Environmental Fate of Pesticides

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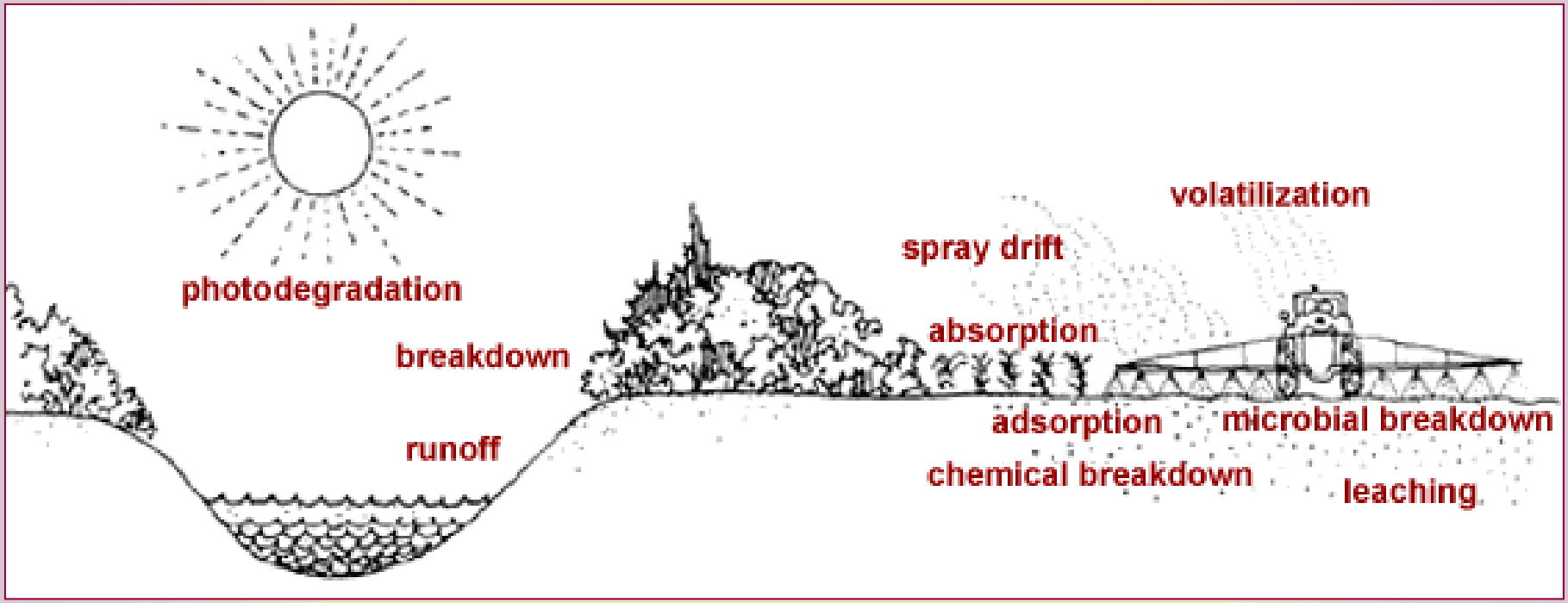
Environmental Fate of Pesticides



Source: B.C. Ministry of Ag & Land

A Significant Amount of Pesticide Is Lost at Application

- **Losses are affected by:**
  - **Method of application**
  - **Rate**
  - **Timing**
  - **Number of applications**
  - **Placement**

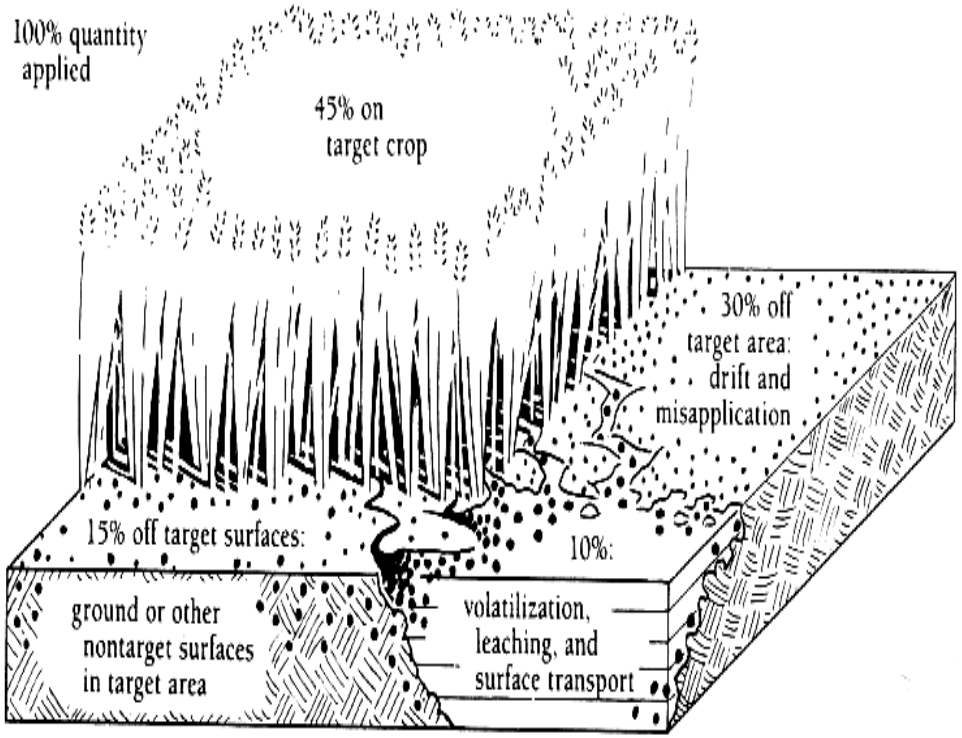


FIGURE 6-9.

As much as 55% of an applied pesticide may leave the application site due to spray drift, volatilization, leaching, runoff, and soil erosion.

Pesticide Characteristics

- **Chemical characteristics of a pesticide will determine how it behaves in the environment**
  - **Solubility**
  - **Adsorption**
  - **Half-life (Persistence)**
  - **Volatility**

Pesticide Characteristics:
Solubility

- How readily a pesticide dissolves in a solvent (water is the most common solvent)
  - Sugar and salt are household examples
- Pesticides that are more soluble are more likely to move with water in surface runoff or through the soil to groundwater

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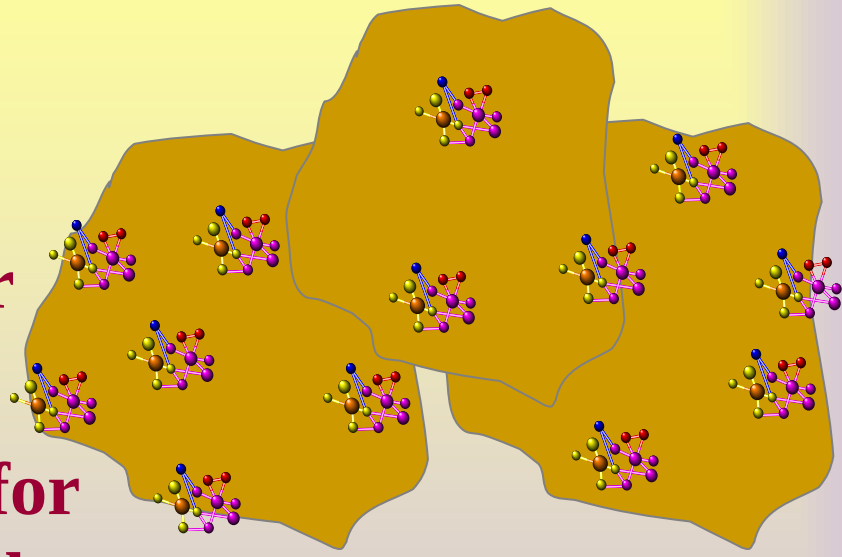
Adsorption

- The binding of chemicals to soil particles
  - Higher with oil-soluble pesticides
  - Clay and organic matter increase binding
  - Decreases the potential for a pesticide to move through soil



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Knowing Soil Adsorption Characteristics

- **Pull a soil sample and include a request OM levels**
  - **UNH soil testing program ($5)**
- **Why?**
  - **Some herbicide labels set specific texture or OM limits**
- **If you have a question and need to know ASAP**

Do A Jar Test

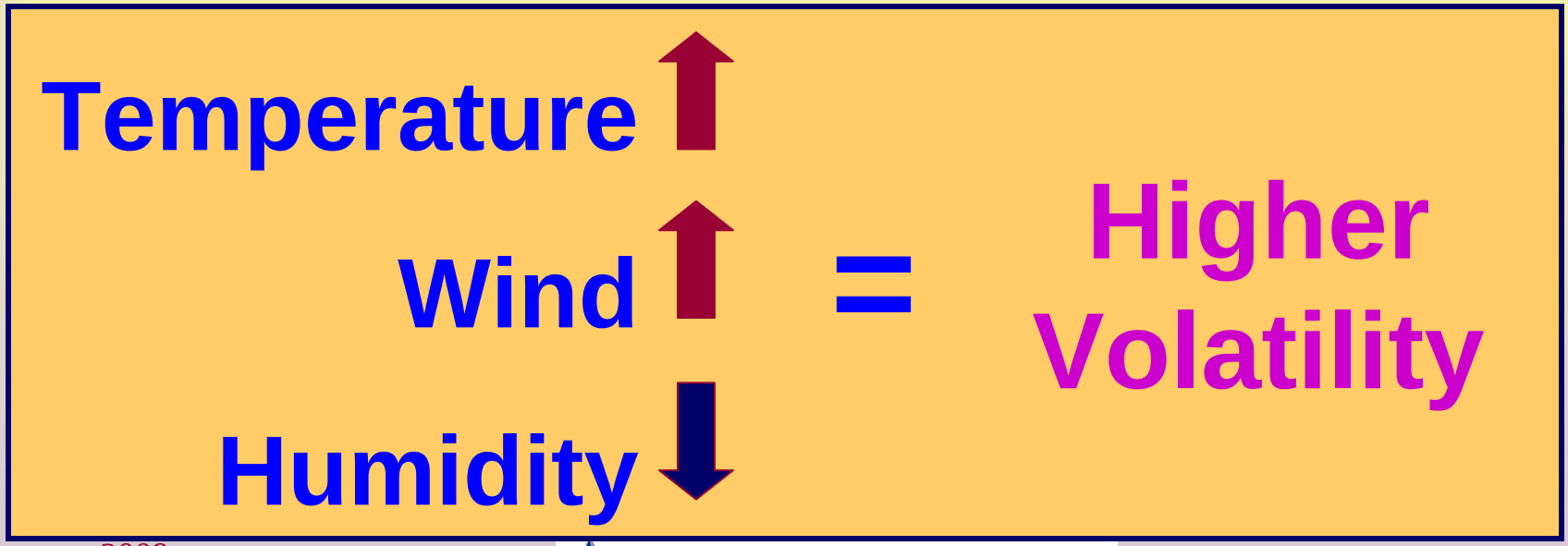
Persistence

- How long will a pesticide remain present and active
- More persistent pesticides provide s term pest control
  - But may harm sensitive plants and animals, and
  - May lead to illegal residues on rotational crops

Graphic: Shepard Univ.

Volatility

- The ease with which a pesticide turns into a gas or vapor



Pesticide Characteristics:
Volatility

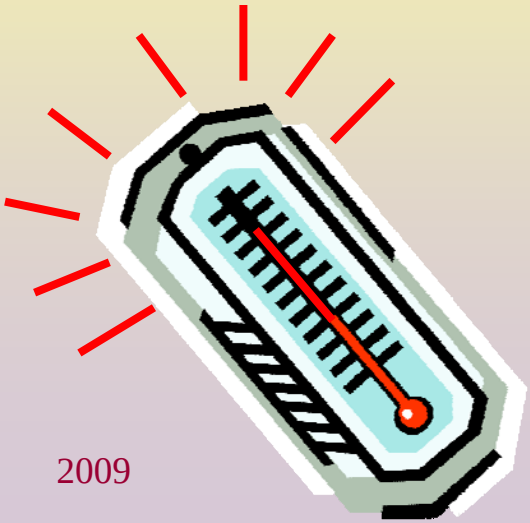
- Fumigants volatilize and move gas through soil, structures or stored commodities
- Several herbicides are quite volatile and pose harm when the vapor moves off target
  - Labels may state cut-off temperatures for application
  - Labels may require pesticide to be incorporated into the soil

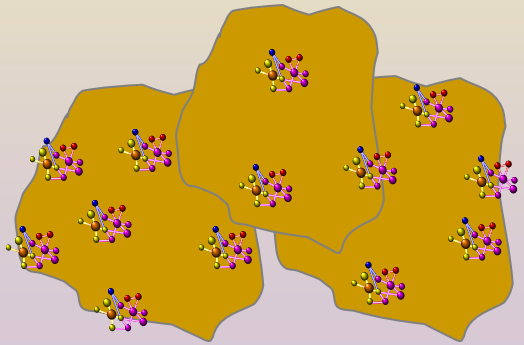
Degradation: Microbial

- **Important means for destroying pesticide in soils**
- **Some soil microorganisms use pesticides as food**
  - **bacteria and fungi**

Soil Conditions that Favor Microbial Degradation

- warm soil temperatures
- adequate soil moisture
- favorable pH
- aeration
- fertility
- adsorption





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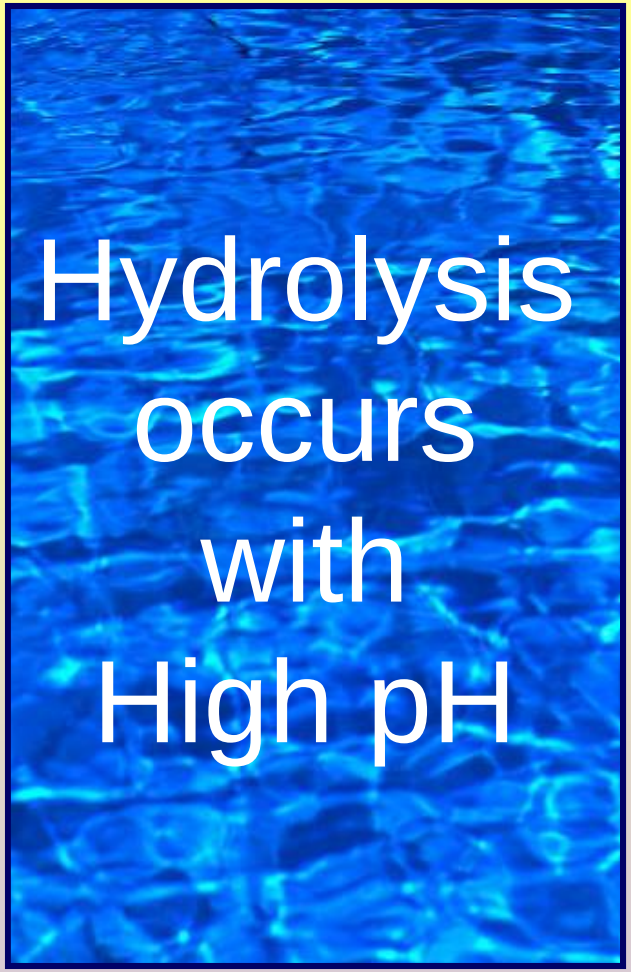
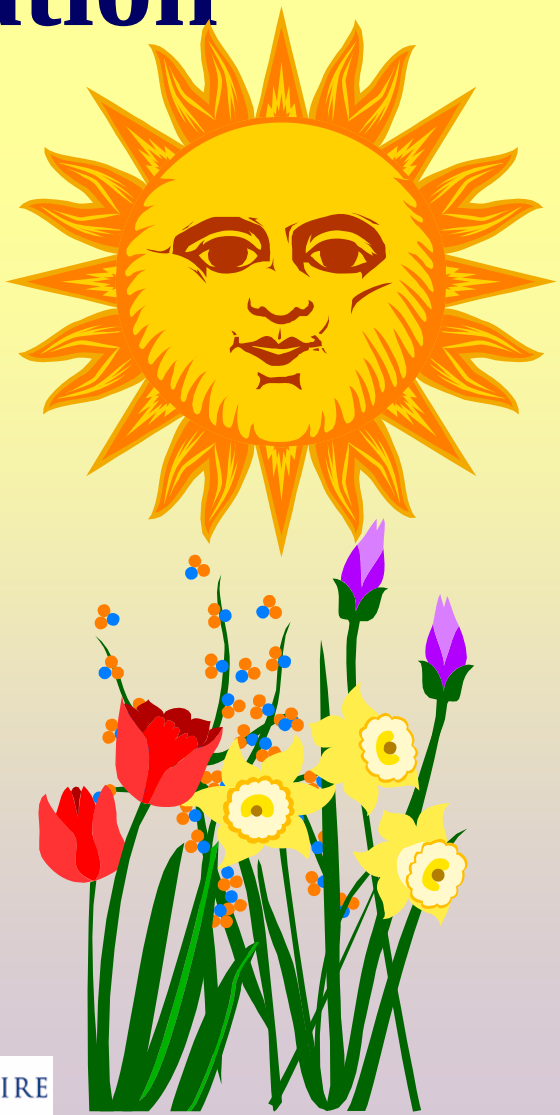
Degradation: Chemical



- **Non-living processes**
- **Hydrolysis:**
  - **A chemical reaction with water, typically high in pH**
    - **Fungicides/spray water**
- **Soil properties and conditions affect the rate and type of chemical reactions**

Photo-degradation

- **Breakdown of pesticide by sunlight**
  - **For some herbicides, incorporation is necessary to prevent photo-degradation**
- **May be reduced by soil incorporation**



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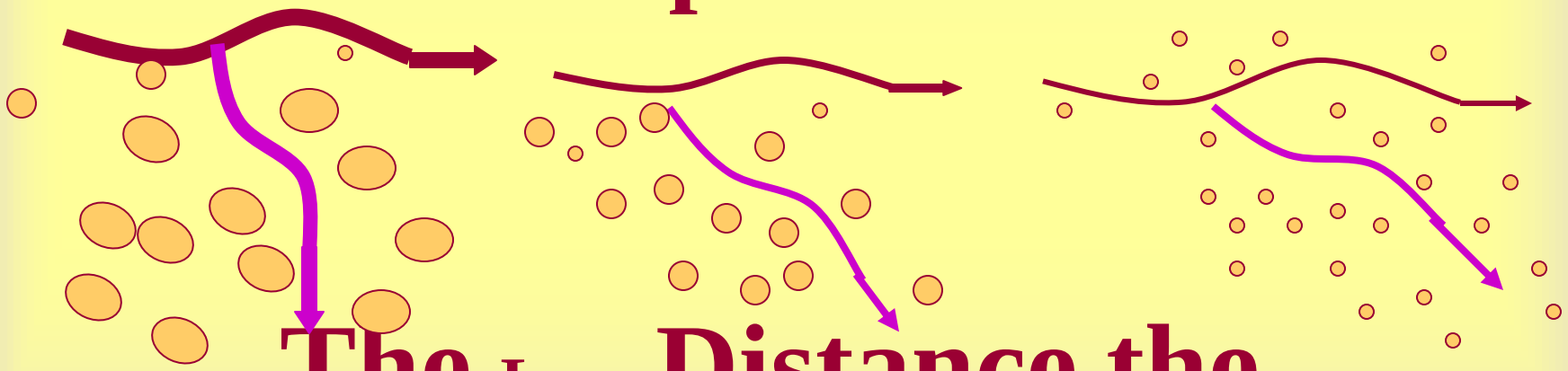
Pesticide Movement

- By air
  - Vapor, particle, spray drift
- By water
  - Surface runoff
  - Movement through soil
- By other objects
  - Residues on plants and animals

Equipment Set Up: Droplet Size

The Larger the Spray Droplet Size



The Less Distance the Droplet Drifts

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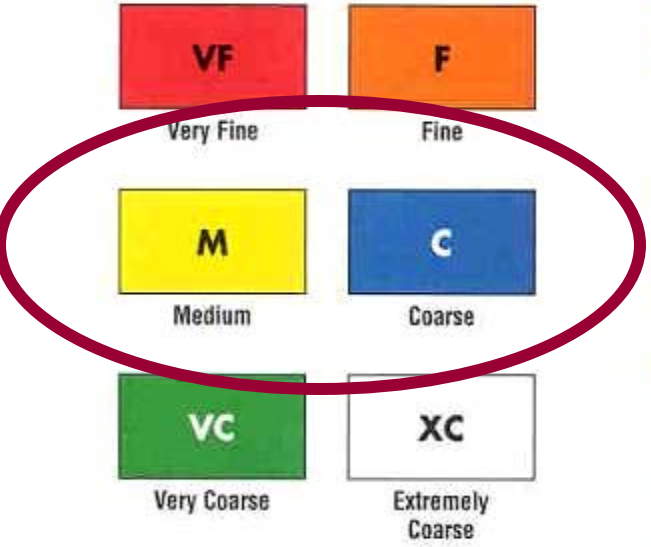
Spray Drift Factors

- **Equipment Set Up**
  - **Nozzle size and pressure set to give an appropriate size droplet to reduce drift**
    - **Use nozzles that produce medium and coarse droplet sizes**
      - **Smaller orifice = smaller droplet**
    - **Use lower pressures**
      - **except with certain nozzles**
  - **Boom height - drift potential increases as distances increase**

Driftable Droplets*

Nozzle Type (.50 GPM Flow)	Approximate Percent of Spray Volume Less Than 200 Microns	
	15 PSI	40 PSI
XR TeeJet® 110°	14%	22%
XR TeeJet 80°	6%	12%
DG TeeJet® 110°	N/A	11%
DG TeeJet 80°	N/A	7%
TT – Turbo TeeJet®	<1%	<6%
TF – Turbo FloodJet®	<1%	<1%
AI TeeJet® 110°	N/A	<1%

Data obtained by spraying water at room temperature under laboratory conditions.



Droplet size classifications are based on BCPC specifications and in accordance with ASAE Standard S-572 at the date of printing. Classifications are subject to change.

XR8005	C	C	C	C	C	M	M
XR8006	C	C	C	C	C	C	C
XR8008	VC	C	C	C	C	C	C
XR11001	F	F	F	VF	VF	VF	VF
XR110015	F	F	F	F	F	VF	VF
XR11002	M	F	F	F	F	F	F
XR11003	M	M	M	F	F	F	F
XR11004	M	M	M	M	F	F	F
XR11005	M	M	M	M	M	M	F
XR11006	C	M	M	M	M	M	M
XR11008	C	C	M	M	M	M	M

TP8005	C	C	C	M	M
TP8006	C	C	C	C	C
TP8008	C	C	C	C	C
TP11001	F	VF	VF	VF	VF
TP110015	F	F	F	VF	VF
TP11002	F	F	F	F	F
TP11003	M	F	F	F	F
TP11004	M	M	F	F	F
TP11005	M	M	M	M	F
TP11006	M	M	M	M	M
TP11008	M	M	M	M	M

TwinJet® (TJ)

	PSI				
	29	36	44	51	58
TJ60-8001	F	VF	VF	VF	VF
TJ60-8002	F	F	F	F	F
TJ60-8003	F	F	F	F	F
TJ60-8004	M	M	M	M	F
TJ60-8006	M	M	M	M	M
TJ60-8008	C	C	M	M	M
TJ60-8010	C	C	C	M	M
TJ60-11002	F	VF	VF	VF	VF
TJ60-11003	F	F	F	F	F
TJ60-11004	M	F	F	F	F
TJ60-11006	M	M	M	F	F
TJ60-11008	M	M	M	M	M
TJ60-11010	M	M	M	M	M

DG TeeJet® (DG E)

	PSI				
	29	36	44	51	58
DG95015E	M	M	F	F	F
DG9502E	C	M	M	M	M
DG9503E	C	C	M	M	M
DG9504E	C	C	C	M	M
DG9505E	C	C	C	C	M

Turbo FloodJet® (TF)

	PSI				
	29	36	44	51	58
TF-2	XC	XC	XC	XC	XC
TF-2.5	XC	XC	XC	XC	XC
TF-3	XC	XC	XC	XC	XC
TF-4	XC	XC	XC	XC	XC
TF-5	XC	XC	XC	XC	XC
TF-7.5	XC	XC	XC	XC	XC
TF-10	XC	XC	XC	XC	XC

DG TeeJet® (DG)

	PSI				
	29	36	44	51	58
DG80015	M	M	M	F	F
DG8002	C	M	M	M	M
DG8003	C	C	M	M	M
DG8004	C	C	C	C	M
DG8005	C	C	C	C	C
DG110015	M	F	F	F	F
DG11002	M	M	M	M	M
DG11003	C	M	M	M	M
DG11004	C	C	M	M	M
DG11005	C	C	C	M	M

Spray Drift Factors

- **Viscosity of Spray Mix**
  - **Thickness of spray batch**
  - **Invert emulsions – thick like mayonnaise – low drift formulation**
  - **Water-based formulations affected by evaporation: temperature and humidity**
  - **Drift-reducing adjuvants may form an increased number of larger droplets**

Spray Drift Factors

- **Weather Conditions – Read the Wind**
  - **What's downwind?**
    Direction
  - **How far will it move?**
    Speed

    - **0-3 mph:**
      could be very stable with airflow, just not sure which direction the air is moving
    - **3-7 mph:**
      manage for off-target movement downwind
    - **>7 mph:**
      carries more material off-target

Spray Drift Factors

- **Weather Conditions**
  - **Temperature – droplet evaporates to smaller droplets as temperatures increase**
  - **Humidity – droplets do not evaporate as humidity increases**

Spray Drift Factors

- **Weather Conditions**
  - **Temperature Inversion – air is STABLE with minor air flow**
    - air at ground has cooled (heavier air)
    - warm air as risen (lighter air)

- ❖ result is stagnant, stable air = inversion
- ❖ long distance drift can result from applications made during inversions

Pesticide Movement: in Air

Vapor Drift

- Certain products volatilize and move with airflow off-target under warm weather conditions (above 85°F)
- Check the label for precautions for cut-off temperatures
- Select low-volatile formulations

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Pesticide Movement: in Air

Particle Drift

- Dust applications can drift
- Certain pesticides attach to soil particles, remain active and can blow off-target
- Check the label for soil incorporation precautions

Protect Bees and Other Pollinators

- **Do not apply toxic pesticides if there is bloom in the target area or in nearby areas**
- **Mow cover blooming crops and weeds**
- **Reduce drift**
- **Apply early or late when they are not foraging**

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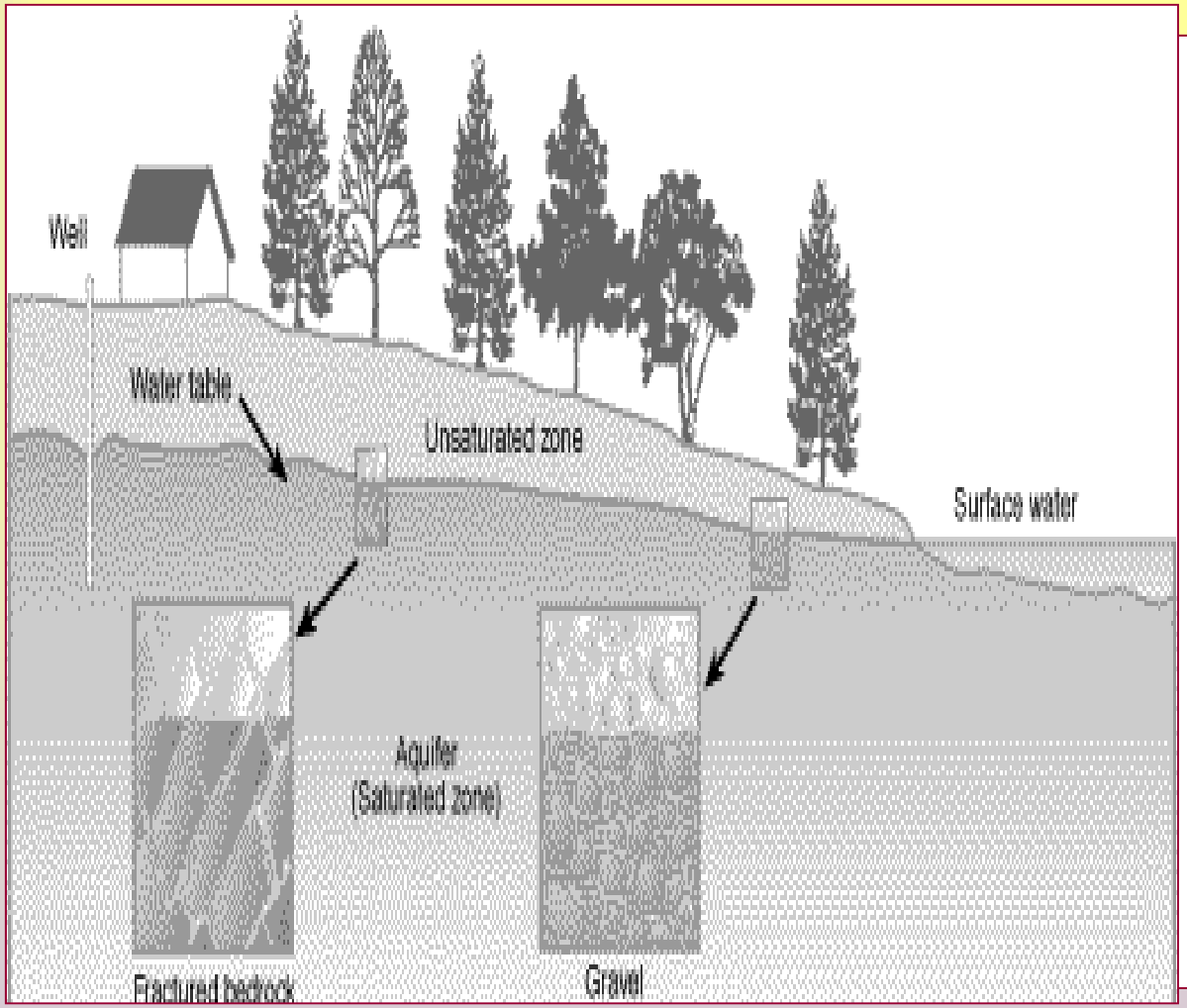
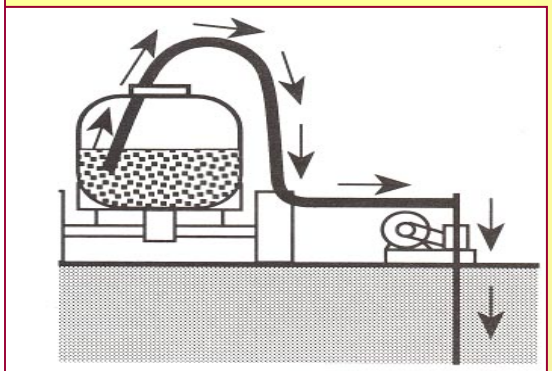
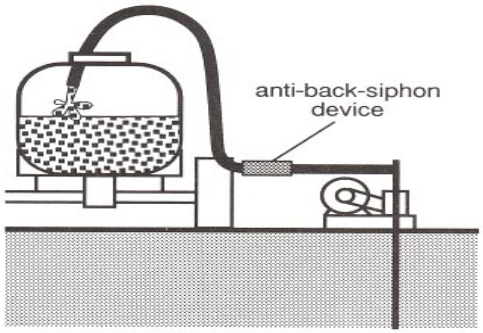
Protecting Water Resources





Avoid back-siphoning
into water source



Keep fill hose
above water level

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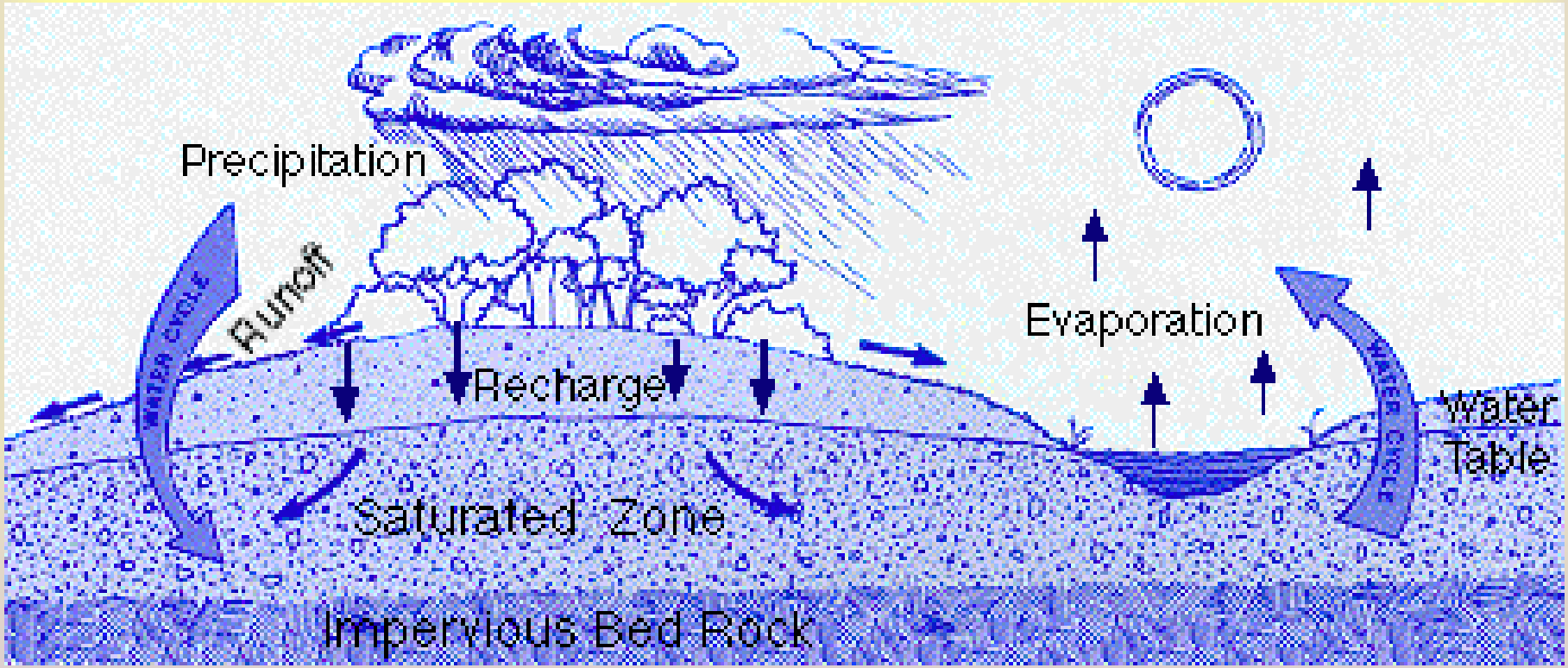
The Water Cycle



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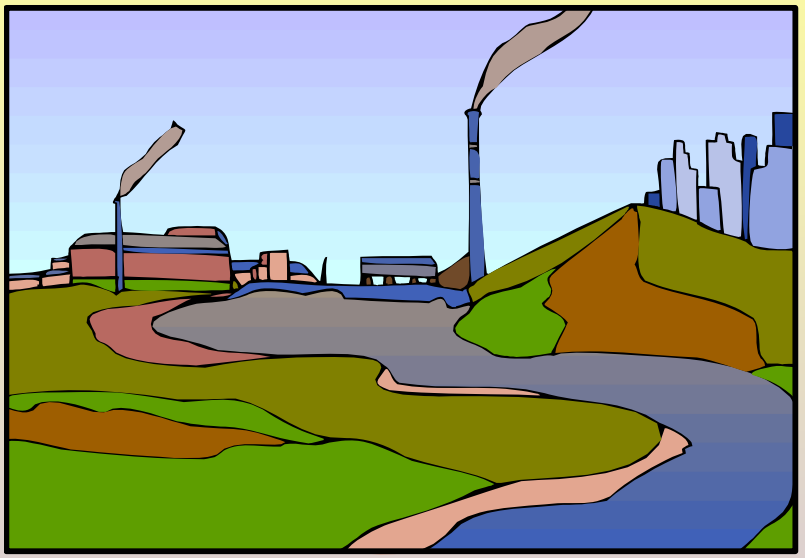
Pesticide Movement: in Water

- **Pesticides can move into water from a identifiable occurrence or from general contamination**
  - **Point Source**
    - **identifiable source**
  - **Non-point Source**
    - **wide area contamination**



Runoff vs. Leaching

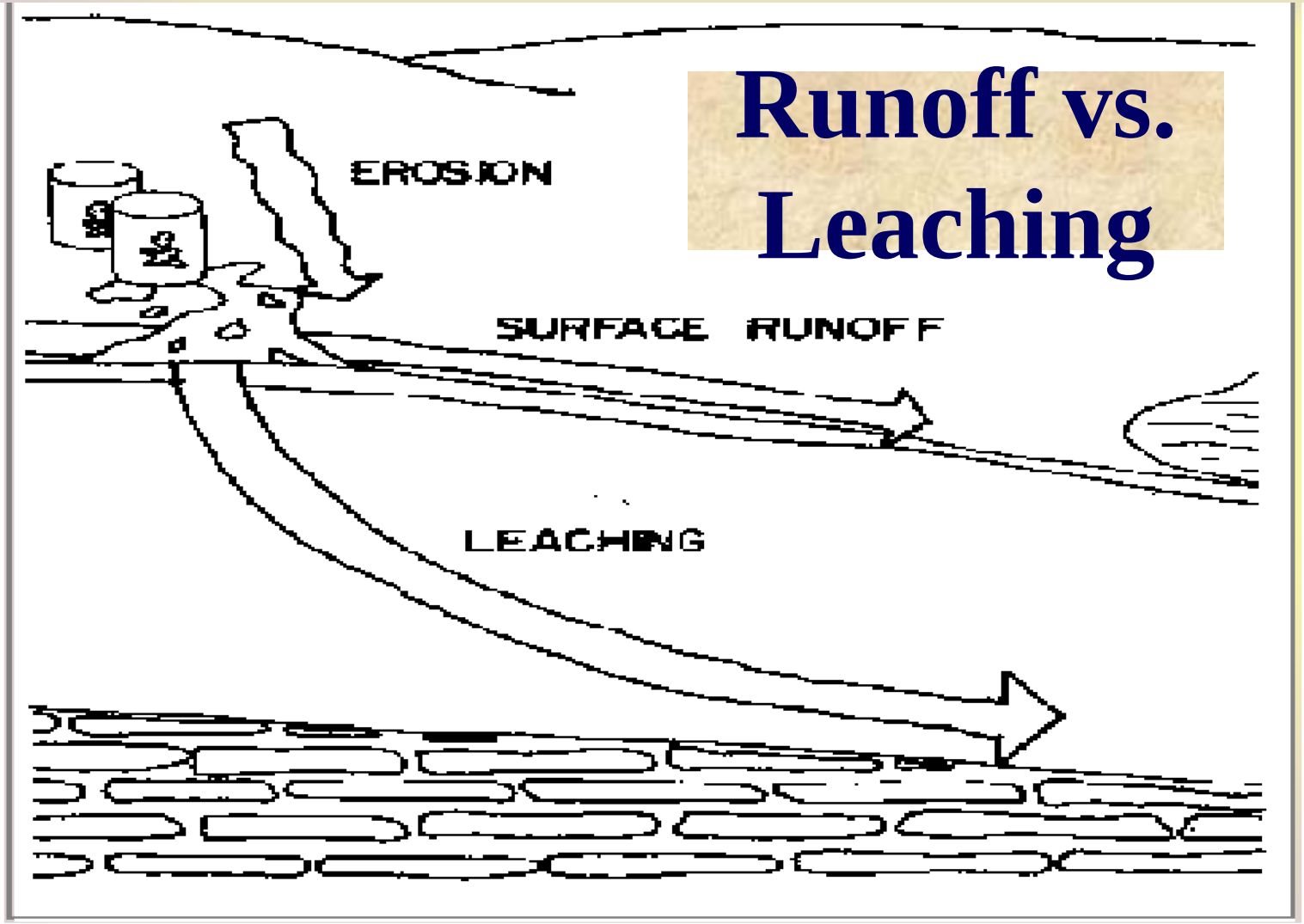


Figure 3. Pesticides can pollute water through either surface runoff or leaching.

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- **Pesticides may enter a well directly from spillage or back-siphonage, thus entering the groundwater directly**
  - **This is called point source pollution**

- **The best protection against groundwater pollution is prevention**

- **To minimize pesticide leaching to groundwater sources, consider the following steps:**
  - **Read the label**
  - **Ask if the application is needed**
  - **Use alternative pest control methods whenever possible**
  - **Identify and know the vulnerability of the soil and leaching potential of the pesticide**

- **Choose pesticides with the least potential for leaching into the groundwater**
- **Follow directions on the label**
- **Apply pesticides at the appropriate time**
- **Measure the pesticide properly and carefully**
- **Calibrate accurately and often**
  - **During calibration, check the equipment for leaks and malfunctions**

Don’t Forget What New Hampshire Requires

- No pesticide applications within 400 feet of a gravel packed well used as a public water supply
- No pesticide applications within 250 feet of other public wells
- Pesticide storage must be at least 75 feet from any drinking water well
- If you are drawing water from surface waters…you must use an anti-siphon device