

This exhibit is made possible thanks to the contributions of the Institute of Theoretical Physics, the Department of Physics, the Community Engaged Learning programme of Utrecht University, and Sonnenborgh Observatory.



Utrecht University

Community Engaged Learning

# SONNENBORGH

Material adapted from:

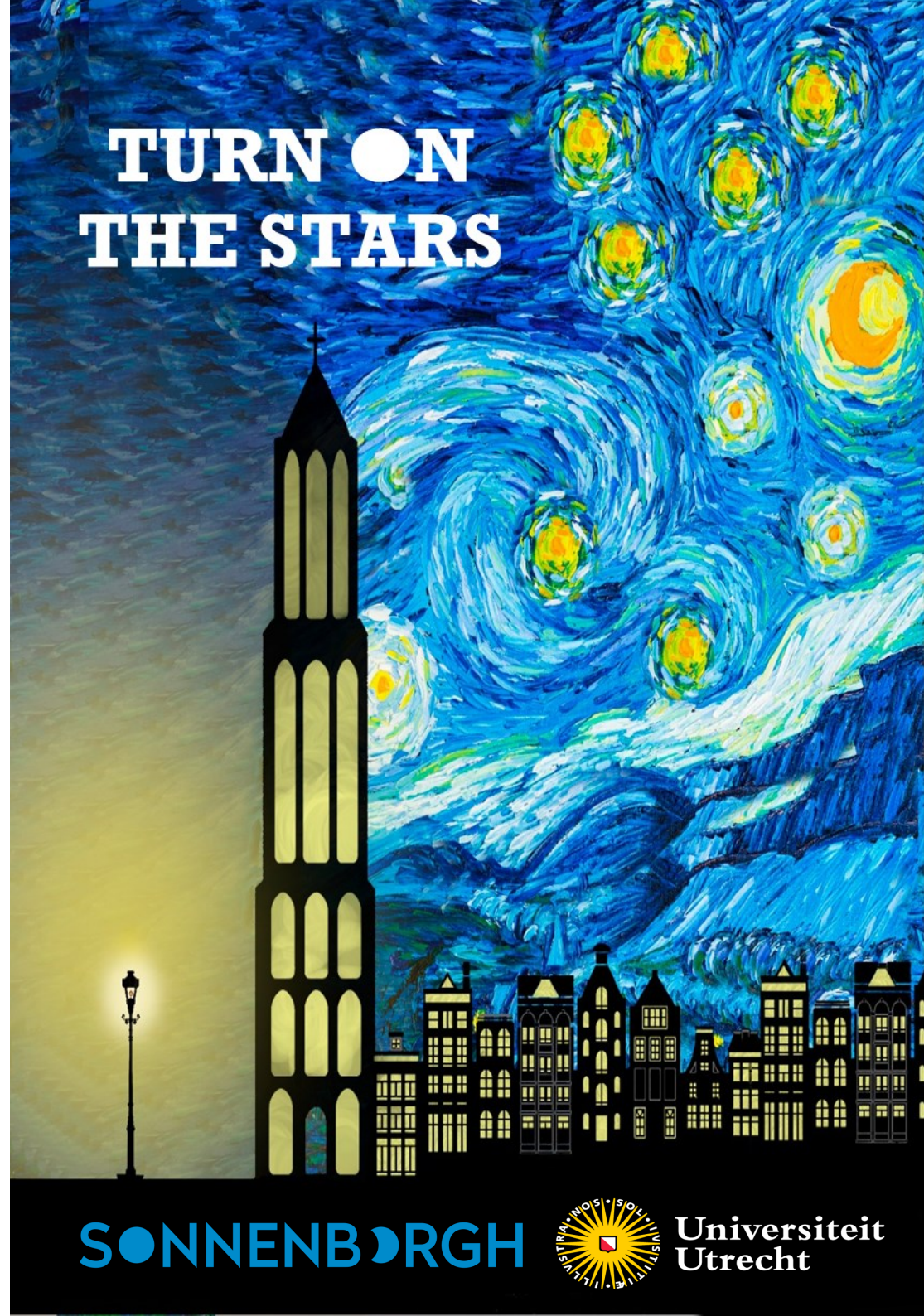
<https://www.nachtvandenacht.nl/>

<https://www.atlasleefomgeving.nl/kaarten>

<https://www.darksky.org/>

<https://www.globeatnight.org/>

# TURN ON THE STARS



# SONNENBORGH



Universiteit  
Utrecht

## WHY TALK ABOUT LIGHT POLLUTION?

How many stars can you count when you look at the night sky? Even considering that the human eye is not a perfect detector, you should be able to see about 6,800 stars from Utrecht on a clear night. Surprised? You should be. Nowadays, due to increasing levels of light pollution, it would take you less than five minutes to count all the stars you can see from a populated area in the middle of Europe. According to estimates, more than 80% of the world's population lives under light-polluted skies, and 88% of European territory experience light-polluted nights.

The increase in artificial light at night has allowed the extension of the human activities to dark hours, but also has altered the levels of light in the environment with various negative effects.

The objective of this exhibition is to raise awareness about light pollution so that you, the visitor, take action and help us save our night skies and turn on the stars again!

## WHAT CAN I DO TO HELP?

Here are some recommendations you can start to apply for efficient lighting to help us turn on the stars again!



Light only where and when you need it. Shut off lights when you are not using them!



The lights should shine towards the target. Avoid light spilling upwards and use shielded bulkhead lights.



Dim lights when the application allows it. Switching to LED lighting can help reduce illuminance and save energy.



Avoid ornamental lights, limit lighting in your garden, and turn off the light of your front door when not in use.



Choose warm white or amber lights for your home.



**Get involved! You can do something right now  
by answering this survey:**



## Light pollution and Wildlife

High-powered lighting installations attract **migrant birds**, alters their orientation, and cause them to collide with buildings.



The signals that guide hatchling **sea turtles** into the ocean are strongly visual as they use the moonlight to find the sea. Hatchling sea turtles are commonly misdirected toward artificial light sources, causing them to die.



**Insects** are attracted to stationary artificial light sources located in gardens and die from exhaustion or predation. Artificial light at night also causes aquatic insects to lay their eggs on flat non-aquatic surfaces, where their hatchlings are unable to survive.

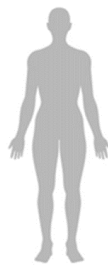


Light is the main source of energy for **plants**, so it is not surprising that light pollution also has effects on their physiological responses, their life cycles, as well as the interaction they have with herbivores and pollinators.



## Light pollution and Human Health

Exposure to bright lights at night and even during the day, cause a disruption of the internal clock of the body (**circadian rhythm**) that affects aspects of human physiology, such as cell cycle regulation and metabolism. Especially, lights at night interfere with the production of a hormone called **melatonin**, known for its role in **sleep regulation**, among other functions. Subjects continuously exposed to light-emitting devices are more likely to have sleep disorders, for example, they take longer to fall asleep, have reduced evening sleepiness, and reduced next-morning alertness.



## WHAT IS LIGHT POLLUTION?

Light pollution refers to the **alteration of the normal amount of light at night** due to artificial lighting built by humans. Much of the light we use is unnecessary and inefficient, misdirected or improperly shielded, and is brighter than we really need. Light then is being wasted and is heading towards the night sky instead of illuminating what we want.

There are 3 main types of light pollution.

**Light trespass** alludes to light falling where is not intended or needed.

**Glare** refers to the excessive brightness of a light that causes visual discomfort.

**Skyglow** occurs when light is emitted above the horizontal angle or reflected towards the night sky and it is scattered by aerosols in the atmosphere, making the night sky brighter than the astronomical objects to be observed, hiding them from people's sights.

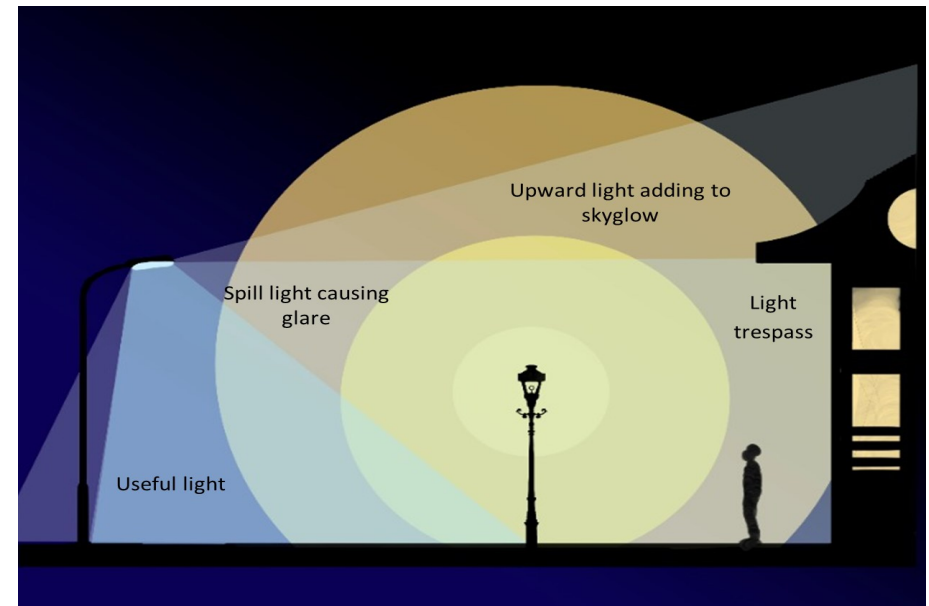


Image adapted from [britastro.org/dark-skies](http://britastro.org/dark-skies)

## LIGHT POLLUTION IN THE NETHERLANDS

The Netherlands is one of the most illuminated countries in the world, where the **Milky Way is no longer visible in 43% of its territory**. The Randstad area is one of the most illuminated places, mainly due to greenhouse horticulture companies. **Urban centres like Amsterdam** and the area of **Delft-Rotterdam-The Hague** also stand out as **highly contaminated places** at night due to the high concentration of people and industrial activities. Utrecht is also one of the cities with a high level of light emission.



North-western of Europe at night. Images taken from NASA/EPA.

### Efforts to improve the situation in The Netherlands

- ⇒ Guidelines for greenhouse lighting in the Environmental Management Activities Decree to reduce light emission from horticulture companies.
- ⇒ Light/Dark Handbook of the Association of Provincial Authorities (IPO) to generate policies on night lighting and protect our night skies.
- ⇒ Dark Sky Parks declared by the International Dark-Sky Association: De Boschplaat and Lauwersmeer National Park. Visit them to experience starry nights!
- ⇒ Researchers from Utrecht University involved in this exhibition investigate how much light during the day, in the evening, and at night impacts the quality of sleep.

## CONSEQUENCES

Light pollution has negative repercussions on nature, human health, and scientific development.

### Light pollution and Astronomy



**Places with quality night skies** for good astronomical observations **are becoming less available** and farther away from the cities. This also limits the access that the general population has to astronomy and scientific outreach. Even though there are new telescopes that allow us to observe even further or with greater clarity, our use of **lighting technology** is limiting its applicability.

### LED Light

Their excessive use makes astronomical observations more difficult because they contain almost all the colors of the light spectrum (from blue to red), which causes the emitted light to mix irreparably with the light coming from astronomical bodies, thus preventing astronomers from observing them using filters on their telescopes.



### Satellite swarms

For astronomers, the problem is not only due to light emissions from Earth, but also from light being reflected from orbiting satellites. In recent years, there has been a rapid increase in the number of satellites orbiting the Earth making astronomical observations difficult.