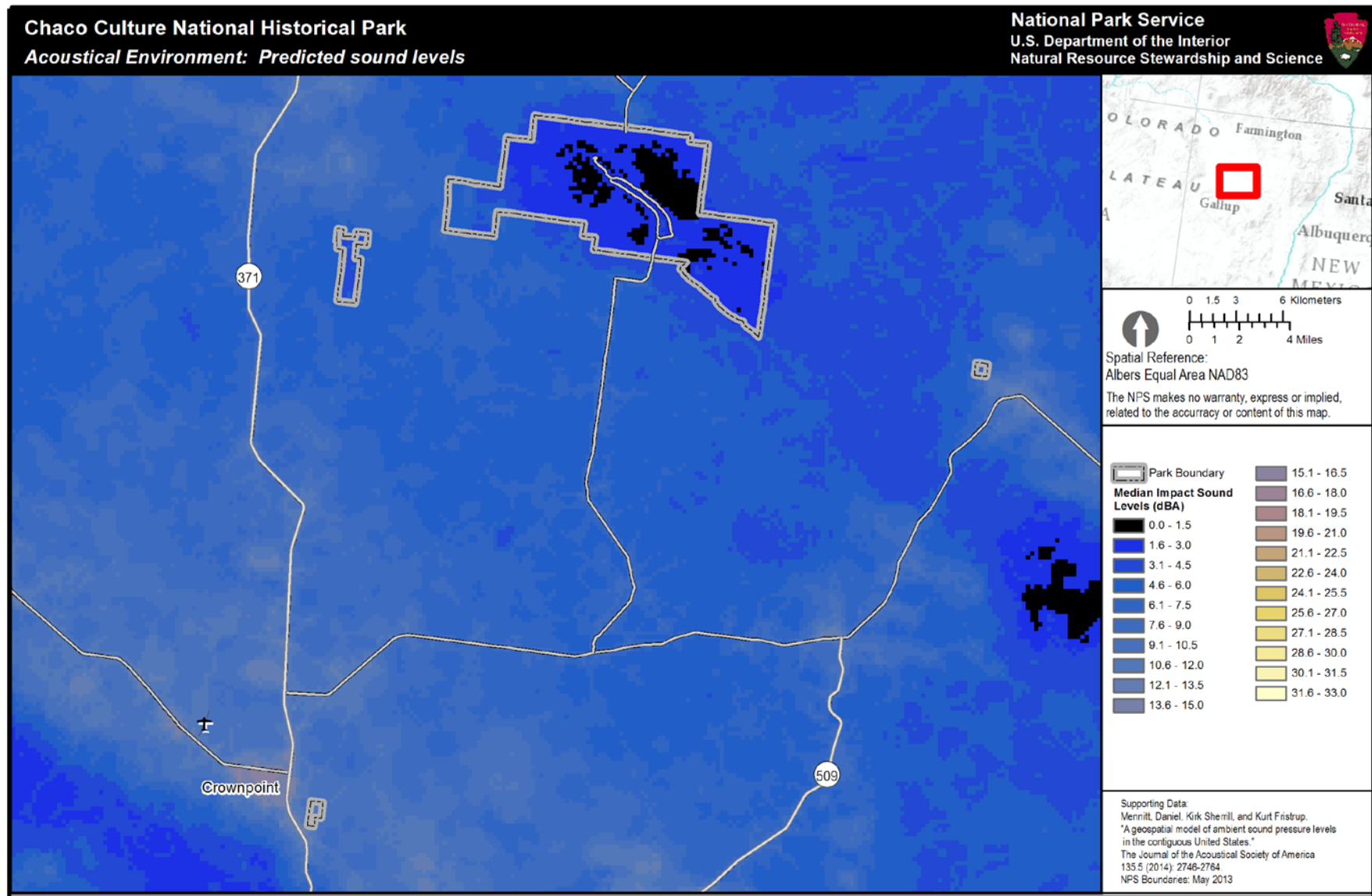
A single parameter that is useful for assessing a park's acoustic environment is the impact of man-made sound sources in relation to natural acoustic conditions. The Natural Sounds and Night Skies Division (NSNSD) estimates the impacts using predictions from a geospatial sound model. The model predicts how much man-made noise raises ambient sound levels. Sound pressure levels for the continental United States were predicted using actual acoustical measurements combined with a multitude of explanatory variables such as location, climate, landcover, hydrology, wind speed, and proximity to noise sources (roads, railroads, and airports). The model predicts daytime impacts during midsummer. The impacts are determined by the difference between the *natural* ambient sounds levels and the *existing* sound levels, as predicted by the model.

To better express the variation of impact across parks, a park-specific impact map was generated from the geospatial sound model. The park map for Chaco Culture NHP is shown in Figure 1 below. The map was generated using 270 meter resolution, meaning that each pixel represents 270 square meters. At Chaco Culture NHP, the mean impact is predicted to be 2.4 decibels (dBA), ranging between 0.9 dBA in the least impacted areas and 11.41 dBA in the most impacted areas. That is, the existing sound level (with the influence of man-made sounds) is predicted to be on average 2.4 decibels above the natural ambient sound level.

A one decibel change is not readily perceivable by the human hear, but any addition to this difference could begin to impact listening ability. An increase of 2.4 dBA would reduce listening area for wildlife and visitors by 42%. For example, if a predator can hear a potential prey animal in an area of 100 square feet in a setting with natural ambient sounds, that animal's ability to hear would be reduced to 58 square feet if the sound levels were increased by 2.4 dBA. Similar reduction would occur for visitors and their ability to hear natural sounds or interpretive programs. Keep in mind this is a mean impact across the park and impacts vary spatially throughout.

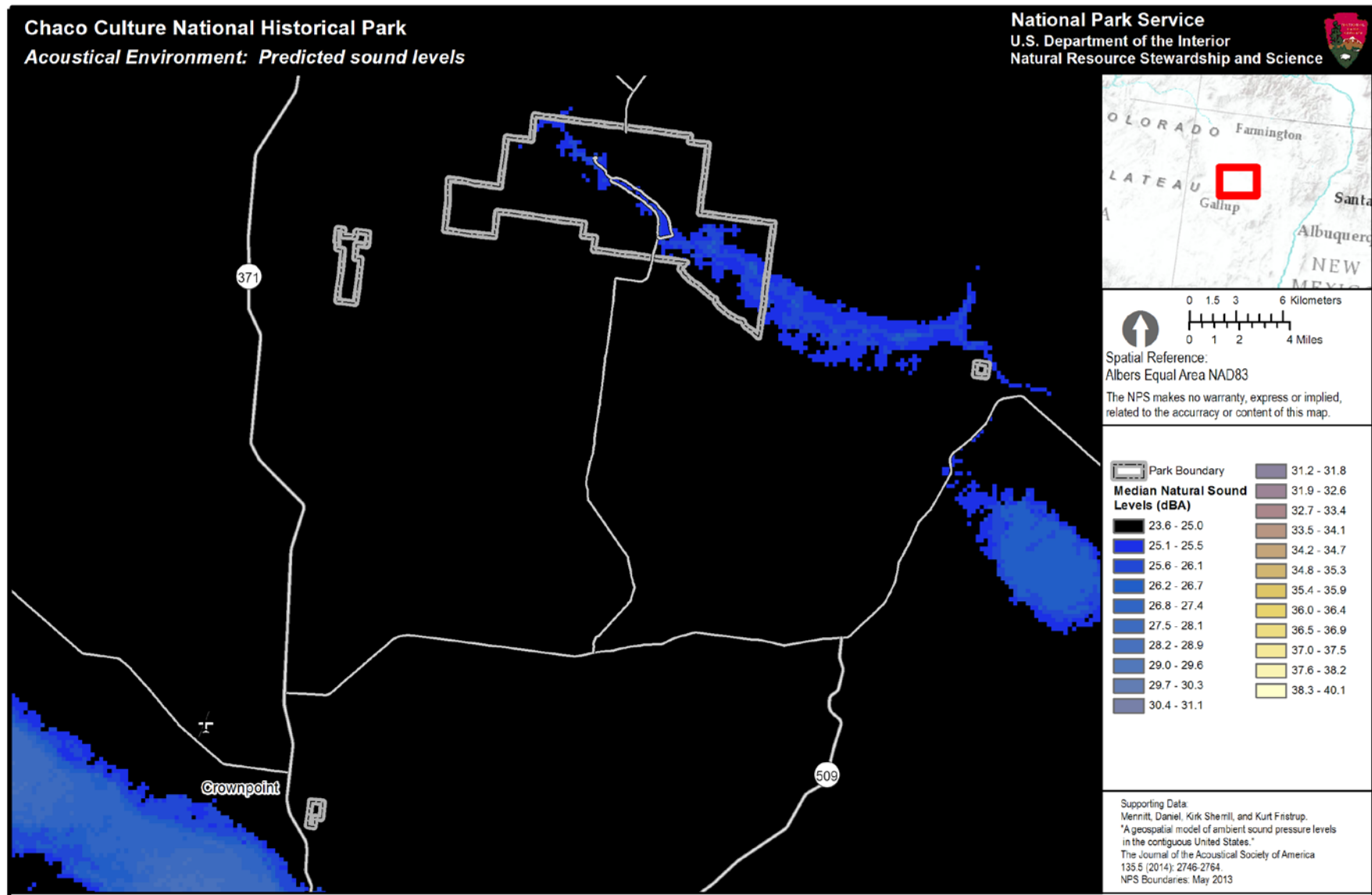
The park-specific map is a subset of the national model and shows median acoustic impact sound pressure levels for the park unit. An inset map is included in each park-specific map to provide a better sense of context, and major roads and highways are labeled for reference. For reference, Figures 3 and 4 show natural and existing sound pressure levels for the park unit, respectively.

In addition to this national model, acoustical monitoring was conducted for Chaco Culture NHP in 2014. This research provides a more comprehensive description of the acoustic environment by characterizing existing sound levels, estimating natural ambient sound levels, and identifying audible sound sources. The methods, data and results of this monitoring effort are provided to the park in an Acoustic Monitoring Snapshot, included as Attachment 2.



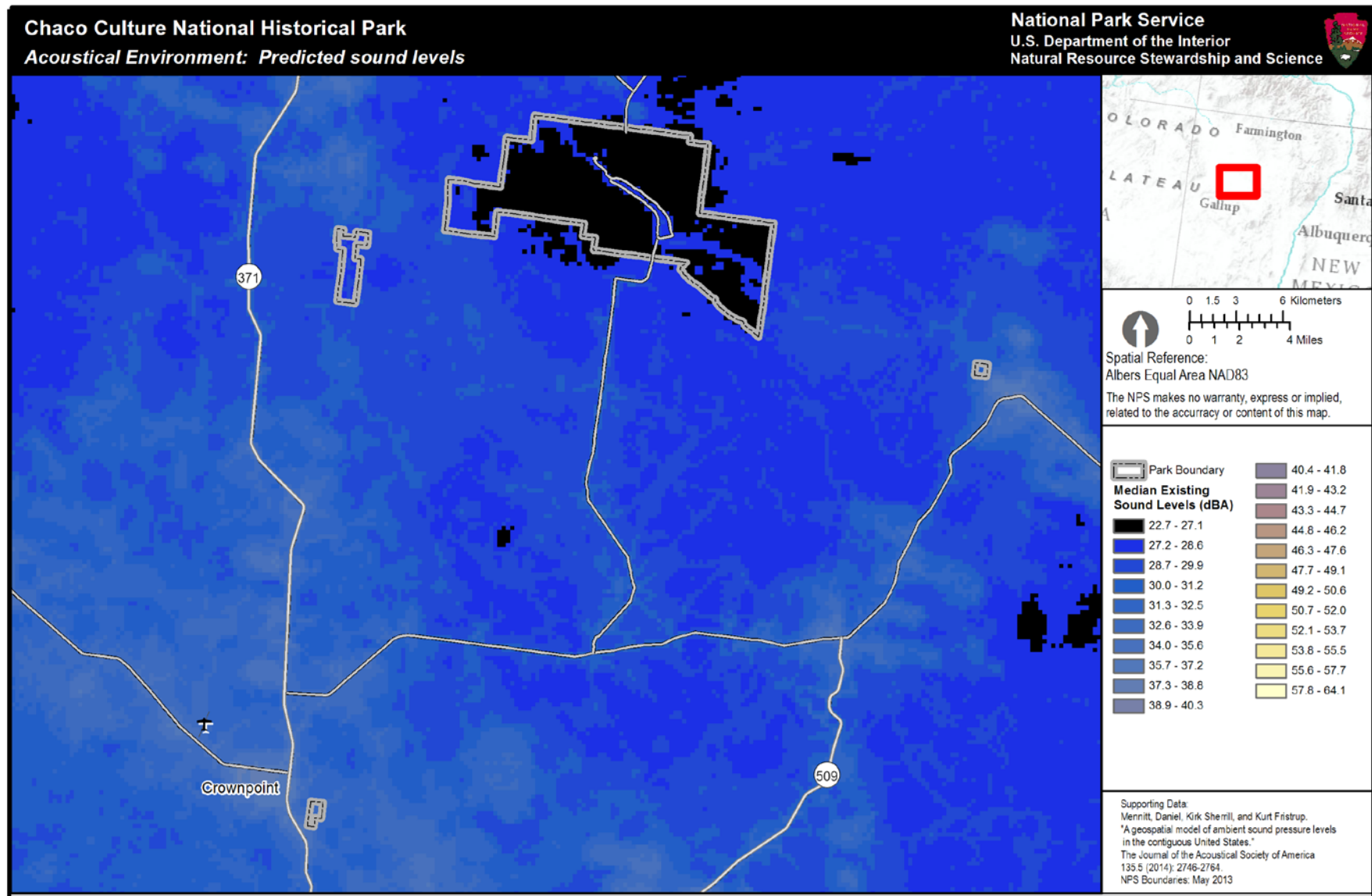
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Figure 1. Median sound level **impact** map for Chaco Culture NHP. This park-specific L50 dBA impact map is generated by ver. 3 of the geospatial model. The color scale indicates how much anthropogenic noise raises the existing sound pressure levels in a given location (measured in A-weighted decibels, or dBA), with 270 meter resolution. Black and dark blue colors indicate low impacts while yellow or white colors indicate greater impacts. (note: each figure has different scale values)



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Figure 2. *Median natural sound pressure levels for Chaco Culture NHP.* This park-specific natural sound level map is generated by ver. 3 of the geospatial model. The color scale indicates the decibel level that is predicted in the park based only on natural sound sources. Sound level is measured in A-weighted decibels, or dBA, with 270 meter resolution. Black and dark blue colors indicate low decibel levels while yellow or white colors indicate higher decibel levels. (note: each figure has different scale values)



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Figure 4. *Median existing* sound pressure levels for Chaco Culture NHP. This park-specific existing sound level map is generated by ver. 3 of the geospatial model. The color scale indicates the decibel level that is predicted in the park based only on both human-caused and natural sound sources. Sound level is measured in A-weighted decibels, or dBA, with 270 meter resolution. Black and dark blue colors indicate low decibel levels while yellow or white colors indicate higher decibel levels. Sound levels in national parks can vary greatly, depending on location, topography, vegetation, biological activity, weather conditions and other factors. For example, the din of a typical suburban area fluctuates between 50 and 60 decibels (dBA), while the crater of Haleakala National Park is intensely quiet, with levels around 10 dBA. (note: each figure has different scale values)