

Night Skies and Photic Environment Resource Information National Capital Parks - East

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
Natural Sounds and Night Skies Division



The quality of the nighttime environment is relevant to nearly every unit in the NPS System. The 2006 NPS Management Policies (section 4.10) speak of the importance of a natural photic environment to ecosystem function and the importance of the natural lightscape for aesthetics and visitor experience. A lightscape can be important as a natural feature, a cultural feature, or both. The importance of lightscares and photic environments is related to an array of park resources and values and has broad implications for park management.



When developing the Foundation Document, park staff should consider night skies as a resource with inherent value that may be recognized in the Fundamental Resource and Value, Other Important Resource and Value, or another section of the document. Parks should consider the photic environment and lightscares as important factors that can have a profound effect on the quality of many other park resources and values such as wildlife, visitor experience, cultural landscapes and historic preservation. This approach provides parks with a degree of flexibility regarding when and how night skies can be addressed in the foundation document. Please see Attachment 1 for an example of how Bryce Canyon National Park incorporated night skies into various sections of their foundation document. The sections in this summary discuss the importance of night skies in relation to park resources and values.



While managing the nighttime environment, a distinction is made between the photic environment and the lightscape. The *photic environment* represents the totality of the pattern of light at night at all wavelengths. It is a natural physical system that affects a broad range of species and is important for ecosystems functioning. *Lightscares* include the human perception of the nighttime scene, including both the night sky and the faintly illuminated terrain. Lightscares are aesthetic and experiential qualities that are integral to visitor experience and cultural resources.



Quality of the Resource and Data Needs for National Capital Parks – East

NSNSD scientists measure the quality of the photic environment by measuring total sky brightness averaged across the entire sky and comparing that value to natural nighttime light levels. This measure, called the Anthropogenic Light Ratio (ALR), can be directly measured or modeled when observational data is unavailable. Lower ALR levels reflect higher quality night sky conditions.

Figure 1 provides modeled ALR levels for the contiguous U.S. This figure illustrates the quality of the night skies found throughout the country and across the national park system. Staff can use this image to determine relative darkness or brightness for a park.

The parks in the National Capitol Parks- East area have night skies with ALR levels that range in brightness. This means that the Milky Way may only be visible when directly overhead in some areas or may not be generally apparent in others. In addition, discoloration of the sky is likely and little natural darkness would be present.

Park staff should take note that national parks in urban settings are key in offering opportunities for people to view the night sky. Even when park sky quality is not pristine, the quality relative to the nearby urban areas can still provide a stunning view and a refuge for nocturnal wildlife. The park's night skies may still be an important attraction for astronomers and star gazers. The refuge that parks offer from light pollution and may serve as the only opportunity for many to experience star gazing.

NSNSD has developed an array of tools and services to help parks manage night sky resources and can provide assistance with a variety of planning and data needs. These include night sky quality assessments, development of night sky indicators and standards, night sky quality modeling, facility lighting inventories, park lighting retrofits, International Dark Sky Park Certification assistance, interpretive training assistance, and coordination assistance with local communities concerning lighting ordinances and best practices. Please contact us via Frank Turina at frank_turina@nps.gov.

Cultural Resource

The night sky is a timeless and boundless resource important to many people, cultures, and religions. Dark night skies and celestial objects have inspired many of our greatest discoveries such as art, music and architecture. Its importance is vast, from the architectural alignments of ancestral Puebloans at Chaco Canyon, to the Washington Monument mimicking a giant gnomon at the center of a sundial, and from lyrics of your favorite songs to the myths of ancient Greece embodied in constellations.

The nighttime environment plays an integral role for human evolution and health. It is essential for our bodies in that dark nights (and bright days) are key in keeping our circadian rhythm in sync – for humans, wildlife, and domestic animals alike. It is well documented that without the restorative power of consistent restful sleep, serious health consequences can arise. Chronic disruption in circadian rhythms has even been associated with an increased risk of certain cancers.

The scenic value of the night sky is also culturally significant to the current generation of visitors. With friends and family, visitors may enjoy viewing of a star-filled sky, seeing the Milky Way clearly for the first time, or searching for a particular constellation. These human traditions are important to our cultural experience in parks. With increasing urbanization and use of artificial lighting, national parks are often the primary place where Americans have the opportunity to view and enjoy night skies.

Cultural and Historical Lighting

Many national parks may have historical or cultural sites where nighttime lighting is an intrinsic part of the park. The grandeur of a memorial or the magnitude of a historical event can be enhanced by nighttime lighting. NSNSD acknowledges that nighttime lighting may be significant to the visitor experience of certain parks or required to effectively manage cultural resources. Careful consideration of such lighting should include how it affects resources and values in the park and whether the timing, amount and direction of the lighting are appropriate, both to protect the surrounding natural environment and to retain the appropriate cultural lightscape.

Wildlife and Other Natural Resources

The condition of the photic environment can affect wildlife interactions and other vital ecological processes including predator/prey relationships, mate selection, navigation and migration. In recognition of this importance, dark night skies are considered an air quality related value under the 1977 Clean Air Act Amendments.

Nearly half the species on Earth are nocturnal. The absence of light, natural or otherwise, is a key element of this habitat. Adding artificial light to such habitat may result in substantial impact to certain species. For example, migrating passerine birds fly at night with reference to the stars and can be disoriented by lights from nearby cities, towers, and some park facilities. Amphibians, with vision far more sensitive than that of humans, are apt to be disoriented by light. Even when night skies may not be valued for their human aesthetic appeal, relative darkness may still be essential to wildlife. Research into the ecological consequences of artificial night lighting is revealing numerous connections between light pollution and species disruption.

Visitor Experience

The lightscape has a profound effect on visitor's experience of parks. Artificial light can impact visitors in two main ways: direct glare from light fixtures can affect nighttime recreation experiences; and sky glow from collective sources of artificial light can reduce the ability to view the night sky. Both aspects of artificial light can unnaturally illuminate the ground and diminish visitors' visual dark adaptation.

Recognizing the importance of lightscapes in the park's Foundation Document demonstrates a commitment to providing opportunities to view the night sky and enjoy a quality nighttime recreation experience. A park's natural features take on a unique and compelling glow under the powerful light of a full moon or the faint glow of starlight. Those who experience the park at night are often treated to a dramatic scene that provides opportunities to enhance the richness their overall park experience.

Considerations for historical and cultural sites are also important. Addressing the lightscape in the Foundation Document for these areas recognizes that the grandeur of a memorial or the emotional resonance of a historical event can be enhanced by nighttime lighting. It is an important step in retaining the cultural landscape for the nighttime, not just the daytime. Addressing the lightscape and photic environment in the foundation document for such areas can provide a basis for managing and protecting a broad range of cultural and historical resources, enhancing visitor experience, and minimizing the effects on natural and cultural resources within and outside the park.

Interpretive Themes

Parks should consider adding night skies to the interpretive theme section of the Foundation Document. When appropriate, Night Skies can be incorporated into interpretive themes addressing the natural environment; cultural landscapes; evidence of historic cultures, religions or early lifestyles; historic resources; wildlife, human health; or other appropriate topic.

Many of our parks provide the best opportunity for people to see a natural night sky. Even parks that don't have the highest quality night skies can connect visitors to the nighttime environment. Some parks include relatively dark areas surrounded by highly urbanized lands. The resources in these areas can often serve as an important natural preserve for nearby residents, and although degraded, these sites often provide the best available night sky conditions for large numbers of people. Visitors often travel to these parks to see starry skies; in fact, in numerous parks stargazing events are the most popular ranger-led activity.

A number of parks now host "Astronomy VIPs" or have staff that serve as night sky ambassadors. Several parks have linked cultural heritage to the night, whether via a candle lit civil war battlefield, a discussion of Native American constellations, or simply the traditional experience of fishing before dawn.

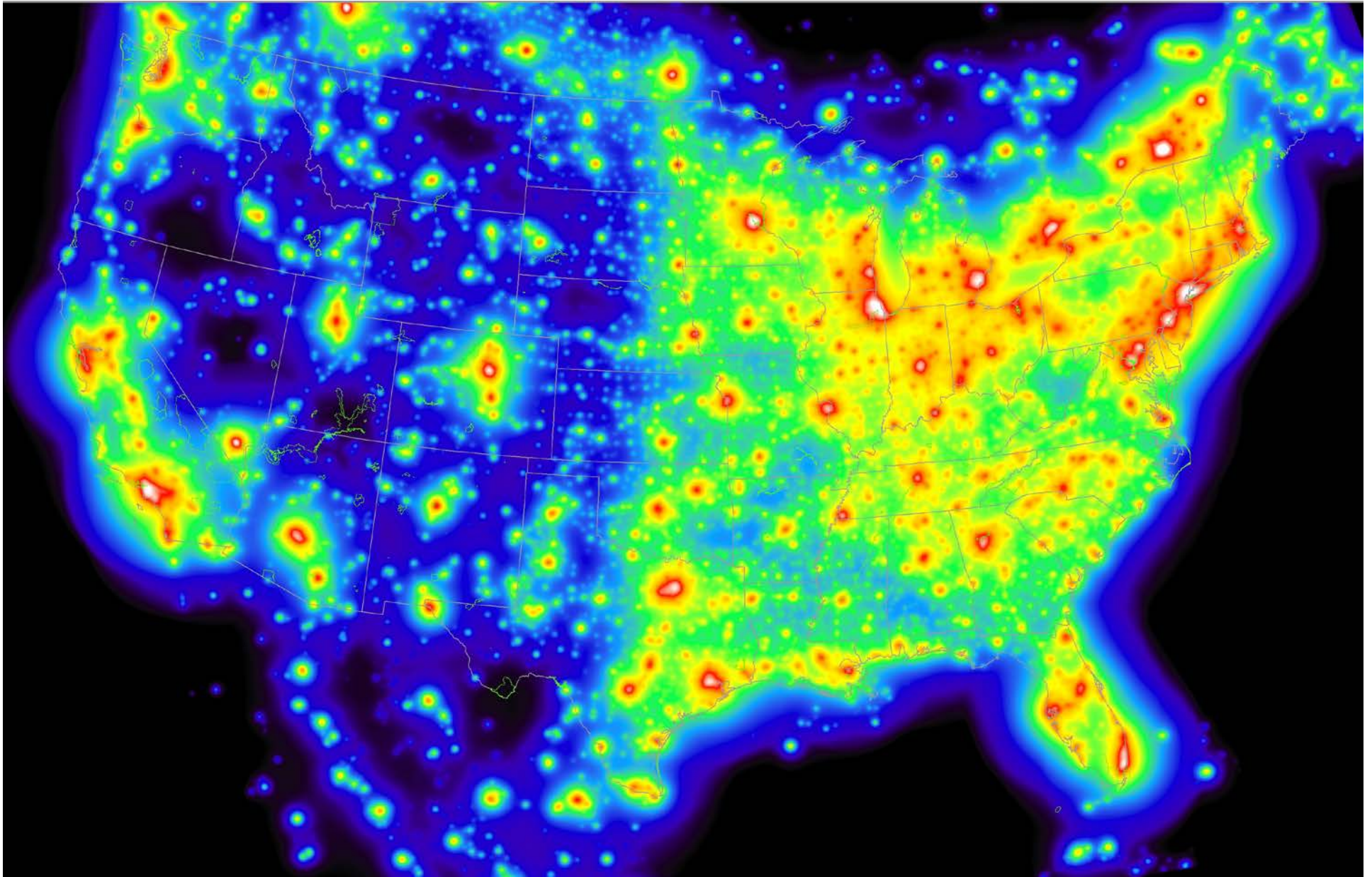


Figure 1 – Anthropogenic Light Ratios (ALRs) for the Contiguous US.