

Garden-Based Learning



Resources for educators, volunteers, and parents working with children and youth.



EDU-Garden



Pre-School Training

August 8th

2011



Long Term Goal

TO BE AMONG THE HIGHEST SCORES IN THE COUNTY ON THE SCIENCE FCAT!

- 2011 State Science Scores:
 - 5th: 51% 8th: 46% 3 or higher
- 2011 County Science Scores:
 - 5th: 58% 8th: 54% 3 or higher
- 2011 Bright Futures Scores:
 - 5th: 47% 8th: 57% 3 or higher

Local School Comparison

2011 Bright Futures Scores:

5th: 47% 8th: 57%

- Local School Highest Scores:
 - 8th: BAK: 86%
 - 8th: Don Estridge High Technical Middle: 81%
 - 8th: Wellington Landings 78%
 - 8th: Palm Beach Maritime 74%
 - 8th: Osceola Creek Middle 74%
 - 8th: Jupiter Middle 72%
 - 8th: Independence Middle 70%

Local School Comparison

2011 Bright Futures Scores:

5th: 47% 8th: 57%

- Local School Highest Scores:
 - 5th: Jupiter Farms Elem. 91%
 - 5th: Addison Mizner 88%
 - 5th: Binks Forest Elem. 86%
 - 5th: HL Johnson Elem. 84%
 - 5th: Del Prado Elem. 83%
 - 5th: Discovery Key Elem. 82%

What are schools around us scoring?

2011 Bright Futures Scores:

5th: 47% 8th: 57%

- **Palm Beach Gardens Elem. 71%**
- **Allamanda Elem. 66%**
- **North Palm Beach Elem. 44%**
- **Lake Park Elem. 27%**
- **Grove Park Elem. 26%**
- Duncan Middle: 68%
- JFK Middle: Grade: 58%
- Roosevelt Middle: 40%
- Watkins Middle: 28%

How are we going to accomplish our goal?

- **IMPROVE PROGRAM**
 - EDU-Garden
 - Dedicate Financial Resources to the Science Program
- **IMPROVE TEACHING STAFF**
 - Increase Teacher science knowledge
 - Hire Teachers with science backgrounds
- **IMPROVE STUDENT INTEREST**
 - Increase student science class time
 - Encourage and motivate students to study science
- **IMPROVE PARENTAL INVOLVEMENT**
 - Increase parent involvement through EDU-Garden
- **IMPROVE COMMUNITY INVOLVEMENT**
 - Encourage Community involvement by inviting guest speakers who are experts in the field of science

What Constitutes a Years Growth

Reading DSS Increase

- 4th to 5th 166 Points
- 5th to 6th 133 Points
- 6th to 7th 110 Points
- 7th to 8th 92 Points

Math DSS Increase

- 4th to 5th 119 Points
- 5th to 6th 95 Points
- 6th to 7th 78 Points
- 7th to 8th 64 Points

Our Student Growth

- Garden Helpers that showed increases in FCAT achievement scores: Reading: Avg. 203 DSS increase
 - Jordan + 334 Minnott +290 Haroutunian + 310
 - Luke +201 Large+ 177 Smith +263
 - Zakarite +281 Muniz+264 Ibarra +219
 - Delguzzi +427 Dingle +287 Primavera +521
 - Perunko +159 Nelson + 386 Rash +316
 - Stoneman +497 Jackson +346 Sweeny +345
 - Wamsley + 420 Prairie +270 Spado +177
 - Manning +137 Allard +214 Murray +148

Our Student Growth

- Garden Helpers that showed increases in FCAT achievement scores: Math: Avg. 102 DSS increase

– Prairie +348	Delguzzi +260
– Manning +189	Stoneman +152
– Haroutunian +186	Gazo +160
– Luke +218	Sweeny +168
– Murray +219	Campana +166
– Mondesir+358	Nelson +140
– Minott +316	Mathews +133
– Jackson +213	Muniz +135
– Wamsley +323	Fantin +128
– Jordan +635	Hughes +102

What is Science?

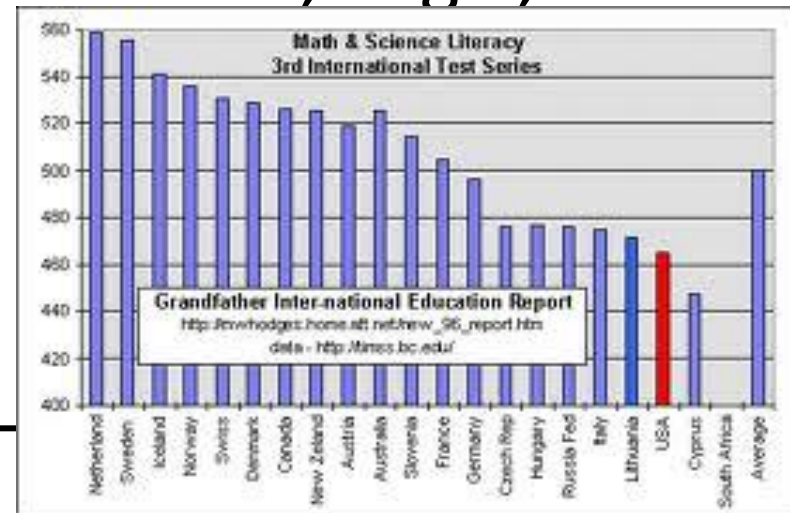
- Latin: Scientia: Knowledge
- Science is an effort to make sense of the world in which we live.
- Science is a labeling system.
- Science is a curiosity.
- Science is Philosophy.
- Science requires a Leap of Faith.



Fields of Science

- Natural Science uses empirical evidence and scientific observations (Biology, Chemistry, Earth Science, Astronomy, Physics, Etc.)
- Formal Science uses systems, definitions and rules (Math, Computer Science, Logic, Statistics).

MATH IS A SCIENCE 😊

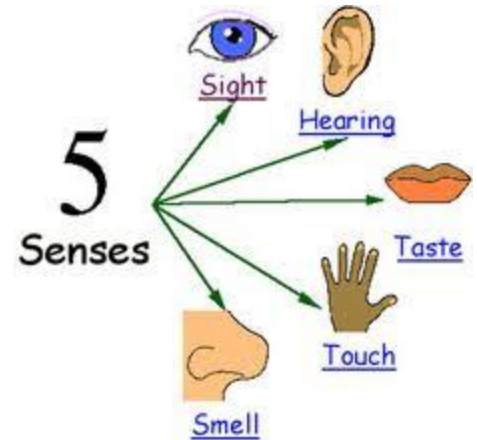


Science is a Philosophy

- Empirical Evidence: Can you use your 5 senses to **observe?**
- Is science truth?
- Science seeks to make sense of the world around us by experimenting to determine if a result can be repeated.
- Science seeks to classify/categorize

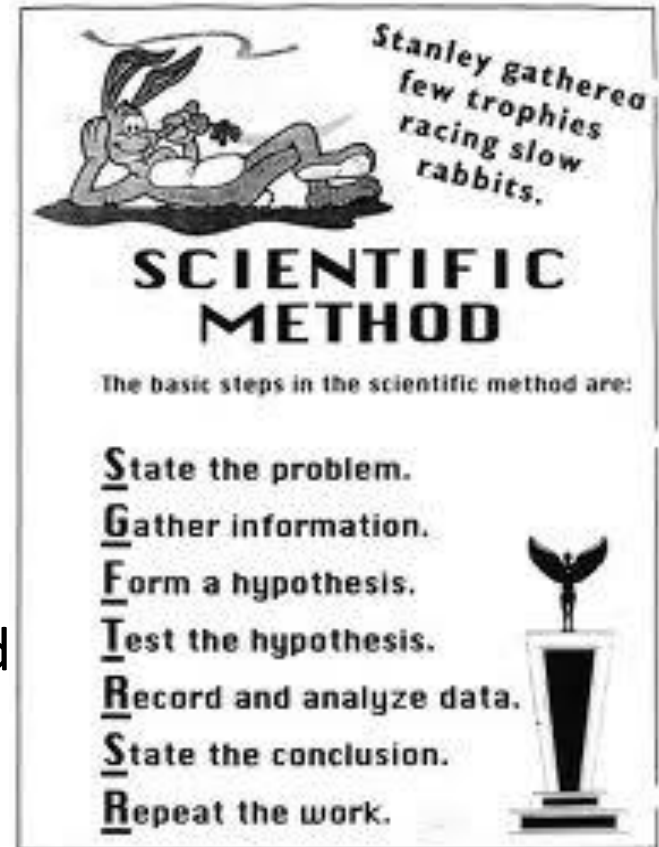
Observations

- Teach students:
 - about their 5 senses
 - how to be a keen observer
 - how to document what they observe
 - Writing
 - Graphing
 - Drawing
 - Making Models
 - Qualitative vs. Quantitative Observations
 - Infer or Interpret
 - Predict or Hypothesize



Designing an Experiment

- Teach students:
 - What is an experiment
 - What is a variable
 - Controlled Experiment
 - What is a conclusion
 - Communicating their findings
 - How to Present- speech
 - How to construct a science board
 - Technology-
 - power point presentations
 - Excel Spreadsheets



Science and Math

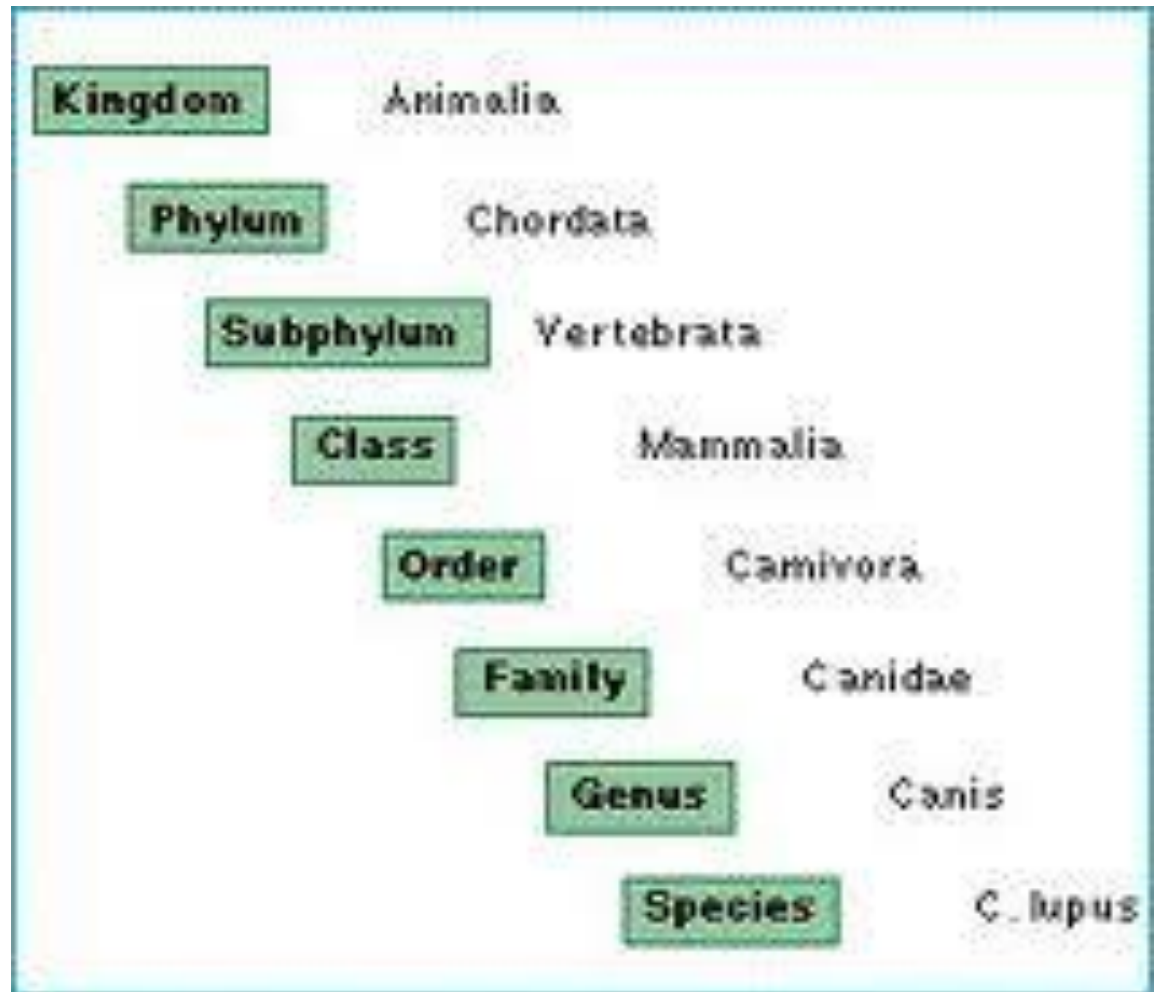
- Teach Students:
 - Graphing –Statistics-Estimation-Scientific Notation
 - Measurement
 - Metrics and Standard
 - Length
 - Volume
 - Mass and Weight
 - Density
 - Time
 - Temperature
 - Conversion



Classification

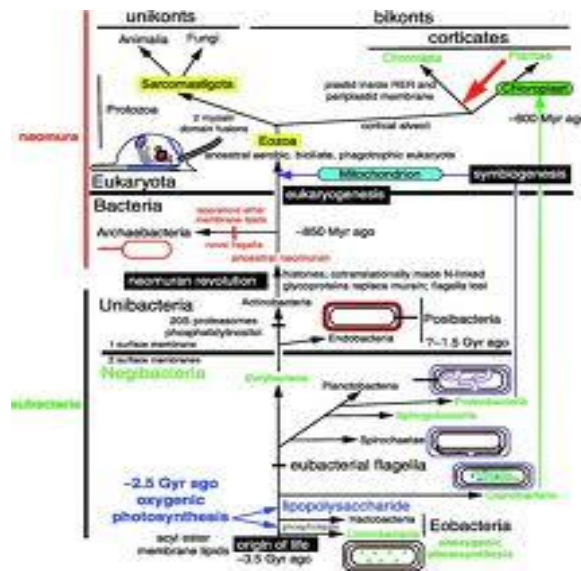
Linnaeus System from General to Specific

- 3 Kingdoms
 - Animals
 - Plants
 - Minerals
- Phylum
- Class-
- Order
- Family
- Genus
- Species



Evolving and 2004 most recent revision

Cavalier-Smith: debatable classification that breaks classes down further, separating unicellular from multi-cellular and the ability to photosynthesize. Additional categories are also delineated such as tissues and membranes.



EDU-Garden

How can a Garden Increase Science Scores?

- According to the *Royal Horticulture Society*, Schools which integrate gardens develop student who:
 - are much more responsive to the challenges of adult life
 - are able to think more independently and adapt their skills to new challenges
 - are more resilient, confident, and responsible
 - learn vital job skills and fuel their entrepreneurial spirit
 - develop a healthier, more active life styles
 - develop the ability to work and communicate with people of all ages and backgrounds
 - show improved literacy, numeracy and oracy

Cornell Research Findings Show Garden Based Learning:

- Increased Nutrition Awareness
 - Increased Environmental Awareness
 - Higher Learning Achievements
 - Increased Life Skills
-
- **It Should be Recognized as a key teaching tool!!**

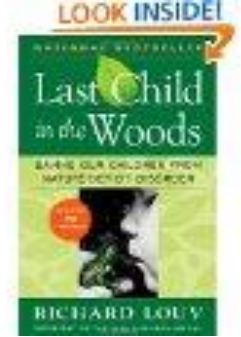
Why a Garden?

Childhood Obesity:

- Approximately 16% of US children (~ 9 million) aged 6-19 are overweight or obese.
- Childhood obesity has doubled over the past 30 years for preschoolers and adolescents and more than tripled for children aged 6-11.
- Children may be spending less time engaged in physical activity during school. Daily participation in school physical education among adolescents dropped 14 percentage points over the last 13 years — from 42% in 1991 to 28% in 2003.²⁶ In addition, less than one-third (28%) of high school students meet currently recommended levels of physical activity.^{27(CDC)}

Nature Deficit Disorder

as taken from Education.com



- **A lack of routine contact with nature may result in stunted academic and developmental growth.** This unwanted side-effect of the electronic age is called **Nature Deficit Disorder (NDD)**. The term was coined by author Richard Louv in his book *Last Child in the Woods* in order to explain how our societal disconnect with nature is affecting today's children.
- Outdoor activity in the natural environment has taken a back seat to television, video games, the computer, and a demanding schoolwork and extracurricular schedule.

Nutrition and Cooking



- Encouraging students to learn about foods
- Teaching students how to cook
- Eating at home has many positives:
 - Saves Money
 - You know what you are eating!
 - Portions- you control them
 - Reduces temptations and bad choices
 - Family Time



Kids and Gardening

- <http://www.kidsgardening.org/>
- <http://www.edibleschoolyard.org/>
- <http://www.citysprouts.org/>
- <http://www.csgn.org/>
- <http://www.woollyschoolgarden.org/?gclid=CKvnxs7306QCFRYM2godVmQYMw>
- <http://schoolgardenweekly.com/>

Essential Parts of Our Garden

- **Container Gardening & Other Planting Methods**

- Soil/Compost

- Plants

Indoor Classroom

- Insects

Outdoor Classroom

- Mammals

Learning Centre

- Tools

Kitchen

- Water

- Weather & Sun



Square Foot Gardening

- <http://www.squarefootgardening.com/home>



Cedar Pyramid

Is Pressure Treated Wood Safe For Gardening



- Your beds will be fine as is. Like Karen, I'd suggest not planting root crops near the edges. In fact, my suggestion is to plant marigolds along the edges!
- Also, be aware of the drainage in the beds. Leaching would be increased if water tended to stand rather than running off and out.
- If there's a section where you just HAVE to plant something 'too close for comfort', then pull back the soil, and line the inside with heavy-duty plastic. Keep it below soil line so that the sun doesn't degrade it.
- No disrespect to the Home Depot manager, but your best bet with answers to questions comes from your County Extension office!
- **United States Environmental Protection Agency**
 - Effective December 31, 2003, no wood treater or manufacturer may treat wood with CCA for residential uses, with certain exceptions.

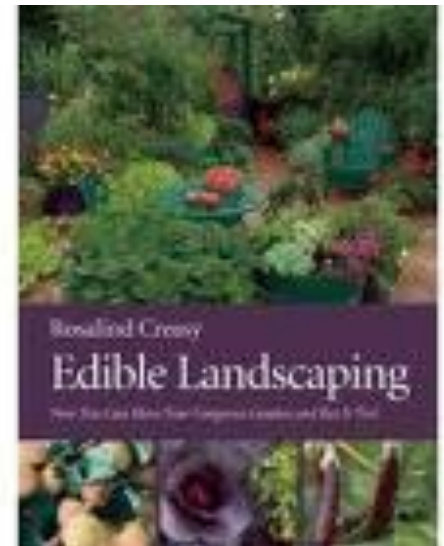
Is Pressure Treated Wood Safe For Gardening

- John,
- Your Home Depot manager is correct: any CCA lumber produced after 2003 does not contain arsenic. In the pressure-treating process, however, chromium and copper are still added as pesticides, so it is always wise to take some precautions when working with new lumber. After the first year any leaching will have subsided and the leaching is usually contained to the soil closest to the wood.
- Arsenic is naturally occurring and we consume small amounts of it daily. The type that was used was more toxic than the natural type but it is still in the foods we consume, as it is found in the soil. Studies have shown that the amount of arsenic that was found in carrots grown in control beds vs. raised beds was doubled but they were still trace amounts, 0.11 parts per million. Carrots, a root vegetable, are the worst since the plants store the arsenic in their roots.
- If you are concerned don't plant any root crops near the edges for the first year.
- Happy gardening!
- Karen



Other Types of Planting

- Hill and Valley Gardening
- Pots
- Hanging Gardens (Wooley Gardens)
- Perimeter
- Edible Landscaping



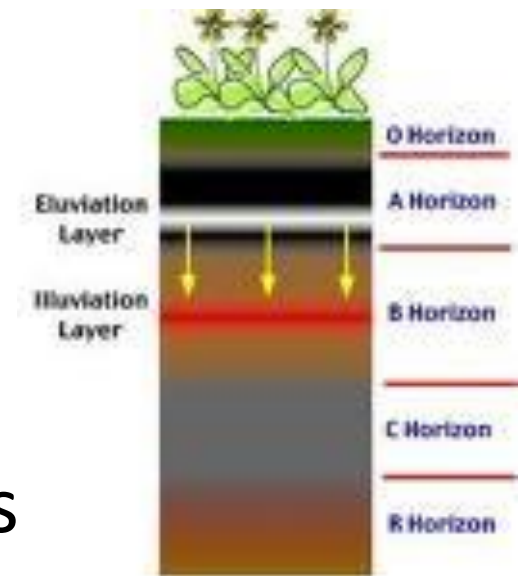
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Planting Medium: Soil/Compost (Environmental Science)

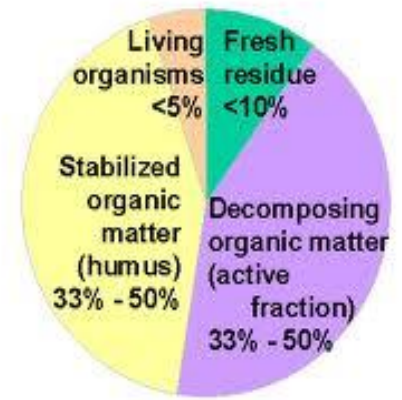
- An organic garden depends upon compost
- Soil Remediation
- Erosion
- Amending the soil
- Crop Rotation
- Soil PH and Fertilizer
- Depth of soil necessary for crops
- Disease



Soil Facts

Earth Science

- Apple Experiment
- Hydroponics & Soil Conservation
- What is soil?
 - “The loose, weathered material on Earth’s surface in which plants can grow. It is a mixture of rock particles, minerals, decayed organic material, water and air.”
 - Westminster Abbey



Compost

- An organic garden depends upon compost-
 - EDU- Garden makes its own compost; however, we can not make enough!!
 - Solid Waste Authority supplies us with FREE compost material for all of our gardening beds.

It has been said by some that we can not mass produce food organically, so growing our own crops makes organic food a reality.

SWA Compost Material



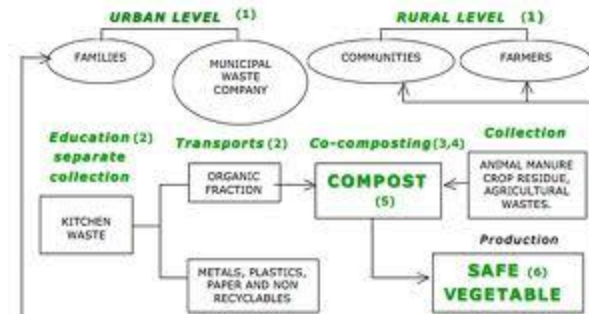
- Product Quality
- The compost mix remains in the bays for a minimum of 14 days (during the summer retention may be as long as 21 days). The compost facility has a curing area, screening system, and product storage area. Finished compost remains on site for a minimum of two months, during which time it is tested for pathogens, vector attraction reduction and stability. Stability, monitored with carbon dioxide respiration testing, shows a stable to very stable rating upon discharge from the bays. Stability tests on the product when it is actually distributed show similar results. **The SWA's compost meets federal and state standards for unlimited use.**

SWA Compost Material

- Compost Feedstock

The Second Nature Compost Facility accepts processed yard trimmings (mulch) from the SWA's [Woody Waste Recycling Facility](#) and wastewater residuals from the City of West Palm Beach and others. The mulch is transported to the compost facility by 100-cubic-yard tractor trailers (similar to the ones used at the transfer stations) and discharged onto the tipping floor area.

- Wastewater residuals are delivered to the compost facility in 30-yard tractor trailers with dump bodies. SWA Compost Operators receive the wastewater residuals and load all delivered mixed residuals and mulch into the compost reactors during the same workday.
- Next to the tipping floor is the mixing area where the processed yard trimmings and wastewater residuals are combined to produce the feedstock mixture. Two stationary batch mixers (capable of handling approximately 16 cubic yards of material at a time) stand side by side. Typically, the operator mixes a 50:50 yard trimmings/residuals combination (by weight) in the batch mixer to obtain a targeted final mixture.



EDU-Garden Compost (Chemistry)

- Rabbit Droppings & Chicken Manure
- Raw vegetables from the kitchen
- Plant clippings
- Coffee Grounds/Tea Bags
- Egg Shells
- This year we hope to:
 - incorporate sea weed
 - Introduce vermiculture



Backwoods Home Magazine

practical ideas for self-reliant living



- **Rabbit droppings**
- When it comes to animal fertilizers, the best readily-available fertilizer is rabbit droppings. Rabbit droppings have the highest nitrogen content of any of the commonly available barnyard manures, such as cow, horse, pig, etc. Rabbit droppings are small, compact, and nearly odorless. One organic gardener described them as “miniature, time-released, fertilizer capsules.” If you raise rabbits, or know someone who does, you’ll have a source of one of nature’s best natural fertilizers.
- We have our rabbit friends living atop our earthworm compost pit. Rabbit droppings can also be called “earthworm caviar.”
- The fertilizer provided by our earthworm compost pit is about the best you could find anywhere, and it’s “free.”



...or those coffee grounds

- Another commonly discarded kitchen item is coffee grounds. Coffee grounds can be particularly useful in the garden, or, at the very least, added to your compost pile.
- Used coffee grounds contain about **two percent nitrogen, about a third of a percent of phosphoric acid, and varying amounts of potash (generally less than one percent)**. Analysis of coffee grounds shows that they contain many minerals, including trace minerals, carbohydrates, sugars, some vitamins, and some caffeine. They are particularly useful on those plants for which you would purchase and apply an “acid food,” such as blueberries, evergreens, azaleas, roses, camellias, avocados, and certain fruit trees.
- We dry our coffee grounds in the oven, too. Then we scatter them lightly, as a mulch, around those plants which we feel would benefit from them. We don't scatter them thickly when they are wet, because the coffee grounds have a tendency to get moldy.
- The growth of plants that like or need lime (which we can provide with eggshells) can be stimulated by adding a mixture of ground-up eggshells and dried coffee grounds.
- Smile the next time you drink your morning cup of coffee and eat your breakfast of eggs, since the by-products of your meal are ideal for your urban garden, and need no longer be “kitchen waste products.”



Don't discard those egg shells...

- If you're in the habit of buying all sorts of liquid fertilizers and other commercial treatments for your garden, you may be happy to learn that at least two commonly discarded kitchen scraps are ideal for many of your garden plants.
- You've heard of "liming" the garden and lawn, right? Most people buy a bag of lime (calcium carbonate) every few years and sprinkle it throughout the garden. **Were you aware that eggshells are 93% calcium carbonate?**
- **In addition to the calcium, the eggshells contain about 1% nitrogen, about a half-percent phosphoric acid, and other trace elements that make them a practical fertilizer. Calcium is an essential plant nutrient which plays a fundamental part in cell manufacture and growth.** Most roots must have some calcium at the growing tips. Plant growth removes large quantities of calcium from the soil, and calcium must be replenished, so this is an ideal way to recycle your eggshells.
- We save our eggshells in a pan in our oven. The pilot light temperature slowly dries them out. Then we crush them by hand and powder them in the blender. The powdered eggshells are then placed around fruit trees, in potted plants and roses, and broadcast throughout the vegetable garden.
- You can also solve your snail problems with the help of recycled eggshells. Instead of powdering the shells, use them at the hand-crushed stage, with plenty of rough, sharp edges. Scatter the crushed shells in circles around those plants that the snails are eating. Since the shells cause discomfort to the snails, they nearly always retreat and do not cross the shell barriers.
- (Did you know that our California brown snails are actually escaped escargot? One method of "control" is simply to eat them—but that's another story.)



COMPOST NO-NO-NOs

- No cooked or processed food products
- No dairy
- No weeds or seeds
- No meat or meat by-products
- No plastic
- No dog, cat or other omnivore manure
- No trash
- **STAY GREEN AND RAW**



Soil Borne Pathogens (bacteria to plants)

- Garden Hygiene- WASH YOUR HANDS and WASH YOUR VEGGIES
- 2 sinks- You can wash your hands in both!
 - 1 for cooking (food related) ONLY in the kitchen
 - 1 for animal and plant care
 - NO ANIMALS IN THE KITCHEN SINK
 - **Keeping your soil healthy helps keep pathogens at bay**

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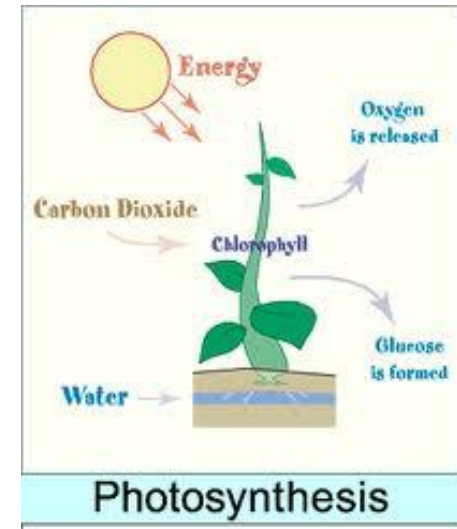
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 - Kitchen
- Insects
- Mammals
- Tools
- Water
- Weather & Sun



Plant Basics:

ALL FOOD CHAINS BEGIN WITH PHOTOSYNTHESIS AND END WITH DECAY

- Vocabulary that you need to know:
 - Photosynthesis-Autotroph
 - Transpiration
 - Propagation: Asexual vs. Sexual
 - Xylem & Phloem
 - Angiosperm & Gymnosperm
 - Pollination
 - Producer, Consumer & Decomposer

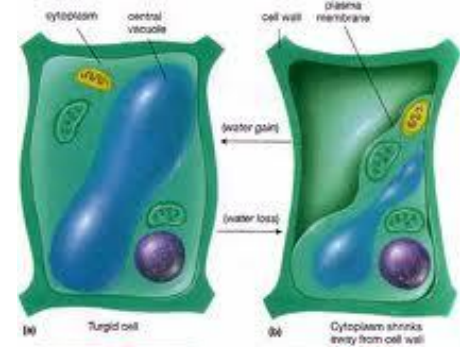


Photosynthesis

- The uppermost, sunlit layer of the ocean is where 70% of the entire amount of photosynthesis in the world occurs- euphotic zone approximately 100 meters or 330 feet.
- Phytoplankton and their growth actually affects the carbon dioxide and nitrogen levels in our atmosphere, also the warming of ocean waters!
 - **EVERYTHING IS CONNECTED!!**

Seed Dispersal (Force Motion & Energy)

- The wind carries seeds which are shaped differently to most effectively self propagate- they do not need animals.
- Turgor Pressure- hydraulic pressure in a plant- how a plant is kept erect- it defies gravity!!
- Geotropism- the turning or growing movement of a plant in response to gravity.

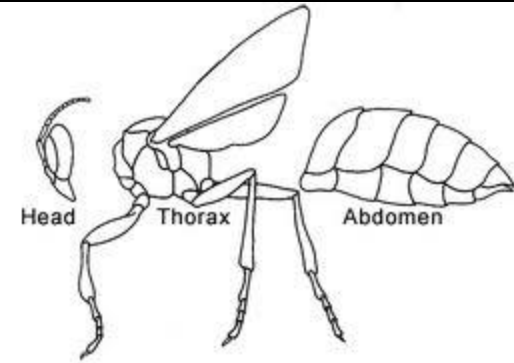


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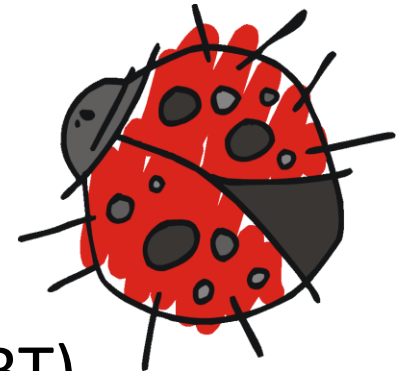
Insects and Disease:



- Pests and Disease Control
- 80% of all animal species are Insects
- Insects are the second trophic level (Plants are the first)
- Insects are arthropods- exoskeleton- no backbone!!
- Parts of an insect: Abdomen, Thorax, Head with 6 legs

Controlling Pests

- Biological Controls encourages beneficial insects (ladybugs)
- Scouts (kids hunt-em down and squish!)
- EDU-Garden=NO CHEMICAL CONTROLLING
 - Soap and water ONLY
 - Garlic and Pepper Spray
 - Companion Planting
 - Store bought organic pest control (BT)



Disease Control

- Majority of diseases are fungual and the most difficult to control
- Biggest Contributor to Crop Failure
- Sub-tropical climates- zone 10- the worst!
- Fungal spores are air borne
- EDU-Gardens uses
 - MILK and WATER
 - Store bought organic disease control



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Garden Rules and Etiquette for Animals (Animals)

- Animals are priority number 1!!!!
- Fresh Water is critical
- Food- appropriate amounts and delivery
- Cleanliness of Cages
- Observing animals for signs of:
 - Stress – disease – pregnancy – heat exhaustion



SUMMER'S COMING...

**Beware of
heat stroke and
fly stike.**



Rabbits are Mammals!!

- Rabbits do not sweat
- A 5 pound rabbit drinks as much as a 24 pound dog
- Love Greens- but no tomato leaves or brassicas
- Rabbits are prey animals- do not chase them



Chicken Chronicles

- Henny and Penny:
 - lay 1 egg each per day
 - love raisins for a reward
 - like to roam free
 - like greens -no brassicas- cabbage family or tomato leaves
 - are curious and may follow you- but chickens are CHICKEN
 - are prey animals- do not chase them!
 - Chicken smell and taste not so good but they feel vibrations in their wings and legs and have very developed hearing



Animal Husbandry

- <http://www.surehatch.com>



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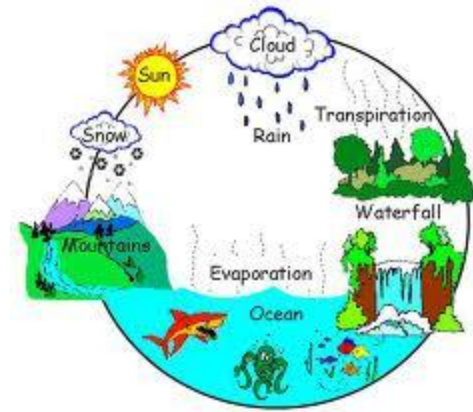
Tools we use

- Vocabulary:
 - Shovel- Round and Square Point
 - Hoe
 - Cultivator
 - Trowel
 - Rakes- Leaf and Hard
 - Wheel Barrows
 - Carts



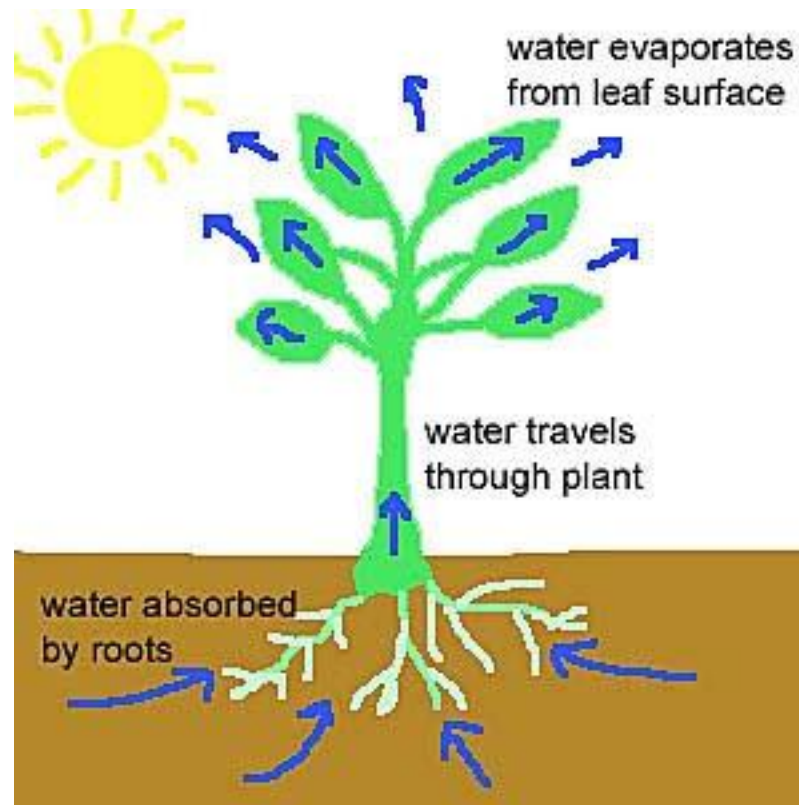
Water: H₂O (Earth's Waters)

- 90 to 94% of your body is made up of water
- EDU-Garden uses rain barrels
- Water Cycle
 - Evaporation, Condensation, Precipitation
- 75% of Earth's surface is water
 - 99% is unusable (mostly frozen)
 - Of the 1% that is usable 99% is found underground



Transpiration- in Plants

- This is the equivalent of perspiration in human



How and when to water (Environmental Science)

- Best time to water is in the morning-
 - Lower evaporation rate
 - Watering at night encourages fungus growth
 - NO transpiration happens at night
- Most efficient way to water is to water the roots
 - **Splashing Water encourages fungus**

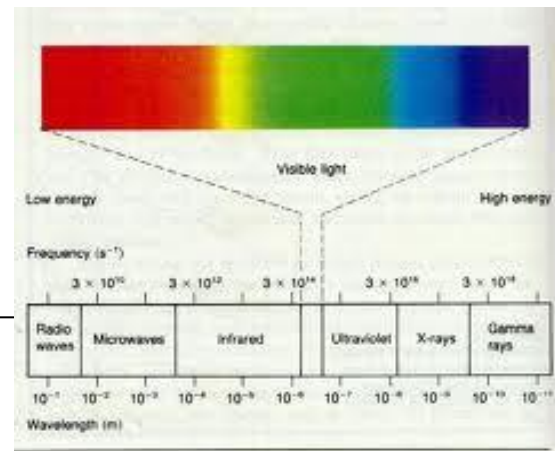
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Weather & Sun (Light and Sound)

- UV Rays- hats, glasses and sunscreen
- Sound: Do plants respond to sound?
- Color Spectrum:
 - Blue light is used for beginning stages of plant growth- better vegetation response in plants
 - Blue light goes the deepest in the ocean
 - Red light is used in phase 2 for better flowering and yield (Clemson University)

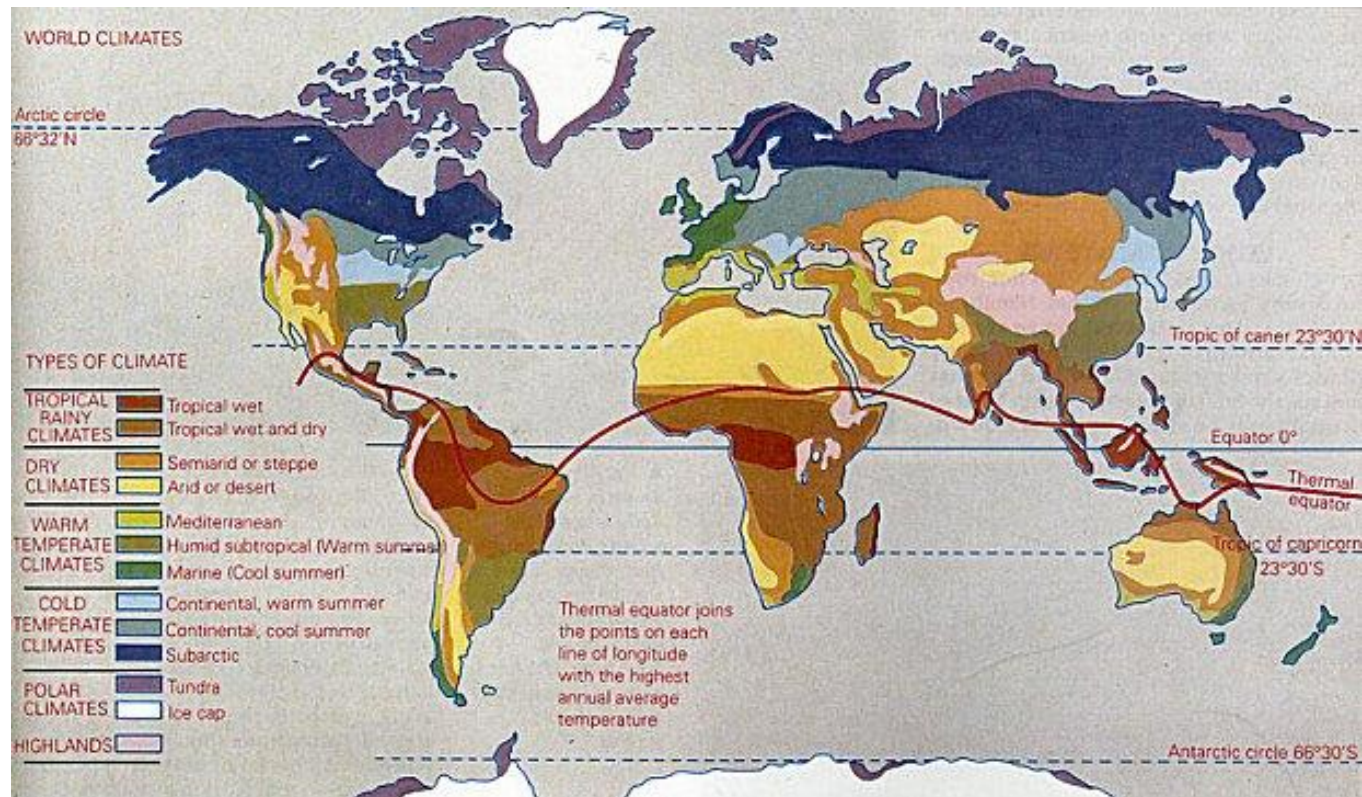


Weather & Sun (Weather & Climate)

- FACTS:
- Photoperiod- amount of day light, important for growth
- Vegetables need a minimum of 6 hours of daylight
- Wind- dries out the soil and causes erosion- transpiration stops during very windy conditions

Weather & Sun (Weather & Climate)

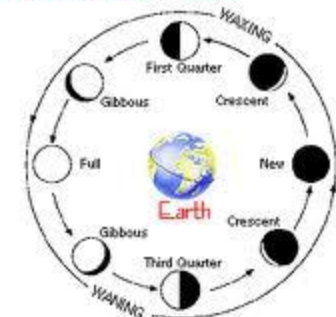
- Plant diversity is determined by the climate zone



Phases of the Moon (Astronomy)

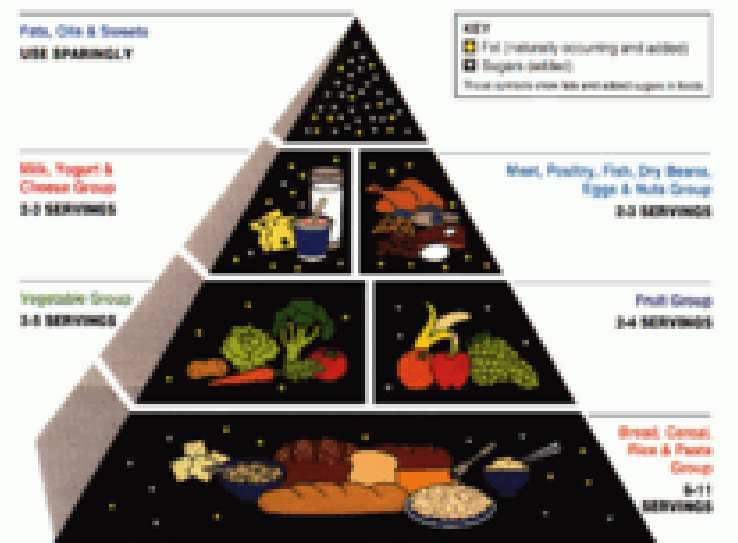
- How do the phases of the moon affect planting?
 - Affects the underground water table
 - Affects the movement of fluid in plants
 - Amount of moonlight available to plants
 - Ancient form of planting
 - What spectrum of light does the moon reflect?

The Moon as seen from Earth



The EDU-Garden and Nutrition

- Human Body and Health
 - Food Chains
 - Food Pyramid
 - Chemistry of Food
 - Cooking
 - Dehydration
 - Exercise
 - Breathing fresh air



Cells & Heredity



- We end up back where we started!
- Plants produce their own food, Animals eat the plants, animals eat animals!
- When we observe our Rabbits, genetics is an easy study
- Mendel Pea study-dominant and recessive genes

