



PLANET
CHANGE

Pollution: Light Pollution

Teachers manual



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Planet change is the short name of an EU Erasmus+ project aimed at VET teachers and their students. With small activities, the idea is to create awareness about sustainability and acquire 21st century skills. All this is done in a technical context, mostly from space technology.

www.planetchange.eu



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1. General information

Duration: 1 sessions of 45 minutes.

Target group: 16-20 y.o.

European qualifications framework level: 1-4

Teacher preparation: No need for previous background on the topic (just knowing how to use an internet browser).

Topic

Theme: Light Pollution

Keywords: sustainability, light pollution, Earth observation

Activity

Goals

The student will get better knowledge and training about:

- 1) How artificial light affects:
 - a) Astronomy (the observation of our Universe) and why this affects us in the sense of sustainability
 - b) Humans and animals
- 2) In which ways we can minimize these negative effects (intelligent lighting)
- 3) How easy or difficult is to find a good spot for sky observation in their cities/countries.
- 4) Training of 21st Century skills including:
 - a) Media literacy: find and gather relevant information
 - b) Critical thinking
 - c) Collaboration
 - d) Communication

Summary

Students will be given the chore to find out the closest spot for installing an astronomy observatory near their homes. This task will lead them to understanding the importance of sky darkness preservation for astronomy (and consequently for the positive aspects astronomy brings to sustainability). Collaterally, they will be warned about the negative effects light might have in our healths and in the lives of animals.



2. Introduction

The vision of the night sky has been of utmost importance to humanity since ancient times. Even if we leave natural, scenic, cultural or religious implications¹ aside, from a technical/practical standpoint, the night stars have been key for human orientation through centuries, particularly for navigation through deserts and seas.

Nowadays we count on high technology and advanced means of positioning, orientation and navigation are available; we might think that we do not need to see the stars at night anymore. Furthermore, our natural concerns for safety (driving, walking the streets at night) and the extension of industrial activity into the hours of darkness, leads us to give great value to the illumination of open spaces, away from their natural darkness at night.

Reducing light pollution means reducing the open emission of light (in all of the electromagnetic spectrum, that is, not only visible light, but also radio or microwave emissions). It has of course a positive implication in reducing the energy consumption related to the generation of that light, however in this unit we focus rather on **what are the negative consequences of light pollution**, leaving apart the energy consumption it requires: accordingly, we will analyze 1) how it affects astronomy (explaining as well **why astronomy is important for sustainability**) and how this pollution affects living beings (humans included).

The relationship between sustainability and Astronomy is normally overlooked, but three examples will suffice to show the connexion: thanks to astronomy, we can detect (which is the first step to control) global threats to life in the Planet by:

- 1) Understanding what can happen if the delicate equilibrium point that allows life in our planet is lost (as a cause of, for example, global warming). This is what we learn when we study other planets like Venus or Mars. See video "[Lessons from Venus and Mars](#)"
- 2) Controlling the negative effects related to the behaviour of the Sun (i.e. coronal mass ejections that could break down satellites).
- 3) Surveying space in the search of potentially harmful NEO's (that could eventually hit the Earth if we do not do something about it).

All these items are described in detail in specific Units. Here are only mentioned for the sake of understanding that **we need astronomy for sustainability**, and consequently, we need dark skies² (so as to be able to see the Universe around us).

The effects of light pollution over life have been studied and reported in detail, in numerous scientific publications. See this one as an example (it has references to many others): "[11 Pressing Research Questions on How Light Pollution Affects Biodiversity](#)".

Description of the activity

Part 1: Introduction

¹ Not having access to the night sky has implications for the population: enjoying the view of the milky way in its full greatness, is something that can bring us back in contact with nature, and make us realize how amazingly beautiful nature can be.

² As well as low air pollution, but that is another topic.



→ Preparations: The classroom needs a screen or a projector to visualize the media content, and needs computers/tablets with internet connection, at least for ⅓ of the pupils (they will join groups of 3).

→ Activity 1 (5 min): The teacher asks the students: Where light pollution comes from? the whole class will compile the answers (building exterior and interior lighting, advertising, commercial properties, offices, factories, streetlights, and illuminated sporting venues...) and determine which of those sources can be minimized and at what cost (security for example).

→ Activity 2 (10 min):

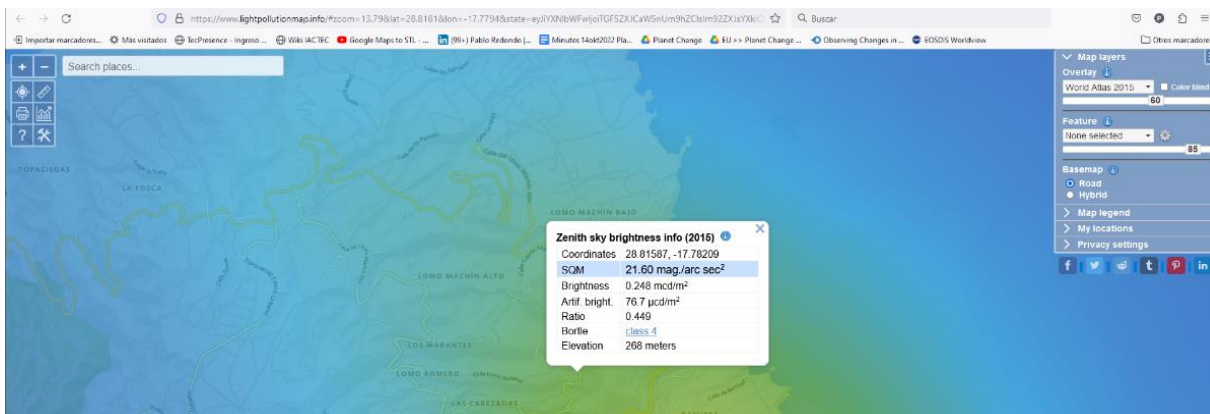
The teacher explains the introduction, the importance of astronomy for sustainability, and then poses the question “where could we install an astronomy observatory near our school?” and explains the three basic requirements: 1) low light and air pollution 2) Atop a mountain 3) Accessible by car.

In order to identify the areas of low pollution close to the school, the teacher will use this resource <https://www.lightpollutionmap.info>. A short introduction on how to use it normally suffices to have students ready to search with this browser.

In this web page there is an icon that takes you to statistics (by country): https://www.lightpollutionmap.info/LP_Stats/

Part 2: Observatory location contest

→ Activity 2 (20 min): **Work in groups**. Find out which is the best location for an observatory near you. Use three parameters in order to determine which is the best proposal, weighting them equally into the final result: distance in km by car (you could use google maps), height over sea level in meters, brightness level at night (last two parameters can be obtained directly in the browser)



Design one person of the group to take notes of your discussion and final conclusions.

The team that gets the highest score wins the competition.

Part 3: How can we reduce Artificial Light at Night?

→ Activity 3 (10 min)



Ask the pupils to find out using internet. As a hint, they need to focus on public lighting orientation (directing the light downwards, not upwards) and the colour of artificial light that is best (sodium lights that are orange are usually recommended).

3. Annex I:

Information to the teachers

[Reconnecting Humanity to the Earth and Stars](#)

[Lessons from Venus and Mars](#)

<https://www.lightpollutionmap.info>

<https://en.fundacionstarlight.org/>

VET Schools

All kinds of VET schools could do this activity.

