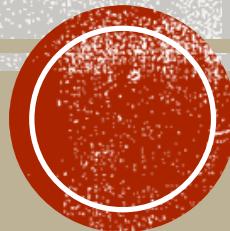




United States Department of Agriculture

Current Issue of 2022:

# WASTE TO RESOURCES



# **THERE WILL BE 3 KEY TOPICS COVERED**

**Landfills and  
Hazardous Materials**



**Reuse, Recycling and  
Waste Treatment**



**Composting and Food  
Waste**



# KEY TOPIC 1: LANDFILLS AND HAZARDOUS MATERIALS

- Describe different types of landfills and explain how they are regulated.
- Identify examples of hazardous materials and toxic substances.
  - how to properly dispose and handle them



# **FOR STARTERS - WHAT IS A LANDFILL?**



- Strictly managed facilities where solid waste is disposed of.
- There are many federal regulations that dictate a landfills location, how it is operated, and what monitoring systems need to be in place.



# **WHY DO LANDFILLS NEED TO BE MONITORED?**

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- There are two main hazards caused by solid waste landfills:
  1. Leachate: This is when water has percolated through a solid and now contains small compounds of that material as it leaks out. This creates a toxic liquid that can contaminate nearby soils, groundwater, and waterways.
  2. Methane, carbon dioxide, and hydrogen sulphide: These are known as “landfill gases” and are caused by the decomposition of landfill materials. These can contribute to greenhouse gases, they can be toxic (even in low concentrations), can damage plant life, and some pose a risk for severe explosions within the landfill.



# **MAIN 3 TYPES OF LANDFILLS**

- **Municipal Solid Waste (MSW) Landfill:** Receives household waste and other nonhazardous waste.
- **Industrial Waste Landfill:** Receives coal combustion residue or construction and demolition debris.
  - Ex: concrete, lumber, metal, bricks, and asphalt.
- **Hazardous Waste Landfill:** Specifically used for hazardous and toxic substances.



# REGULATIONS FOR LANDFILLS

- In NYS the Department of Environmental Conservation (DEC) is the agency in charge of regulating landfills. They regulate everything from how the landfill is built to the monitoring systems in place once it is functional.



- Landfills are built on top of a liner. The minimum liner required for an MSW landfill is a double composite liner with primary and secondary leachate collection and removal system.



# REGULATIONS FOR LANDFILLS

- Monitoring wells are designed and installed to track groundwater flow and water quality below the surface of a solid waste facility.
- The buildup of landfill gases can pose safety risks for nearby residents and structures. At smaller landfills, a gas venting layer allows for the effective collection and dispersion of landfill gas. At larger landfills, the gas is often actively collected and either burned in flares or utilized in Landfill Gas-to-Energy projects.
- Materials entering landfills are placed in specific layers to ensure regulations are being met. This includes multiple plastic liners, clay layers to reduce permeability, and layers of sand or gravel with piping to collect gases or leachate.



# WHAT IS A HAZARDOUS WASTE?

- Hazardous waste is defined as any waste that has the potential to be dangerous or harmful to the environment or to human health.
- Pesticides/herbicides
- Fluorescent light bulbs
- Mercury-containing batteries
- Medical waste
- Wastewater Treatment Sludge
- Wood-preserving waste
- Paints
- Metal finishing waste



# **HAZARDOUS WASTE TRANSPORTATION**

- Transportation companies are responsible for moving hazardous materials from where they are produced to where they will be stored or disposed of.
- Each company will receive an Environmental Protection Agency (EPA) tracking ID number.
- A log is maintained that tracks the companies/individuals in charge of transporting or storing the hazardous material.



# HAZARDOUS WASTE TREATMENT AND STORAGE

- Treatment: Some processes allow for the waste to be reused while others significantly reduce the amount or toxicity of the hazardous waste.
- Storage: Hazardous waste is often stored before it can be treated or disposed of, this must be done in regulated containers that follow specific requirements.



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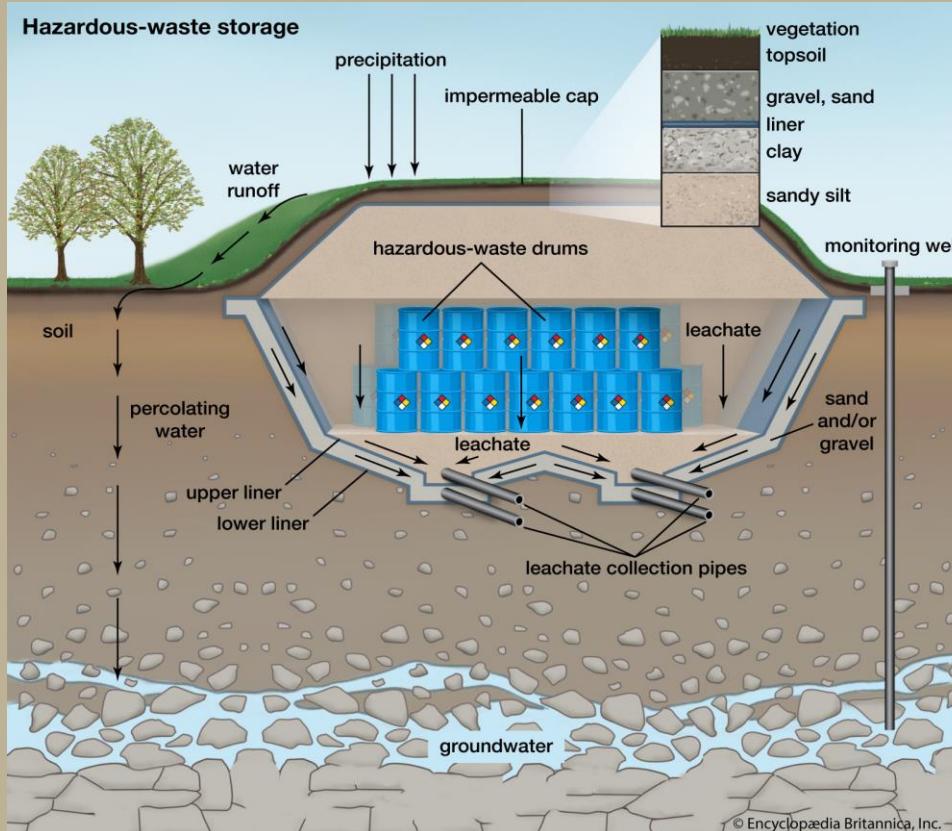


# HAZARDOUS WASTE DISPOSAL

- Landfills: An engineered location created for the purpose of disposing of non-liquid hazardous waste. These are above ground, but the waste is often covered by another material such as dirt.
- Surface Impoundments: Topographic depressions or man-made excavation sites created to store liquid hazardous waste. These are below ground and are completely sealed off.



# EXAMPLES OF DISPOSAL SITES



Surface Impoundment



Hazardous Waste Landfill in Oregon planning an expansion



# CHAUTAUQUA COUNTY LANDFILL AND WASTE TRANSFER STATIONS

- **Waste Transfer Station:** This is where municipal solid waste is sorted and temporarily held before going to the landfill.
- Transfer stations have scheduled hours for the public, while the landfill is commercial only.
- There are household hazardous waste drop off events scheduled for residents every few months throughout the year.



# **KEY TOPIC 2: REUSE, RECYCLING AND WASTE TREATMENT**

- Explain how the practice of reusing or recycling products conserves natural resources.
- Describe how recycled materials can be repurposed and further diverted from landfills.
- Explain how waste can be repurposed?
- Identify examples of closed loop energy system facilities.
- Compare methods of carbon sequestration and describe its potential as an energy source.
- Evaluate the differences between municipal waste treatment and home sewage treatment systems.



# **HOW REUSING OR RECYCLING CAN HELP CONSERVE NATURAL RESOURCES**

- Humans are using resources faster than they can be replenished, meaning every year we have fewer resources available.
- Recycling and reusing will help reduce the strain on our natural resources by using them at a slower rate.
- Sustainable practices ensure that future generations will have the resources that they will need.
- Reduces the amount of waste entering incinerators and landfills, both of which release greenhouse gases that contribute to climate change.
- This also means that less waste would result in a decrease in space needed for landfills.



# HOW REUSING OR RECYCLING CAN HELP CONSERVE NATURAL RESOURCES

- The collection, transportation, and processing of raw materials generally consumes more energy than recycling does.
- Reusing materials lowers the amount of mining, logging, and other processes that can be harmful to the environment.



Deforested land



Active mine

# WHAT'S THE DIFFERENCE?

- Recycling: This refers to turning an item back into the raw materials in which it was made from. After this we can create the same object all over again or entirely new object. This consumes more energy than repurposing or reusing.
- Repurposing or Reusing: There is no need to break down the item when repurposing or reusing. This is simply using an object over and over again for it's intended purpose or using it in a creative way for a new purpose.



# HOW CAN WASTE BE REPURPOSED?

## Reusing examples:

- Ex: You're at a thrift store and find an old ladder. You can take it home and continue using it as a ladder or repurpose it into an antique shelf.



## Recycling examples:

- Glass bottles being broken down and recycled to create more glass bottles, or being made into other glass objects such as windows or picture frame panels.
- Metal cans are generally made from steel and tin, these are separated during the recycling process. These metals can then be found in items such as appliances, bike parts, and even car parts.



# RECYCLING FACTS

- One ton of recycled paper saves around 17 trees, 7000 gallons of water, and 3.3 cubic yards of landfill space.



- Using aluminum from recycled aluminum cans takes only about 5% of the energy that's typically used when creating aluminum from bauxite (sedimentary rock aluminum is made from).
- Recycling one glass bottle will save enough electricity to power a 100-watt light bulb for about 4 hours.



# RECYCLING FACTS

- Recycling one ton of cardboard can save around 46 gallons of oil.
- In America, every hour an estimated 2.5 million plastic bottles are thrown away.
- A plastic bag can take up to 1,000 years to decompose, and Styrofoam will never decompose.
- Glass and aluminum can be recycled endlessly without losing quality.

- Enough trash is thrown away by Americans every year that it could circle the Earth 24 times.
- A recycled aluminum can has the potential to be back on a store shelf as a new can in as little as 60 days.



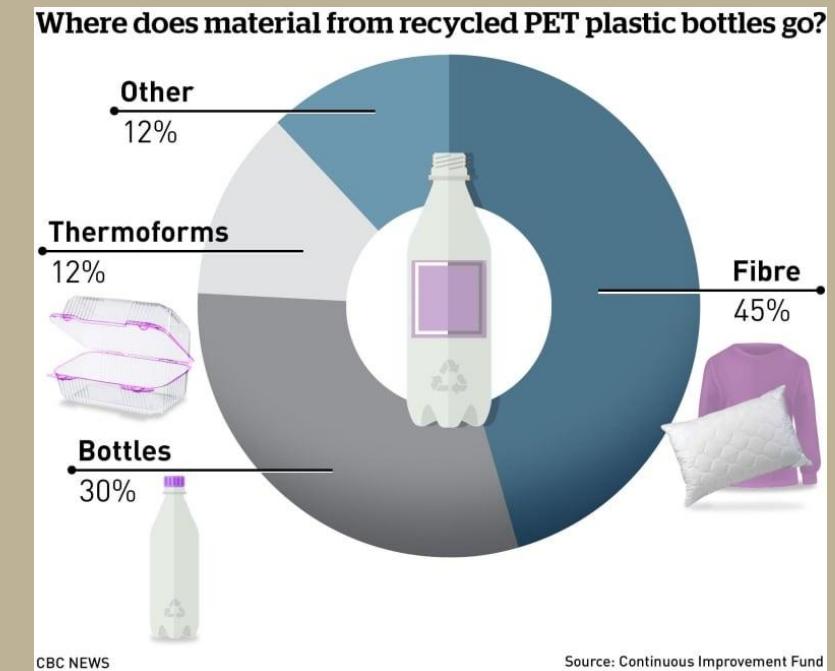
# **WHAT HAPPENS TO A PLASTIC BOTTLE AFTER IT'S RECYCLED?**

- In NYS you are charged a 5 cent deposit fee when you purchase certain bottles or cans. This is an incentive to recycle these materials.
- There are 7 different types of recyclable plastics, water and pop bottles are polyethylene terephthalate (PET) which is also known as No. 1 plastic.
- PET is the one plastic that can be continuously recycled.
- Once a bottle has been collected by your waste management agency it will enter a recycling plant that sorts them from other recyclables and packages them into bales.
- These bales will be purchased by another facility that washes the plastic, grinds it up, and sells the recycled PET.



# WHAT HAPPENS TO A PLASTIC BOTTLE AFTER IT'S RECYCLED?

- Most of this plastic is sold as a “fibre” which means it’s turned unto materials such as carpets, pillow stuffing, and even fleece sweaters.
- Why isn’t more of this plastic used to make water or pop bottles again? Bottle-to-bottle recycling uses more energy and financial resources to sufficiently clean material to meet quality and safety requirements.
- The higher quality of PET needed for food and beverage containers tends to be more expensive than using raw plastic that is made from fossil fuels.
- Recycling plastic help reduce the amount of natural resources used, but the real solution is to lower the amount of plastic you purchase.



# WHY DID NEW YORK STATE BAN PLASTIC BAGS?



- These plastic bags are used for a short duration and then end up in a landfill where they will last hundreds or thousands of years.
- The main goal of the plastic bag ban is to reduce the amount of single use plastic being consumed.
- In NYC alone, residents had used more than 10 million plastic bags during 2020 which cost more than \$12 million to dispose of.



# WHY DID NEW YORK STATE BAN PLASTIC BAGS?

- Many plastic bags don't just pack landfills but will also end up littering our environment by polluting roadsides and waterways.
- Even plastics that enter oceans will begin to break down resulting in small particles known as "microplastics". These will begin to harm and kill wildlife by contaminating their food source and building up within their bodies.



# **WHAT IS A CLOSED LOOP ENERGY SYSTEM?**

- A company or business that conserves natural resources by repeatedly using the same materials to make new products.

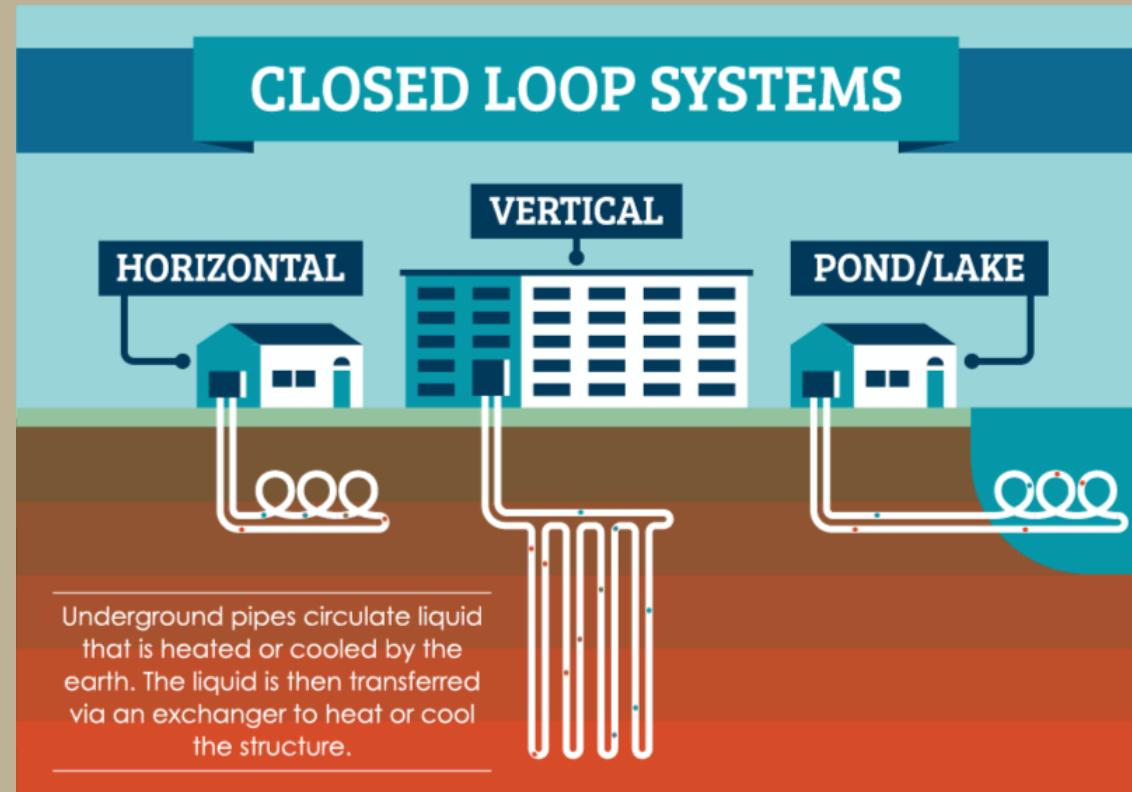
## **Examples:**

- Farmers using composted waste to fertilize crops that will eventually be used to feed the animals.
- Factories reusing fabric from torn or stained clothes to create new shirts or pants.
- Soda companies using recycled aluminum to produce cans for their beverages.



# GEOTHERMAL ENERGY

- This is a type of closed loop energy system.
- Uses the temperature from the Earth's core to generate electricity that will heat or cool a building.
- The water within the pipes is continuously used throughout the heating and cooling process, meaning no new resources are needed to generate the electricity.



# WHAT IS CARBON SEQUESTRATION?

Definition of Sequester: To isolate or hide away.

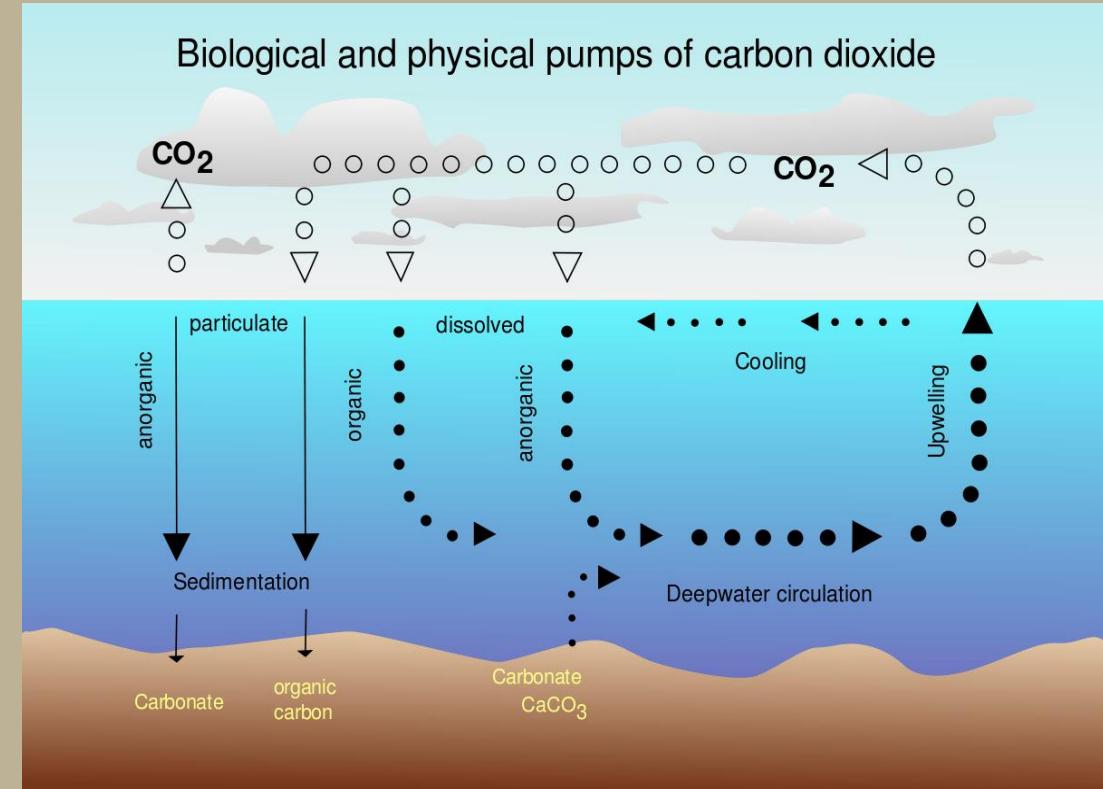
Definition of Carbon Sequestration: The process of capturing and storing atmospheric carbon dioxide, there are 2 main types:

1. **Biological Carbon Sequestration:** The storage of carbon within our soils and oceans, as well as in vegetation such as grasslands and forests.
2. **Geological Carbon Sequestration:** When carbon is stored underground in geological formations and porous rocks.



# BIOLOGICAL CARBON SEQUESTRATION IN THE OCEAN

- The ocean can take in CO<sub>2</sub> as well as release it into the atmosphere.
- The ocean takes in roughly 25% of the annual CO<sub>2</sub> that is emitted from human activities.
- CO<sub>2</sub> can be absorbed in greater quantities in colder and more nutrient rich parts of the ocean, such as the polar regions.
- Most of the global ocean is expected to be CO<sub>2</sub> by the year 2100. This can potentially alter the chemistry of the water and can lower the overall pH, making the ocean more acidic.



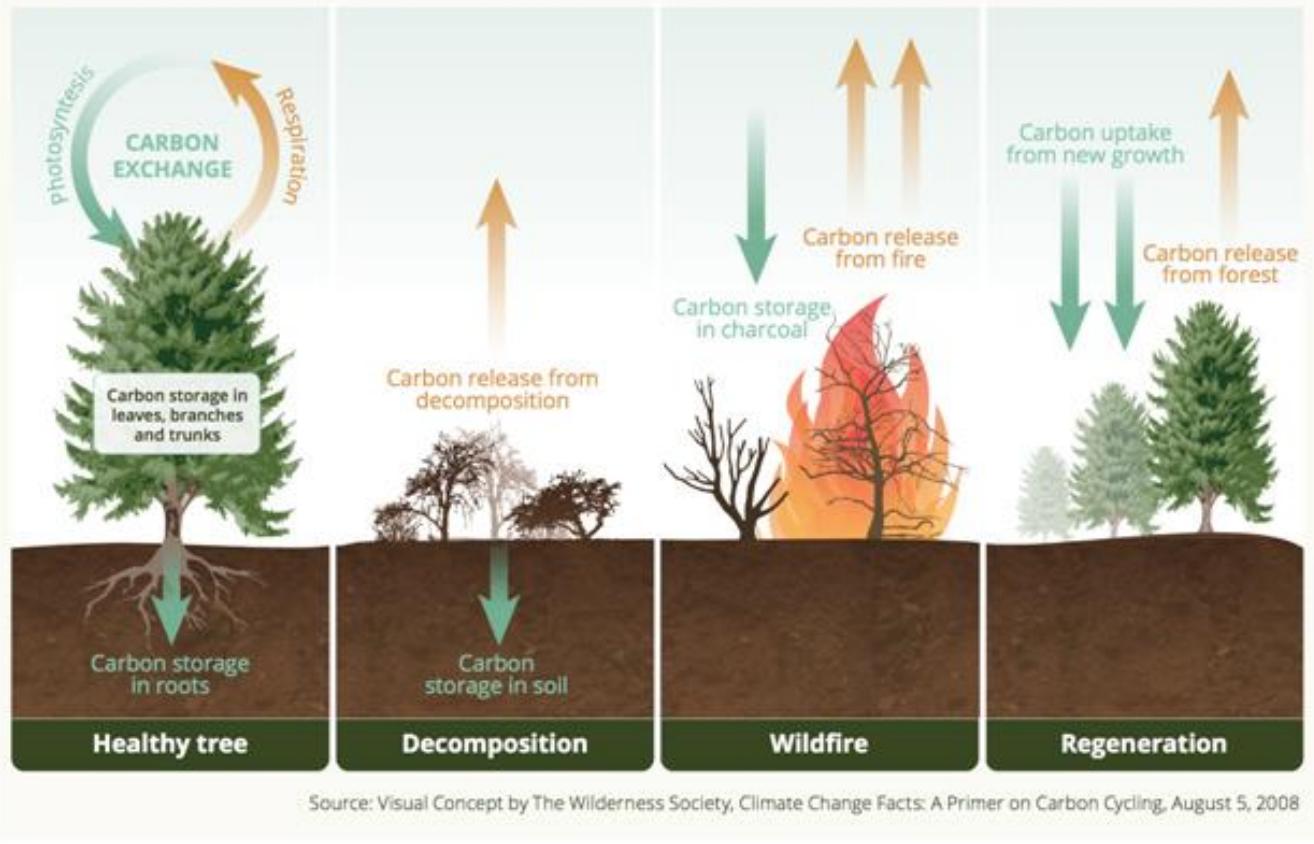
# BIOLOGICAL CARBON SEQUESTRATION IN THE SOIL

- Carbon can be stored in the soil by plants through photosynthesis, this type of carbon is known as soil organic carbon (SOC).
- It can also be stored in the soil as carbonates. Carbonates is the process of CO<sub>2</sub> dissolving in water and percolating throughout soil for thousands of years.
- SOC can store carbon in the soil for several decades while carbonates can store carbon for more than 70,000 years.



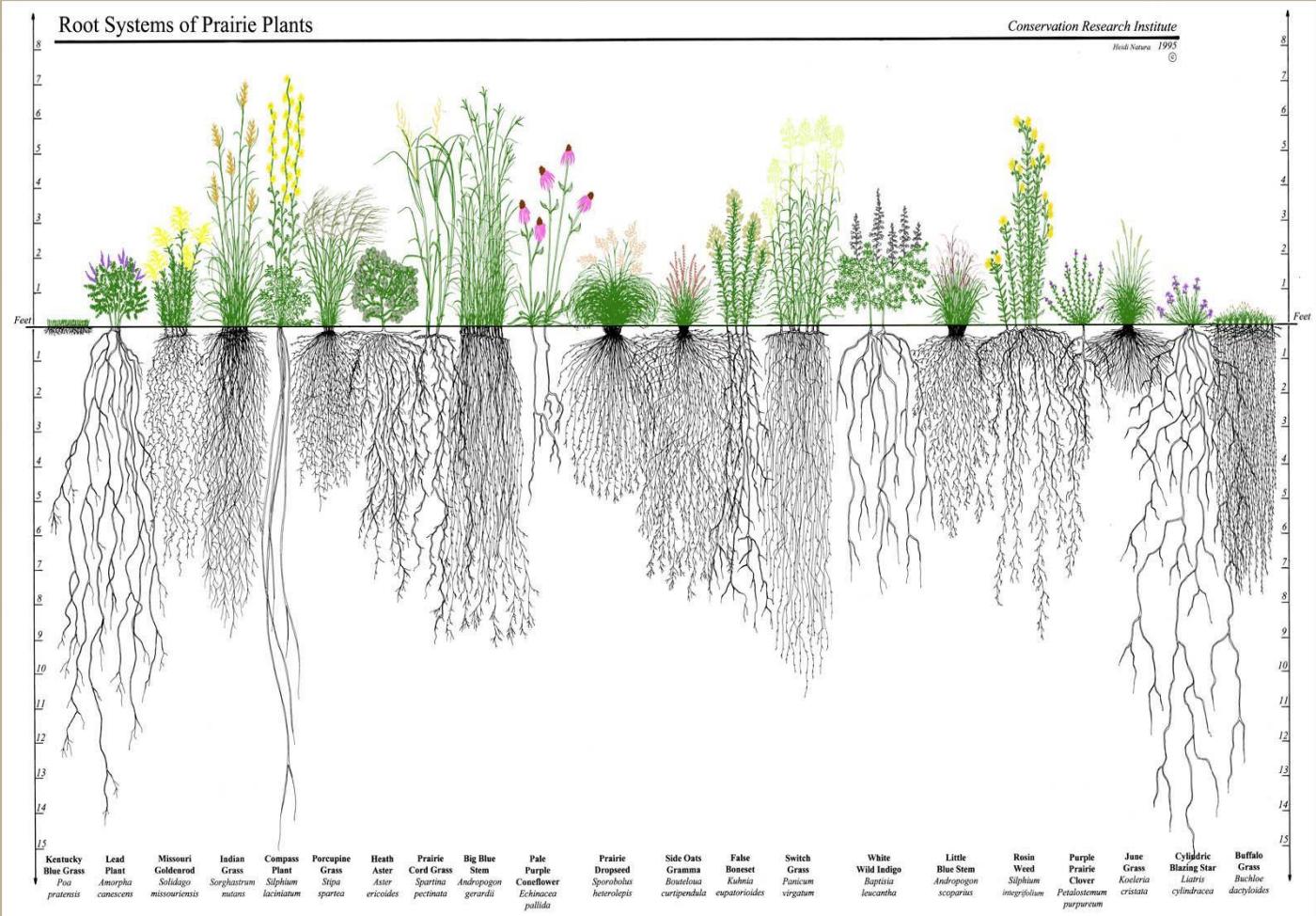
# BIOLOGICAL CARBON SEQUESTRATION IN VEGETATION

Figure 1: Carbon cycles through forests simultaneously in several ways



- Grasslands, rangelands, and forests capture around 25% of global carbon emissions.
- Forests mostly store sequestered carbon in their leaves and woody biomass.
- Grasslands store most of their carbon in the soil and their roots.

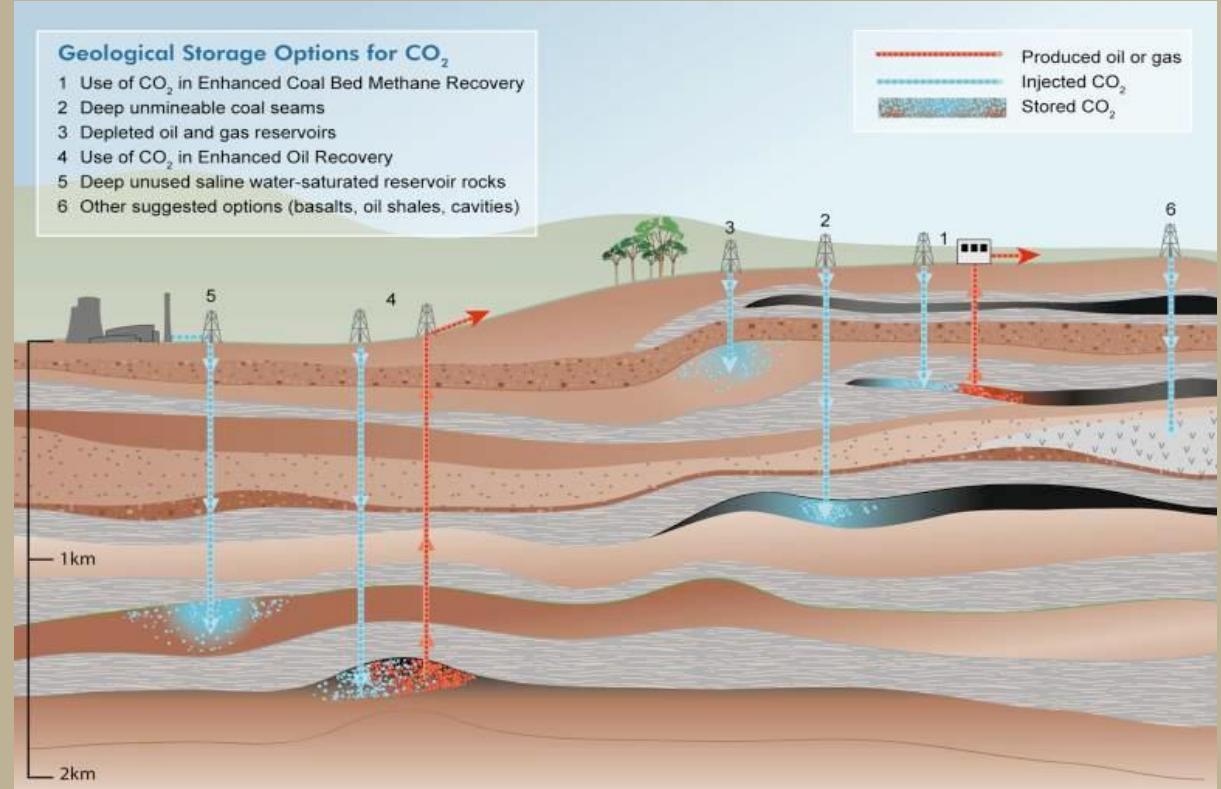
# BIOLOGICAL CARBON SEQUESTRATION IN VEGETATION



- This means that forests can store more carbon than grasslands, but they pose a risk in areas that are prone to wildfires.
- When a forest catches on fire it will release that carbon back into the atmosphere or into the soil, whereas grasslands will burn but the carbon in the roots or soil will not face much impact.

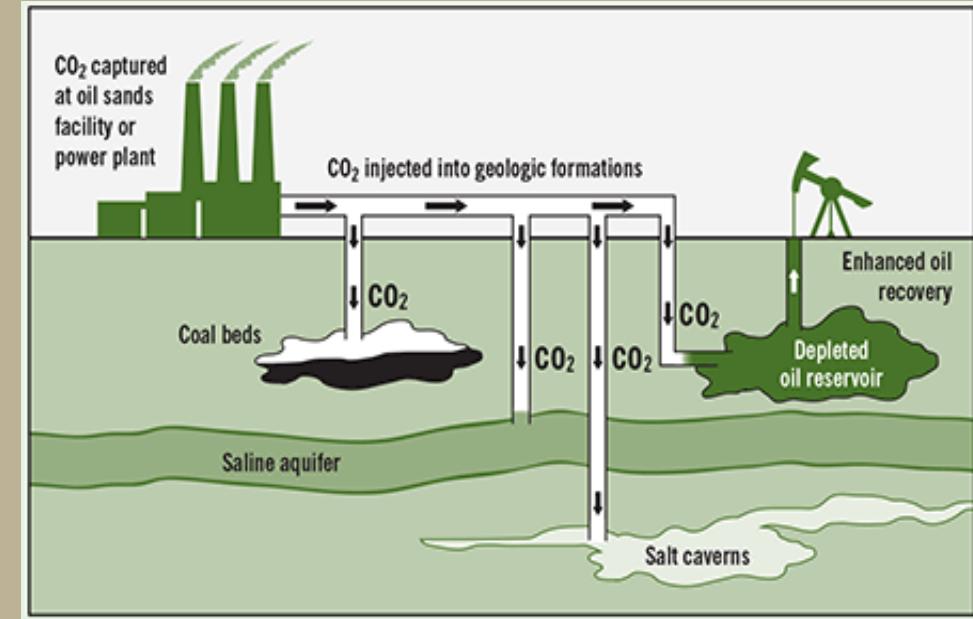
# GEOLOGICAL CARBON SEQUESTRATION

- Unlike biological carbon sequestration, the geological process is conducted by humans.
- This is when we capture carbon from industrial sources and inject it underground where it can be stored in porous rocks.
- These industrial sources are typically power plants, steel and cement production facilities, and natural gas processing facilities.



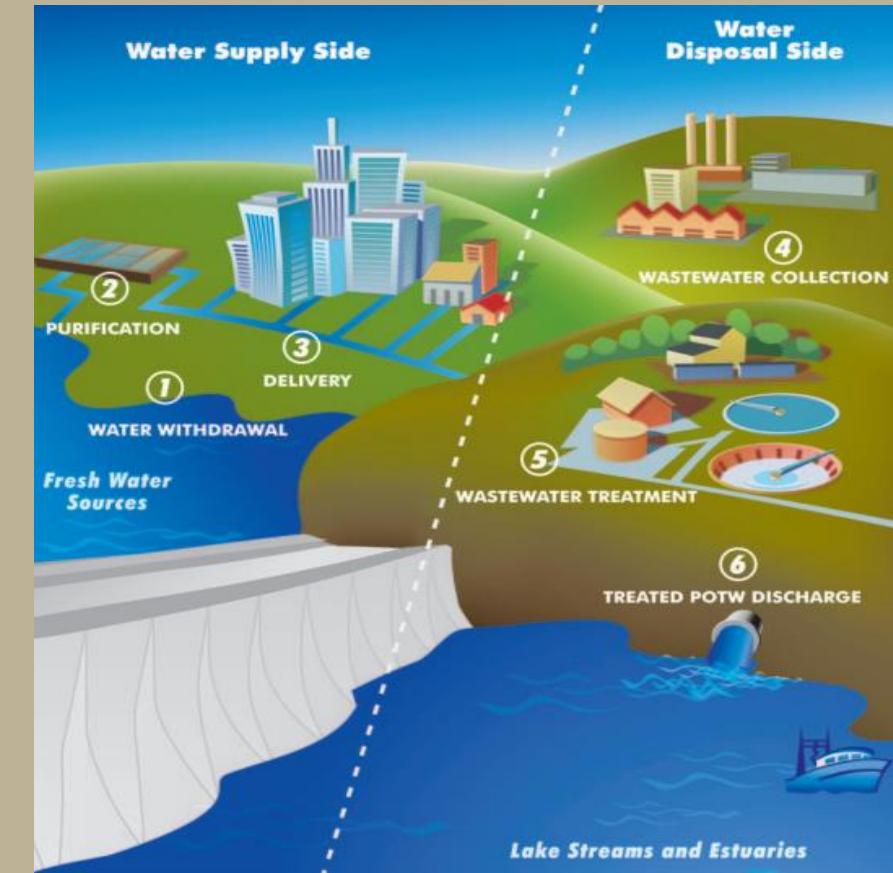
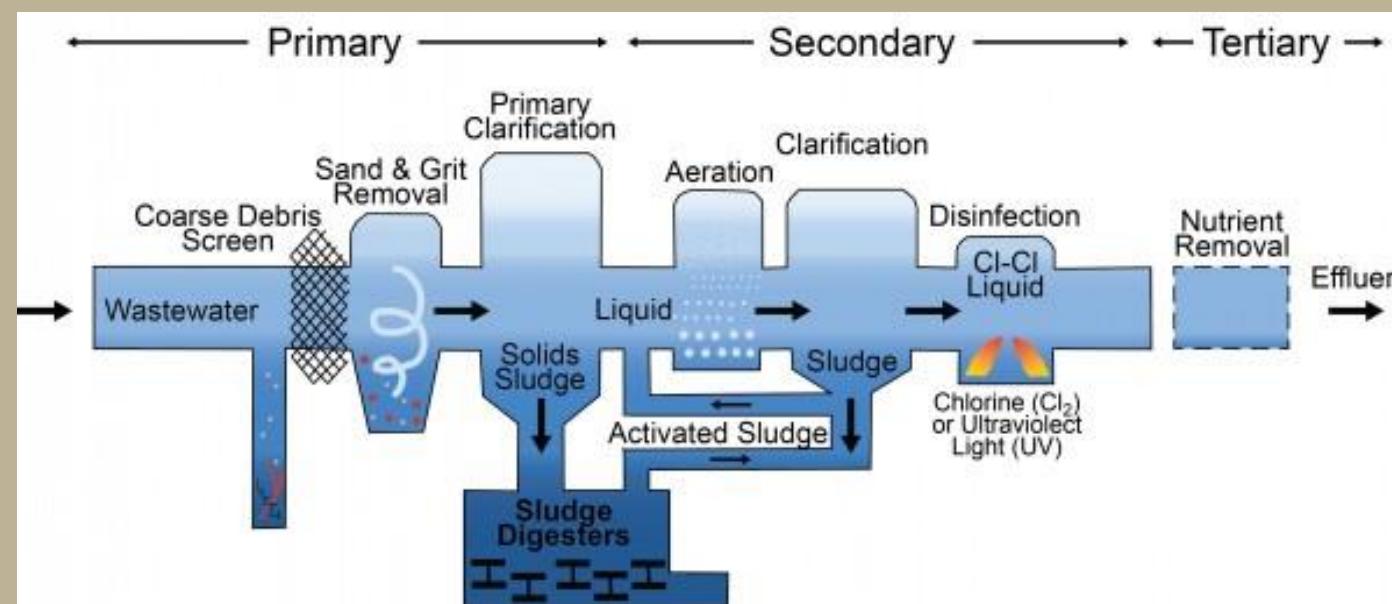
# CARBON SEQUESTRATION AS AN ENERGY SOURCE

- Carbon capture, use, and storage technologies can capture more than 90% of carbon dioxide (CO<sub>2</sub>) emissions from power plants and industrial facilities.
- There are 26 commercial-scale carbon capture projects operating around the world with 21 more in early development.
- For nearly a half century, in a practice called enhanced oil recovery (EOR), carbon dioxide has been used to extract additional oil from developed oil fields in the United States. U.S. companies are also investing in new technologies to re-use captured carbon emissions in innovative ways, including jet fuel and automobile seats.



# MUNICIPAL WASTE TREATMENT

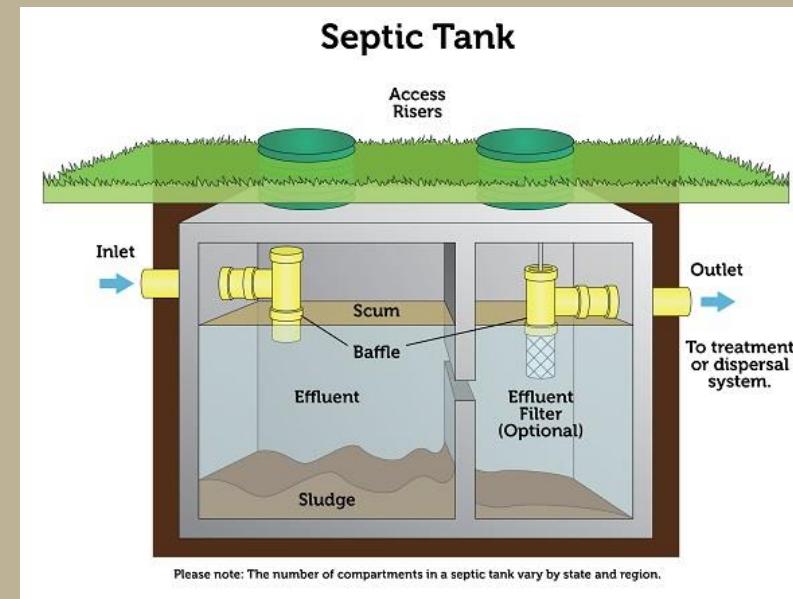
- All the wastewater within a specified area will follow a sewage system that transports the waste to a treatment facility.
- The treatments done at the facility will remove physical, biological, and chemical contaminants from the water.



- Once the water is sufficiently cleaned it will be returned to a body of water or land.

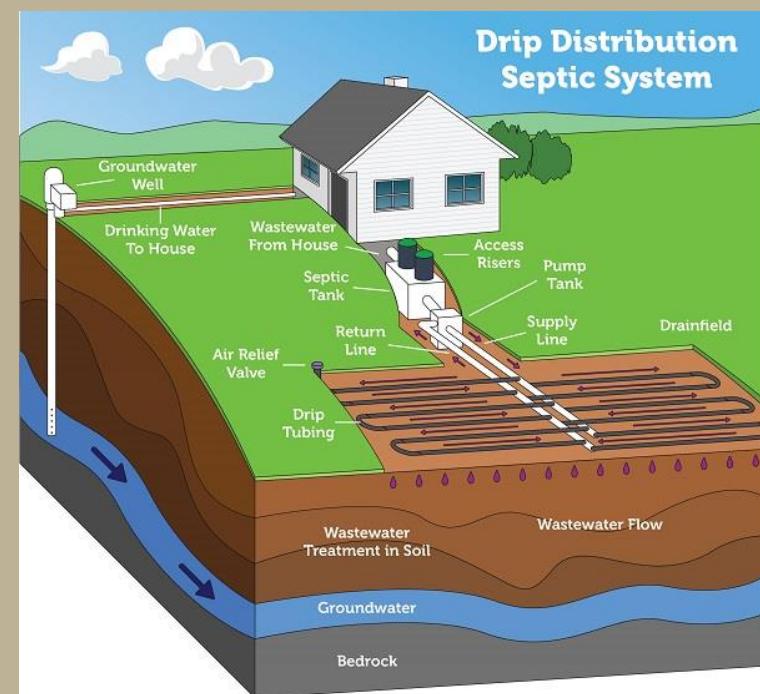
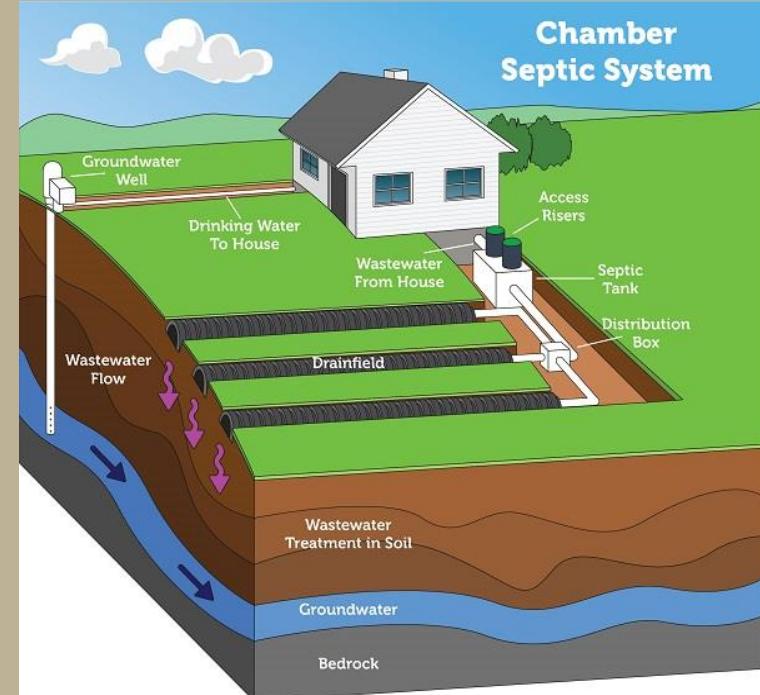
# HOME SEWAGE TREATMENT

- There are many different types of septic systems used at houses, most of which use a septic tank that is connected to a treatment/dispersal system
- The processes are very similar to those conducted at a treatment facility, just on a much smaller scale.
- The septic tank is responsible for removing the solids from the wastewater.
- The water from the septic tank is then pumped through a series of trenches where pipes have been laid on top of stone or gravel.



# HOME SEWAGE TREATMENT

- Some of the treatment/dispersal systems use gravel and rocks as a method of treating the wastewater.
- Other systems use the microbes in the surrounding soil to clean and treat the water.
- The diversity in different types of home sewage treatment options means that there is an option for every situation given the resources and amount of land available to you.



# KEY TOPIC 3: COMPOSTING AND FOOD WASTE



- Describe composting processes and identify how composting supports waste diversion efforts.
- Explain how composting improves soil health and provide evidence for how composting supports water conservation efforts.
- Describe the problem of food waste and explain how it impacts the sustainability of the global food supply.



# WHAT IS COMPOSTING?

- Composting is defined as the controlled decomposition of organic materials such as yard trimmings, food waste, and even wood chips.
- Many organisms are responsible for the decomposition process, it is key to make sure we provide these organisms with the proper environment in order to compost correctly.



# WHAT DO THESE ORGANISMS NEED?

- Oxygen: Composting is an aerobic process (meaning it requires oxygen), these organisms take in oxygen as they break down materials.
- Water: A compost pile must be kept moist. However, too much water will restrict air flow and oxygen levels. A good way to test if your compost has the proper moisture is to grab a handful and squeeze. If a few drops of water run down your hand, then it is good.
- Heat: The best composting temperature is between 90 and 140 degrees Fahrenheit. This means that in New York the composting process will stop during the winter and will resume once the temperature is high enough in the spring.



# WHAT DO THESE ORGANISMS NEED?

- **Carbon and Nitrogen:** These are found in compostable materials and are referred to as “browns” (C) and “greens” (N). They are used as an energy source as the organisms break down materials. They also help the organisms grow and multiply. They work best in a compost pile in a ratio of 1-part greens and 2-parts brown.
- **Particle Size:** It is important to increase surface area by shredding the materials going into your compost pile. If pieces are too large then it will take a very long time for decomposition to occur.
- It can take anywhere between 3-12 months for a compost pile to become usable in a garden.



# HOW COMPOSTING SUPPORTS WASTE DIVERSION

- Composting materials means less trash being put to the curb and less waste entering landfills.
- When we limit the amount of waste going to landfills, we see a reduction in energy costs for transporting this waste and a reduction in the demand for landfill space.
- Around 30% of household waste is compostable, this would mean saving money in trash disposal fees or purchasing gardening soil.



# HOW COMPOST HELPS SOIL HEALTH AND WATER CONSERVATION

- Natural way to add nutrients into your soils without the need for fertilizers. And unlike fertilizer, compost enriched soil will hold these nutrients in the soil longer while slowly releasing them over time.
- This reduces the amount of nutrient runoff entering our waterways and effecting nearby ecosystems.
- Composted soils help retain water, meaning there will be a reduction on the amount of water needed for your crops or flowers.
- It also encourages healthy and strong root systems which decreases the threat of erosion
- The organisms found in composted soils help control pests and insects that can harm crops.



# DIFFERENT TYPES OF COMPOSTING

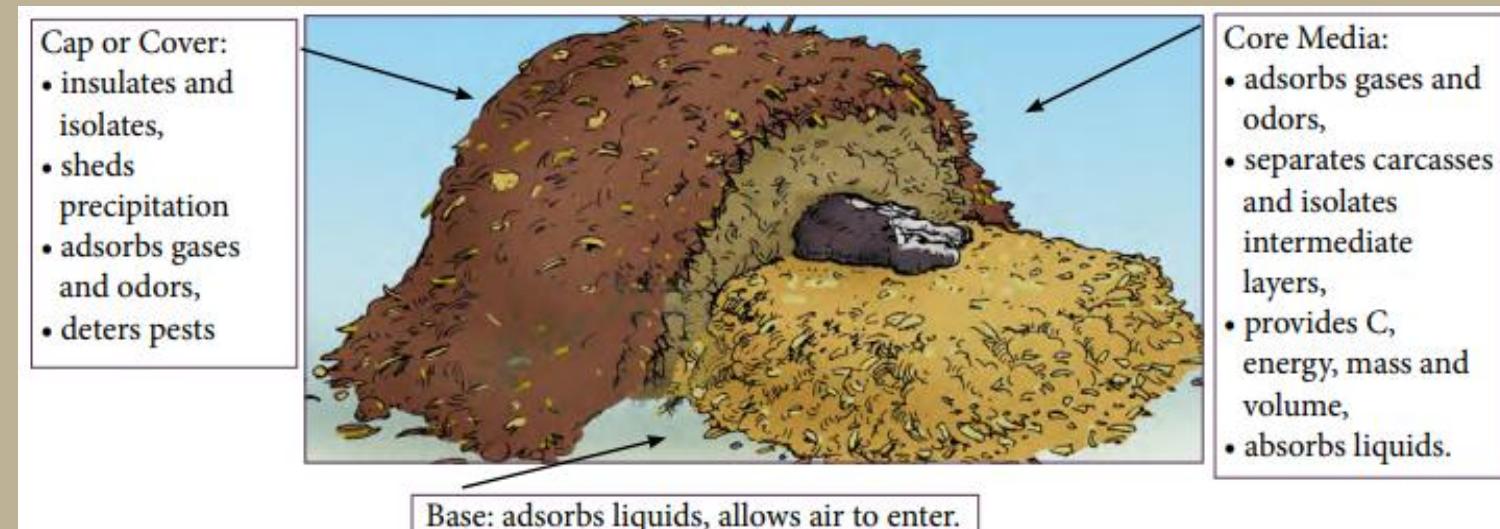
1. Vermicomposting: This method uses red worms in bins to break down material into high quality compost called castings.
  - Can be conducted on a small scale, good for apartments
  - Food scraps, paper, and yard trimmings (grass and plants) can be used in this type of composting.
  - Generally takes 3-4 months to produce usable casting.
2. Aerated (Turned) Windrow: This method arranges organic waste into rows called “windrows” and aerates them periodically by manually or mechanically turning the piles. Takes up a lot of space.
  - Suited for large volumes generated by an entire community.
  - Diverse waste such as yard trimmings, grease, liquids, and animal waste (such as fish or poultry) can be composted.
  - Ideal piles are 4-6ft tall and 14-16ft wide. This means the core temperature will remain hot enough during the winter for composting to continue.

# DIFFERENT TYPES OF COMPOSTING

1. Aerated Static Pile: This method is simply a pile of organic waste that has bulking agents such as wood chips added to increase air flow. A network of piping is often used with this method to pump air into the pile along will draw air out.
  - Suitable for large quantities of waste, works best with a homogenous mixture
  - Yard trimmings, food scraps, and paper products can be composted but does not work well with grease or animal byproducts.
  - Relatively quick (3-6 months).
2. In-Vessel: This method involves feeding organic material into a drum, silo, or similar container. The material is mechanically turned periodically to make sure the compost is aerated.
  - Can be any size you need and does not take up much space.
  - Compost is produced in a few weeks, need to wait for pile to completely cool.
  - Any type of organic waste can be used with this method.

# DIFFERENT TYPES OF COMPOSTING

1. Animal Mortality: This is often associated with agriculture sites where livestock mortality is common. However, it is also known to occur within other organizations such as butchers.
  - Different than composting other types of organic matter because carcasses are about 50% water and can contain internal gases.
  - It is important to have a solid barrier underneath this compost to prevent this leachate from contaminating the soil.
  - Animal carcasses need a ratio of 5-parts brown for every 1-part greens.
  - The different parts of an animal carcass will decompose at different rates, so it is important to separate bones, tissue, feathers, organs, hides and fur.



# OUR PROBLEM WITH FOOD WASTE

- Around 30% of food is wasted at the consumer level every year. In 2010 this added up to around 133 billion pounds and \$161 billion dollars.
- There is always the chance of food becoming damaged during packaging and distribution. However, in industrialized (wealthy) countries food waste often occurs at the consumer level. This means people are throwing away food after purchasing it.
- In North America or Europe consumers often waste 209-253lbs of food a year while consumers in Africa or Southeast Asia waste 13-24lbs.
- Americans have an abundance of food and money, meaning they are more comfortable throwing away food than people in developing countries.



# **FOOD WASTE AFFECTING OUR SUSTAINABILITY**

- Throwing away this much food is a major concern for resource conservation. These resources include the land, water, labor, and energy that was used while growing, transporting, and storing of the food.
- Nearly 38% of the Earth's land surface is agriculture, but with our growing population this resource is strained more and more each year.
- Poor agriculture practices can overuse resources such as soil and water, and result in land degradation from loss of carbon and biomass.



# **FOOD WASTE AFFECTING OUR SUSTAINABILITY**

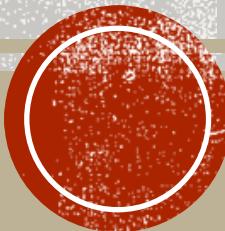
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- A lot of energy is used to produce and transport food. This includes everything from the diesel used in farm equipment or tractor trailers, to the electricity used to keep the food refrigerated.
- Some of these resources are non-renewable, so when we throw food away these resources are being thrown away as well.
- Certain types of food are over collected, resulting in a severe decline in populations. This is very prominent in our oceans with fish populations.
- Food waste that has been thrown away contributes to 18% of total U.S. methane emissions that come from landfills.
- Food waste also correlates to the wasted resources used to package our food. This includes metal cans, plastic bags, and cardboard boxes.





**QUESTIONS?**



# REFERENCES/WEBSITE LINKS

- <https://www.epa.gov/landfills/basic-information-about-landfills>
- <https://www.epa.gov/hw/learn-basics-hazardous-waste>
- <https://www.epa.gov/hwpermitting/hazardous-waste-management-facilities-and-units>
- <https://www.sustainable.pitt.edu/zerowaste/recycling-facts/>
- <https://www.greenmatters.com/business/2018/08/15/Z16xhYS/closed-loop-system-sustainability-production>
- <https://www.twi-global.com/technical-knowledge/faqs/geothermal-energy#HowisitUsed>
- <https://clear.ucdavis.edu/explainers/what-carbon-sequestration>
- <https://www.crowcon.com/blog/monitoring-and-analysis-of-landfill-gases/>
- <https://www.paulsrubbish.com.au/difference-recycling-upcycling-repurposing/>
- <https://www.roadrunnerwm.com/blog/50-interesting-recycling-facts>
- <https://www.epa.gov/recycle/composting-home>
- [https://storage.googleapis.com/wzukusers/user-35074691/documents/c2e65449925e4eb0bf7bd705ba0cb226/Quick-start Guide to Compost View Quality.pdf](https://storage.googleapis.com/wzukusers/user-35074691/documents/c2e65449925e4eb0bf7bd705ba0cb226/Quick-start%20Guide%20to%20Compost%20View%20Quality.pdf)
- <https://chqgov.com/landfill/landfill>
- <https://www.dec.ny.gov/regulations/8749.html>
- <https://www.cbc.ca/news/science/bottle-recycling-1.5416614>
- <https://www.dec.ny.gov/chemical/50034.html>
- <https://www.thirteen.org/blog-post/plastic-bag-ban-new-york-what-to-know/>
- <https://www.c2es.org/content/carbon-capture/>
- <https://www.epa.gov/sustainable-management-food/types-composting-and-understanding-process>
- <https://www.medicalnewstoday.com/articles/sustainable-gastronomy-can-food-abundance-be-sustainable#What-key-factors-should-we-consider?>



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