

Acoustic Environment and Soundscape Resource Summary Petroglyph National Monument

National Park Service
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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. The topics in Attachment 1 discuss the importance of the soundscape and the acoustic environment in relation to park resources and values.



At **Petroglyph NM**, protecting acoustic resources and noise reduction are related to these park priorities:

- enhancing visitor experience
- conducting interpretive programs
- historic and cultural settings throughout the park
- diverse flora and fauna

Potential Threats

- Noise from park facilities and operations
- Noise from nearby development, transportation, and aircraft
- Noise from visitors such as visitor vehicles, music, shouting, electronics

Potential Opportunities

- Reduce noise from park operations (time activities to preserve quiet times, purchase quieter equipment)
- Communicate with visitors about benefits of noise reduction to park experience and wildlife health

Existing data/planning:

- Baseline acoustic conditions from sampling in 2010
- Predicted acoustic conditions based on continental geospatial sound model

Future data/planning:

- Re-measure acoustic conditions to describe trend
- Develop acoustic goals, indicators and standards in an acoustic resources plan or other related park plan

Quality of the Resource at Petroglyph NM

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 (without the influence of human-made sound) and the *existing* sound levels (including human-caused sound) as predicted by the model. It should be noted that while the model excels at predicting acoustic conditions over large landscapes, it may not reflect recent localized changes such as new access roads or development.

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 Petroglyph NM is shown in Figure 1 below. The map was generated using 270 meter

resolution, meaning that each pixel represents 270 square meters. At Petroglyph NM, the mean impact is predicted to be 13.2 decibels (dBA) (ranging from 9.6 decibels (dBA) in the least impacted areas to 14.7 decibels (dBA) in the most impacted areas.) That is, the average existing sound level (with the influence of man-made sounds) is predicted to be 13.2 dBA 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 13.2 dBA would reduce listening area for wildlife and visitors by 95%. 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 5 square feet if the sound levels were increased by 13.2 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. Figures 3 and 4 show natural and existing sound pressure levels for the park unit, respectively.

In addition to this national model, baseline acoustic inventory was conducted for Petroglyph NM in 2010. 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 in an Acoustic Monitoring Report, included as Attachment 2.

The overall median daytime sound level during the summer was between 30.9 dBA and 33.4 dBA. Daily (twenty-four hour) median sound levels ranged from 26 to 38 dBA. The windy nature of data collection sites is evident in both the hourly data, as well as in the frequency data. A loud day occurred on 8/23/10 due to a heavy storm that included increased winds, rain and thunder.

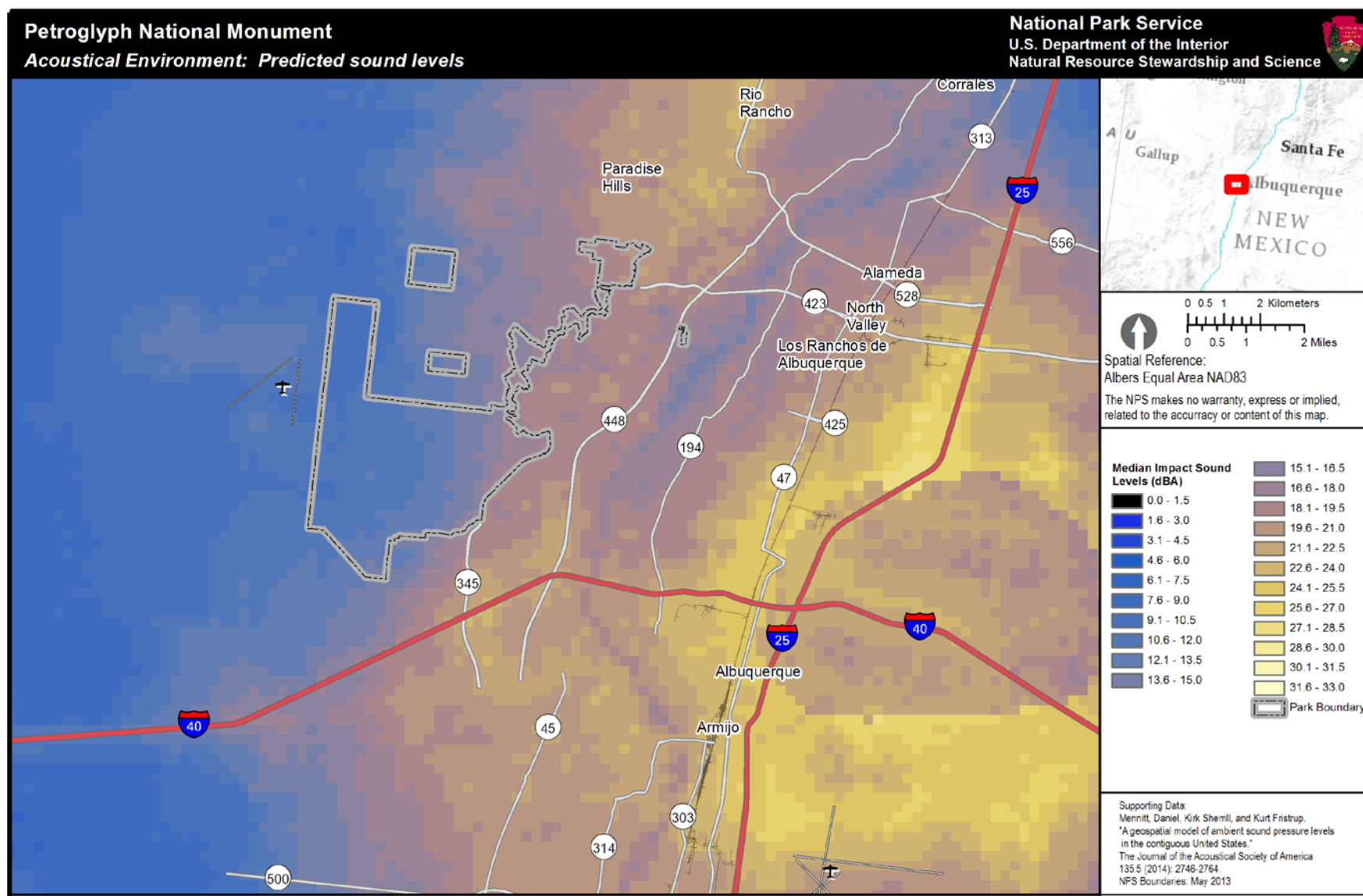
On-site observations and off-site review of recorded audio data concluded that aircraft were audible 49 % - 54% of daytime hours (7 am to 7 pm); total human-related sounds were audible at this site 53% - 55% of daytime hours. As such, noise-free sound conditions (i.e., natural only) were audible 45%- 47% of the day. The majority of the human sounds were due to roadway traffic and aircraft. Sounds from wind, birds, and insects were the most prevalent natural sound sources.

Table 1. Percent Time Above Metrics (dBA)

Site ID	Site Name	% Time above sound level: 7:00 am to 7:00 pm				% Time above sound level: 7:00 pm to 7:00 am			
		35 dBA	45 dBA	52 dBA	60 dBA	35 dBA	45 dBA	52 dBA	60 dBA
PETR001	Rinconada	47.7	6.8	1.2	0.2	56.1	2.3	0.5	0.1
PETR002	Volcano Vista	30.8	5.9	2.1	0.3	11.4	1.4	0.5	0.1

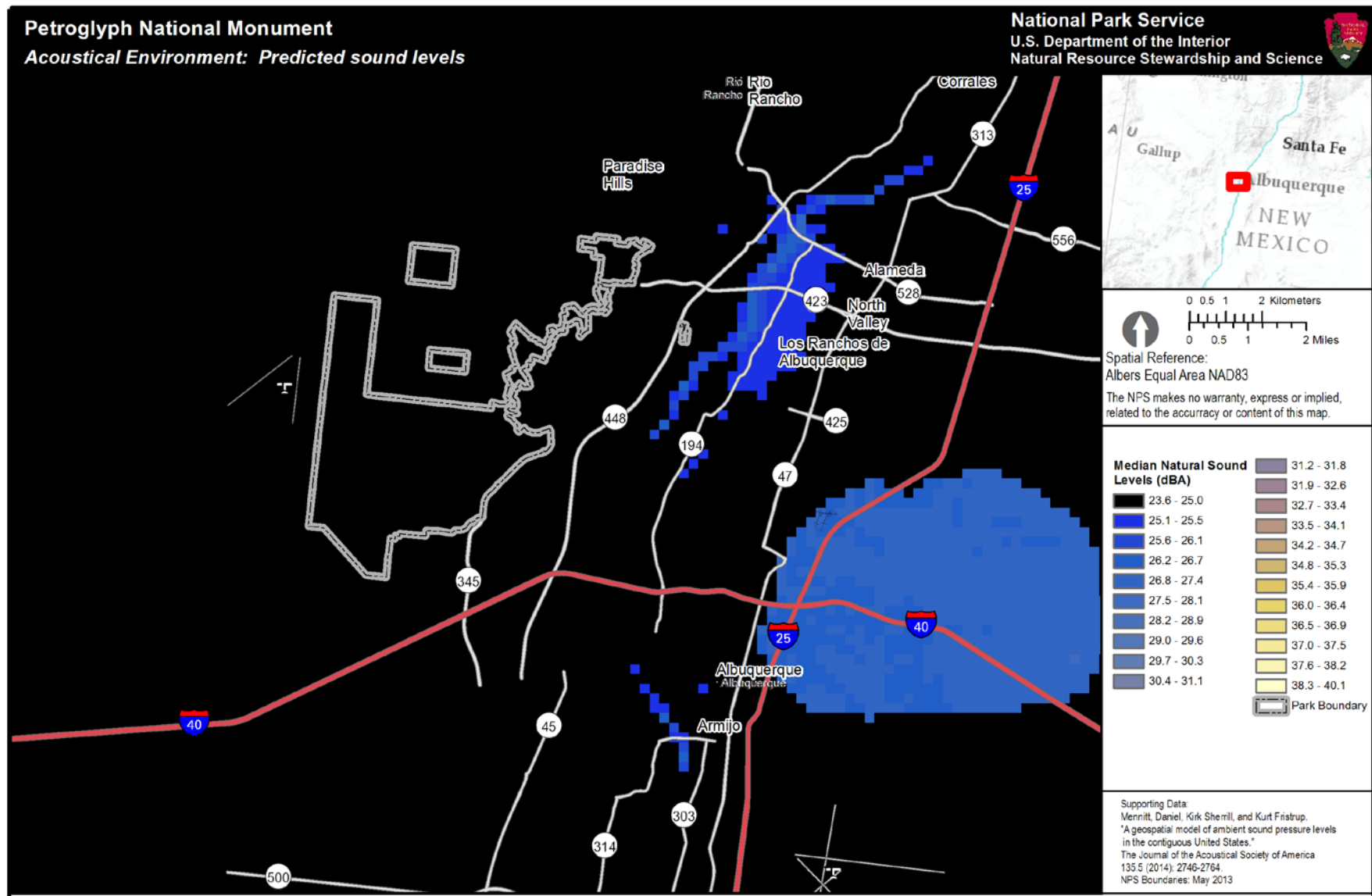
Table 2. Summary of acoustic observer log data (in situ and office listening combined) for all sites for the summer season

Site ID	Site Name	% Time Audible			
		Fixed-Wing Aircraft and Helicopters	Other Aircraft Sounds	Other Human Sounds	Natural Sounds
PETR001	Rinconada	15.2	38.6	1.6	44.6
PETR002	Volcano Vista	30.5	17.9	4.1	47.4



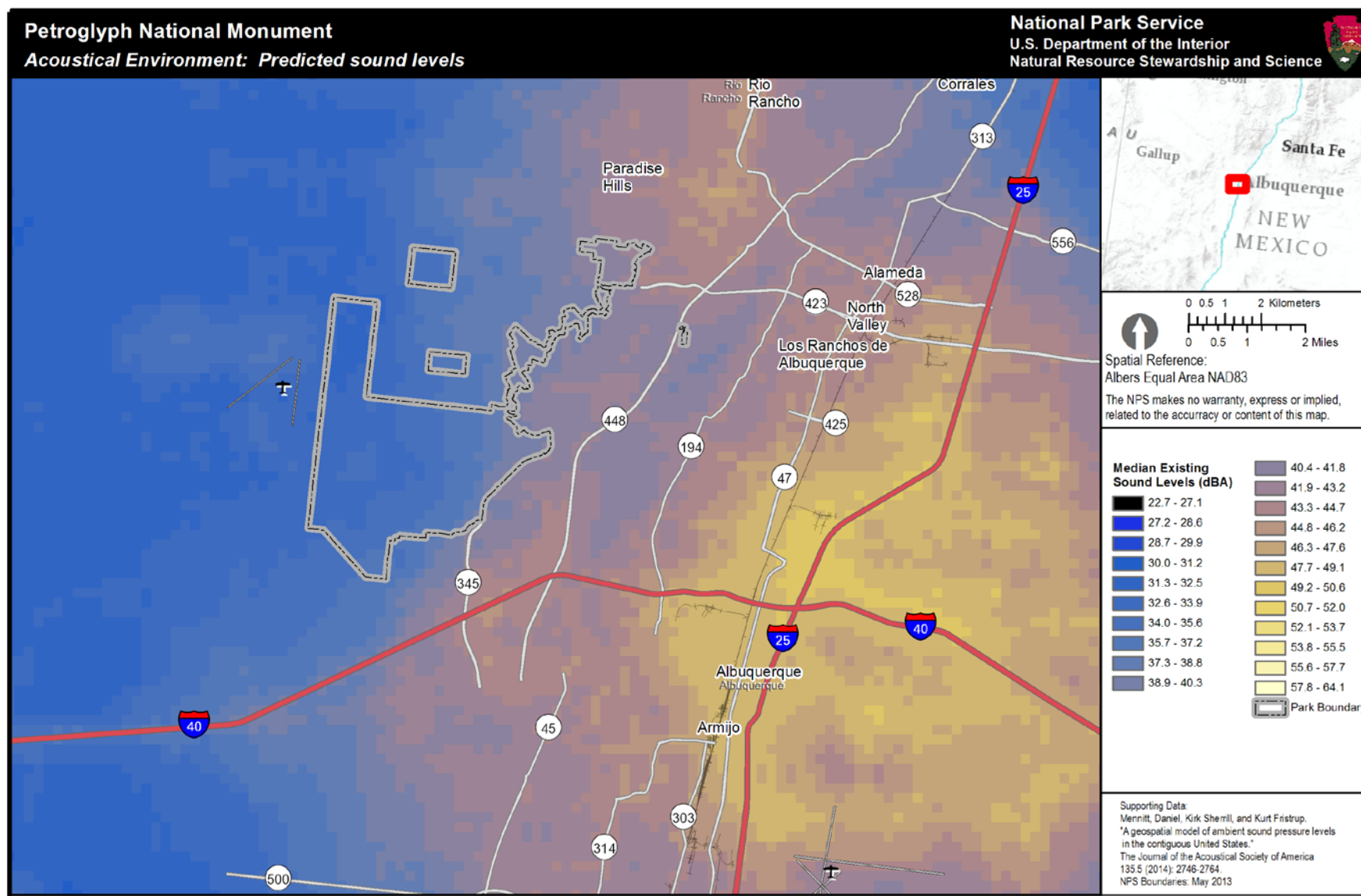
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Figure 1. Median sound level **impact** map for Petroglyph NM. This park-specific L50 dBA impact map is generated by version 3 of the geospatial model. The color scale indicates how much anthropogenic noise raises the existing sound pressure levels 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 Petroglyph NM. This park-specific natural sound level map is generated by version 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 3. Median **existing** sound pressure levels for Petroglyph NM. This park-specific existing sound level map is generated by version 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)