Sowing the Seeds for Healthy Waterways:

How Your Gardening Choices Can Have a Positive Impact in Your Watershed

EPA-820-C-08-001
June 2008

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If we lived in a perfect world…

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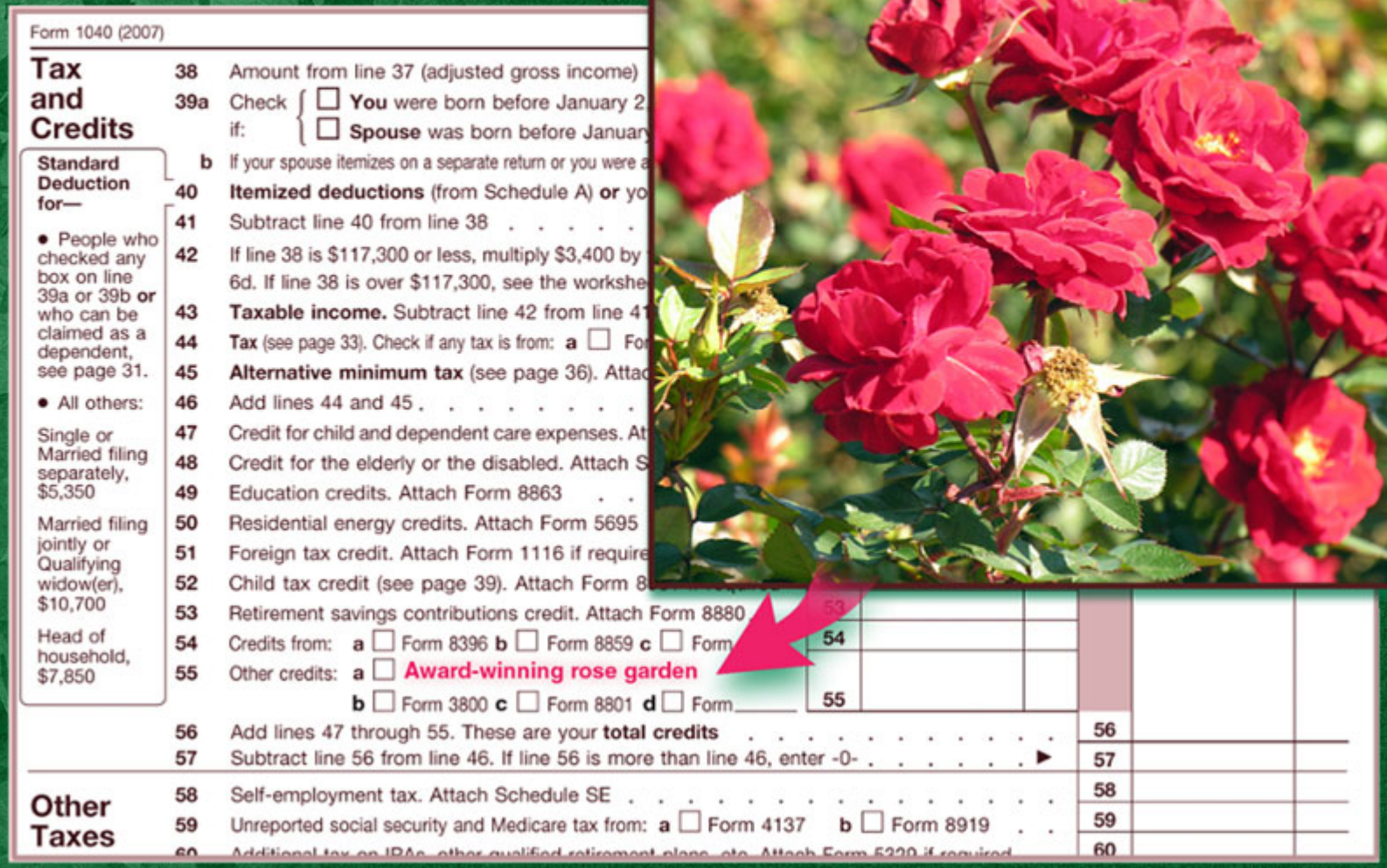

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Nitrogen and Phosphorus pollution, also known as "Nutrient Pollution"

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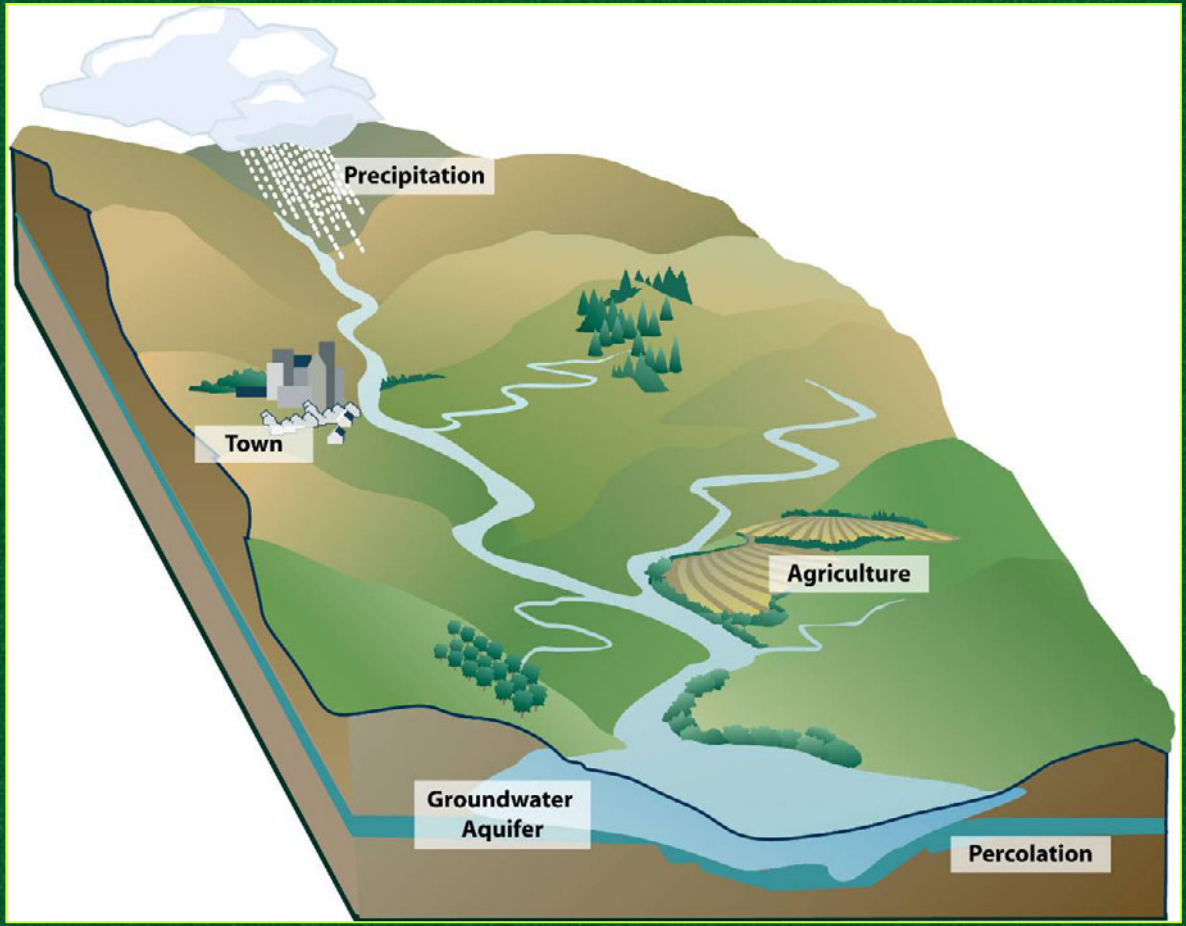
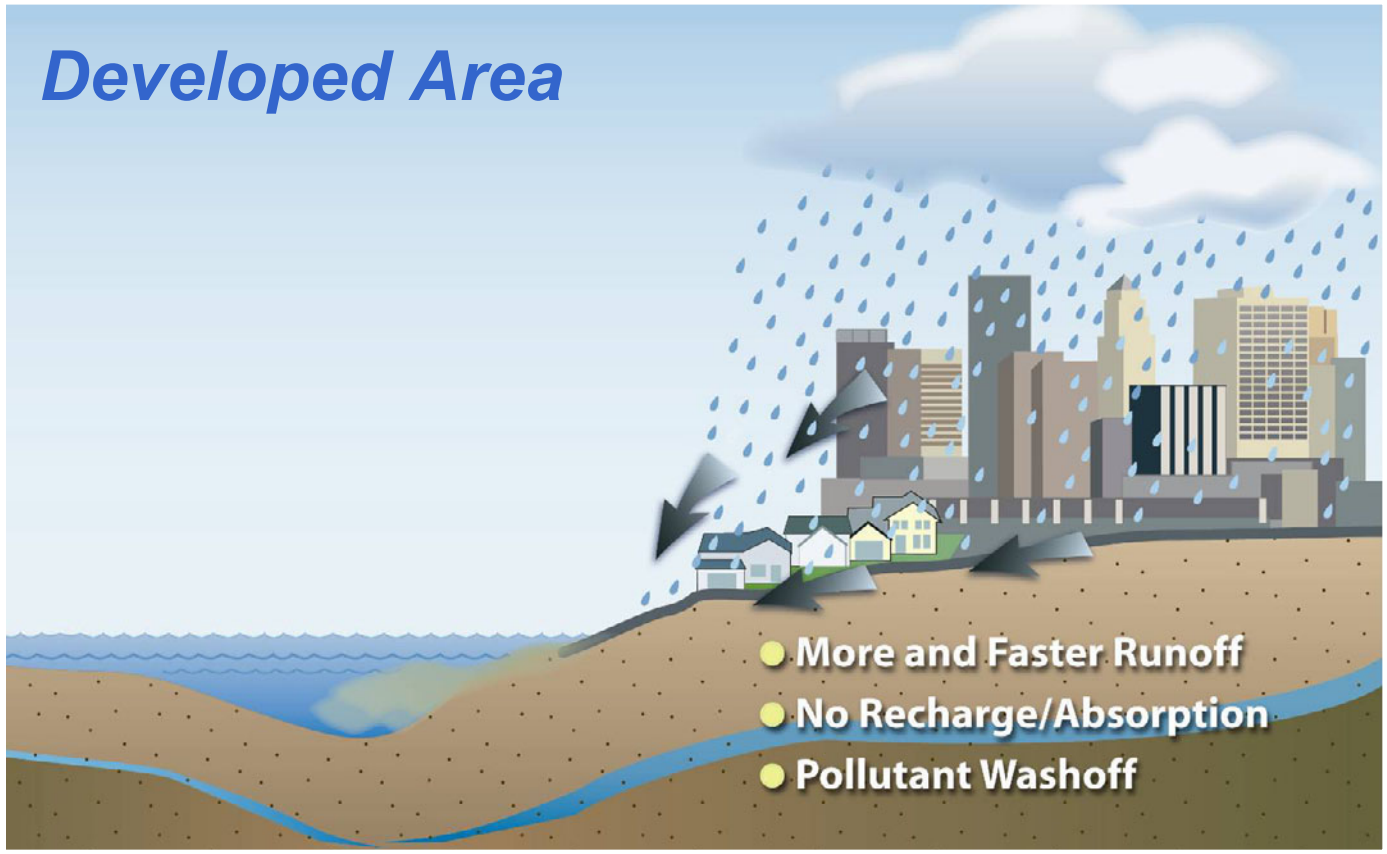
Watershed

- A watershed is an area of land where all the water drains into a common body of water. Watersheds are also referred to as “drainage basins.”

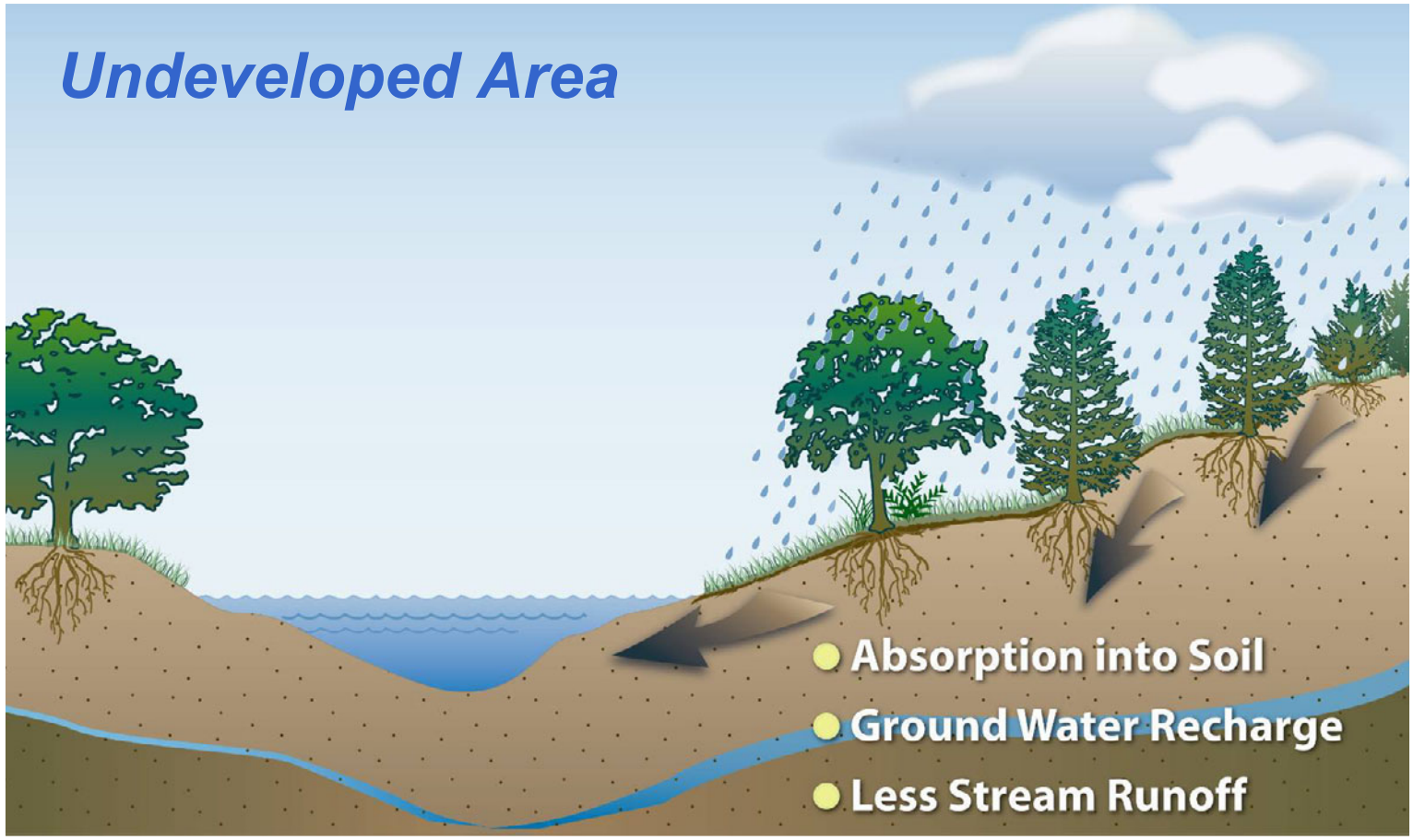


The path water takes as it flows downhill impacts water quality.



Water runs off the land, carrying fertilizer, dirt, pet waste and many other pollutants with it directly into the waterway.

The path water takes as it flows downhill impacts water quality.



Water percolates through the ground slowly.

Nitrogen and Phosphorus 101

Periodic Table of the Elements

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 **H** hydrogen 1.007 94(7)																	2 **He** helium 4.002 602(2)
3 **Li** lithium 6.941(2)	4 **Be** beryllium 9.012 182(3)											5 **B** boron 10.811(7)	6 **C** carbon 12.0107(8)	7 **N** nitrogen 14.0067(2)	8 **O** oxygen 15.9994(3)	9 **F** fluorine 18.998 4032(5)	10 **Ne** neon 20.1797(6)
11 **Na** sodium 22.989 769 28(2)	12 **Mg** magnesium 24.3050(6)											13 **Al** aluminium 26.981 538 6(8)	14 **Si** silicon 28.0855(3)	15 **P** phosphorus 30.973 762(2)	16 **S** sulfur 32.065(5)	17 **Cl** chlorine 35.453(2)	18 **Ar** argon 39.948(1)
19 **K** potassium 39.0983(1)	20 **Ca** calcium 40.078(4)	21 **Sc** scandium 44.955 912(6)	22 **Ti** titanium 47.867(1)	23 **V** vanadium 50.9415(1)	24 **Cr** chromium 51.9961(6)	25 **Mn** manganese 54.938 045(5)	26 **Fe** iron 55.845(2)	27 **Co** cobalt 58.933 195(5)	28 **Ni** nickel 58.6934(2)	29 **Cu** copper 63.546(3)	30 **Zn** zinc 65.409(4)	31 **Ga** gallium 69.723(1)	32 **Ge** germanium 72.64(1)	33 **As** arsenic 74.921 60(2)	34 **Se** selenium 78.96(3)	35 **Br** bromine 79.904(1)	36 **Kr** krypton 83.798(2)
37 **Rb** rubidium 85.4678(3)	38 **Sr** strontium 87.62(1)	39 **Y** yttrium 88.905 85(2)	40 **Zr** zirconium 91.224(2)	41 **Nb** niobium 92.906 38(2)	42 **Mo** molybdenum 95.94(2)	43 **Tc** technetium [98]	44 **Ru** ruthenium 101.07(2)	45 **Rh** rhodium 102.905 50(2)	46 **Pd** palladium 106.42(1)	47 **Ag** silver 107.8682(2)	48 **Cd** cadmium 112.411(8)	49 **In** indium 114.818(3)	50 **Sn** tin 118.710(7)	51 **Sb** antimony 121.760(1)	52 **Te** tellurium 127.60(3)	53 **I** iodine 126.904 47(3)	54 **Xe** xenon 131.293(6)
55 **Cs** caesium 132.905 451 9(2)	56 **Ba** barium 137.327(7)	57-71 **lanthanoids**	72 **Hf** hafnium 178.49(2)	73 **Ta** tantalum 180.947 88(2)	74 **W** tungsten 183.84(1)	75 **Re** rhenium 186.207(1)	76 **Os** osmium 190.23(3)	77 **Ir** iridium 192.217(3)	78 **Pt** platinum 195.084(9)	79 **Au** gold 196.966 569(4)	80 **Hg** mercury 200.59(2)	81 **Tl** thallium 204.3833(2)	82 **Pb** lead 207.2(1)	83 **Bi** bismuth 208.980 40(1)	84 **Po** polonium [209]	85 **At** astatine [210]	86 **Rn** radon [222]
87 **Fr** francium [223]	88 **Ra** radium [226]	89-103 **actinoids**	104 **Rf** rutherfordium [261]	105 **Db** dubnium [262]	106 **Sg** seaborgium [266]	107 **Bh** bohrium [264]	108 **Hs** hassium [277]	109 **Mt** meitnerium [268]	110 **Ds** darmstadtium [271]	111 **Rg** roentgenium [272]							

57 **La** lanthanum 138.905 47(7)	58 **Ce** cerium 140.116(1)	59 **Pr** praseodymium 140.907 65(2)	60 **Nd** neodymium 144.242(3)	61 **Pm** promethium [145]	62 **Sm** samarium 150.36(2)	63 **Eu** europium 151.964(1)	64 **Gd** gadolinium 157.25(3)	65 **Tb** terbium 158.925 35(2)	66 **Dy** dysprosium 162.500(1)	67 **Ho** holmium 164.930 32(2)	68 **Er** erbium 167.259(3)	69 **Tm** thulium 168.934 21(2)	70 **Yb** ytterbium 173.04(3)	71 **Lu** lutetium 174.967(1)
89 **Ac** actinium [227]	90 **Th** thorium 232.038 06(2)	91 **Pa** protactinium 231.035 88(2)	92 **U** uranium 238.028 91(3)	93 **Np** neptunium [237]	94 **Pu** plutonium [244]	95 **Am** americium [243]	96 **Cm** curium [247]	97 **Bk** berkelium [247]	98 **Cf** californium [251]	99 **Es** einsteinium [252]	100 **Fm** fermium [257]	101 **Md** mendelevium [258]	102 **No** nobelium [259]	103 **Lr** lawrencium [262]

Key:
atomic number
Symbol
name
standard atomic weight

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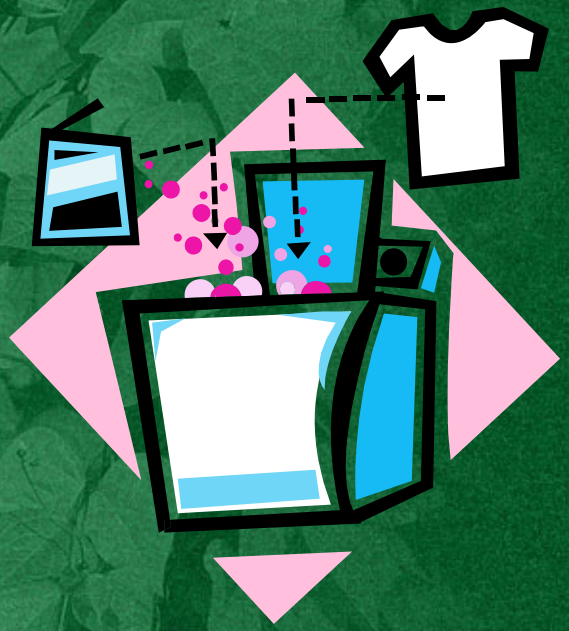
What are Nutrients?

- Nutrients are elements, like nitrogen and phosphorus, that occur naturally in water, soil and air
- Sources of nutrients
  - Decaying plant matter
  - Animal and human wastes (pet waste, septic tanks, waste water treatment plants)
  - Detergents
  - Fertilizer (residential, commercial, and agricultural)

Advanced: Phosphorus and Detergents

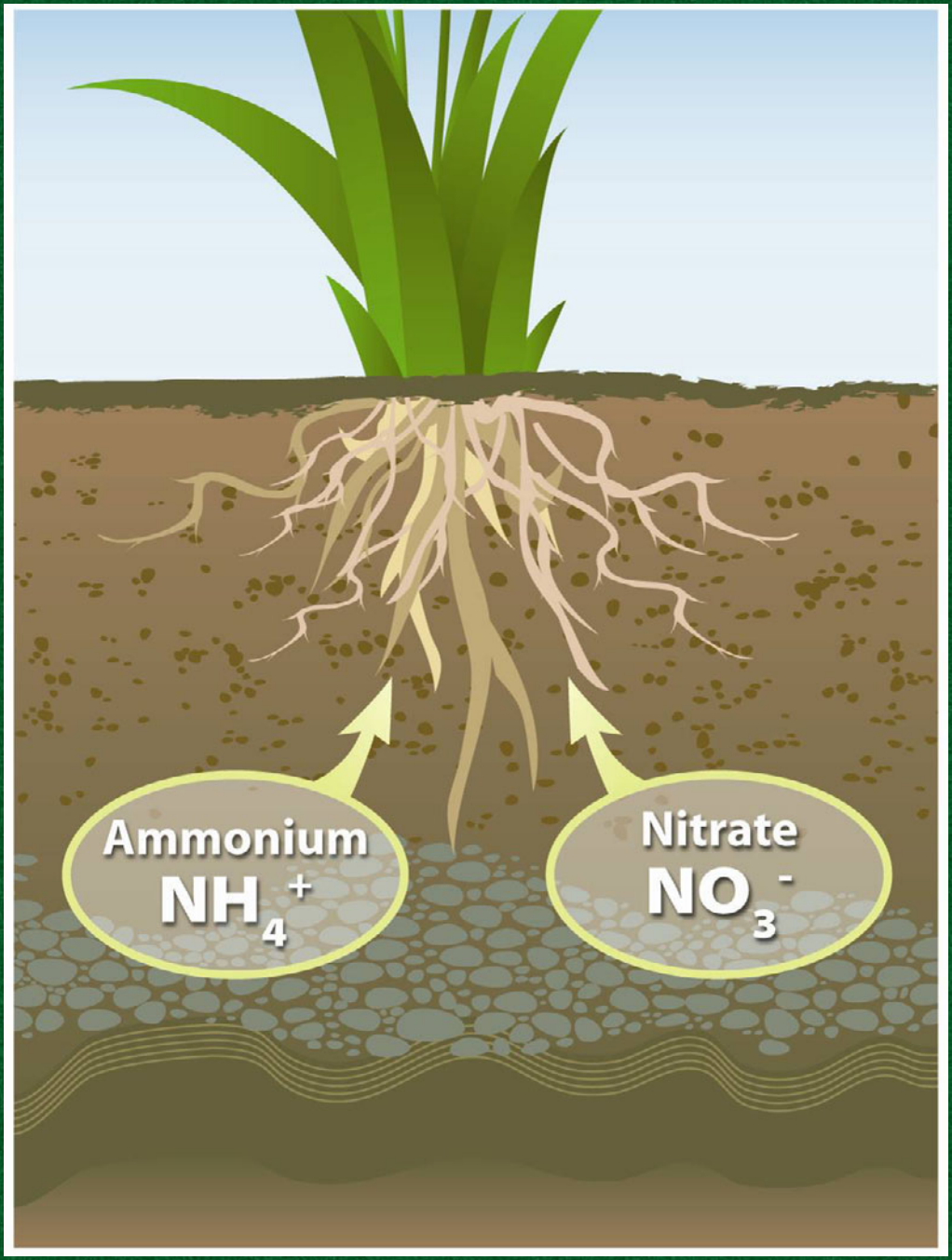


Nitrogen

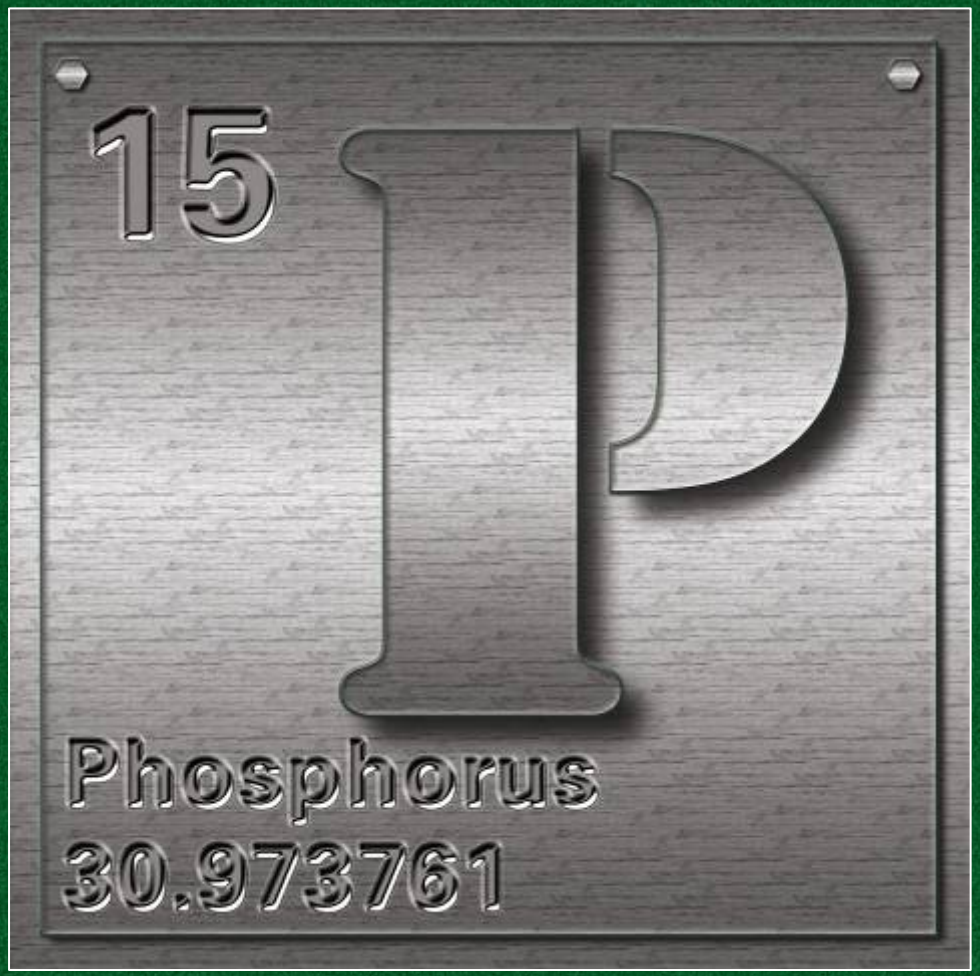
- Highly soluble in its common compound form, nitrate.
- Easily washed from the soil by rain or irrigation.
- Leached from the soil or absorbed by plants within weeks of application.
- Stimulates shoot growth in plants.
- Signs of deficiency can mimic other plant illnesses; yellowing leaves (with or without a reduction in size).

Advanced: Nitrogen – How it Works

Most plants are able to absorb nitrogen when it is in an ammonium or nitrate form



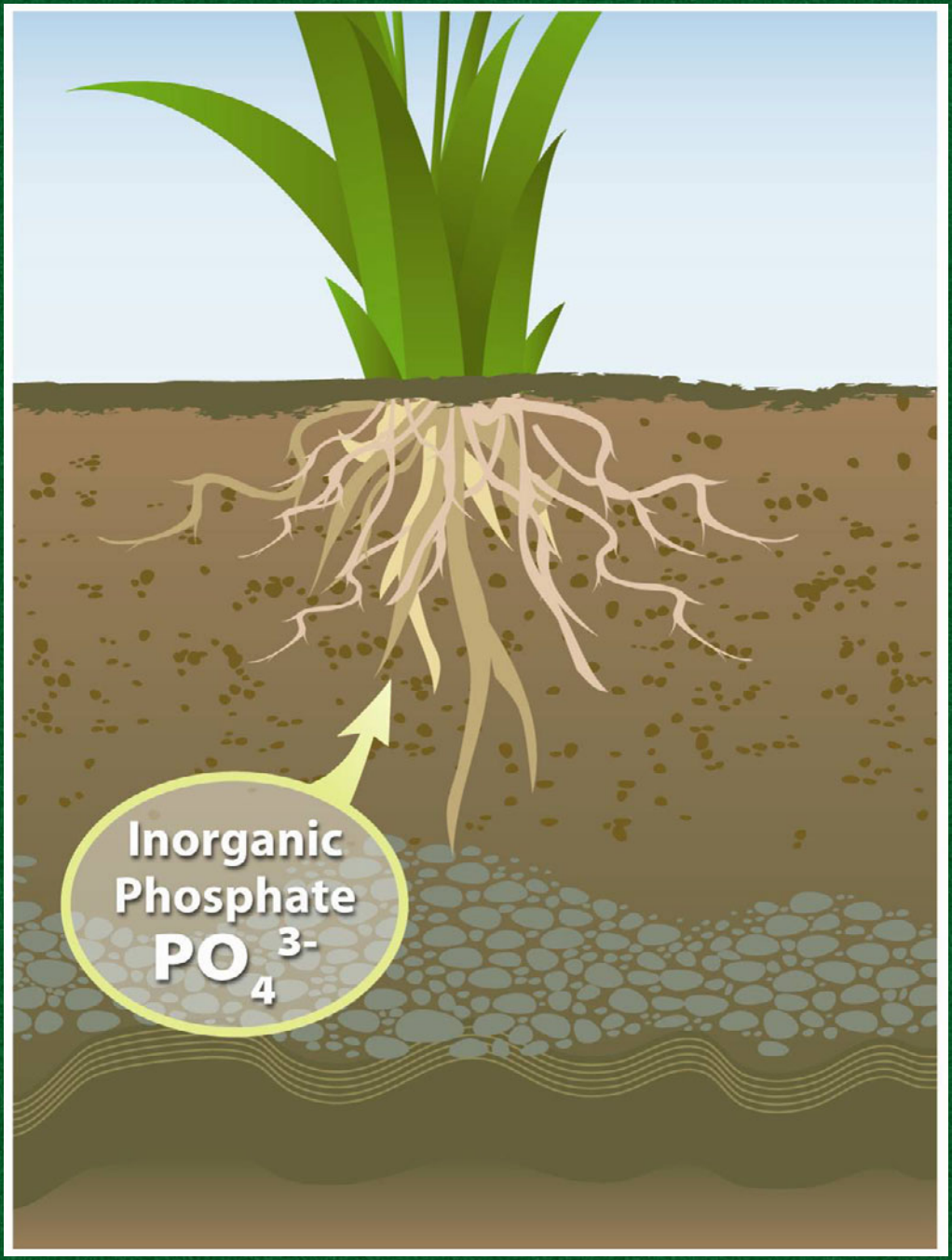
Phosphorus



- Typically found in soil as an insoluble compound.
- Leaches from the soil very slowly.
- Deficiency appears first as slowed growth. The leaves will become dull and dark green or grayish green.

Advanced: Phosphorus – How it Works

Plants absorb the inorganic form of phosphorus



Nutrients are similar to chocolate – a little is good, but too much is a bad thing

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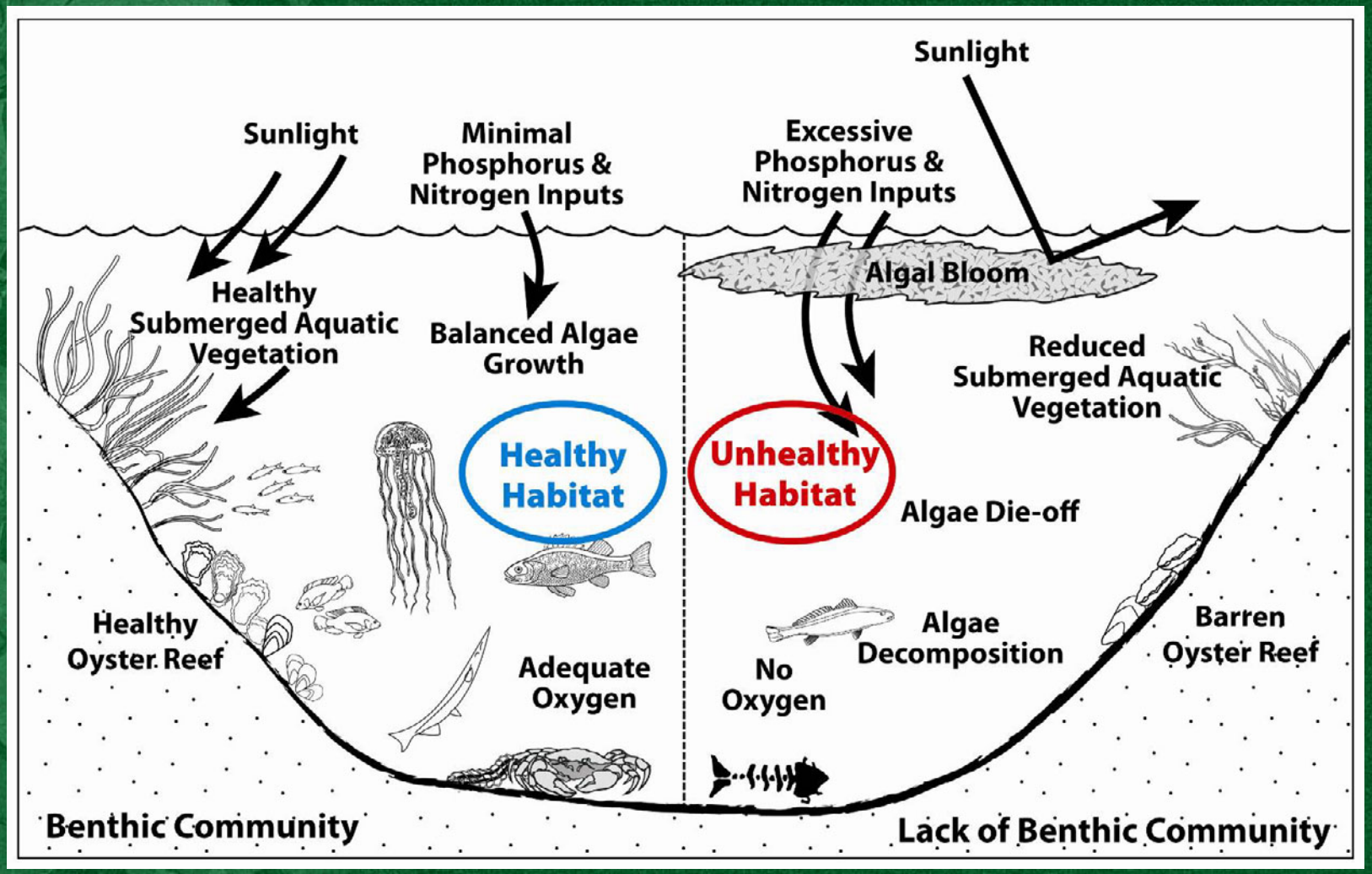
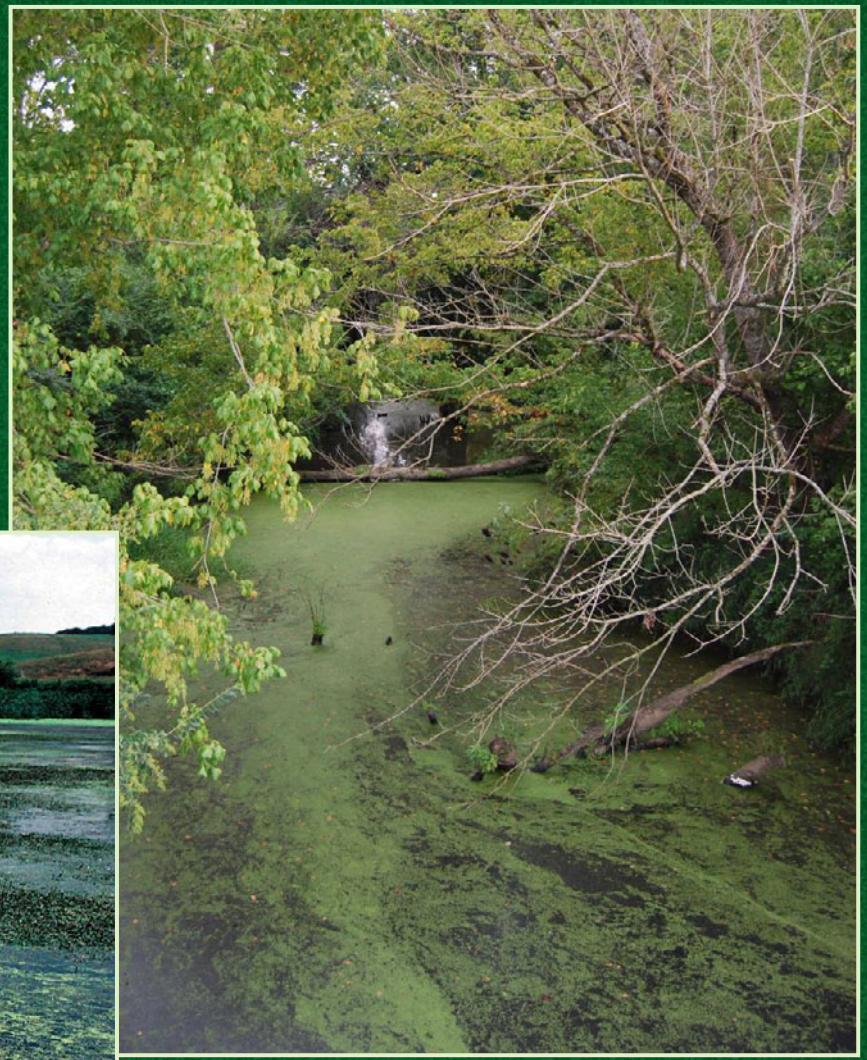
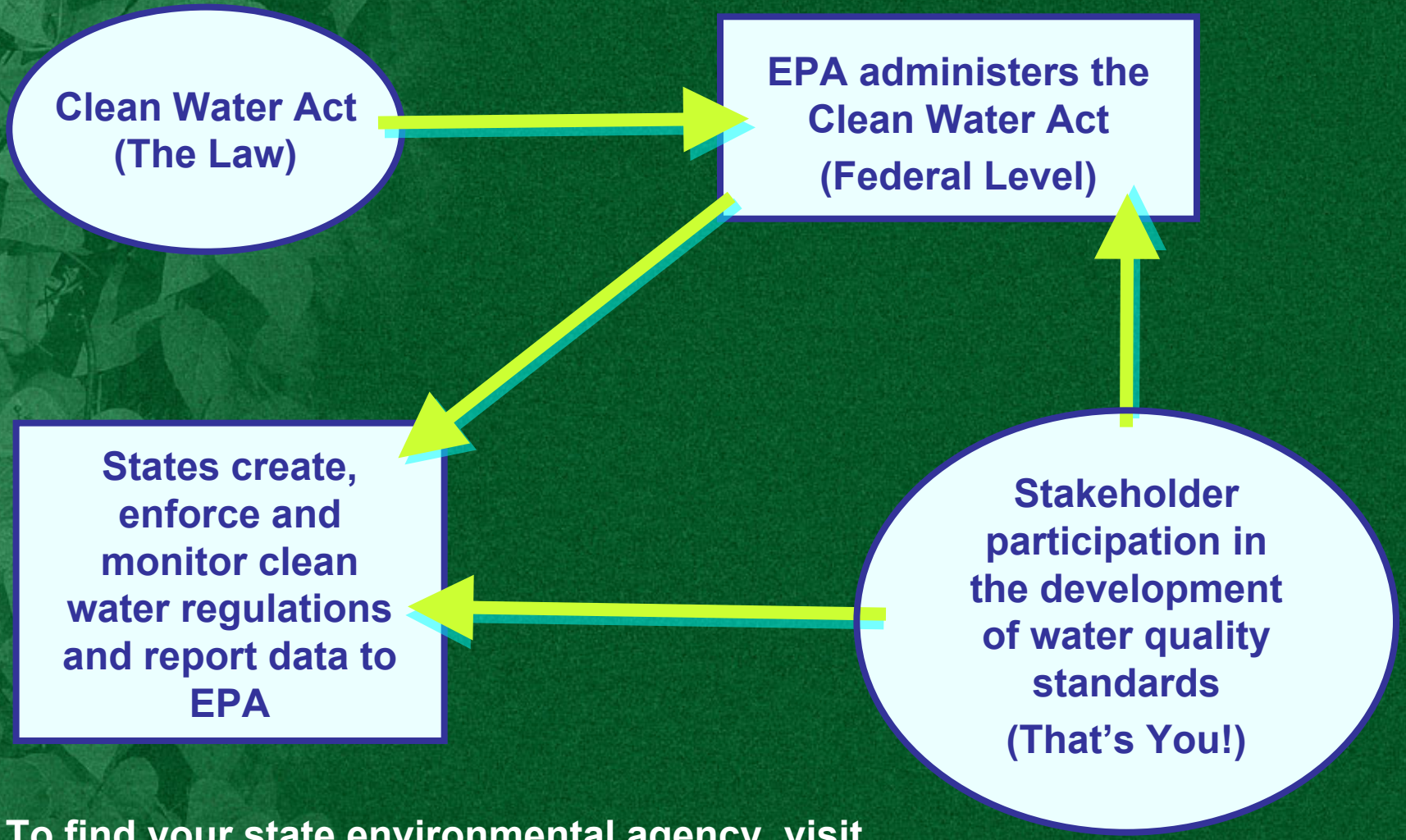
Eutrophication: The process of excess nutrients (nitrogen and phosphorus) accelerating the growth of algae in a waterway, which often results in a decrease of oxygen in the waterbody.



Eutrophic Waterways



Advanced: The Clean Water Act & You



To find your state environmental agency, visit
www.epa.gov/epahome/state.htm

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Nutrient Pollution Is a Serious Problem

- Waterbodies in almost every state and territory are impacted by nutrient pollution.
- States have identified more than 10,000 waterbody segments impaired by nutrients.

http://www.epa.gov/waters/ir/

Top Causes of U.S. Waterbody Impairments
• Mercury
• Pathogens
• Sediment
• Metals
• **Nutrients**

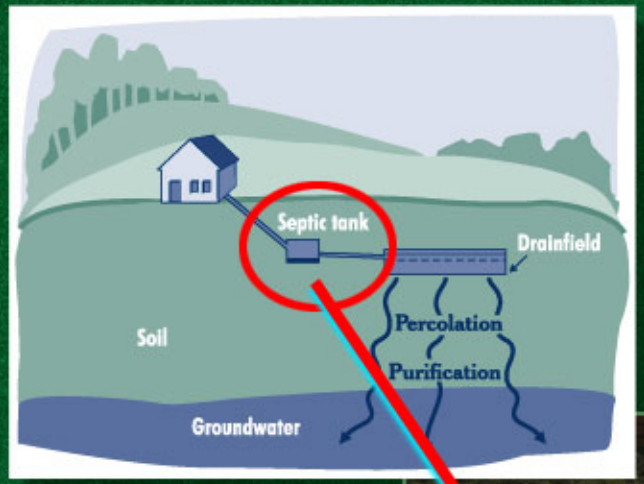
Advanced: Nutrient Criteria for Rivers and Streams

- TN, HI, American Samoa, Guam, Cherokee Nation: Approved nutrient parameters
- DC, FL, OK, NV: Approved parameters for N, P and chlorophyll
- MA, ME, VT, KY, MI, WI: Are developing criteria for their parameters
- Thirty-four states are collecting data for their parameters and waters
- WV, ND, SD, WY, AK, ID, OR, WA: Are just beginning the process

Information is current as of May 14, 2007

Go to www.epa.gov/waterscience/criteria/nutrient/strategy/status.html to find more updated information or contact your state environmental agency by visiting www.epa.gov/epahome/state/htm.

Nutrients that Enter Our Waters Come from a Variety of Sources



And More!

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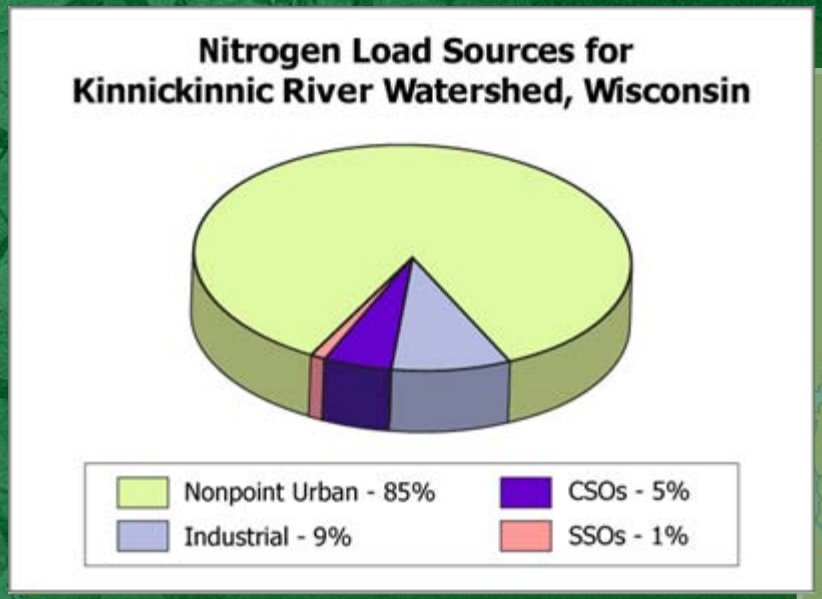
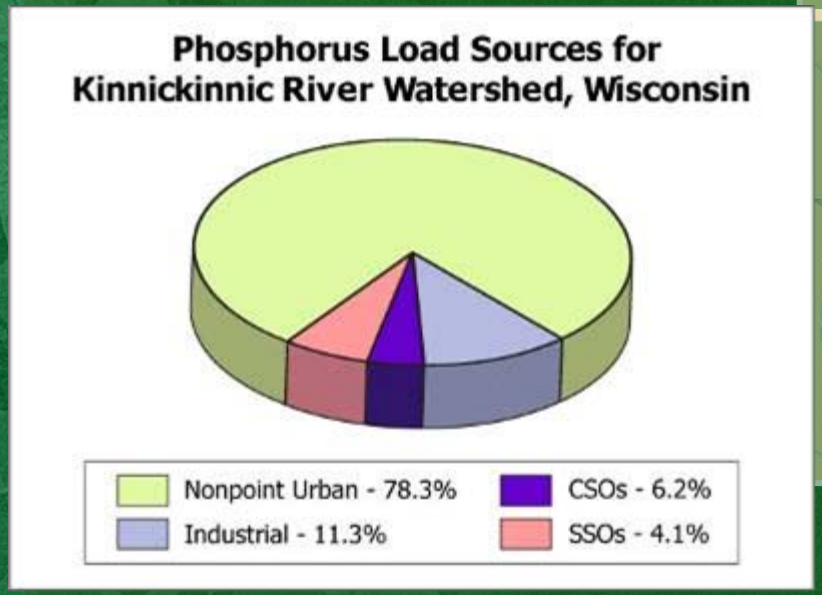
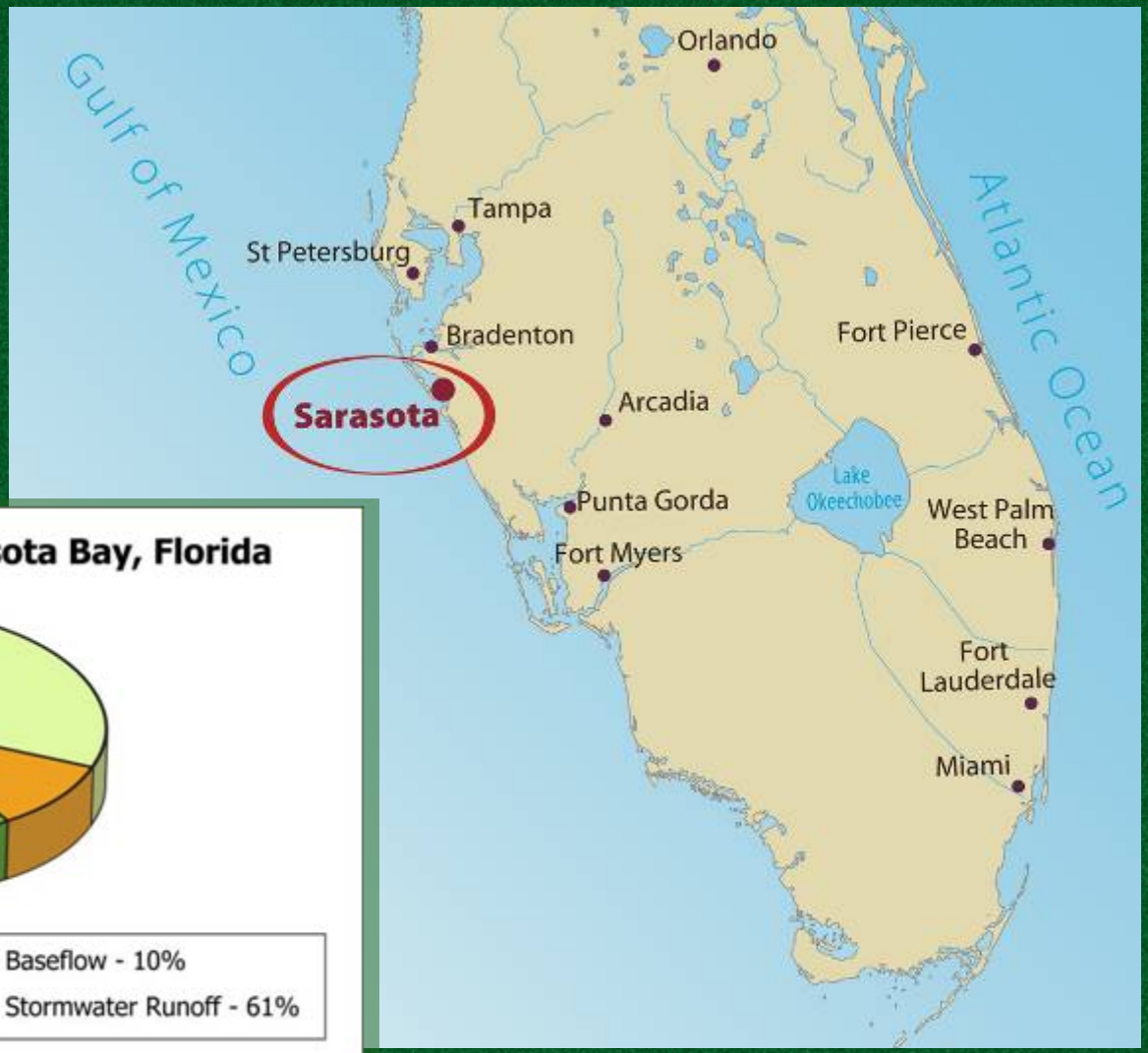
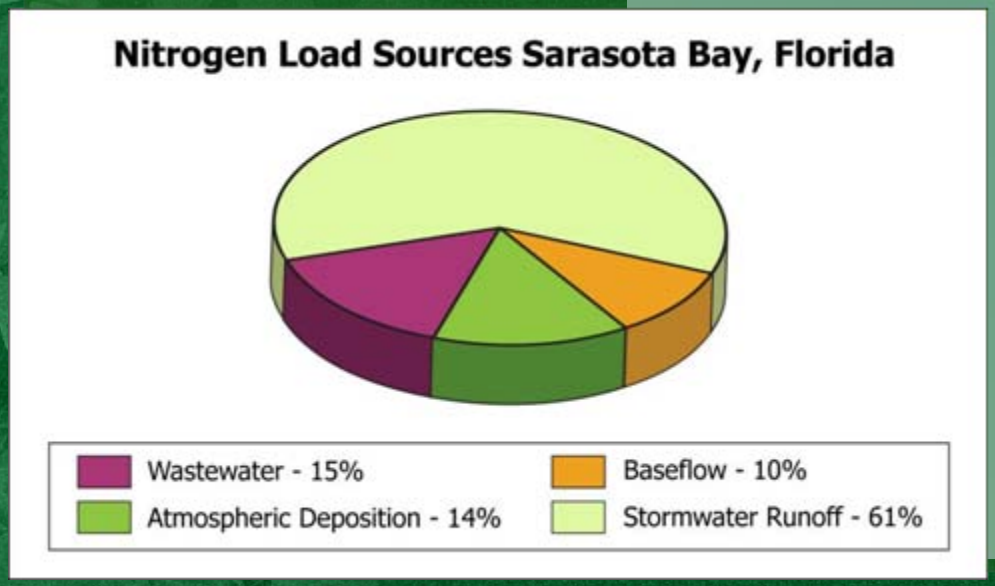
Kinnickinnic River, Wisconsin





Sarasota, Florida





Note: Data taken from Sarasota Bay Estuary Program.
"*State of the Bay 2006*"

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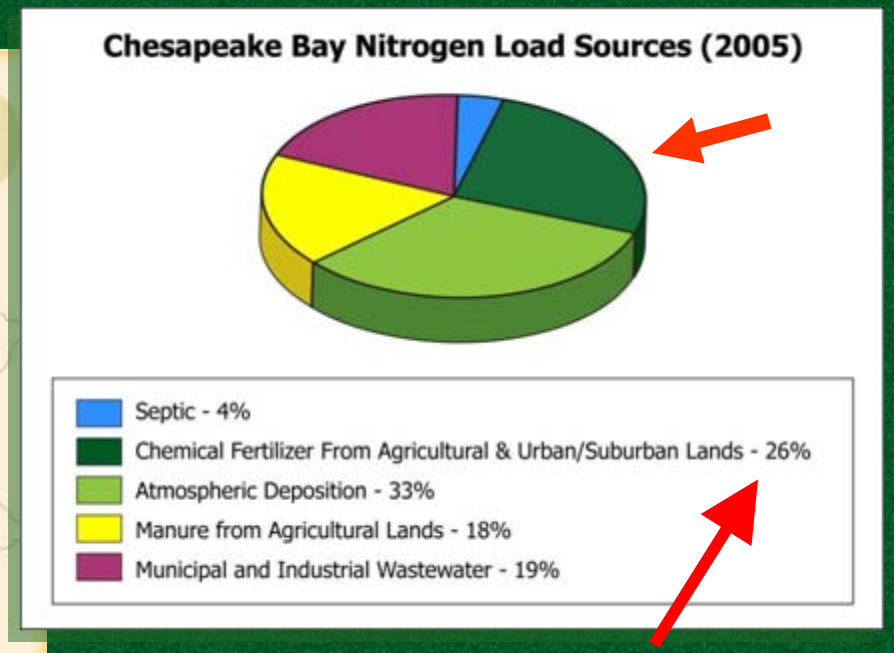
The Chesapeake Bay



Note: Data taken from the Chesapeake Bay Program www.chesapeakebay.net

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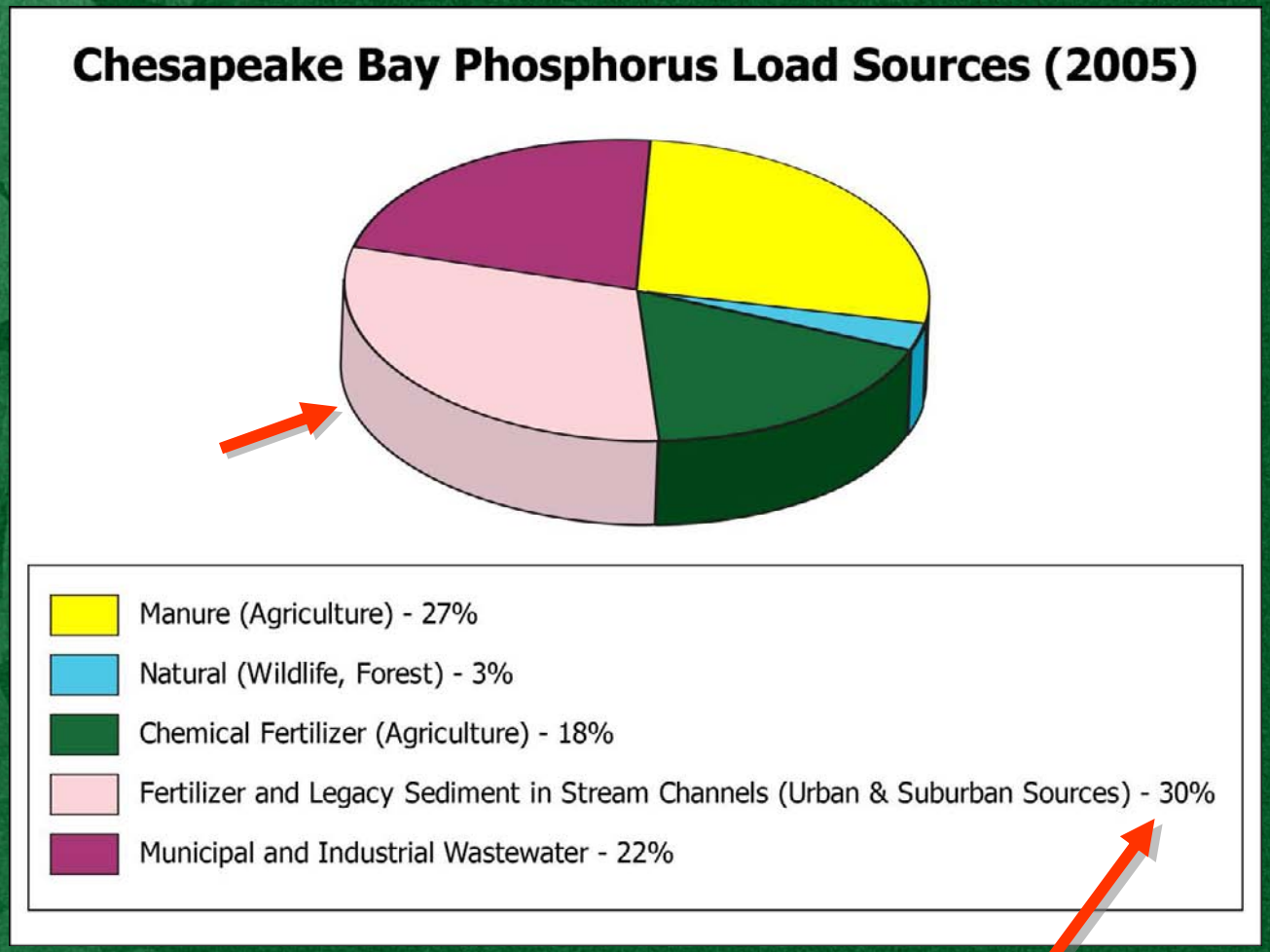
Chesapeake Bay - Phosphorus



Note: Data taken from the Chesapeake Bay Program www.chesapeakebay.net

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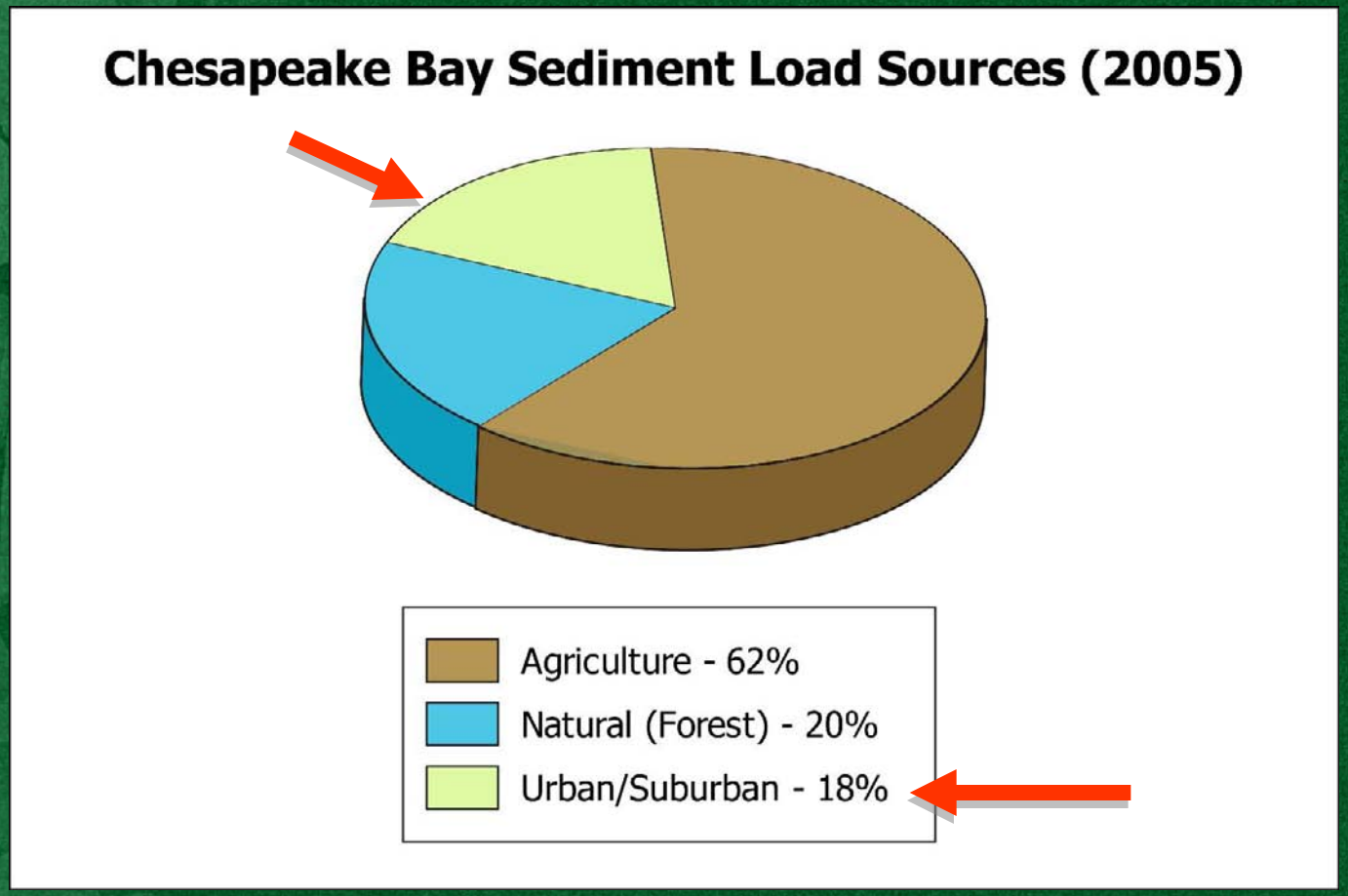
Soil Erosion Also Carries Nutrients to Waterways

Erosion not only washes away valuable soil but carries pollutants, including phosphorus, into waterways.

The Chesapeake Bay – Sediment



Note: Data taken from the Chesapeake Bay Program www.chesapeakebay.net

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Summary

Too much fertilizer is applied

Nutrients and sediment reach waterway

Algal blooms and other water quality problems result

So What Can You do About Nutrient Pollution?

It's simple! Follow these tips:

1. Test Your Soil
2. Apply Fertilizer Sparingly
3. Adopt Sustainable Lawn Care Practices
4. Improve Soil Drainage
5. Use Water Wisely
6. Plant Natives
7. Plant Lawn Alternatives
8. Get Involved in Your State's Water Quality Standards!

Tip#1: Test Your Soil First!

- Soil test results provide specific nutrient levels and the pH of the soil.
- They allow you to make an informed fertilizer selection.
- Where do you get a test kit?
  - Over-the-Counter kits are available at garden centers
  - Tests run by skilled labs are available from local extension offices

60% of Tennessee residents use fertilizer regularly. Only 25% of those who report using fertilizer also used soil tests.

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Tip#2: Use Fertilizer Sparingly

- Fertilizer Basics
  - Fertilizer has three numbers on the label
    - 1st number: % nitrogen
    - 2nd number: % phosphorus (or its compound phosphate)
    - 3rd number: % potassium (also listed as potash)
- Your fertilizer selection should address the needs of your soil based on the results of the soil test.

Fertilizer Application Best Practices

- Read the instructions – apply the correct amount at the correct time of year – more is NOT better.
- Match the fertilizer to your plants – the appropriate fertilizer for your roses might not be the correct one for your lawn.
- If there is a forecasted weather event, like high winds or rain, fertilize after the weather event.
- Spread fertilizer only to vegetated areas. Don't fertilize sidewalks, driveways and other paved surfaces! Sweep up spills.
- Leave an unfertilized buffer between a waterway and where fertilizer is applied.

Tip#3: Adopt Sustainable Lawn Care Practices

Select the grass that fits your geographic region

	Cool Season Zone – Fertilize in the Fall	Warm Season Zone – Fertilize in the Late Spring/Early Summer	Transition Zone
Examples:	Fescue, Bluegrass, Ryegrass	Zoysia, Bermuda	Warm or cool season grasses can be selected
Ideal Height	2” – 4”	½” – 1”	
Typical Geographic Region	Throughout Northern United States	Southern United States: Texas to North Carolina and as far north as Tennessee	Between the Cool and Warm zones, running east to west – Virginia to Southern California

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Other Lawn Care Tips

"If grass were harvested as a crop, it would represent one of the United States' largest commodities (USDA, 1992)."

- Compost grass clippings and leaves.
- Aerate your lawn.
- Use a bagless lawn mower and allow the lawn and leaf clippings to decompose on the lawn.
- Never apply fertilizer, pesticides or herbicides within 10 feet of a stream, creek or other waterway.
- When mowing, only remove the top third of the grass height.
- Plant buffer strips along drainage ditches and waterways.
- Use mulch to reduce the need for fertilizers.

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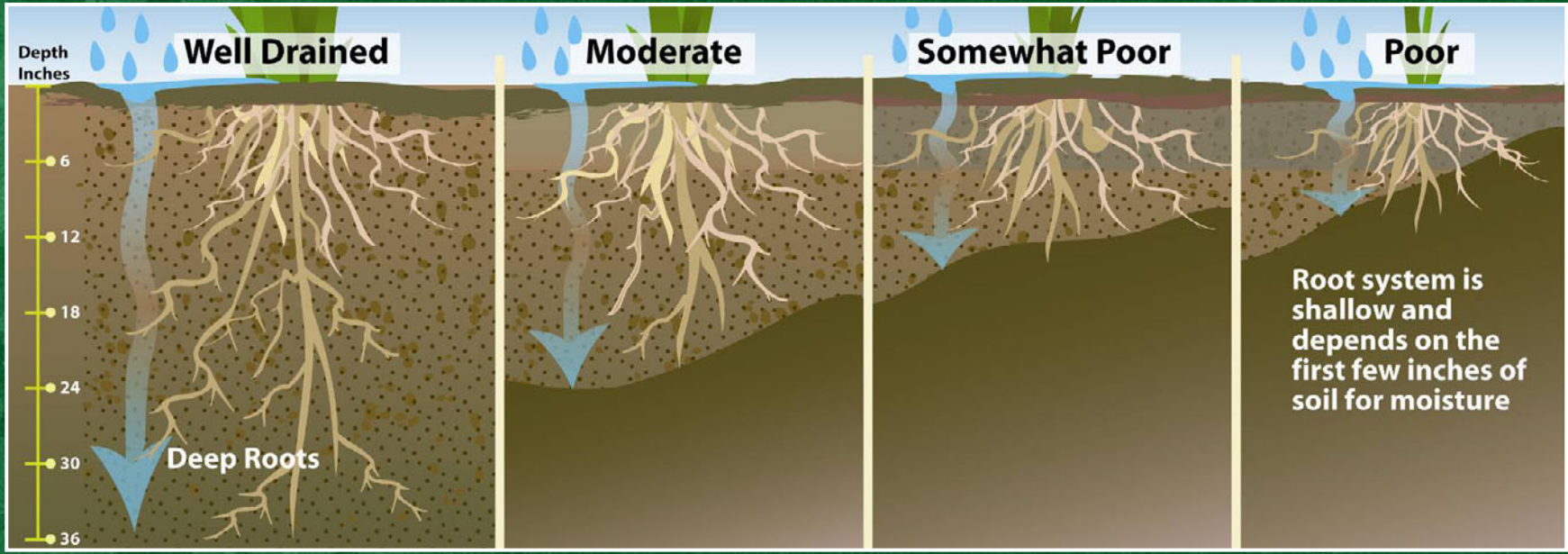
Tip #4: Improve Soil Drainage

- Evaluate the amount of impervious surface on your property. Can it be reduced?
- A well-drained soil creates a good environment for grass, plants and trees to set deep roots and take advantage of deep water and nutrients.

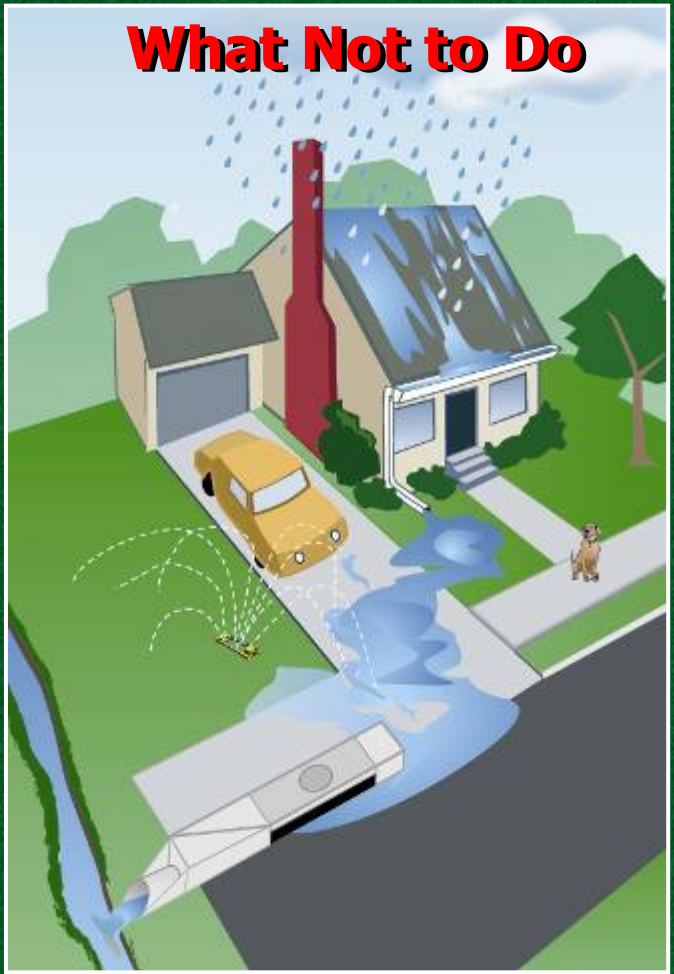


Improve Soil Drainage with Composted Material or Mulch

- The proper soil alterations can help a soil drain faster or slower and increase its nutrient content.
- Well-composted organic material acts as a source of slow release nutrients for plants.
- Thoroughly blend or till compost into the soil.

Tip#5: Use Water Wisely

- Use water in moderation (if at all).
- Water only the places that require moisture.
- Use drip systems or micro-emitters to help keep water and fertilizers in place.
- Water plants “deeply”—encouraging the roots to grow deeper and lessening the need for future watering.
- Water in the early morning or evening and skip watering on windy days.
- Install a rain barrel to use in watering your plants.



Using Water Wisely

- Recycle household water for watering plants instead of pouring it down the drain.

  For example:

  - Old water in a dog/cat bowl
  - Left over water in a glass
  - Water used to boil vegetables and wash fruits and vegetables

Want More Tips for Water Conservation? Visit

- EPA Water Sense: www.epa.gov/WaterSense
- EPA Brochure *Make Your Home the Solution to Stormwater Pollution*: www.epa.gov/npdes/pubs/solution_to_pollution.pdf
- Rain Garden and Rain Barrel Information – www.stormwaterauthority.org/library/view_article.aspx?id=944

Tip#6: Plant Natives

- Reflect the local, natural history
- Provide food and habitat for local and migratory animals
- Reduce the need for chemical pesticides, herbicides and fertilizer
- Are adapted to local climate and soil types

Exotic plants that lack environmental stressors, like disease or pests, will out-compete native plants and will decrease the area's biodiversity.

Did you know that English Ivy is a non-native plant? It spreads aggressively, killing native plants and trees by covering and shading them out. English ivy also hosts bacterial leaf scorch, a plant pathogen that spreads to native elms, oaks, and maples.

Tip #7: Plant Lawn Alternatives
Create a Rain Garden or Bayscape

Bayscaping	Rain Garden
Located in dry or moist areas	Located near downspouts and other drainage areas where water collects following a storm
Visually more interesting than a lawn	
Reduces time and expense for mowing, watering, fertilizing and maintaining	
Addresses erosion, poor soil, steep slope or poor drainage problems	
Utilizes native plants	
Reduces stormwater runoff and allows water to slowly percolate through the soil; allows up to 30% more water to percolate through the soil	

Sample Bayscape

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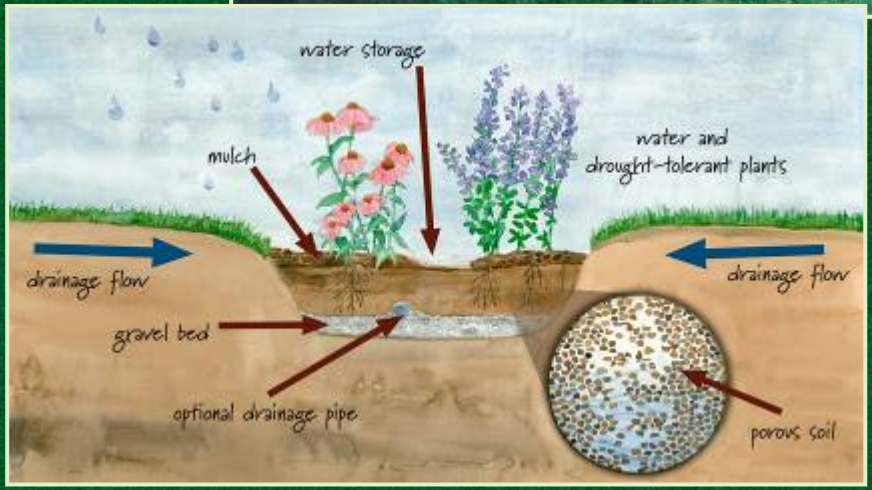
Getting Your Rain Garden Started:

- Don't forget the soil test!
- Position the garden downhill of the water source.
- Remember – it is a garden, not a pool.
- Make it a community event!
- Post a sign explaining your rain garden.



Tip #8: Get Involved in Your State's Water Quality Standards!

- Visit EPA's Surf Your Watershed Web site http://cfpub.epa.gov/surf/locate/index.cfm

  Once you locate your watershed, click on *Citizen-based Groups in Your Watershed* to learn about local ways that you can get involved in water monitoring and other watershed-related activities.

Get Involved in Your State's Water Quality Standards

- Participate in the public review process of your state's water quality standards

http://www.epa.gov/waterscience/standards

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Synopsis

1. When present in the proper quantities, nutrients and algae are important components of an ecosystem.
   In excessive amounts, the ecosystem becomes out of balance.
2. Your choice of plants impacts the need for supplemental watering and fertilization.
3. Keeping soil covered with plants or mulch is an important step to protecting water quality.
4. Soil test results will tell you the type of fertilizer that is needed. Always follow the fertilizer application directions.
5. Spread the word to your friends and neighbors!

To Learn More, Visit:

Environmentally Friendly Landscaping:

- Backyard Conservation (Includes Fact Sheets): http://www.nrcs.usda.gov/feature/backyard
- EPA WaterSense Landscape Irrigation Services: http://www.epa.gov/WaterSense/pp/irrprof.htm
- Florida Friendly Landscaping: http://www.floridayards.org/
- Home and Garden Tips: http://www.nrcs.usda.gov/feature/highlights/homegarden/lawn.html

EPA Water Quality Standards and How to Get Involved:

- EPA – Locate Your State Environmental Agency: http://www.epa.gov/epahome/state.htm
- EPA – Water Quality Standards for Nitrogen and Phosphorus Pollution: http://www.epa.gov/waterscience/criteria/nutrient/
- EPA – Water Quality Standards Online Academy: http://www.epa.gov/waterscience/standards/academy
- EPA – National Nutrient Strategy Current Status: http://www.epa.gov/waterscience/criteria/nutrient/strategy/status.html

More Places to Visit:

Rain Gardens:

- The New Jersey Native Plant Society's Rain Garden Manual: http://www.npsnj.org/rain_garden_home.htm
- Wisconsin Department of Natural Resources – A How-To Manual for Homeowners: http://www.dnr.state.wi.us/org/water/wm/dsfm/shore/documents/rgmanual.pdf
- Virginia Department of Forestry – Rain Gardens (includes Rain Garden Technical Guides): http://www.dof.virginia.gov/rfb/rain-gardens.shtml
- 10,000 Rain Gardens: http://www.rainkc.com