

SEEn T 1.1.1 D Explain the Earth's motion through space including precession, nutation, the barycenter, and its path around the galaxy.

UNIVERSE GALAXIES STARS PLANETARY SYSTEMS PLANETS MOONS

PRECESSION

- A change in the axis of the Earth.
- This change takes 26,000 years
- changes the axis star from Polaris (North Star) to Vega

ROTATION

1 full spin 24 hours day & night

REVOLUTION

1 full trip 365 days 1 year

KEPLER'S LAWS OF PLANETARY MOTION

1. Elliptical (oval) orbits
2. Planets revolve around the sun at varying speeds
3. Time to orbit is proportional to its distance

SEASONS caused by the tilt of the Earth's axis

WINTER N. Hemi points away from the sun. Short, cold days

SPRING N. Hemi is parallel to sun. Avg days, mod temp.

SUMMER N. Hemi points toward the sun. long, warm days

FALL N. Hemi is parallel to Sun. Avg days, mod. temps.

HEMISPHERES Northern Hemi. Southern Hemi.

ECLIPSES

Solar: moon between Earth and sun

Lunar: Earth between sun and moon

Can only happen Full + New

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BARYCENTER

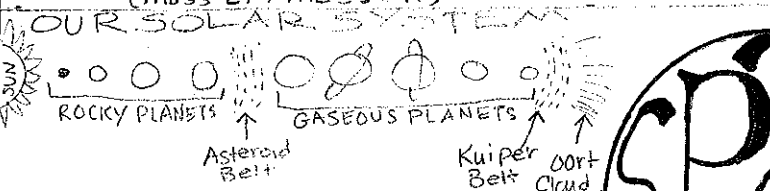
Point of balance between two orbiting objects

Need to know

- Distance between E1 and itself
- Distance between E1 and M1
- mass of E1
- mass of M1

$(\text{mass E1} \times \text{distance \#1}) + (\text{mass M1} \times \text{distance \#2})$

$(\text{mass E1} + \text{mass M1})$



SEEn T 1.1.3 D Explain how the sun produces energy which is transferred to the Earth by radiation

THE SUN IS A STAR!!

Solar Interior

- Photosphere: visible surface
- Chromosphere: the sun's atmosphere
- Corona: can be seen during eclipses

Solar prominences: Big gas clouds with intense activity

Solar Flare: brief outburst above a sunspot cluster releases HUGE amounts of energy

ex. uv radiation, x-ray radiation, radio radiation

SUNSPOTS: cool spots on the sun's surface

Electromagnetic waves "EMRS"

How the sun's energy flows to earth examples

- Gamma Rays
- x-Rays
- uv light etc.

How the sun's energy (heat) is transferred

1. Radiation by EMWs - flows to earth
2. Convection through liquids and gases - atmosphere and hydrosphere
3. Conduction through solids - lithosphere

EARTH'S MAGNETOSPHERE

Flares

solar wind deflection

magnetosphere

earth's protective shield

caused by earth's core spinning as earth rotates

weak spots

The magnetosphere shields earth from the sun's harmful particles - they are deflected away.

At the poles the magnetosphere is weak so some of the solar particles come close to the earth and interact with the earth's atmosphere. This causes **Auroras** at both poles of the earth.

The magnetosphere is compressed on the side facing the sun and tailed on the side away.

SEEn T 1.1.2 D Explain how Earth's rotation and revolution about the sun affects its shape and is related to seasons and tides.

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TIDES

Tidal range: difference in height between high and low tide

Caused by the gravitational pull of the moon (and a little bit of the sun)

Tidal Bulge: the moon pulls on the Earth and oceans, distorting its shape

Affects both sides of the Earth.

SPRING TIDES

- when Earth/Moon/Sun all align during Full or New Moons
- high tides are extra high
- low tides are extra low

NEAP TIDES

- when earth/moon/sun are NOT aligned
- you get little change in tidal range

SEEn T 1.1.4 D Explain how incoming solar energy makes life possible on earth.

SOLAR ENERGY

Nuclear Fusion: "Radiant Energy of the stars"

How the sun makes energy

4 H nuclei → FUSE → 1 He nuclei = HUGE release of energy

PHOTOSYNTHESIS

How plants convert solar energy to chemical energy

also known as **Energy Transformation**

$6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow{\text{SUNLIGHT}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

Carbon Dioxide

Water

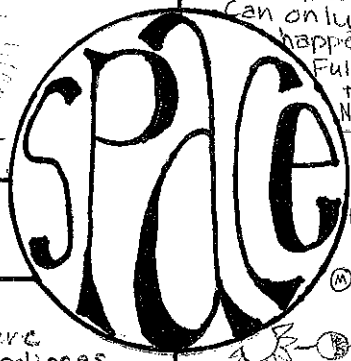
Glucose (plant food)

Oxygen

Humans need oxygen for cellular respiration to LIVE!

Q Why is land hotter than water?

Ans Land absorbs more solar radiation than water. Land surfaces are darker and absorb more heat while water reflects it back to the atmosphere.



SEEn. T 2.5.1 Summarize the structure and composition of our atmosphere

Layers of Atmosphere

Layers are distinguished by ① Altitude ② Temperature

Pressure ↓ as Altitude ↑

EXO SPHERE

- Orders Space
- Satellites

THERMO SPHERE

- Outermost layer
- highest temp
- very thin air so doesn't feel hot
- Auroras

MESO SPHERE

- coldest layer
- Protects us from meteors

STRAIO SPHERE

- ozone is here
- Commercial planes fly here
- weather balloons

TROFO SPHERE

- We live here
- Weather happens here
- Densest air (due to gravity pulling in all the layers)

EARLY

99% Nitrogen
1% Argon

Protects us from UV Radiation

SEEn. T 2.5.2 Explain the formation of typical air masses and the weather systems that result from air mass interactions.

AIR MASSES

Continentals - DO NOT MIX

large volumes of air with the same temp density and moisture.

HUMIDITY

water vapor in the air

- measured with a psychrometer
- humidity
- HEAT ↑ humidity
- COLD ↓ humidity

PRECIPITATION

cooler

Condensation

Precipitation

rain Sleet SNOW

WEATHER vs CLIMATE

Conditions in the atmosphere at a particular place and a particular moment.

the average weather in a given area over a long period of time.

PRESSURE SYSTEMS

the force exerted by the weight of a column of air above a particular location.

- measured (mb) in millibars
- Low Pressure
- High Pressure

air is lighter winds drawn in counterclockwise spin

air heavier winds move away clockwise spin

Sunny Skies light winds

forms clouds Precipitation

SEEn. T 2.5.3 Explain how cyclonic storms form based on the interaction of air masses.

CORIOLEIS EFFECT

Rotation of earth causes a deflection of winds

N. Hemisphere → deflected right → clockwise

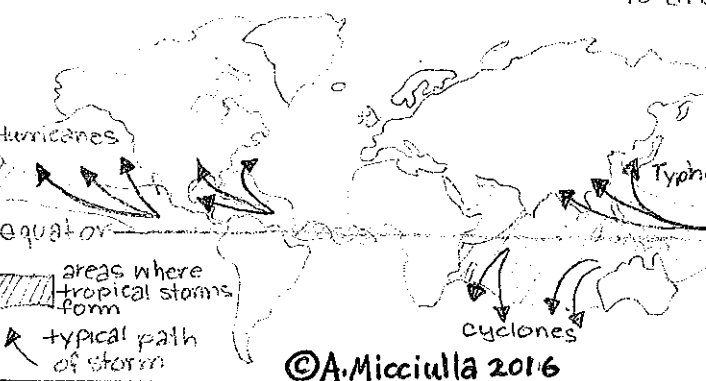
S. Hemisphere → deflected left → counterclockwise

HURRICANE VS TORNADO

Characteristic	Hurricane	Tornado
Formation	low pressure over warm water	rotating column of air (land or water)
wind speed	74mph or more	300mph or more
Severity scale	Saffir-Simpson category 1-5	Enhanced Fujita EF 1-5

CYCLONIC STORMS

Differ by location and the direction in which they rotate.



SEEn. T 2.5.4 Predict the weather using available weather maps and data including surface, upper atmosphere winds and satellite imagery.

FRONTS

boundary between two air masses of different temperature and density.

- warm air rises
- cold air sinks

COLD FRONT

- heavy precipitation before front
- severe weather
- cool dry air behind front

WARM FRONT

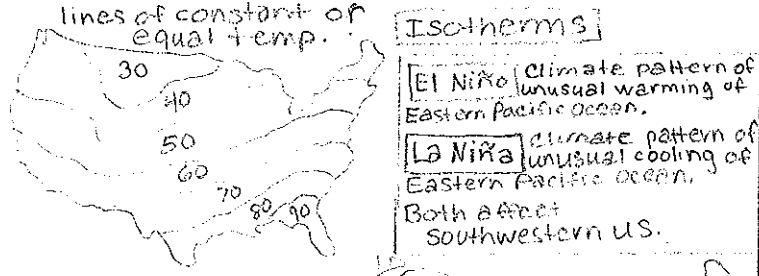
- light drizzle before front
- warm humid air behind front

STATIONARY FRONT

- not moving
- associated with flooding

OCCULDED FRONT

- two cold air masses come together and push the trapped warm air mass up.



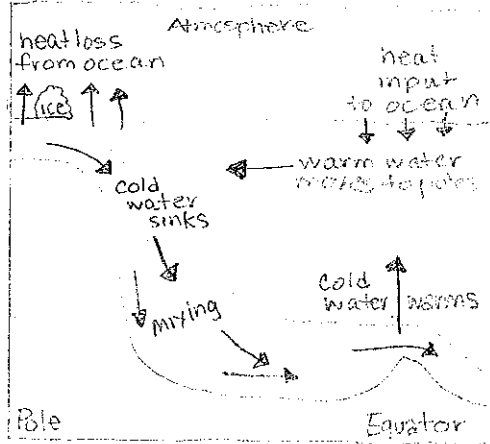
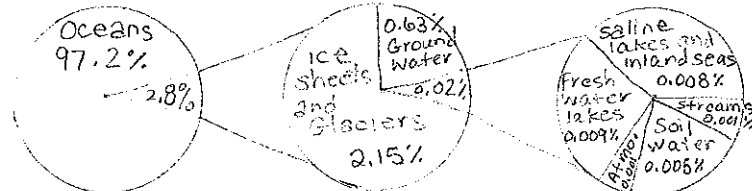
ISOBARS

lines of constant or equal pressure

- In low pressure systems the bars are close together
- In high pressure systems the bars are far apart

SEEn. T 2.3.1 Explain how water is an energy agent (currents and heat transfer)

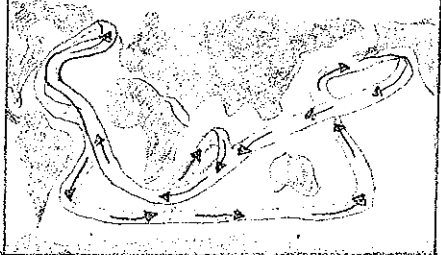
SEEn. T 2.3.2 Explain how ground water and surface water interact.



OCEAN CURRENTS

- ① Surface
 - caused by wind
 - less salty
 - less dense
- ② Deep Water
 - caused by differing densities due to temperature and salinity
 - more salty
 - more dense

GLOBAL CONVEYOR BELT



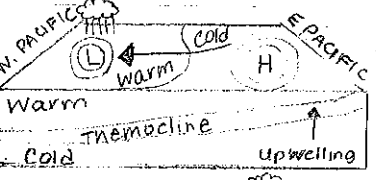
warm water less dense rises
higher salt more dense
Cold water more dense SINKS

→ warm, shallow current
← cold, deep, high saline current

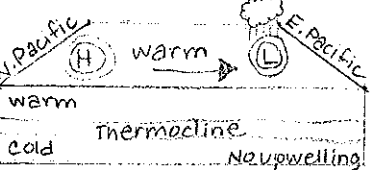
COASTAL CLIMATES



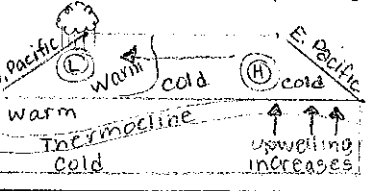
Ocean currents can influence climate along the coasts.
California Current cools coastal climates along the west coast
Gulf Stream warms coastal climates along the east coast



TRADE WINDS
• Large scale surface winds that blow from East to West
• Air flows from High Pressure to low pressure (E to W)
Normal condition
• W Pacific/stormy - E Pacific/cold



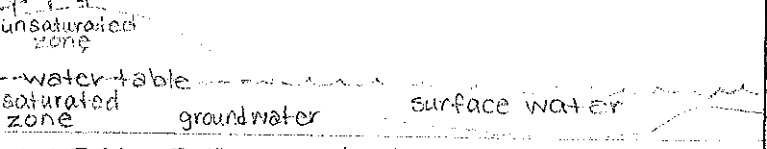
EL NIÑO
• Trade winds reverse
• Warm, moist, stormy weather moves to the Eastern Pacific
• No upwelling/No nutrients Fish Die



LA NIÑA
• Trade winds strengthen
• Eastern Pacific becomes cold and dry
• Increase of upwelling brings up nutrients for better fishing
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INFILTRATION
water trickles down between particles of soil and through cracks and spaces in layers of rock.

- Permeable** - large pores, water flows easily ex. sand, gravel
- Impermeable** - few or no pores, water does not flow ex. clay, granite



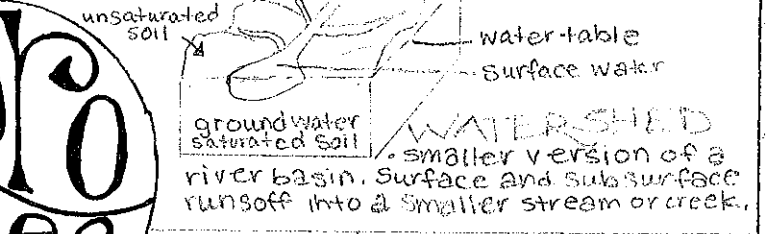
SPRINGS - groundwater naturally comes up through cracks in rocks.

GEYSERS - gusher of very hot water from deep within the earth

AQUIFERS - underground layer of rock or sediment that holds water.

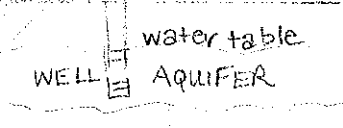
RIVER BASIN

an area of land that drains off into a river through surface and subsurface run-off.



WELLS

groundwater can be obtained from an aquifer by drilling a well below the water table.
• If the level of the aquifer drops, a well can run dry
• heavy rains fill it back up.

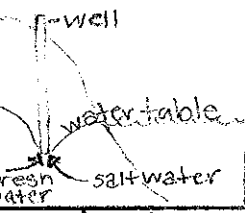


INLET WATERWAYS

An inlet waterway leads to an enclosed body of water such as a sound, bay, lagoon or marsh.

ESTUARY

An estuary is a unique aquatic ecosystem where freshwater from rivers mixes with saltwater from the ocean forming a nutrient trap.



SALT WATER INTRUSION

The movement of saltwater into freshwater aquifers, which can lead to contamination of drinking water sources. The treatment for saltwater intrusion is very expensive.

SEEn. T 2.4.2 Evaluate human influences on water quality in North Carolina's river basins, wetlands and tidal environments.

WQ	Point source pollution direct dumping
AU	non-point source pollution many sources-run-off
TAL	Thermal pollution excessive amounts of heat added - Nuclear power plants
EL	EUTROPHICATION excess nitrogen run off algae bloom → die off low oxygen - fish die
RY	OCEAN ACIDIFICATION Burn fossil fuels - release CO2 absorbed by oceans ↓ CO2 ↓ pH - kills shellfish, corals

SEEn. T 2.1.1 Explain how the rock cycle, plate tectonics, volcanoes, and earthquakes impact the lithosphere.

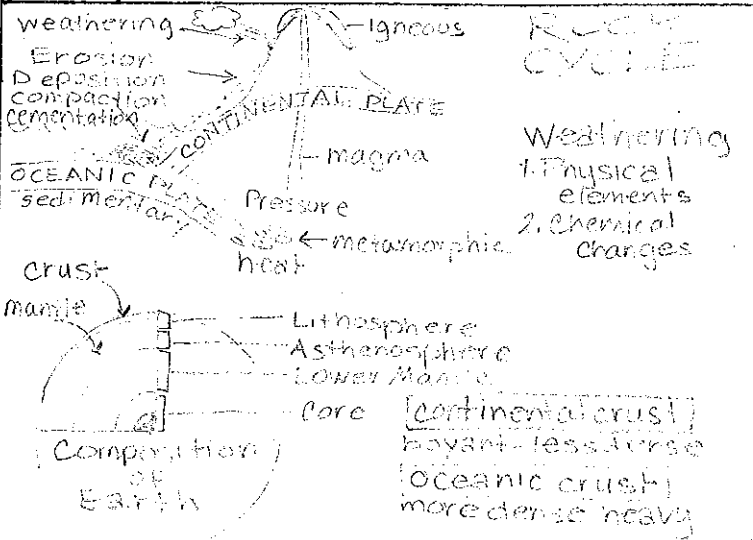
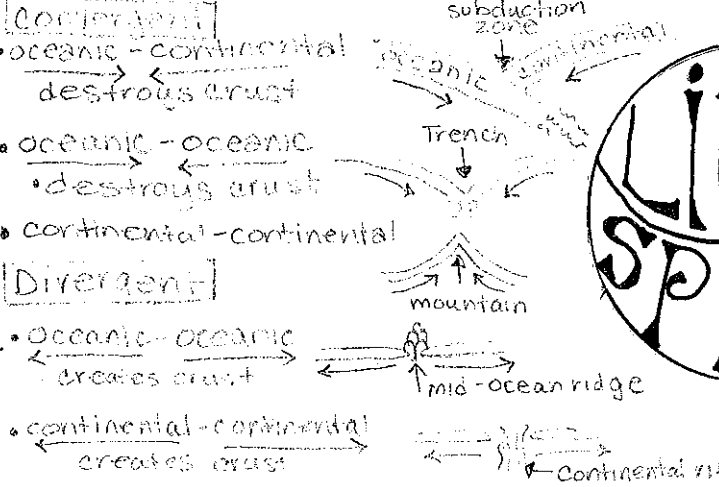


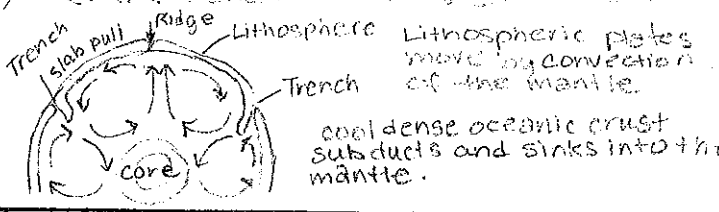
PLATE TECTONICS
 • Lithosphere is broken into plates that float on the asthenosphere.

PLATE BOUNDARIES



Transform plates slide past each other. Neither create nor destroy.

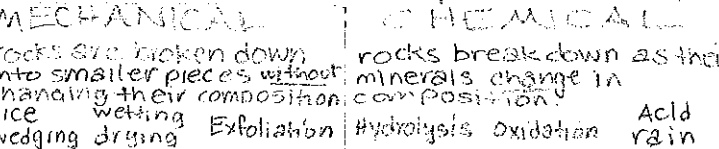
MANTLE CONVECTION



SEEn. T 2.1.3 Explain how natural actions such as weathering, erosion (wind, water, gravity) and soil formation affect Earth's surface.

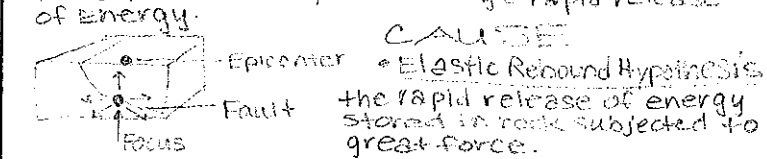
WEATHERING - the breaking down of rocks that have been exposed to the atmosphere.

EROSION - once the rocks are broken down, the pieces are transported from one place to another.



SEEn. T 2.1.2 Predict the locations of volcanoes, earthquakes, and faults based on information contained in a variety of maps.

EARTHQUAKES



CAUSE
 • Elastic Rebound Hypothesis - the rapid release of energy stored in rock subjected to great force.

MEASURING EARTHQUAKES

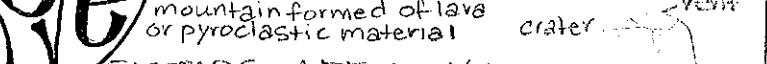
Magnitude - amount of energy released
Amplitude - size of earthquake waves
SEISMOGRAPH - instrument that records waves
SEISMOGRAM - print out showing waves
Surface waves - most destructive
body waves - p (primary) waves - fastest
 s (secondary) waves - travels through solids only

SCALES
 ① Richter Scale • based on Amplitude • not accurate for big quakes
 ② Moment Magnitude • based on magnitude • accurate for big quakes

DAMAGE FACTORS

① Intensity & Duration
 ② Ground under Buildings (rock, sand, etc)
 ③ Building design
Liquifaction - soil is shaken so much it acts like a liquid

VOLCANOES



FACTORS AFFECTING ERUPTIONS

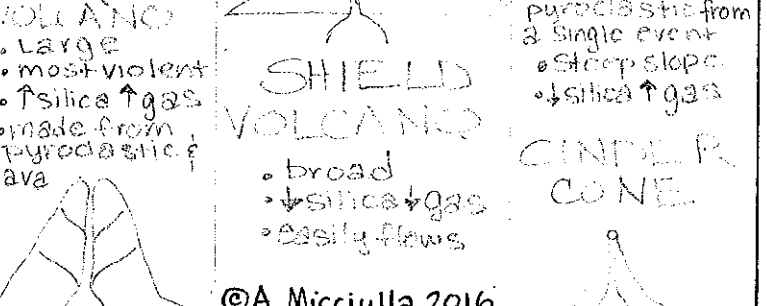
① composition of magma - silica
 ② temperature of magma
 ③ dissolved gases in magma - water vapor & CO2 expand at vent
Viscosity • resistance to flow • affected by temperature & silica content

↑ viscosity ↑ violent eruption
 ↑ silica ↑ viscosity
 ↓ temperature ↑ viscosity
 ↑ viscosity ↓ gases can escape ↑ violent eruption

VOLCANIC MATERIAL

① Lava
 ② Gases, water vapor + CO2
 ③ Pyroclastic material - ash, rocks, etc.

COMPOSITE STRATO VOLCANO



SEEN. T 2.7.1 Explain how abiotic and biotic factors interact to create the various biomes in North Carolina.

- N.C. BIOMES**
- 1 Appalachian Highlands
 - 2 Piedmont
 - 3 Coastal Plains

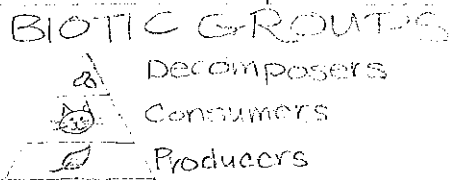
GLOBAL BIOME
Temperate Deciduous Forest

BIOSPHERE
All the life and supporting environments on Earth.

Hydro + Atmo + Litho

BIOTIC FACTORS
organisms or organic matter produced.

ABIOTIC FACTORS
Non-living things: water, air, rocks, temperature, sunlight

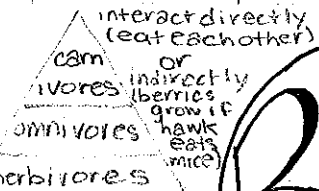


ECOSYSTEM GROUPS

INDIVIDUALS - organisms
POPULATIONS - a species
COMMUNITIES - all species in an area
ECOSYSTEMS - abiotic + biotic
BIOMES - set of ecosystems

BIOMES	Location	Temp	Precip	ABIOTIC	BIOTIC
Tundra	Arctic	Very cold	Very low	Permafrost	low growing plants
Tundra	Canada	Cold	Mod	Mountains	Coniferous trees
Deciduous Forest	NC	Moderate	Mod	Rich Soil	deciduous trees
Tropical Rainforest	Equator	Hot	very high	Poor Soil	Iron canopy
Grasslands	Prairie	Mod/Hot	Mod	Rich Soil	grasslands
Savannah	Africa	Hot	Mod	Rich Soil	Grasses and trees
Desert	US Southwest	Hot	very low	sand	succulents
Chaparral	California	Moderate	low	Poor soil	scrubland

ECOLOGY
study of the relations of organisms to one another and to their physical environment



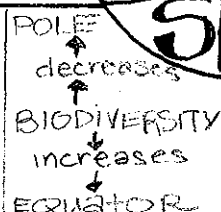
INTERDEPENDENCE
the survival of species is dependent on other living organisms and on non-living components.

ECOSYSTEM
all the organisms and non-living environments found in a particular place.

SEEN. T 2.7.2 Explain why biodiversity is important to the biosphere.

BIODIVERSITY
the variety of life in the world, or in a particular habitat or ecosystem.

- Measured by the number of species in an area and the amount of variation within each species.



IMPORTANCE

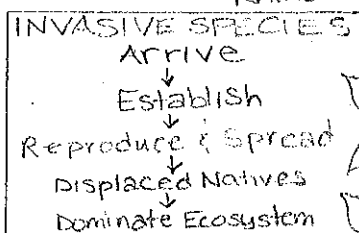
- Beauty
- ecosystem stability
- food
- food chains
- provides materials
- medicine

LIFE EXPECTANCY

Extinction
all members of a species are gone and will never return
ex. Passenger Pigeon

Endangered Species
Close to becoming extinct
ex. Black Rhino

Threatened
number of remaining members of the species is declining and is close to becoming endangered
ex. African Elephant



SEEN. T 2.7.3 Explain how human activities impact the biosphere.

POPULATION
a group of individuals of one species that interact with each other.

POPULATION GROWTH
increase in population in an area usually measured annually. Population growth occurs when births exceed deaths.

EXPONENTIAL GROWTH
Population growth that grows at a rate that is proportional to the size of the population.

Exponential Growth
seen when there are unlimited resources

INVASIVE SPECIES IN NORTH CAROLINA

plants, animals, or other organisms that are introduced to a given area outside their original range and cause harm in their new home. They have no known natural predators.

KUDZU: smothers other plants cutting off access to sunlight
introduced for erosion control

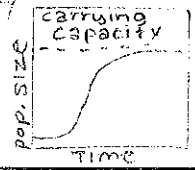
STINK BUGS
native to china introduced by accident serious agriculture pest feeding on market produce especially soybeans

FIRE ANTS
introduced by accident + from South America. Displaced many native species

CARRYING CAPACITY

the number of individuals a habitat can sustain with the resources available.

LIMITING FACTORS
Factors that keep population growth in check



THREATS TO BIODIVERSITY
poaching • invasive species • population growth
Global warming • habitat loss

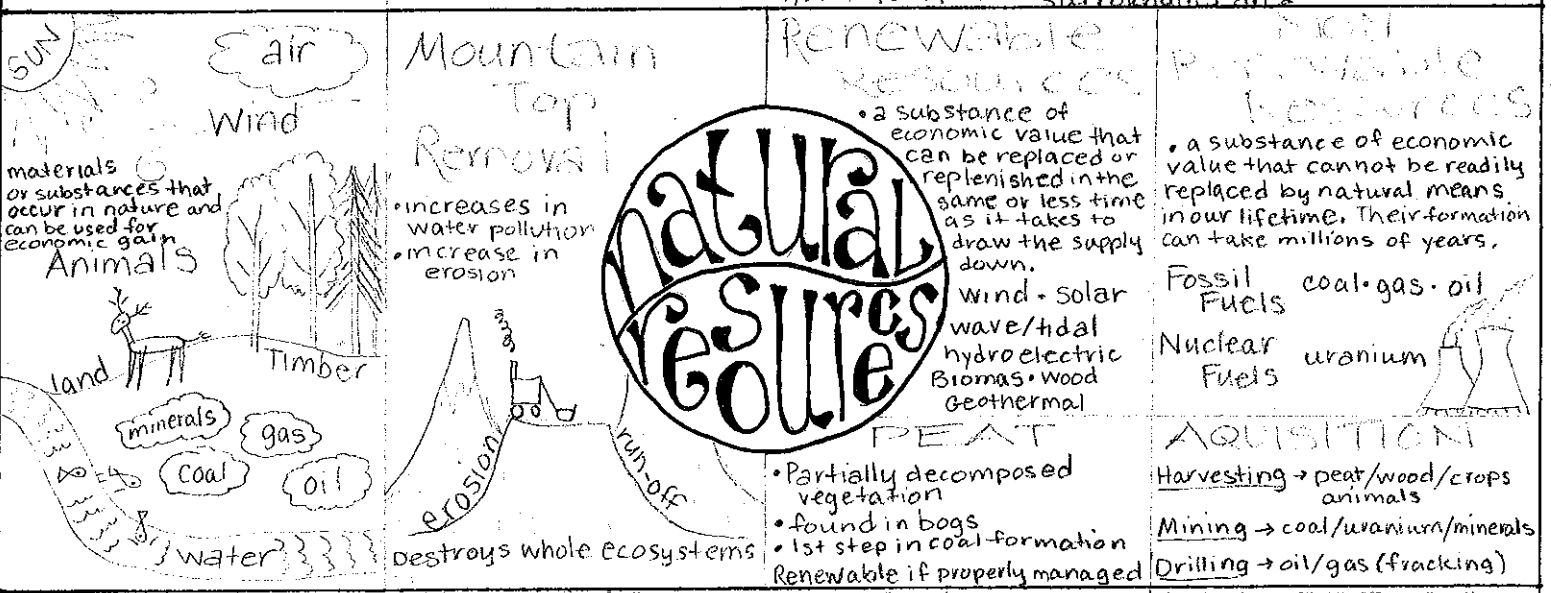
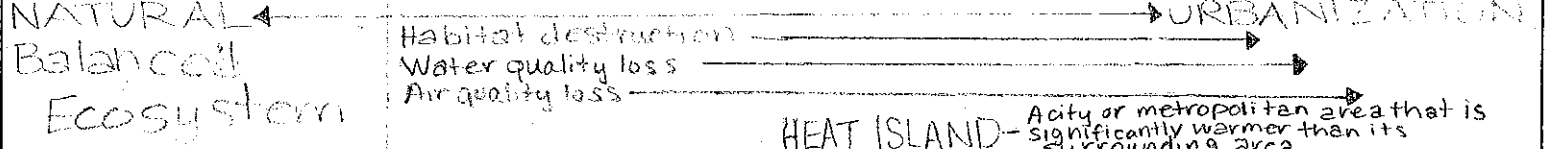
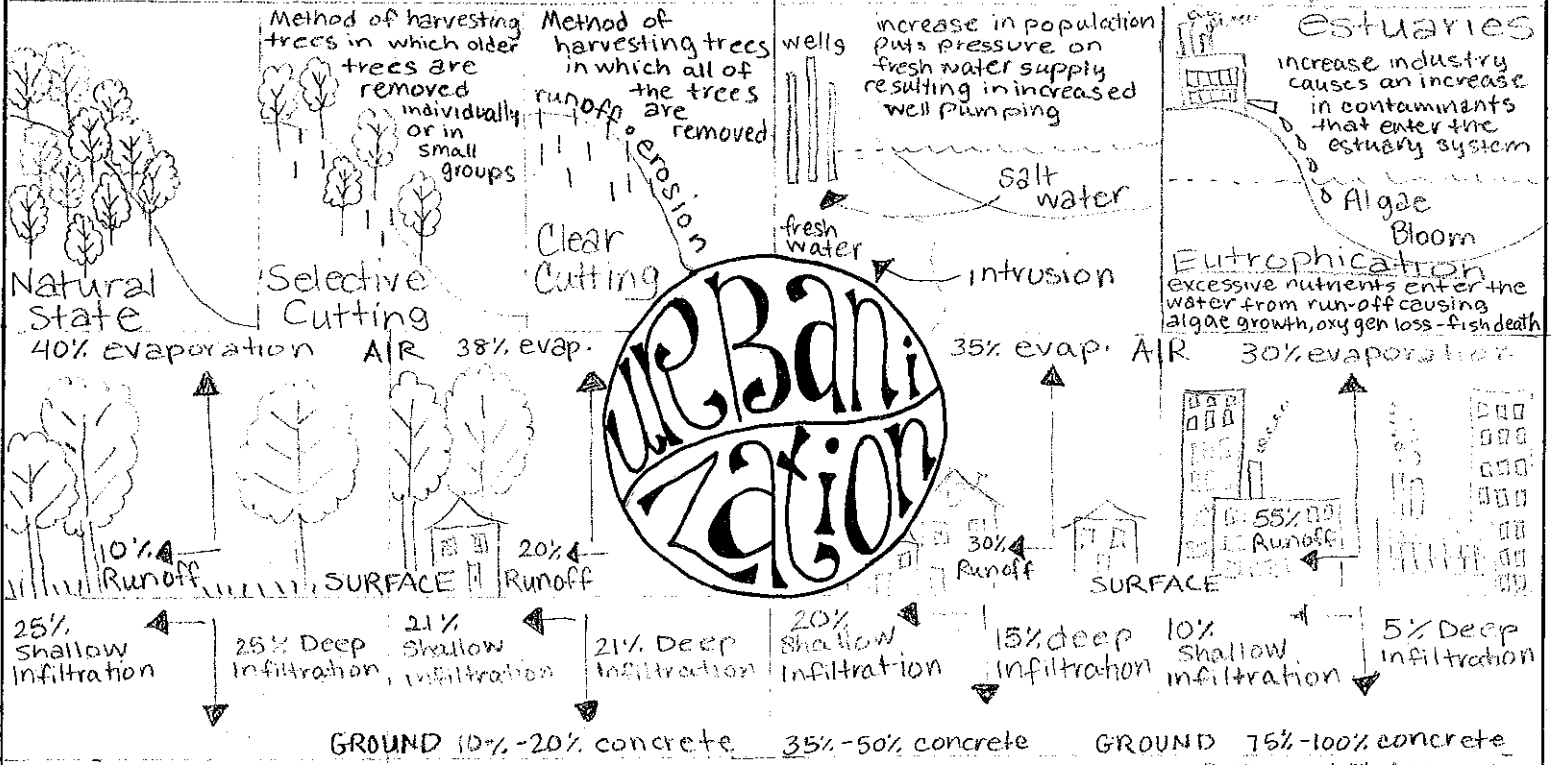
HABITAT FRAGMENTATION
habitats divided by roads

HABITAT DESTRUCTION
water pollution • air pollution • Acid Rain

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MOUNTAIN EFFECTS

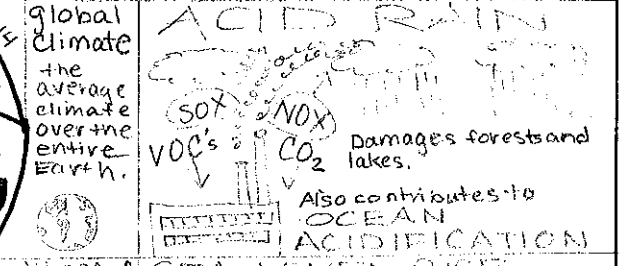
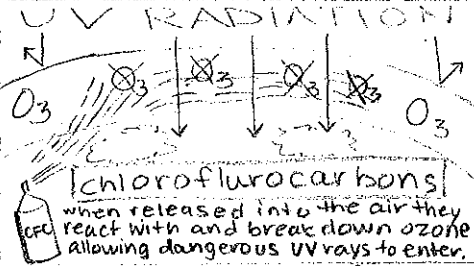
COASTAL EFFECTS



GREENHOUSE GASES
gases whose absorption of solar radiation is responsible for the greenhouse effect
Water vapor • CO₂ • Ozone • methane • CFC's

PH SCALE
Neutral 7
acid ← → base 14

GREENHOUSE EFFECT
trapping of the sun's warmth in Earth's lower atmosphere due to the presence of greenhouse gases



GLOBAL WARMING
gradual increase in earth's temperature that causes changes in climate. Caused by greenhouse gases.

CLIMATE vs WEATHER
how weather behaves over a long period of time
conditions of the atmosphere over a short time

SEA LEVEL RISE
caused by global warming and melting of glaciers. Coastal flooding will occur
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SUSTAINABLE AGRICULTURE

Growing crops or resources in a way that mimics natural processes.

Sustainable planting practices minimize use of energy, water, pesticides, fertilizers

use manure or compost and organic matter to retain water in the soil.

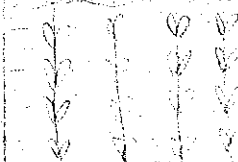
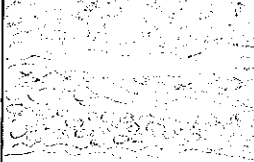
cuts slits into the soil and drops seed in to maintain soil structure and health.

growing crops across a slope to reduce runoff and soil erosion, contours catch it.

COMPOST

NO-TILL

CONTOUR



Rotation of crops so successive plantings vary, to avoid soil nutrient depletion, weeds, disease and pest infestation.

Growing different crops on alternating strips to increase crop yields and to avoid soil erosion. Alters narrow and deep root plants.

OLD METHODS

PLOWING SOIL

- ⊕ fast / cheap
- ⊖ ruins soil

FERTILIZER USE

- ⊕ easy / cheap
- ⊖ run-off

PESTICIDE USE

- ⊕ easy / cheap
- ⊖ eco-logical
- trickle down

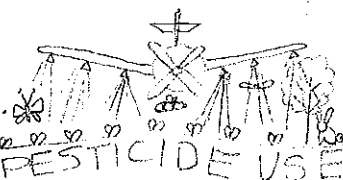
CROP ROTATION



STRIP CROPPING



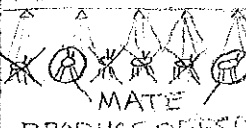
Pesticide use contaminates soil, water, turf and other vegetation. Toxic to target and non-target species



PESTICIDE USE

- Pesticide use affects non-target species
- Birds - bpr use to control mosquitoes caused thin egg shells
- Pesticides bio-accumulate
- run-off kills fish and other aquatic life
- can affect human health cancer, lung disease, skin irritants • birth defects

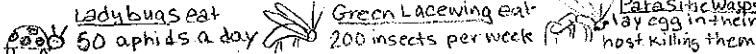
PEST RESISTANCE



PRODUCE OFFSPRING

Each successive generation becomes more resistant to the pesticide, so it becomes less effective

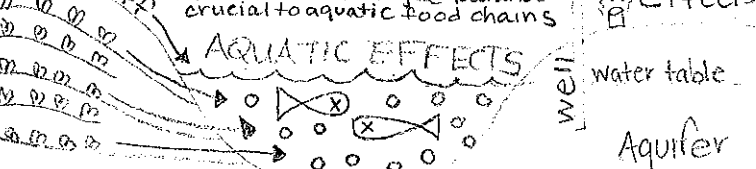
BENEFICIAL INSECTS do the job for us!



Ladybugs eat 50 aphids a day
Green Lacewing eat 200 insects per week
Parasitic Wasps lay egg in their host killing them

Fertilizer use contaminates water and aquatic environments and humans

FERTILIZER USE



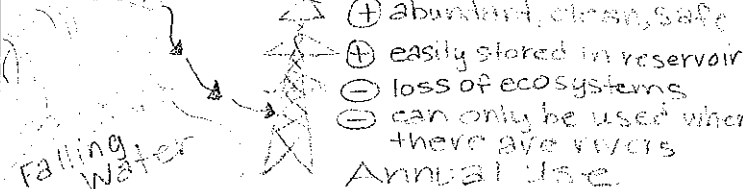
PROS OF ORGANIC FERTILIZERS

- improve soil structure
- improve soil nutrients
- improve water holding ability
- compost
- lime
- bone meal
- kelp

SUSTAINABLE ENERGY

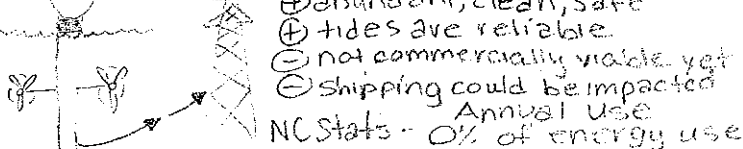
Forms of energy from non-exhaustible resources that does not compromise the ability of future generations needs.

HYDROELECTRIC



- ⊕ abundant, clean, safe
- ⊕ easily stored in reservoirs
- ⊖ loss of ecosystems
- ⊖ can only be used where there are rivers

TIDAL POWER



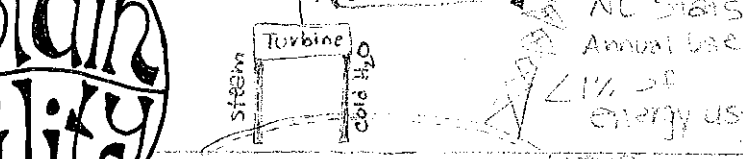
- ⊕ abundant, clean, safe
- ⊕ tides are reliable
- ⊖ not commercially viable yet
- ⊖ shipping could be impacted

SOLAR POWER



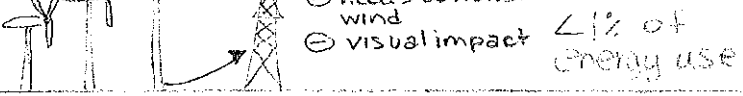
- ⊕ unlimited supply
- ⊕ non-polluting
- ⊖ not cost effective
- ⊖ needs sunlight

GEO THERMAL POWER



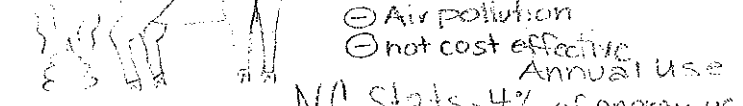
- ⊕ unlimited supply
- ⊕ no pollution
- ⊖ only available in certain places
- ⊖ high start up costs

WIND POWER



- ⊕ no pollution
- ⊕ cheap to build
- ⊖ needs constant wind
- ⊖ visual impact

BIOMASS

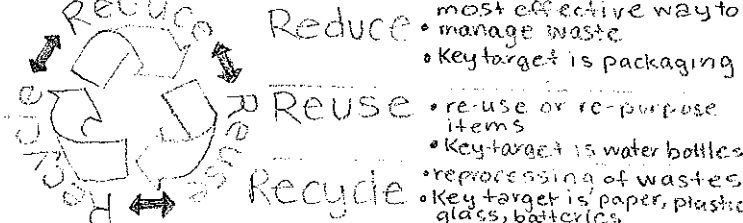


- ⊕ abundant and renewable
- ⊕ used to burn waste products
- ⊖ Air pollution
- ⊖ not cost effective

TRADITIONAL SOURCES

oil use 37%
Nat. Gas use 10%
Coal use 31%
Nuclear Power use 17%
Annual consumption in North Carolina

RECYCLING



Reduce: most effective way to manage waste. Key target is packaging
Reuse: re-use or re-purpose items. Key target is water bottles
Recycle: reprocessing of wastes. Key target is paper, plastic, glass, batteries



ECOLOGICAL FOOTPRINT: the impact of a person or community on the environment, expressed as the amount of land required to sustain their use of Nat. Resources.