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Proposal for an Astronomical Observing Site in the Cibola

National Forest, West of Magdalena, New Mexico

Purpose of Proposal

A very dark sky for astronomical observing is a natural resource found in fewer and fewer places. The relatively remote Cibola National Forest near Magdalena, NM offers these dark skies in abundance. Local professional and amateur astronomers support designating an astronomical observing site in the Magdalena Ranger District of the Cibola National Forest. For the purposes of this proposal, this site is named "Silver Hill" due to its close proximity to a nearby prominent hill with that name.

Such an observing site would provide amateur astronomers with a place to camp and use their telescopes at night. It would also provide a location for astronomical star parties - conference-like gatherings of typically 100 or more people interested in observing and enjoying the night sky.

Proposed Activity

The proposed activity is centered on the appreciation, enjoyment, wonder and understanding that come from observation of the night sky. When our location on the Earth rotates away from the sun and the moon (near the new moon), we can peer out into the universe and sense our place in it. This profound experience is lost to the majority of people in the US, who live in massively light polluted urban areas. Those smitten by the experience take up the hobby of amateur astronomy and/or become professional astronomers.

Amateur astronomers have formed clubs all across the country. On nights around the new moon, when the night skies are at their darkest, small groups of amateur astronomers travel to dark sites, where they observe the night sky and share telescopic views of stars, star clusters, nebulae and galaxies. The larger clubs frequently organize conference-like gatherings of amateur astronomers. Night sky observing is the central activity of these gatherings, though it is augmented by talks on astronomical topics given during daylight hours -typically by professionals or advanced amateurs. Star party attendance ranges from several dozen to several hundred. We anticipate attendance in the range of 80 to 250 people.

Site Requirements

The observing site should have the following attributes:

- 1) Very dark (virtually light pollution-free) moonless skies;
- 2) Freedom or shelter from vehicular lights;
- 3) Shelter from potentially strong winds;
- 4) 10 to 20 acres of area;
- 5) Extensive, level or nearly level terrain;
- 6) Easy access by cars and minivans;
- 7) Within 2-3 hours travel time from cities along the Rio Grande valley, from Albuquerque to Las Cruces.

Based on the experience some of the proposal authors have had with large, successful star parties and with observing sites, the availability of toilets, showers and water would greatly increase the level of site utilization. These could be provided on a temporary basis for star parties. In the long

run, use of the site would be substantially increased if these amenities were provided year-round.

Why the Magdalena Area?

The Magdalena area enjoys a "front line" border between the increasingly lightpolluted, hazy urban/suburban skies of New Mexico's I-25 corridor and the more pristine dark skies along Route 60 west to the Arizona-New Mexico border.

Appreciating the value of preserving dark skies for both personal satisfaction and as offerings to less fortunate residents of severely light-polluted areas, organizations such as the recently formed Catron County Astronomy Association in Pie Town, The Magdalena Chamber of Commerce and The Magdalena Astronomical Society have been advocating preservation and promotion of this regional asset.

The area between Magdalena and the Arizona-New Mexico border has some of the darkest skies in the United States (see Appendix A). Amateur and professional astronomers seek out places like this. The dark skies allow their instruments to reveal details in astronomical objects only hinted at, or simply not visible at more light polluted locations. In addition to dark skies, the Silver Hill observing site is further aided by the natural beauty of the area, and by nearby astronomical and space facilities. Magdalena and the "Silver Hill" site sit at the center of a burgeoning scientific community. The Magdalena Ridge Observatory (MRO), and Langmuir Laboratory sit atop the Magdalena Mountains at South Baldy. Spaceport America, around 100 miles south, draws people from all over the world. It promises to have increasing prominence as time goes by. The Karl Jansky Very Large Array (VLA) radio telescope, just 20 miles west on Highway 60, has played and will continue to play a large role in providing expertise at the "Silver Hill" events.

Area Overview

The proposed "Silver Hill" Astronomical Observing Site was chosen through field testing for: sky darkness, vehicle access, unobstructed horizons, and its proximity to supporting services in Magdalena (food, gasoline, etc.). It is located approximately 4 miles from the center of Magdalena on Forest Road 10, immediately west of Silver Hill. The site is roughly a 10-minute drive from the Village of Magdalena. The proposed site's location in a shallow valley provides shelter from vehicular lights, while affording a largely unobstructed horizon (especially to the south).

Current Use of Area

In the past year, the Magdalena Chamber of Commerce has successfully hosted three Star Parties in this area of the Cibola National Forest. Attendees have come from Albuquerque, Santa Fe and as far away as Colorado, Arizona and Texas.

Under single-event permits granted by the Forest Service, dry camping is being offered to attendees of Star Parties. Camping in such a place, with the opportunity for stargazing guided by experienced astronomers and educators, offers rich new dimensions to this traditional outdoor activity.

Natural History

The proposed site is the floor of an upland 'headwater' valley. The elevation (above mean sea level) ranges from approximately 6,780 feet to 6,820 feet. The valley trends north-northeast, from Forest Road 10, for a distance of about 800 feet (Figures 1 and 2). The floor of the valley is approximately 40 to 80 feet wide, nearly level transverse to the trend of the valley, and slopes gently 'downstream' with a grade of about 3 percent. The soil in the floor of the valley is organic-rich dark gray clayey silt. Material exposed in animal burrows located on the adjacent hills is fine gravelly sand. The valley appears to be developed in Santa Fe Group: interbedded, weakly consolidated sand, silt, clay and gravel, eroded from nearby mountains and uplands. The valley terminates at the foot of the Silver Hill uplands. Scattered bedrock exposures in the Silver Hill uplands, adjacent to the proposed observing site, consist of andesitic to rhyolitic volcanics. Cattle from a nearby ranch actively graze this site and the surrounding area. Wild grasses, cactus, along with scattered pinon and juniper cover the site. The site is frequented by a number of animals known from the high desert, including elk, deer, pack rats, kangaroo rats, rabbits and snakes.

Figure 1 (top photo) Air photo of proposed Silver Hill astronomical observing site.

Figure 2 (bottom photo) Photo of proposed Silver Hill astronomical observing site, looking up the valley from Forest Road 10.

Proposed Management

Upon designation of the "Silver Hill" Astronomical Observing Area, the Forest Service in coordination with the stakeholders, would develop a management plan designed to protect and enhance the area's observational, educational and recreational purposes.

- * The Forest Plan should include a standard that would disallow uses that would compromise the area's observational, educational, and recreational purposes, including new road building and lighting installations.

- * The Forest Plan should include a guideline for projects occurring in the Bear Mountains that reads as follows:

- o Development on public lands will be required to use dark-sky-friendly technologies to provide opportunities for stargazers and amateur astronomers. Impacts to dark night skies will be prevented or reduced through the application of specific mitigation measures identified in activity level planning and NEPA review. Measures may include, but will not be limited to directing all light downward, using shielded lights, using only the minimum illumination necessary, using lamp types such as sodium lamps (less prone to atmospheric scattering), using circuit timers, using motion sensors, or using flight proximity detectors.

- o Any facilities authorized will use the best technology available to minimize light emissions.

Schools, families, individuals and community organizations would be encouraged to visit and participate in educational dark sky activities. The Magdalena Astronomical Society would work alongside the Forest Service, New Mexico Tech's MRO and the VLA to provide interpretive programs and star parties to facilitate utilization of the area.

Supporting Information - Appendices

Appendix A

Light Pollution Primer

So, why the Magdalena area in particular? Why can't people simply drive into the nearby countryside, adjacent to their city? The reason is light pollution. Lights used to illuminate cities form a light dome. The major cities have light domes that extend far beyond their borders and impact night sky darkness for distances of over 100 miles. In areas with many cities closely spaced, the light domes coalesce, forming huge areas with light polluted skies. Figure 3 is a small section of the 2006 World Light Pollution Map. The map is based on a complex computer-aided analysis of satellite imagery. White, red, orange, yellow, green, blue, gray and black areas depict areas of decreasing levels of light pollution. White corresponds to inner city areas where only a few dozen stars are visible on a moonless night. Yellow corresponds to suburban areas where the Milky Way is an obvious swath of dim, pale gray light, lacking structure. Green corresponds to outer suburban and inner rural areas, where the Milky Way is obviously bright, and displays some gradations and mottling.

Blue corresponds to rural areas where the Milky Way is prominent and displays abundant structure. Gray and black correspond to areas remote from large cities, which have a 'near natural' or 'natural' dark night sky, with minimal light pollution. The Milky Way from these areas is bright and spectacularly detailed. Indeed, it is bright enough to cast visible shadows. Naked eye and telescopic views are spectacular.

With this background in mind, consider Figure 3, a light pollution map of the United States. Nearly the entire eastern half of the country is massively light polluted. The light domes of the countless

cities overlap, leaving only a few small areas with truly dark skies: notable examples include the Allegheny Plateau in northern Pennsylvania (home of the Cherry Springs and Black Forest star parties), the Adirondack Mountains in upstate New York, The Spruce Knob area in West Virginia, and the Chief land area in northern Florida. In contrast, the western US is characterized by several discrete light domes, and strings of smaller light domes, with intervening areas of blue, gray and black. The overall level of light pollution is much less than in the eastern US.

Figure 4 is a close-up view of the Arizona - New Mexico area, with the Magdalena area in the center. Huge light domes are associated with Albuquerque, Phoenix, Tucson, and El Paso. These light domes and several associated 'strings' surround the Magdalena area. This central area, which includes the proposed observing site, is a remnant of the once extensive dark night skies. This dark central area is only about 80 miles across. Magdalena is located on the eastern edge. The proposed Silver Hill observing site is located just beneath the small circle with a pine tree inside, labeled 'Cibola National Forest'. From the proposed Silver Hill observing site, the major source of light pollution is the Albuquerque light dome. Although the obvious, visible light dome extends only a few degrees above the northern horizon, it does slightly lighten the entire sky.

Why not choose a site further west, in the darkest portion of the dark sky remnant?

1) There is little to be gained by traveling further west.

A light pollution survey performed by one of the proposal authors indicates that traveling to the center of the dark sky remnant only brings about a subtle improvement (slightly greater darkness).

2) Most of the observers using the site for observing during dark windows will come from the Rio Grande valley: from Albuquerque to Las Cruces. For most of those people, the Silver Hill observing site is an easy 1 to 3 hour drive on Interstate 25 and US Route 60. Much further and there is a risk that the site would just be too remote.

3) The darkness at the proposed Silver Hill observing site is comparable to the two major star party sites in the western US: the Texas Star Party, near Fort Davis, Texas, and the OkieTex Star Party in the western panhandle of Oklahoma.

Figure 3 Light Pollution Map (2006) of the United States

Figure 4 Light Pollution Map (2006) of the Phoenix-Albuquerque Region

Appendix B

Brief History of Astronomical Star Parties

Regional educational meetings of amateur astronomers, typically "camp out" affairs in natural settings beneath relatively dark skies, began in the 1920s and have become increasingly popular all across the country. The inspirational ancestor of these events is the annual summertime Stellafane Convention that started in 1926 on Breezy Hill near Springfield, Vermont. Stellafane continues to this day, drawing around 1,000 participants to the 80-acre site for a long

weekend of astronomical observation, demonstrations and lectures. Over the decades since Stellafane began these astronomical events, "Star Parties," have proliferated, mostly as smaller, more intimate local and regional events, typically organized by non-profit regional astronomical societies.

Participants bring innovative and sometimes surprisingly large instruments to star parties. Homemade telescopes mix with the latest commercial products. New imaging and computer technologies are shared along with views through antique instruments. Stories, theories, concepts, tricks of the trade are grist to the star party mill, generating projects and friendships.

Family vacations are organized around star party timetables. Children and adults alike are exposed to science as an inherently interesting activity - science as an active manifestation of human enthusiasm. At the same time, star party participants are exposed to the night sky and the wonders of our wild

land environment. When the gathering is over, everyone packs up and departs.

In terms of the population served, star parties are low impact events.

The local cornerstone for star parties is the New Mexico's "Enchanted Skies Star

Party" (ESSP), which has been running for over 20 years under the auspices of the New Mexico Tech Astronomy Club. ESSP is typical of regional star parties in that it has become significantly more popular since its inception.

But ESSP is uncommon in several important aspects:

- * It strives to feature increasingly rare, near-pristine dark skies, while remaining reasonably accessible to a large population from New Mexico's I-25 corridor and beyond.

- * It has received long-term and ongoing volunteer support of dedicated professional astronomers and educators associated with an extraordinary university (NM Tech) and a major national research organization (National Radio Astronomy Observatory).

Appendix C

Outstanding Opportunities for Learning and Recreation

The proposed "Silver Hill" site would be used as a long-term location for regional star parties now organized as annual Spring and Fall events. In addition, we expect

a growing number of astronomical observers to visit "Silver Hill" each month during the "dark window" when the moon is less present in the night sky.

Perhaps most importantly, establishment of such a site will promote appropriate attitudes toward recognition and conservation of increasingly rare dark skies, allowing more of the public to see and understand the sublime splendor of the Milky Way, the zodiacal light and the even more elusive ' gegenschein ' - a counter- glow to the Sun caused by dust in the solar system, famous among astronomers but typically never seen by most of them. Yet for the experienced observer, it can be readily seen, just outside Magdalena, NM.

The Magdalena Ranger District of the Cibola National Forest affords an ideal opportunity to support astronomical activity, which by its unobtrusive nature, will impact the Forest in minimal ways. It will benefit local people and the local economy, and attract visitors from across the country.

Document Reviewed (draft plan, wilderness process paper, map)Resource SectionPage #Line #Comment
Cibola National Forest Mountain Ranger Districts Plan Revision July 2016 Alternate B179 3-5 The creation of a dark skies designated area will benefit the community of Magdalena as well as the state of New Mexico by promoting astro-tourism and maintaining one of its most pristine natural resources our "dark skies" free of light pollution. The area selected on the proposed map has some of the darkest skies free of light pollution in the United States This proposed "dark skies" area is supported by The Magdalena Astronomical Society, The New Mexico Astronomical Society and The New Mexico Department of Tourism, The Magdalena Chamber of Commerce. For additional information please see the attached original proposal and request to Cibola National Forest Service for a dark skies designated area by the Magdalena Astronomical Society.

" " " "Alternate E

(larger area for Dark Skies)185 18 The creation of a dark skies designated area will benefit the community of Magdalena as well as the state of New Mexico by promoting astro- tourism and maintaining one of its most pristine natural resources our "dark skies". This proposed "dark skies" area is supported by The Magdalena

Astronomical Society, The New Mexico Astronomical Society and The New Mexico Department of Tourism, The Magdalena Chamber of Commerce. Extending the area as suggested in Alternate E will create a larger perimeter for "Dark Skies" free of light pollution allowing a broader area for observation of the night sky.

For additional information please see the attached original proposal and request to Cibola National Forest Service for a dark skies designated area by the Magdalena Astronomical Society.