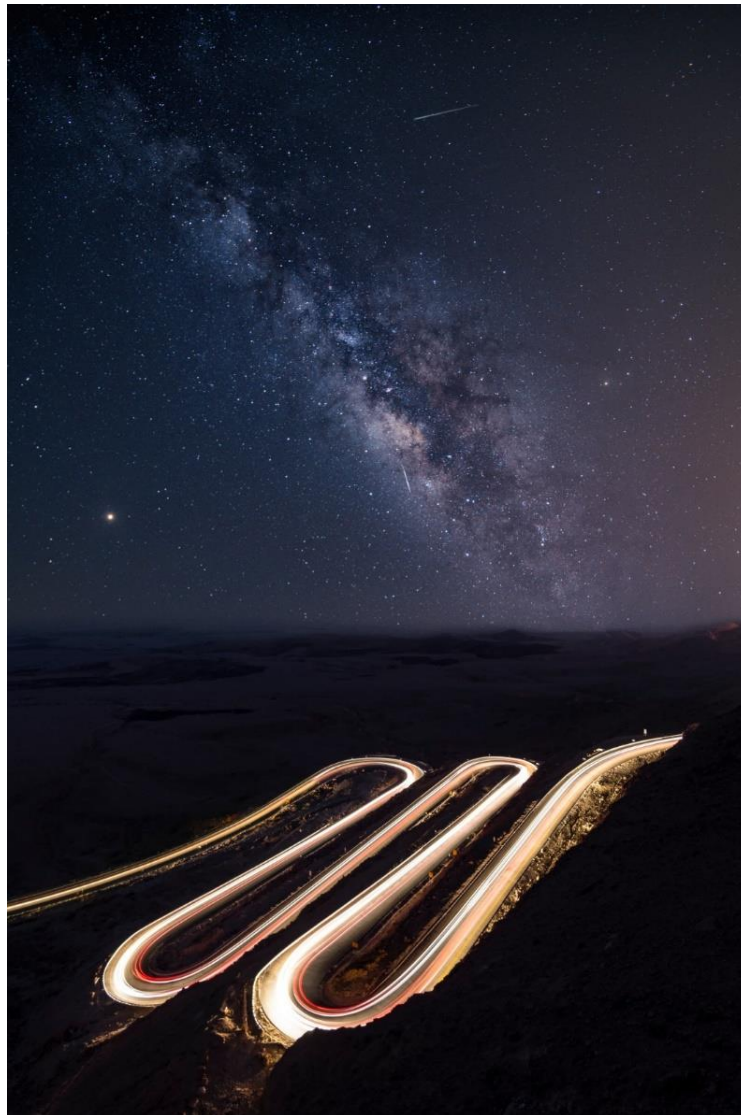


THE RAMON CRATER INTERNATIONAL DARK SKY PARK

שמורת אור כוכבים בינלאומית מכתש רמון

2020 ANNUAL REPORT
SUBMITTED TO THE INTERNATIONAL DARK SKY ASSOCIATION



Driving down the road leading into the Ramon Crater (timelapse).
Photo: Dr. Raid Omar. 1st place winner of the 2020 photography
exhibition, Ramon Visitor Center.

SEPTEMBER 2020

Preface

The Ramon Crater International Dark Sky Park was designated by the IDA in September 2017.

Located in the Negev highlands, it represents one of Israel's most isolated wilderness areas, and is within Israel's largest nature reserve (1,100 square kilometers). This public land is protected by law and managed by the Israel Nature & Parks Authority (INPA) and is designed to protect the Ramon Crater, the largest of the three erosion craters (geologically termed Maktesh), uniquely formed in the Negev desert of Israel. The Ramon Crater is 40 kilometers long and 2 to 10 kilometers wide, shaped like an elongated heart. It contains geological formations unparalleled elsewhere in the world. Together with magnificent panoramic views, it presents a fascinating story and an important natural laboratory of geomorphologic evolution. Its remoteness and Genesis-like landscape attracts numerous visitors. Its location far from big cities offers not only an exceptional daytime visiting experience, but also a unique night time experience, when the extraordinarily clear night skies can be enjoyed at their fullest.

A great emphasis is given by the INPA towards the preservation of the night skies, recognized as an important natural resource, having its own intrinsic value and due to its importance to the natural ecosystem as a whole. Throughout the years, star gazing activities have become an inherent part of the experience of thousands of visitors, who visit, hike, and camp for the night and enjoy the exceptional undisturbed night sky views, now preserved in the Ramon Crater International Dark Sky Park.

The year 2020 will long be remembered for the worldwide Covid-19 epidemic and lockdown. The spectacular night skies above the Ramon Crater International Dark Sky Park have provided a view of hope, optimism and inspiration in this hour of need for thousands of its visitors this year.

This report represents the third annual report of the Ramon Crater International Dark Sky Park submitted to the IDA.

On behalf of the Ramon Crater Dark Sky Park management team



Noam Leader, PhD

"

It's not dark yet, but it's getting there".

Bob Dylan, Nobel Prize Literature laureate 2017



"A marriage proposal under the Milky Way". Photographed at the B'eerot campground in the Ramon Crater during the August 2020 Perseids meteor shower. Photo by Kfir Veler, Starchasers (Mazal-Tov to Mike & Yuval!).

General

Current information for the site IDA contacts:

The Ramon Crater International Dark Sky Park management team:

- Maayan Levi, Ramon Crater Nature Reserve Manager, INPA
- Ben Drori, Ramon Visitor Center Manager, INPA
- Zehava Siegal, Har Hanegev Ecologist, INPA
- Amir Shafir, Har Hanegev Regional Manager, INPA
- Dr. Asaf Tsoar, Southern District Biologist, INPA
- Dr. Noam Leader, Head of the Ecology Department, Science Division, INPA;
leader@npa.org.il

- Does the Park currently have a Provisional status? No.
- Does the Park plan to apply for a tier status upgrade in the future? No.

Visitation and Night Sky Programming:

- Ramon Crater 2019-2020 Total Visitation: ~270,000 (estimate).
- Overnight camping at the Be'erot Campground in the Ramon Crater: 24,200.
- INPA Astronomy Program Visitor Contacts since Oct 1, 2019: ~34,000 (Table 1). Local astronomical tour operators reported on up to 70,000 visitors during Sept. 2019 –Sept. 2020, among them several hundred foreign tourists.

Date	Location	No. participants	Event type	Description
Sukkot holiday 4-19/10/2019	Be'erot campground	1750	Guided astronomic viewing with telescopes	Nightly activity all week long
Sukkot holiday 11-19/9/2019	Multiple designated sites within the Ramon Crater and the nearby area	7,000	Guided astronomic viewing with telescopes	Nightly activity all week long
Perseids meteor shower 10-16/8/2020	Be'erot campground, Tzivey Haramon and in multiple designated sites within the Ramon Crater and the nearby area	25,000	Guided astronomic viewing with telescopes	Visitors took part in all activities in the Crater and in Mitzpe-Ramon, throughout the following week.
Summer vacation July-August 2020	Be'erot campground	60	Night & star photography workshop	Six workshops were conducted (ten participants per workshop)

Table 1. Details of astronomy-related public activity in the Ramon Crater (Only activity offered by INPA)

- Stargazing arena

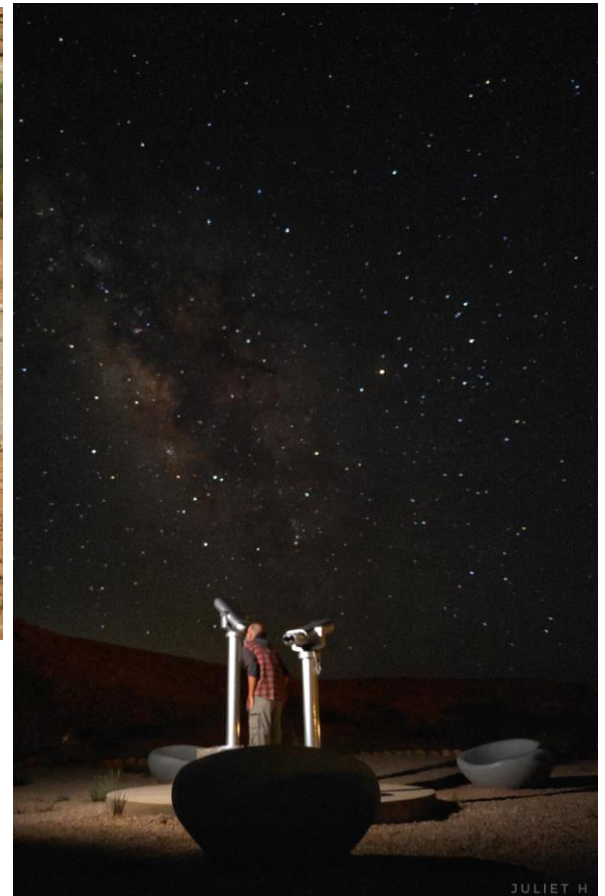
During 2020, INPA set up a stargazing arena adjacent to the B'eerot campground for optimal public astronomical and dark sky awareness activities. The arena is equipped with two permanently mounted 100X25 telescopes at the arena center and a dozen specially designed large bowl-shaped stone seats circling around it at different distances, thus simulating different orbiting planets.

The design and the construction of the stargazing arena were all conceived locally by Maayan Levi, the Ramon Crater Nature Reserve Manager, together with B'eerot campground personnel. The project received an award for its merit from INPA CEO, including funding for construction. INPA Science Division supported the acquisition of the telescopes.

The Stargazing arena has turned out to be a success. The arena and telescopes are in use on a nightly basis by campers at the B'eerot campground and public reception is very positive.



Stargazing arena adjacent to the B'eerot campground equipped with two permanently mounted telescopes and specially designed seating arrangements for optimal guided astronomical and dark sky awareness activities. Photos: (top) Maayan Levi, INPA; (right) Juliet H., INPA.





Stargazing event in the Ramon Crater. Photo: Nadav Taube, INPA.

Lighting

The INPA has continued to preserve the lighting management plan in the Ramon Crater Dark Sky Park to comply with IDA standards. Two campgrounds within the crater (one only recently operational) and a road segment are currently the only permanent sources of artificial light within the Park boundaries:

Be'erot campground (point 7 in map, Fig. 2): No lighting changes or additions were made in 2020 at the Be'erot campground. Following changes made in 2018 (described in the 2018 annual report), all lighting in the campground currently consists of Lightscape Management Plan (LMP) approved lights, and is in total compliance.

Geves campground (point 2 in map, Fig. 2): A small campground operating since mid-2019, located in an old abandoned gypsum quarry, adjacent to Road 40. The campground at the bottom of the quarry is about 25 m below the crater floor and is completely surrounded by the excavated area's walls. The campground is therefore not visible from the road or from any other location on the crater floor. The campground is operated by a private developer. The campground consists of a large Bedouin tent, a small building which serves as reception and kitchen and another serving as public toilets and showers. These facilities are lit at night with several LED floodlights around the kitchen and tent and smaller LED path lights in the public toilet areas (detailed in Appendix I.).

Following last year's report, INPA has worked together with the campground operator in order to replace all in-compliant lighting in the complex with lights that conform to the park's LMP, similar to the lighting at Be'erot campground. All lighting currently used in the campground complies with the park's LMP (see Appendix I). Additionally, the campground operator has guaranteed INPA not to hold public events where there will be nighttime illumination that will illuminate towards the sky or exceed the area of the quarry pit.

Road lighting (point 1 in map, Fig. 2): Following a retrofit of road lighting at Ma'ale Atzmaut, (Independence Pass), at the northern entrance to the Ramon Crater in 2019, as reported in last year's report, no new road lights have been added.



Footpath in the B'eerot campground, with embedded solar-charged resin-based glow stones lights up the way between the tent area and public toilets/shower area. No additional lights are required. Photo: Juliet H., INPA.

Sky Quality

In 2020 INPA Ramon Crater Ranger, Yedidya Shmuel and Har Hanegev Ecologist, Zehava Siegal, surveyed and conducted measurements throughout the crater to track the stability of night skies within the park and monitor any improvement or degradation at 12 predetermined permanent locations, located along the main axes (north-south / east-west) and roads within the crater (Table 2, Figure 2). Measurements were taken using a handheld Unihedron Sky Quality Meter (model SQM-L). A GIS based collection system was developed to enable easy data collection and long-term analysis of night sky quality at the determined sampling locations.

Overall sky brightness did not increase in the crater, when compared to past measurements conducted in 2015 (Table 3) and measured at a similar mean of 21.35 mpsas. Moreover, most 2020 SQM measurements in the darkest point, core area and minimal lighting areas were similar to previous measurements.

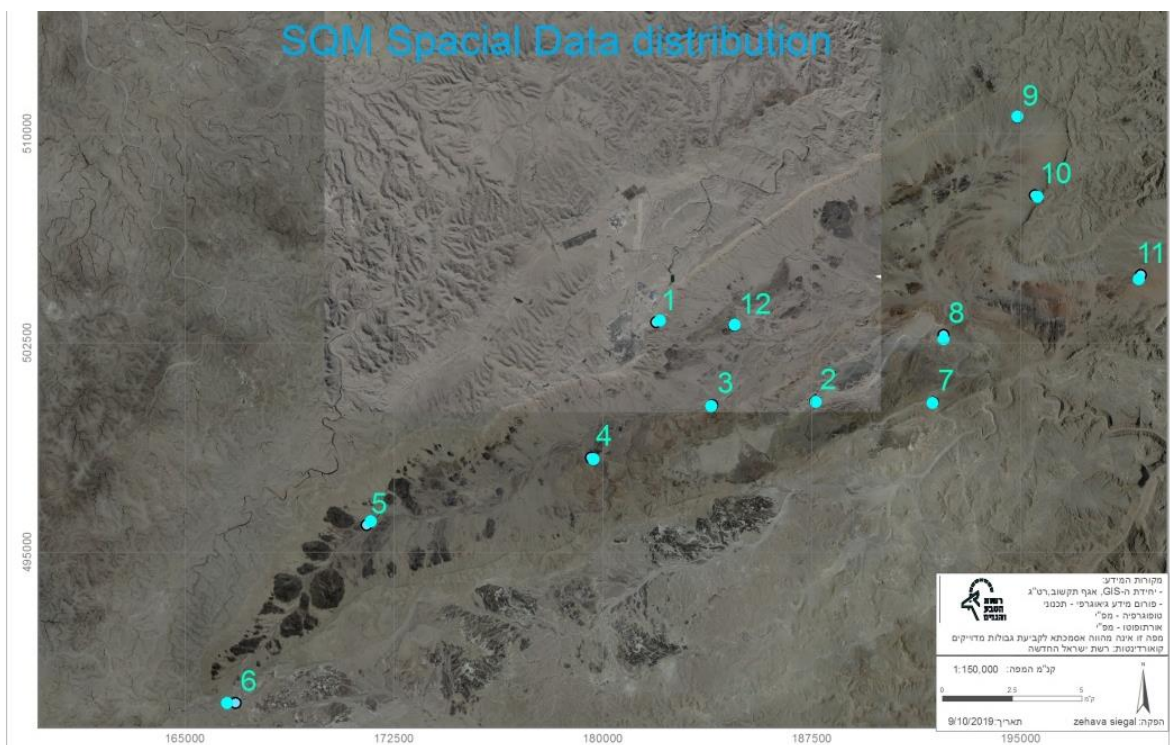


Fig. 2. Annual Sky quality monitoring plots carried out by INPA Ramon Crater staff to track the stability of night skies within the park and monitor any improvement or degradation at 12 permanent locations, located along the main axes (north-south / east-west) and roads within the crater.

ID	Location: Longitude – East	Location: Latitude – North	Mean SQM Reading 2015	Mean SQM Reading 2019	Mean SQM Reading 2020	Notes
1	34.81357	30.6189	21.00	20.57	20.65	Near Mizpe Ramon
2	34.87196	30.59282	21.33	21.48	21.38	Near Geves Campground
3	34.83286	30.59138	21.32	21.15	21.31	In The Core Area
4	34.78879	30.57405	21.38	21.37	21.24	In The Core Area
5	34.7055	30.55365	21.54	21.59	21.47	In The Core Area
6	34.65222	30.49467	21.70	21.68	21.59	Darkest Point
7	34.91555	30.59261	21.47	21.36	21.48	Near Be'erot Campground
8	34.91979	30.61323	20.74	21.32	21.39	Minimal Lighting Area
9	34.94722	30.68516	21.48	21.42	21.45	Minimal Lighting Area
10	34.9548	30.65931	21.50	21.47	21.51	Near Campground
11	34.99281	30.63268	21.32	21.54	21.54	Minimal Lighting Area
12	34.84144	30.61759	21.18	21.05	21.18	Near The Road
All			21.33±0.25	21.33±0.29	21.35±0.25	Mean±SD all

Table 3: Locations and latest SQM measurements of the 12 locations for long term monitoring in the Ramon Crater.

- A permanently mounted sky quality monitor (Unihedron SQM-LU) provides continuous monitoring of the effects of artificial lighting on night sky quality at the Be'erot Overnight Campground, and the campground's compliance with the parks lighting guidelines. The monitor installed above the office building at the Be'erot Campground had malfunctioned due to an electrical problem and has ceased to operate. Consequently, all data collected was lost. We have recently purchased a replacement from the manufacturer and will begin to continuously monitor the campground.

Conservation and Research

- There are currently no ongoing research programs at the park relating to night-sky conservation. A Mars simulation project - "D-Mars", in cooperation with the Israel Space Agency and the INPA is planning to utilize the Ramon Crater as a simulation platform for investigating living conditions of future scientific missions to Mars (<https://www.d-mars.org/about>, Fig. 3). Unfortunately, the Covid-19 lockdown has postponed this project.



Fig 3. D-Mars "Ramonauts" simulating scientific expedition on Mars, in the Ramon Crater. Photo: Tomer Nachmani, INPA .

Funding

- The INPA is currently not administering any grants related to dark-skies programming.

Arts and Culture

- An ongoing photographic art exhibition entitled "Let there be dark" is on display at the Ramon Crater Visitor Center (Fig. 4). The exhibition focuses on night sky photography of the Crater by local amateur astronomers and photographers. From the exhibition advertisement excerpt: *"Since the Ramon Crater was declared as an International Dark Sky Park in September 2017, the area has become a center of pilgrimage for amateur and professional photographers who come to photograph the heavenly wonder, and now everyone has the opportunity to be exposed to the phenomenon during the day"*.

The success of this exhibition prompted the beginning of an annual photography competition at the Ramon Crater Visitor Center, with prizes donated by the local community, which include photography equipment and astro-photography courses. Additionally the first place photo will appear as the cover of the annual report.

This year's exhibition and competition was organized by Ben Drori, Olga Khananaev and Nadav Taube from INPA, together with Ziv Barak.

The exhibition opened on December 21, 2019, the shortest day of the year. The exhibition was planned to be displayed for about 3 months before announcing the winners of the competition. However, due to the Covid-19 outbreak and lockdown, we extended the competition time and finally announced winners in a ceremony held on 12th of August, 2020, just before the peak of the annual Perseids meteor shower.

More than twenty amateur and professional photographers participated in the competition, who sent about 60-70 photos. This year's winning photograph was taken by Dr. Raid Omer (see cover). The winner received a high-quality Nikon photo lens generously donated by Ziv Barak and CameraCity.

The ceremony was held under Covid-19 restrictions and attended by about 20 family members of the competing photographers, Mr. Roni Marom, mayor of the town of Mizpe Ramon and Dr. Shai Caspi, director of the Wise Observatory.

The exhibition will be displayed until August 2021. So far, due to Covid-19, there was relatively little exposure, but we expect that over the next year more than 100-150 thousand people will view the exhibition.



Second place winning photo: The Ramon Visitor Center under the stars. Photo: Amit Lieber



Third place winning photo: An Atlantic Picstacia tree in the Ramon Crater under the stars. Photo: Benny Credo.



Photo competition ceremony held on 12th of August, 2020, just before the peak of the annual Perseids meteor shower. The ceremony was held under Covid-19 restrictions and attended by about 20 family members of the competing photographers, Mr. Roni Marom, mayor of the town of Mizpe Ramon and Dr. Shai Caspi, director of the Wise Observatory. Photo: Nadav Taube, INPA.



The winning photograph presented by the photographer- Dr. Raid Omar (see cover). Photo: Nadav Taube, INPA.

Outreach

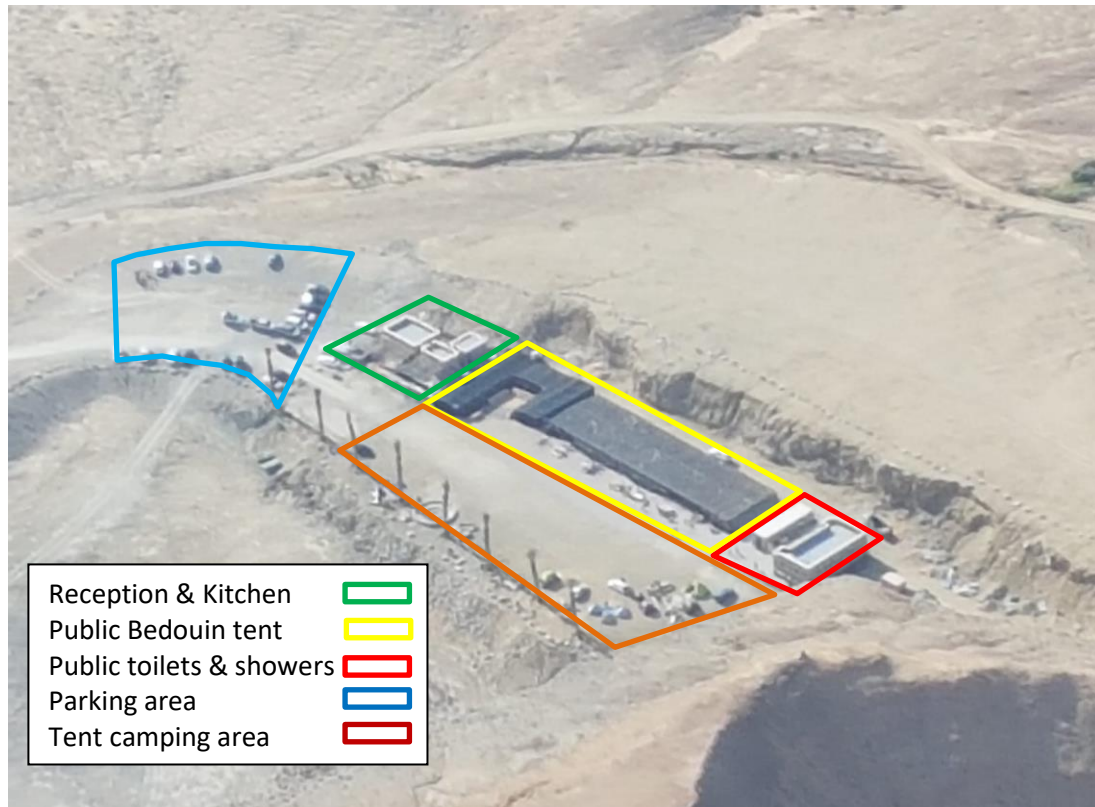
- Since the designation of the Ramon Crater as an International Dark Sky Park, there has been continued collaboration between the town of Mitzpe Ramon, Har Hanegev Regional Council and the INPA, focusing on astro-tourism and night-sky conservation. Revolving around major holidays and dates of central astronomical phenomena such as the annual Perseid shower celebrated yearly by thousands in the city and within the crater. In spite of the Covid-19 crisis, yearly visitation was high. Local astronomical tour operators reported on up to 70,000 visitors during Sept. 2019 –Sept. 2020.
- The INPA is collaborating with the Israeli Astronomical Association on establishing a campground at Borot Lotz, located 3 km to the west of the Ramon Crater. Due to exceptional viewing conditions for astronomers, creating a campground is challenging, and requires a stringent lighting regime of the highest standard. We plan to implement the same strict standards applied at the B'eerot campground, based on the park's LMP and apply a differential and more strict lighting regime for peak astronomical viewing and photography periods (moonless nights). We hope this will serve as a model campground.
- The park's designation has triggered fruitful dialogue between INPA and the Israeli military on methods to combat light pollution from army bases in the vicinity. Draft lighting guidelines, detailing technology, planning, and sustainable use, have been written, and INPA is closely supervising their implementation.
- INPA participated in an international webinar series entitled "Light for Life" - a global conversation about the impact of light on the lives of humans, plants, and animals, <https://www.ies.org/events/light-for-life-a-global-collaboration/> The webinar hosted by the Illuminating Engineering Society (IES), included 17 presentations over the course of two days, with 15 partner organizations from around the world. Dr. Noam Leader of the INPA was invited to represent Israel by the Society of Electrical, Electronics and Energy Engineers in Israel (SEEEI). The title of the webinar: "Let There Be Dark" – Ecological Consequences of Light Pollution and Mitigation for Nature Conservation in Israel. Other speakers included Dr. John Barentine from the IDA, Dr. Jeremy White from the US National Park Service, along with speakers from many countries around the globe.






Final Words

We would to extend our deepest appreciation to the many dedicated INPA personnel involved in preserving the Ramon Crater International Dark Sky Park, to our neighbors and friends and to the tens of thousands of visitors who we hope we have inspired during these troubling times.

Appendix I

Geves Overnight Campground



Lighting Inventory – Geves Overnight Campground							
Total lights: 67							
Total in compliance: 67							
Total not in compliance: 0							
No.	Photo	Fixture*	2020*	No. of fixtures	Application	Fully-shielded	Conformity with Lighting Guidelines
1		LED 50 W 3000K	SAME	2	Above reception office & kitchen doors	YES Angle adjusted so no light spillage upward	YES
2		LED 50 W 4000K	LED 50 W 2700K	11	Around the tent	YES Angle adjusted so no light spillage upward	YES
3		LED 5 W 3000K	SAME	19	bathrooms	YES	YES
4		LED 5 W 3600K	LED 5 W 2700K	29	bathrooms	YES	YES
5		NONE (NEW)	LED 5 W 2700K	6	reception	YES	YES

* CCT values were inspected using a Sekonic C-800 Spectromaster Color Meter.