

MARIGOLD PROJECT TOPICS

Environmental Issues



The Project. . .



- With a partner, grow and collect data on **six marigold plants**
- Add an environmental variable to 3 plants and measure the differences
- This project will be worth 20% of your 4th quarter grade!
 - 25% Participation points (collected randomly)
 - 25% Presentation points
 - 50% Research, poster and raw data
- All projects are due on May 26 to present in class!

Marigold Facts



- **Kingdom:** Plantae (includes all plants)
- **Subkingdom:** Tracheobionta (vascular plants with xylem and phloem)
- **Superdivision:** Spermatophyta (seed plants)
- **Division:** Magnoliophyta or Angiosperms (flowering plants)
- **Class:** Magnoliopsida or Dicotyledons (dicots—seeds make two leaves)
- **Subclass:** Asteridae (star-shaped)
- **Order:** Asterales (also includes daisies, sunflowers, bellflowers, etc.)
- **Genus:** *Tagetes* (all marigolds)
- **Species:** *Tagetes patula* (French marigold)

Marigold Facts



- **Native Range:** Mexico and Central America—brought to Europe in the 1600's and spread quickly as a popular garden plant.
- **Culture:** Marigolds will adapt easily to most garden soils.
- **Light:** Full sun
- **Moisture:** Water sparingly (10-20 mL/day)
- **Hardiness:** USDA Zones 9 - 11. Marigolds are tender tropical plants and are killed by frost.
- **Life cycle:** In Montana, these plants are *annuals* (An **annual plant** is a **plant** that completes its life cycle, from germination to the production of seed, within one year, and then dies).

Marigold Facts

- **Growth:** Marigolds bloom continuously until frost. Breaking the dead blooms off the plant will increase blooming rate.
- **Flower:** Up to 2 in (5 cm) across, composed of a dense arrangement of "rays."
- **Colors:** Yellow, orange, bronze, gold, red, russet and striped.
- **Leaves:** Dark green and deeply divided with an aromatic fragrance.
- **Seeds:** Long, sharp black points develop in the fall and plant themselves near the parent.



Marigold Facts

• Uses :

- Important nectar source for butterflies
- Discourages certain insect pests like white flies and nematodes, natural insecticide
- Deer-resistant and fairly drought-resistant
- Flower petals are fed to chickens to give the meat and fat a yellow color- this provides no nutritional benefits but is said to be preferred by consumers.
- Many cultures eat the dried petals or leaves
- Petals used to dye wool
- Oil from the plants can be used to treat fungal infections
- Used to make teas and medicines
- Used in weddings and ceremonies in India



Marigold decorations





Marigold Facts

- **Planting tips:** Plant seeds in loose soil at a depth: $\frac{1}{4}$ to $\frac{1}{2}$ inches (one pencil eraser), seeds 6 inches apart.
- **Plant height:** 8-12 inches
- **Days to germination:** 8-10 days **Days to flower:** 20-25



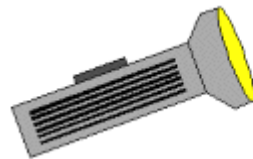
Marigold Project Topics

- Pick something that is easy to model and interesting to you
- It must be a real ecological problem
- You must research your topics and how they would specifically affect garden plants like marigolds
- It must be safe for you and your plant—don't kill your experimental group!
- All topics must be approved before you start.



Household Hazardous Waste

- Americans generate 1.6 million tons of household hazardous waste per year.
- Such products may include certain paints, cleaners, stains and varnishes, car batteries, motor oil, and pesticides.
- How could you expose your marigolds to these variables?



Solid Waste

- The U.S. has 3,091 active landfills and over 10,000 old municipal landfills, according to the Environmental Protection Agency
- Litter, sanitary landfills, composting, biogas (organic waste as a source of fuel), and incineration
- Solid waste includes paper, metal, wood, and garbage.
- How could you expose your marigolds to these variables?



Pesticide and Herbicide Use

- Pesticides are synthetic organic chemicals used to control weeds in fields and lawns, and unwanted or harmful pests, such as insects and mites that feed on crops
- Soil is full of living organisms that can be harmed by pesticides and herbicides and the chemicals can keep plants from absorbing nutrients
- How could you model the effects of pesticides with your marigolds?



Air Pollution

- We breathe 3 gallons of air /day
- After the Industrial Revolution in the 1800's there was an increase in:
 - -urban smog
 - -small particulate matter
 - -toxic pollutants
- How could you expose your marigolds to these variables?



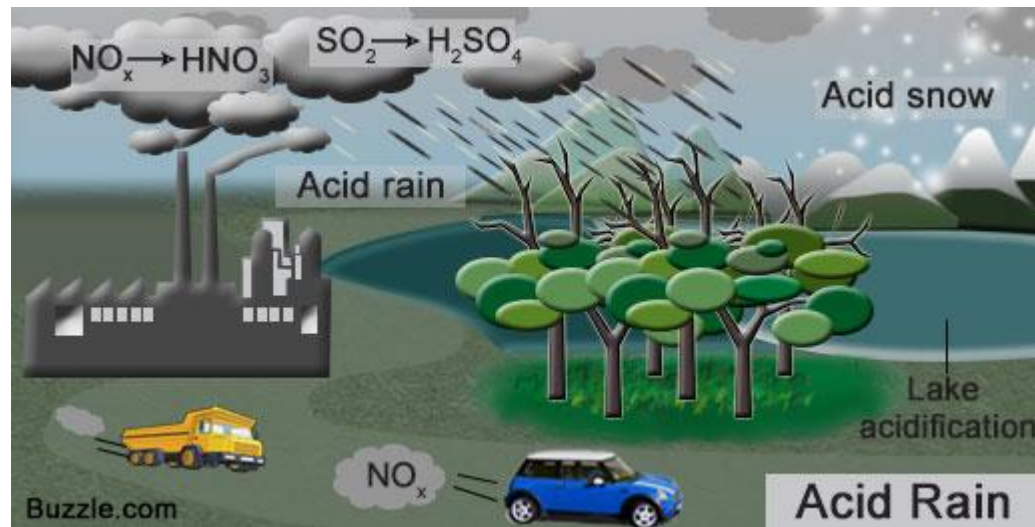
Wildfires—soil impacts

- Wildfires are currently increasing in number and severity in the west due to climate change and drought.
- Fires add ash to soil which can alter the pH and drainage.
- How could you expose your marigolds to these variables?



Acid Rain

- sulfur dioxide (SO_2) and nitrogen oxides (NO_x) are the primary causes of acid rain
- In the US, About $\frac{2}{3}$ of all SO_2 and $\frac{1}{4}$ of all NO_x comes from electric power generation that relies on burning fossil fuels like coal.
- How could you model acid rain with your marigolds?



Global Warming



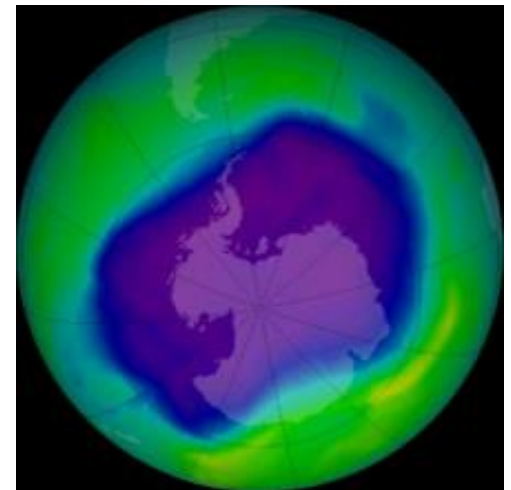
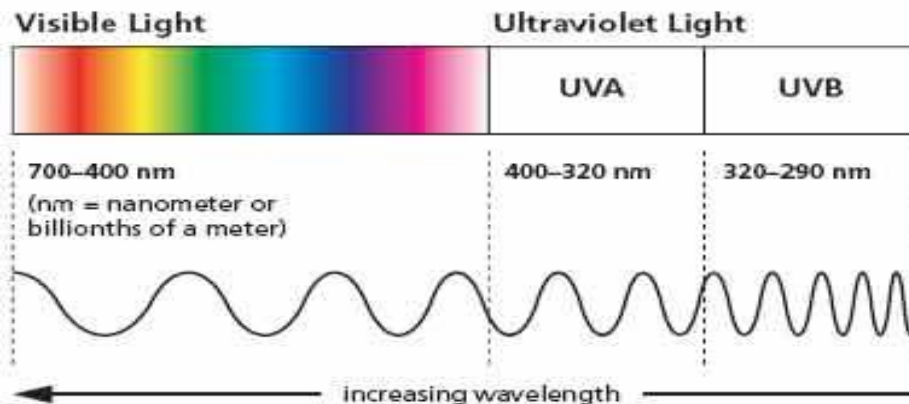
- Issue: Power plants and vehicles emit gases that then trap the sun's heat energy and prevent it from leaving our atmosphere. This leads to an increase in temperature.
- Results in: Melting of polar ice caps, rise in temperature Ocean warming, sea-level rise, and coastal flooding
- Which could lead to:
 - Earlier spring arrival
 - Spreading of disease
 - Plant and animal range shifts and population changes
 - Coral reef bleaching
 - Downpours, heavy snowfalls, and flooding
 - Droughts and fires



Ozone Depletion

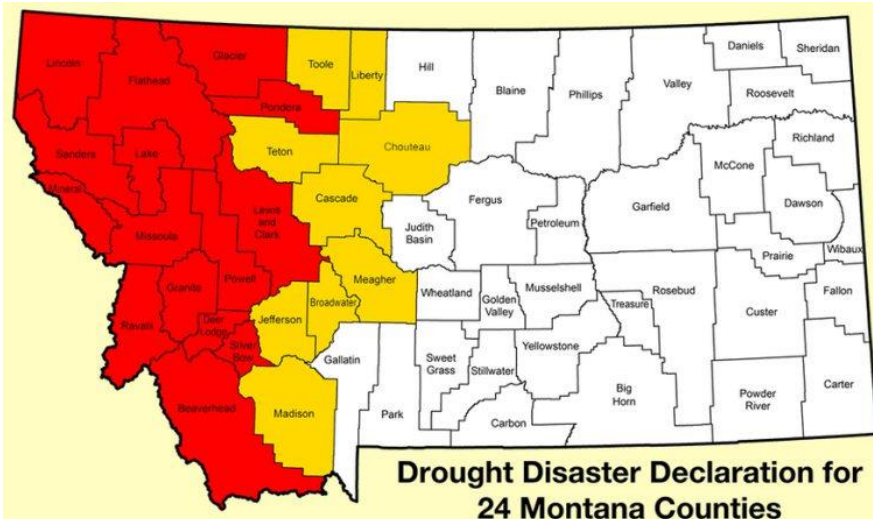
- Ozone in Earth's atmosphere, is responsible for absorption of Ultraviolet (UV) radiation from the sun.
- When stratospheric ozone levels decrease, higher levels of UVB reach the Earth's surface.
- An increase of UV radiation would be expected to affect crops.
- How could you model increased UV radiation on your marigolds?

Visible Light/UV



Drought

- A **drought** is a period of below-average precipitation in a given region, resulting in prolonged shortages in its water supply, whether atmospheric, surface or ground water.
- A **drought** can last for months or years, or may be declared after as few as 15 days.



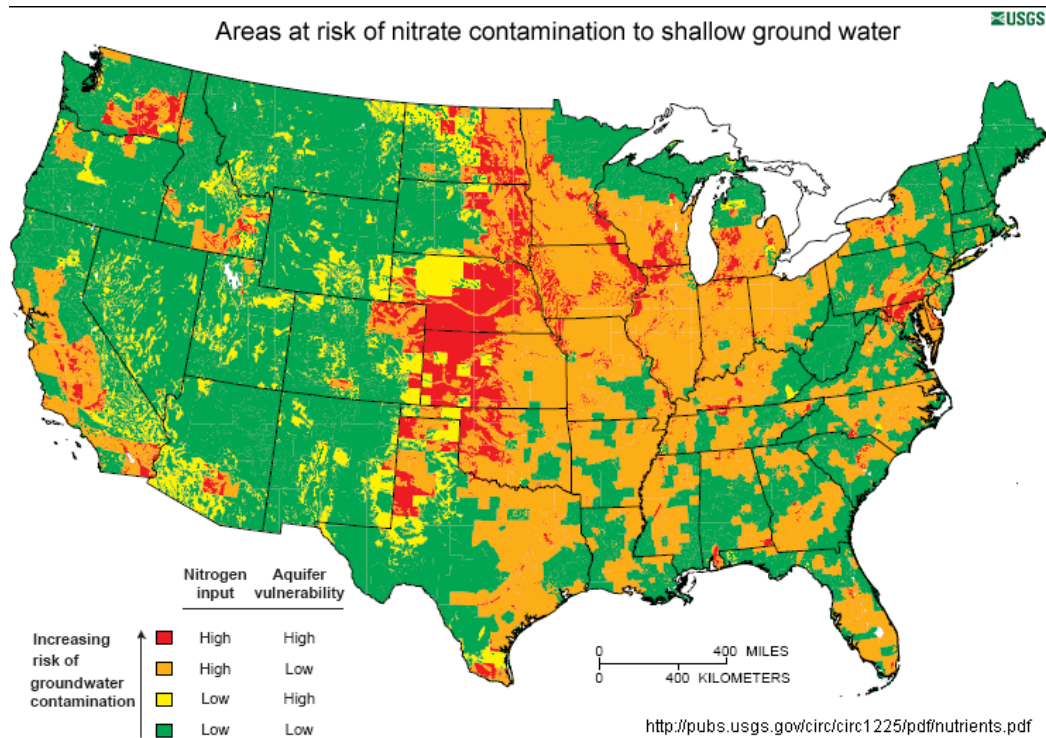
Oil Spills

- March 24, 1989- Exxon Valdez, April 20 2010-Deepwater Horizon
- Spilled oil can affect animals and plants in two ways: from the oil itself or from the cleanup process.
- A smaller spill at the wrong time/wrong season and in a sensitive environment may prove much more harmful than a larger spill at another time of the year in another or even the same environment.
- Oil makes a “slick” over soil and water that blocks light.
- How could you model an oil spill with your marigolds?



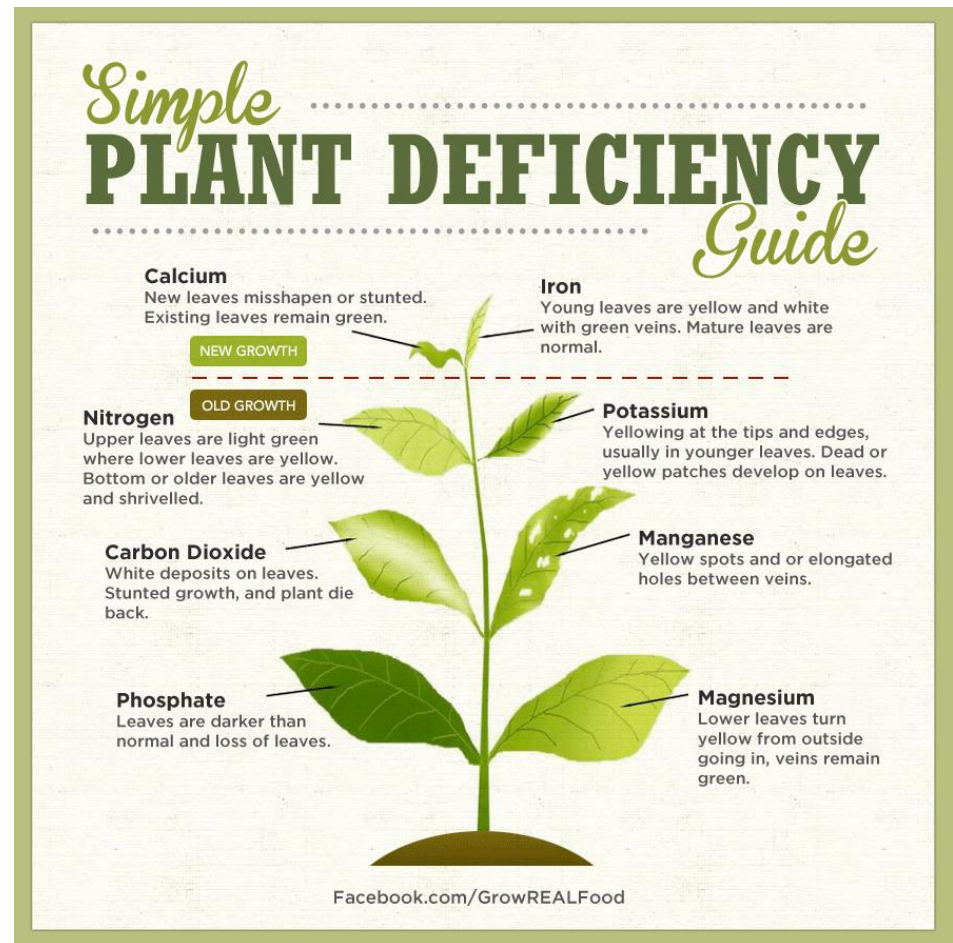
Eutrophication

- Humans and livestock add excessive amounts of plant nutrients (primarily phosphorus, nitrogen, carbon) to ecosystems
- Can come from soaps, detergents or fertilizers and agricultural runoff



Nutrient Deficiencies

- Many areas of the world lack essential plant nutrients in the soil
- Nitrogen, Calcium, magnesium, Phosphate, Potassium and Iron are essential for plant cell production
- How could you model this with your plants?



Thermal Pollution

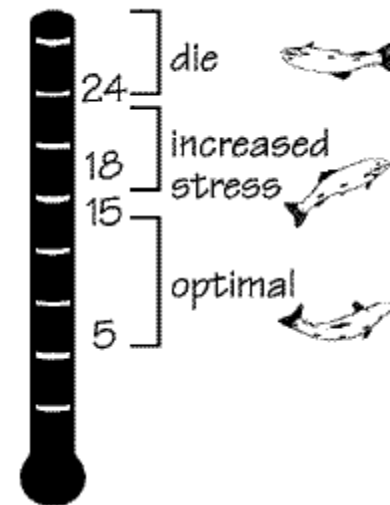
- The raising of the air, soil or water temperature by artificial means.

- Causes:

- ✓ use of water as a cooling agent
- ✓ soil erosion
- ✓ deforestation of shorelines
- ✓ run-off from hot paved surfaces

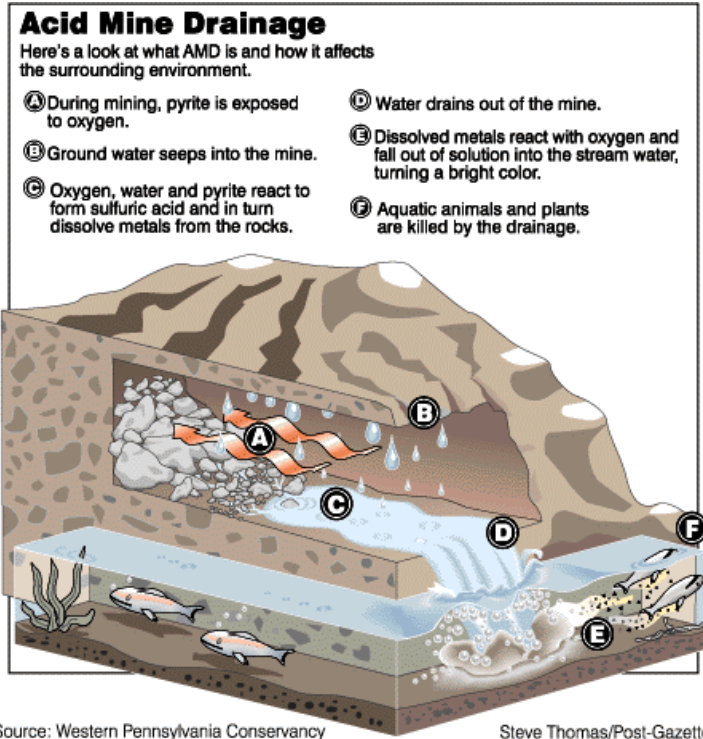
Results in:

thermal shock = killing of fish, plants and wildlife due to extreme water and soil temperatures



Acid Mine Drainage

- Areas where the earth has been disturbed (e.g. construction sites, subdivisions, and transportation corridors) may create acid rock drainage.
- How could you model this with your marigolds?



Source: Western Pennsylvania Conservancy

Steve Thomas/Post-Gazette



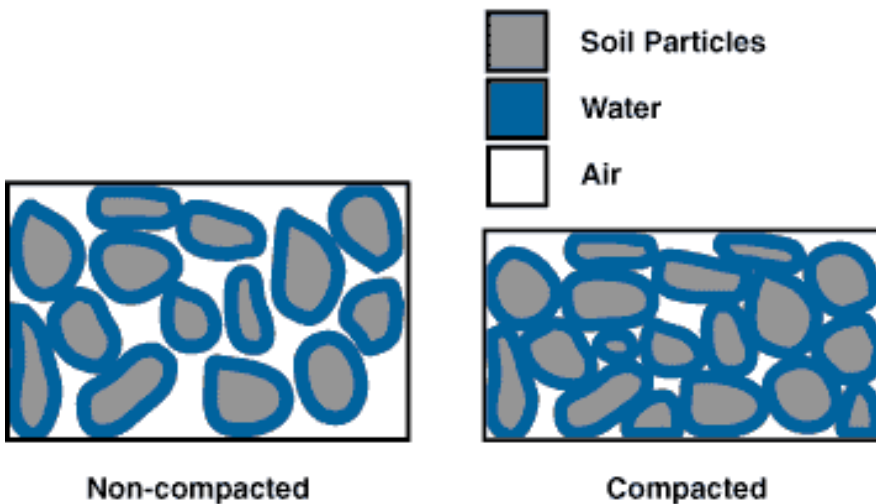
Heavy Metal Contamination

- Excess heavy metal accumulation in soils is toxic to humans and other animals.
- Exposure to heavy metals is normally chronic (exposure over a longer period of time), due to food chain transfer through plants.
- Chronic problems associated with long-term heavy metal exposures are:
 - Lead – mental lapse
 - Cadmium – affects kidney, liver, and GI tract.
 - Arsenic – skin poisoning, affects kidneys and central nervous system.



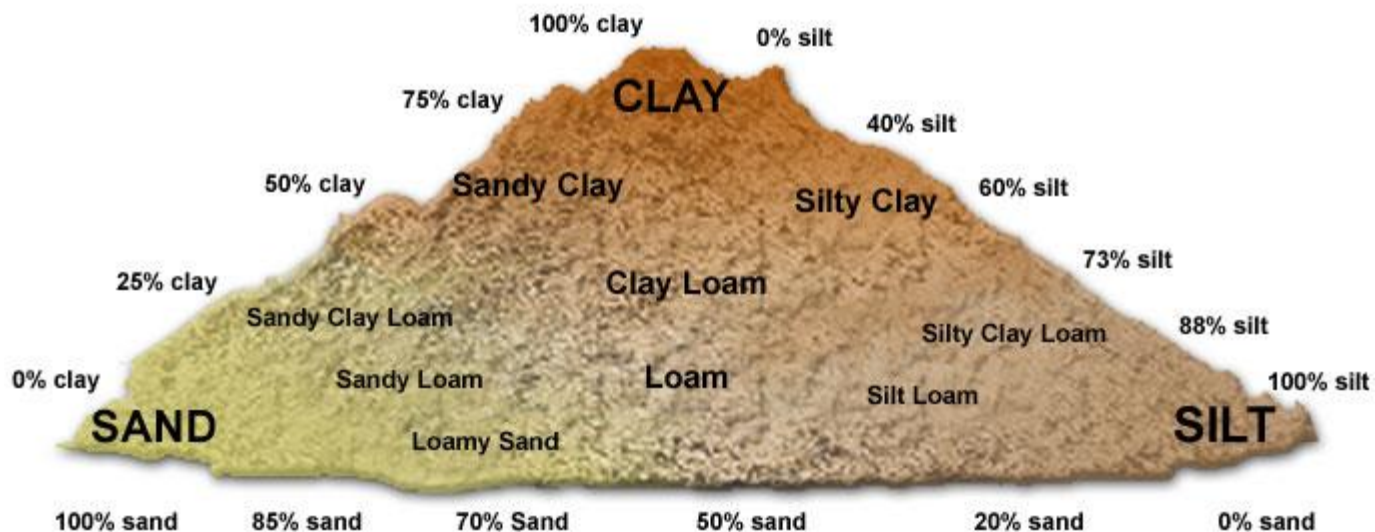
Soil Compaction

- Soil compaction occurs when soil particles are pressed together, reducing pore space between them
- Slightly compacted soil can speed up the rate of seed germination because it promotes good contact between the seed and soil
- Excessive soil compaction impedes root growth and therefore limits the amount of soil explored by roots
- How could you model compacted soil with your marigolds?



Soil Type

- Soil is made up of varying amounts of sand, silt, clay, and organic material such as decomposed plant matter.
- Each component, and their size, play an important role.
- The largest particles, sand, determine aeration and drainage characteristics, while the tiniest, sub-microscopic clay particles, are chemically active, binding with water and plant nutrients.



Other ideas?

- Noise pollution?
- Light color?
- Soil salination?