International Dark Sky Place Annual Report: October 2021 - December 2022

Date
Wednesday, December 21, 2022

General Information

International Dark Sky Place Name
Mont-Mégantic International Dark Sky Reserve

International Dark Sky Place Category
International Dark Sky Reserve

Designation Year
2007

Guidelines Version
N/A

Your Name
Rémi Boucher Scientific Coordinator

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Secondary Contact Phone Number

[redacted]

Place Manager Name (if different from above)

Dany Gareau

Management Agency (if applicable)

Parc national du Mont-Mégantic

What is the physical address of the Place?

189 route du parc
Notre-Dame-des-Bois, Qc, J0B 2E0
Canada

Is the site currently under Provisional Status?

No

Are you an IDA Delegate, Affiliate, or Chapter Representative?

No

Night Sky Quality Monitoring

Total average or typical zenith night sky brightness reading reported in the original application:

0

Provide the Tier you were certified under, if applicable:

Silver

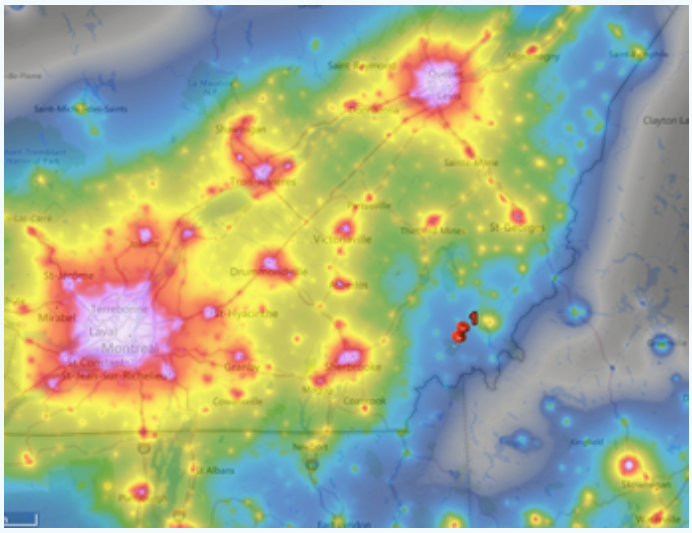
Total average or typical zenith night sky brightness reading for this reporting period:

21.75

Upload your night sky quality raw data documents for this reporting period:

MontMegantic_SkyQuality_... .docx

Upload a map (PDF or image) that shows the locations and names of the places that were used to take SQM measurements:



Describe any changes detected in night sky quality from receiving your certification to the present:

See the complete text in attached file (MontMegantic_SkyQuality_AdditionalInfo.docx)

Typical Zenith Night Sky Brightness - 2022

* *Total average or typical zenith night sky brightness reading reported in the original application:*

N/A. At that time (2007), no measurements in mag/arcsec^2 were done for the application.

Provide the Tier you were certified under, if applicable:

Silver

* *Total average or typical zenith night sky brightness reading for this reporting period:*

Typical zenith sky brightness (with SQM-LE): 21,75 mag$_{SQM}$/arcsec^2
Typical zenith sky brightness (with TESS-W): 21,52 mag$_{TESS}$/arcsec^2

This is when those conditions are respected:
Sun below -18°, Moon below -5° and Milky Way latitude >40°.

* *Upload your night sky quality raw data documents for this reporting period:*
The file was too big for upload. Here are links to get them :

SQM raw data :
https://www.dropbox.com/s/tairziz5c1zfwup/MontMegantic_SkyQuality_SQM2022.zip?dl=0
TESS raw data :
https://drive.google.com/drive/folders/1LBbvNg_BgodzwqH46yWG7vh9bxKWUsy8?usp=share_link
For TESS data analysis, this link is more useful :
http://data.eelabs.eu/?device=stars657

* *Upload a map (PDF or image) that shows the locations and names of the places that were used to take SQM measurements:*

Continuous measurements were taken from the summit of mont Mégantic (45.4556, -71.1494) with both SQM-LE and TESS-W photometers.

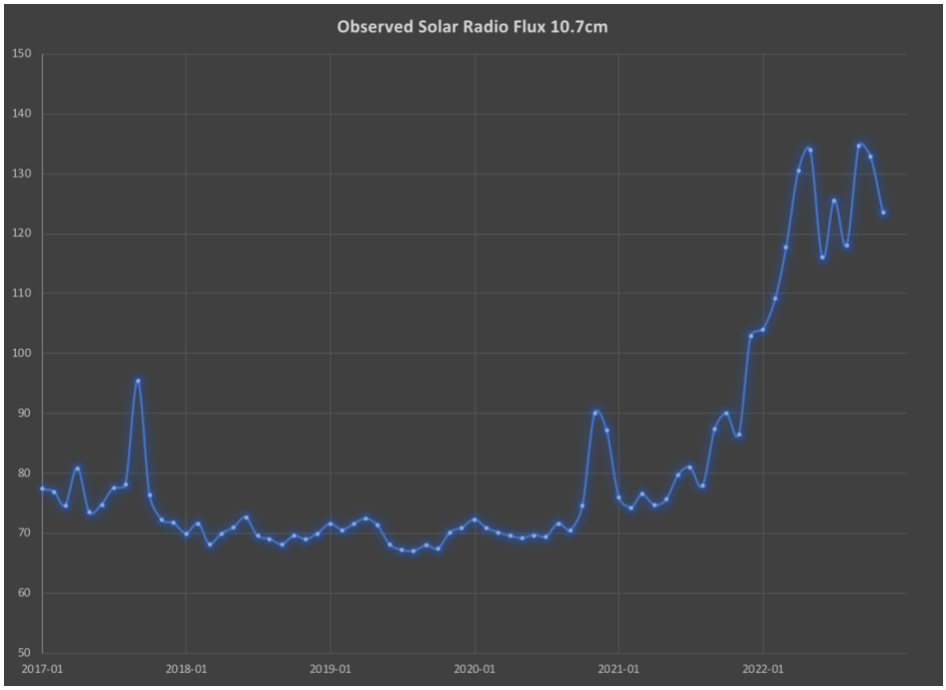
Describe any changes detected in night sky quality from receiving your certification to the present:

***We didn't have SQM measurements for the certification back in 2007. We did have all-sky measurements that was done at the inauguration event by Chad Moore of the U.S. National Park Service (NPS). These measurements were done for a second time 10 years later, in 2017, by Jeremy White. It was shown in our 2017 annual report that light pollution was very stable in 10 years, with a slight decrease. Since then, we have installed a SQM-LE and a TESS-W photometers on mont Mégantic and we can now follow more closely the evolution of the zenith night sky brightness.**

Comparing both measurements from the SQM and the TESS-W with those of the previous year, we can see a significant increase in zenith sky brightness in 2022. From 2021 to 2022, the typical zenith sky brightness with the SQM has increased by -0.15 $mag_{SQM}/arcsec^2$ while the typical zenith sky brightness with the TESS-W has increased by -0.17 $mag_{TESS}/arcsec^2$. To avoid any possible effect due to a difference in snow cover, we only use the values that were recorded when there was no snow on the ground (i.e. April 1st to October 31st).

Such a large increase in night sky brightness would normally be very concerning and certainly don't fit with the global trend of the last years nor with the use of outdoor lighting we see on the ground. For example, the TESS-W reported median values of 21.64, 21.62 and 21.69 $mag_{TESS}/arcsec^2$ for the same periods of 2019, 2020 and 2021 respectively.

Based on our observations and other measurements, we are very confident that the brightening of the night sky is of natural cause and is due to the very large increase in airglow. Apart from the presence of the Moon and the Milky way, night sky brightness is known to be strongly influenced by the natural airglow, which is itself directly linked to the solar activity. When looking at the observed solar radio flux recordings, we can indeed see a very strong increase that started in late 2021 (see graph on next page).



We can also see the increase in brightness with the measurements from the TESS-W (stars475) installed in the Hautes-Gorges-de-la-Rivière-Malbaie National Park, another very dark national park located 275 km north of Mont-Mégantic. Over there, the typical zenith sky brightness went from 21,70 to 21,49 $mag_{TESS}/arcsec^2$ between 2021 and 2021.

It will be interesting to see how this will evolve in the coming years, since we are entering the maximum of the 11-years solar cycle. Relying on zenith sky brightness measurements to identify trends and changes will certainly be challenging in places with very little artificial light at night and we think that everyone involved, including IDA, should be careful before drawing conclusions based on a year-over-year difference.

Additional note : Due to a failure of our original TESS-W (stars237), we had to replace the unit with a new one (stars657) in early 2022. Some of the difference between 2021 and 2022 could be due to this change of unit (we have seen variation within approximately ±0,1 $mag_{TESS}/arcsec^2$ when comparing different TESS-W units side by side), but the fact that the SQM at Mont-Mégantic, plus other TESS-W installed elsewhere, also show a brightening, makes us believed the airglow is the main cause here.

Lighting Compliance

Reserves, please fill out the applicable row to describe your lighting compliance rate (%) with your Lighting Management Plan (whole numbers only):

	Year of Certification	Compliance % in Original Application	Current Compliance %	Anticipated % for Next Reporting Period
Core	2007	100	100	100
Periphery	2007	75	100	100

What actions have you taken to meet the requirements of your Lighting Management Plan/Policy during this reporting period? Include a summary of any actions taken with privately owned lighting that helped improve your night sky quality as well:

*Since the above table doesn't allow for a lot of customization, here is some more info:

-With it's very large area, the periphery of the Mont-Mégantic IDSR has always been divided in 3 zones based on their light pollution contribution and prioritization of efforts:
Zone 1 (towns in a ~25km radius around mont Mégantic, covering 2716 km2)
Zone 2 (towns in the 25-50km radius, covering 2177 km2)
Zone 3 (city of Sherbrooke, ~60-70 km west of mont Mégantic)

For zones 2 and 3, the compliance % are unknown for the original application but were very low.

Zone 2 is now at 55% (1465 streetlights) and could grow to 65% nest year.

The exact number of luminaires in Sherbrooke (zone 3) is unknown, but is approximately around 15,000. We know that ~1000 (2200K LED) luminaires/year were installed or changed each year in 2019, 2020 and 2021. The city has not yet released numbers for 2022 but we expect it to be similar or higher for 2022. Prior to 2019, compliant HPS or PC-Amber LED luminaires were installed by the city.

For particular actions about private lighting :

A new project with door-to-door evaluation of outdoor lighting for residential and commercial properties was conducted in 4 municipalities (Lac-Mégantic, Nantes, Weedon and Westbury) this year by a member of our team. Door hangers with

information about their non-compliant light fixtures and a reminder about the ordinance were left and a second visit was done a couple of months later to document changes.

Expanding our awareness campaign aimed at enterprises along Sherbrooke's largest commercial artery. See our 2021 annual report for more details on the "Objectif Ciel Étoilé" project.

Providing technical help to municipal inspectors for certain cases for new lighting projects, or where non-compliant lights were recently installed and needed to be corrected.

Upload any relevant documentation showing examples of lighting changes made during this reporting period:




Have you used any fixtures from the IDA Fixture Seal of Approval (FSA) Program?

No

If you answered yes to the previous question, please describe:

We do not use or refer to the IDA FSA because these products are not compliant with the ordinances enforced in the Mont-Mégantic IDSR. CCT accepted in the FSA (3000K) is too high for general lighting applications in the IDSR (<2200K). In

fact, this often cause us problem because some companies will install 3000K fixtures and tell us they were "'dark sky approved", without checking if they are compliant with the regional ordinance. It often happens with large company, were the head office is not in the region and were contracts are given by the management without consulting with municipal inspectors.

For International Dark Sky Communities and Reserves, have there been any changes to your local outdoor lighting ordinances? If yes, please describe and provide a link to the updated policy if available:

Changes were done in 2019 and 2021 for the Haut-Saint-François and Granit RCMs ordinances. More details available in previous annual reports of those years.

Sherbrooke's ordinance will be updated in early 2023 after the work we did on it this year. The main modifications are:

-Adding provisions for greenhouses to use blackout curtains.
-Adding CCT as a way to measure the colour of light sources (previously only used % of blue light spectrum, which made things a bit complicated sometimes)
-Lowering max CCT (or blue%) of light sources used for building entrances to 3000K.

Outreach, Education, and Media

Please fill out the following table to summarize all outreach efforts from the past reporting period (whole numbers only).

Total # of Events	# of Unique Efforts Offered	Total # of Attendees for All Events
850	14	56000

Note - "unique efforts" offered represent different programs at your site. For example, all star/astronomy related events should be classified as one type of effort, "night hikes" as another type of effort, etc.

For each unique event type your Place hosted, provide all of the following information (up to 100 words per entry; 1000 total word limit): Event name; Date or range of dates of all events under that name; Number of attendees; Brief description of the event and the values that you promoted (i.e. wildlife/ecology, lighting, culture/heritage, IDSP status, ordinance/policy, astrotourism, energy security and conservation, human health, etc.).

1. New IDSR/light pollution outreach sessions in primary school; September-December 2022; 477 students; 48 sessions; A science popularization activity in classroom, on the themes of night, stars and light pollution. Designed for students of 2nd and 3rd primary cycles (given in 2 sessions).

2. Special facebook live presentation for the inhabitants of the Mont-Mégantic IDSR; December 8th 2021; 5700 views; 230 comments. Presentation explaning light pollution, its impacts, the solutions and showing our recent work.

3. Under One Sky presentation; October 2021. Presentation by Remi Boucher: "Long-Term Protection of the Night: Challenges and Successes of IDA's First and Largest Dark Sky Reserve"

4. Mont-Bellevue UNSP inauguration event; September 2, 2022; Hundreds of attendees. Presentation by Remi Boucher about the importance of keeping a connection with the night sky.

5. Daytime visit to the ASTROLab+Observatories in Mont-Mégantic National Park; May-November 2022; ~90 days; 10835 visitors; While the activities are centered on astronomy, the IDSR is almost always mentioned or presented.

6. Astronomy evenings at the ASTROLab; May-November 2022; 77 events; 6427 visitors; The astronomy evenings at the ASTORLab start with a presentation about the IDSR and light pollution.

7. Astronomy evenings at the Popular Observatory; June-October 2022; 104 events, 3837 visitors; The evening program does not start with a presentation about the IDSR , but it is often mentioned to visitors during different parts of the activity (telescope observation, on the panorama lookout, etc).

8. Astronomy Festival; July 2022; 3 nights, 264 visitors. One of our special annual event, where people can come inside the research observatory.

9. Perseid meteor shower special event; August 202; 3 nights, 907 visitors; Our other special annual event, with multiple activities at the ASTORLab and the Popular Observatory.

10. School groups (on site); all year except summer, 4335 students for 2022; The precise activities depends on what the teacher chooses, but can be during the day or the evening. Presentations are similar to was is done with the public in summer.

11. Zoom presentations with school groups : all year except summer; 352 sessions, 22 565 students; We have a range of presentations with different topics depending. Each presentation usually starts with an introduction of the IDSR. There is also a presentation on the theme of light pollution.

12. New ASTROLab staff training about light pollution and the IDSR; June 9th 2022; 10 astronomy staff members; Long presentation of everything about light pollution and the IDSR.

13. Presentation for the whole staff of the national park; June 21st 2022; ~50 staff members; Shorter presentation about the IDSR and some of our ongoing projects.

14. Presentation at a COP-15 satellite event with the Chinese-Quebec Cooperation Forum; December 8th, 2022; Presentation about light pollution and biodiversity, given by Dany Gareau, director of the national park.

Did you promote the IDA and its mission during your outreach programs/events? If so, describe:

It always depends on the specific event, but IDA is often mentioned in a way or another. Logo can be used sometimes, often when showing other dark sky places or when mentioning the certification of the IDSR.

Website is not often promoted, mostly because we have our own website and because IDA's website is in english. The different types or dark sky places can be mentioned and explained.

Provide social media handles or website links used to promote dark skies (these will be added to your Place's IDA page):

our website : meganticdarksky.org
or
cieletoilemontmegantic.org

ASTROLab facebook :
facebook.com/MontMegantic

Mont Megantic national park :
https://www.sepaq.com/pq/mme/

Has your Place participated in any IDA-led initiatives such as International Dark Sky Week, the Under One Sky conference, or other relevant promotions during this reporting period?

Yes

If you answered yes to the previous question, please describe:

We gave a presentation in the 2021 Under One Sky conference (October 2021). We could not attend in 2022.

To update our records, please provide a photo of your erected sign with your respective International Dark Sky Place label:

Briefly describe how educational materials are being dispersed/provided at your Place:

Our website (meganticdarksky.org) is our main hub for any kind of information about the ISDR.

We also have a brand new (available in printed and pdf forms) Lighting Guide that we are really proud of and that are available in every municipal office.

The “Objectif ciel étoilé” project and “Ami du ciel étoilé” certification also have their own form of material (window stickers, brochures, floor stickers).

We also designed a few brochures and posters for organizations outside of the IDSR.

Upload examples of new (not developed/provided by the IDA) printed educational materials that have been created this reporting period. These may include brochures, handouts, policy-related materials such as utility notices, and/or informative messages distributed through utility companies:

D426_GuideEclairageRICEM… .pdf

Briefly describe any efforts undertaken to reach new audiences. If this was not part of your efforts last year, describe what you plan to do to engage new visitors in the 2023 reporting period:

Earlier in 2022, we gave a formation about outdoor lighting, light pollution, and the IDSR to the team of municipal inspectors of the city of Sherbrooke.

We are currently working on a formation about outdoor lighting and the ordinances in the IDSR for electricians. The formation will be officially recognized by the Corporation of Master Electricians of Quebec. This will allow us to give this formation to electricians as part of their continuous formation hours.

Partnerships

Have you worked with any external partners to promote the dark-sky movement within and outside of your Place's boundaries? If so, identify these partners and explain the result of this collaboration:

We are working with the SEPAQ (managing agency of the national parks of Québec) on a long term project to increase awareness about light pollution in the national parks. This includes the installation of night sky brightness monitoring station (TESS-W) in almost each parks of the province. Also part of this project is the inventory of every outdoor light fixtures for the parks, similar to what is needed for a DarkSkyPlace application process, all centralized on a georeferenced database. We built a lighting guide specifically made for the parks that is available to them since 2021. We are also supporting other parks currently working or looking forward a DSP designation.

We worked in collaboration with the team responsible for creating the Mont-Bellevue Urban Night Sky Place in Sherbrooke, Qc.

SNC-Lavalin, one of Canada's largest engineering company, asked us for assessing light pollution from a large area of commercial and industrial uses in Montreal. The city had asked SNC-Lavalin for a study on multiple environmental impacts of this area and light pollution was one of them. Measurements, evaluation and recommendations were provided by us in a report and in presentations.

Other partnerships are mentioned elsewhere in this annual report.

Were you awarded any grants or funding for projects during this reporting period? If yes, please describe:

The work of the Mont-Mégantic IDSR team is funded by the Mont-Megantic National Park (SÉPAQ), Haut-Saint-François RCM, Granit RCM, city of Sherbrooke, and the Mont-Megantic Observatory.

Projects outside of the IDSR received funding from those specific partners.

Have you collaborated with an IDA Delegate or IDA Chapter on dark-sky issues since the last reporting period? If so, please describe:

Mont-Bellevue Urban Night Sky Place : measurements, presentation, pictures, etc.

IDA-Massachusetts : online presentation about light pollution from greenhouses, the ways to limit it, and our new regulations to address it.

Briefly describe future plans (in 2023 and beyond) to engage with existing and new partners and how you will expand the dark-sky movement:

Many of the projects mentioned earlier in this report are continuing in 2023.

The efforts within the other national parks of Quebec is one example. Our new sessions in primary school of the ISDR is another one. Our new lighting guide will soon be available in english to reach a larger audience. Door-to-door evaluation for outdoor lighting will be expanded to 2 more municipalities next year. We are also continuing the sharing of dark sky specific communications through municipal journals and facebook pages.

We hope that having an officially recognized formation for electricians will also help against the installation of non-compliant light fixtures.

We honestly have too many ongoing and future projects to list them all here… ;)

Success in Light Pollution Control, Leadership, and Future Threats

For Dark Sky Reserves, briefly describe any new (or ongoing) examples of night sky friendly installations on private sites and/or public spaces such as roadways or parks:

Except than what is continually installed in Sherbrooke, there were no major roadways elsewhere in the IDSR. We know that the city of Sherbrooke did prioritize the installation of 1800K PC-Amber LED fixtures near Mont-Bellevue (instead of the 2200K it now installs), for the new Urban Night Sky Place.

Have the "threats" identified in your application for certification:

Stayed the same

If the "threats" identified in your application for certification have increased or decreased, please provide a brief explanation of how they have changed (i.e., increased/decreased visibility of light domes, new sources of glare/problematic lighting, new industry/development, etc.):

It might be because it was made in 2007 and their were no specific guidelines at the time, but there were no "threats" that were identified other that the usual broad ones.

One interesting thing looking back at the application document is this paragraph about the "Long term acton plan" :

"Of course, the regulation represents the ideal legislative structure to ensure good lighting installations for years to come. But everyone knows regulation is not a guarantee of success if it’s not well applied, monitored and enforced. In addition, the population needs to be reminded constantly of its existence and the importance to respect it."

That has proven to be 100% true and it still guides most of our actions today.

Provide a brief description of how you will continue to manage "threats" over the next year:

One particular threat that was identified more recently is light pollution from greenhouses, which are quickly becoming one of the biggest threat in light pollution growth.

We move swiftly to include provisions about greenhouses in our lighting ordinances that was previously only applied to "outdoor lighting". Sherbrooke ordinance is the last one that needs to be officially updated for this, but it should be done very early in 2023, when the whole bureaucracy process is completed.

Our work on this is already being copied in other municipalities.

Change in Ownership, Place Size, or Access

Have there been any changes to the size, access and/or boundaries of your Place (this could be property acquisition, sale, road development/closure, easement access, etc.)? If so, please describe:

No

What is the total size of your Place (in square kilometers only)?

5260

For Dark Sky Communities and Reserves, what is the current population size?

218377