The Problem

Environmental challenges are posing an increasing threat to human health and challenge the sustainability of the global resources. While healthy lifestyle choices reduce our risk of chronic disease, if we do not have clean water to drink, clean air to breathe, and uncontaminated land to grow crops and animals on, we cannot survive.

Some of the greatest environmental challenges we face include global warming and climate change; over-reliance on fossil fuels and non-renewable energy sources; polluting our land, water, and air; deforestation and desertification, or the degradation of land. These challenges are daunting but not insurmountable. All of us can adopt responsible environmental practices at home, work, school, and play to help sustain natural resources and restore balance to the environment.

Know the Terms:

1. **Carbon Footprint**: The total set of greenhouse gas emissions caused by an organization, event, product or person.
2. **Ecosystem**: The relationship between physical (nonliving) and biological (living) components of an environment.
3. **Fossil Fuels**: Carbon-based material such as coal, oil, and natural gas, produced by the decomposition of (fossilized) plants and animals.
4. **Greenhouse Gases**: Gases that accumulate in the atmosphere that contributes to global warming by trapping heat near Earth's surface.
5. **Ionizing Radiation**: Radiation that has enough energy to remove tightly bound electrons from atoms, thus creating ions. This is the type of radiation that people usually think of as 'radiation, and is used to generate electric power, kill cancer cells, etc.
6. **Nonionizing Radiation**: Radiation that has enough energy to move atoms in a molecule around or cause them to vibrate, but not enough to remove electrons; examples include sound waves, visible light, and microwaves.
7. **Nonpoint Source Pollutants**: Contaminants picked up from broad areas of land as water from rainfall and snowmelt flows over and through the landscape.
8. **Outgassing**: Also referred to as offgassing, is the release of a gas that was dissolved, trapped, frozen, or absorbed in some material. Term is often used in reference to indoor air quality.
9. **Ozone**: Gas composed of 3 atoms of oxygen; found in two regions of the earth's atmosphere; at ground level and in the upper regions of the atmosphere.
10. **Particulates**: Tiny subdivisions of solid matter suspended in gas or liquid.
11. **Pesticides**: Chemical compounds that “kill pests”, such as insects or rodents.
12. **Point Source Pollutants**: A single identifiable source of air, water, thermal, noise, or light pollution.
13. **Pollutant**: Any agent or substance that contaminates some aspect of the environment, and has the potential to harm living organisms.
14. **Radon**: Naturally occurring radioactive gas (colorless, odorless, tasteless) resulting from the decay of certain radioactive elements.
15. **Sustainability**: To maintain, support, or endure; to meet the needs of the present without compromising the ability of future generations to meet their own needs.
Environmental Health: Basic Training

1. Basics Defined:
   o Pollution:
     ▪ Pollution is the introduction of a contaminant into the environment.
     ▪ It is created mostly by human actions, but can also be a result of natural disasters.
     ▪ Pollution has a detrimental effect on any living organism in an environment, making it virtually impossible to sustain life.
   o Point Source Pollutants:
     ▪ Point source of pollution is a single identifiable source of air, water, thermal, noise or light pollution.
   o Non-Point Source Pollutants:
     ▪ Nonpoint source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification, where there is no single identifiable source.
     ▪ The term "nonpoint source" is defined to mean any source of water pollution that does not meet the legal definition of "point source" in section 502(14) of the Clean Water Act.
   o Greenhouse Gases:
     ▪ Gases that trap heat in the atmosphere are called greenhouse gases.
     ▪ Carbon dioxide is the most predominant and harmful of the greenhouse gases.
     ▪ Many greenhouse gases occur naturally in the atmosphere, such as carbon dioxide, methane, water vapor, and nitrous oxide, while others are synthetic.
     ▪ Those that are man-made include the chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs) and Perfluorocarbons (PFCs), as well as sulfur hexafluoride (SF6).
     ▪ Atmospheric concentrations of both the natural and man-made gases have been rising over the last few centuries due to the industrial revolution.
   o Global Warming:
     ▪ Global warming refers to the recent and ongoing rise in average global temperature near the earth's surface.
     ▪ Referred to as the enhanced greenhouse effect, it is caused by increased concentrations of greenhouse gases in the atmosphere trapping excess solar heat near the earth's surface.
     ▪ Global warming is changing global climate patterns. However, global warming itself represents only one aspect of climate change.
   o Climate Change:
     ▪ Climate change refers to any significant change in the measures of climate lasting for an extended period of time.
     ▪ Climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer.
     ▪ In recent years, rising global temperatures have been accompanied by changes in weather and climate.
       ▪ Many locations have seen changes in rainfall, resulting in more floods, droughts, or intense rain, as well as more frequent and severe heat waves.
       ▪ The planet's oceans and glaciers have also experienced some big changes as oceans are warming and becoming more acidic, ice caps are melting, and sea levels are rising.
       ▪ As these and other changes become more pronounced in the coming decades, they will likely present challenges to our society and our environment.
   o Sustainability:
     ▪ Sustainability refers to our ability as people to live a quality life without sacrificing the natural resources that future generations will depend on.
     ▪ Sustainable growth meets present-day needs without compromising the ability of future generations to meet their needs (WECD, 1987).
     ▪ As a Community, sustainability is about balancing economic prosperity and population growth with resource conservation.
o **Ecological Footprint:**
  - An Ecological Footprint is a measure of load that a given population places on the earth to meet its resource consumption and waste disposal needs.
  - A calculated measure of human demand on the Earth's ecosystems; i.e. a standardized measure of demand for natural resources that may be contrasted with the planet's ecological capacity to regenerate.

o **Carbon Footprint:**
  - Your carbon footprint is the total amount of greenhouse gases produced by human activities, and is measured in units of carbon dioxide.
  - Carbon footprint differs from ecological footprint as it focuses strictly on the greenhouse gases released due to burning of fossil fuels, and not the total resources people consume with the land and water area.

2. **Global Environmental Issues:**
   o **Over-Population:**
     - Experts agree that slowing current population growth worldwide is the number one environmental challenge of today.
     - If current birthrates continue, the world's population will grow to 9.4 billion by 2050, and to 11.5 billion by 2150.
     - The human population is living far beyond its means and is inflicting damage on the environment that may already be irreparable.
       - Changes in the ecosystem are resulting in mass destruction of many species.
       - Food shortages and famine are occurring in many regions of the world with increasing frequency.
       - The per capita availability of freshwater is declining rapidly.
       - The predominant energy source for the the growing population is fossil fuels, rapidly increasing the carbon footprint of global populations.
     - Major difficulties loom unless we take action to change our current rate of population growth and our consumption of natural resources.
       - Zero Population Growth:
         - Some countries have enacted strict population control measures or have encouraged their citizens to limit the size of families.
         - Zero population growth encourages each couple to produce no more than two offspring.
         - Education may be the single biggest contributor to zero population growth.
   o **Climate change:**
     - The United States is the second largest emitter, after China, of carbon dioxide from the burning of fossil fuels.
     - The energy policy of the United States is widely debated; many call on the country to take a leading role in fighting global warming.
     - The U.S. is one of only two countries that has not signed up to the Kyoto Protocol.
       - The Kyoto Protocol is an international treaty intended to bring countries together to reduce global warming and to cope with the effects of temperature increases caused by 150 years of industrialization.
       - The goal of the Kyoto Protocol is to reduce worldwide greenhouse gas emissions to 5.2 percent below 1990 levels between 2008 and 2012.
   o **Air Pollution:**
     - Air pollution is a mixture of natural and man-made substances in the air we breathe such as fine particles produced by the burning of fossil fuels, ground-level ozone, which is a reactive form of oxygen that is a primary component of urban smog, and noxious gases such as sulfur dioxide, nitrogen oxides, carbon monoxide, and chemical vapors.
     - The health effects of air pollution have been reported in research studies over the past 30 years.
       - These effects include respiratory diseases such as asthma, cardiovascular diseases, changes in lung function, and death.
       - There is mounting evidence that exposure to air pollution has long-term effects on lung development in children.
• **Geographically air pollution** (including smog) tend to form in areas that experience temperature inversions such as valley locations.
  - Weather condition where cool air is trapped under a layer of warm air preventing air from recirculating.
• **Most experts agree** that the only effective way to reduce air pollution is the reduction of fossil fuel use in automobiles.
  - Shifting to alternate sources of fuels, improving gas mileage, and using mass transit are crucial to air pollution reduction.
• **The Clean Air Act of 1970**, amended in 1977 and 1990, developed standards for six of the most widespread air pollutants that seriously affect health.
  - Sulfur dioxide is a yellowish-brown gas that is a by-product of burning fossil fuels.
  - Particulate pollution refers to a mix of very tiny solid or liquid particles in the air we breathe.
  - Carbon monoxide (CO) is an odorless, colorless gas that is a byproduct of combustion, such as motor vehicle emissions.
  - Nitrogen dioxide is a gas emitted by coal-powered electrical utility boilers and by motor vehicles.
  - Ground-level ozone is a form of oxygen produced when nitrogen dioxide reacts with hydrogen chloride.
  - Carbon dioxide (CO²) is a principle component of emissions from internal combustion engines; it is the most prominent greenhouse gas and the major culprit in global warming.
• **Air Quality Index:**
  - Measured daily, the air quality index (AQI) is a number used by government agencies to communicate to the public the current and forecasted air pollution levels.
• **Indoor Air Pollution:**
  - Because people in industrialized countries spend as much of 80% to 90% of their time indoors, indoor air pollution has been ranked as one of the world's greatest public health risks.
  - Recent studies indicate that the air within homes and other buildings can be 10 to 40 times more hazardous than outdoor air.
  - Sources of indoor air pollution include tobacco smoke, woodstoves, poorly ventilated furnaces, and chemicals in interior fabrics and glues.
  - The EPA recommends three strategies for reducing indoor air pollution:
    - Controlling sources of pollution,
    - Ventilating adequately
    - Cleaning or filtering indoor air.
• Can houseplants help indoor air quality?
  - Recent studies conducted by NASA, scientists have identified 50 houseplants that remove many of the pollutants and gases found indoors, including:
    - Aloe, Snake plant, Spider plant, Golden pothos, Gerber daisy, Chrysanthemum, to name a few.
• **Sources of Indoor Air Pollution:**
  - Environmental tobacco smoke is the great source of indoor air pollution.
  - Woodstoves emit significant levels of particulates, carbon monoxide, and other pollutants.
  - Asbestos fibers in the air lead to many serious health problems, including cancer.
  - Formaldehyde is a colorless, strong-smelling gas in some carpets, draperies, wood paneling, countertops, adhesives, and furniture
    - Especially prevalent in new homes.
  - Radon is an odorless, colorless gas that penetrates homes through cracks, pipes, and other openings in the basement or foundation; it can cause lung cancer and other respiratory problems.
  - Lead is a metal pollutant found in paint, batteries, drinking water, pipes, dishes, and other items.
  - Molds produce tiny spores that many people are allergic to.
Water and Marine Pollution:

- Each U.S. resident uses three times more water each day than the world average.
- The availability and quality of water for use by humans, plants, and animals is affected by the increasing demand for water and increasing pollution of our oceans, lakes, rivers, and streams.
- Run-off from farms and paved surfaces, effluent from factories and power plants—all contribute to pollution of groundwater and surface water.
- This pollution makes its way to the oceans, where, added to overfishing and effects of climate change, is altering the health of the ocean biota (organisms of a geographic region) and marine resources.
- Awareness of these changes and their consequences is crucial if we are to protect this most precious natural resource.
- Among the pollutants causing the most concern and the greatest potential harm are:
  - Petroleum products and gasoline
  - Chemical contaminants
  - Polychlorinated biphenyls (PCBs)
  - Pesticides
  - Dioxins
  - Lead

Land Pollution:

- Changes in land-use patterns are impacting microenvironments across the globe.
- Industrial-scale agriculture typically leads to loss of biodiversity and increased use of fertilizers.
- Sprawling urban growth takes over lands once used for traditional agriculture and fragments wildlife habitats, affecting the biodiversity of the surrounding ecosystem.
- Conversion of pervious to impervious surfaces such as pavement, parking lots, and rooftops—increases how much stormwater flows into sewers and surface waters, carrying with it heavy metals, oil, grease, and pesticides.
- Sustainable land use practices can help resolve these environmental problems.

Solid Waste:

- Strategies to control the growth of MSW include:
  - Source reduction of solid waste.
  - Recycling
  - Composting
  - Waste to energy combustion

Hazardous Waste:

- The 1980 Superfund was enacted to provide funds for cleaning up chemical dump sites that endanger our health and our land.
- The EPA has taken action to manage hazardous waste by monitoring generation, transportation, storage, treatment, and final disposal.

Radiation and Nuclear Pollution:

- Nuclear Power Plants:
  - The routine health risks and greenhouse gas emissions from nuclear fission power are small relative to those associated with coal, but there are "catastrophic risks"

- Nonionizing Radiation:
  - Radiation that has enough energy to move atoms in a molecule around or cause them to vibrate, but not enough to remove electrons, is referred to as "non-ionizing radiation."
  - Examples of this kind of radiation are sound waves, visible light, microwaves, and cell phones.
  - Cell phone use:
    - The World Health Organization (WHO) recently listed mobile phone use in the same carcinogenic (cancer causing) hazard category as lead, engine exhaust, and chloroform.
    - A team of 31 scientists from 14 countries, including the United States, made the decision after reviewing peer-reviewed studies on cell phone safety.
The team found enough evidence to categorize personal exposure as "possibly carcinogenic to humans."

- Ionizing Radiation:
  - This type of radiation contains enough electromagnetic energy to strip atoms and molecules from the tissue and alter chemical reactions in the body.
  - Examples include Gamma rays, X-rays, and nuclear power plants.

Other Environmental Issues:

- Deforestation
  - Deforestation is the clearing of earth’s forests on a massive scale, often resulting in damage to the quality of the land.
  - Forests still cover about 30 percent of the world’s land area, but swaths the size of Panama are lost each and every year.
  - The world’s rain forests could completely vanish in a hundred years at the current rate of deforestation.

- Energy Conservation and Alternative Energy Production:
  - Energy conservation and production refers to efforts made to reduce energy consumption and the development of renewable energy sources, such as:
    - Alternative and renewable energy sources such as Biofuel, Biomass, Geothermal, Hydroelectricity, Solar energy, Tidal power, Wave power, and Wind power.
    - Structure insulation
    - High efficiency lighting and machinery.

- Conservation:
  - Habitat conservation is a land management practice that seeks to conserve, protect, and restore habitat areas for wild plants, animals, and birds, especially conservation reliant species.

Talk’n Stats:

- **According to the Green Student U (greenstudentu.com)**

  - **Air Pollution:**
    - Every year in the U.S. factories release over 3 million tons of toxic chemicals into the land, air and water. This hazardous waste causes us to lose over 15 million acres of land every year, it leads to respiratory complications and other health problems and it makes our rivers and lakes too polluted for us to swim in and drink.
    - Almost 232 million different types of vehicles are driven by U.S. citizens every day, adding greenhouse gases into the air.
    - U.S. vehicle emissions contribute 45% to global warming.
    - The average adult consumes 3,000 gallons of polluted air every day.
    - Vehicle exhaust contributes to 60% of carbon monoxide emissions in the U.S. and up to 95% in large cities.
    - Every year 335,000 Americans die of lung cancer, a direct result of air pollution.

  - **Water Pollution:**
    - Over two-thirds of U.S. estuaries and bays are severely degraded because of nitrogen and phosphorous pollution.
    - Every year almost 25% of U.S. beaches are closed at least once because of water pollution.
    - Over 73 different kinds of pesticides have been found in the groundwater that we eventually use to drink.
    - 1.2 trillion gallons of sewage, stormwater and industrial waste are discharged into U.S. waters every year.
    - 40% of U.S. rivers are too polluted for aquatic life to survive.
    - Americans use over 2.2 billion pounds of pesticides every year, which eventually washes into our rivers and lakes.

  - **Land Pollution:**
    - Every year one American produces over 3285 pounds of hazardous waste.
    - Land pollution causes us to lose 24 billion tons of top soil every year.
• Americans generate 30 billion foam cups, 220 million tires and 1.8 billion disposable diapers every year
• We throw away enough trash every day to fill 63,000 garbage trucks
• Every day Americans throw away 1 million bushels of litter out their car window
• Over 80% of items in landfills can be recycled, but they’re not.

• America’s Troubled Waters, a report by US Public Interest Research Groups (U.S. PIRG), cites the following statistics regarding the state of America’s waterways:
  o Approximately 39% of our rivers, 46% of our lakes, and 51% of our estuaries are still too polluted for safe fishing or swimming.
  o Pollution caused nearly 20,000 beach closings in 2004, the highest level in 15 years.
  o In 2004, 31 states had statewide fish consumption advisories in place because of toxic pollution.

• According to American Rivers and the website healthyrivers.org:
  o Eighty percent of streams contain insecticides, drugs, or other chemicals.
  o During 2002 and 2003, in just Wisconsin, Iowa, Minnesota and Missouri, pollution in rivers and streams killed 3.5 million fish.
  o The number of miles of rivers containing fish that may be harmful to your health due to pollution, increased from 2% to 14% from 1993 to 2001.
  o Waterborne germs and parasites cause an estimated 7.1 million mild-to-moderate cases of infectious disease in the U.S. annually.
  o Every year more than 1.2 trillion gallons of untreated sewage, storm water and industrial waste are discharged into U.S. waters.
  o The EPA warns that sewage levels in our rivers could be back to 1970s levels by the year 2016.

Know Your Numbers:

Reducing Your Pollution Numbers:

How to Prevent Air Pollution:

• Walk or bike more and drive less; this is the number one way to prevent fossil fuels from polluting the air.
• Carpool or join a ride share with friends and coworkers
• Keep your car maintenance up-to-date and maintain a clean air filter.
• When driving accelerate slowly and use cruise control when possible.
• If you have to drive, do your errands at one time.
• Avoid buying products that come in aerosol spray cans, use pump sprayers or go sprayless.
• Avoid using lighter fluid when barbecuing outside.
• Limit fireplace use, especially wood.
• Use a push or electric lawnmower rather than a gas-powered one
• Don’t use harsh chemical cleaners that can emit fumes
• Inspect your gas appliances and heaters regularly
• Avoid Smoking (cigarettes, cigars, pipes, etc)

How to Prevent Land Pollution:

• Follow the 3 R’s in Thoughts for Living below.
• Buy biodegradable products.
• Store all liquid chemicals and waste in spill-proof containers.
• Shop for, and buy organic foods that are grown without pesticides.
• Don’t use pesticides or chemical fertilizers.
• Use a drip tray to collect engine oil.
• Buy products that have the least amount of packaging.
• Don’t dump motor oil or gasoline on the ground.
How to Prevent Water Pollution:

- Avoid using pesticides and fertilizers that can run off into water systems
- Sweep your driveway instead of hosing it down
- Use non-toxic and biodegradable cleaning products.
- Clean up oil and other liquid spills with kitty litter or sawdust, sweet them up, and dispose of properly.
- Avoid cleaning paint brushes or pads in the sink
- Wash your car far away from city storm-water drains
- Don’t throw chemicals, solvents, or petroleum products into sewer drains.
- Have your septic system inspected every 3-5 years.

Thoughts for Living:

An Ecological Footprint is a measure of load that a given population places on the Earth to meet its demands for resource consumption and waste disposal. The more a population (a county, a city, or even a family) can reduce their impact, the "shallower" their footprint will be. Practicing the Three R's will reduce your Ecological Footprint, and is an essential step toward a safer, more health-friendly environment. Reduce how much you use, Reuse what you can, then Recycle the rest. If disposal is the only option, do so in an environmentally friendly way.

- Reduce:
  - Buy permanent items instead of disposables.
  - Buy and use only what you need.
  - Buy products with less packaging.
  - Buy products that use less toxic chemicals.
  - Remove your name from the mailing lists of materials you no longer want to receive: write to Mail Preference Service, c/o Direct Marketing Assoc., P.O. Box 90008, Farmingdale, NY 11735.
  - Buy a home water filter or filtration system to reduce water bottles (plastic).

- Reuse:
  - Repair items as much as possible.
  - Use durable coffee mugs.
  - Use cloth napkins or towels.
  - Clean out juice bottles and use them for water.
  - Use empty jars to hold leftover food.
  - Reuse boxes.
  - Purchase refillable pens and pencils.
  - Participate in a paint collection and reuse program.
  - Donate extras to people you know or to charity instead of throwing them away.

- Recycle:
  - Recycle paper (printer paper, newspapers, mail, etc.), plastic, glass bottles, cardboard, and aluminum cans. If your community doesn't collect at the curb, take them to a collection center.
  - Recycle electronics.
  - Check collection centers and curbside pickup services to see what they accept, and begin collecting those materials. These can include metal cans, newspapers, paper products, glass, plastics and oil.
  - Compost food scraps, grass and other yard clippings, and dead plants.
  - Bring your own bags to the grocery store, either cloth, or the bags used from a previous shopping visit.
  - Close the loop - buy recycled products and products that use recycled packaging. That's what makes recycling economically possible.