

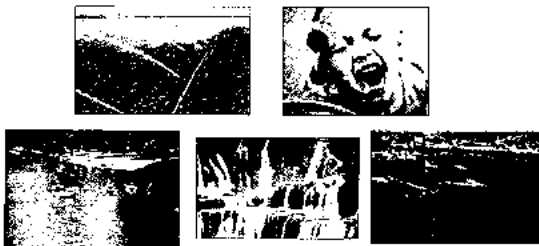
Water Quality Friendly Gardening

Jacqueline Fern
 Natural Resource Specialist
 Oregon Dept. of Environmental Quality

Topics

- Groundwater and Surface Water Basics
- Water Quality Challenges
- How Can Gardeners Help?
 - Water management
 - Soil nutrient retention
 - Fertilizer and pesticide practices
 - Streamside practices

Why is Protecting Water Quality So Important?



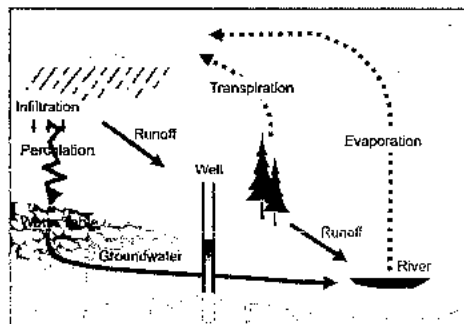
And clean-up can be costly and difficult

Global Freshwater Resources (< 1% of All Water on Planet!)



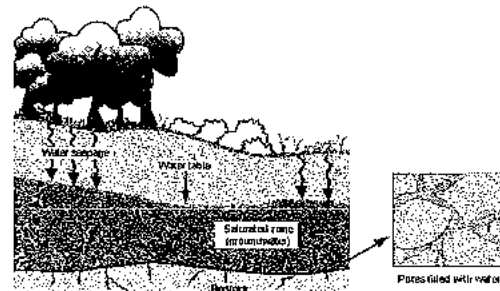
- Icecaps/Glaciers
- Groundwater
- Lakes, Rivers, Soil, Atmosphere

The Water Cycle



Graphic: University of Wisconsin

What Exactly Is Groundwater?

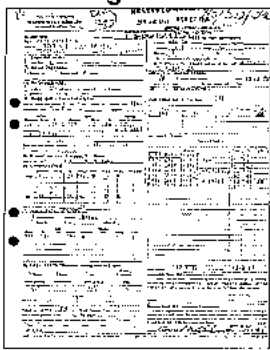


What's in a Well Log?

- Age and depth of well
- Type of aquifer (confined or unconfined)
- Geology of subsurface

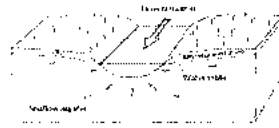
Database Maintained by Oregon Water Resources Department

http://apps.wrd.state.or.us/apps/gw/well_log/

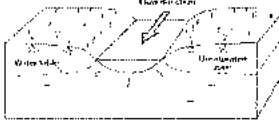


Connections Between Surface Water and Groundwater

Gaining Stream



Losing Stream

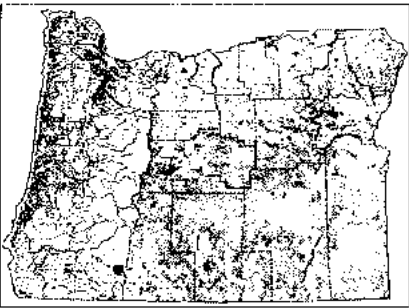


- In our region, most streams receive a portion of their flow from groundwater
- Pollutants can travel between aquifers and streams-- direction depends on water table


USGS Circular 1139

Oregon's Drinking Water Sources

- Almost 1/4 of Oregonians rely on private wells (groundwater)
- 2,500 public water systems across the state
- Majority of public water customers rely on surface water sources

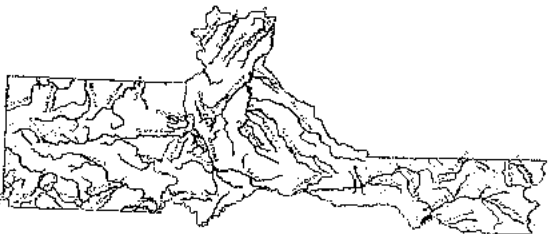


Waterways in Marion and Polk Counties



Lakes
 Streams

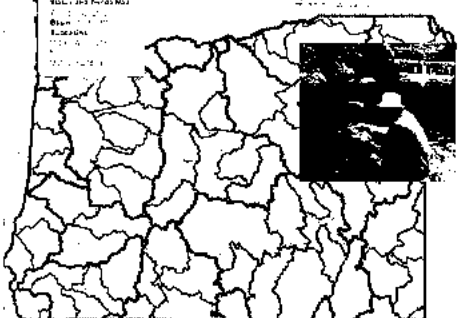
Impaired Waterways in Marion and Polk Counties

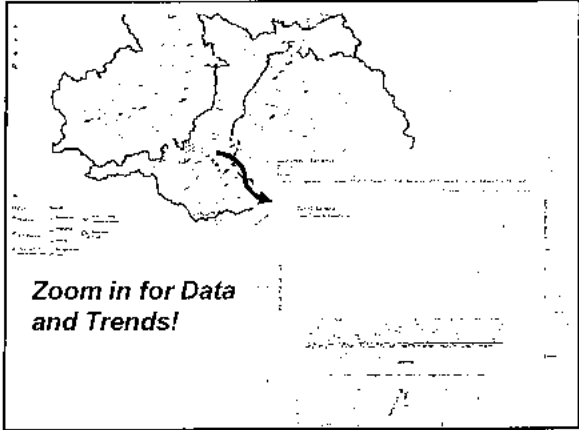


Impaired Lakes
 Impaired Streams

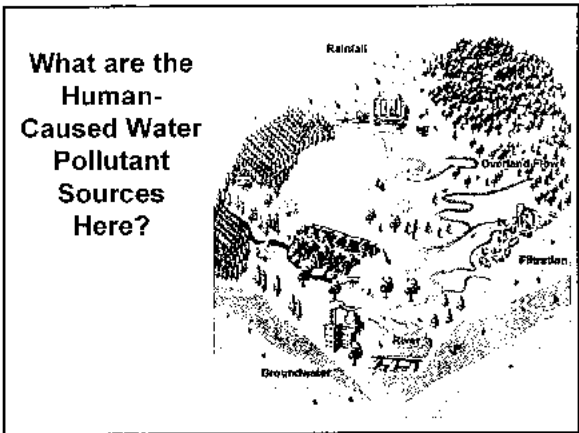
New Water Quality Status & Trends Data!

https://deq15.deq.state.or.us/SC/WQWebReporting/wqst_2019/map_locator.html





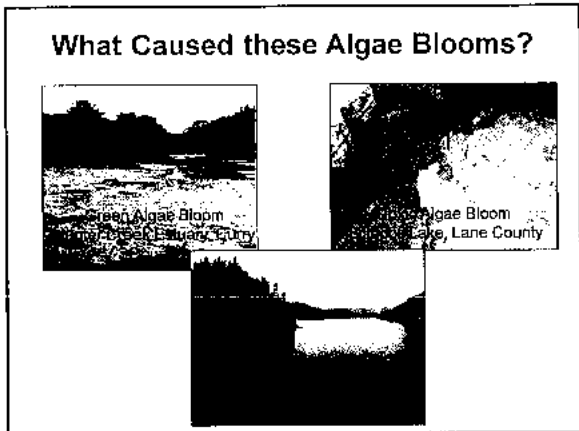
Overview of Water Quality Challenges



How Does Water Get Contaminated?

- Leaching
(nitrate, some pesticides)
 - Water soluble pollutants
 - Permeable soil and underlying geology
- Runoff and erosion
(soil, nutrients, pesticides)
 - Stormwater / flood events
 - Vegetation/root removal
 - Clay soils
 - Steep slopes

Graphic: Cornell University Extension
Photo: American Rivers
Photo: ER Creek Watershed Council



Contributing Factors to Algae Blooms

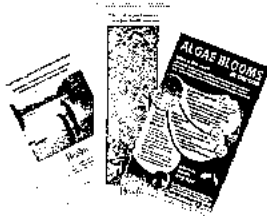
- Warmer temps
- Increased nutrient inputs
- Riparian vegetation removal
- Poor management practices combined with drought

HOW ALGAL BLOOMS ARE FORMED

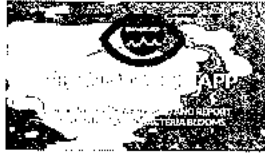
The diagram shows 'AGRICULTURAL INPUT' and 'RESIDENTIAL INPUT' leading to 'NUTRIENT' runoff, which causes 'ALGAL BLOOM'.

Harmful Algae Bloom Resources

Visit OHA's
Cyanobacteria Website



Getting Involved!



<https://cyanos.org/bloomwatch/>

What are the Issues Here?



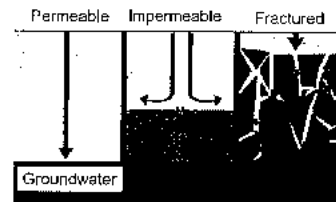
- Sediment (turbidity) in waterways
- Mobilization of contaminants (e.g. excess fertilizer, pesticide) to groundwater and waterways
- Leaching and/or runoff of soil nutrients

Factors that Affect Movement of Contaminants

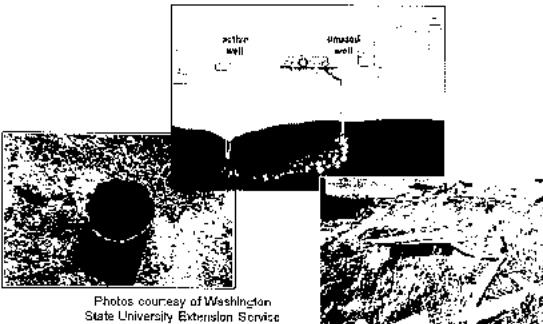
- Soil type/texture (refer to soil surveys!)
- Permeability
- Porosity
- Topography
- Site-specific conditions
- Irrigation practices
- Precipitation
- Vegetation



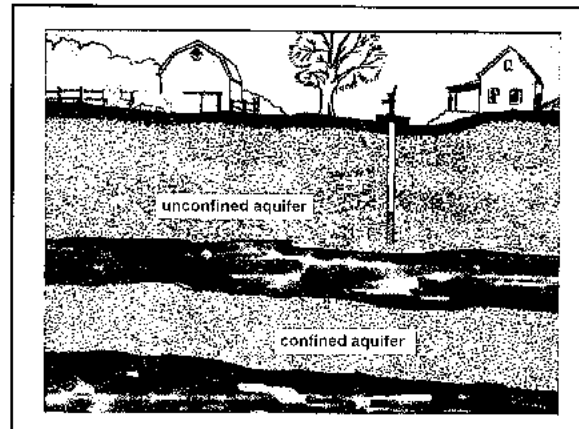
Subsurface Geology Affects Movement of Water and Contaminants to Aquifers

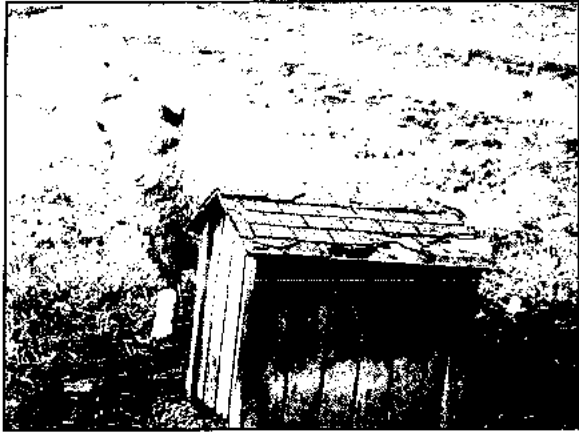


Unused Wells Can Be Direct Conduits to Groundwater

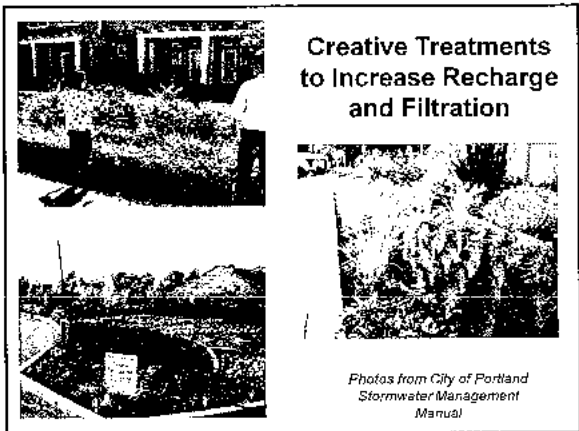
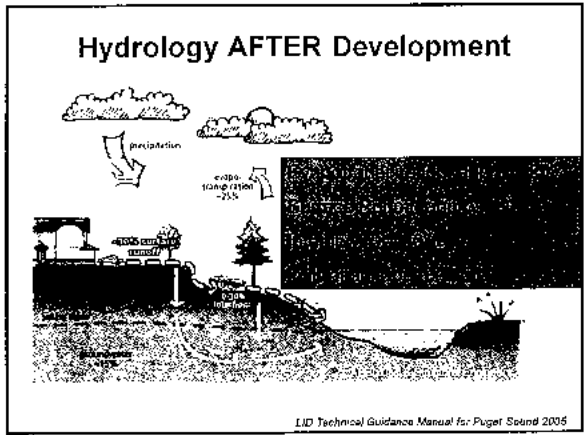
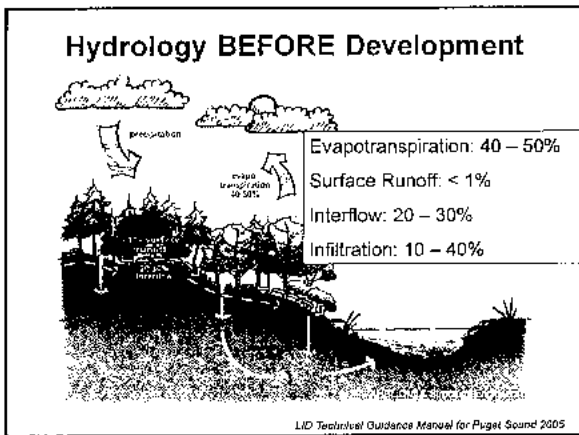


Photos courtesy of Washington State University Extension Service



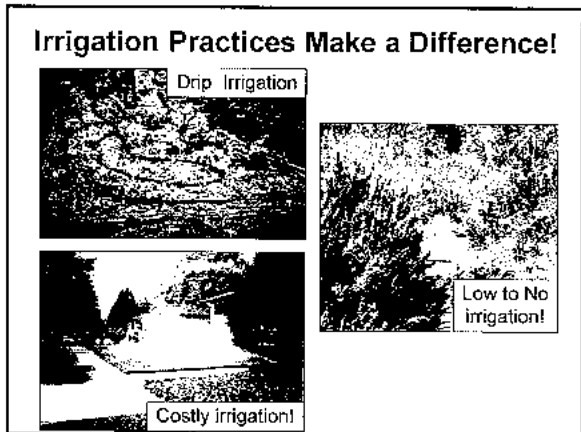
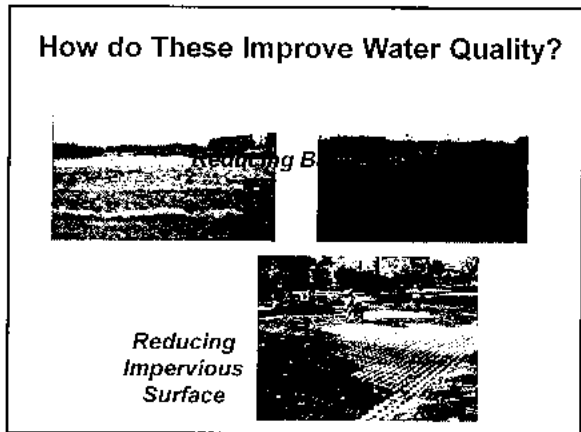
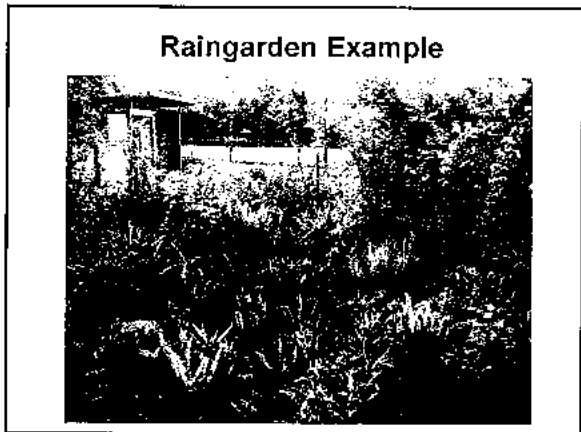
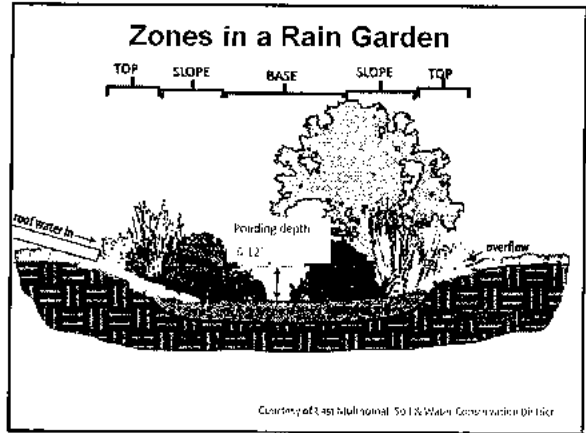
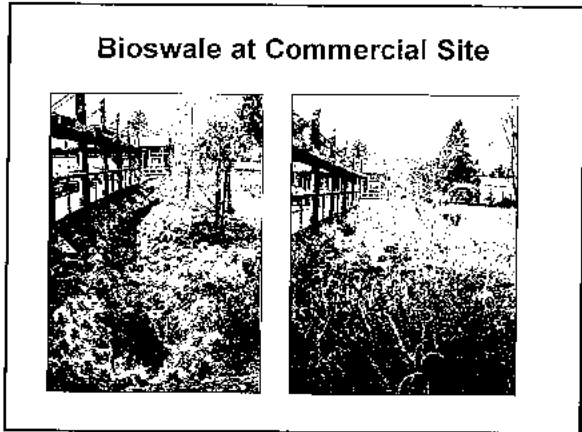


Management Practices to Improve Water Quality



Rain Gardens and Bioswales

- Filtration/purification of water
- Recharging aquifers
- Flood prevention
- Beneficial insect habitat
- Attractive native plants to select from!
- Easy to maintain if installed properly



Small Group Exercise

Take 10" to conduct a water quality assessment of your team's photo !!

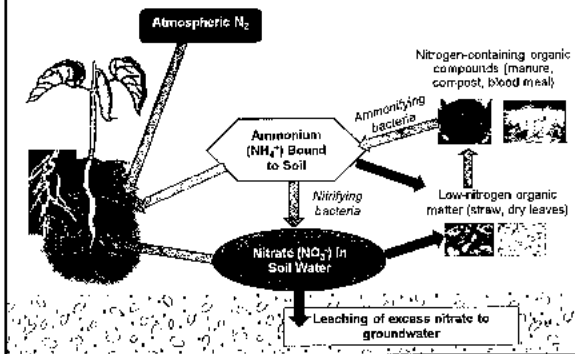
- 1) What water related problem(s) do you see?
- 2) What do you recommend?

Nutrient Management and Water Quality

Important Plant Nutrients Found in Soil Water

- Iron
- Manganese
- Copper
- Sulfur
- Nitrate
- Phosphorus
- Potassium
- Calcium
- Magnesium
- Molybdenum
- and others!

Nitrogen Cycle in the Soil



How Do We Lose Nutrients?

Dissolved in water that runs off surface or leaches through soil



Carried away by soil erosion



Removal when we harvest



Used by microorganisms - especially with low nitrogen inputs



Volatilization



What can we do?

Tips to Prevent Nutrient Loss

- Add lots of decomposed organic matter!
- Intercrop with legumes
- Use slower release fertilizer
- Consider seasonal needs—plan ahead (e.g. cover crops, leaves)
- Water deeply with drip irrigation
- Minimize paved and compacted surfaces

Oregon Wells with Elevated Nitrate

Drinking water standard = 10 ppm

OHA Real Estate Transaction Data

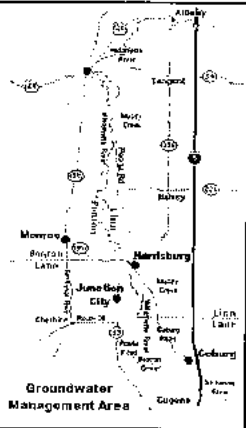


Legend
 • High Nitrate Levels (7 ppm to 400+)
 • Moderate Nitrate Levels (3 to 6 ppm)

Area in Southern Willamette Valley with High Nitrate in Drinking Water Wells

Contributing Sources:

- Fertilizer
- Animal waste
- Septic systems



What's the Issue with Nitrate?

- Drinking water standard = 10 ppm to reduce risk of "blue-baby" syndrome (low oxygen condition)
- Other illnesses may be correlated with nitrate levels below the current standard.
- Nitrate detection may indicate presence of other contaminants, e.g. herbicides or other water soluble contaminants

Nitrate Screening for Well Water

- Divide into groups of 3 to 4
- Each group should have:
 - 1 nitrate test kit
 - 1 or 2 well water samples
 - Instructions for conducting the test

When done, place capped test tubes in container up front

Interpreting Nitrate Screening Results

- Nitrate in groundwater at or above 3 parts per million (ppm) is likely human-caused.
- What are the sources?
 - Septic Systems
 - Fertilizer
 - Animal manure
- Screenings provide general info about water quality; they are NOT equivalent to lab tests.

Other Important Drinking Water Tests

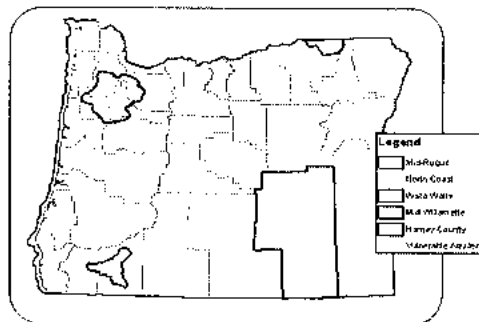
- Bacteria:

TOTAL COLIFORM
Fecal Coliform
E. coli




- Lead: leaching from plumbing in older homes
- Arsenic: geology, historic pesticides
- Other contaminants depending on surrounding land use risks

DEQ Groundwater Studies




Pesticide Use and Water Quality

Before Using Pesticides...


Identify problem...  Is it REALLY a pest?

Photos courtesy of University of Nebraska

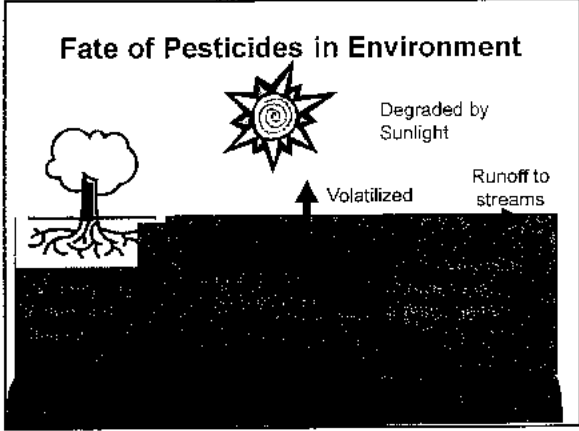
Field Scouting can provide valuable insights! 

Pesticides in U.S. Waterways

More than half of streams sampled by USGS contained pesticides at concentrations above levels that support aquatic life.




Low concentrations detected in groundwater, but little is known about synergistic effects.



Water Quality Considerations for Pesticide Products

- Is it water soluble?
- How easily will it adsorb to soil particles?
- On what type of soil and terrain will it be applied?
- How toxic is it to humans and wildlife?
- How persistent is it? (half-life)



FIPRONIL GENERAL FACT SHEET

npic National Pesticide Information Center

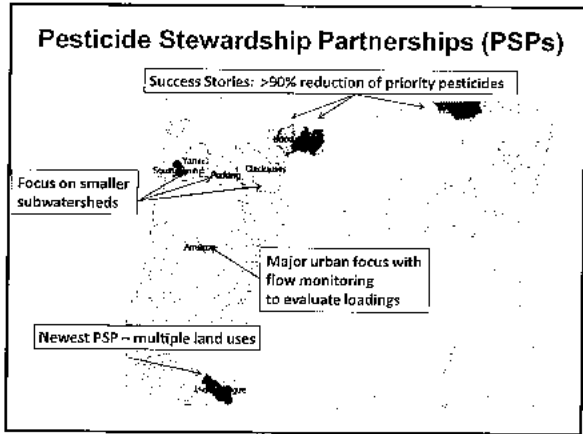
- Science-based info about pesticides
- Partnership between OSU and EPA
- E-mail: npic@ace.orst.edu
- Phone: (800) 858-7378

Why is it used?
Fipronil is used to control a wide range of insects on ornamental plants, turf, and lawns. It is also used to control insects on crops and in stored grain.

What are the risks to humans and the environment?
Fipronil is highly toxic to aquatic life and birds. It is also toxic to bees and other beneficial insects. It is not toxic to mammals.

How is it applied?
Fipronil is applied as a spray or granules. It is also available as a bait.

How should it be stored and handled?
Fipronil should be stored in a cool, dry place. It should be handled with care to avoid contact with skin and eyes.



Pesticide Reduction Case Study Lower Neal Creek (Hood River Basin)

Hood River Grower-Shipper Association
OSU Extension
Department of Environmental Quality

Planting and Maintaining Cover Crops

- Increases water infiltration / decreases runoff
- Slows water movement

Hood River Grower-Shipper Association - Best Management Practices Project

Avoiding Spray Drift

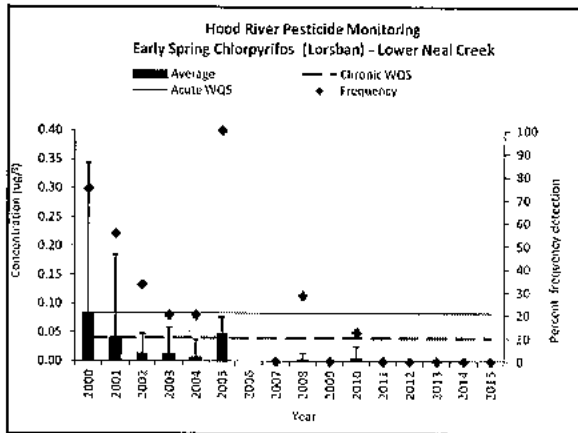
Potential for spray drift is LOW

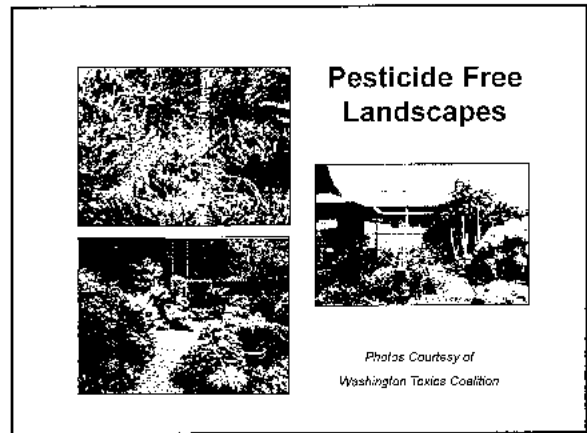
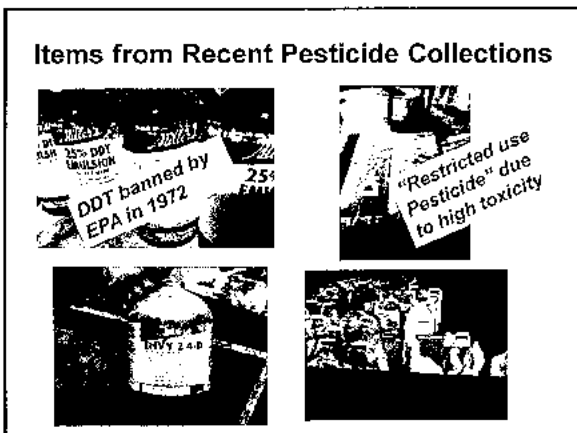
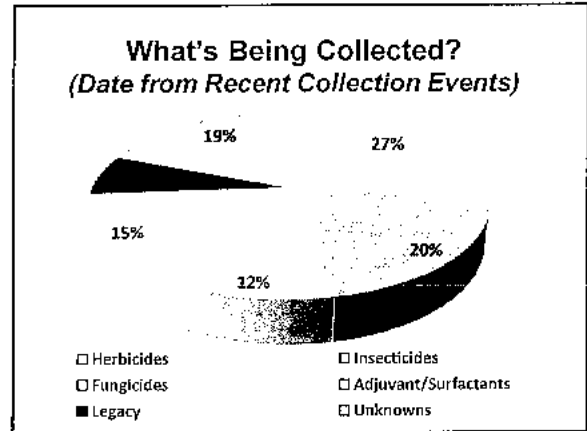
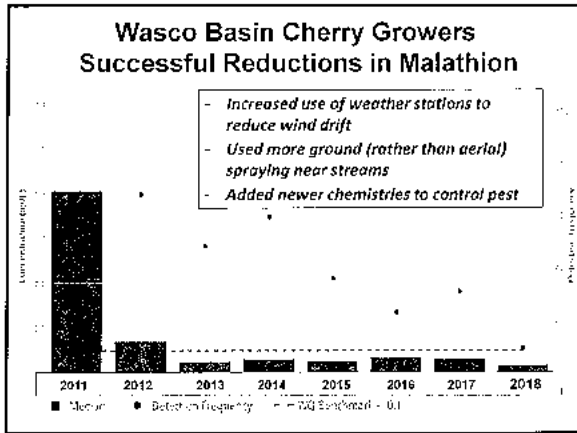
*Recommendations from:
Hood River Grower-Shipper Association - Best Management Practices Project*

Unsprayed Vegetated Buffers

- Reduces water pollution by filtering
- Reduces potential for drift
- Provides habitat for beneficial insects

Hood River Grower-Shipper Association - Best Management Practices Project





Healthy Riparian Areas

- Shade cools water
- Vegetation slows water; allows time for infiltration, breakdown of pollutants
- Habitat for beneficial insects and wildlife
- Streambank roots control erosion and reduce sediment, benefiting aquatic life

Riparian restoration in progress: Amazon Creek

Restoration of streambank

Photo Credit: Gary Benfup

Why all the Talk about *Native Plants*?

- Typically require less care and fewer chemicals
- Encourage beneficial insects (natural pest control!)
- Supply food for wildlife for longer periods
- Promote biodiversity
- Reduce habitat loss and waterway degradation



Riparian Invasives & Exotics: Some (but not all) of the Culprits!



Himalayan Blackberry
I:PA



Reed Canarygrass
EPA



Japanese Knotweed
Glenn Miller, ODA

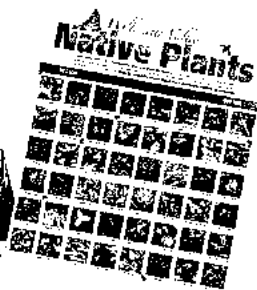


Yellow Flag Iris
J.S. Petersen, NMCS



Butterfly Bush
Glenn Miller, ODA

Dive into the Resources to find Hearty Riparian Natives!



Partnerships to Help Landowners with Restoration

- Watershed Councils
- OSU Extension
- County Soil and Water Conservation Districts
- Public drinking water providers



For more information....

- Jacqueline Fern – 686-7898
fern.jacqueline@deq.state.or.us
- Gardening with Native Plants: OSU Extension Publication EC1577
- GardenSmart (non-invasive plants):
<https://www.nature.org/media/oregon/gardensmart-rev-2010.pdf>
- WaterWise Gardening
<https://extension.oregonstate.edu/gardening/techniques/water-wise-home-landscape-xeriscape>
- National Pesticide Information Center: <http://npic.orst.edu/>
- The Oregon Rain Garden Guide
<http://seagrant.oregonstate.edu/sgpubs/onlinepubs/h10001.pdf>
- OSU Integrated Plant Protection Center: <http://ipmnet.org>