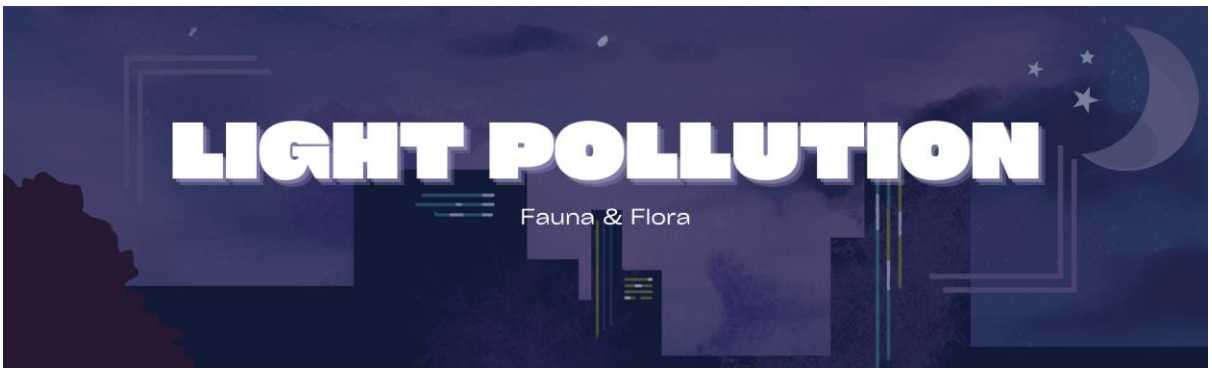

Light Pollution and its Impact on Astronomy – Awareness and Action

Duration	45 minutes
Age group	15-19 yo.
Aim and objectives	**Aim:** To help Learners understand how artificial light at night (ALAN) affects ecosystems and the behaviour of living organisms, and to introduce responsible lighting as a way to restore natural balance. **Objectives**: Learners will: • Recognise the difference between natural day–night cycles and artificial light at night (ALAN). • Identify at least three ecological consequences of light pollution for animals, plants and whole ecosystems. • Describe how different species (e.g. bats, moths, frogs, trees, humans) change their behaviour under increasing artificial light.

	• Explain that responsible lighting choices can reduce negative impacts on biodiversity, human health and energy use.
Learning Outcomes in Line with Curriculum	**Natural Sciences / Biology / Environmental Science:** Learners will be able to: • Describe examples of nocturnal and crepuscular species and their ecological roles (e.g. pollination, seed dispersal, predation). • Explain how changes in light conditions can affect feeding, migration, pollination, communication, reproduction and sleep. • Recognise human activity and artificial light at night as factors that alter habitats and ecological balance. **Geography / Environmental Studies:** Learners will be able to: • Relate light pollution to patterns of land use (urban, suburban, rural) and to local environments (streets, parks, school grounds). • Identify and describe local sources of artificial light at night and their potential influence on wildlife. **Civic Education / Sustainable Development:** Learners will be able to: • Propose realistic actions to reduce light pollution at individual, school and community level. • Recognise that responsible use of technology (lighting design, timing, colour and intensity) can protect

	biodiversity, human health and energy resources.
Teaching Methods	• Brainstorming and guided discussion • Role-play / simulation (Option A – indoor) • Simple field observation and comparison (Option B – outdoor) • Group work and short presentations • Reflective questioning

Materials Needed

Common to both options:

☐ Two contrasting images: a dark sky reserve or very starry rural sky (e.g. attachment 1); a bright urban skyline at night (attachment 9)

☐ Whiteboard or flipchart and markers

☐ Sticky notes or small pieces of paper

☐ Printed worksheet (attachment 10): Ecosystem in the Dark – Observation Sheet (one per Learner or pair)

Option A – Indoor visualisation (role-play)

☐ Species role cards written on folded post-its (attachment 11)

☐ 2–3 torches or headlamps (ideally at least one "cold/blueish" and one "warm/yellowish")

☐ Possibility to dim or switch lights on and off in the classroom

☐ Clear floor space for safe movement

Option B – Outdoor mini-experiment

☐ Access to three contrasting zones (or portable lamps to create them):

one cold, bright LED light;

one warmer, dimmer bulb;

one relatively dark zone for comparison

☐ Clipboards or something firm to write on

☐ Pens/pencils

☐ Stopwatches or phones to time short observation periods

☐ Optional: simple insect pots or magnifying glasses (only if ethical and safe handling of animals is ensured).

Workshop/Lesson Plan

Duration	Description	Notes
10 minutes	**Introduction – What happens at night in nature?** • Educator greets Learners and asks: "What happens outside when it gets dark?" Learners brainstorm examples of night-time activity (animals, plants, people, lights). Educator writes key words on the board (e.g. bats, insects, stars, streetlights, sleep). • Educator shows two images: a dark sky reserve vs. a brightly lit city at night. Short guided discussion: Which place looks better for animals? For astronomers? For sleeping? Why? • Educator introduces the term Artificial Light at Night (ALAN): human-made light that shines during the night, often where or when it is not needed. Four impact areas are mentioned briefly: human health (sleep and hormones),	Keep vocabulary simple. For less advanced groups, focus on "day-night rhythm" and "body clock" rather than technical terms.

	biodiversity (animals and plants), energy use and climate, visibility and safety (seeing vs glare).	
25 minutes	**Main Activity – Ecosystem in the Dark** <u>Option A – Indoor role-play (simulation)</u> • Educator explains that the class will create a "living ecosystem" in the room. Learners receive species role cards (bats, moths, frogs, night-flowering plants/trees, humans). In species groups they answer: "What do we normally do at night in natural darkness? What do we need from our habitat? • **Round 1** – Natural darkness: lights are dimmed as much as safely possible. Each species acts out what they do in a naturally dark night (bats "flying" and hunting insects, moths visiting flowers, frogs calling near an imaginary pond, plants "opening" flowers or simply standing, humans walking carefully or resting). After 2–3 minutes, short pause: how easy was it to move, feed, communicate, rest? Learners record brief notes on the worksheet. • **Round 2** – Some artificial light: one or two warm, low-level lights or torches are switched on to represent well-designed, limited lighting. Ecosystem runs again for 2–3 minutes. Learners notice what has changed (e.g. some insects move towards light; some animals avoid bright patches). Short debrief, notes on worksheet. • **Round 3** – A lot of artificial light: more lights are turned on, including	Educator chooses one option in advance. For Option A, ensure safe movement (no running in the dark). For Option B, choose locations in the school grounds or very nearby, ideally where existing lights already provide cold/warm contrast; otherwise use portable lamps. If insects are scarce (season or weather), focus on how it feels in each light: comfort, glare, ability to see stars, etc.

	cold/blueish light. The room now represents a brightly lit town or car park. Ecosystem runs again for 2–3 minutes. Then each species reports how their behaviour changed compared with natural darkness: Did they avoid lit areas? Lose food sources? Become more visible to predators? Did "night" feel shorter or disappear? Learners summarise in the worksheet, listing at least one consequence per species. <u>Option B – Outdoor mini-experiment (observation)</u> • Educator explains safety rules: staying with the group, watching footing, staying away from roads. Class is split into three groups: A – cold LED, B – warm bulb, C – darker zone. • Each group spends around 5 minutes at its assigned location counting or estimating the number of insects (and any other animals) and noting their behaviour (circling lights, resting on surfaces, avoiding area). They also note nearby plants (flowers, trees) and how bright it feels. • Groups rotate so each visits all three zones (LED, warm bulb, dark). They fill in the observation table on the worksheet for each zone. Back together, they quickly compare: Where were most insects? Did cold or warm light attract more? What about the dark area?	
10 minut	**Debrief – Ecological consequences and solutions** • Whole-class discussion: "What did you notice when light increased?" "Which species seemed most sensitive to light?"	You can display the five principles as a simple slide or

	"What might happen to this ecosystem if it was bright every night for years?" Educator supports Learners to name ecological consequences, e.g. disrupted pollination (moths at lights instead of flowers), predators losing dark hunting areas, prey more visible, habitat fragmentation when animals avoid bright zones. • Educator links back to four impact areas of ALAN: biodiversity, human health, energy/climate, visibility and safety. Short mention of human circadian rhythms: bright, especially blue, light at night can confuse the body clock and disturb sleep. • Educator introduces or recalls five principles of responsible lighting (when, where, how much, colour, shielding) and asks Learners to suggest at least one realistic change at home, school or in their town (e.g. turning off outdoor lights after a certain hour, using motion sensors, choosing warm, shielded lamps). Learners write one personal action idea on their worksheet.	poster. For groups that already did the "Understanding the Night" activity, explicitly connect to skyglow, glare, light trespass and clutter. Encourage Learners to link ecological impacts to places they know (local car park, playground, street).

Reflection Questions

These can be used as written questions on the worksheet, for homework, or as discussion starters.

Ecosystem and Behaviour

- Which species in our activity seemed to suffer most when light levels increased? Why?

- How did artificial light change interactions between species (for example, between pollinators and plants, predators and prey)?
- If this ecosystem remained brightly lit every night, what might happen to its biodiversity after several years?

Understanding ALAN

- In your own words, what is artificial light at night (ALAN)?
- How is ALAN different from natural light from the Moon and stars?
- Which of the four impact areas (biodiversity, human health, energy, visibility/safety) do you think is most important in your community? Explain your choice

Human Health and Circadian Rhythms

- How might bright or very blue light in the evening affect a person's sleep and daily rhythm?
- Where in your home or school do you think people are most exposed to bright light at night (screens, streetlights through windows, indoor lighting)?

Solutions and Action

- Choose one place you know well (your street, the school entrance, a sports field). What is currently good about the lighting there, and what could be improved?
- Which of the five responsible lighting principles (only when needed, only where needed, minimum brightness, warm colour, good shielding) is easiest to apply in your life right now? How could you do it?
- What small action could you personally take, or propose to others, to reduce unnecessary light at night while still keeping people safe?

Kahoot Quiz

1. What does ALAN stand for?

A. Artificial Light Around Nature
B. Artificial Light At Night
C. Astronomical Light And Nature
D. Added Light At Night

 Correct: B

2. Which ecological process can be disrupted by light pollution?

A. Photosynthesis
B. Pollination
C. Evaporation
D. Erosion

 Correct: B

3. What happens to predators when areas are too bright?

A. They hunt better
B. They lose dark hunting spaces
C. They disappear instantly
D. They become herbivores

 Correct: B

4. Why do insects gather around artificial lights?

A. They confuse light with natural navigation cues
B. They are attracted to heat only
C. They use lights as food sources
D. They avoid predators there

 Correct: A

5. Which best describes ecological fragmentation caused by light?

A. Loss of vegetation cover
B. Division of habitats into light and dark “islands”
C. Increase in urban green spaces
D. Soil degradation due to heat

 Correct: B

6. In the classroom experiment, why did insects gather near LED light?

A. LEDs emit ultraviolet food signals
B. Short-wavelength light disrupts insect orientation systems
C. Insects prefer artificial surfaces
D. LEDs simulate moonlight

 Correct: B

7. W What is the MOST likely long-term ecosystem effect of increasing ALAN?

A. Higher biodiversity in cities
B. Stabilization of nocturnal ecosystems
C. Decline of nocturnal species and ecosystem imbalance
D. No significant change

 Correct: C

8. Which chain of events is MOST scientifically accurate?

A. Light → predators disappear → insects increase → plants decline
B. Light → insect attraction → reduced pollination → plant decline → herbivore decline
C. Light → more oxygen → biodiversity increase
D. Light → climate cooling → ecosystem stabilization

 Correct: B

9. Increased urban lighting leads to fewer nocturnal predators. What is a likely secondary effect?

A. Increase in prey species followed by resource depletion
B. Immediate ecosystem stabilization
C. Reduction in all species equally
D. No ecological response

Correct: A

10. Which factor MOST strongly links astronomy and ecology in light pollution studies?

A. Telescope technology
B. Shared dependence on absence or presence of light as an environmental signal
C. Planetary motion
D. Weather forecasting

Correct: B

Additional materials

Additional activities (attachement 12)

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