

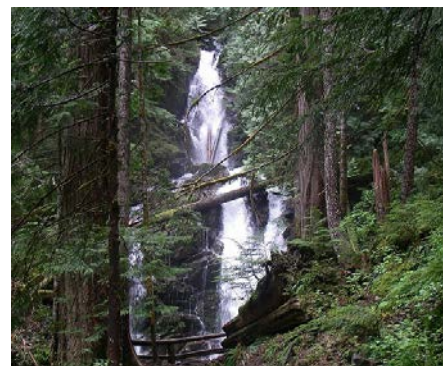
Acoustic Environment and Soundscape Resource Summary Mount Rainier NP

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 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 that may be recognized, when appropriate, in the Fundamental Resource and Value, Other Important Resource and Value, or other section of the document. The topics in Attachment 1 discuss the importance of the soundscape and the acoustic environment in relation to park resources and values. See Attachment 2 for an example of how Bryce Canyon National Park incorporated soundscapes into various sections of the foundation document.

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. Below are some examples of sound pressure levels measured in national parks.

Decibel level (dBA)	Sound Source	Decibel level (dBA)	Sound Source
10	Volcano crater (Haleakala NP)	80	Snowcoach at 30 m (Yellowstone NP)
20	Leaves rustling (Canyonlands NP)	100	Thunder (Arches NP)
40	Crickets at 5 m (Zion NP)	120	Military jet, 100m above ground level (Yukon-Charley Rivers NP)
60	Conversational speech at 5 m (Whitman Mission NHS)	126	Cannon fire at 150m (Vicksburg NMP)

Quality of the Resource at Mount Rainier National Park

Acoustic Monitoring

Extensive acoustical monitoring has been conducted for Mount Rainier NP. These data provide a 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 detailed results are available in the Mount Rainier National Park Acoustical Monitoring Report 2009 (Attachment 3) and the Acoustical Monitoring Snapshot, April 2009 (Attachment 4). Data were gathered from six sites (2006, 2007, and 2009). Sound pressure level, wind speed data, and audio recordings were collected. Numerous attended listening sessions were also conducted.

Monitoring results provide base-line information that documents the resource condition and informs management decisions. Specifically, the acoustic monitoring has been useful in wilderness management and air tour management. During analysis, NSP staff discovered recordings of numerous species such as woodpeckers at Trail of Shadows, barred owls and red-tailed hawks at Green Lake, elk at Crystal Mountain, bears at Lakes Trail, and pikas at Sunrise Ridge. Recordings of a rock slide at Green Lake and shale sliding down the slope on Crystal Mountain were collected. These along with wind and flowing water, are just a few of the many natural sounds which join to create the acoustic environment in Mount Rainier National Park.

In addition to natural sounds, this study found MORA to be moderately impacted by human-caused noise. Over all hours of the day, human-caused sounds were audible between 12.5 and 26 percent of the time in the backcountry and 40 percent of the time in the frontcountry. At the backcountry sites aircraft were the most pervasive non-natural sound source, audible between 11 and 24 percent of the time. The primary source of aircraft noise was high altitude jets, except for Sunrise Ridge where propeller aircraft were heard more frequently. At the frontcountry site, Trail of Shadows, vehicles were the most pervasive non-natural sound source audible 26 percent of the time. Analysis determined that the median noise free interval (time between noise events) ranged from one to four minutes in the backcountry and was only 34 seconds in the frontcountry.

Geospatial model

In addition to the acoustic monitoring, NSNSD can estimate acoustic impacts using predictions from a geospatial sound model. The model predicts how much man-made noise raises natural ambient sound levels and can display the results in computer-generated maps (see figures below). 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 modeled *natural* ambient sounds levels and the predicted *existing* sound levels.

A park-specific impact map was generated from the geospatial sound model for Mount Rainier National Park and is shown in Figure 1. The map was generated using 270 meter resolution, meaning that each pixel represents 270 square meters. At Mount Rainier NP, the mean impact is predicted to be 0.8 decibel. That is, the existing sounds level (with the influence of man-made sounds) is predicted to be less than one decibel above the natural ambient sounds level. Compared to other parks throughout the national park system, this impact level is very low and shows a predominance of natural sounds at Mount Rainier NP that should be preserved and protected. This is consistent with the extensive wilderness planning and management efforts in the park. Figure 4, provides impact levels for the continental United States. Figures 2 and 3 show estimated natural and predicted existing sound pressure levels for Mount Rainier NP, respectively.

One decibel change is not readily perceivable by the human ear, but any addition to this difference could begin to impact listening ability. An increase of 1.0 dBA would reduce listening area for wildlife and visitors by 21%. For example, if a prey animal can hear a potential predator in an area of 100 square feet in a setting with natural ambient sounds, that area would be reduced to 79 square feet if the sound levels were increased by 1.0 dBA. A similar reduction would occur for visitors and their ability to hear natural sounds or interpretive programs. At Mount Rainier NP, the impact of 0.8 would reduce the listening area by approximately 17%.

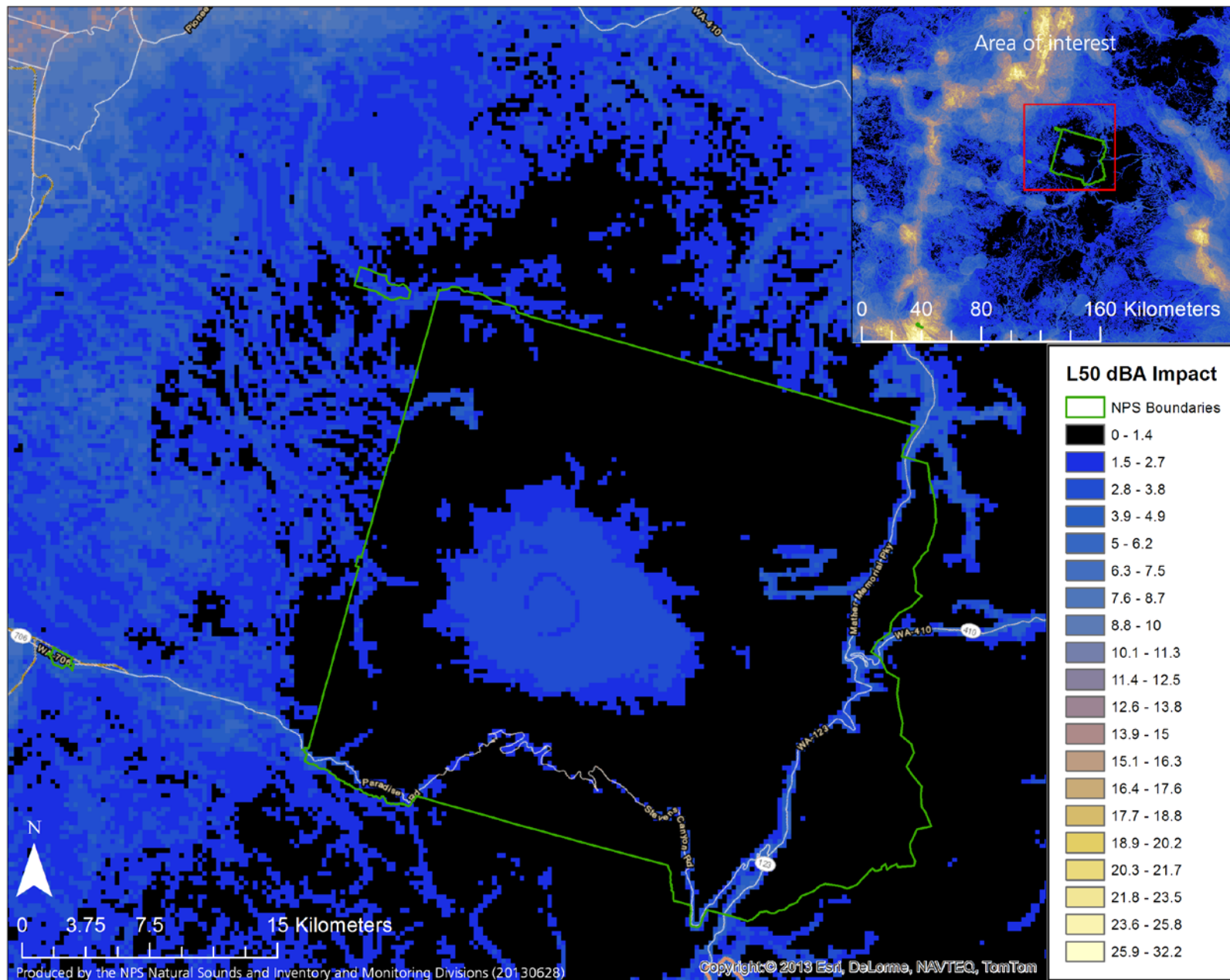


Figure 1. Park-specific impact map for Mount Rainier NP.

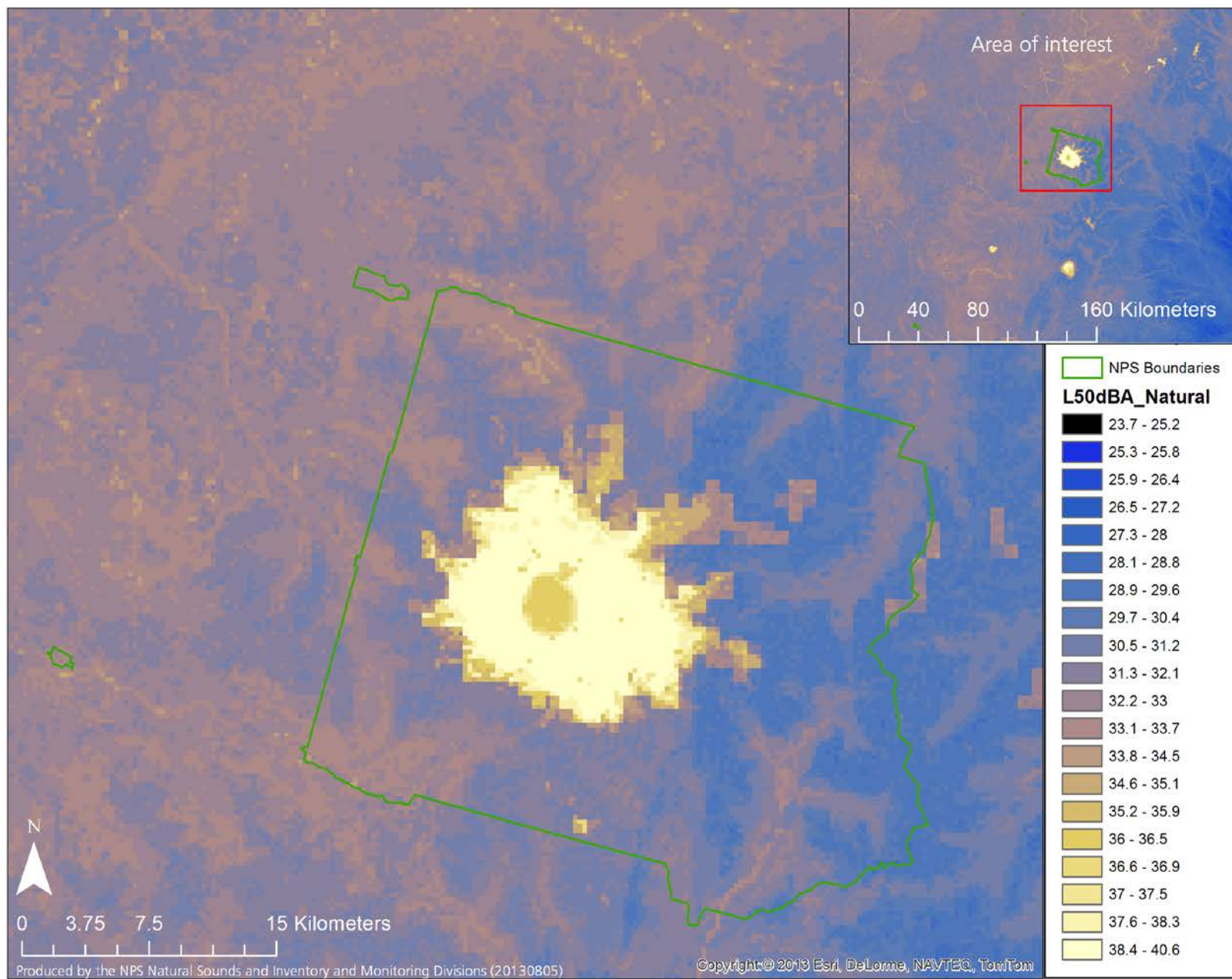


Figure 2. L₅₀ dBA natural sound pressure levels for Mount Rainier NP.

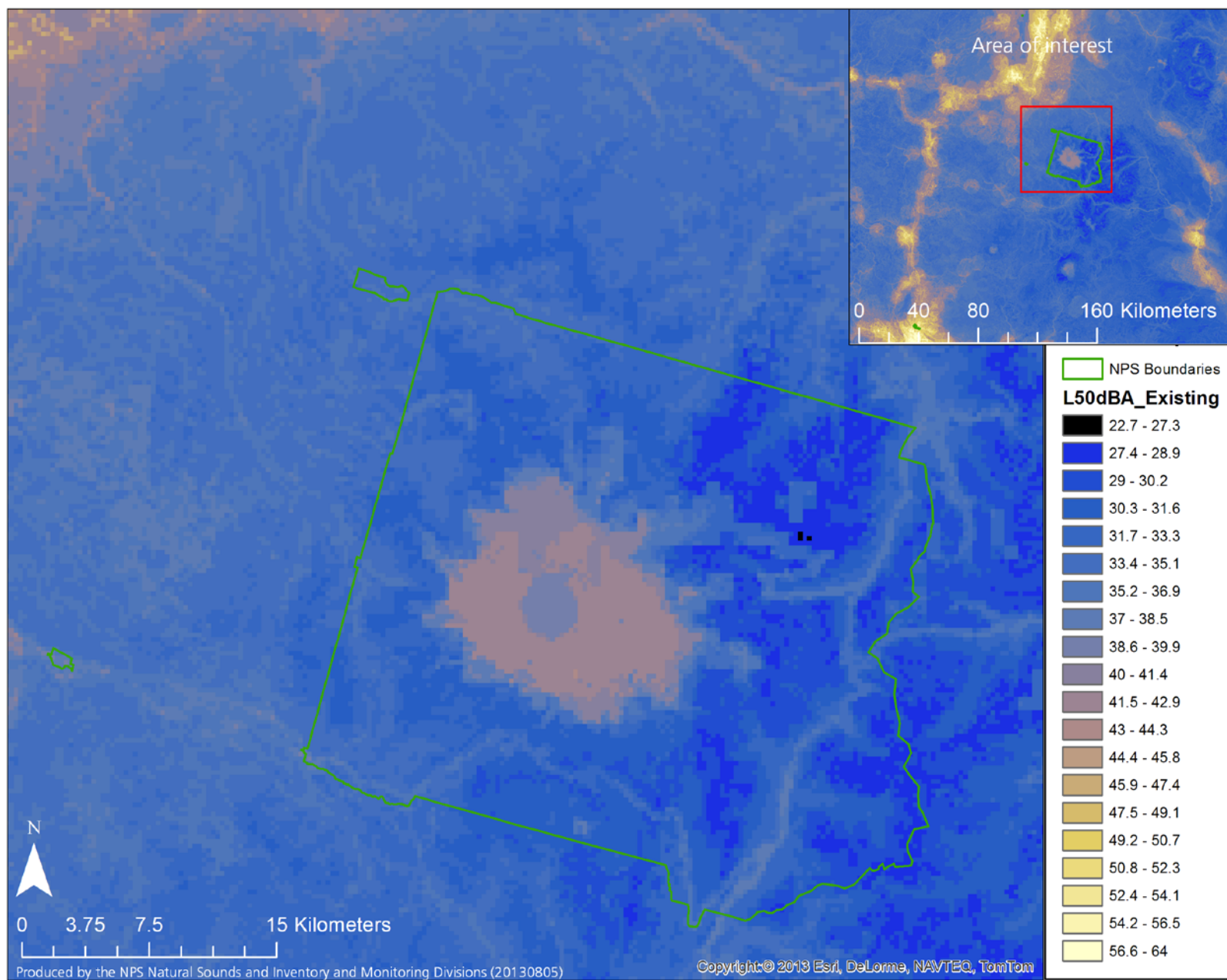


Figure 3. L₅₀ dBA existing sound pressure levels for Mount Rainier NP.

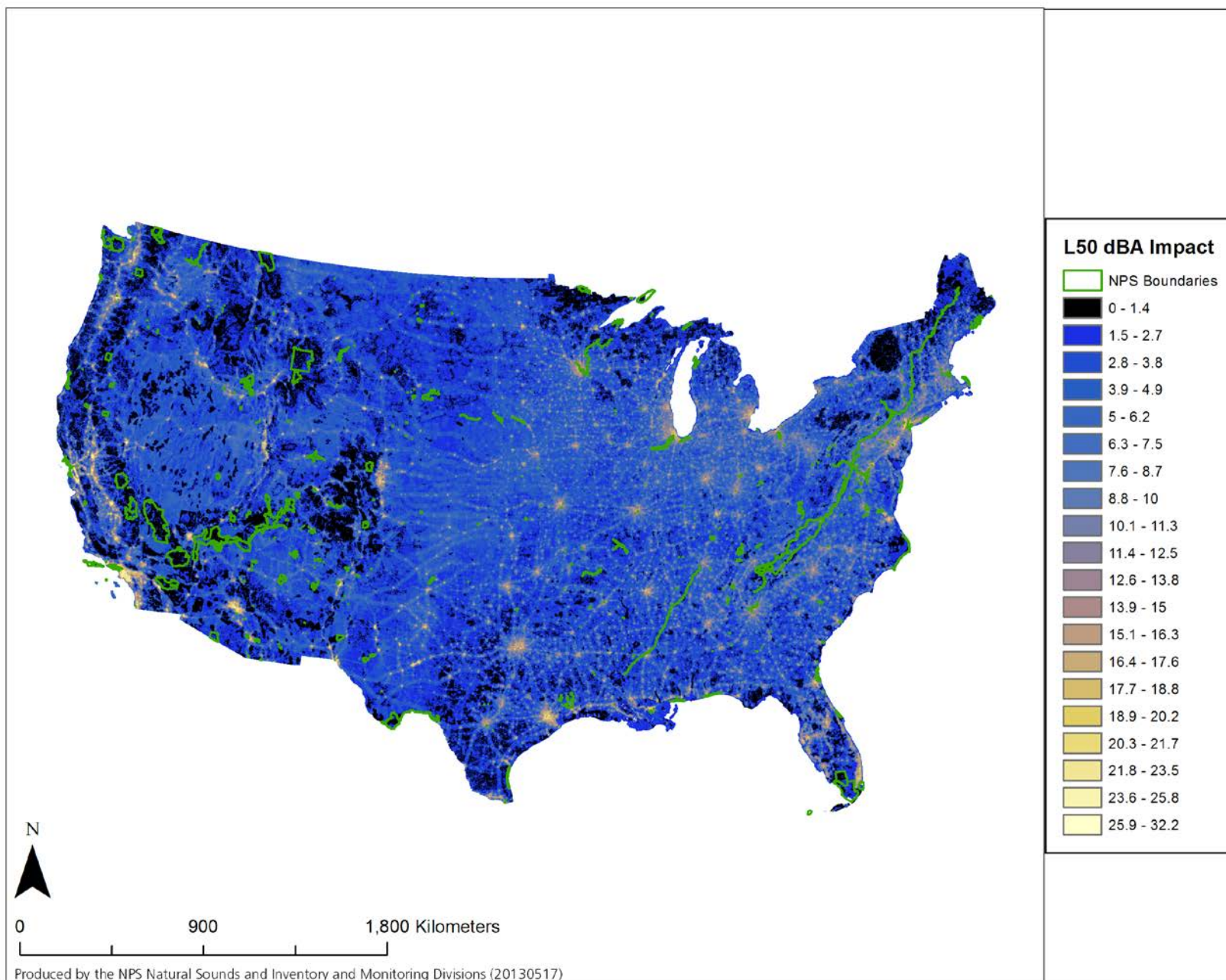


Figure 4. L₅₀ dBA impact sound pressure levels for the continental United States.