Pollution can be energy, not matter

Noise pollution is unwanted or harmful sound. At sufficiently high levels it can cause physiological stress and hearing loss; disturbance also depends on timing, duration and the listener.

1. RECOGNIZE HUMAN SOURCES

Transportation: road traffic, trains and aircraft.
Construction and industry: drilling, demolition, machinery and factories.
Domestic and recreational activity: power tools, lawn equipment, amplified music and loud events.
One location can receive noise from several sources at once.

2. DESCRIBE THE EXPOSURE, NOT JUST THE SOURCE

LEVEL	How strong is the sound at the receiver? Distance, barriers and surroundings affect the received level.
DURATION	How long and how often does exposure occur? A short intense burst and prolonged noise can both matter.
TIMING	Does noise occur during sleep, learning, feeding or breeding? The same event can have different consequences.

Sound level and pitch are different: pitch relates to frequency. A higher-pitched sound is not automatically a higher-decibel sound.

3. HUMAN HEALTH AND WELL-BEING

Loud sound can damage sensory hair cells in the inner ear and cause lasting hearing loss. Noise exposure can also disrupt sleep and concentration and contribute to stress and cardiovascular effects. A level below a hearing-damage threshold is not necessarily free of disturbance.

Do not treat one decibel number as a universal safe/unsafe boundary. Hearing risk depends on level and exposure time; sound characteristics and individual susceptibility also matter.

Hearing mechanisms and exposure: NIH/NIDCD, Noise-Induced Hearing Loss.
Sleep, learning and cardiovascular effects: WHO Europe, Noise.

Scope: College Board AP Environmental Science CED, Topic 7.8, p. 149.

Noise changes an animal’s soundscape

Animals use sound to find mates and food, detect danger and navigate. Human-made noise can interfere with these tasks even where vegetation and water quality appear unchanged.

1. MASKING: A SIGNAL BECOMES HARDER TO DETECT

USEFUL SIGNAL	→	COMPETING NOISE	→	REDUCED DETECTION
A mate calls or prey makes a movement sound.		Traffic or machinery overlaps the signal in time/frequency.		The listener may miss the signal or hear it less clearly.

Possible consequences include difficulty finding a mate, detecting predators or locating prey. Masking does not mean the original signal has stopped, and it does not require permanent hearing damage.

Example: road noise can mask prey movements for bats that hunt by listening.

2. STRESS, HEARING AND MOVEMENT

Noise can produce physiological stress or hearing damage and cause animals to avoid otherwise useful habitat or alter migratory routes. Some species change the pitch or timing of their calls. A behavioral adjustment does not prove that all ecological costs have disappeared.

3. UNDERWATER NOISE MATTERS TOO

Shipping, marine construction and some exploration activities add sound to the ocean. Whales, dolphins, fish and invertebrates use sound in communication and other life functions. Noise can disrupt feeding, reproduction and movement; effects depend on the source, duration, location and species.

Masking, hunting and behavioral changes: National Park Service, Noise and Wildlife.
Marine sources and impacts: NOAA Fisheries, Ocean Noise.

Scope: College Board AP Environmental Science CED, Topic 7.8, p. 149.

Lower the sound reaching the receiver

Noise control can act at the source, along the transmission path or at the receiver. Match the method to the situation and check whether it protects the people or wildlife affected.

1. THREE PLACES TO INTERVENE

SOURCE

Use quieter equipment, maintain mufflers and enclose machinery. Scheduling can avoid sensitive periods, but merely shifts exposure if others are affected.

PATH

Use a well-designed solid barrier or earth berm, or increase separation through land-use planning. Sound can travel over and around a barrier; it does not create total silence.

RECEIVER

Building insulation and suitable hearing protection can reduce personal exposure. They do not remove the outdoor noise or protect nearby wildlife.

A narrow row of trees is not equivalent to a solid noise barrier. Meaningful vegetation-based reduction needs a sufficiently wide, tall and dense buffer.

2. EXTENSION: DECIBELS ARE LOGARITHMIC

For sound intensity levels measured with the same reference:

Intensity ratio = $10^{(\text{level difference in dB}) / 10}$

+10 dB	+20 dB	-10 dB
10 times the intensity	100 times the intensity	One-tenth the intensity

A tenfold intensity increase is not tenfold perceived loudness or biological harm.

Illustrative check: a comparable reading falls from 80 to 70 dB after a control. The intensity is 10^{-1} = 0.10 of the original, a 90% reduction. Repeat measurements at the same receiver and under similar operating conditions; record duration and peaks as well as average levels.

Barrier design and vegetation limits: Federal Highway Administration, Noise Barriers.
Intensity level and perceived loudness: OpenStax, College Physics 2e 17.3.
Personal exposure reduction: NIH/NIDCD, Noise-Induced Hearing Loss.

Scope: College Board AP Environmental Science CED, Topic 7.8, p. 149.