

# LIGHT POLLUTION AND LIGHTING SOLUTIONS [ KEWEENAW DARK SKY PARK EXAMPLES ]

JOHN MUELLER

SEPTEMBER 13, 2025

A GLAD JAM TALK

[ GREAT LAKES AURORA DARK-SKY JAMBOREE ]



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Is this Light Pollution?



October 10, 2024  
Northern Lights / Stars  
Photo: Chris Guibert

Is this Light Pollution?



October 10, 2024  
Northern Lights / Stars  
Photo: Chris Guibert

Is this Light Pollution?



August 11-12, 2024  
Perseid Meteor Shower  
Photo: Chris Guibert

Is this Light Pollution?



Dark Sky Walking Path  
APT Solar Lights 2024  
Photo: Chris Guibert

Established in 1934



THIS PROPERTY  
HAS BEEN PLACED ON THE  
NATIONAL REGISTER  
OF HISTORIC PLACES  
BY THE UNITED STATES  
DEPARTMENT OF THE INTERIOR



A four-season historic wilderness resort at the top of the Keweenaw,  
focused on outdoor activities, rustic worldly food, and education

Marrying history with the future to get to a vibrant and progressive present

Established in 1934



A four-season historic wilderness resort at the top of the Keweenaw, focused on outdoor activities, rustic worldly food, and education

Marrying history with the future to get to a vibrant and progressive present

Established in 1934



PUN JOYOUS. ADVENTURESOME



[ The Why ]

**getting people closer to nature**

[ The What and How ]

A historic lodging establishment

Be closer to Nature

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HOTELS + RESORTS

## 13 Best U.S. Resorts for Reconnecting With Nature — Hot Springs, Hiking Trails, and Open-air Massages Included

From Alaska to Maine, these U.S. nature resorts beautifully combine wilderness and wellness.

By [Stephanie Vermillion](#) | Published on June 10, 2022



PHOTO: CHRIS GUIBERT

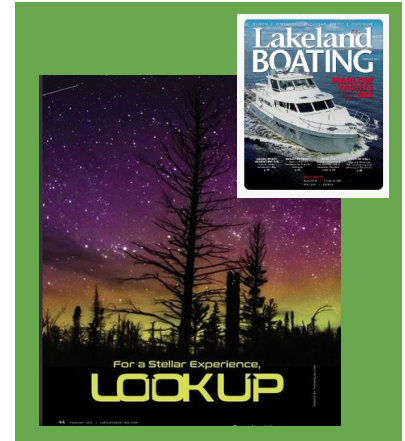
There's an aura of ease that hits the second travelers cross the bridge from Lower Michigan into the Upper Peninsula — and that serenity gets kicked up a notch for those who journey all the way to the Keweenaw. The Lake Superior-flanked Keweenaw Peninsula is about as wild as the Midwest gets, and one of Michigan's northernmost resorts, the [Keweenaw Mountain Lodge](#), immerses guests in this unspoiled beauty. Adventure is woven into Keweenaw Mountain Lodge's DNA. This property, part of the National Register of Historic Places, has its own web of mountain-biking and hiking trails. And, it's spearheading a [movement](#) to create the Keweenaw's first International Dark Sky Park — a particularly enticing move given this area is one of the best places to catch auroras in the lower 48 states.

### Wild Rice Retreat, Wisconsin



PHOTO: COREY GAFFER

Part artist's escape, part wellness resort, Wisconsin's new [Wild Rice Retreat](#) gives guests the perfect opportunity to unwind and recenter in the calming forests of northern Wisconsin. The retreat sits on the rocky shore of Lake Superior, where steady waves provide a soothing soundtrack for on-site activities like yoga and meditation in the Peace Pod or detoxification in the sauna. Property trails offer travelers the chance to get their blood pumping in between meditation sessions, while farm-to-table outdoor dining leaves guests nourished and ready for more.



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## 9 wild stays for your next winter adventure

From an ice hotel in Québec to a new National Park lodge in the Everglades, these North American resorts offer seasonal escapes.



Green Lodging

We are working towards being an [Audubon International Certified Green Lodging Establishment](#). Click the image below to learn more about Audubon International's program and our progress toward certification.



Good for the Environment, Good for Business

[ get closer to nature ]

## RUSTIC AND HISTORIC CABINS

TREAT WITH RESPECT



The Cabins at the Keweenaw Mountain Lodge are listed on the National Register of Historic Places. The Cottages, as they were originally called, were built between 1936 and 1940 as part of a federally funded Works Progress Administration (WPA) Project.

Staying in a cabin is a special and unique experience. We expect you to be respectful of these rustic structures.

Each cabin has it's own unique quirks. Embracing these characteristics will enhance your stay.

THIS PROPERTY HAS BEEN PLACED ON THE NATIONAL REGISTER OF HISTORIC PLACES BY THE UNITED STATES DEPARTMENT OF THE INTERIOR



MARRYING HISTORY WITH THE FUTURE



# LEAVE NO TRACE

## Proud Partner



ADVENTURE NORTH

# KEWEENAW

MICHIGAN, USA

Sustainable Tourism

[ get closer to nature ]



## The Leave No Trace Seven Principles



### PLAN AHEAD AND PREPARE

- Know the regulations and special concerns for the area you'll visit.
- Prepare for extreme weather, hazards, and emergencies.
- Schedule your trip to avoid times of high use.
- Visit in small groups when possible. Consider splitting larger groups into smaller groups.
- Repackage food to minimize waste.
- Use a map and compass to eliminate the use of marking paint, rock cairns or flagging.



### TRAVEL AND CAMP ON DURABLE SURFACES

- Durable surfaces include established trails and campsites, rock, gravel, dry grasses or snow.
- Protect riparian areas by camping at least 200 feet from lakes and streams.
- Good campsites are found, not made. Altering a site is not necessary.
- In popular areas:
  - Concentrate use on existing trails and campsites.
  - Walk single file in the middle of the trail, even when wet or muddy.
  - Keep campsites small. Focus activity in areas where vegetation is absent.
- In pristine areas:
  - Disperse use to prevent the creation of campsites and trails.
  - Avoid places where impacts are just beginning.



### DISPOSE OF WASTE PROPERLY

- Pack it in, pack it out. Inspect your campsite and rest areas for trash or spilled foods. Pack out all trash, leftover food and litter.
- Deposit solid human waste in catholes dug 6 to 8 inches deep, at least 200 feet from water, camp and trails. Cover and disguise the cathole when finished.
- Pack out toilet paper and hygiene products.
- To wash yourself or your dishes, carry water 200 feet away from streams or lakes and use small amounts of biodegradable soap. Scatter strained dishwater.



### LEAVE WHAT YOU FIND

- Preserve the past: examine, but do not touch cultural or historic structures and artifacts.
- Leave rocks, plants and other natural objects as you find them.
- Avoid introducing or transporting non-native species.
- Do not build structures, furniture, or dig trenches.



### MINIMIZE CAMPFIRE IMPACTS

- Campfires can cause lasting impacts to the environment. Use a lightweight stove for cooking and enjoy a candle lantern for light.
- Where fires are permitted, use established fire rings, fire pans, or mound fires.
- Keep fires small. Only use sticks from the ground that can be broken by hand.
- Burn all wood and coals to ash, put out campfires completely, then scatter cool ashes.



### RESPECT WILDLIFE

- Observe wildlife from a distance. Do not follow or approach them.
- Never feed animals. Feeding wildlife damages their health, alters natural behaviors, and exposes them to predators and other dangers.
- Protect wildlife and your food by storing rations and trash securely.
- Control pets at all times, or leave them at home.
- Avoid wildlife during sensitive times: mating, nesting, raising young, or winter.



### BE CONSIDERATE OF OTHER VISITORS

- Respect other visitors and protect the quality of their experience.
- Be courteous. Yield to other users on the trail.
- Step to the downhill side of the trail when encountering pack stock.
- Take breaks and camp away from trails and other visitors.
- Let nature's sounds prevail. Avoid loud voices and noises.

## Nurturing and Fostering Quiet

One of the best compliments we get when people stay at the lodge is how quiet and peaceful it is, and that they were able to get the best night of sleep in a long time.

To help quantify and formalize the quietness at the resort, we are talking with Quiet Parks International about becoming a Quiet Parks Quiet Stay resort. Quiet Parks International is an organization that works to foster quiet areas around the world. This is important to us as our guests come from urban areas and want a getaway that is calm and quiet in the wilderness. This gives them the ability to restore their balance in silence and nature.

We are in communication with Vikram Chauhan at Quiet Parks International, and working on an application to be certified as a quiet park. This will give us the ability to host quiet experiences (quiet stays, quiet retreats) and provide education about the benefits of quiet [ Initial communication with Vikram Chauhan, February 2022 ]



#SAVEQUIET

Everybody needs quiet right now

*April 22, 2023*

---

**ON EARTH DAY I...**

# **EARTH DAY**

[ it is when we submitted our initial version dark sky park application, and our last version (4.1)



business as a force for good.

Overall B Impact Score



Keweenaw Resort, LLC (dba, Keweenaw Mountain Lodge)

For Fiscal Year End Date: 31 Dec 2022



Governance

QUESTIONS ANSWERED 25/25

OVERALL SCORE 8.2



Workers

QUESTIONS ANSWERED 44/44

OVERALL SCORE 33.1



Community

QUESTIONS ANSWERED 43/43

OVERALL SCORE 33.2



Environment

QUESTIONS ANSWERED 35/35

OVERALL SCORE 12.6



Customers

QUESTIONS ANSWERED 5/5

OVERALL SCORE 3.6



FOR IMMEDIATE RELEASE, A JOINT PRESS RELEASE  
June 21, 2022



## **Keweenaw Dark Sky Park Designated as an International Dark Sky Park**

As the headquarters for the Keweenaw Dark Sky Park, the Keweenaw Mountain Lodge leads the effort in the region to foster the dark skies.

Copper Harbor, Michigan

The International Dark-Sky Association (IDA) has named Keweenaw Dark Sky Park (KDSP) the newest addition to the International Dark Sky Places (IDSP) Program. The headquarters for the dark sky park will be at the Keweenaw Mountain Lodge (KML), where visitors and supportive community members can meet, learn, and look U.P. to the stars for inspiration and to get closer to nature, while traveling around the top of the Keweenaw peninsula. The park becomes the 3rd IDA-certified Dark Sky Park in the State of Michigan, joining the Headlands International Dark Sky Park and the Dr. T.K. Lawless International Dark Sky Park; and is the first International Dark Sky Park in the Upper Peninsula of Michigan.

“Keweenaw Dark Sky Park offers a unique experience to stargazing in the Midwestern United States,” stated Ashley Wilson, IDA’s Director of Conservation. “The historic wilderness lodge allows visitors to view the magnificence of the night sky in a window of the pristine boreal landscape while also having the opportunity to further engage with the nocturnal environment with astrophotography and lighting management workshops.”



#### 4 International Dark Sky Parks & Sanctuary in Michigan

- Beaver Island Dark Sky Sanctuary
- Headlands Dark Sky Park
- Keweenaw Dark Sky Park
- Dr. T.K. Lawless Dark Sky Park

[ Around 250 parks worldwide currently ]

#### 6 Dark Sky Preserves in Michigan (DNR)

- [Lake Hudson Recreation Area \(Lenawee County\)](#)
- [Negwegon State Park \(Alcona County\)](#) - No winter plowing.
- [Port Crescent State Park \(Huron County\)](#) - No winter plowing, visitors can hike from the parking lot to the preserve.
- [Rockport Recreation Area \(Presque Isle County\)](#) - Plowed in the winter.
- [Thompson's Harbor State Park \(Presque Isle County\)](#) - Plowed in the winter.
- [Wilderness State Park \(Emmet County\)](#) - No winter plowing; however, area near park headquarters is plowed.



**DarkSky**  
INTERNATIONAL





# KEWEENAW DARK SKY PARK

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[Astrophotography](#)

[Maps](#)

[Events](#)

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[ nurturing and fostering the dark skies ]

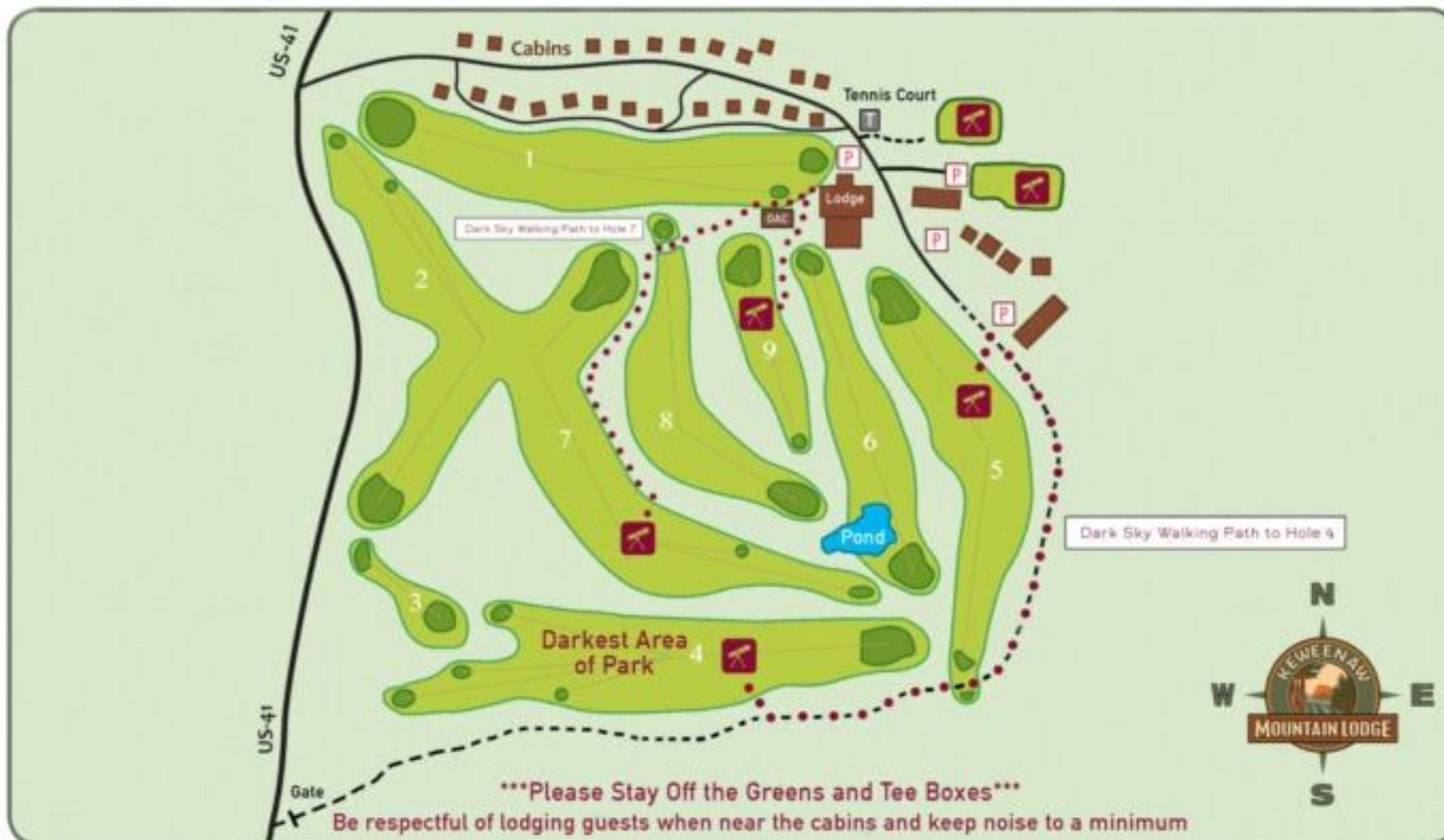
[keweenawdarksky.com](http://keweenawdarksky.com)



# Keweenaw Dark Sky Park Night Sky Viewing Area



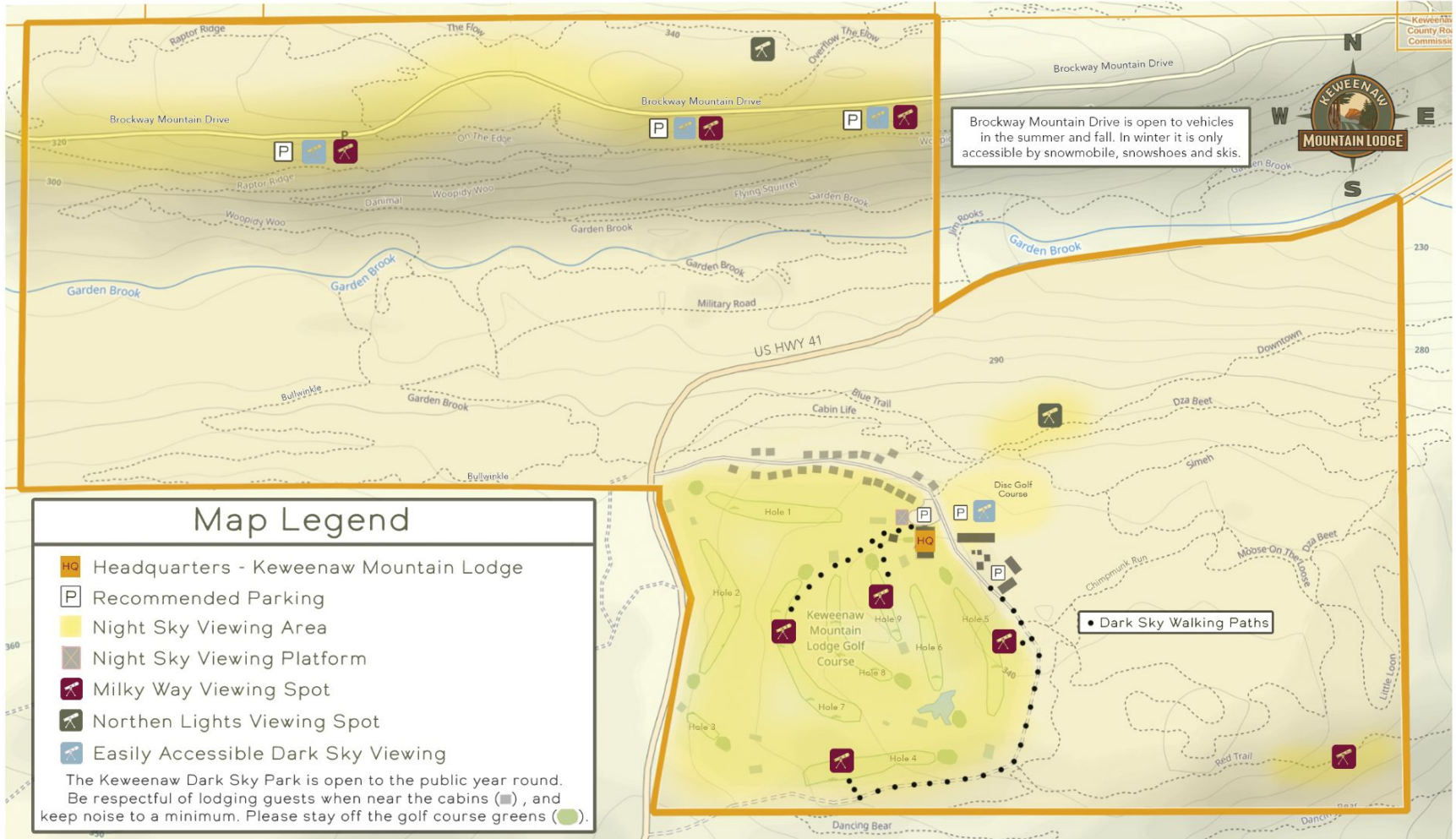
DarkSky



| Map Key                                       |  |                                     |
|---|--|-------------------------------------|
| Holes On the Golf Course                      | Outdoor Activity Center<br>Information - Open 9am - 5pm                  | Paved Roads                         |
| Greens and Tee Boxes - Please Stay Off        | Keweenaw Mountain Lodge<br>Headquarters of the<br>Keweenaw Dark Sky Park | Dirt Roads                          |
| Fairways and Open Areas - Open For Stargazing |  | Dark Sky Walking Paths              |
| Parking for Stargazing                        |  | Recommended Night Sky Viewing Areas |

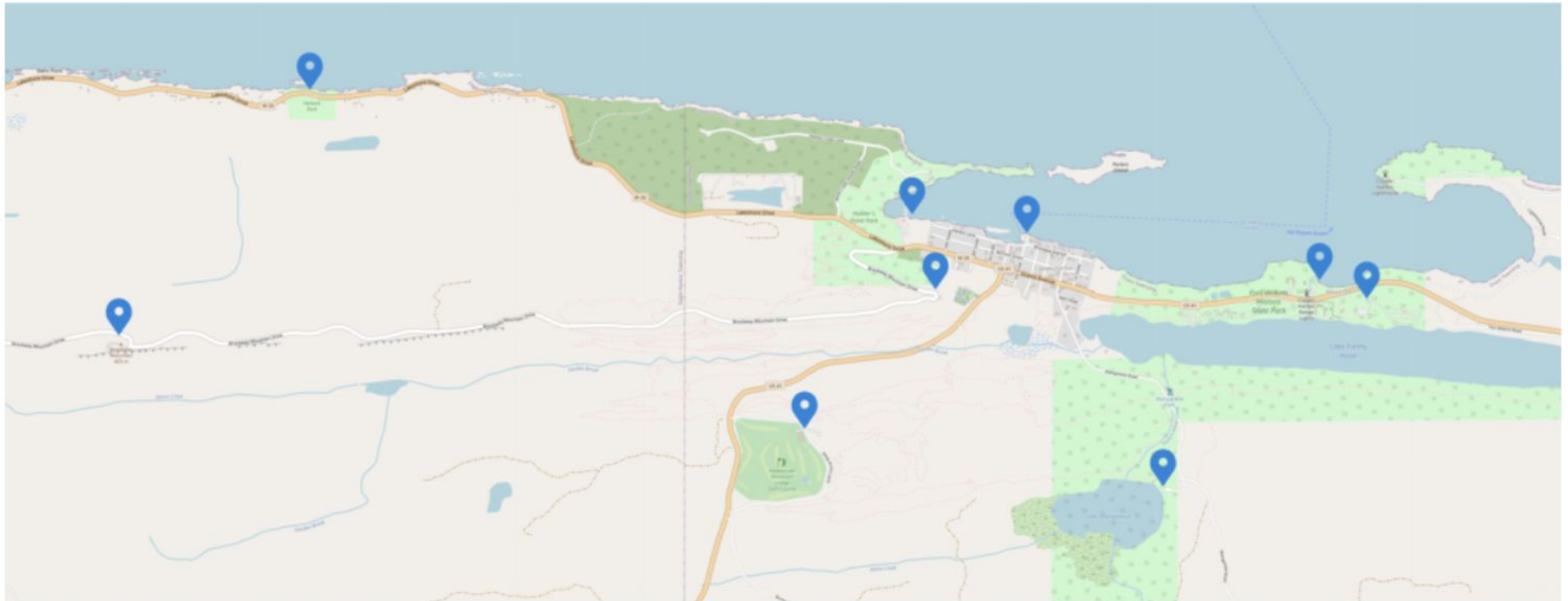


# KEWEENAW DARK SKY PARK NIGHT SKY VIEWING AREAS



## Surrounding Areas

At the top of the Keweenaw, there are not very many areas that are developed. This offers stargazers multiple locations to look up and see the stars. This includes places along the Lake Superior lake front (on M-26 and US Hwy 41), in multiple county and state parks, and up Brockway Mountain; all of which are just a short jaunt away from the Lodge. Below is a map of several vantage points in surrounding areas.



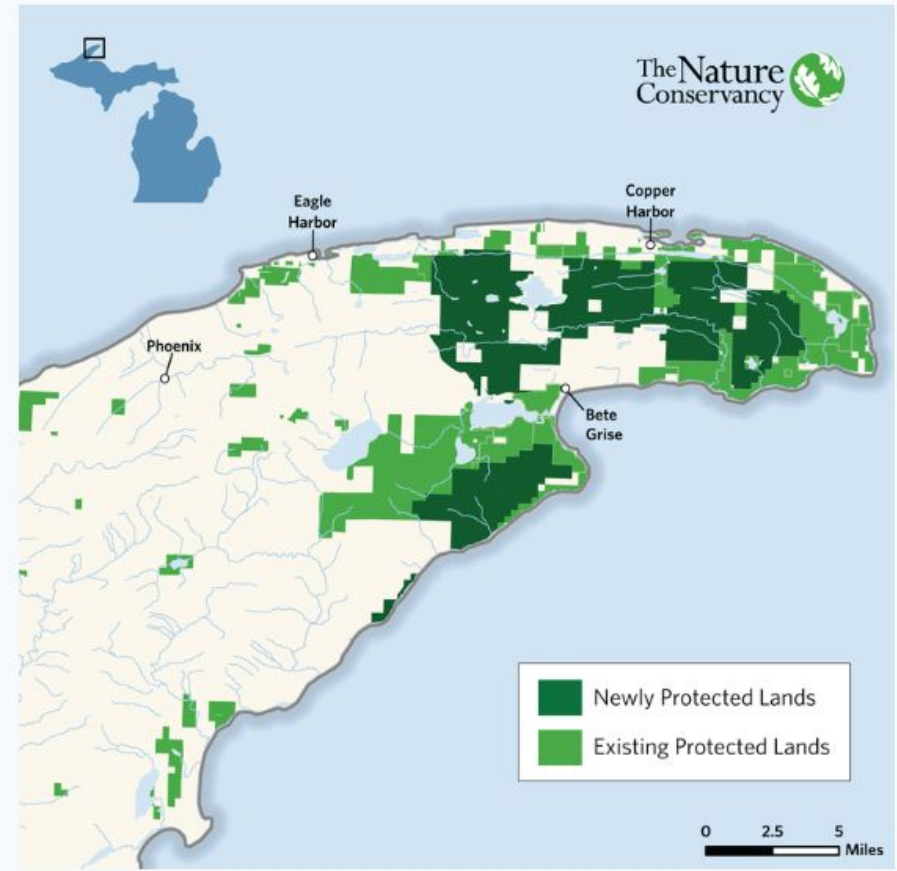
# WHAT IS THE KEWEENAW HEARTLANDS PROJECT?

In late 2022, [The Nature Conservancy in Michigan \(TNC\)](#) announced the purchase of approximately 32,600 acres of working forestland near the tip of the Keweenaw Peninsula in Keweenaw County, known as the Keweenaw Heartlands. This purchase from The Rohatyn Group was completed with the support and input of community leaders, the Michigan Department of Natural Resources (DNR) and many people who love the Keweenaw.

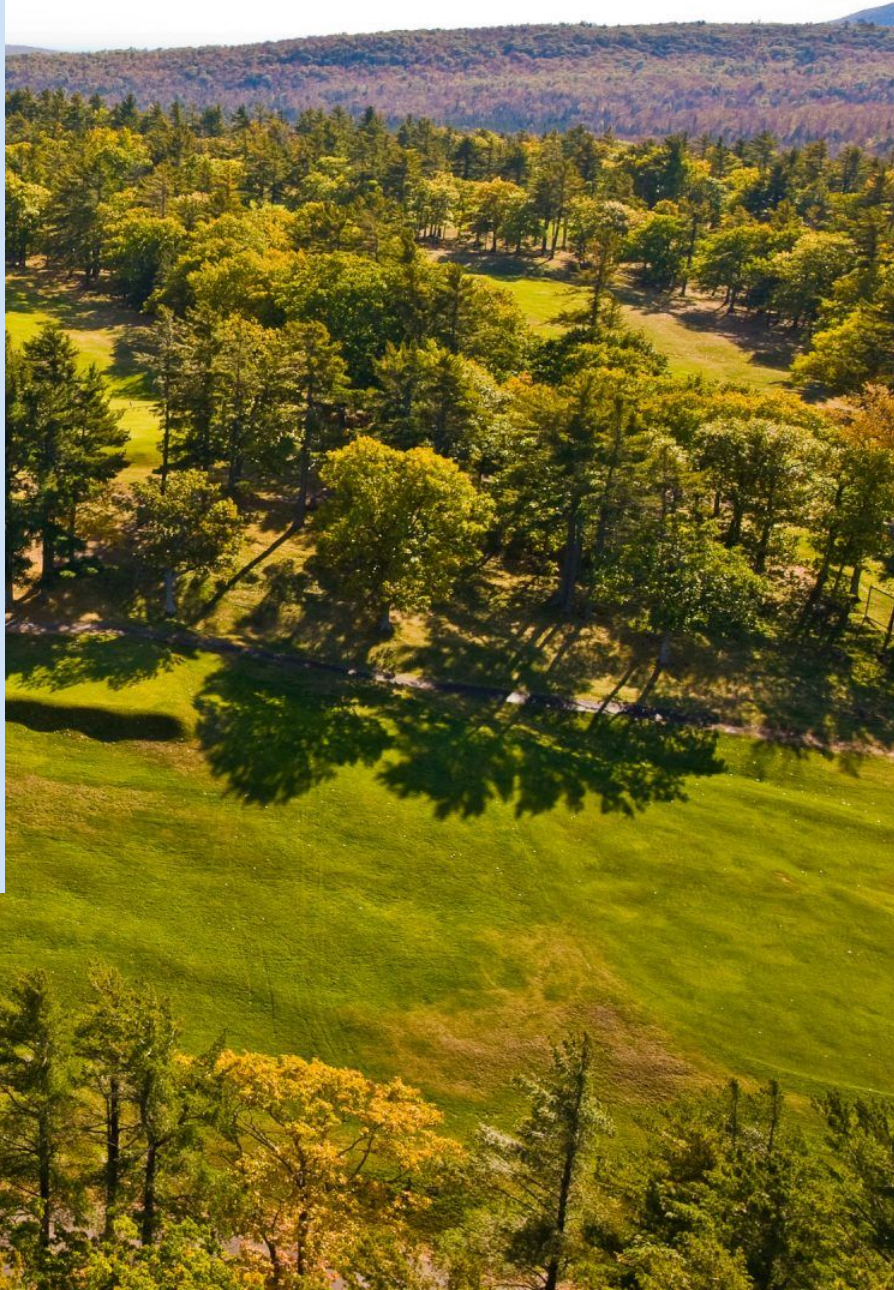
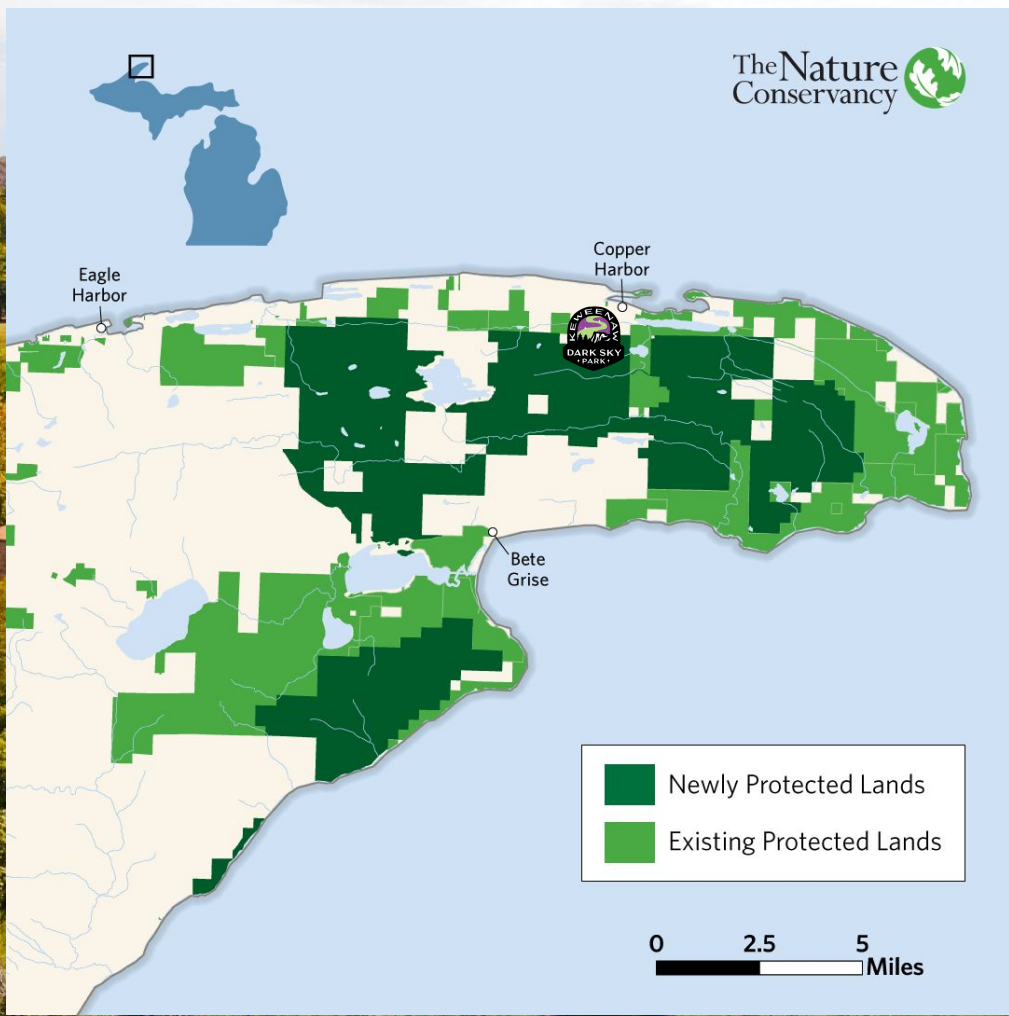
TNC and DNR have convened a planning committee to develop a long-term governance and management plan for the Keweenaw Heartlands. As the interim owners while these plans for the property are developed, TNC will steward the property and lay the foundation for its continued conservation and sustainable use as part of a resilient Keweenaw community.

These lands help define the identity of Keweenaw County and its residents. They contain many sites of [unique ecological, historic, cultural and scenic beauty](#) that help make the peninsula so beloved by the thousands who live and visit here.

Through this project, the Keweenaw Heartlands will be sustainably managed and kept available for the public to access and enjoy for generations to come.



**PROJECT MAP** This map outlines the existing protected lands and the newly protected lands in the Keweenaw Peninsula as of autumn 2022.




## MICHIGAN'S NORTHERNMOST GOLF COURSE. AND DARK SKY PARK.

The Golf Course at the Keweenaw Mountain Lodge is a wilderness-focused 9-hole golf course designed during the great depression using the Keweenaw terrain, with spectacular views of Brockway Mountain. Being that the course is in the wilderness, individuals can enjoy the natural environment and the wildlife during the day time while playing traditional and fling golf, or just going for a nature hike. And during the night time, individuals can walk the golf course and designated night-time trails to enjoy the stars and possibly the northern lights. These day-and-night efforts marry history with the future to provide a vibrant and progressive wilderness golf course for you to enjoy.


Get closer to nature.



 (906) 289-4403

 [info@keweenawresort.com](mailto:info@keweenawresort.com)

 [keweenawmountainlodge.com](http://keweenawmountainlodge.com)

 14252 US Hwy 41  
Copper Harbor, Michigan 49918



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[ get closer to nature ]



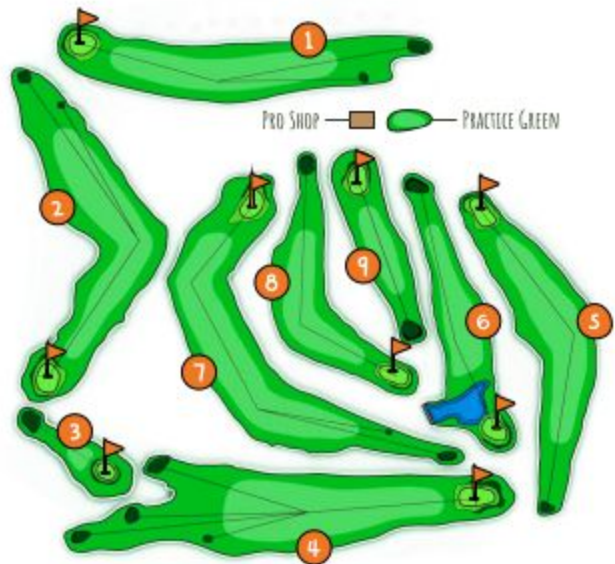
USGA rules shall govern all play except where modified by the local rules (see website)

Date:

| Hole     | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | Out   |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-------|
| Black    | 390 | 394 | 121 | 460 | 392 | 330 | 510 | 336 | 187 | 3,120 |
| Copper   | 339 | 384 | 116 | 398 | 378 | 321 | 495 | 331 | 182 | 2,944 |
| Par      | 4   | 4   | 3   | 4   | 4   | 4   | 5   | 4   | 3   | 35    |
| Handicap | 9   | 1   | 17  | 3   | 5   | 11  | 7   | 13  | 15  |       |
|          |     |     |     |     |     |     |     |     |     |       |
|          |     |     |     |     |     |     |     |     |     |       |

Scorer:

Attester:



Walking encouraged.

[info@keweenawresort.com](mailto:info@keweenawresort.com)

FUN. JOYOUS. ADVENTURESOME.



For more details on each hole, scan the QR code.

[ get closer to nature ]

# Keweenaw Mountain Lodge

Copper Harbor, MI



*Application for Dark Sky Park Designation*

## Keweenaw Dark Sky Park

V4.1

Designated June 21, 2022

- Our goal was to improve on the dark sky environment and experience, not to get the certification. The designation provided us a guiding light.
- Part of the bigger Keweenaw, not just the Keweenaw Mountain Lodge
- Application took around 1.5 years. 1 year from first version submitted.
- First version submitted on April 22, 2021, fourth (last) version submitted on April 22, 2022 (Earth Day).
- Revise and resubmit process, similar to academic journals / scholarly research.
- Projects page – showing the process
- Worked with 3 program managers, and now Amber has taken the lead – our point person at IDA.
- Annual reports, SQM readings, regular improvements

# Keweenaw Mountain Lodge

Copper Harbor, MI

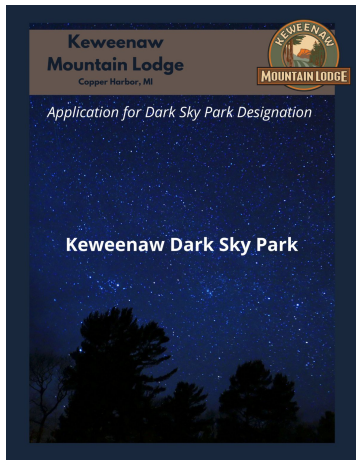


*Application for Dark Sky Park Designation*

## Keweenaw Dark Sky Park

### Application progress / schedule:

- **June 6, 2022:** Application accepted. Full Endorsement of Keweenaw Dark Sky Park Certification by the IDA.
- **May 20, 2022:** Submitted version 4.1 of application to our IDA program manager Ashley Wilson, with "ver 4.1 change log"
- **May 19, 2022:** Received response from Ashley Wilson regarding version 4.0 application
- **April 22, 2022:** Submitted version 4.0 of application to our IDA program manager Ashley Wilson, with "ver 4.0 change log"
- **March 23, 2022:** Meeting with Ashley Wilson and Amber Harrison to discuss the ownership structure, and discuss the Lodge deed restriction that pertains to the guidelines set by the Michigan State Historical Preservation Office (SHPO) because the Lodge is on the National Register of Historic Places. A clear direction to address the committee's concerns was established for the required updates to the application
- **March 22, 2022:** Received response from Ashley Wilson regarding the ownership structure
- **February 15, 2022:** Received feedback from Ashley Wilson with initial responses from the Dark Sky Places Committee's review of our application. There is one item that Ashley Wilson is still working to get clarity on before we start to work on the updates to the application (*guidelines for a for-profit company to manage a dark sky park*)
- **January 20, 2022:** The Dark Sky Places Committee reviewed our application, and Ashley Wilson is formulating their response
- **December 25, 2021:** Received confirmation that our application is complete and will be reviewed by the Dark Sky Places Committee at their January 20, 2022 meeting
- **December 15, 2021:** Submitted version 3.0 of application to our IDA program manager Ashley Wilson, with "ver 3.0 change log"
- **December 14, 2021:** Online Meeting with IDA program manager, Ashley Wilson, to review the latest draft of version 3.0 and answer additional questions about the updates.
- **November 29, 2021:** Online Meeting with IDA program manager, Ashley Wilson, to go through her review and discuss updates for version 3.0.
- **November 8, 2021:** Received feedback on version 2.1 of our application from our IDA program manager, Ashley Wilson
- **October 9, 2021:** Submitted version 2.1 of application to our IDA program manager Ashley Wilson, with "ver 2.1 change log"
- **October 1, 2021:** Submitted version 2.0 of application to our IDA program manager Ashley Wilson  
*(our program manager changed, as John Barentine has left the IDA as of August)*
- **May 29, 2021:** Received feedback on version 1.0 of our application from our IDA program manager, John Barentine
- **April 22, 2021:** Submitted version 1.0 of application on Earth Day to our IDA program manager, John Barentine



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[ a robust application ]

# Keweenaw Mountain Lodge

Copper Harbor, MI



*Application for Dark Sky Park Designation*

## Keweenaw Dark Sky Park

### Corporate Resolution

We have drafted a corporate resolution supporting the Dark Sky Park. This has further solidified the dark sky initiatives that the Keweenaw Mountain Lodge's dark sky initiatives and intent for fostering stargazing activities at the top of the Keweenaw. The resolution is officially recorded with the company's official documents, being a signed corporate resolution by its sole member — approved and adopted on December 6th, 2021.

- [KML – Resolution No 2021-001 – Dark Sky Park 20211206](#)



### RESOLUTION No. 2021-001

#### A RESOLUTION SUPPORTING THE FOSTERING OF THE DARK SKY ACTIVITIES IN THE KEWEENAW

WHEREAS, the Keweenaw Resort, LLC company, the owner of the Keweenaw Mountain Lodge, supports efforts to foster Dark Sky initiatives at the Keweenaw Mountain Lodge and in Keweenaw county; and

WHEREAS, the Keweenaw Mountain Lodge represents an outstanding opportunity to view the dark sky under a pristine and undiluted viewing environment; and

WHEREAS, the natural starry night as found at the Keweenaw Mountain Lodge represents an important and valuable asset to the County of Keweenaw that contributes to the quality of life for its residents, visitors, and wildlife in and around the resort; and

WHEREAS, the Keweenaw Mountain Lodge recognizes the pristine quality of dark skies at the top of the Keweenaw as an important natural, cultural, and environmental resource of significant value and believe it should be fostered; and

WHEREAS, the Keweenaw Mountain Lodge seeks to preserve the Dark Sky at the Keweenaw Mountain Lodge through responsible lighting; and

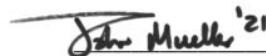
WHEREAS, the Keweenaw Mountain Lodge supports sponsored events that help educate the public on the sensible outdoor lighting practices that help preserve the Dark Sky asset in and around Keweenaw County; and

WHEREAS, the Keweenaw Mountain Lodge believes its Lighting Management Plan approved by top management at the Keweenaw Mountain Lodge in 2021 is more stringent than the current Keweenaw County Zoning Ordinance, and the Keweenaw Mountain Lodge supports it as a means to protect the pristine Dark Sky asset at the top of the Keweenaw; and

THEREFORE, BE IT RESOLVED, that the owner of the Keweenaw Mountain Lodge, the Keweenaw Resort, LLC company, pledge its support in the creation of a Dark Sky Park at the Keweenaw Mountain Lodge within Keweenaw County, Michigan.

APPROVED AND ADOPTED THIS 6th day of December, 2021.

Attest:

  
\_\_\_\_\_  
John Mueller, Member  
Keweenaw Resort, LLC

[ first privately owned and operated international dark sky park ]

# Keweenaw Mountain Lodge

Copper Harbor, MI



*Application for Dark Sky Park Designation*

## Keweenaw Dark Sky Park

### Lighting Management Plan

Date last updated: December 14, 2021  
Author(s): Mike Miller, John Mueller



**We take lighting seriously.**

For our lighting requirements we follow the International Dark-Sky Association's guidelines, and are inline with fostering the dark skies and being designated as an International Dark Sky Park.

We have the following overarching guidelines when evaluating new lighting on Lodge property:

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- Reduction of energy consumption using energy saving light fixtures, minimizing the time lights are on, and the removal of unnecessary lighting.
- Provide a safe observing area for dark sky viewing where the public can enjoy the beauty of the stars.
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The use of auxiliary lighting at night can detract from a guest's experience. When walking around the property at night, guests are advised to use red light, and to shine the light towards the ground in order to not hinder the stargazing experience of others. For example, below is the text we have on our Stargazing page of our website regarding using flashlights on property.

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#### Temporary Lighting

Any temporary installation of outside lighting will adhere to the dark-sky compliant guidelines to the greatest possible extent, and whose duration will be limited to the shortest possible time.

# Keweenaw Mountain Lodge

Copper Harbor, MI



Application for Dark Sky Park Designation

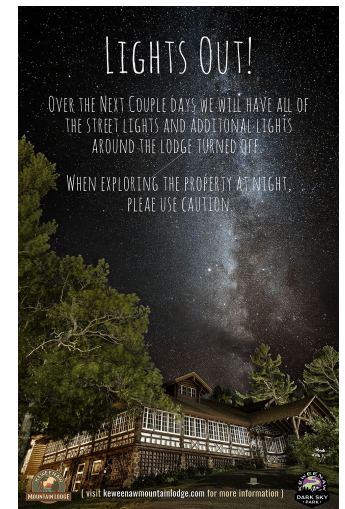
## Keweenaw Dark Sky Park



ADVENTURE NORTH  
**KEWEENAW**  
MICHIGAN, USA

Name of the park:

- Wanted the dark sky initiative to encompass the region, not just the KML.



# Is this Light Pollution?



Hong Kong skyline at night. Lighting the ground AND the sky.

# Lighting and Economic Development (humans)

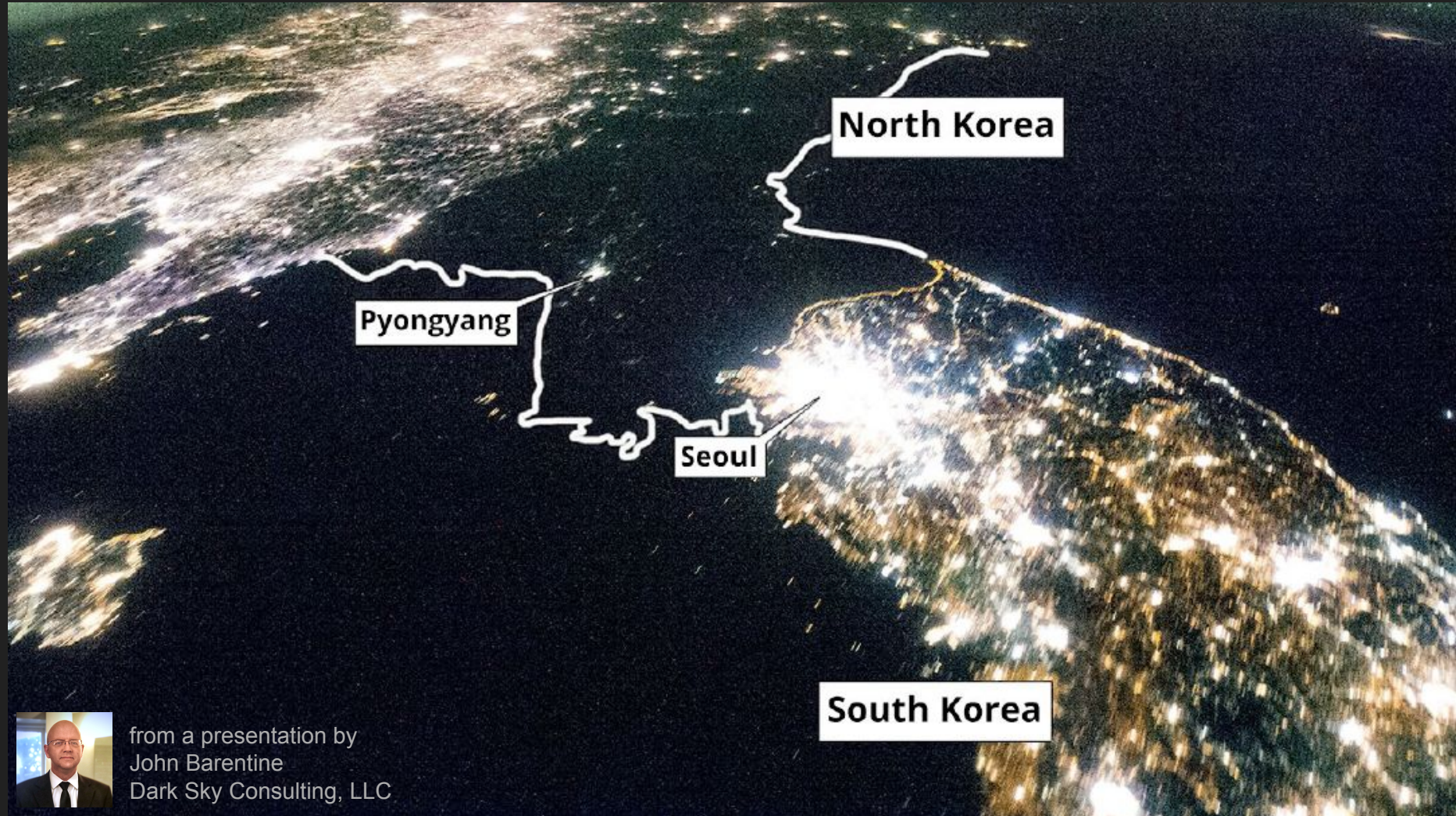
as seen from the perspective of space



from a presentation by  
John Barentine  
Dark Sky Consulting, LLC

# Lighting and Economic Development (humans)

as seen from the perspective of space



from a presentation by  
John Barentine  
Dark Sky Consulting, LLC

# Lighting and Economic Development (humans)

as seen from a historic town (downtown Calumet)



# Lighting and Economic Development (humans)

as seen from a historic town (downtown Calumet)



**MICHIGAN ECONOMIC**  
DEVELOPMENT CORPORATION



## Calumet: Where Collaborative Economic Development Drives Michigan Prosperity

Garrett Anderson

Monday, November 6, 2023

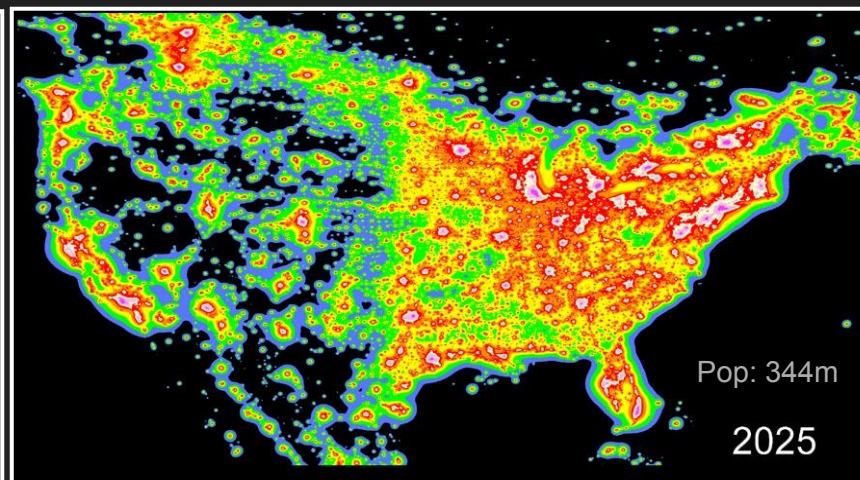
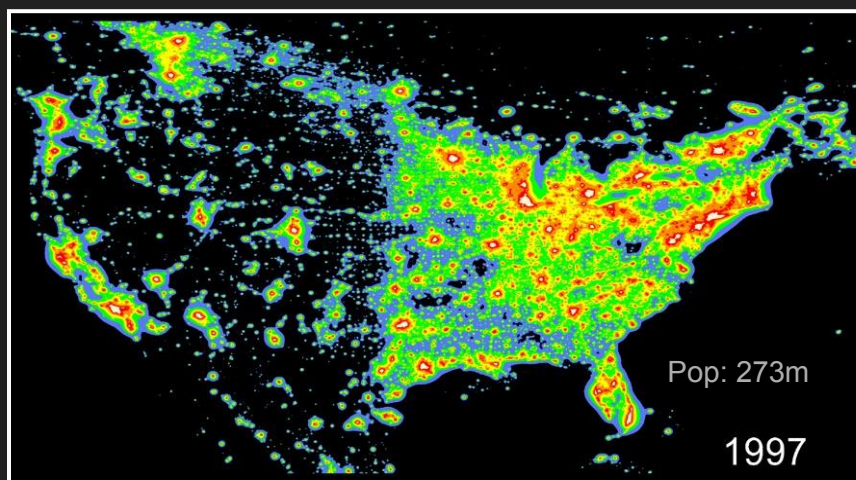
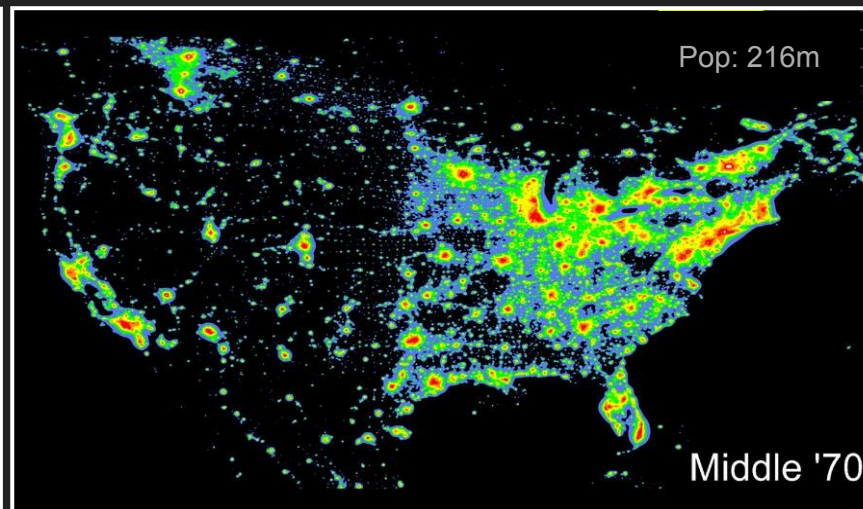
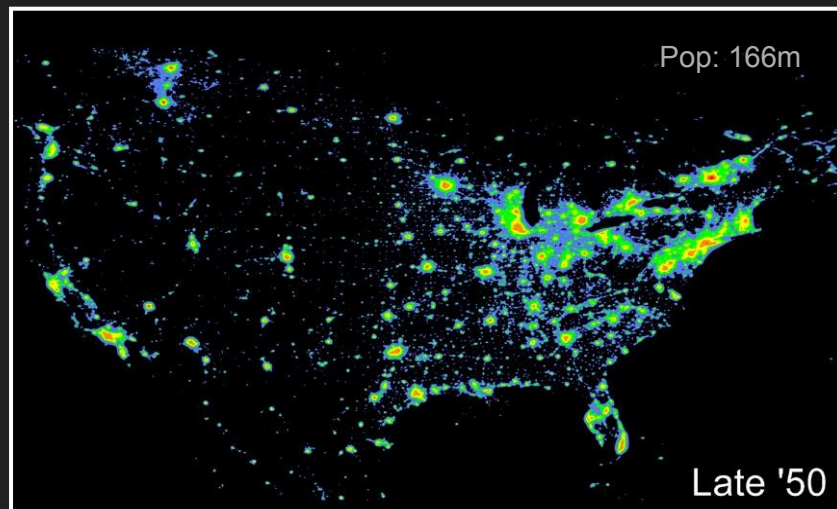
Nestled in the Keweenaw Peninsula – the northernmost area of Michigan’s Upper Peninsula (U.P.) – Calumet is central to the state’s efforts to drive prosperity for all Michiganders. With locally driven initiatives and statewide support, the people of Calumet are demonstrating what it means to have an impact through economic development.



# Lighting in the USA over time - Sky Glow



from a presentation by  
Sally Oey  
University of Michigan

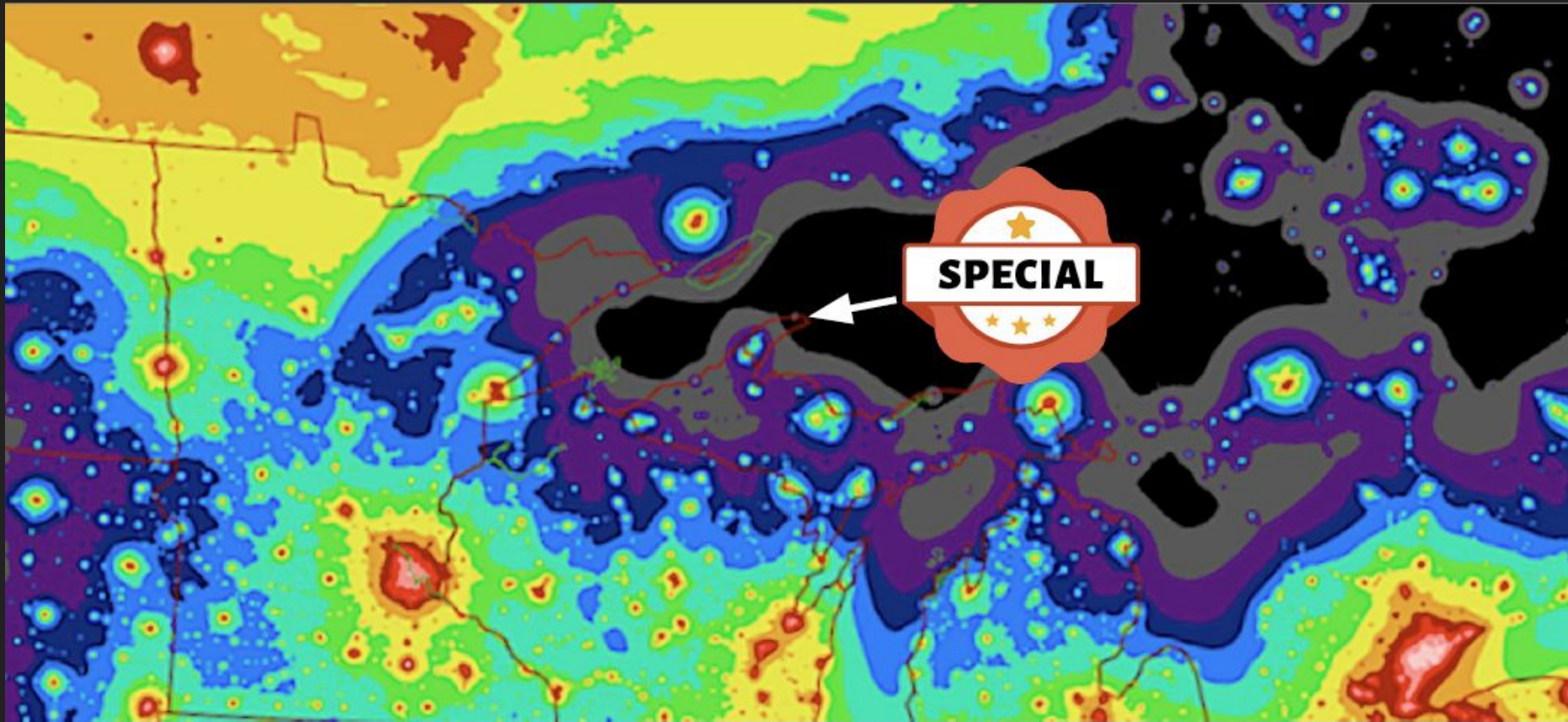


# The Location of the Keweenaw

...



# The Keweenaw - dark skies



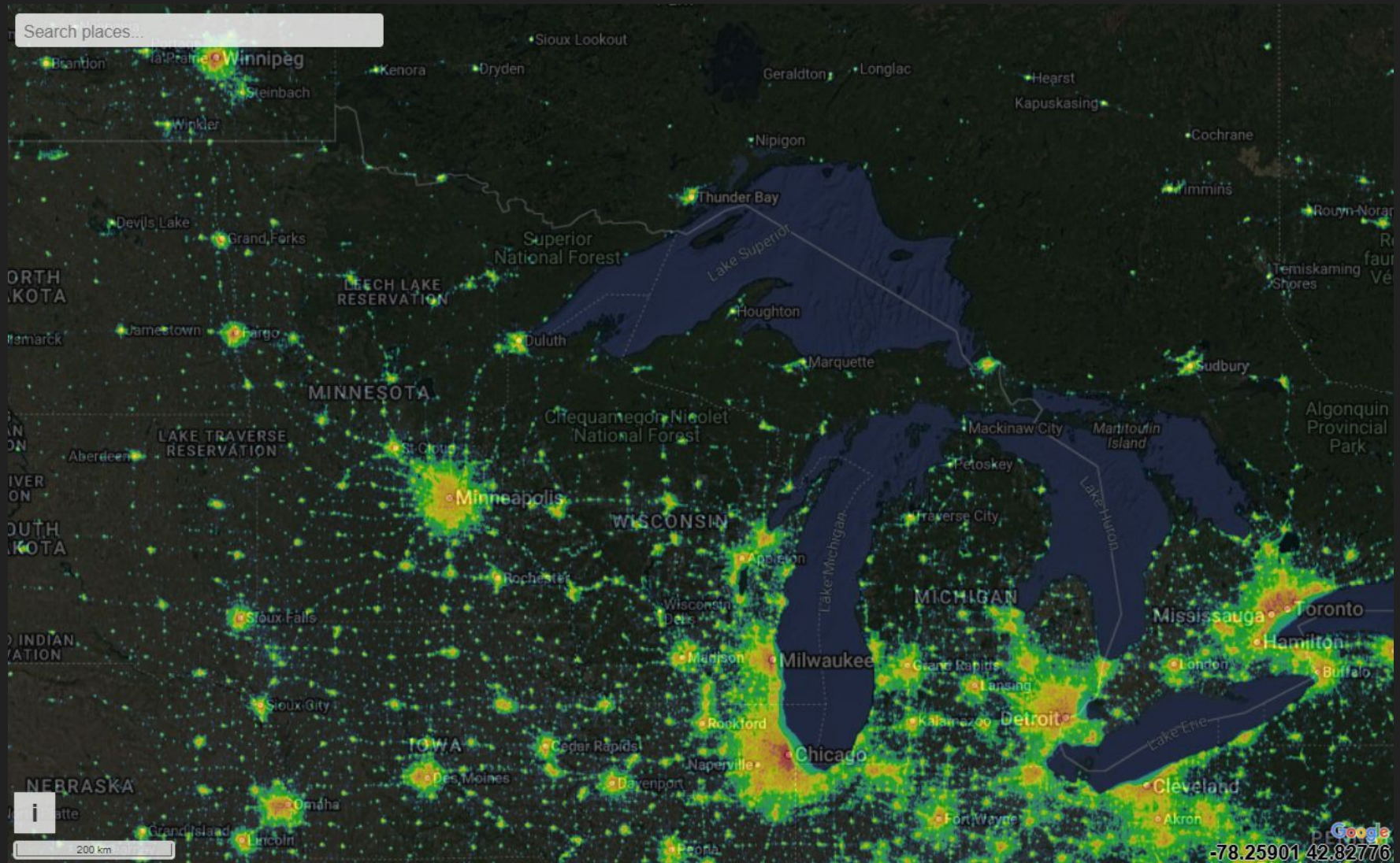
J. Barentine  
Keweenaw Sustainable Tourism Series  
10 November 2023



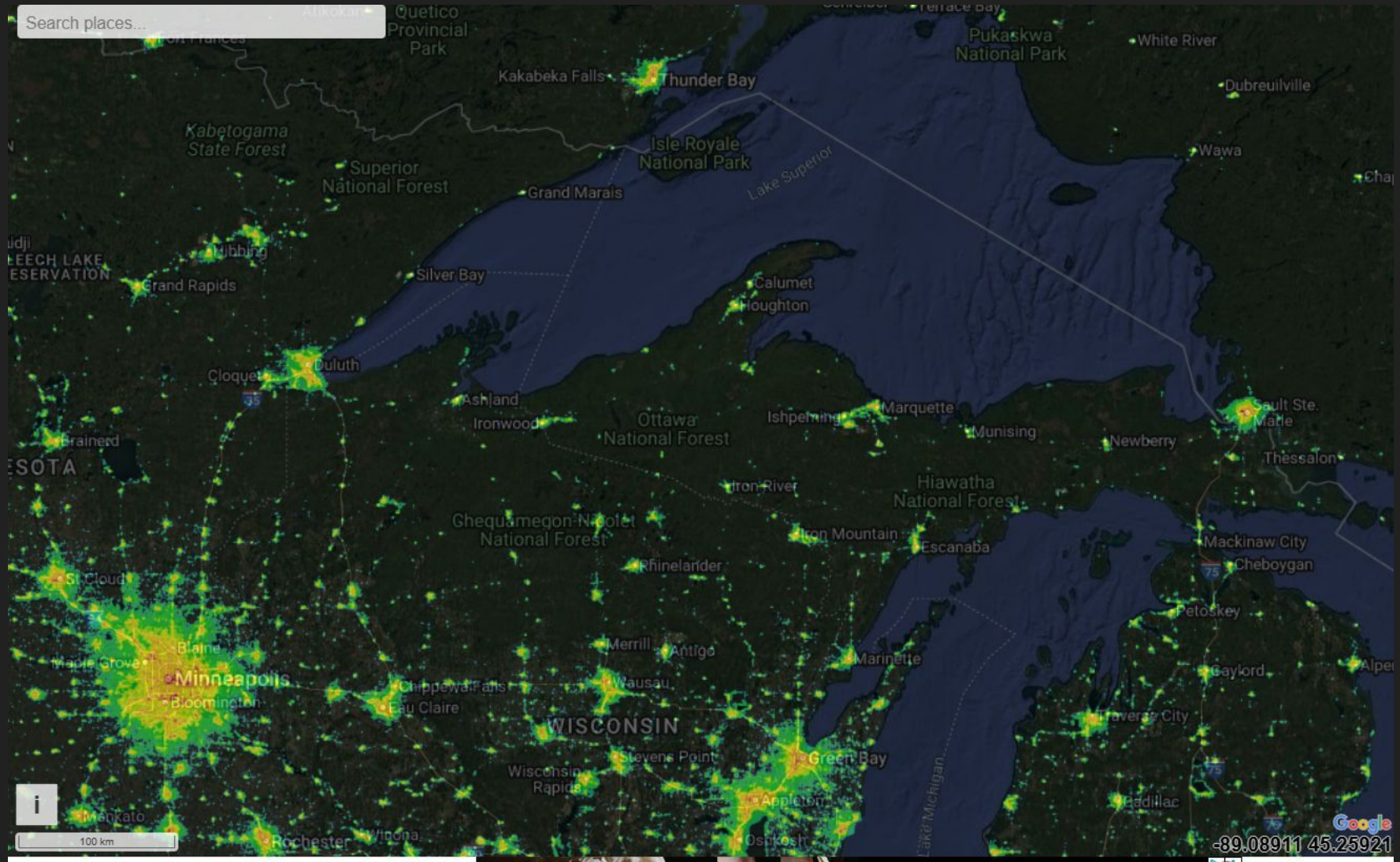
**KEWEENAW**  
DARK SKY CONSULTING, LLC



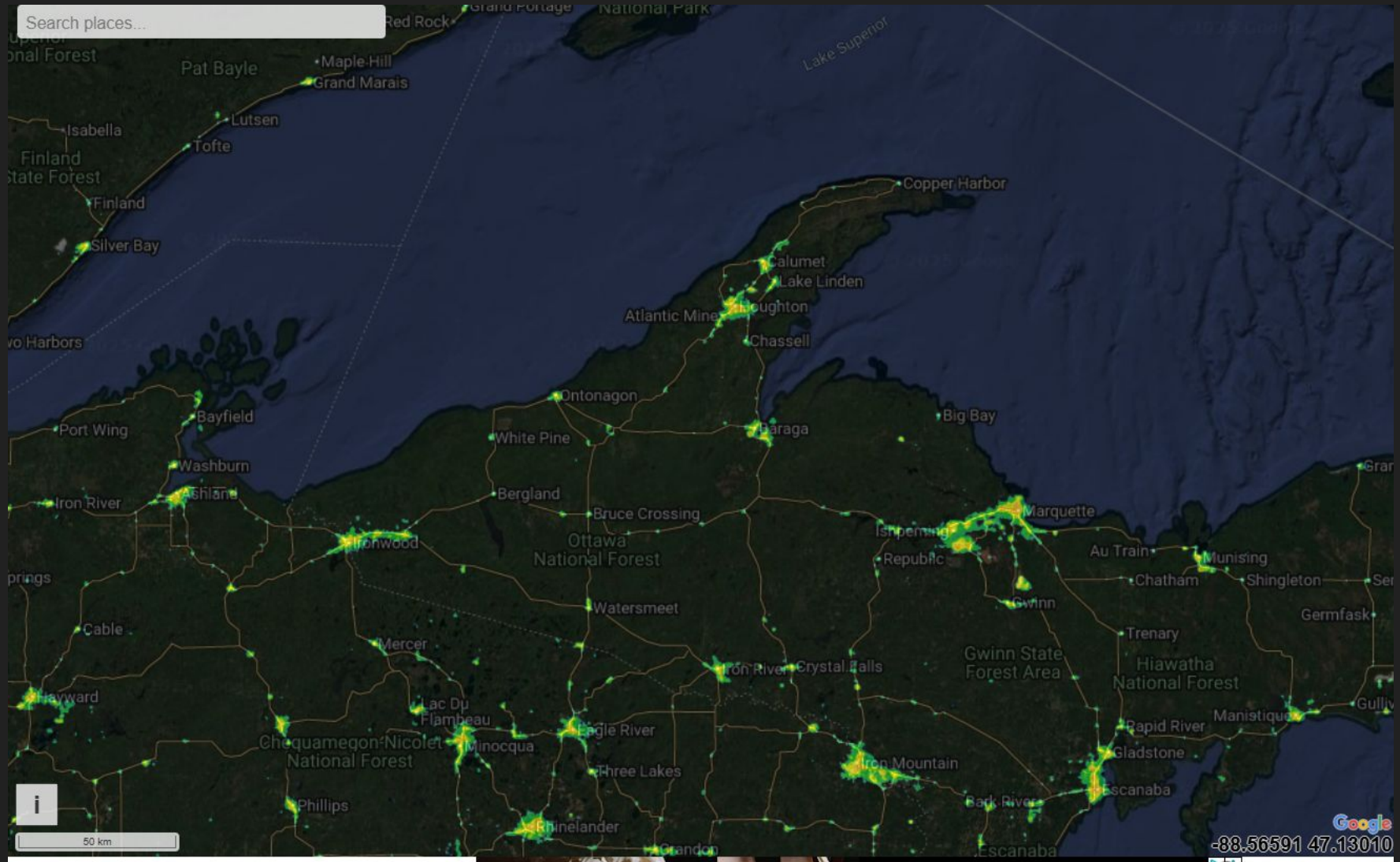
# The Keweenaw - Dark Skies



# The Keweenaw - Dark Skies

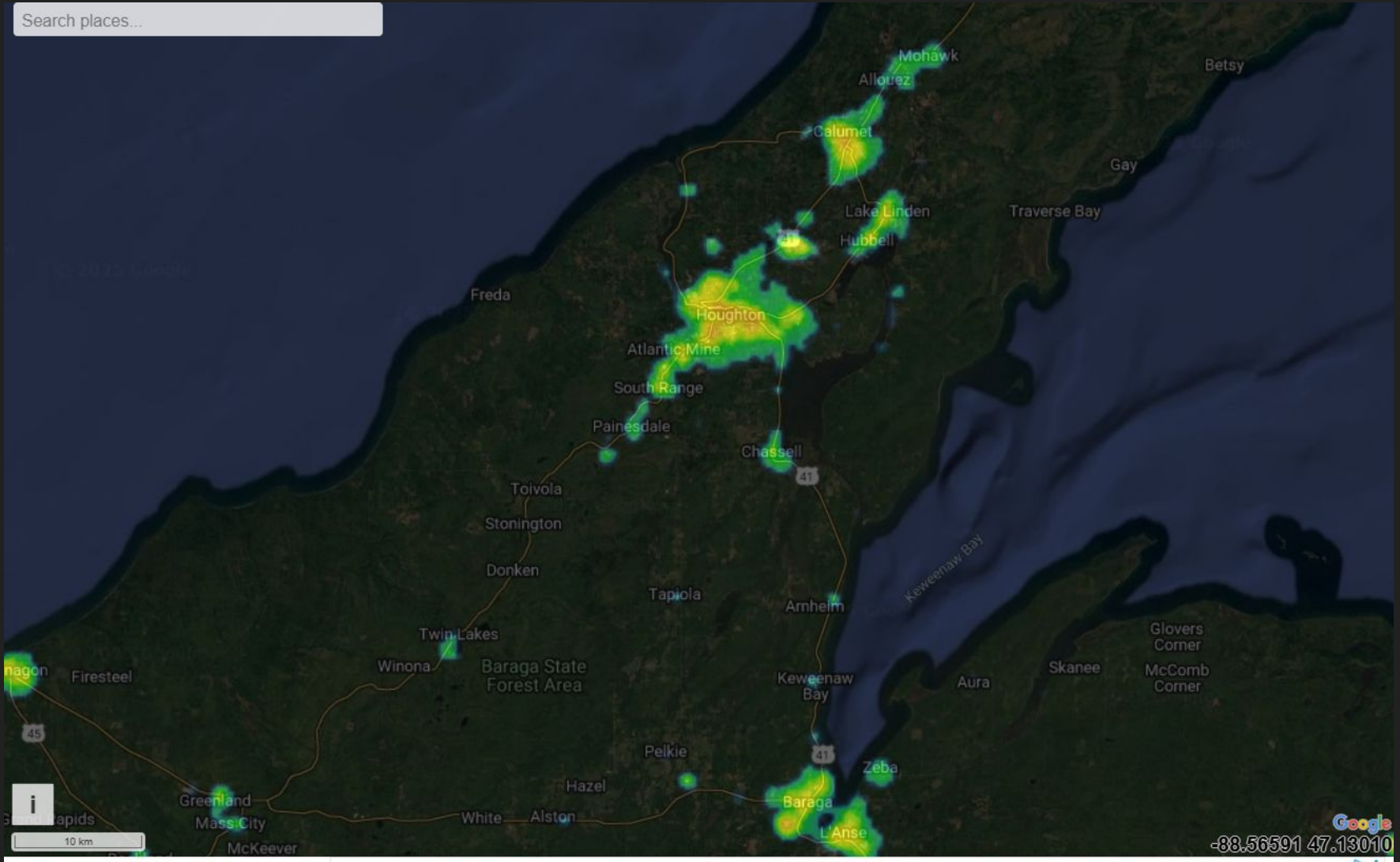


# The Keweenaw - Dark Skies



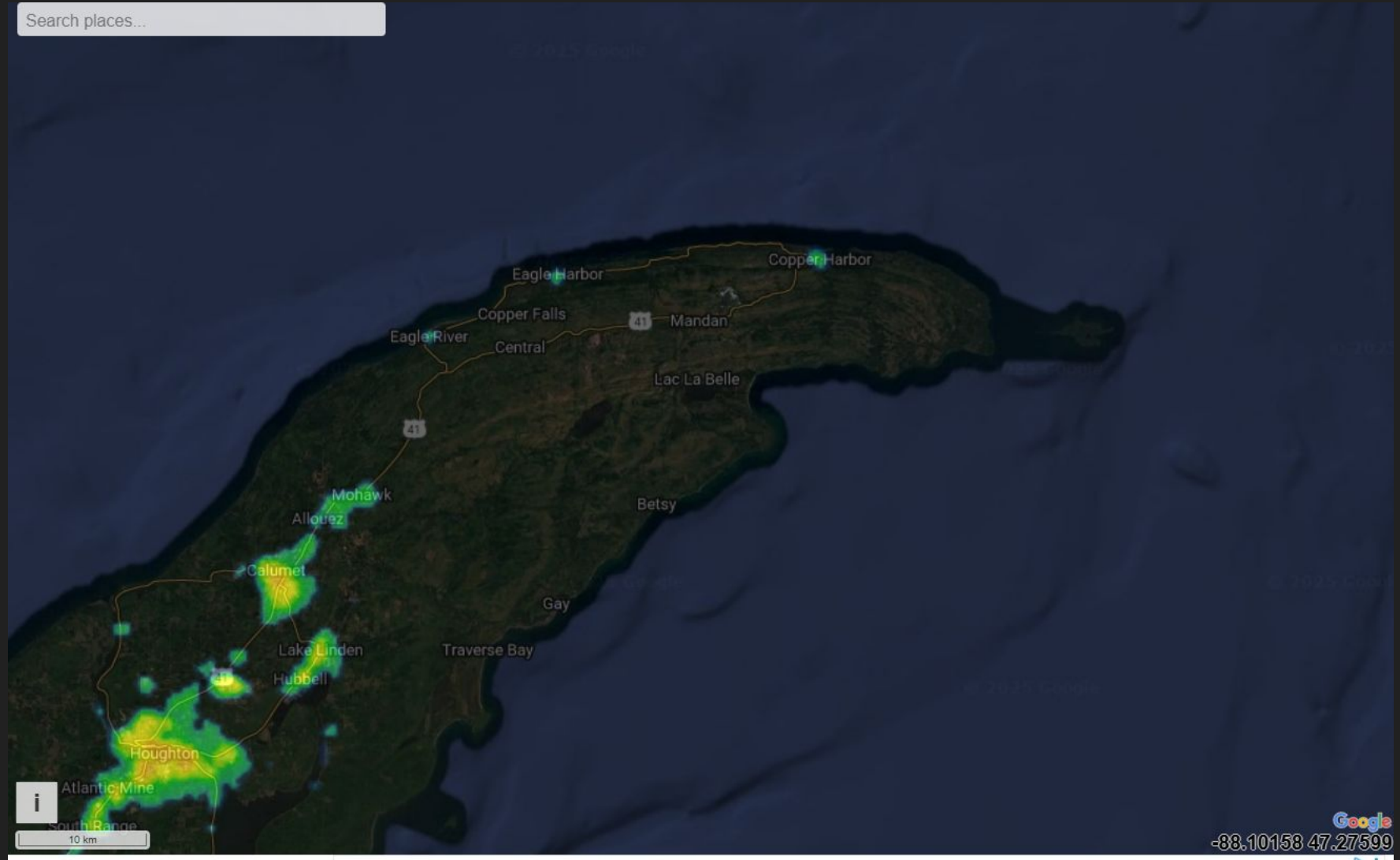


# The Keweenaw - Dark Skies



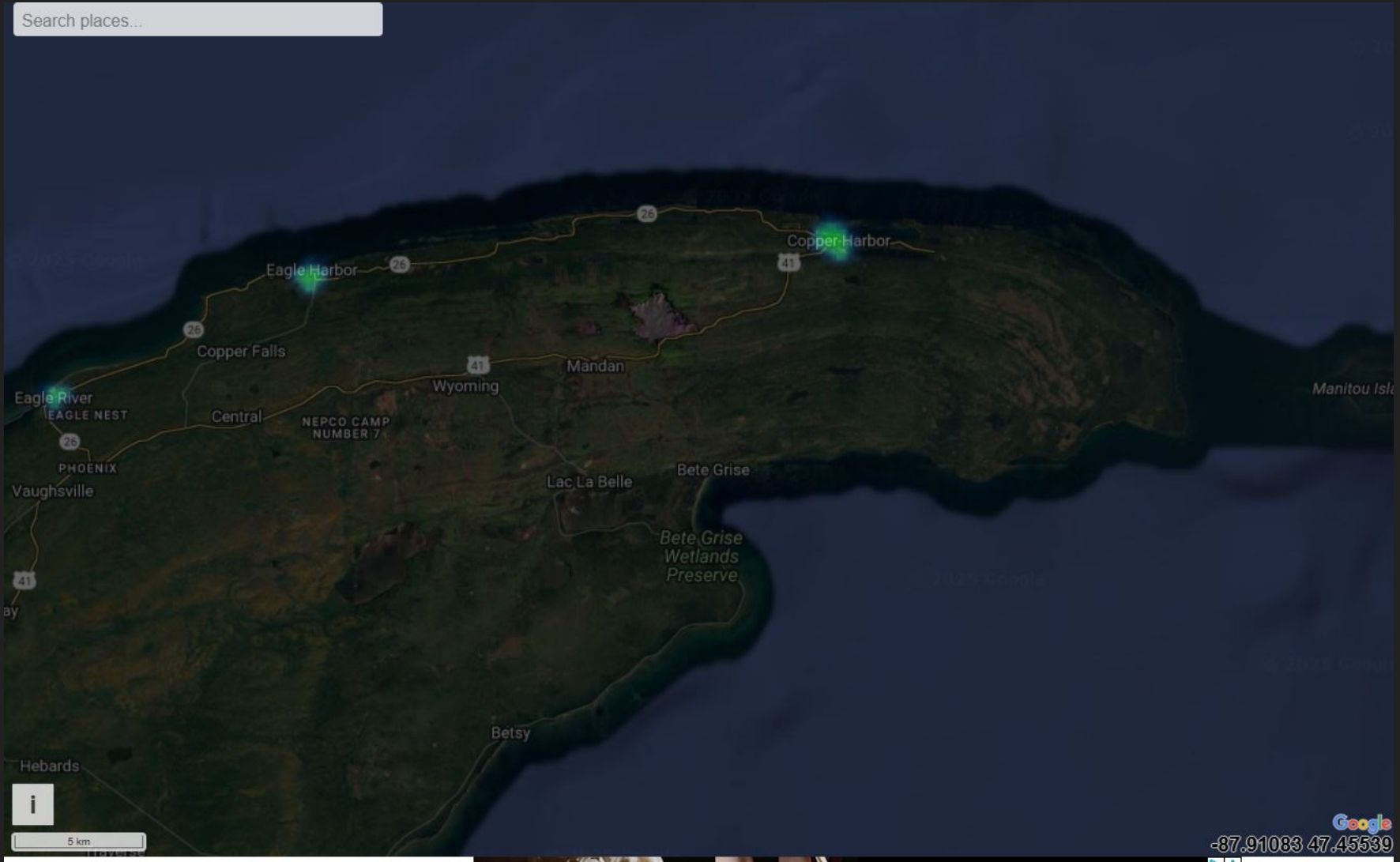
# The Keweenaw - Dark Skies

Search places...



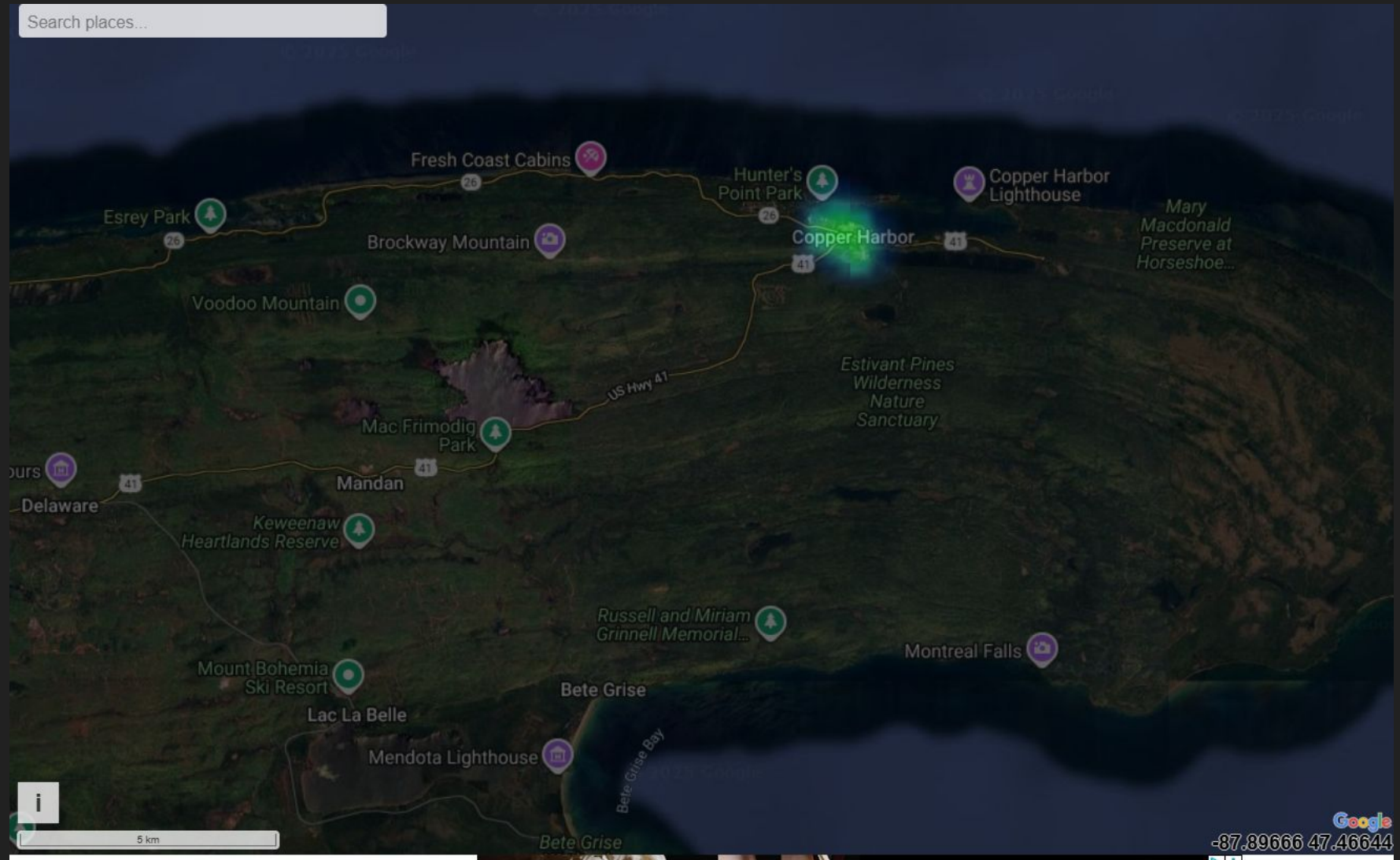
# The Keweenaw - Dark Skies

Search places...



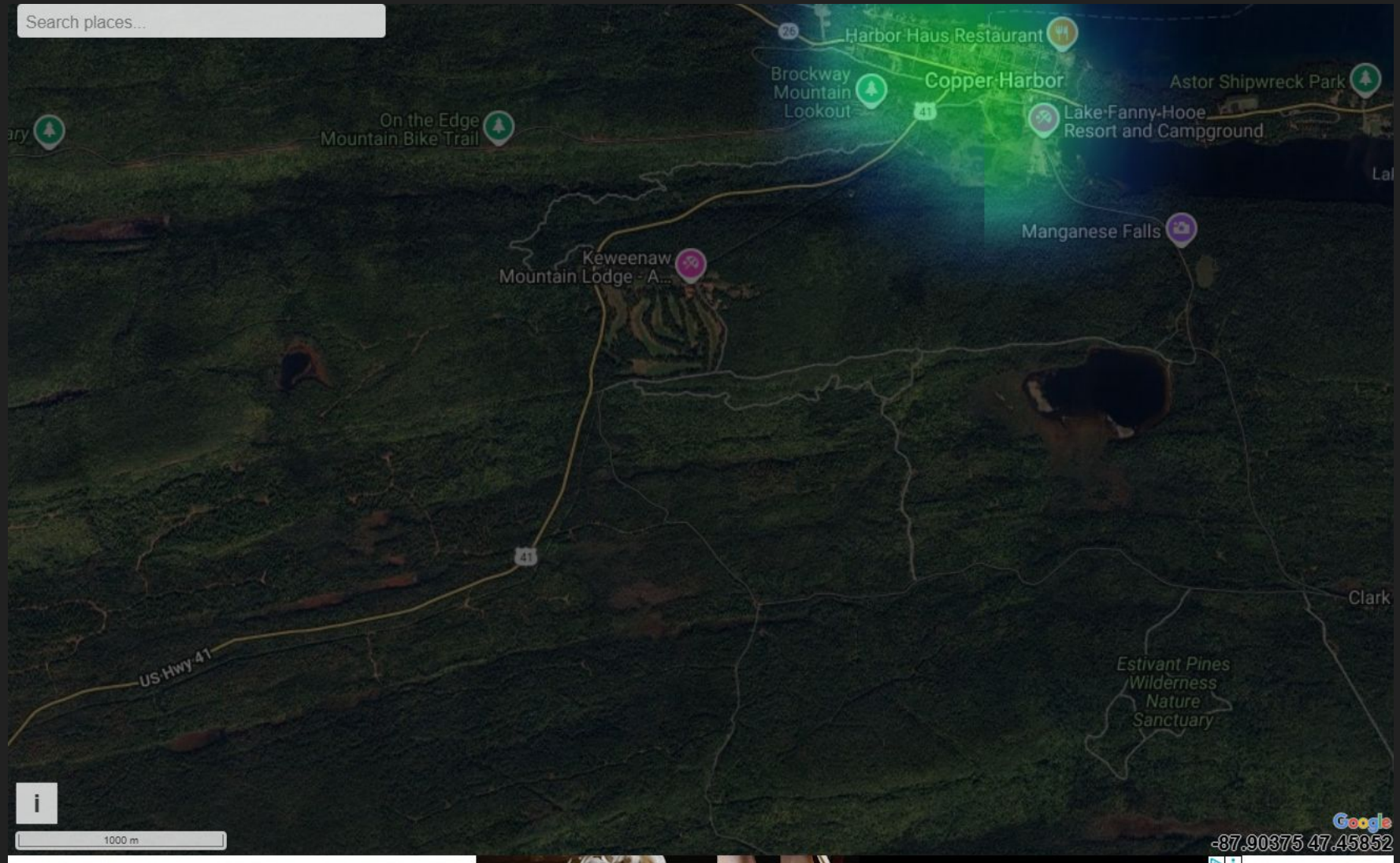
# The Keweenaw - Dark Skies

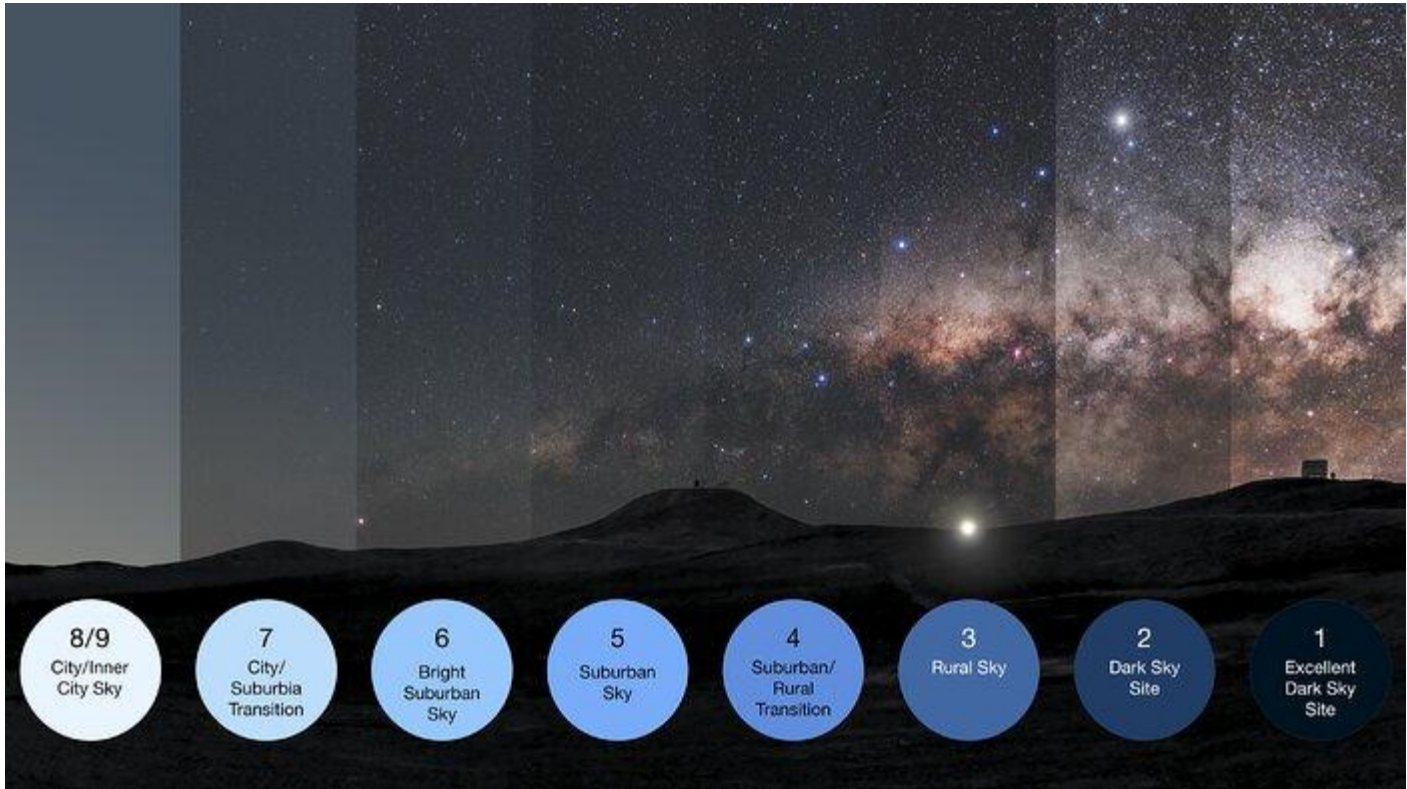
Search places...





# The Keweenaw - Dark Skies





Source: IDA | Dark Sky International

Top of the Keweenaw: Bortle 2 or 1

# Sky Quality Measurements

As part of our IDA application, we regularly take sky quality measurements. We use a Unihedron SQM light meter to take these measurements.



As of November 4, 2021, we have taken 368 readings in 2021 (February – November 2021), with an average reading of **21.50** using all the data points, and **21.60** when removing the outliers.

Below is a link to the spreadsheet where we store the data for our sky quality measurements (*updated as new readings are taken, containing more than 500 readings*).

- [KML – Sky Quality Measurements Spreadsheet](#)

**Magnitudes per Square Arc Second.** Magnitudes are a measurement of an object's brightness.

Another measurement Bortle Scale – estimate sky brightness and interpret how light pollution is affecting your view of night sky phenomenon. The lower the number is, the better sky quality.

# Lighting at the Keweenaw Mountain Lodge | Keweenaw Dark Sky Park

Street Light Dimming: 5% strength



# Lighting at the Keweenaw Mountain Lodge | Keweenaw Dark Sky Park

Street Light Dimming: 50% strength



# Lighting at the Keweenaw Mountain Lodge | Keweenaw Dark Sky Park

Street Light Dimming: 100% strength



# Lighting at the Keweenaw Mountain Lodge | Keweenaw Dark Sky Park

Street Light Dimming: 100% strength + another street light



# Lighting at the Keweenaw Mountain Lodge | Keweenaw Dark Sky Park

Street Light Dimming: 5% strength



# Lighting at the Keweenaw Mountain Lodge | Keweenaw Dark Sky Park

Street Light Dimming: 100% strength



# Lighting at the Keweenaw Mountain Lodge | Keweenaw Dark Sky Park

Street Light Dimming: 0% strength



# Lighting at the Keweenaw Mountain Lodge | Keweenaw Dark Sky Park

Street Light Dimming: 5% strength



# Lighting at the Keweenaw Mountain Lodge | Keweenaw Dark Sky Park

Street Light Dimming: 0% strength



The street lights being replaced January / February 2021, showing the older lights



Hole 1 / Brockway Webcam, with the old street lights in place. Hole 1 street light pole is where the cameras are installed



Hole 1 / Brockway Webcam, with the Hole 1 street light and cabin road street lights replaced with Dark-Sky Compliant light fixture (note: even with more street lights working on the cabin road, there is less light pollution on the golf course)



Hole 1 / Brockway Mountain Webcam, looking at lights along the cabin road, after installing dark-sky compliant street lights (fully-shielded, LED lights) -- the Northern Lights are on the upper-right of the picture



The make/model of the new street lights that were installed, in January / February 2021



RWL2-S-30-30-D-7P7-3-G- ALUM ARM  
When ordered in 3K this is dark sky rated



RWL™ G2

Cobrahead

DESCRIPTION

The RWL™ G2 fixture from TGS represents a new performance-based, forward-thinking design for roadway lighting for residential/commercial streets, intersections, and high-speed roadways. Designed for both retrofit and new construction, RWL™ G2 provides multiple lumen packages with field adjustability and distribution options. A Comfort view optic lens is applied to minimize glare and backlight while maximizing luminaire efficacy. RWL™ G2 has tool-less entry providing quick access for installation and maintenance. A variety of control options are available for future upgrades.

APPLICATION

Roadway, Parking Lots, Walkways and General Outdoor Spaces



# LIGHTS OUT!

OVER THE NEXT COUPLE DAYS WE WILL HAVE ALL OF THE STREET LIGHTS AND ADDITIONAL LIGHTS AROUND THE LODGE TURNED OFF.

WHEN EXPLORING THE PROPERTY AT NIGHT, PLEASE USE CAUTION.



( visit [keweenawmountainlodge.com](http://keweenawmountainlodge.com) for more information )





Wi-fi Module for Street Lights – Installed October/November 2023



### Golf Course-side Cabin Road

Control • 6 Devices • Dimmer - 5%



### Lodge Parking Lot

Control • 6 Devices • Dimmer - 5%

OFF ON 5%

#### Sensors



Sensor One - 15acc0

MAC: 15ACC0

Status: No Light, sensor last updated 11 minutes ago

#### Lights



Lodge Parking Lot - Light 1 - 15acc0

MAC: 15ACC0

5%

BLINK



Lodge Parking Lot - Light 2 - 15acc4

MAC: 15ACC4

5%

BLINK



Lodge Parking Lot - Light 3 - 15acbc

MAC: 15ACBC

5%

BLINK



Lodge Parking Lot - Light 4 - 15babb

MAC: 15BABB

5%

BLINK



### Golf Course-side Cabin Road

Control • 6 Devices • Dimmer - 5%

OFF ON 5%

#### Lights



Cabin 1 - Light 15ac9f

MAC: 15AC9F

5%

BLINK



Cabin 11 - Light 15af9d

MAC: 15AF9D

5%

BLINK



Cabin 12 - Light 15b480

MAC: 15B480

5%

BLINK



Cabin 5 - Light 15b715

MAC: 15B715

5%

BLINK



Cabin 6 - Light 15b111

MAC: 15B111

5%

BLINK



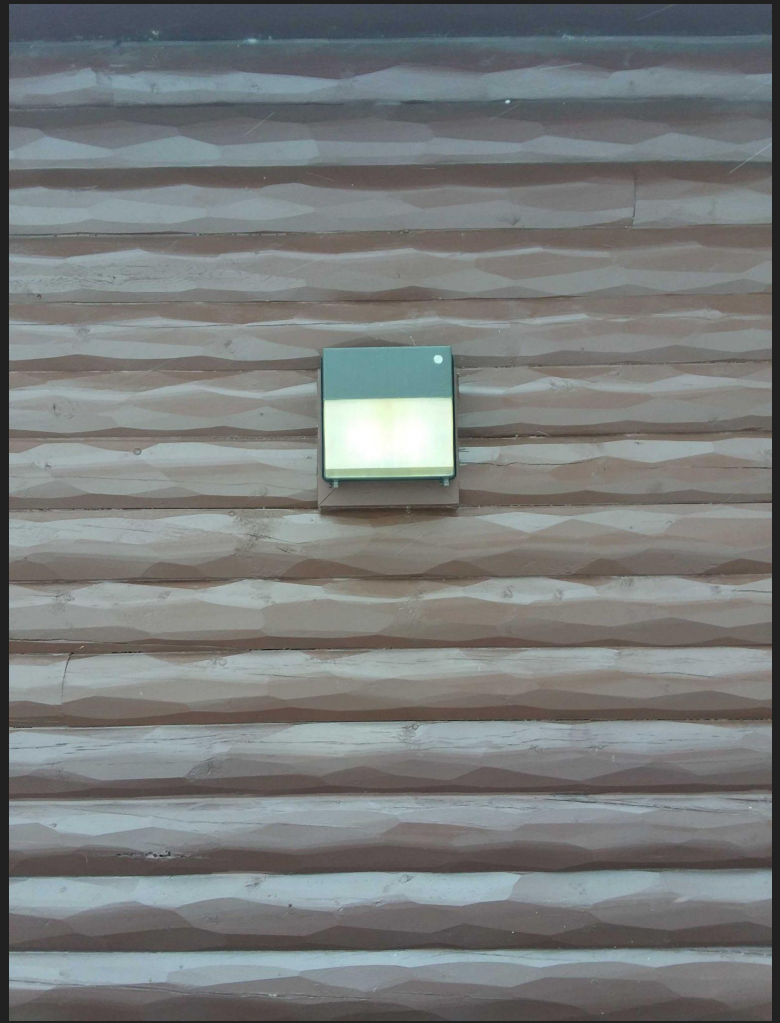
Cabin 9 - Light 15b688

MAC: 15B688

5%

BLINK







**Flashlights:** It is useful to take a flashlight with you when you are walking around the property so you watch where you are stepping. To be considerate of others, a red flashlight is preferred. If you do not have one, inquire at the OAC about borrowing one. If using a flashlight that uses standard colored bulb, be respectful of others while viewing the night sky by making sure to shine it downwards and turn it off when not needed.



# EXPLORE THE NIGHT WITH A RED LIGHT



The use of a red flashlight can help preserve night vision for you and others.

"The big player in human night vision is the chemical rhodopsin, and that takes from 20 to 40 minutes for humans to start benefiting from it. The body does not produce this chemical in daytime. It takes a very low light level sensed by the eyes to produce rhodopsin. When the light is detected at a low level for 20 minutes or so, the body starts producing rhodopsin and night vision starts setting in.

A key trait of this feature is that rhodopsin is photoreactive. It only takes a few seconds of bright light to cause the rhodopsin to decay into two parts with a photosensitive reaction, and the rods in your eyes stop working. Then the cycle starts again.

It is an interesting trait that deep red lights do not trigger the neutralization of the rhodopsin, so astronomers and safety officials use red lights for night lighting to allow night vision to continue."

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**Hole 1 / Brockway Mountain Webcam, looking at lights along the cabin road, after installing dark-sky compliant street lights (fully-shielded, LED lights) -- the Northern Lights are on the upper-right of the picture**



3:15:27 AM

# Hole 1 / Brockway Mountain Webcam, April 19, 2023

[ illustrating the darkness with Lights Out! ]



Nest

3:15:09 AM

# Lodge Webcam, April 19, 2023

[ illustrating the darkness with Lights Out! ]



Nest



**Northern Lights over the 1930s Toro tractor, with a crescent moon, March 23, 2023**  
[ illustrating the connection with the golf course and the cabins ]



What has been the result on the sky glow at the top of the Keweenaw?



What has been the result on the sky glow at the top of the Keweenaw?

2020



What has been the result on the sky glow at the top of the Keweenaw?

2024



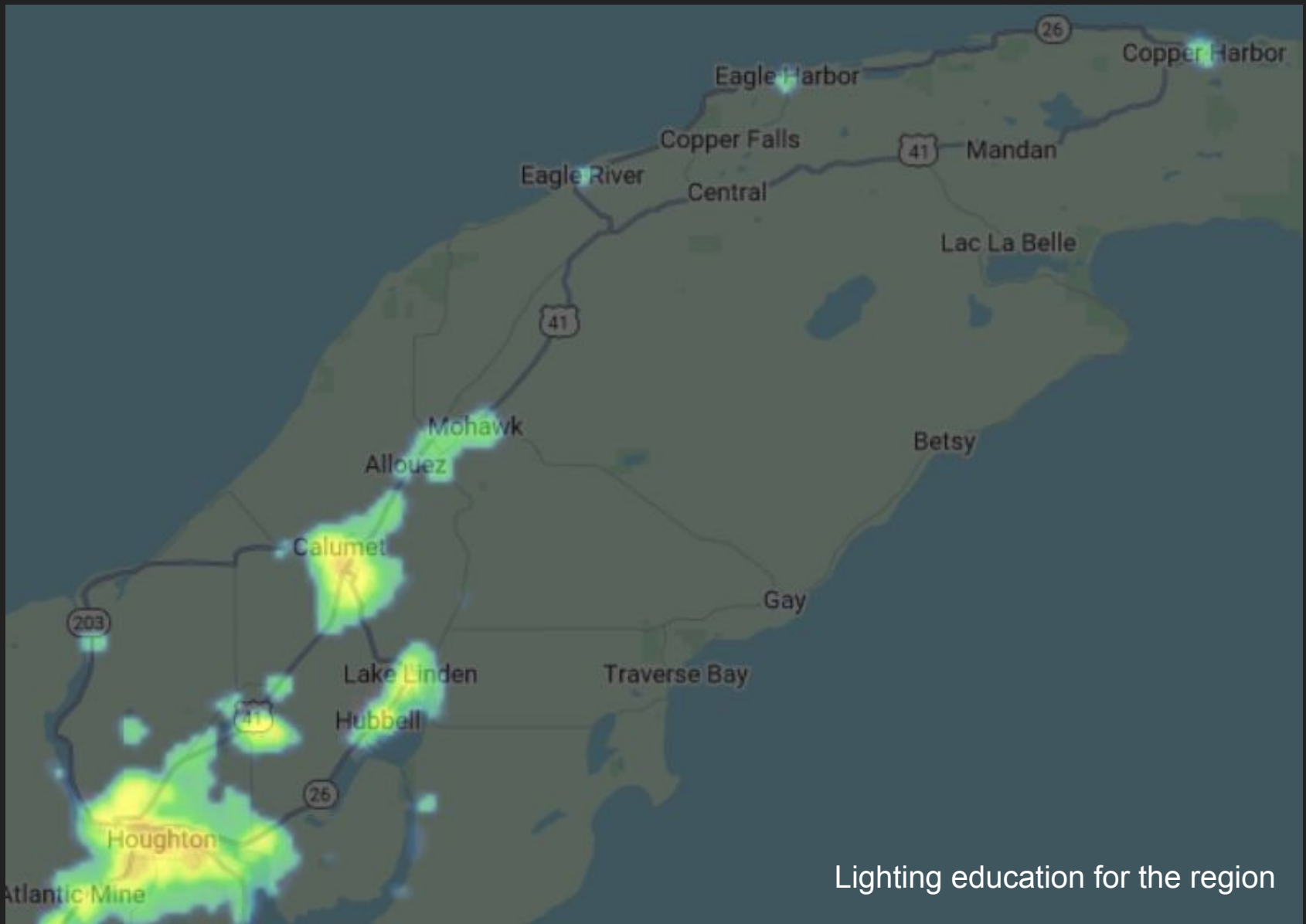
Part of determining the sky quality is to understand if there are any light dome effects in the vicinity. This requires taking horizon photos. Below is a horizon image which was taken from hole 4 on the property on December 12, 2021 between 2:25am and 4:05am ET (taken by KML team member, Tom Oliver). This image is a spherical panorama merge of 24 photos.



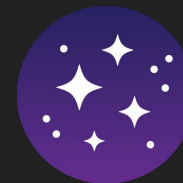
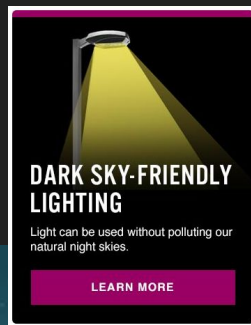
Click on the image to view and download a [high quality version of this image](#) (~86mb).

On the night these photos were taken the temperature was 28°F, with a relative humidity of 81%. Winds were SSW 15 knots, gusting to 30 knots. Moonset was at 01:40 EST moonrise was 14:09 EST. Astronomical twilight began at 6:38 and ended at 18:52. The camera used to take the images was a Canon 7D Mark II, with Canon EFS 17-55mm lens [@17mm (w/ sensor 1.6x crop factor = 27.2mm). The camera details and settings are as follows:

Zoom Out: Look at the light dome for the peninsula



# Solutions to Light Pollution



Light polluted sky

Visible night sky



**UNACCEPTABLE**  
Unshielded

**VERY BAD**

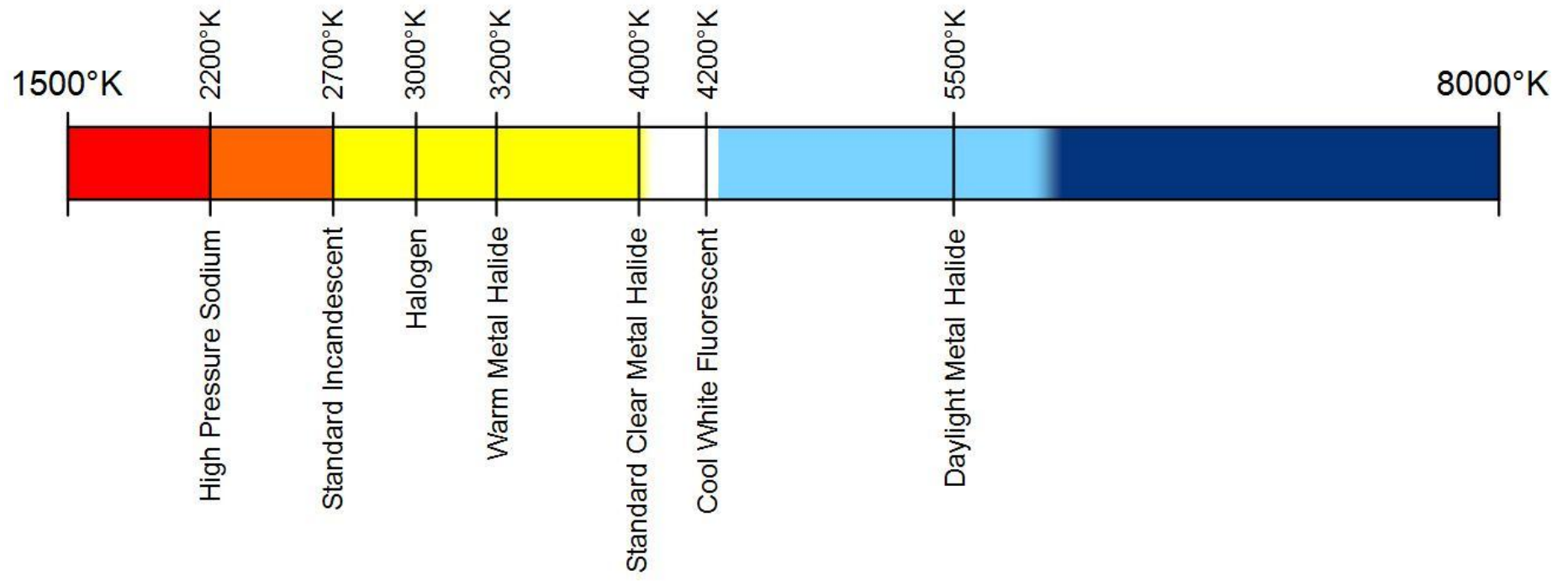
**BAD**

**BETTER**  
Fully shielded

**BEST**  
 Fully shielded + timer  
or motion sensor

Use outdoor lighting by only using it where it's needed, when it's needed, & in the amount required. Use the lowest light level required, limit blue-violet light, utilize timers or motion sensors, & use shielding.

# Kelvin Temperature Chart



# Lighting Guidelines

The International Dark-Sky Association has specific guidelines for lighting in order to foster dark skies. We follow those guidelines at the Lodge and as part of our goal of establishing the Keweenaw Dark Sky Park as an International Dark Sky Park.

- Lighting Management Plan

## Lighting Management Plan

Date last updated: December 14, 2021  
Author(s): Mike Miller, John Mueller



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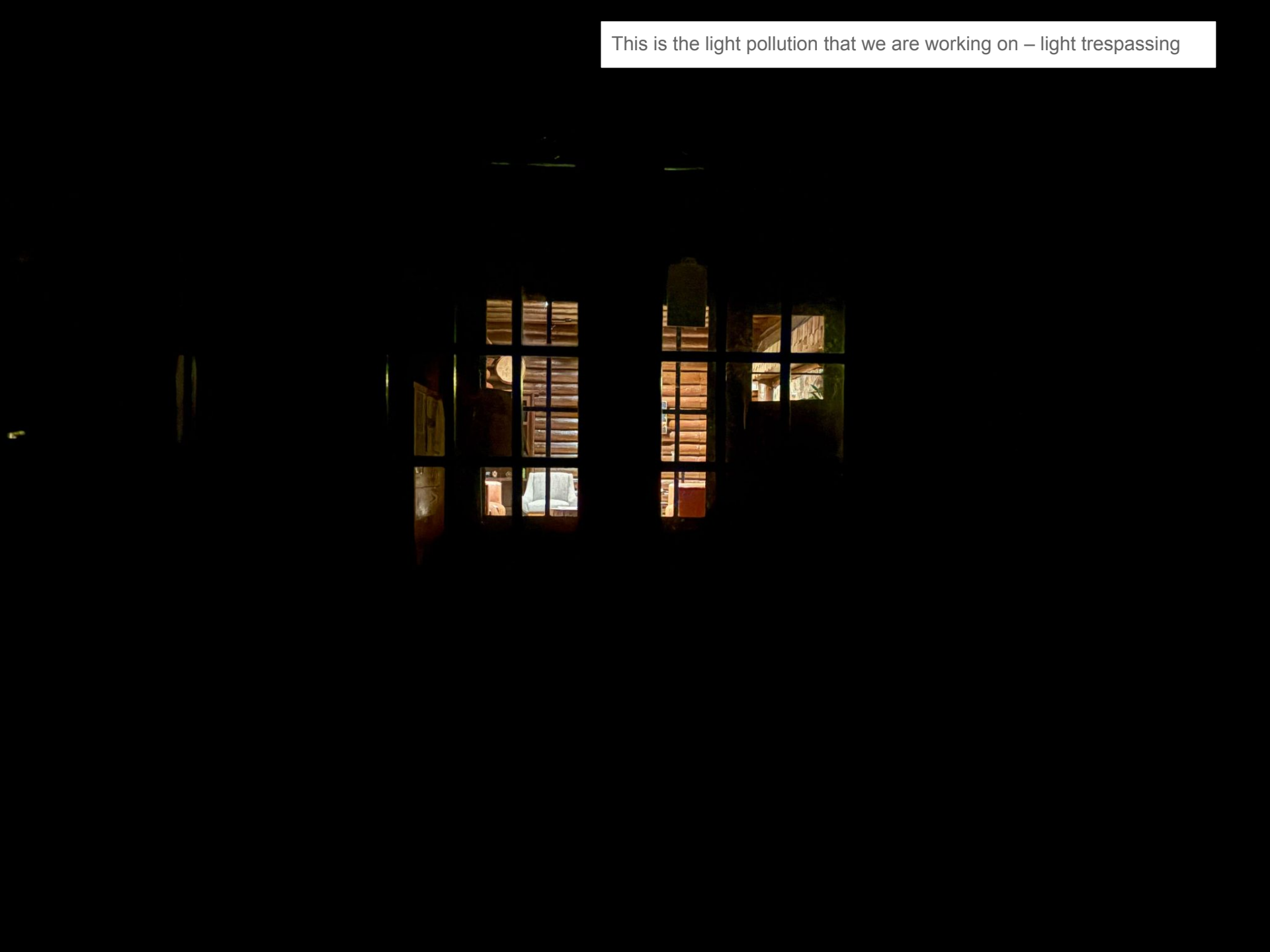
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This is the light pollution that we are working on – light trespassing



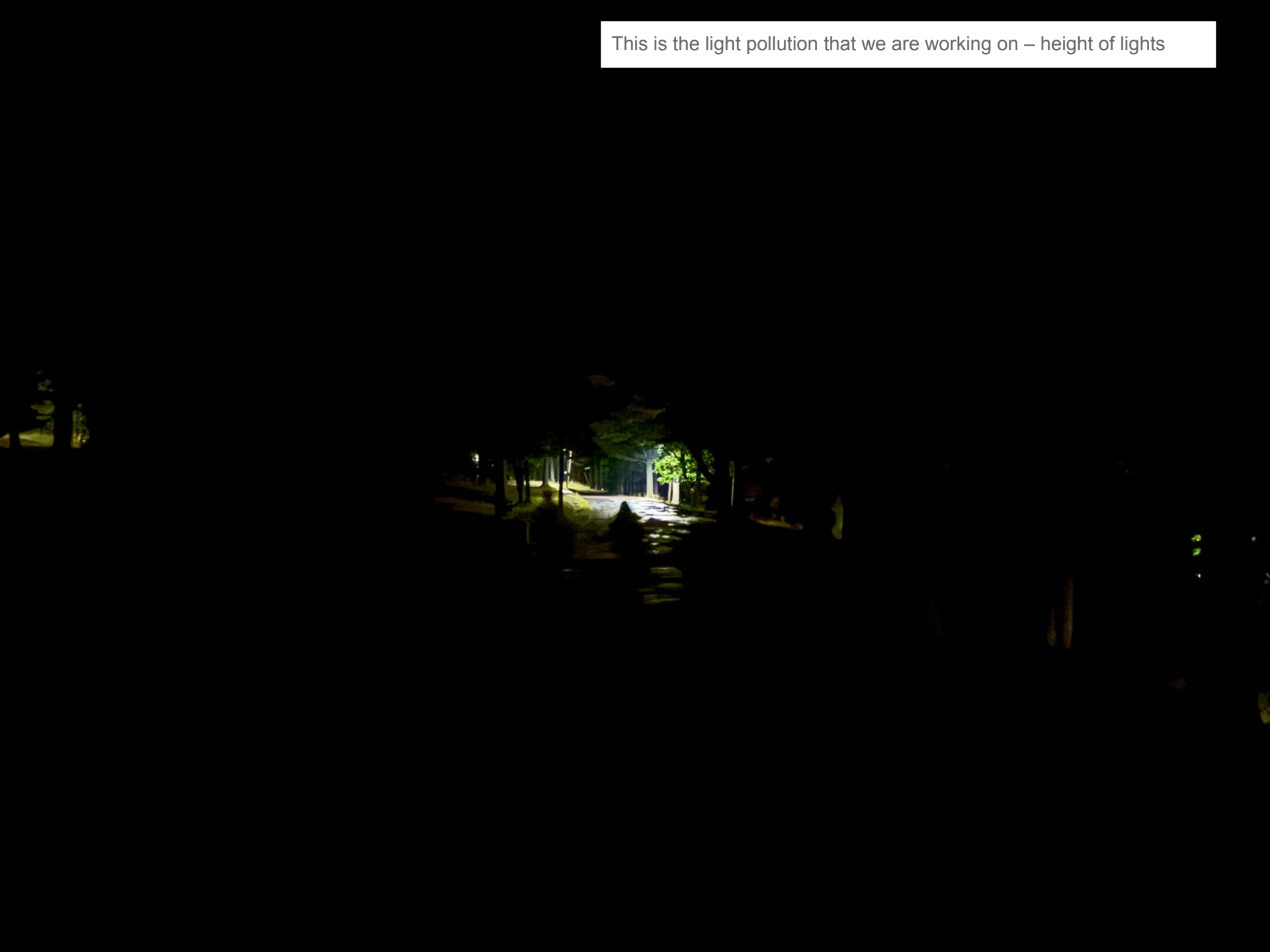
This is the light pollution that we are working on – light trespassing



This is the light pollution that we are working on – height of lights



This is the light pollution that we are working on – height of lights

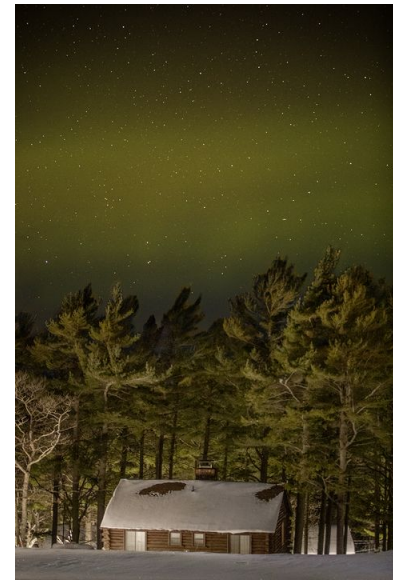


This is the light pollution that we are working on – height of lights



This is the light pollution that we are working on – wayfinding lights





## **Northern Lights, The Lodge and Cabins Sunday, February 26, 2023**

Photos by: Chris Guibert

[ illustrating high quality photography ]

# Light Pollution Affects Us All!



Wildlife



Health



Energy



Heritage



Safety

## The benefits of dark skies are:

- Improve one's circadian clock (or rhythm) — sleep patterns, hormone release, eating habits and digestion, and body temperature; for good health, we need sunshine as well as darkness
  - [ i.e. better circadian clock means a better sleep, which contributes to better overall health ]
- Improving ecological integrity — many plants, wildlife, and insects rely on darkness to forage, breed and navigate, thus dark skies help them survive.
  - [ e.g. many birds migrate at night, and the top of the Keweenaw is one of their byways ]
- Ensuring the full enjoyment of a wilderness experience

# What is Light Pollution?

....human-made alteration of outdoor light levels from those that occur naturally.

[ Dark Sky International ]



Light pollution increasing at an average of 10%+ per year.

Artificial light at night (ALAN) – outdoors and indoors



# Types of Light Pollution?

**Glare:** excessive brightness that causes visual discomfort

**Sky Glow:** brightening of the night sky over inhabited areas

[ 80% of World Population Lives Under Skyglow - 2016 ]

**Light Trespass:** light falling where it is not intended or needed

**Clutter:** *bright, confusing, and excessive groupings of light sources*



# Solutions to Light Pollution

- **Light fixtures (fully shielded and shine down)**
  - light the ground, not the sky
- **Use the right amount of light that is needed**
- **Install timers / dimmer switches, and turn off lights when not in use**
- **Use only lighting with a color temperature of 3000K or below (reduces blue cool light, that is harmful to animal species)**
- **Work with your neighbors and local governments to ensure outdoor lighting isn't harming the environment, people, animals**

