

## Notes for the Light Pollution Workshop

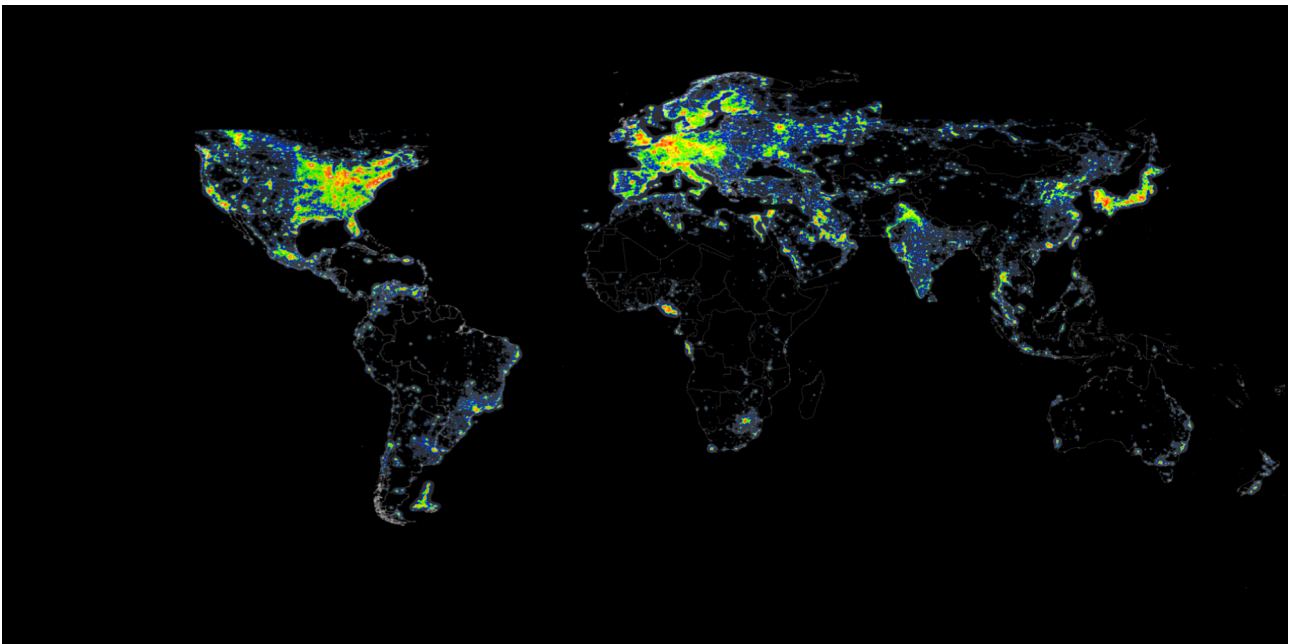
Concerns for air or water pollution, are necessarily acute when the pollution conditions are acute. If the air we breathe, or the water we drink is slowly getting poisoned, we cannot afford to ignore these issues in any way - steps will automatically be taken - standards for industrial and domestic pollution will fall in place sometime or other and measures for reducing the pollution will be ongoing - sooner or later. Simply because - we cannot afford to ignore slow poisoning!

There is, however, a slow poisoning to our creative spirits that many do not realize is happening insidiously, all around us. As this poisoning is non life threatening - it is largely ignored.

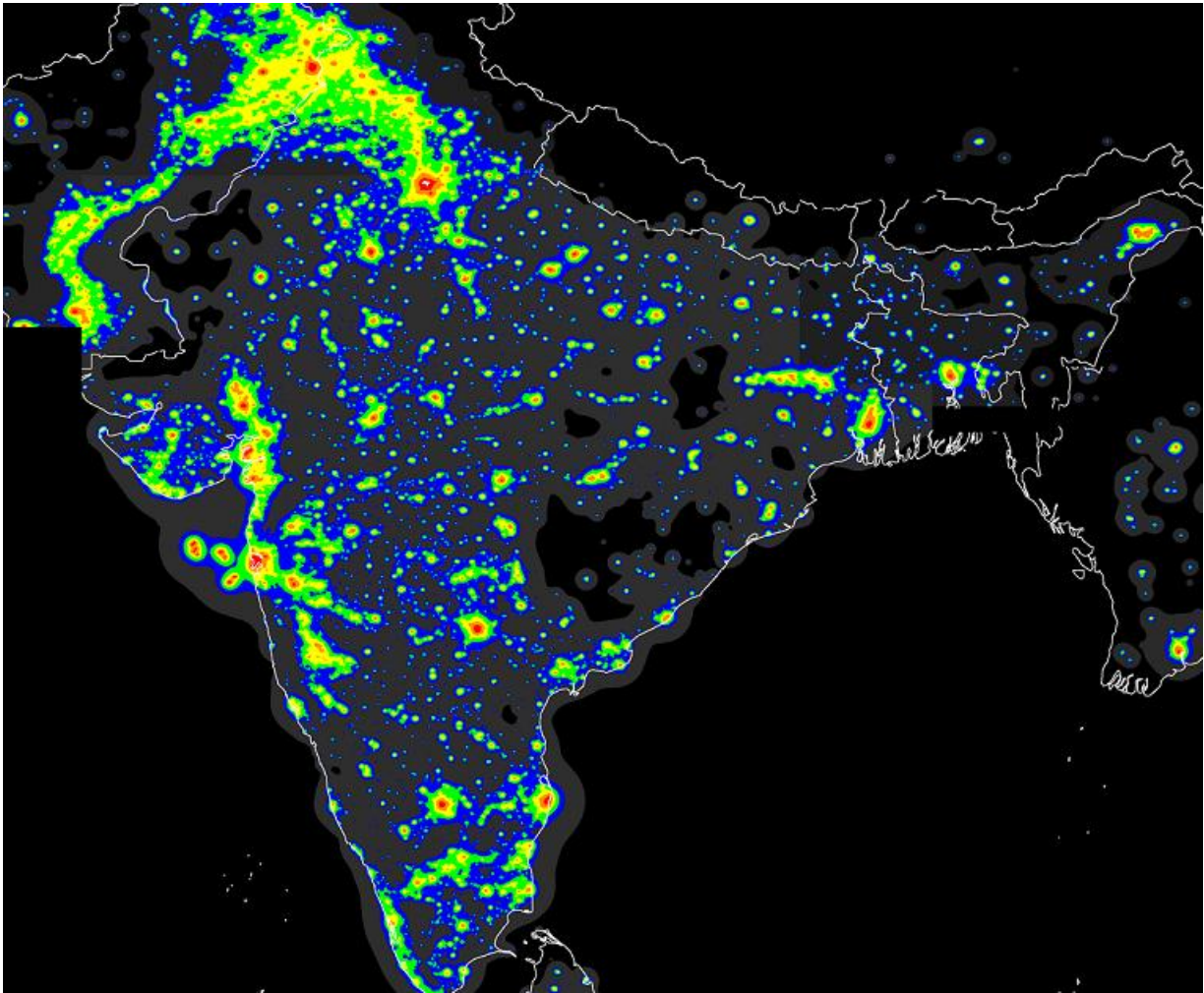
We are talking about the issue of light pollution, here. The degradation of our night skies and the vanishing of stars from city and town skies. The light that we need down here on the ground tends to be over used and spills over in directions away from the Earth, towards the atmosphere and outwards. Some of this excess gets scattered back from the atmosphere, creating a uniform umbrella of light pollution, mushrooming over each and every city and town of our country. Within India, there are no systematic studies that have been done, to give a quantitative idea about the amount of light pollution in different locations. No ground based wide spread studies exist.

However, one spacecraft data based estimate exists - that obtained from a detailed modelling of the night sky brightness obtained by the Italian Light Pollution Institute, using satellite images of the night lights of the Earth obtained by the US DMSP satellite.

Here is an image of the night sky brightness of the world, from this estimate:

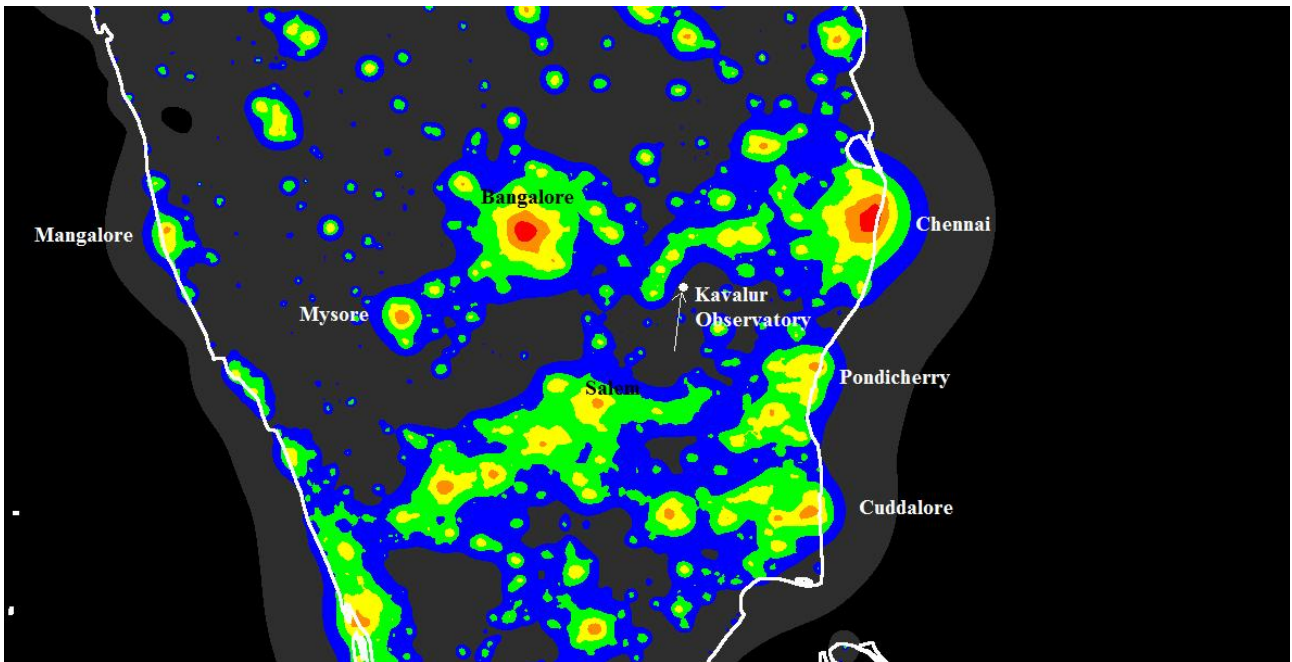


And, a close up view of the light pollution map of India: Each and every city and sizeable town can be picked up in this image through its light pollution footprint.



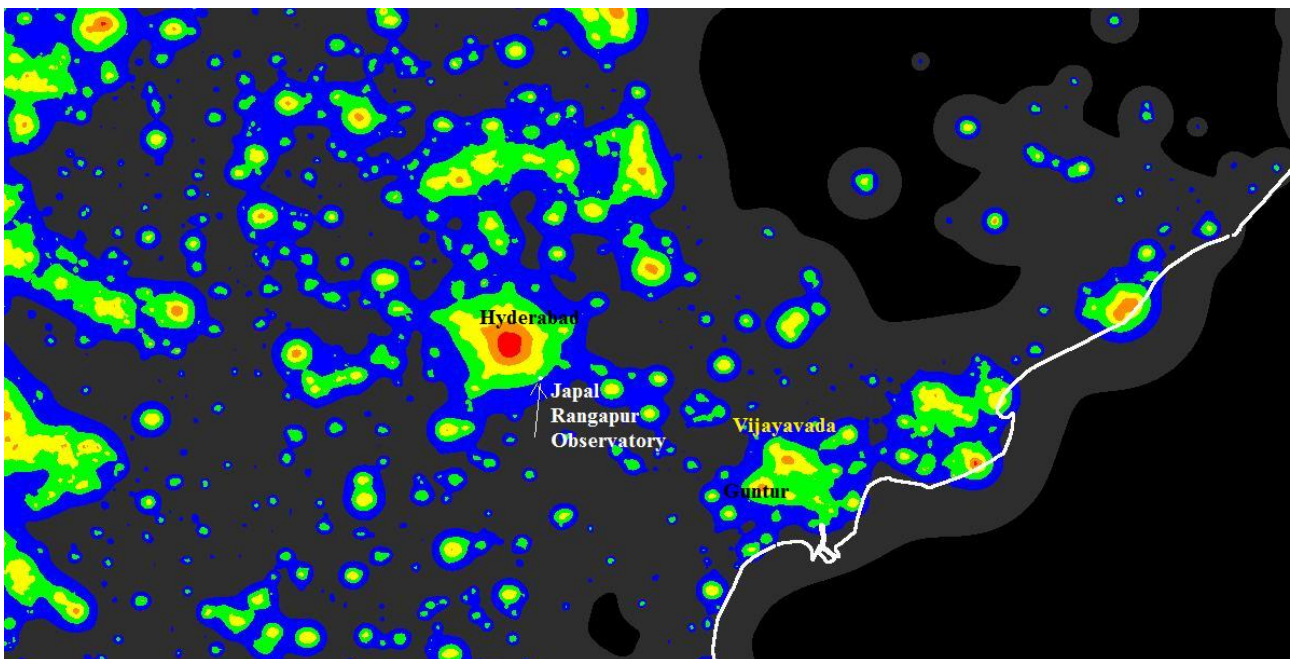
The colour scheme in these maps shows the darkest sites as black, followed by grey, blue, green, yellow, orange and red as highly light polluted city central regions.

And here is a close up view of the southern parts of India, where the two Metros : Bangalore and Chennai are very clearly demarcated by their light footprint. By comparison with a political map of India, one can delienate many of the other cities and towns in this map which are recognizable from the light pollution that they generate.

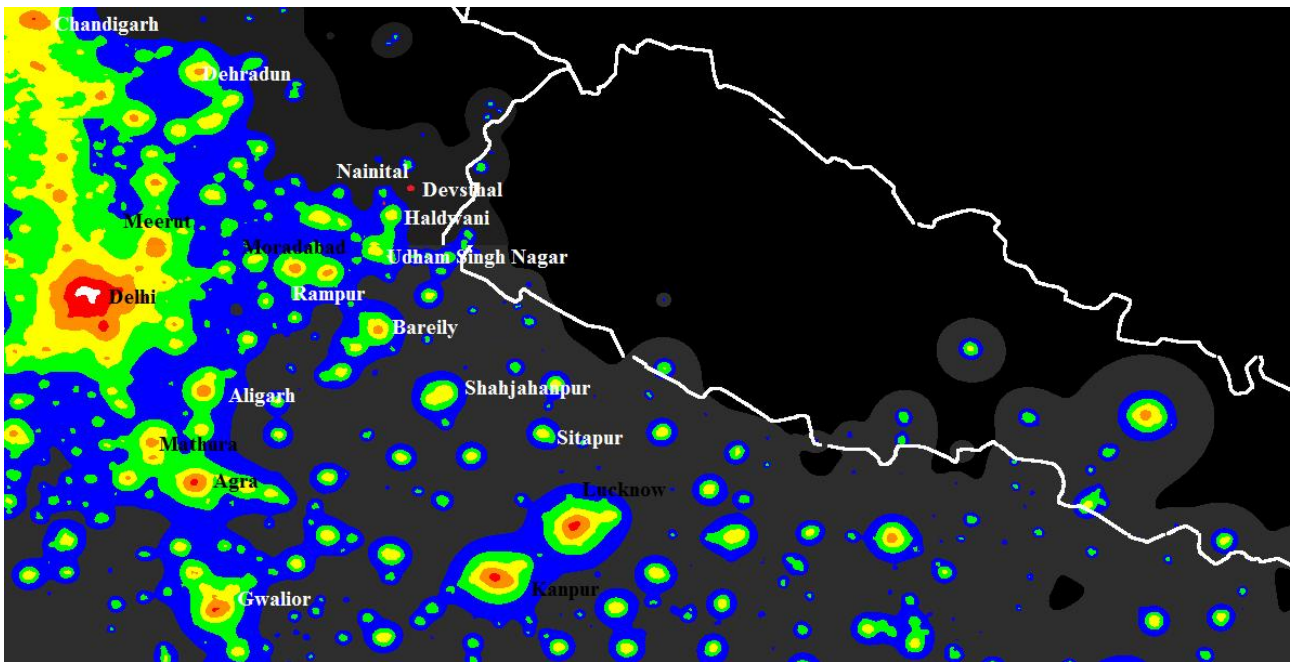


In the map above, the location of the Kavalur observatory is also shown. Indian astronomers chose this location in 1986, as an ideal dark site for the installation of the then largest telescope in the country. While the site still continues to be astronomically demarcated as a dark site, the growing fingers of light pollution seem to be threateningly moving closer to engulf it soon.

Here, in this map, regions around Hyderabad, showing the location of the Japal Rangapur observatory can be seen. This observatory was set up in - when the site was astronomically dark. The current situation of light pollution seems to certainly have invaded close to the observatory.



The largest aperture optical telescope coming up now in India, is being set at a location close to Nainital, called Devsthal, which is marked as a red dot in the map below: How long will this location remain a dark site?



Well, it seems that the disappearing dark sites are a matter for the astronomers : observatories are set up in locations which are considered ideal and give and take a few decades, the sites might be anything from ideal.

Amateur astronomers, who love the skies, and spend so much of their time aquanting themselves with the visual distribution of celestial objects in the sky, frequently make trips to dark locations around the cities they live in, for night sky observations. This is another group which is getting more and more concerned with the pervasion of light pollution to many corners of our country.

But, it is not as though, astronomers and amateur astronomers are the only group of people who stand to lose something due to these growing fingers of light pollution. The vanishing of stars due to the increasing brightness of the night skies from artificial lighting, is taking away the inspiration that dark skies filled with hundreds of stars could be, for all our city children. And then, it is not as though there are no health issues arising from light pollution. We are diurnal creatures, evolutionarily used to alternating day brightness and night time darkness. The absence of darkness from city lives (in particular, for those lives trapped on the city streets), is quite likely to be creating serious health issues which are not even studied as yet, in Indian environments. And then, there are the nocturnal creatures like bats in whose lives absolute havoc must be created due to these growing fingers of light pollution.

Given that light pollution is of seriousness, what can we, as citizens concerned about it, do?

It seems the first thing to do, is be aware of the issue. Raise awareness about the issue. Have a quantitative idea about the extent of light pollution that has spread to each and every city, town and village in the country. And then perhaps, such an awareness could be spread also to the powers that be and the powers that decide. Soon, policy decisions about implementing some standards, after recognising light pollution as a cause of concern, would need to be taken.

But, coming to the first preliminary step: The maps above give us some idea about the overall extent of light pollution. Mind, that these are maps obtained from data more than a decade old. And, these are maps obtained through some modelling, based on Earth observations through satellites.

What about estimated from ground?

Astronomers measure sky conditions rigorously while selecting a site as appropriate for setting up an observatory. Through their observations, sky conditions in some locations have been measured during specific periods.

Amateur astronomers might have some qualitative idea about the “goodness” of a site with respect to visibility of stars as they go to different sites for observing.

It would be good to have a ground observation based estimate for many central locations in cities and towns which fall outside the perimeter of the areas tested by astronomers or amateur astronomers. We as citizens will have to make these estimates.

When we are looking at obtaining a qualitative measure of light pollution, we do not need to be so rigorous as astronomers. We just need a thumbrule estimate of how bad or decent a location is, with respect to the issue of light pollution. We are, after all not looking at numbers in nature here. We are just looking at a rough estimate of man made damage.

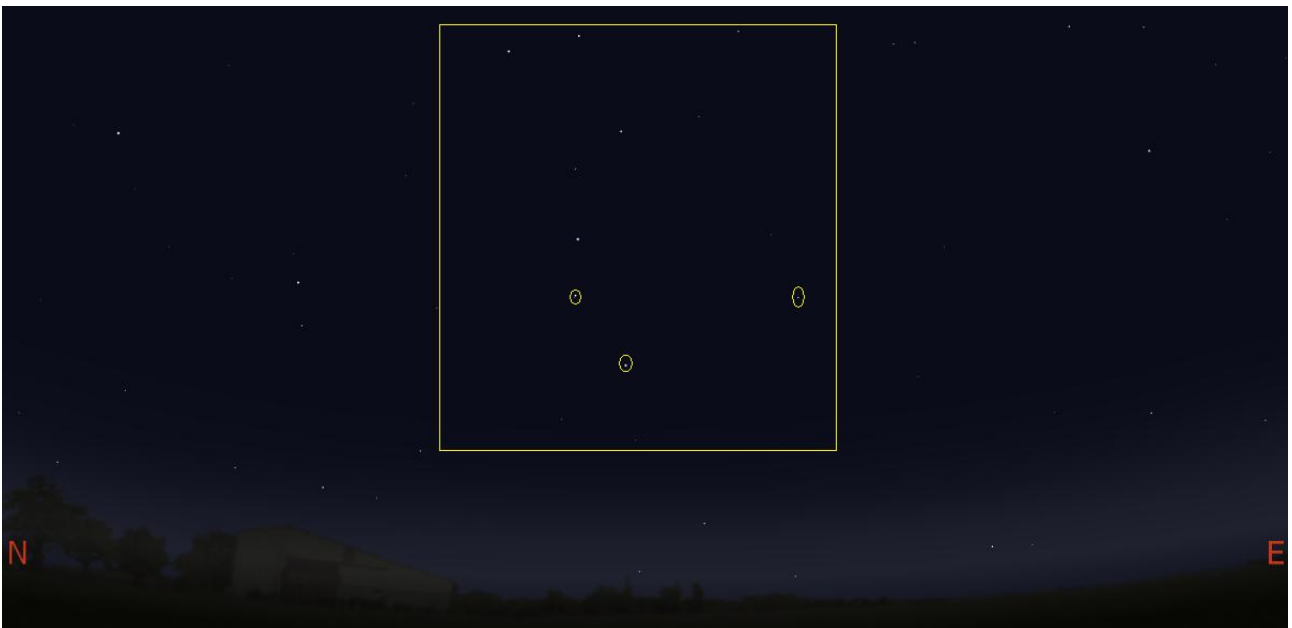
There is a very interesting and creative activity : that of counting the number of stars visible in some specific region of the sky, while observing from a specific location in a city or a town – simple star counts which will give an idea of the amount of light pollution in different parts of a city, town and in fact over the whole country. All one has to do is follow these lines from the immortal song of Suraiya:

*“jab saari duniya soti hai, hum taare ginte rahte hain ...”*

A little familiarity with the skies would be needed, for such a starcount activity.

For instance, many might be familiar with the star grouping the Big Bear or the Saptarishi.

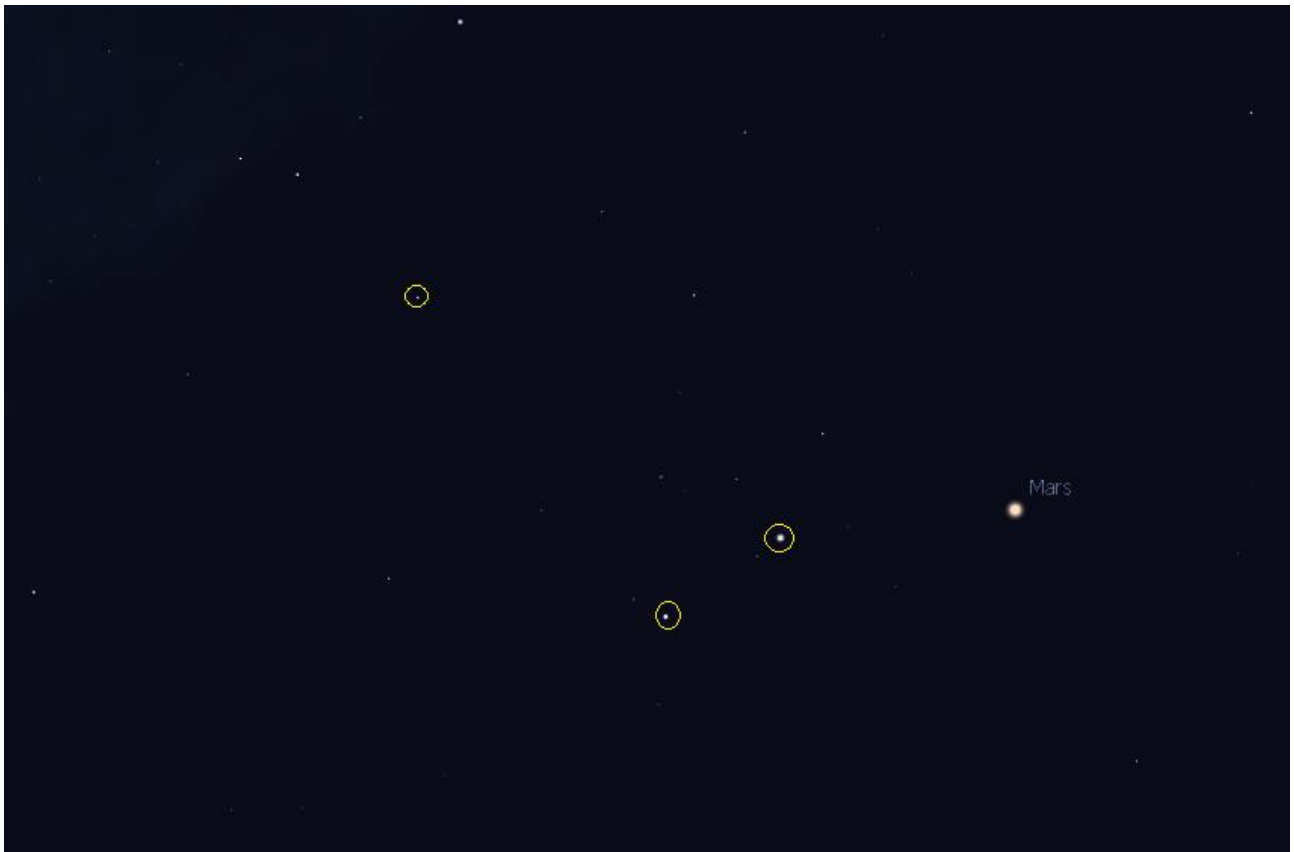
Go out at about 9 PM in the coming days. Saptarishi will be rising due North – North east, looking like a soaring kite in the sky. The view might be something like this:



The seven saptarishi stars are shown enclosed by a rectangular box. Two of the tail end stars of the soaring kite, Vashishta and Marichi or the stars Mizar and Alkaid, are marked with a yellow circle. Yet another star, not part of the Saptarishi but, a little to the right of it, is also marked with a yellow circle. This is the star Cor Corolli.

If one counts the number of stars visible in the triangle formed by these three stars : Mizar, Alkaid and Cor Corolli, including the boundary stars, this could be one data point for the star counts.

Another region which can easily be identified and where star count observations can be conducted, is in the constellation of Gemini – visible about overhead, in the evening skies.



Bright planet Mars is in that part of the sky, these days. Gemini extends from the two stars marked in yellow circles to the left of Mars – the stars Castor and Pollux, towards the west-south west. Another stars inside the constellation of Gemini, is also marked with a yello circle. Counting the number of stars visible within the traingle formed by these three yellow corcled stars will also be a useful excercise for starcounts.

There could be many other locations like this, for star counts. The Trapezium formed by four stars of the Leo constellation – the majestic lion in the sky that would have risen due exactly east, with Saturn a little below it, is shown in this figure. Counting the number of stars within this trapezium region, including the four corner stars, can also be reported as part of the star count project.



Given dark skies free of light pollution, many stars might be seen in this and other such specific locations of the sky where star counts could be done. The number of stars seen in such regions of the sky could be reported to the Nehru Planetarium, New Delhi : [nehruplanetarium@gmail.com](mailto:nehruplanetarium@gmail.com)

The following format can be used for reporting star count observations:

Name of the Observer :

Location of Observation : city/town and colony/address

Date and Time of observation :

Star counts in : Saptarishi/Gemini/Leo Which constellation?

Number of stars seen :

And finally, those of you unfamiliar with the skies, do not feel disheartened – it does not take much of an effort to learn one's way around the skies and that is all that is needed, for this exercise – nothing else – just a familiarity with the skies.

It becomes a fun and useful familiarity, if it can be converted into getting a quantitative feel about the quality of skies in locations that you are at. With observations from you, me and everyone else interested in getting back inspiring views of the night skies for all our city and town children – we could get an easy handle on keeping tabs on degradation of our night sky environments – being aware is a powerful tool against the forces of our modern lives which invariably seem to go towards degradation of our environment in so many ways!

