



The **Nachtlichter** app project

Nachtlichter is one of two projects within the Citizen Helmholtz Network for the study of night light phenomena (**Nachtlicht-BühNE**), a citizen science project funded by the Helmholtz Association of German Research Centres.

What's it about?

Nachtlichter is a **Web App** that was co-designed by a team of citizen scientists and researchers at the German Research Centre for Geosciences (GFZ). The project aims to count the sources of light emission from human settlements. Nighttime satellite imagery shows that the world is becoming brighter, but it's not clear why. **Lighting inventories including ALL light sources over large areas** do not currently exist. We aim to create such inventories in a number of cities during **measurement campaigns in September and October, 2021**. Once the data is collected, researchers from the GFZ will analyze the data to study the relationship between satellite images and the actual light sources installed on the ground. We're also open to worldwide participation. The collected data and project results will be published in **open access** form. **Are you interested in organizing a personal campaign** (in total 4-10 hours of work)? Then this document is for you.

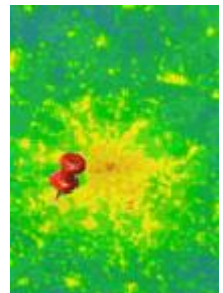
How do we count lights?

We aim to document **all of the artificial lights** that are visible from publicly accessible spaces in selected areas, from bright floodlights to dim doorbells. In order to make this easy and fun, we've developed a mobile app called '**Nachtlichter**' ('**night lights**'). This free app allows participants to systematically count light sources, and document their **type, color, emission direction, size, and brightness**. Data are collected along street segments (typically from one street corner to another).



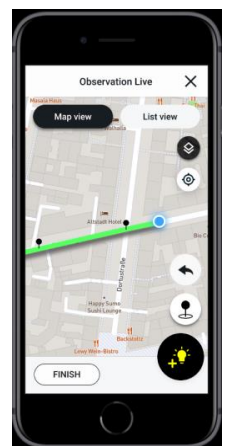
Where do we count lights?

Measurement campaigns can be organized anywhere that artificial lights are visible from publicly accessible spaces. Privacy is ensured by including either zero or more than 3 households along a given transect. For the analysis, we're looking for regions that have relatively homogenous land use types, for example in a **city center, suburban area, or a commercial or industrial area** (again, provided that the light sources in the area can be seen from public spaces). Areas that are right at a transition zone (e.g. a bright area next to an unlit park or water body) are not appropriate, as the satellite data is less reliable in such areas.



How does a personal campaign work?

For our large campaigns (larger than 1 km²), we work together with a local team to pre-define the street transects in an area. However, for smaller scale campaigns we invite you to simply create the transects within the app yourself. The next pages will explain how to do this. As a first step, you should do our **online tutorial**, which explains our categorization system and how to use the app in 15-20 minutes.





Instructions for running a personal Nachtlichter campaign

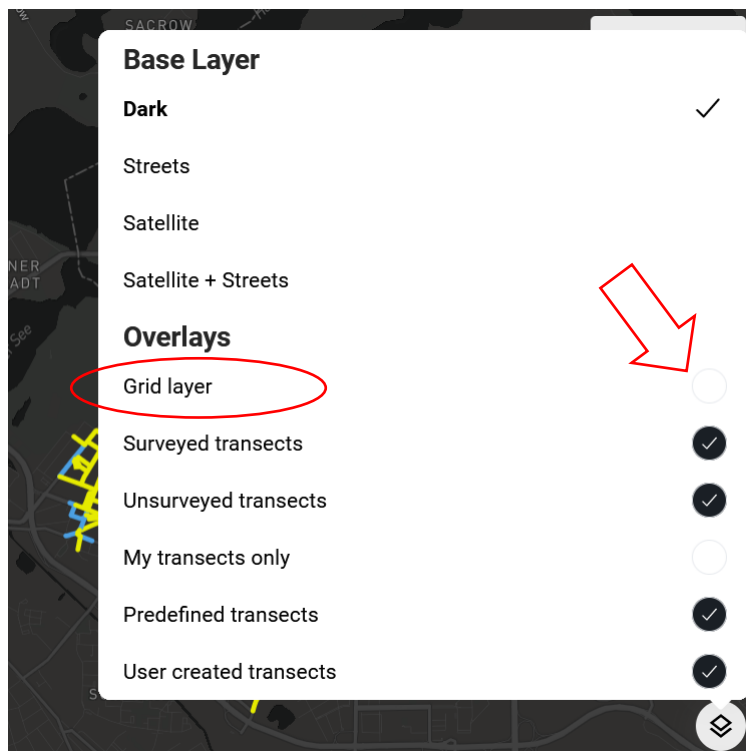
Step 1: Make sure you want to do this

- Covering the a scientifically relevant area will take around 3 hours in a small village, and up to about 10 hours or so in a large city.
- Make sure that such a measurement campaign is legal in your country, and that it is legal for you to send your data to servers in the European Union.
- Watch our [Webinar](#) and go through our [tutorial](#), so that you understand the app works.
- Make sure the app works on your phone by [installing it](#), creating an account, and checking that your location is found when you click the button shown at the right.
- If you have problems with these steps, please check our [Frequently Asked Questions](#) page. If you need further help, contact us directly (see end of document).



Step 2: Define your study area

- Choose the app map view and zoom into the area where you want to count lights (via the location button, see above)
- Click on the "Layers" button in the lower right corner of the app (see right).
- Choose your preferred background (dark, streets, satellite view).
- Click under "Overlays" on "Grid layer" (see picture below left). The grids depict the resolution of satellite images that capture the light emissions of your study area. The grid is taken from the website [radiance light trends](#) (see appendix below).





The grids marked in red (see below) show an ideal study area. The land use structures inside and outside the red boxes are very similar. Thus, we can assume that similar light sources are to be found inside and outside the study area. This is important because satellites not only detect light emissions that radiate vertically into the sky, but also light that radiates somewhat upwards from adjacent areas. If the area around the red grid were significantly lighter or darker, this would influence the satellite measurement.



The grids marked below are an example of a study area that is *not* ideal: The use of space north of the red boxes (a stadium) is very different from that inside the boxes (housing estate and green space). We can therefore assume that in the satellite image of the area outlined in red, different light sources, types of lighting and scattered light from inside and outside the investigation area overlap, which makes it difficult to interpret the data you have collected in relation to the satellite data. For example, you might only count relatively few light sources within the box, but the satellite image of your red-marked boxes might still show high radiance levels because the stadium next produced a lot of upwards-shining light.



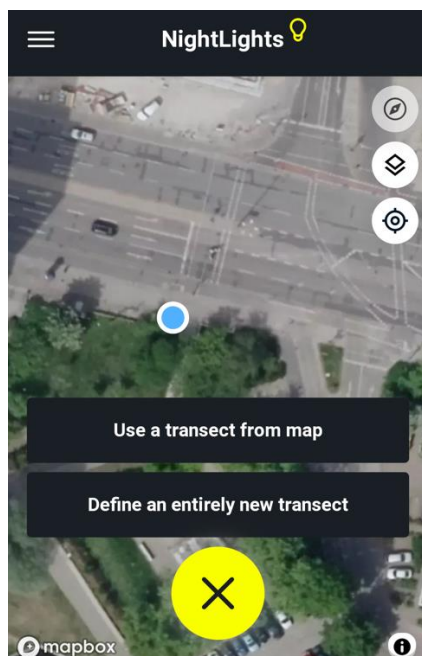


Step 3: Make a plan for where you will walk and count

- Orientate yourself on the satellite grid to select your measurement area and plan your route. Think about which counting sections you will create to capture all of the lights along the streets and squares in your study area.
- You can also count the lights in more than one of the red boxes.
- **NOTE:** In villages and small towns it will not always be possible to find a grid box that has a homogeneous spatial structure. That is not an obstacle! But please choose a place where the difference between the box and its surroundings is as small as possible.
- **IMPORTANT:** To protect the privacy of individuals, we have a rule that transects must contain either zero or at least four households.
- Transects should generally go from one street corner to the next, but you may need to sometimes do something different (e.g. do two streets as one transect) to ensure that you don't have 1-3 households living along your transect.

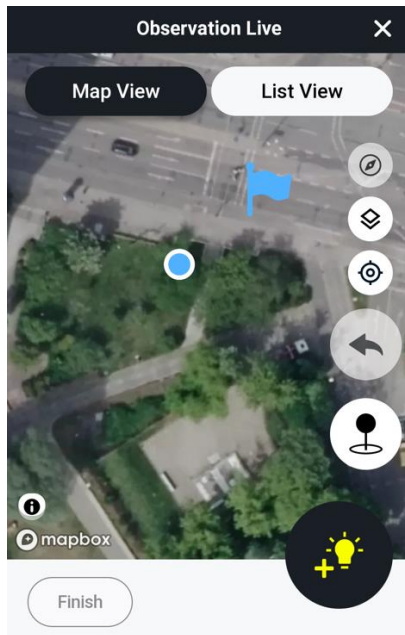
Step 4: Go out at night, create the transects, and count the lights

- Go to the location where you want to start your first transect.
- If your location is not already shown by the blue dot, click the location button.
- Make sure that the blue dot is correct (to within about 15 meters). If the location is very wrong, wait a bit to see that it finds your correct location, or quit and start the app again.
- Click the yellow + button, and then "Define an entirely new transect":

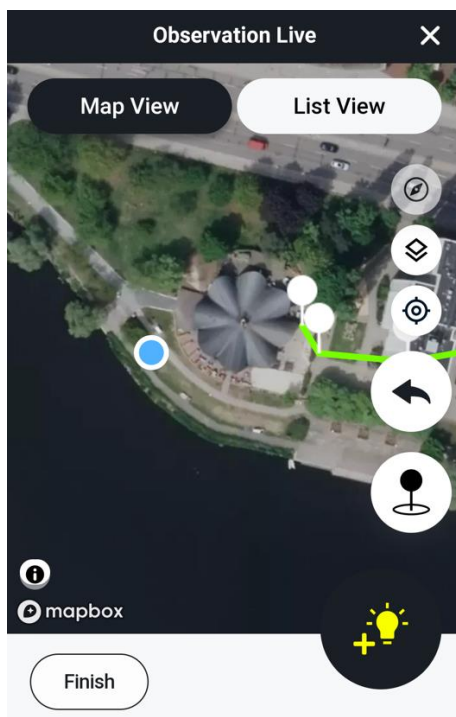






- The app will add a blue flag at your starting location (see below).
- **IMPORTANT:** Make sure the flag is correct (within about 15 meters)! If it is shown in the wrong location, then your transect will be marked incorrectly on the map.

We count lights, because the night counts!



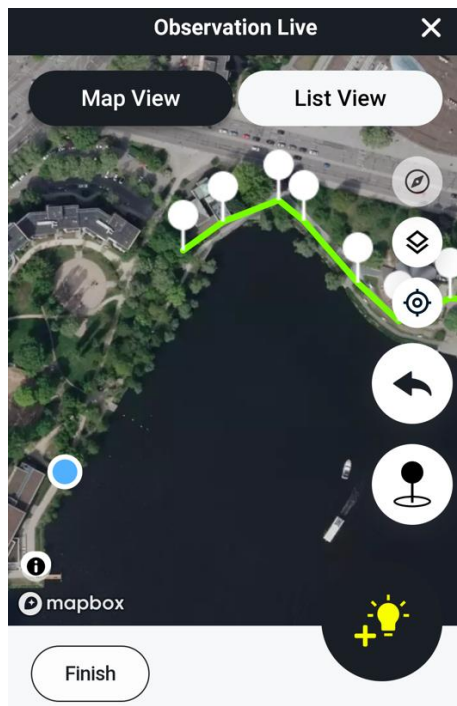
- Use the “add light” button (bottom right) to add the first light source you see.
- Walk along your transect, adding lights as you go.
- If you come to a bend in the road, use the “pin” button to mark your path.



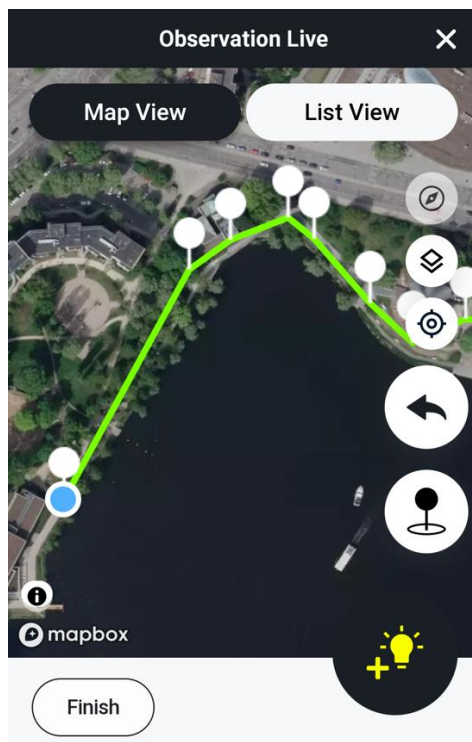
-  Location button
-  Undo pin button
-  Pin button
-  Add light button

- If you placed a pin and then realize that it is in the wrong location, use the undo button to remove the last pin.
- Continue adding lights (and pins if necessary) as you walk along your transect.

We count lights, because the night counts!

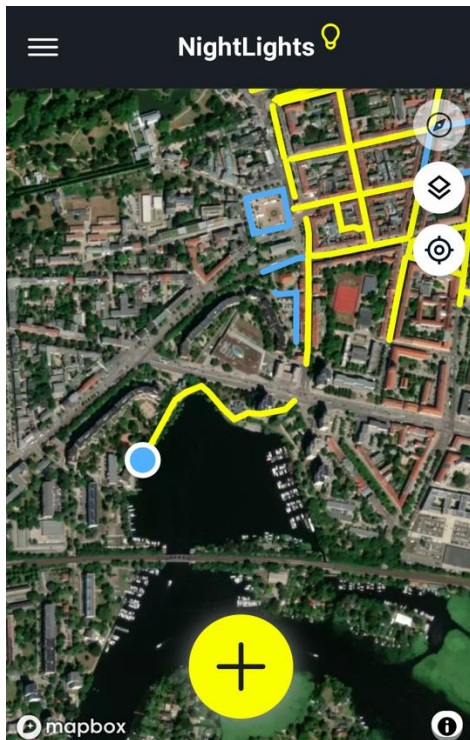


- **IMPORTANT:** When you reach the end of your transect, do not forget to add a final pin! Otherwise, the transect will end at the last point you added a pin, not at your current location shown by the blue dot (see the screen above)
- Once you have counted all the lights placed your final pin, click the “Finish” button.
- Answer the final questions, and submit your transect.



- Your new transect and data should now be shown within the app:

We count lights, because the night counts!



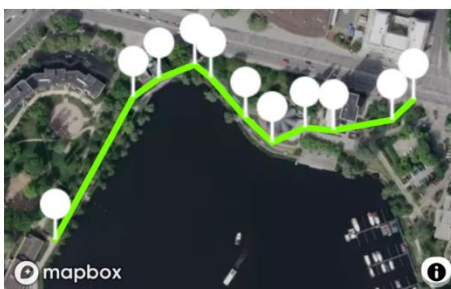
Step 5: Check your data

- Your data will be shown within the app, and can also be viewed on a desktop.
- If you made a mistake, and want to delete your data, you can flag it as incorrect by going to “My Recordings” and clicking “Mark as incorrect” (see below).
- **IMPORTANT:** In case you have forgotten one or some lights, please DO NOT create a new transect in which you only record the forgotten light(s). This would completely distort the data because in our analysis, we will create an average value of all lights in a transect whenever it has been counted twice.

○

User Generated Transect

99942459102



Is there a problem with your survey?

Mark as incorrect



Start Time

2021-09-20 14:46

- If you click this button by accident, it can be undone.
- If this was the only observation along this transect, then the transect will no longer be shown on the map.

Step 6: Complete your survey, and let us know it is done!

- Use the same procedure to walk along all of the publicly accessible streets in your campaign area.
- Do not create transects in areas where you do not have permission to go to (e.g. private back yards)
- **IMPORTANT:** You can count the lights on a transect more than one time (for example, at different times of nights). However, if you do this, then at step 4 make sure you should click “use a transect from map” instead of “create an entirely new transect”. If you create two nearly identical transects running along the same street, the lights will be double counted, rather you’re your surveys being averaged together!
- **IMPORTANT:** Once you have finished your observation, please send us an email and **tell us where you’ve counted lights:** nachtlichter@gfz-potsdam.de

Have fun and thank you so much for supporting the project!



Contact GFZ-Team
Dr. Christopher
Kyba & Dr. Nona
Schulte-Römer
[https://bit.ly/nacht
LICHTER2021](https://bit.ly/nachtLICHTER2021)

Appendix

Alternative to step 2 and 3: Choose your study area

- Open the [Radiance Light Trends webapp](#) on your browser.
- Zoom to the area that you want to study.
- Click the “Layers” button in the top right corner, which is shown in the icon at the right.
- Choose which map you prefer (e.g. “aerial imagery”).
- Turn the “Lights layer opacity” lower if necessary.
- Click the “Show grid” checkbox.
- The grid shows the area of a single (reprojected) satellite pixel. This is the minimum area that we need you to survey, in order to be able to use your data to compare to the satellite.
- If you click the + button (see right in red) at the top left, you can select an individual pixel. It will be outlined with a red box and the word “VIIRS” underneath it, as below:



- Click the polygon button (shown at right), and draw an outline of the area you want to study by clicking once at each of the corners, and double clicking when you are done.
- In the box that pops up, click the red “download” button (shown at right), so that you can save your selected area to your computer.
- You can view your selected area again in the future by uploading the file you downloaded, using the green upload button (to the right of the red download button).
- Send us an email including the file you downloaded, to let us know what area you plan to examine.

