SUGGESTED SKILL

Concept Explanation

1.A

Describe environmental concepts and processes.

Objective/EKs/Skill

LEARNING OBJECTIVE

STB-3.A

Identify differences between point and nonpoint sources of pollution.

ESSENTIAL KNOWLEDGE

STB-3.A.1

A point source refers to a single, identifiable source of a pollutant, such as a smokestack or waste discharge pipe.

STB-3.A.2

Nonpoint sources of pollution are diffused and can therefore be difficult to identify, such as pesticide spraying or urban runoff.

Unit 8

Aquatic & Terrestrial Pollution

8.1 Sources of Pollutants

Point vs. Nonpoint Pollutant Sources

Point Source

Pollutant that enters environment form an easily identified and confined place

You can “point” 👉 to it

Nonpoint Source

Pollutants entering the environment from many places at once. Difficult to “point” to one individual source

Must-Know Pollution Examples

Point Source

- Animal waste runoff from a CAFO (ammonia (N), fecal coliform bacteria)
- Emissions from smokestack of a coal power plant (CO_2, NO_x, SO_2, PM)
- BP Oil Spill (hydrocarbons, benzene)

Nonpoint Source

- Urban runoff (motor oil, nitrate fertilizer, road salt, sediment)
- Pesticides sprayed on agricultural fields; carried by wind and washed off large agricultural regions ino bodies of water

⚠ **Estuaries and bays are polluted by many nonpoint pollution sources from the large watersheds that empty into them**

Pollutants vs. Pollution

Pollutants

Specific chemicals or groups of chemicals from specific sources with specific env. & human health effects

Much more likely to earn you FRQ credit

⚠ **On any pollution-related FRQ:**

1. Specific pollutant names
    a. Their sources
    b. Their env. & human effects
    c. Their mitigation strategies

Pollution

Vague, nondescript term for any substance that is harmful to the environment

Never acceptable on an APES FRQ

Exceptions:

Specific categories of pollution

- Thermal pollution
- Noise pollution
- Sediment pollution

SUGGESTED SKILL

Concept Explanation

1.A

Describe environmental concepts and processes.

Practice FRQ 8.1

Describe the difference between a point and nonpoint source of pollution.

Identify ONE point source of NO_x emissions and ONE nonpoint source of NO_x emissions.

8.2
HUMAN IMPACTS ON ECOSYSTEMS

OBJECTIVE/EKS/SKILL

LEARNING OBJECTIVE

STB-3.B

Describe the impacts of human activities on aquatic ecosystems.

SUGGESTED SKILL

Mathematical Routines

6.B

Apply appropriate mathematical relationships to solve a problem, with work shown (e.g., dimensional analysis).

ESSENTIAL KNOWLEDGE

STB-3.B.1

Organisms have a range of tolerance for various pollutants. Organisms have an optimum range for each factor where they can maintain homeostasis. Outside of this range, organisms may experience physiological stress, limited growth, reduced reproduction, and in extreme cases, death.

STB-3.B.2

Coral reefs have been suffering damage due to a variety of factors, including increasing ocean temperature, sediment runoff, and destructive fishing practices.

STB-3.B.3

Oil spills in marine waters cause organisms to die from the hydrocarbons in oil. Oil that floats on the surface of water can coat the feathers of birds and fur of marine mammals. Some components of oil sink to the ocean floor, killing some bottom-dwelling organisms.

STB-3.B.4

Oil that washes up on the beach can have economic consequences on the fishing and tourism industries.

RANGE OF TOLERANCE

⚠ **Organisms have range of tolerance for abiotic conditions in their hab.**
pH, temperature, salinity (saltiness), sunlight, nutrient levels (ammonia, phosphate)

- Organisms also have range of tolerance for pollutants that human activities release into their habitats
  - Pollutants cause physiological stress such as
    - Limited growth
    - Limited reproductive function
    - Difficulty respiring (breathing), potentially asphyxiation (suffocation)
    - Hormonal disruption
    - Death (if concentration of pollutant is high enough)

⚠ **A big theme of Unit 8 is being able to explain <u>specific</u> effects of pollutants on organisms**

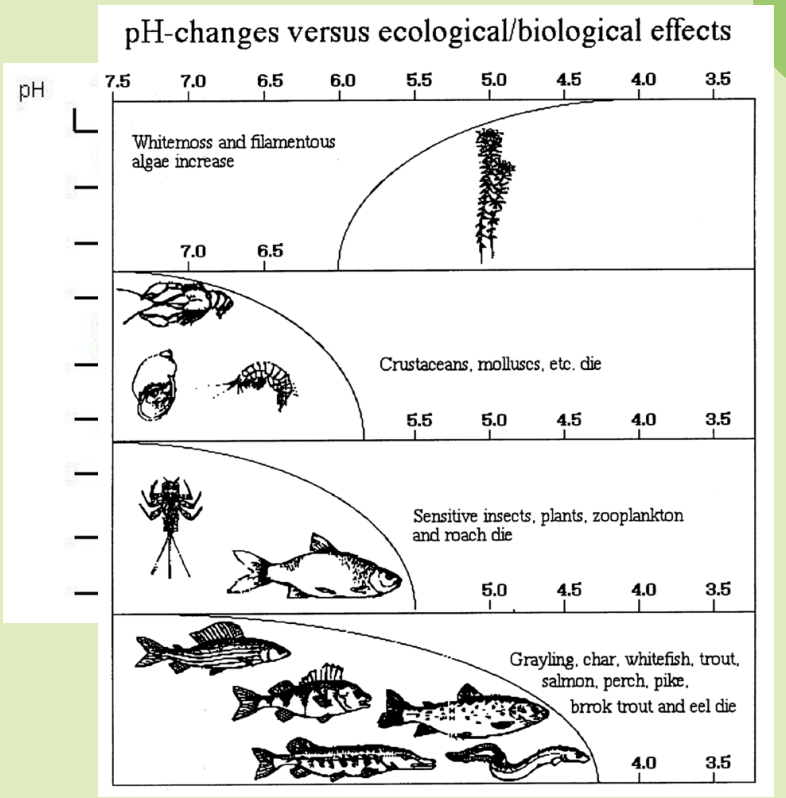
Env. Effects of Acid Rain

Aquatic species have diff. pH tolerances

pH Tolerance

- As pH decreases (more acidic) outside optimal range for a species, pop. declines
  - When pH leaves range of tolerance, they cannot survive at all, due to:
    - Aluminum toxicity
    - Disrupted blood osmolarity (Na^+/Cl^- balance disrupted at low pH)

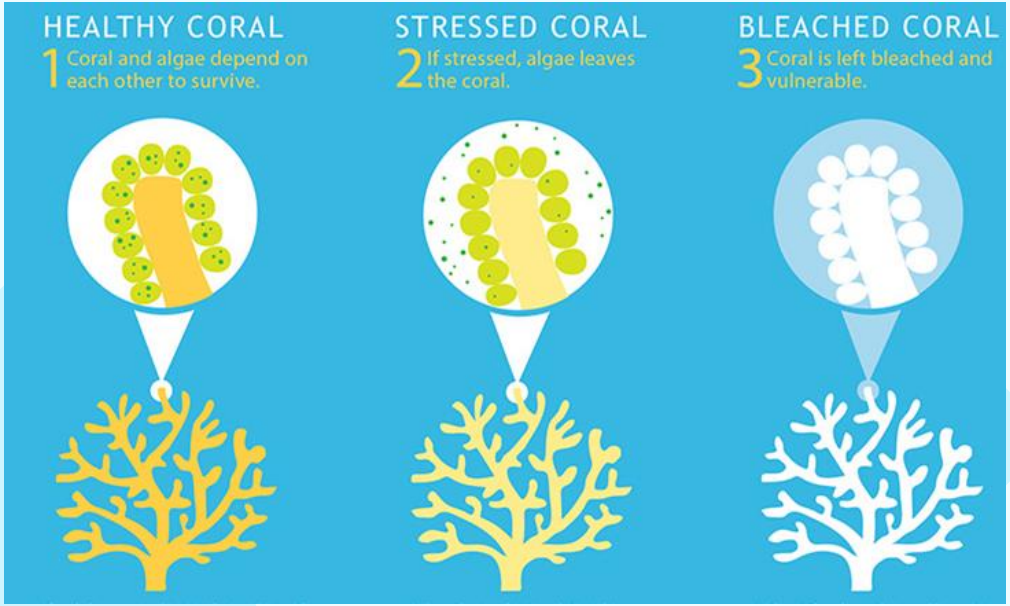
- **Indicator species** can be surveyed and used to determine conditions of an ecosystem (soil, water, etc.)
  - Ex: high whitemoss/filamentous algae pop. indicates pH < 6.0
  - High crustacean pop. indicates pH > 6.0



Temp. Tolerance of Reef Algae

⛰ Coral reef = mutualistic relationship between coral & photosynthetic algae called zooxanthellae; algae supply sugar & coral supply CO_2 + detritus (nutrient containing org. matter.)

- Algae have <u>narrow temp. tolerance</u> and leave the reef when temp. rises
    - Pollutants from runoff (sediment, pesticides, sunscreen) can also force algae from reef
- Coral lose color & become stressed and vulnerable to disease without algae (main food source)



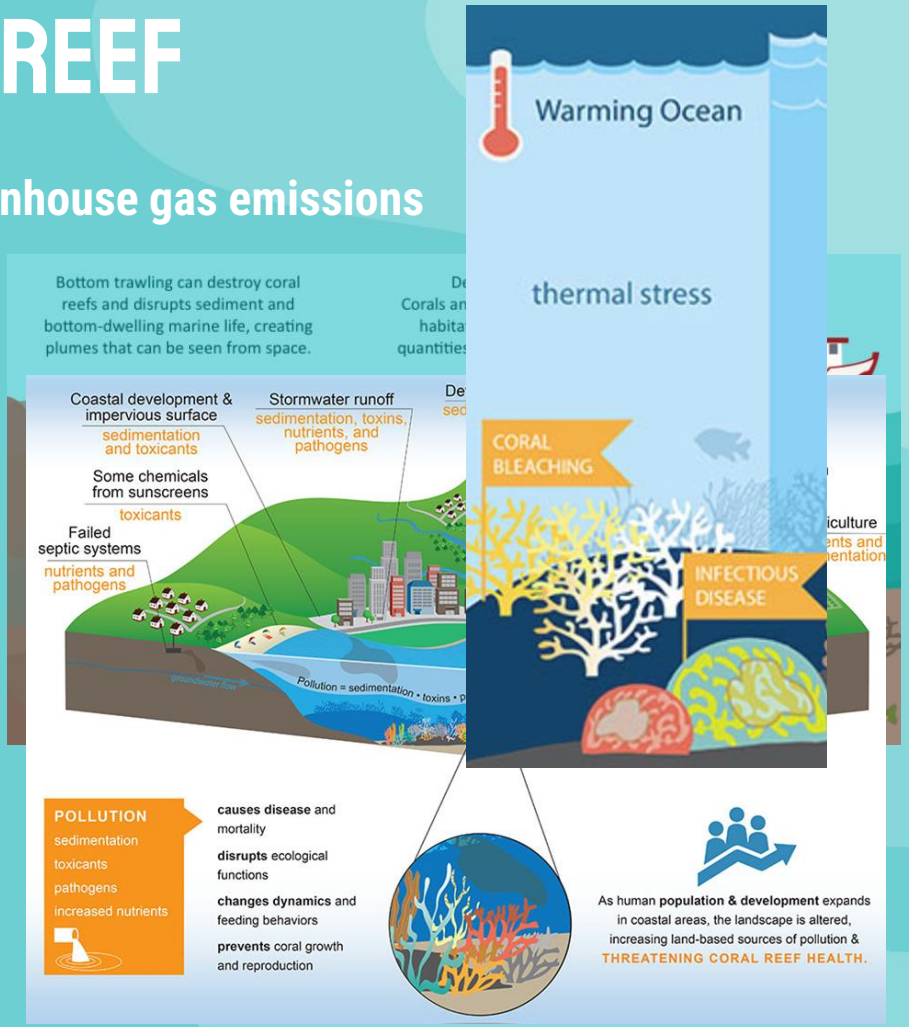
HUMAN IMPACTS ON CORAL REEF

Humans disrupt coral reef ecosystems via greenhouse gas emissions (warming ocean temp. & bleaching coral)

Overfishing decreases fish populations in coral reef ecosystem & bottom trawling can break reef structure and stir up sediment

Urban and agricultural runoff also damages coral reef ecosystems

- Sediment pollution: sediment carried into ocean by runoff makes coral reef waters more turbid, reducing sunlight (photosynthesis)
- Toxicants: chemicals in sunscreen, oil from roadways, pesticides from ag. runoff
- Nutrients (P/N): ammonia from animal waste, nitrates/phosphates from ag. or lawn fertilizers

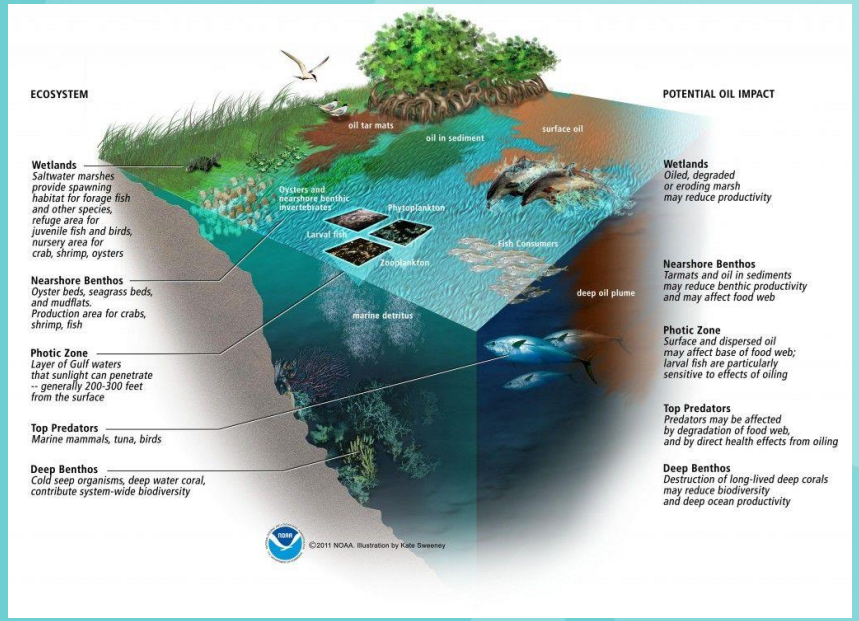


OIL SPILL EFFECTS

⚠ Hydrocarbons in crude oil (petroleum) are toxic to many marine organisms and can kill them, especially if they ingest (eat) the oil or absorb through gills/skin

Other physiological effects:

- Decreased visibility and decreased photosynthesis due to less sunlight penetrating water surface
- Oil sticking to bird feathers
- Oil sinking to bottom and killing bottom-dwellers due to: direct toxicity or suffocation



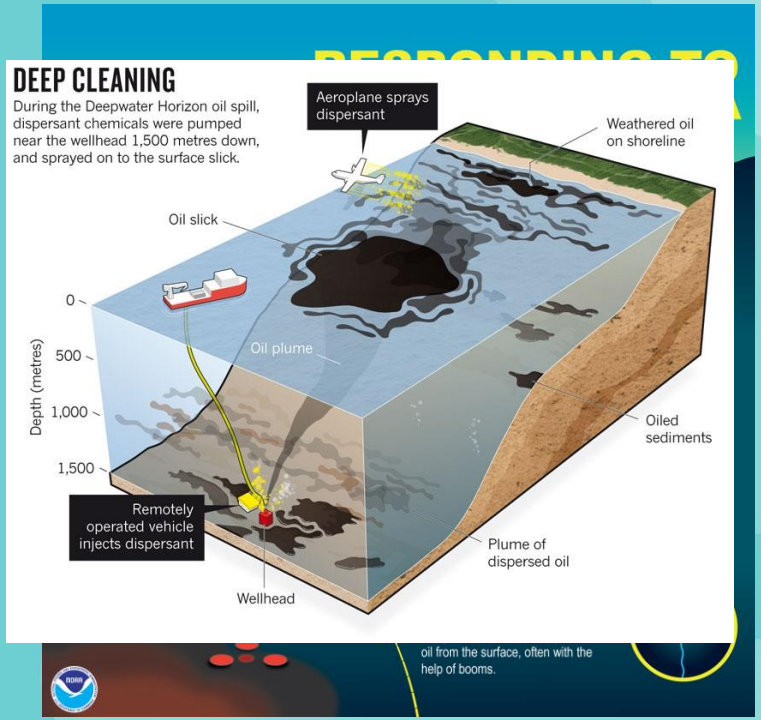
⚠ Oil can wash ashore and decrease tourism revenue and kill fish, decreasing fishing industry revenue, hurt restaurants that serve fish

- Oil can settle deep in root structures of estuary habitats like mangroves or salt marshes
  - Can be toxic to salt marsh grasses, killing them and loosening their root structure, leading to coastline erosion
    - Can remove habitats used by fish & shellfish for breeding grounds

OIL SPILL CLEAN UP

Oil spills can occur when an underwater oil well explodes/blows out (BP Gulf Spill) or when a tanker runs into a rock/iceberg and is punctured (Exxon Valdez)

- **Cleanup can involve booms on surface to contain spread and ships with vacuum tubes to siphon oil off of the surface or devices to skim It off**
- **Physical removal of oil from beach sand and rocks with towels, soaps, shovels**
- **Chemical dispersants sprayed on oil slicks to break up and sink to the bottom**
  - **Clears up surface, but can smother bottom-dwellers**
  - **Dispersant chemicals may be harmful**
- **Burning oil off surface**



PRACTICE FRQ 8.2

SUGGESTED SKILL

Mathematical Routines

6.B

Apply appropriate mathematical relationships to solve a problem, with work shown (e.g., dimensional analysis).

The Alaskan National Wildlife Refuge (ANWR) on Alaska's North Slope is frequently in the news because petroleum geologists estimate that there are billions of barrels of economically recoverable oil beneath the surface of its frozen tundra. According to a 1998 United States Geological Survey (USGS) estimate, ANWR could contain up to 10 billion barrels of technically recoverable oil. Oil company officials advocate opening the refuge to oil exploration and the subsequent development of its petroleum resources. Environmentalists argue that oil exploration and development will damage this fragile ecosystem and urge Congress to protect ANWR by designating it as a wilderness area.

The united states uses approximately 20 million barrels of oil per day. According to the USGS estimate, for how many days would the technically recoverable oil resource in the ANWR supply the total United States demand for oil?

8.3

Endocrine Disruptors & Industrial Water Pollutants

Objective/EKs/Skill

STB-3.B.7

Heavy metals used for industry, especially mining and burning of fossil fuels, can reach the groundwater, impacting the drinking water supply.

STB-3.B.10

When elemental sources of mercury enter aquatic environments, bacteria in the water convert it to highly toxic methylmercury.

SUGGESTED SKILL

Concept Explanation

1.A

Describe environmental concepts and processes.

LEARNING OBJECTIVE	ESSENTIAL KNOWLEDGE
STB-3.C Describe endocrine disruptors.	**STB-3.C.1** Endocrine disruptors are chemicals that can interfere with the endocrine system of animals.
STB-3.D Describe the effects of endocrine disruptors on ecosystems.	**STB-3.D.1** Endocrine disruptors can lead to birth defects, developmental disorders, and gender imbalances in fish and other species.

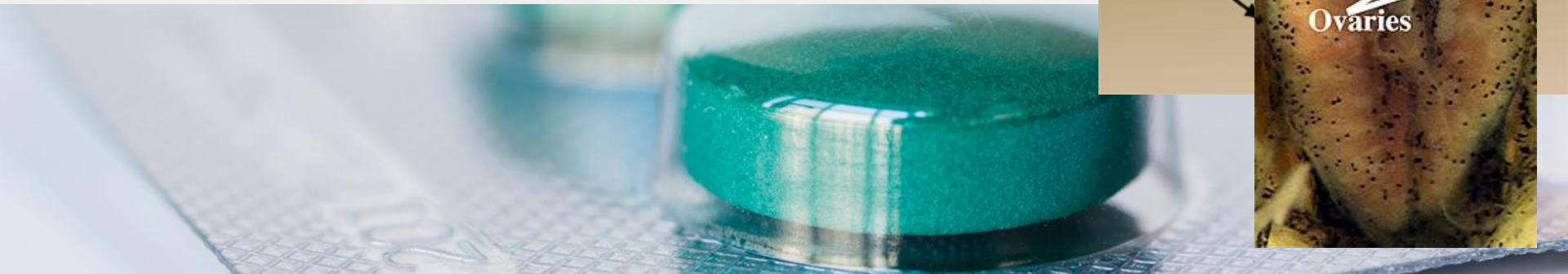
Endocrine Disruptors

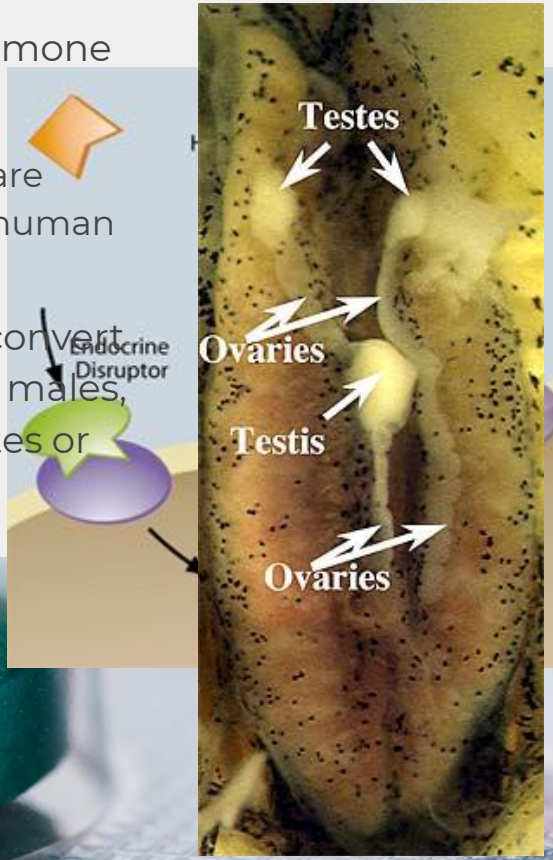
⚠️ **Chemicals that interfere with the endocrine (hormonal) systems of animals**

- Bind to cellular receptors meant for hormones, blocking the hormone from being received, or amplifying its effects

🤔 Human medications that pass through urine & into sewage or are flushed down toilet are a common source (meant to influence human hormones, so they can also disrupt animals')

Example: atrazine (herbicide) binds to receptors of cells that should convert estrogen into testosterone in male frogs, leading to: high estrogen in males, low sperm count, even feminization (development of eggs in the testes or ovary formation)





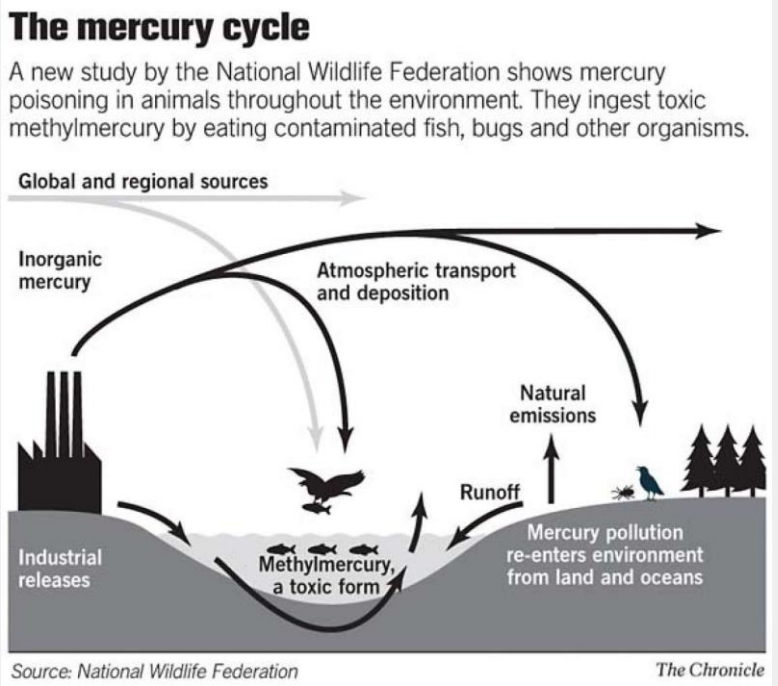
Endocrine Disruptors

- **Atrazine** - broad-spectrum herbicide used to control weeds & prevent crop loss
  - Applied to ag. fields, runs off into local surface or groundwater or is carried by wind
  - Can contaminate human well-water, or enter body via unwashed produce

- **DDT**- broad-spectrum insecticide that was phased out, but still persists in env.
  - Applied to ag. fields, runs off into local surface or groundwater or is carried by wind
- **Phthalates -** compounds used in plastic and cosmetic manufacturing
  - Enter surface & groundwater via intentional dumping of trash, or chemical waste from plastic/cosmetic factories improperly disposing of waste, landfill leaching
  - Also found in some cosmetics & plastic food containers (#3 plastic & “fragrance”)
- **Lead, arsenic, mercury -** heavy metals *(will be focused on upcoming slides)*
- Many **human medications** that enter sewage via human urine or flushed meds

Mercury

- **Mercury** - naturally occurring in coal, released by anthropogenic activities:
  - Coal combustion, trash incineration, burning medical waste, heating limestone for cement
    - Attaches to PM released by burning & deposits in soil/water wherever PM settles
    - Can be released if coal ash stored in ponds overflow & runoff
  - Endocrine disruptor: inhibits estrogen & insulin (interferes with menstrual cycle & ovulation)
  - Teratogen: (chemical harmful to developing fetuses) can accumulate in fetus brain
    - Pregnant women can reduce risk by eating less seafood

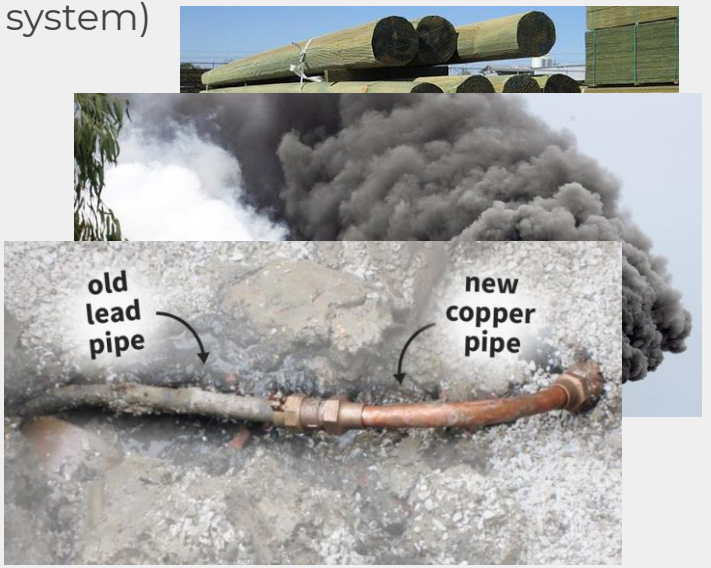


⚠ **Mercury itself isn't toxic, but bacteria in water sources convert it to methylmercury which is highly toxic to animals (neurotoxicant that damages central nervous system)**

Arsenic & Lead

- **Arsenic** -naturally occurring element in rocks underground that can dissolve into drinking water; Natural release into groundwater can be worsened by mining
    - Anthropogenic sources: formerly in pesticides applied to ag. Fields (can still linger in soil, wood treatment chemicals to prevent rot, coal combustion & ash
        - Carcinogenic (lungs, bladder, kidneys) & endocrine disrupting
        - Endocrine disruptor (specifically glucocorticoid system)
            - Can be removed with water filters

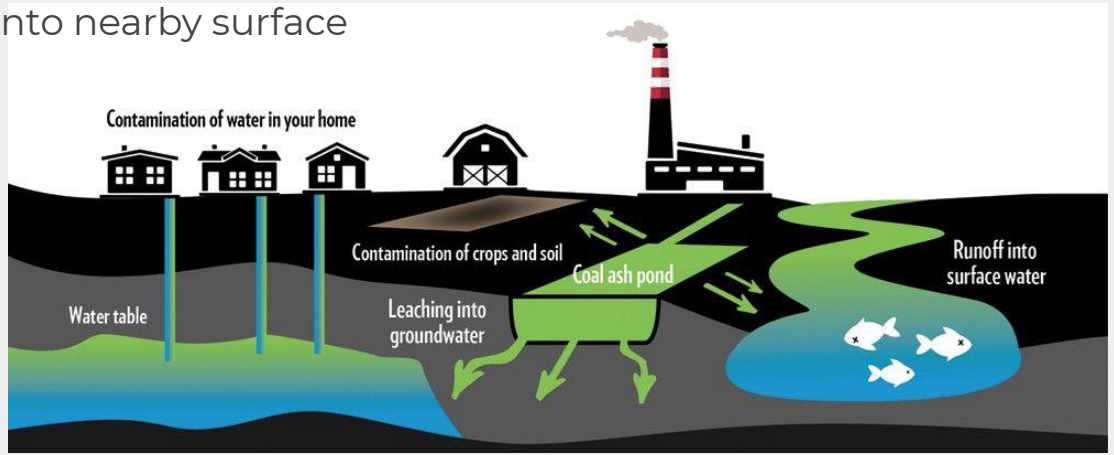
- **Lead** - found in old paint (in homes), old water pipes, and soils contaminated by PM from vehicle exhaust before lead was phased out of gas in 70s
    - Also released in fly ash (PM) of coal combustion
        - Neurotoxicant (damages central nervous system, especially in children)
        - Endocrine disruptor
            - Can be removed with water filters



Coal Ash

⚠**Coal ash can be a source of mercury, lead, and arsenic**

- Can attach to fly ash (PM) from smokestack and be carried by wind, deposited in ecosystems far away
- Both fly and bottom coal ash are often stored on site in ponds, dug into soil & lined with plastic (sometimes)
  - Ponds can leach into groundwater, contaminating it with arsenic, lead, mercury
  - Ponds can overflow & runoff into nearby surface waters & agricultural fields



Practice FRQ 8.3

SUGGESTED SKILL

Concept Explanation

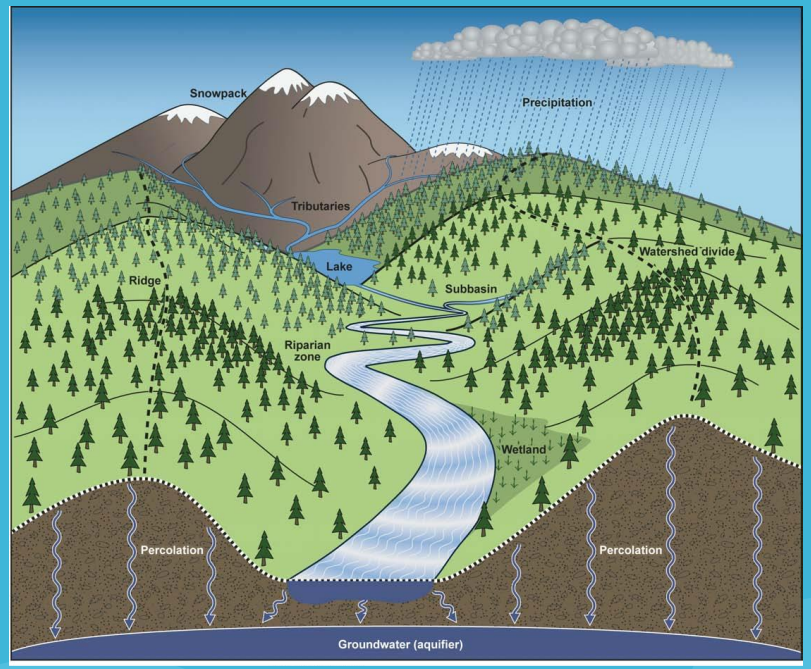
1.A

Describe environmental concepts and processes.

Identify a toxic metal other than mercury that has a negative effect on human health and **describe** how it is introduced into the environment.

Included here intentionally as an important preface to 8.4

4.6
Watersheds



Objective/EKs/Skill

LEARNING OBJECTIVE

ERT-4.F

Describe the characteristics of a watershed.

ESSENTIAL KNOWLEDGE

ERT-4.F.1

Characteristics of a given watershed include its area, length, slope, soil, vegetation types, and divides with adjoining watersheds.

SUGGESTED SKILL

Concept Explanation

1.C

Explain environmental concepts, processes, or models in applied contexts.

Watersheds

⚠ All of the land that drains into a specific body of water (river, lake, bay, etc.)

- Determined by slope; ridges of land divide watersheds (diff. runoff directions)
- Vegetation, soil composition, slope play a large role in how watersheds drain
  - More vegetation = more infiltration & groundwater recharge
  - Greater slope = faster velocity of runoff & more soil erosion
  - Soil permeability determines runoff vs. infiltration rates

⚠ Human activities of a watershed impact H_2O quality
Ex: ag, clearcutting, urbanization, dams, mining

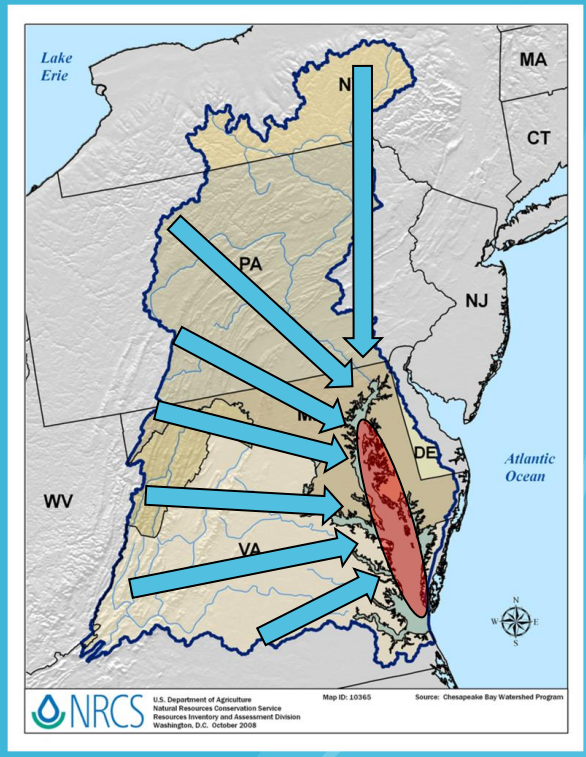
Chesapeake Bay Watershed

6 state region that drains into a series of streams/rivers & eventually into Chesapeake Bay

- Mix of fresh & salt water + nutrients in sediment make estuary habitats like the salt marshes in the bay highly productive

💰 **Estuaries & wetlands provide ecosystem services:**

- Tourism revenue – hotels, restaurants, permits
- Water filtration (grass roots trap pollutants)
- Habitats for food sources (fish & crabs)
- Storm protection (absorbing & buffering floods)



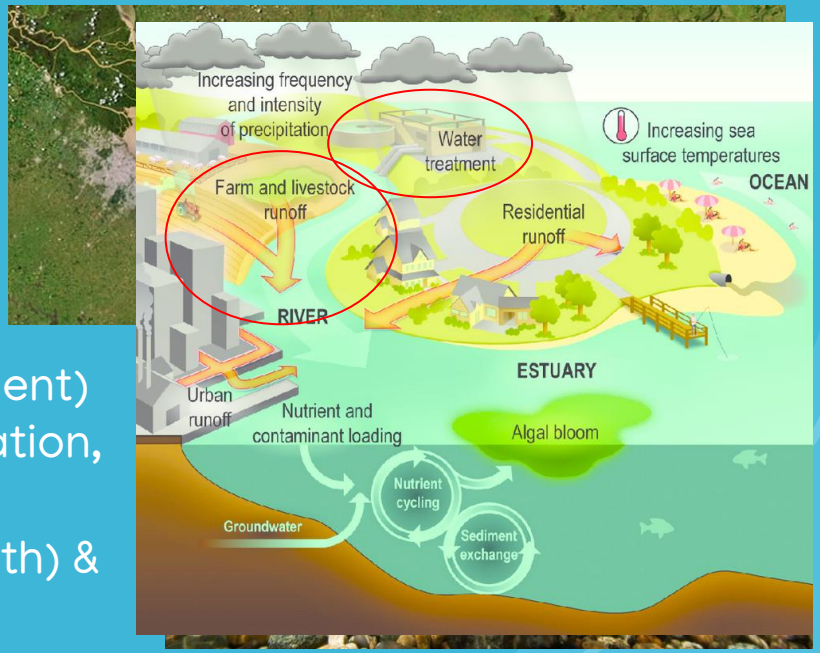
Human Impacts on Chesapeake Bay

⚠ Nutrient pollution (N & P) leads to eutrophication in the Bay

- Algae bloom due to increase of N/P → decreased sunlight → plants below surface die → bacteria use up O_2 for decomp. → hypoxia (low O_2) & dead zones

⚠ Major N/P sources:

1) Discharge from sewage treatment plants (N/P levels from human waste)
2) Animal waste from CAFOS
3) Synthetic fertilizer from ag. fields & lawns



Other major pollutants:

- Endocrine disruptors (from sewage treatment)
- Sediment pollution (deforestation, urbanization, tilling ag. fields)
  - Increases turbidity (reduced photosynth) & covers over rocky streambed habitats

Direct Effects of Clearcutting

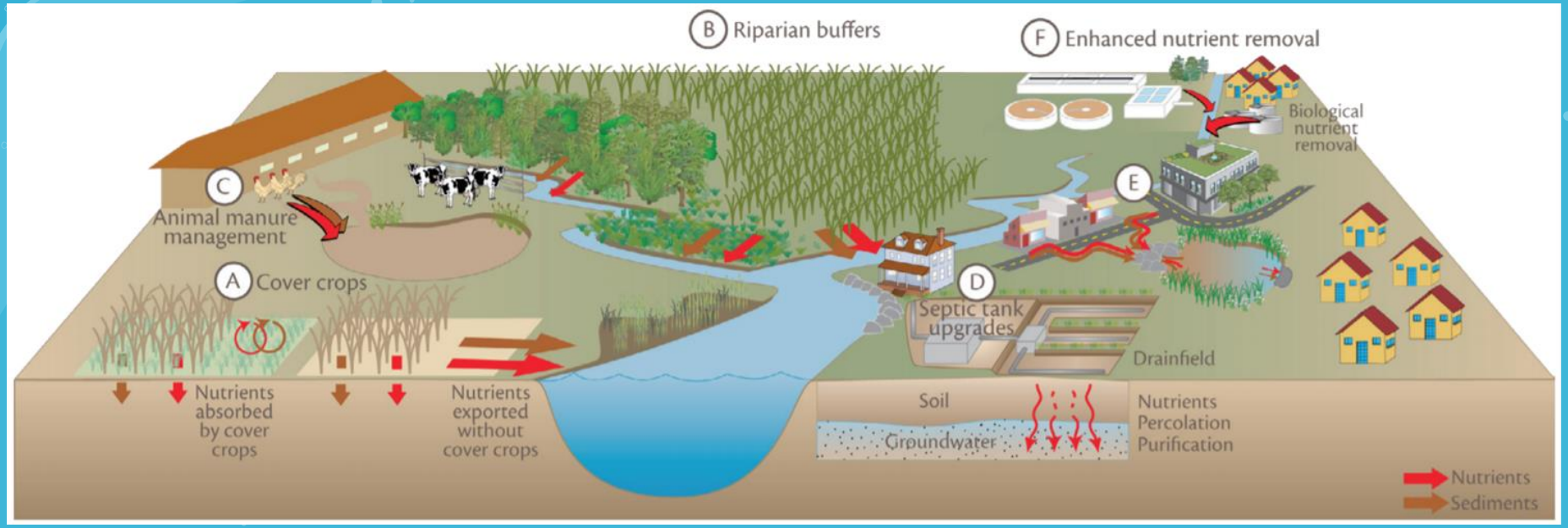
Soil Erosion

- Caused by loss of stabilizing root structure
- Removes soil organic matter & nutrients from forest
- Deposits sediments in local streams
  - Warms water & makes it more turbid (cloudy)

Increased soil & stream temp.

- Loss of tree shade increases soil temperature
  - Soil has lower albedo than leaves of trees
- Loss of tree shade along rivers & streams warms them
  - Erosion of sediments into rivers also warms them

Solutions to Watershed Pollutants



Practice FRQ 4.6

SUGGESTED SKILL

Concept Explanation

1.C

Explain environmental concepts, processes, or models in applied contexts.

Deforestation can affect water quality. **Identify** one change that can occur in the water quality of streams within a watershed that has been deforested. **Explain** how deforestation can lead to this change.

8.4

Human Impacts on Wetlands and Mangroves

Objective/EKs/Skill

SUGGESTED SKILL

Environmental Solutions

7.B

Describe potential responses or approaches to environmental problems.

LEARNING OBJECTIVE

STB-3.E

Describe the impacts of human activity on wetlands and mangroves.

ESSENTIAL KNOWLEDGE

STB-3.E.1

Wetlands are areas where water covers the soil, either part or all of the time.

STB-3.E.2

Wetlands provide a variety of ecological services, including water purification, flood protection, water filtration, and habitat.

STB-3.E.3

Threats to wetlands and mangroves include commercial development, dam construction, overfishing, and pollutants from agriculture and industrial waste.

Wetlands

An area with soil submerged/saturated in water for at least part of the year, but shallow enough for emergent plants

- Wetland plants have *adapted* to living with roots submerged in standing water (cattails, lily pads, reeds)

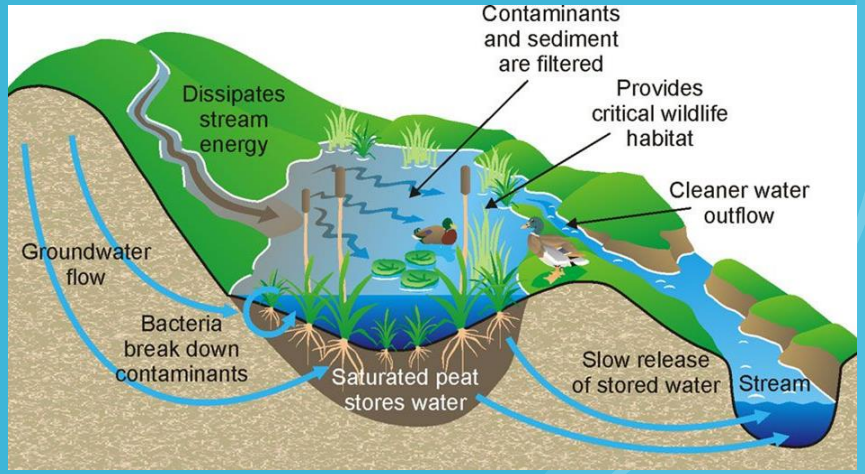
Ecosystem Services of Wetlands

Provisioning: habitat for animal & plant foods

Regulating: groundwater recharge, absorb. of floodwater, CO_2 sequestration

Supporting: H_2O filtration, pollinator habitats, nutrient cycling, pest control

Cultural: tourism revenue, fishing license, camping fees, ed/med research



Threats to Wetlands

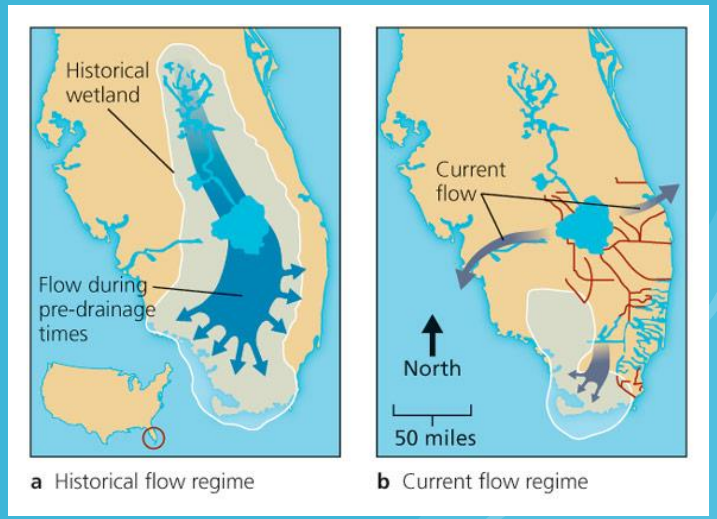
Pollutants – nutrients (N/P), sediment, motor oil, pesticides, endocrine disruptors

Development – wetlands can be filled in or drained to be developed into homes, parking lots, stores, or agricultural land

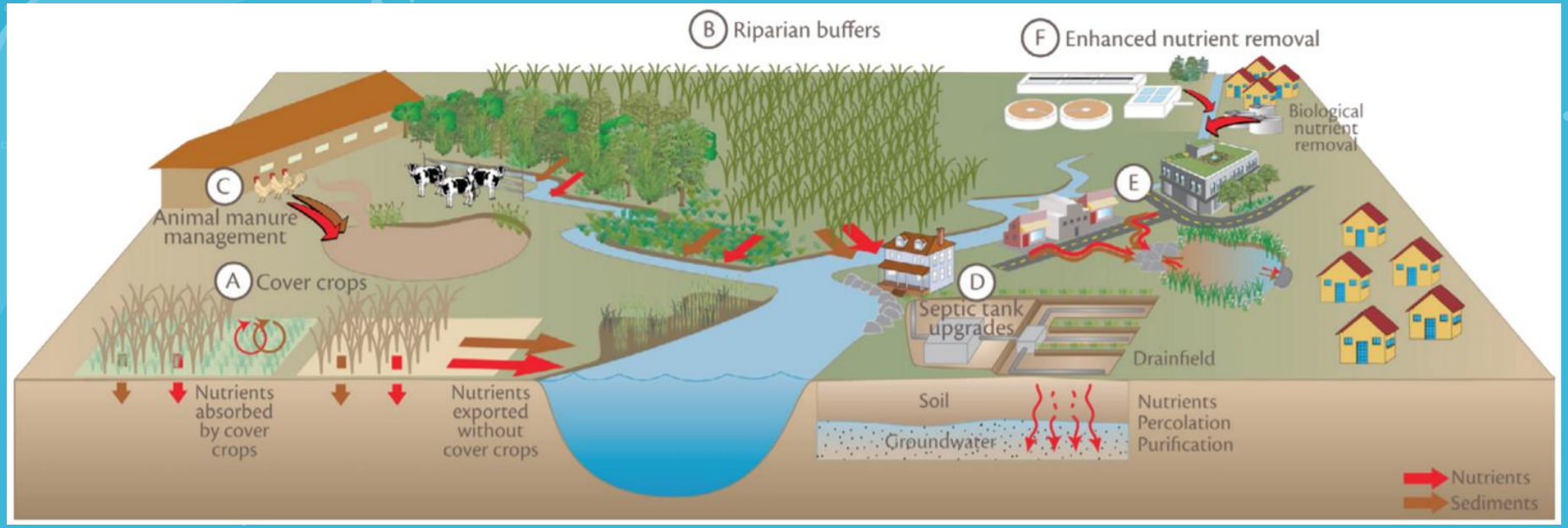
Water diversion upstream for flood control, agriculture, or drinking water can reduce water flow and dry up wetlands (ex: Everglades)

- Dam construction for flood control/hydroelect. reduces water & sediment (N/P) flow to wetlands

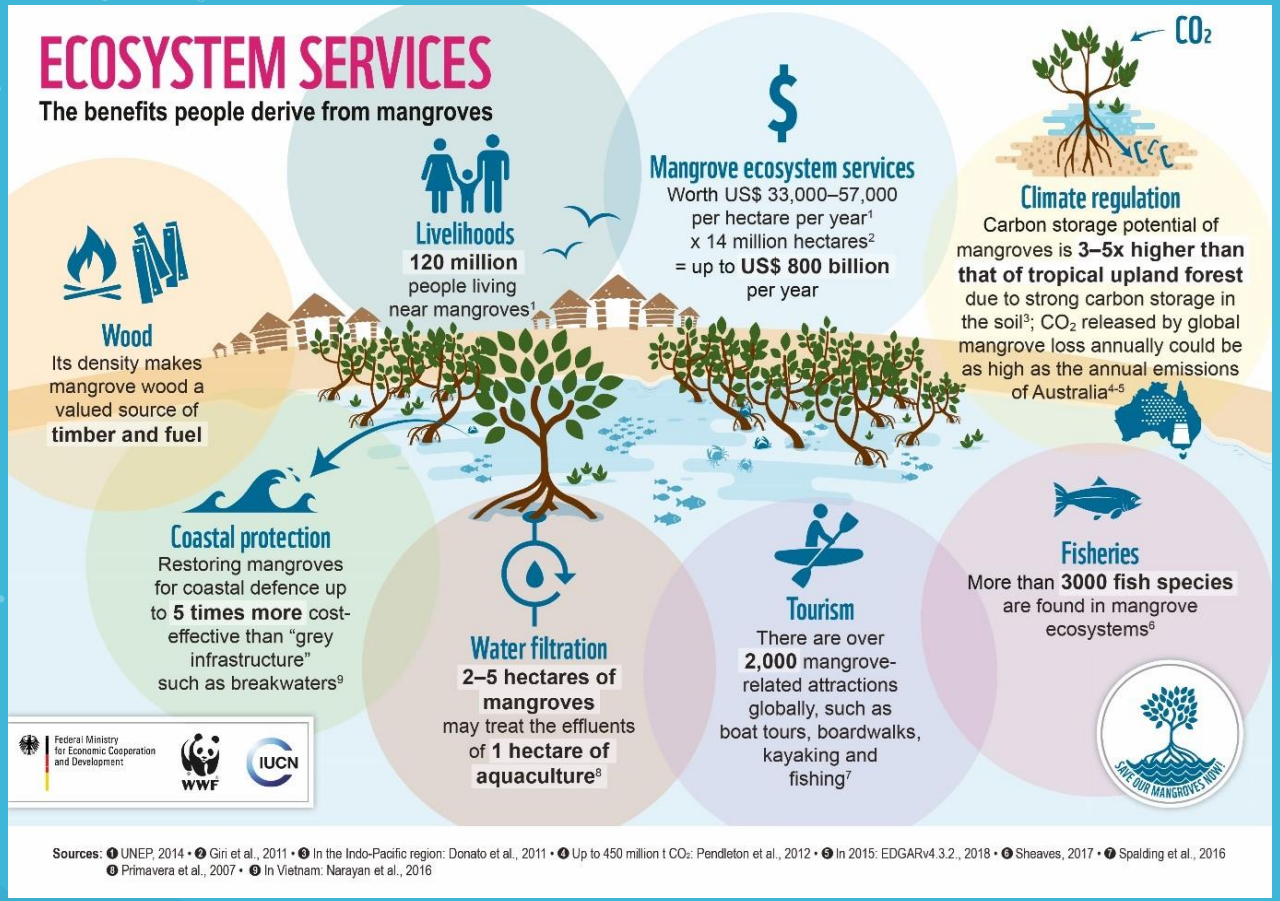
Overfishing: disrupts food web of wetlands (decrease in fish predators, increase in prey)



Solutions to Watershed Pollutants



Benefits of & Threats to Mangroves



Practice FRQ 8.4

SUGGESTED SKILL

Environmental Solutions

7.B

Describe potential responses or approaches to environmental problems.

Describe how one specific human activity can lead to increased phosphorus levels in an estuary ecosystem.

Describe one step that could be taken to reduce the phosphorus inputs from the activity you described above.

8.5
Eutrophication

Objective/EKs/Skill

LEARNING OBJECTIVE	ESSENTIAL KNOWLEDGE
STB-3.F Explain the environmental effects of excessive use of fertilizers and detergents on aquatic ecosystems.	**STB-3.F.1** Eutrophication occurs when a body of water is enriched in nutrients. **STB-3.F.2** The increase in nutrients in eutrophic aquatic environments causes an algal bloom. When the algal bloom dies, microbes digest the algae, along with the oxygen in the water, leading to a decrease in the dissolved oxygen levels in the water. The lack of dissolved oxygen can result in large die-offs of fish and other aquatic organisms. **STB-3.F.3** Hypoxic waterways are those bodies of water that are low in dissolved oxygen. **STB-3.F.4** Compared to eutrophic waterways, oligotrophic waterways have very low amounts of nutrients, stable algae populations, and high dissolved oxygen. **STB-3.F.5** Anthropogenic causes of eutrophication are agricultural runoff and wastewater release.

SUGGESTED SKILL

Visual Representations

2.C

Explain how environmental concepts and processes represented visually relate to broader environmental issues.

Eutrophication Process

B/c they're limiting nutrients in aq. ecosystems, extra input of N & P lead to **eutrophication** (excess nutrients) which fuels algae growth

- Algae bloom covers surface of water, blocking sunlight & killing plants below surface
- Algae eventually die-off; bacteria that break down dead algae use up O_2 in the water (b/c decomp. = aerobic process)
- Lower O_2 levels (dissolved oxygen) in water kills aquatic animals, especially fish
- Bacteria use up even more O_2 to decompose dead aq. animals
- Creates pos. feedback loop: less O_2 → more dead org. → more bacterial decomposition → less O_2

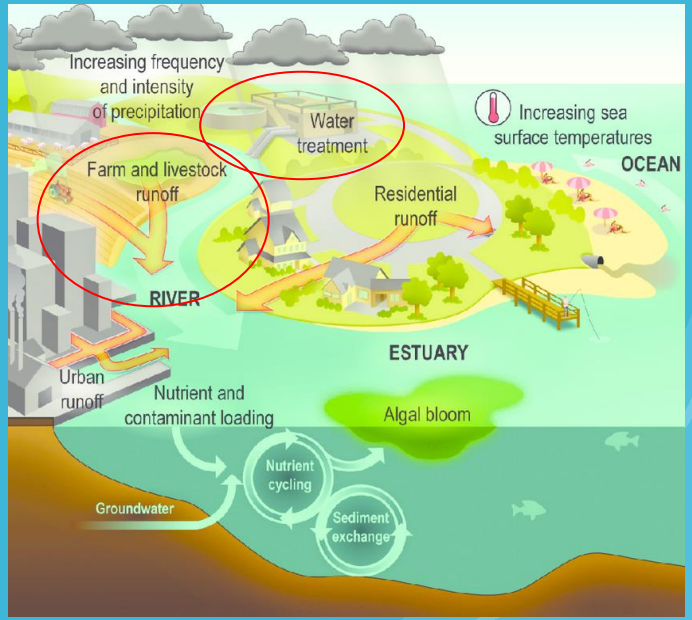
Cultural Eutrophication

⚠ Anthropogenic nutrient pollution (N & P) that leads to eutrophication

- Algae bloom due to increase of N/P → decreased sunlight → plants below surface die → bacteria use up O_2 for decomp. → hypoxia (low O_2) & dead zones

⚠ **Major N/P sources:**

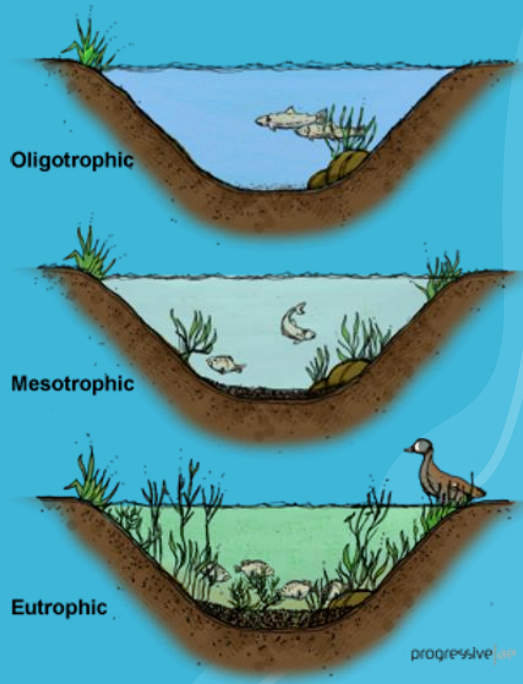
1) Discharge from sewage treatment plants (N/P in human waste & phosphates in soaps/detergents)
2) Animal waste from CAFOS
3) Synthetic fertilizer from ag. fields & lawns



Oligotrophic Waterways

⛵Waterways with low nutrient (N/P) levels, stable algae pop, and high dissolved oxygen

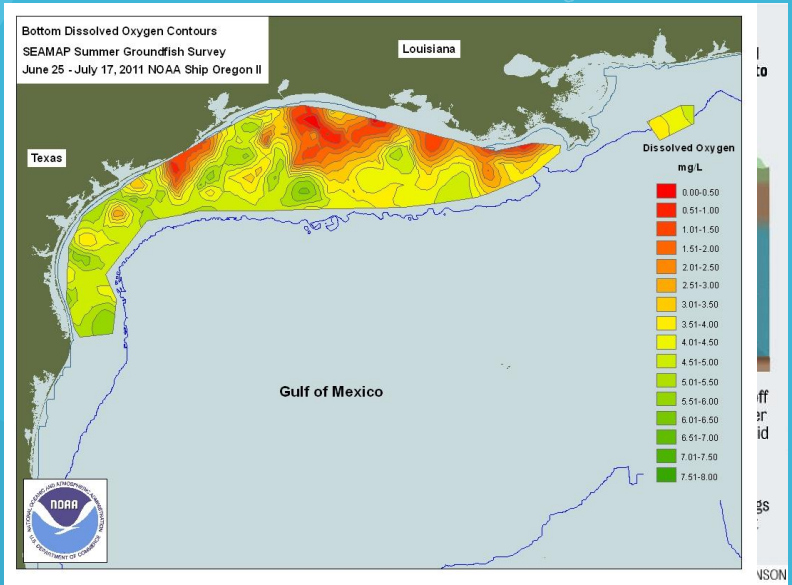
- Can be due to lack of nutrient pollution, or age of the body of water
- Aquatic ecosystems naturally undergo succession
  - Sediment buildup on bottom (benthic zone) leads to higher nutrient levels
  - Overtime, ponds naturally shift from oligotrophic, to mesotrophic, to eutrophic

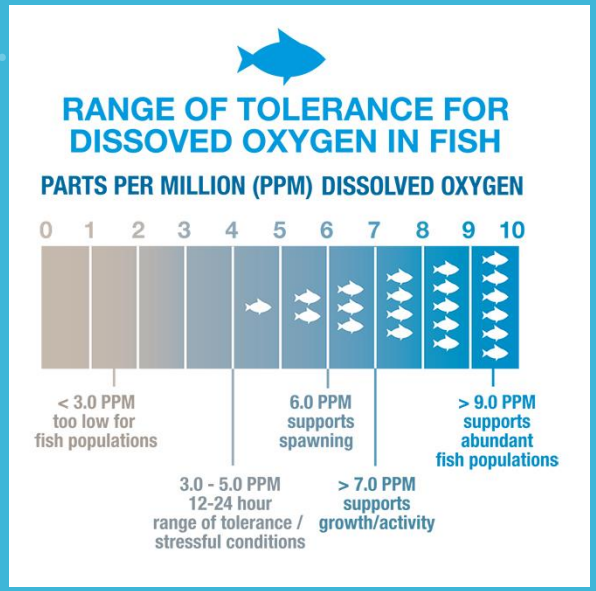


Dissolved Oxygen & Dead Zones

⚠ Decrease in dissolved oxygen (hypoxia) is what causes a dead zone

- All aq. life requires DO (dissolved oxygen) in water for respiration
- As DO decreases, fewer species can be supported
  - Most fish require at least 3.0 ppm to survive, 6.0 ppm to reproduce





SUGGESTED SKILL

Visual Representations

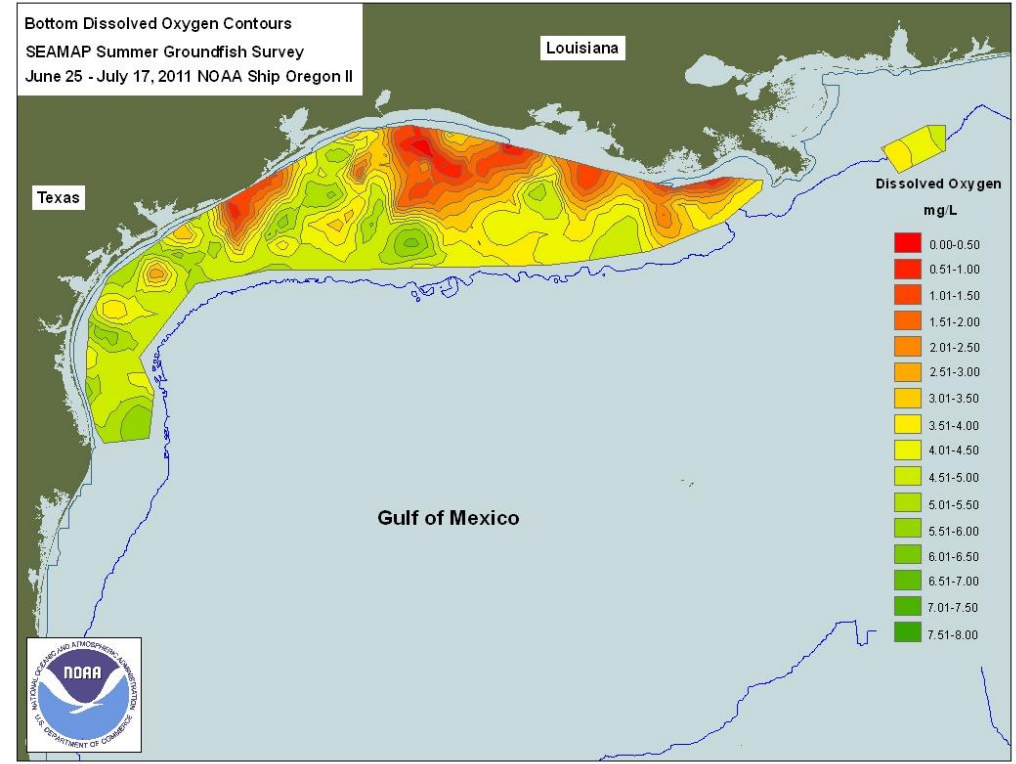
2.C

Explain how environmental concepts and processes represented visually relate to broader environmental issues.

Practice FRQ 8.5

Make a claim about which state's fishing industry likely had lower than average profits in the summer of 2011.

Justify this claim with evidence from the map.



8_6
Thermal Pollution

Objective/EKs/Skill

SUGGESTED SKILL

Concept Explanation

1.C

Explain environmental concepts, processes, or models in applied contexts.

LEARNING OBJECTIVE

STB-3.G

Describe the effects of thermal pollution on aquatic ecosystems.

ESSENTIAL KNOWLEDGE

STB-3.G.1

Thermal pollution occurs when heat released into the water produces negative effects to the organisms in that ecosystem.

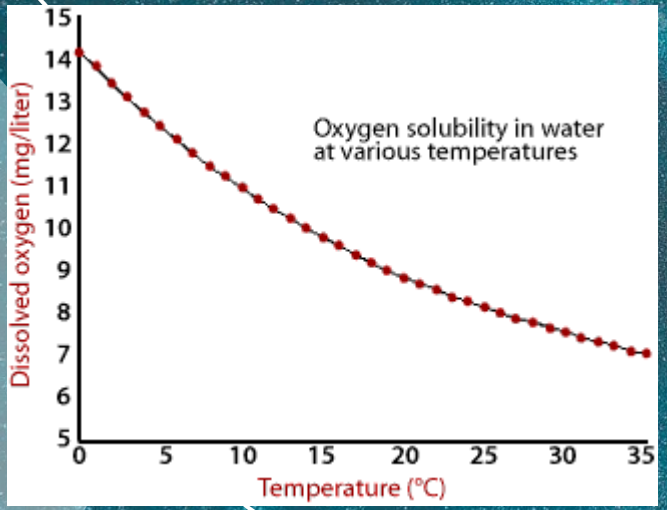
STB-3.G.2

Variations in water temperature affect the concentration of dissolved oxygen because warm water does not contain as much oxygen as cold water.

Solubility of Oxygen & Temperature

Solubility = the ability of a solid/liquid/gas to dissolve into a liquid (oxygen dissolving into water in this case)

⚠ **Inverse relationship between water temp & oxygen solubility**
As water temp. ↑ DO (dissolved oxygen) ↓



⚠ **Thermal pollution:** when heat released into water has negative effects on organisms living in the water

- Heat increases respiration rate of aquatic organisms (thermal shock)
- Hot water also has less O_2
  - This can lead to suffocation without enough O_2 to support respiration

Sources of Thermal Pollution

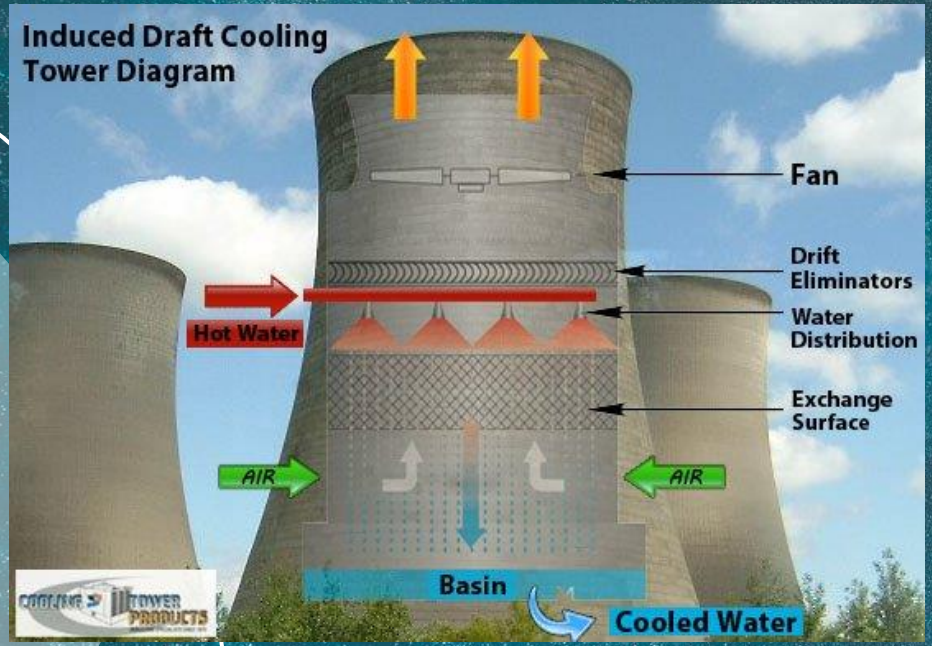
⚠ **Power plants use cool water from surface/ground water sources nearby to cool steam used to turn a turbine back into water to reuse**

- Steel mills, paper mills, and other manufacturing plants also use cool water to cool down machinery & return warmed water to local surface waters
- Urban stormwater runoff can also cause thermal pollution due to heat from blacktop/asphalt

☢ **Nuclear power plants require especially large amounts of cool water to cool steam back into water & to cool the reactor core**

Cooling Towers

⚠ **Cooling towers/ponds** are used to cool steam back into water & to hold warmed water before returning to local surface water



- Already standard in nuclear power plants, but can be optimized to cool water better or hold it longer before returning to nearby surface waters

Practice FRQ 8.6

SUGGESTED SKILL

Concept Explanation

1.C

Explain environmental concepts, processes, or models in applied contexts.

Explain how an increase in nuclear power generation in a town may lead to a decrease in biodiversity in nearby aquatic ecosystems.

8.7 - POPS
Persistent Organic Pollutants

OBJECTIVE/EKS/SKILL

LEARNING OBJECTIVE

STB-3.H

Describe the effect of persistent organic pollutants (POPs) on ecosystems.

SUGGESTED SKILL

Concept Explanation

1.B

Explain environmental concepts and processes.

ESSENTIAL KNOWLEDGE

STB-3.H.1

Persistent organic pollutants (POPs) do not easily break down in the environment because they are synthetic, carbon-based molecules (such as DDT and PCBs).

STB-3.H.2

Persistent organic pollutants (POPs) can be toxic to organisms because they are soluble in fat, which allows them to accumulate in organisms' fatty tissues.

STB-3.H.3

Persistent organic pollutants (POPs) can travel over long distances via wind and water before being redeposited.

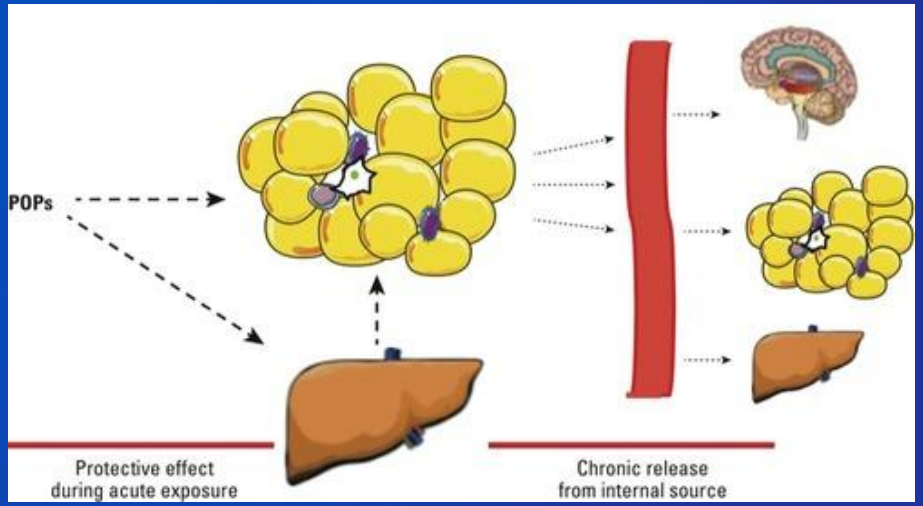
POPS

⚠ **Persistent (long-lasting) Organic (carbon-based) Pollutants**

- Synthetic (human-made) compounds that do not easily breakdown in the environment; accumulate and buildup in water & soil

  ⚠ **Fat-soluble, meaning they also accumulate and persist in animals' fat tissue instead of passing through the body (don't easily dissolve into blood/urine)**

Can slowly be released from fatty tissue into blood stream and impact brain & other organs over time (esp. reproductive system)



Examples & Sources of POPs

Examples

- DDT (outdated insecticide)
- PCBs (plastic/paint additive)
- PBDEs (fire-proofing)
- BPA (plastic additive)
- Dioxins (fertilizer production & combustion of waste and biomass)
- Phthalates (Plastics)
- Perchlorates (rocket/missile fuel, fireworks)

Pesticides

DDT was widely used as an insecticide before phaseout in most dev. nations

Still persists in soils & sediments in aq. ecosystems and builds up in food webs

Medications (pharmaceutical compounds)

Steroids, reproduct. hormones, antibiotics, that pass through human bodies & into sewage release from treatment plants

Persist in streams/rivers & disrupt aq. organisms' endocrine function

Dioxins

Byproduct of fertilizer production & burning of medical waste, FFs, biomass

90% of human dioxin exposure comes from animal fats (meat, dairy, fish) since dioxins buildup in animal fat tissue

Examples & Transport of POPs

PCBs

Additives in paint and plastics, released into aquatic ecosystems by industrial wastewater

Toxic to fish, causing spawning failure and endocrine disruption

Reproductive failure & cancer in humans

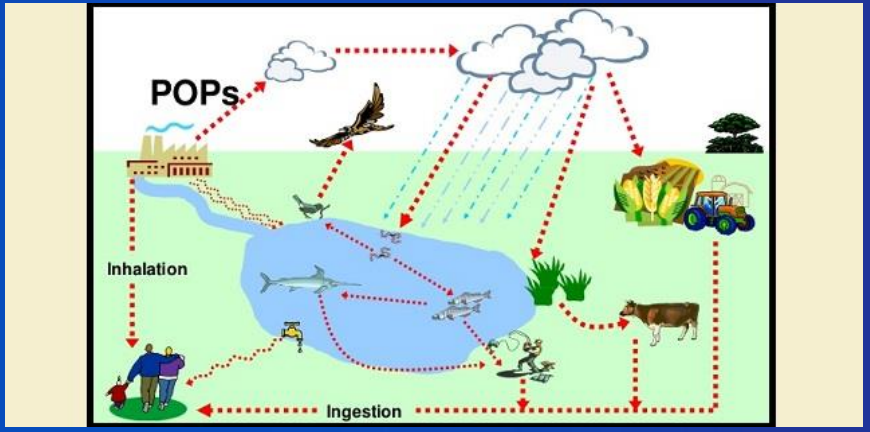
- Human exposure comes through animal products

Perchlorates

Given off by rockets, missiles, and fireworks

Especially common near military testing sites or rocket launch pads

Remain in soil and can leach into groundwater or runoff into surface waters



⚠ **POPs travel long distances through wind & water, impacting ecosystems far away**

Wastewater release from industrial processes, leachate from landfills or improperly buried industrial waste, fertilizer/pesticide production, emissions from burning waste/biomass

Enter soil/water, eaten by animals, stored in their fat, eaten by humans or taken in via drinking water

SUGGESTED SKILL

Concept Explanation

1.B

Explain environmental concepts and processes.

Practice FRQ 8.7

Explain why the release of PCBs into an aquatic ecosystem may have longer-lasting negative impacts on organisms than the release of synthetic nitrates.