

Six Pressures and the Words Engineers Use

Learning target: I can use the chapter's terms to classify human pressures on ecosystems, connect them to design solutions, and tell criteria, constraints and tradeoffs apart.

Vocabulary in action

About 35 min

Individual

MS-LS2-5 · supports

MS-ETS1-1 · practice

MS-ESS3-4 · supports

independent practice

visual modeling

writing

Name _____

Date _____

Period _____

Directions

Read the word bank first; the definitions are there to use, not to copy. Each part asks you to do something with the words: sort, connect, choose or explain. Write a short reason for every choice. Some items could fit more than one word; if you think so, say which word fits best and why.

You will need: This worksheet, Pencil

per capita

Per person. Take a group's total (water used, energy used, money earned) and divide it by how many people share it.

natural resource

A material or energy source from nature that people use, such as fresh water, soil, wood, minerals or fossil fuels.

ecosystem services

Benefits people get from working ecosystems, such as clean water, pollination of crops, flood protection, food and the recycling of nutrients.

biodiversity

The variety of life in a place: how many different species live there, the variety within each species, and the variety of ecosystems.

over-exploitation

Taking living things from the wild faster than their populations can replace themselves, so their numbers fall.

by-catch

Animals caught by accident while fishing for something else, such as sea turtles in a shrimp net or young fish too small to sell.

pollution

Harmful materials or energy that people add to an environment, such as plastic, extra nutrients from fertilizer or sewage, or toxic chemicals.

habitat degradation

Damaging or destroying a natural area so it can no longer support its usual living things and processes, such as clearing a forest for farms.

invasive species

A species that people have moved outside its native range, where it spreads and causes harm to ecosystems or to the economy.

emerging disease

A disease that is new to people, or is suddenly reaching many more of them, often after people and their farm animals come into new contact with wildlife.

climate change

A long-term shift in Earth's climate patterns, including average temperatures and how often severe weather happens. Today's warming is caused mainly by burning fossil fuels.

criteria

What a design must do or achieve to count as a success. One criterion, many criteria.

constraints

The limits a design must work within, such as cost, time, available materials, laws, or what people will accept and use.

tradeoff

Giving up some of one benefit to gain more of another.

Part A: Name the pressure

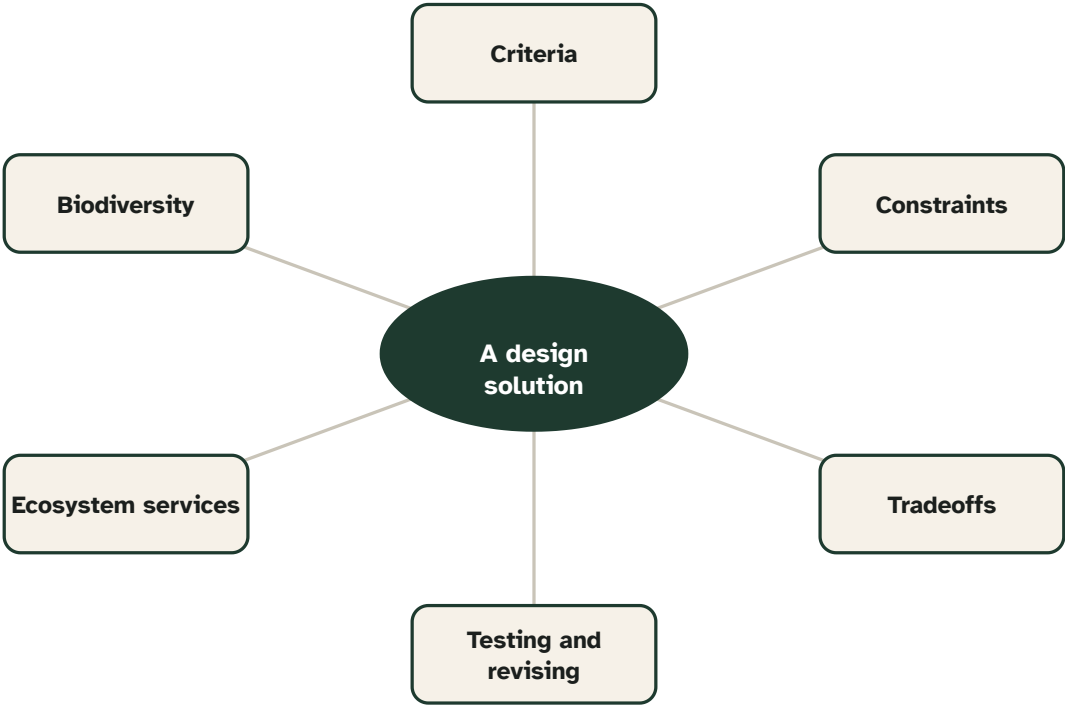
The six pressures are over-exploitation, pollution, habitat degradation, invasive species, emerging disease and climate change. Each headline below describes one of them. These headlines are written for this worksheet; they describe realistic situations, not specific news stories.

1. For each headline, write the pressure that fits best and the clue word or fact that decided it.

Pressure	Clue that decided it
1. Mussels from another continent arrive stuck to a boat, spread through a lake and clog its water-intake pipes.	
2. A housing tract and new roads replace most of a valley's oak woodland.	
3. Lawn fertilizer washes into a bay and feeds thick mats of algae.	
4. A fishing fleet catches so many cod that only a few percent of the old population is left.	
5. A virus passes from wild bats to farm pigs to the people who care for the pigs.	
6. Warmer air and higher seas slowly flood the lowest zone of a salt marsh.	
7. Seabirds near a harbor are found tangled in plastic bags and fishing line.	
8. Sea turtles drown in nets that were set to catch shrimp.	

Part B: Connect the ideas

What goes into a design solution for an ecosystem



Concept map with the linking words missing. Each line joins the center to one idea.

2. Write a linking phrase for each line so that 'A design solution ___ [idea]' becomes a true sentence. Then add an example from this chapter.

Linking phrase	Example from the chapter
Criteria	
Constraints	
Tradeoffs	
Testing and revising	
Ecosystem services	
Biodiversity	

Part C: Criterion, constraint or tradeoff?

Fishing families around Lake Malawi, in southeastern Africa, want to reduce a snail-spread disease called bilharzia by protecting the small fish that eat snails. Each statement below is about their net design, or about a design problem from another part of the chapter.

3. Label each statement criterion, constraint or tradeoff, and give a reason.

Criterion, constraint or tradeoff?	Reason
a. The nets must leave enough small snail-eating fish in the lake to keep snail numbers down.	
b. A new net must cost about the same as the nets families already buy.	
c. Success means families still catch enough fish to eat and to sell.	
d. Nets can only be made from cord sold at the local market.	
e. Larger holes mean fewer fish in each haul at first, but more snail-eaters survive.	
f. The new nets must be in use before the next rainy season.	
g. Coffee grown under tall shade trees yields fewer beans but keeps forest birds.	
h. Fewer children should test positive for bilharzia within five years.	

Part D: Tell the words apart

4. Town A has 10,000 people and uses 1,500,000 liters of water a day. Town B has 2,000 people and uses 400,000 liters a day. Which town uses more water in **total**? Which uses more **per capita**? Show both per capita calculations.

5. A wetland holds 40 kinds of birds, and it also soaks up floodwater before it reaches a town. Which fact describes **biodiversity** and which describes an **ecosystem service**? Explain how losing the first could affect the second.

6. Oranges and tomatoes grown on California farms first came from other parts of the world. Are they invasive species? Use both parts of the definition in your answer.

7. Which one does **not** belong with the others?

- ☐ A. Bees pollinating an almond orchard
- ☐ B. A forested hillside keeping a reservoir's water clean
- ☐ C. A concrete seawall built in front of a town
- ☐ D. A healthy lake supplying fish that families eat

8. Which term fits? (a) A plan must cost less than \$2 million; that limit is a _____. (b) Dolphins caught in a net set for tuna are _____. (c) Cutting a forest to plant one crop is an example of _____. (d) Average energy used by each person on Earth is the world's _____ energy use.

Part E: Use the words

9. Write three or four sentences that explain why a growing human population puts more pressure on ecosystems than a growing hare population does. Use **per capita**, **natural resource** and **ecosystem services** correctly, and underline each one.

Questions to ask yourself

For Part A, ask: Is someone taking too much (over-exploitation)? Adding something harmful (pollution)? Wrecking a place (habitat degradation)? Moving a species to a new place (invasive species)? Is a germ reaching people in a new way (emerging disease)? Is the long-term climate shifting (climate change)? For Part C, ask: Does the statement describe success (criterion), a limit (constraint), or something given up to get something else (tradeoff)?

When one problem is two pressures

Real problems often combine pressures. Choose one headline from Part A that could fit two pressures (for example, plastic fishing line is pollution, and a net lost at sea that keeps catching fish is also a kind of over-exploitation). Write a paragraph explaining both labels, then explain why naming both might lead an engineer to a better solution than naming only one.