UCDAVIS COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES

University of California Agriculture and Natural Resources

Best Practices to Keep Pesticides Out of Water

October/2020

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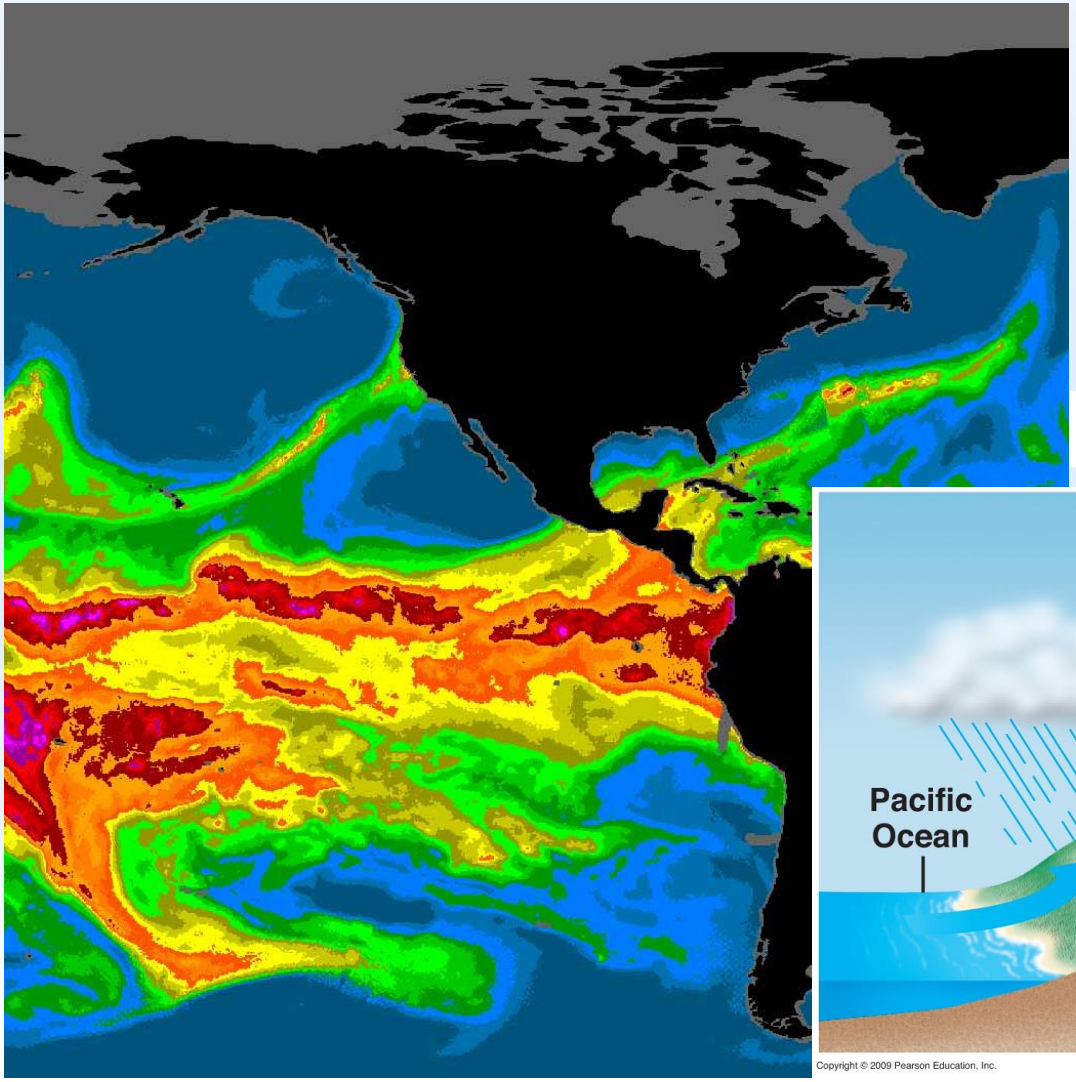
Water Resources Management

UCDAVIS WATER MANAGEMENT LAB

UC IPM

HYDROLOGY 101

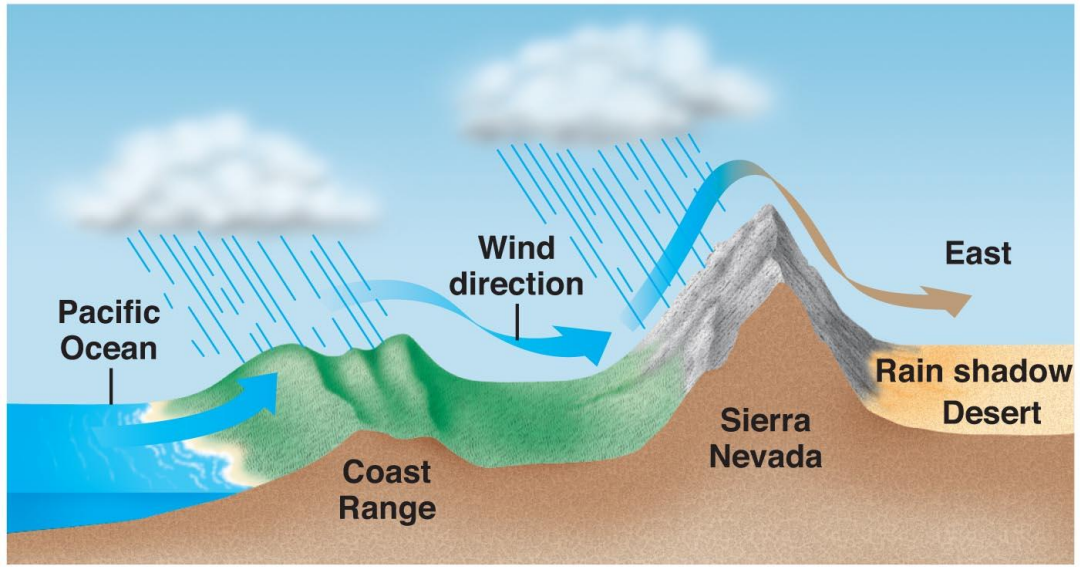
CALIFORNIA CLIMATE



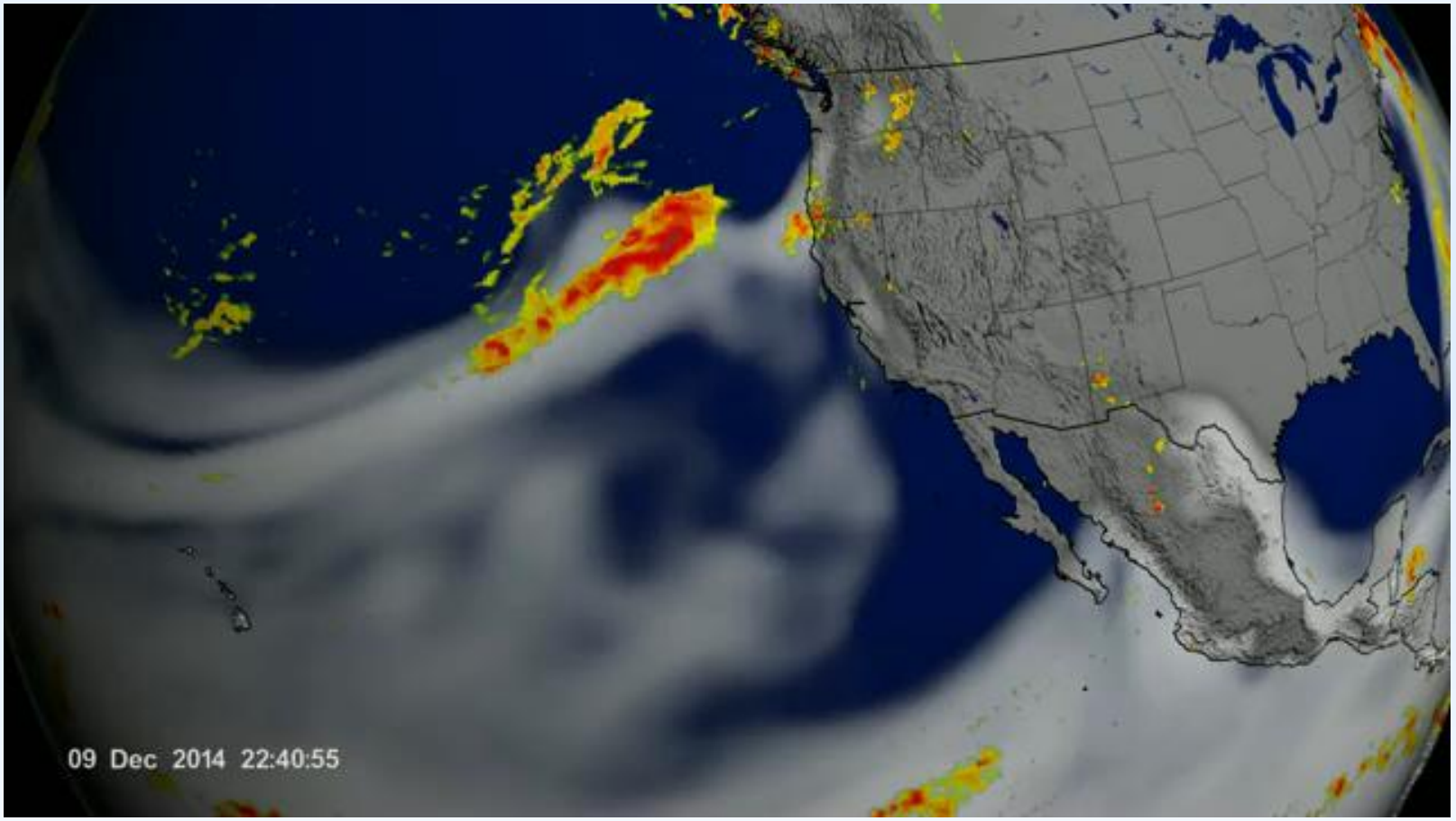
Mediterranean Climate

- Dry Summers
- Wet Winters

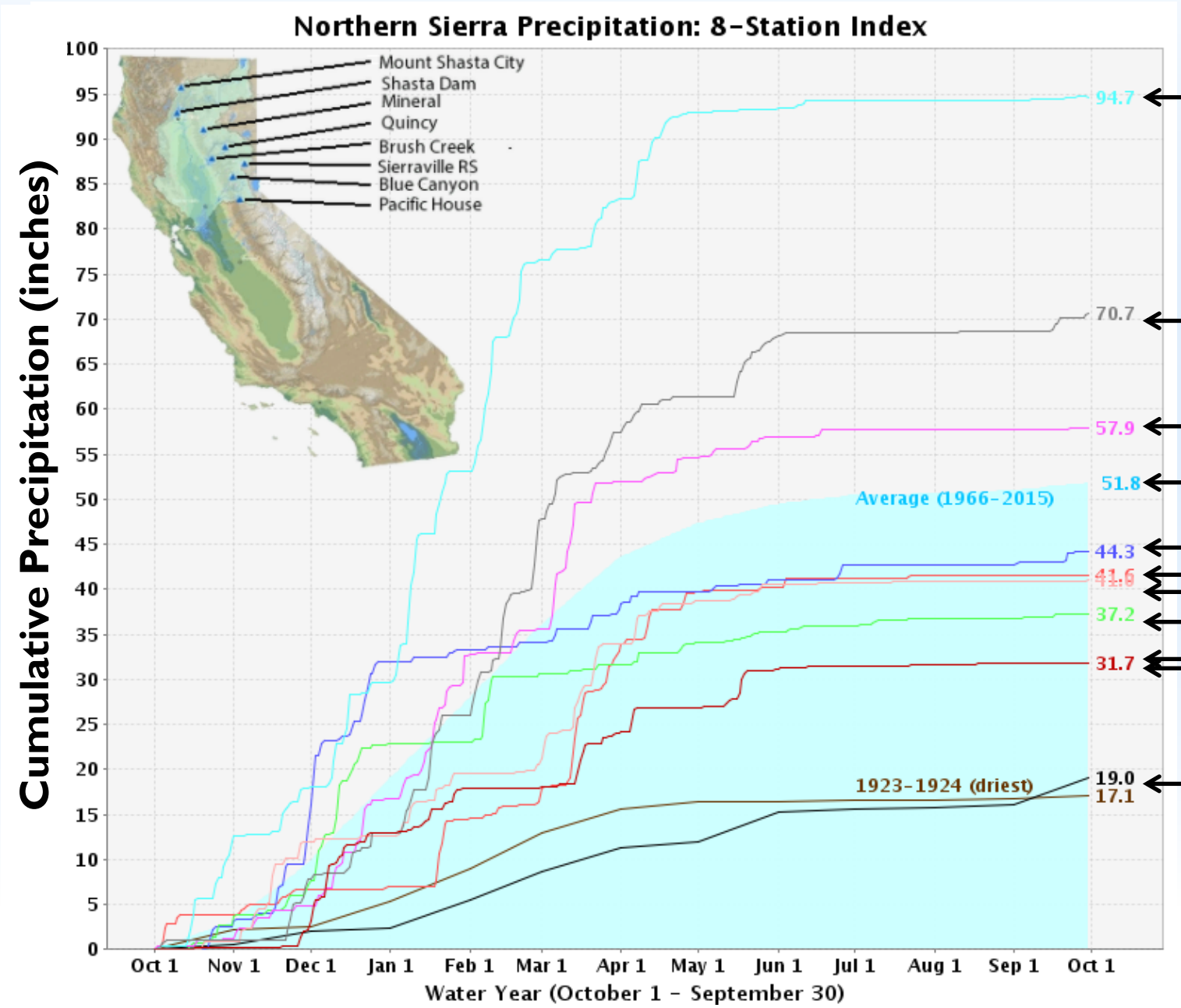
Atmospheric Rivers



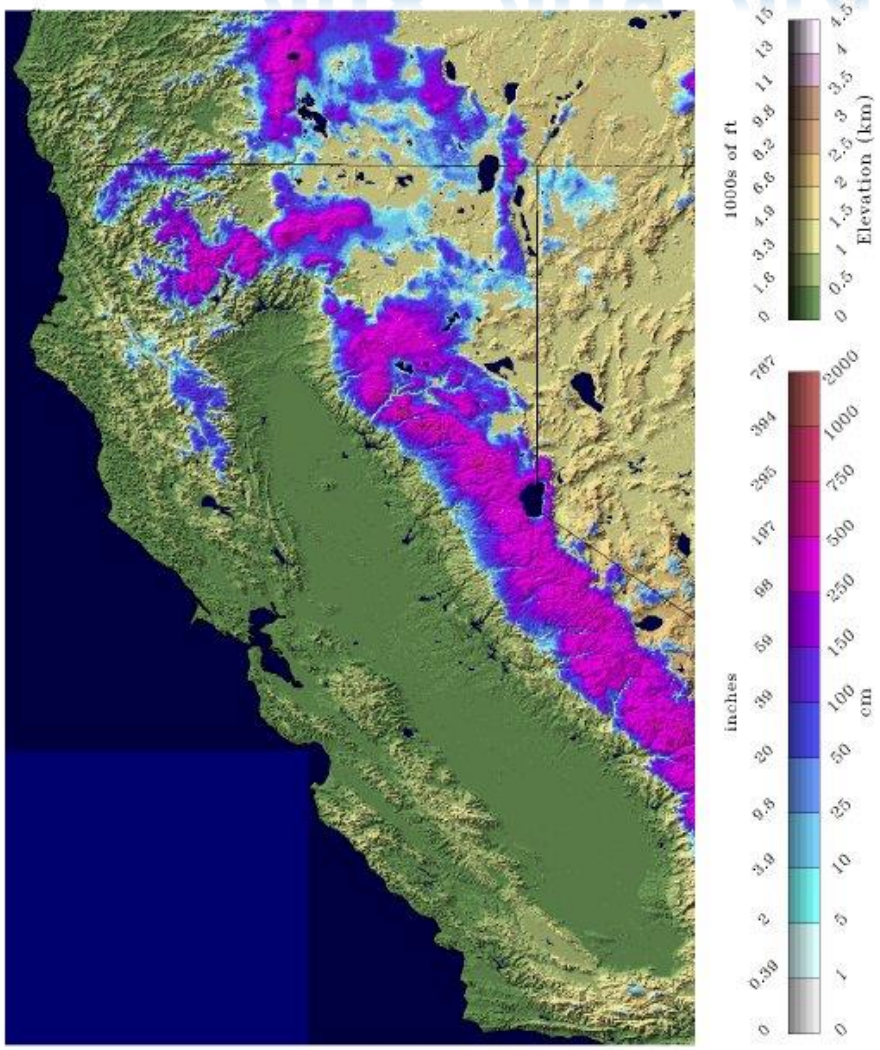
CALIFORNIA CLIMATE: FULL OF EXTREMES

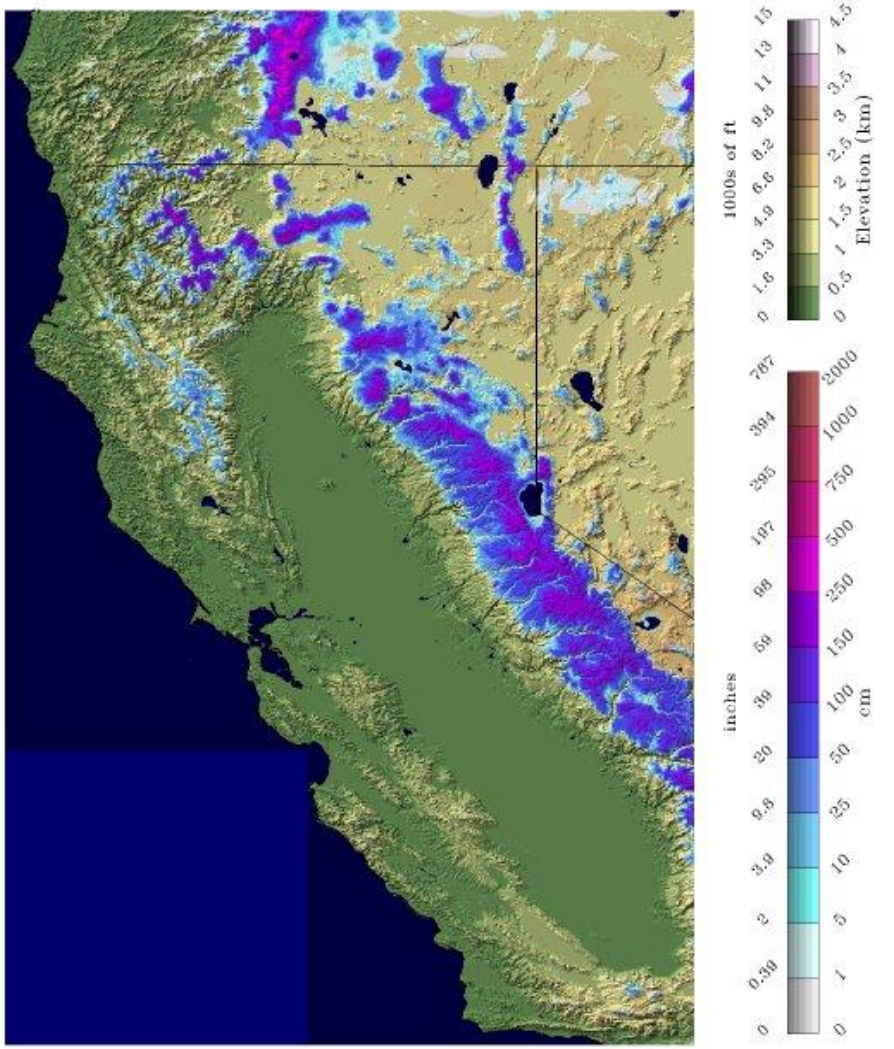


CALIFORNIA CLIMATE: FULL OF EXTREMES



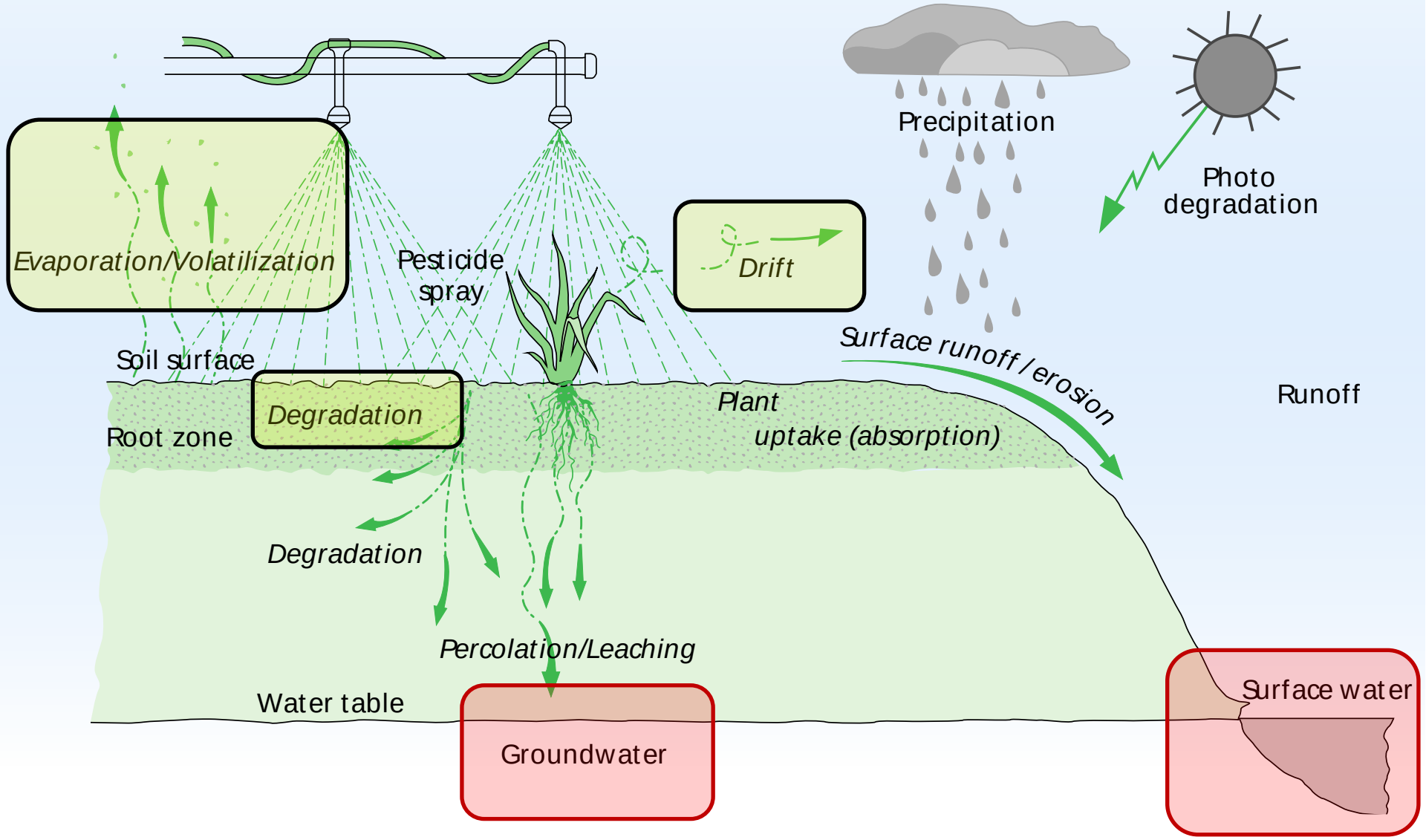
APRIL: 2011, 2012, 2013. 2014. 2015. 2016. 2017 2018, 2019, 2020

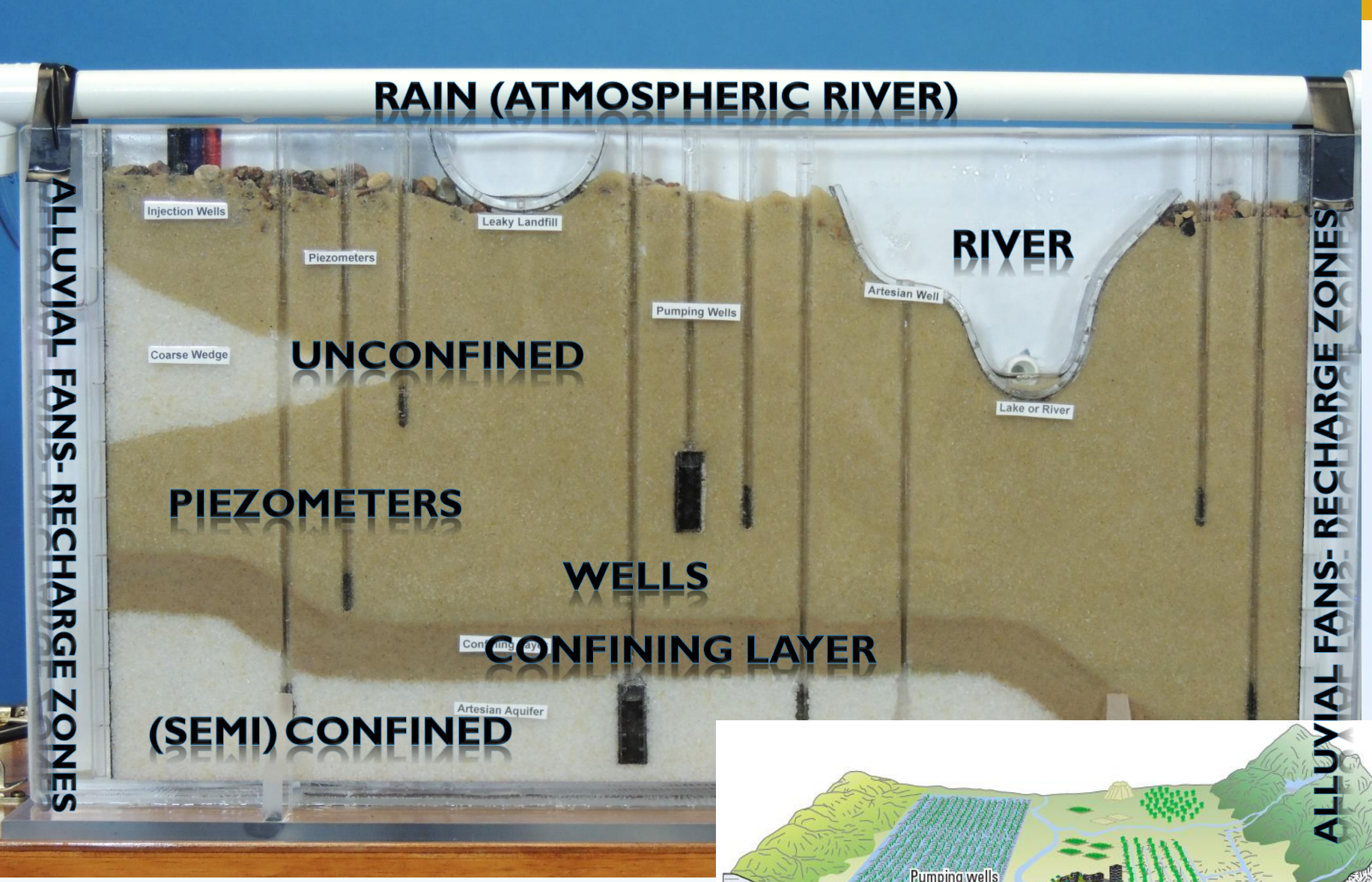


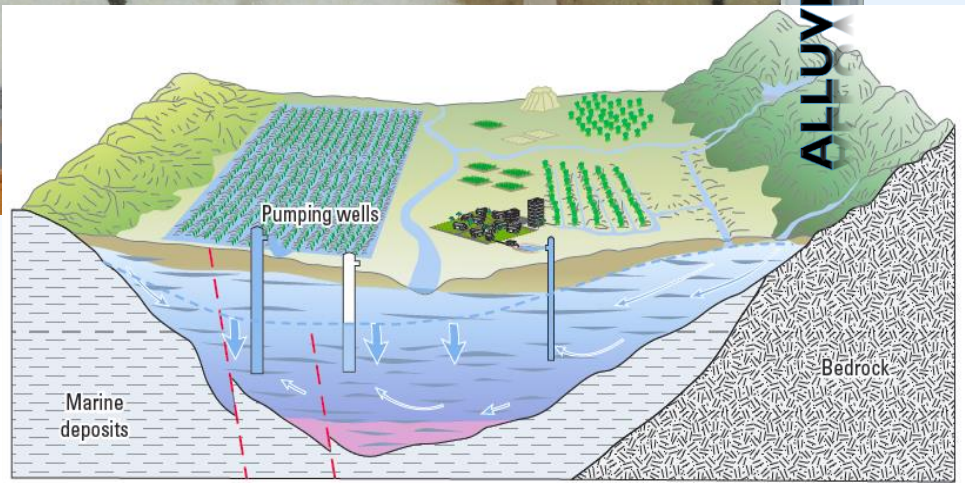


KEEPING PESTICIDES OUT OF WATER

THE VARIOUS FATES OF PESTICIDES

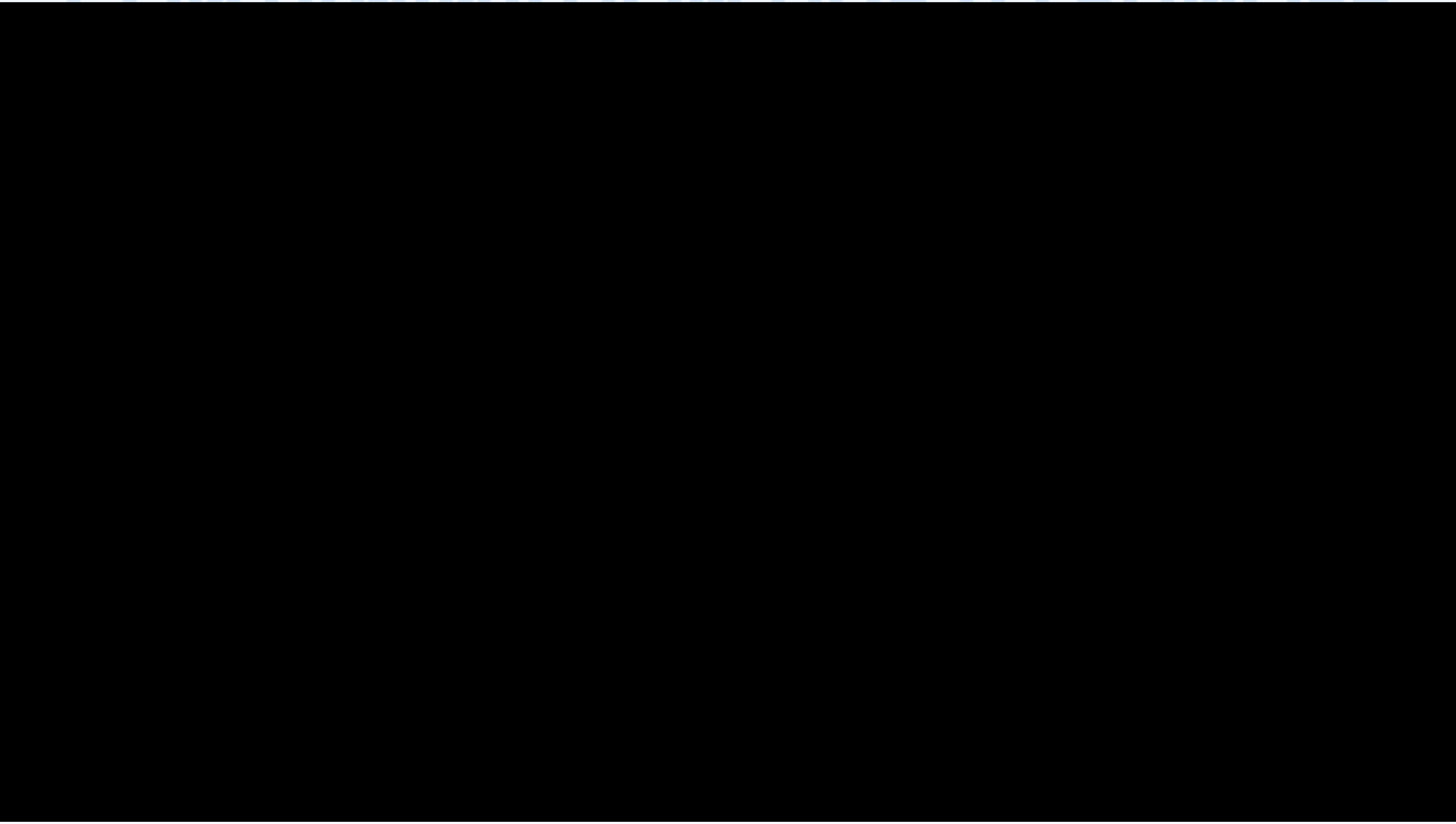



RAIN (ATMOSPHERIC RIVER)
ALLUVIAL FANS- RECHARGE ZONES
Injection Wells
Leaky Landfill
Piezometers
RIVER
Artesian Well
Pumping Wells
Coarse Wedge
UNCONFINED
Lake or River
PIEZOMETERS
WELLS
CONFINING LAYER
Artesian Aquifer
(SEMI) CONFINED
ALLUVIAL FANS- RECHARGE ZONES


Pumping wells
Marine deposits
Bedrock

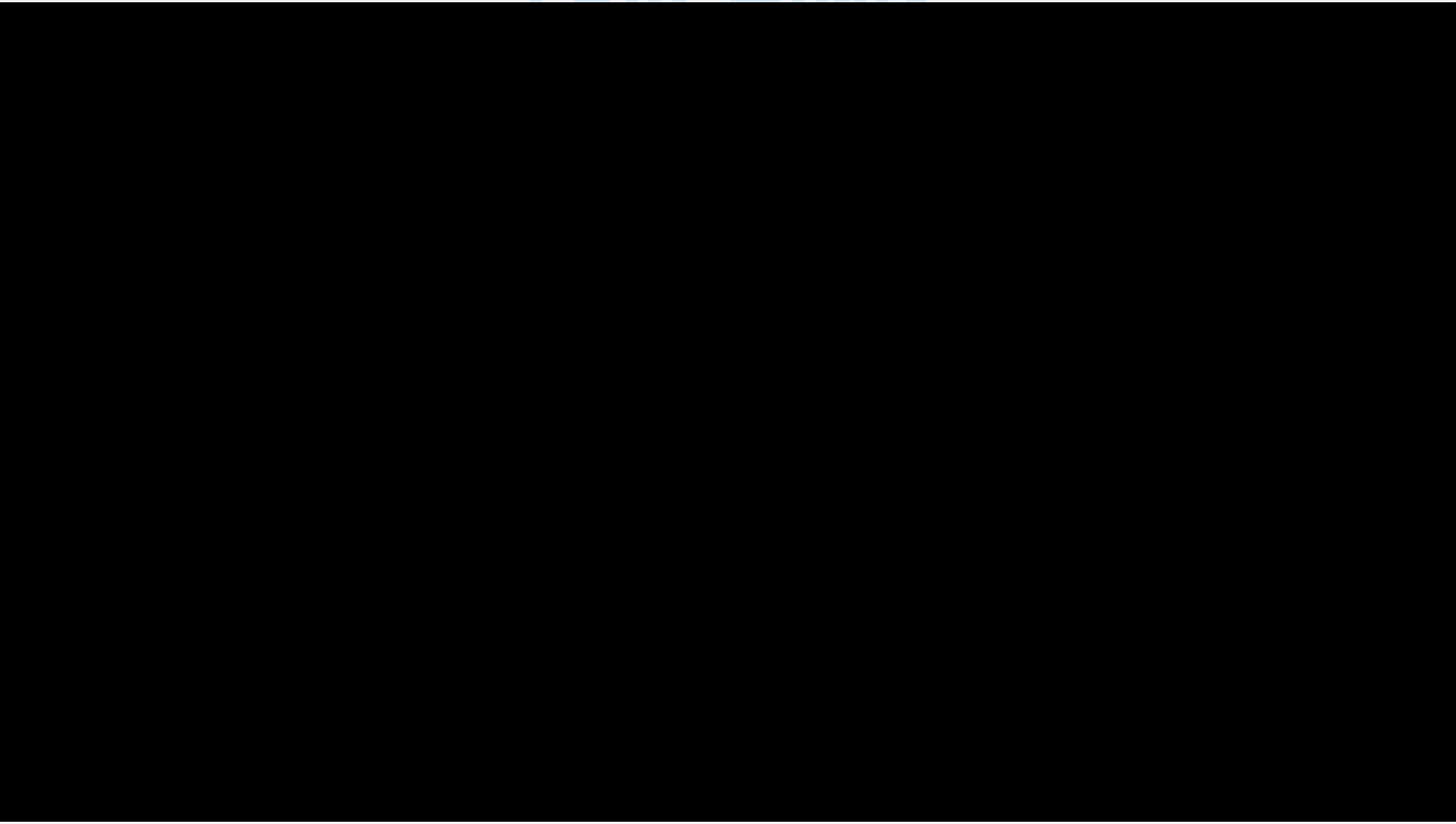
"THE SYSTEM"

CONTAMINATION DUE TO RUNOFF



Runoff – over-applying pesticides and/or overwatering (or applying pesticides right before a heavy rain) lead to runoff

LEACHING



Leaching – soil applied pesticides applied right before heavy rain or excess irrigation water will lead to leaching

BEST PRACTICES TO KEEP PESTICIDES OUT OF WATER

What are some ways pesticides get into water?

- Soil properties
- Pesticide properties
- Applicator practices

- Leaching
- Runoff
- Direct channels

KEY CONCEPTS

Soil Properties

- Soil Texture [silt, clay and sand]
- Depth to Groundwater
- Groundwater Protection Areas (GWPA)

Pesticides Properties

- Persistence [Explanation/examples]
- Solubility
- Adsorption

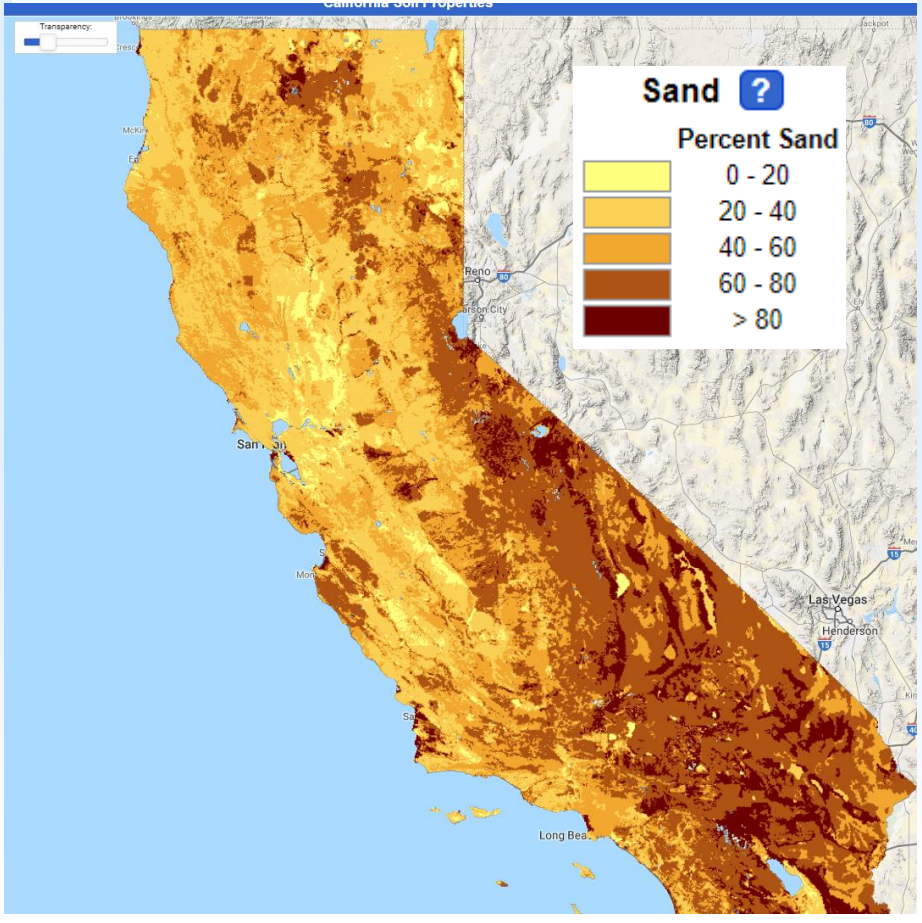
Application practices

- Monitoring the weather
- Irrigation practices (scheduled and monitoring system)
- Reading and following label instructions
- Good application practices (mixing and loading)

SOIL PROPERTIES

Soil Texture

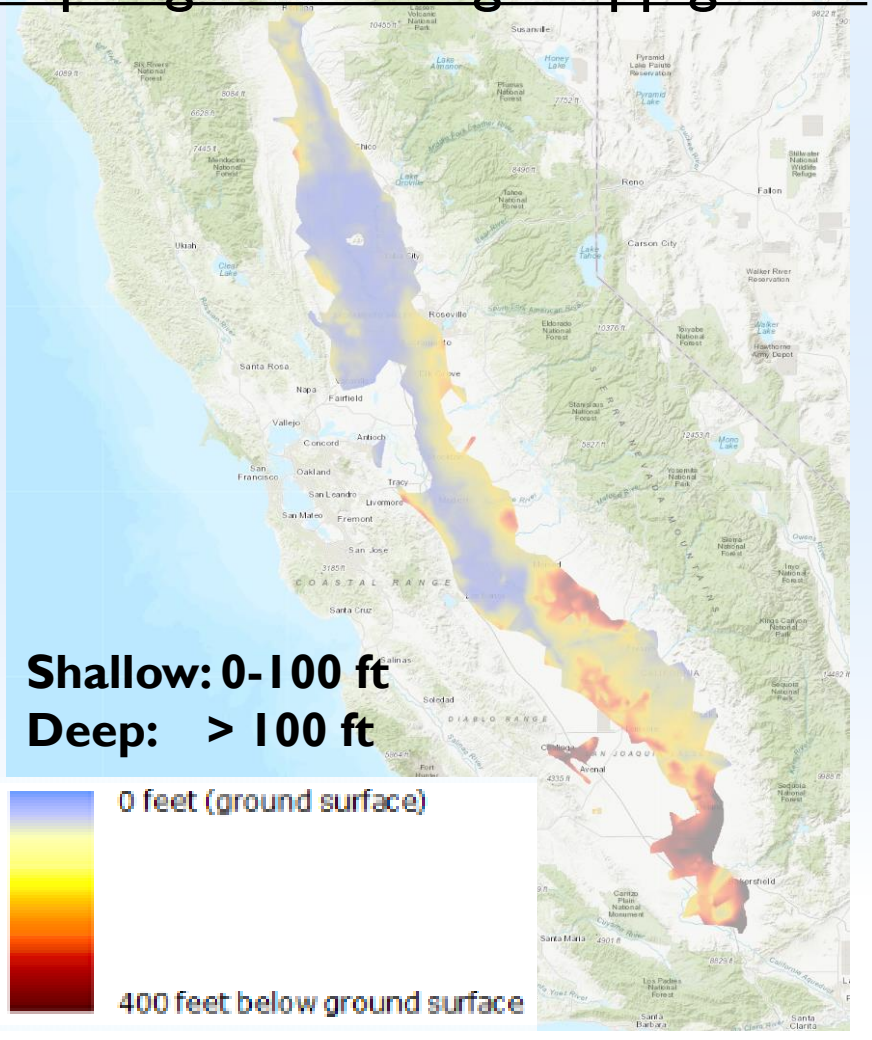
California Soil Properties
Physical: Sand/Silt/Clay



https://casoilresource.lawr.ucdavis.edu/ca-soil-properties/

Depth to Groundwater

Groundwater Information Center
Interactive Map
https://gis.water.ca.gov/app/gicima/

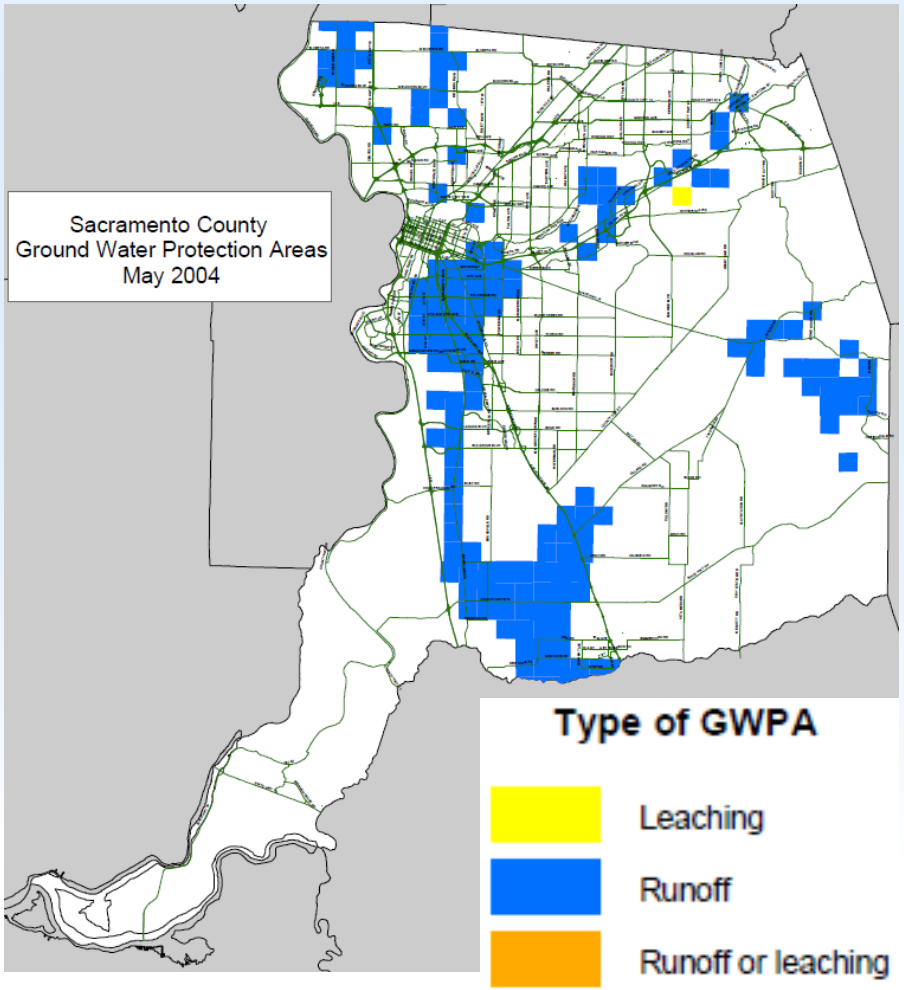


GROUND WATER PROTECTION AREAS (GWPA)

Area that is vulnerable to the movement of pesticides to GW due to leaching or runoff.

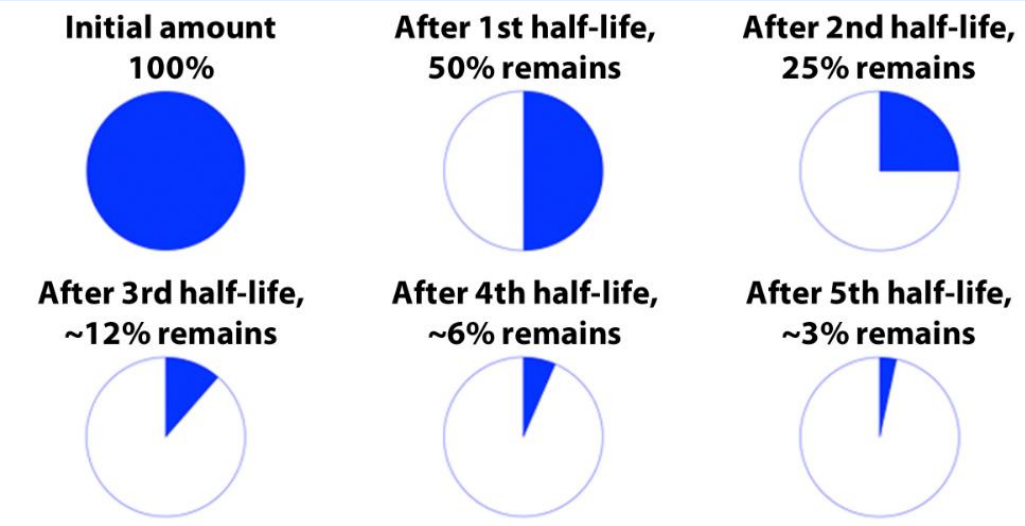
https://www.cdpr.ca.gov/docs/emon/grndwtr/gwpa_locations.htm

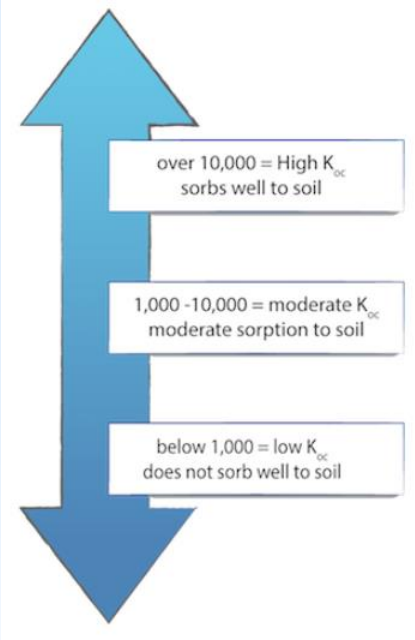
Counties with GWPAs		
Butte	Modoc	Solano
Colusa	Monterrey	Sonoma
Contra Costa	Orange	Stanislaus
Fresno	Placer	Sutter
Glenn	Riverside	Tehama
Kern	Sacramento	Tulare
Kings	San Bernardino	Ventura
Los Angeles	San Joaquin	Yolo
Madera	S.L.O.	Yuba
Mendocino	Shasta	
Merced	Siskiyou	



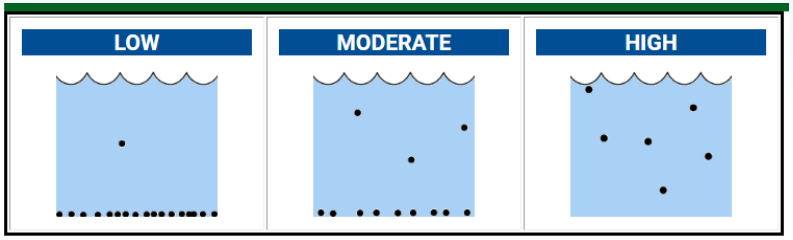
PESTICIDES PROPERTIES

Persistence: Time it takes to be break down in the environment (half-life). **Solubility**: Concentration (mg/l). **Sorption**: Soil binding affinity (K_{OC})



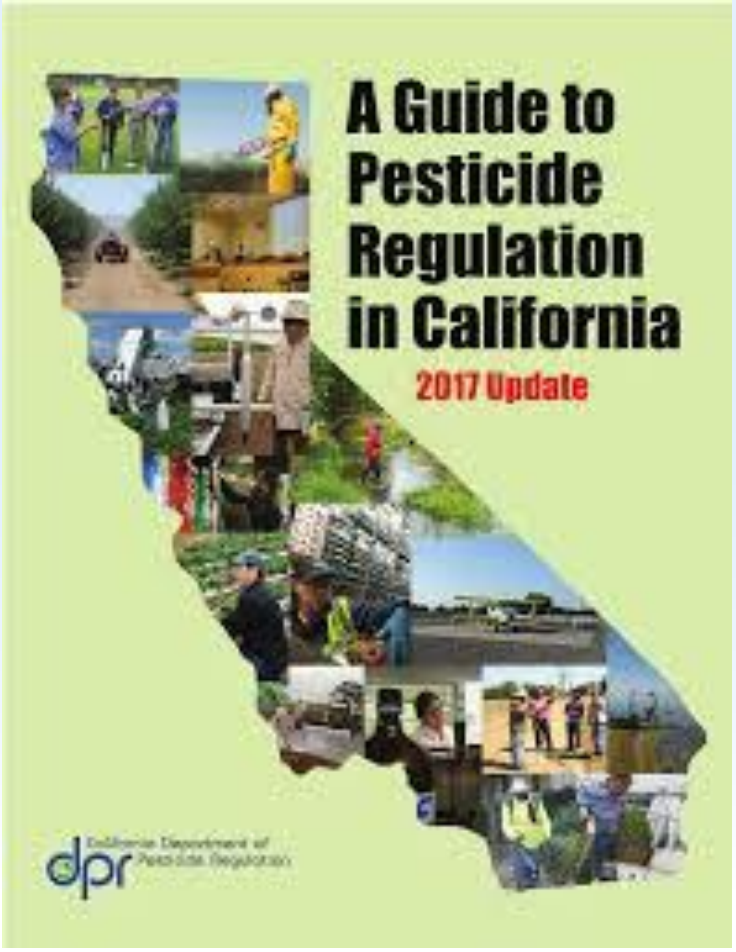


Low water solubility:	less than 10 mg/L or 10 ppm[1]
Moderate water solubility:	10-1,000 mg/L or 10-1,000 ppm[1]
High water solubility:	more than 1,000 mg/L or 1,000 ppm[1]



APPLICATION PRACTICES

- Monitoring the weather
- Irrigation practices (scheduled and monitoring system)
- Reading and following label instructions
- Good handling practices (mixing and loading)



Soil Properties:

Soil Texture: e.g. Silt

Depth to GW: 17 ft. (Shallow)

GW Protection Areas: N/A

Pesticide Properties:

Persistence: Silt – 293 days (Very persistent).

Solubility: Is not very soluble.

Unlikely to reach shallow GW in silty/loam and sandy soils.

Adsorption: Silt: 18,995 > 10,000 (Binds very well to soil)

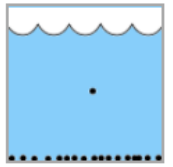
National Pesticide Information Center
http://npic.orst.edu/HPT/#

Oxyfluorfen

CAS #: 42874-03-3

Oxyfluorfen

Water Solubility:



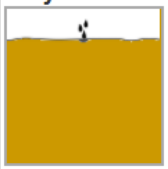
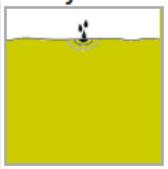
Oxyfluorfen is not very soluble in water (0.116mg/L)[1]. It doesn't disolve very well.

Vapor Pressure:

Oxyfluorfen is not very likely to volatilize or become a vapor (0.000000354 mmHg at 25°C/77°F)[2].

Groundwater Ubiquity Score (GUS):

Pesticide movement in soil depends on many factors. Soil properties and pesticides properties are equally important, and these data only describe the pesticide's properties. The more organic matter, the more slowly things tend to move. Compost is high in organic matter, while sand is not. Different soil types have different water-penetration rates. The pesticide's ability to dissolve in water is also very important. For more information, check the "Environmental Hazards" section of the pesticide label, or call NPIC at **1-800-858-7378**.

Silty/Loam:	**Sandy:**
	
Oxyfluorfen is very unlikely to reach shallow groundwater in silty/loam soils. (-0.69)[8]	Oxyfluorfen is unlikely to reach shallow groundwater in sandy soils. (0.72)[8]

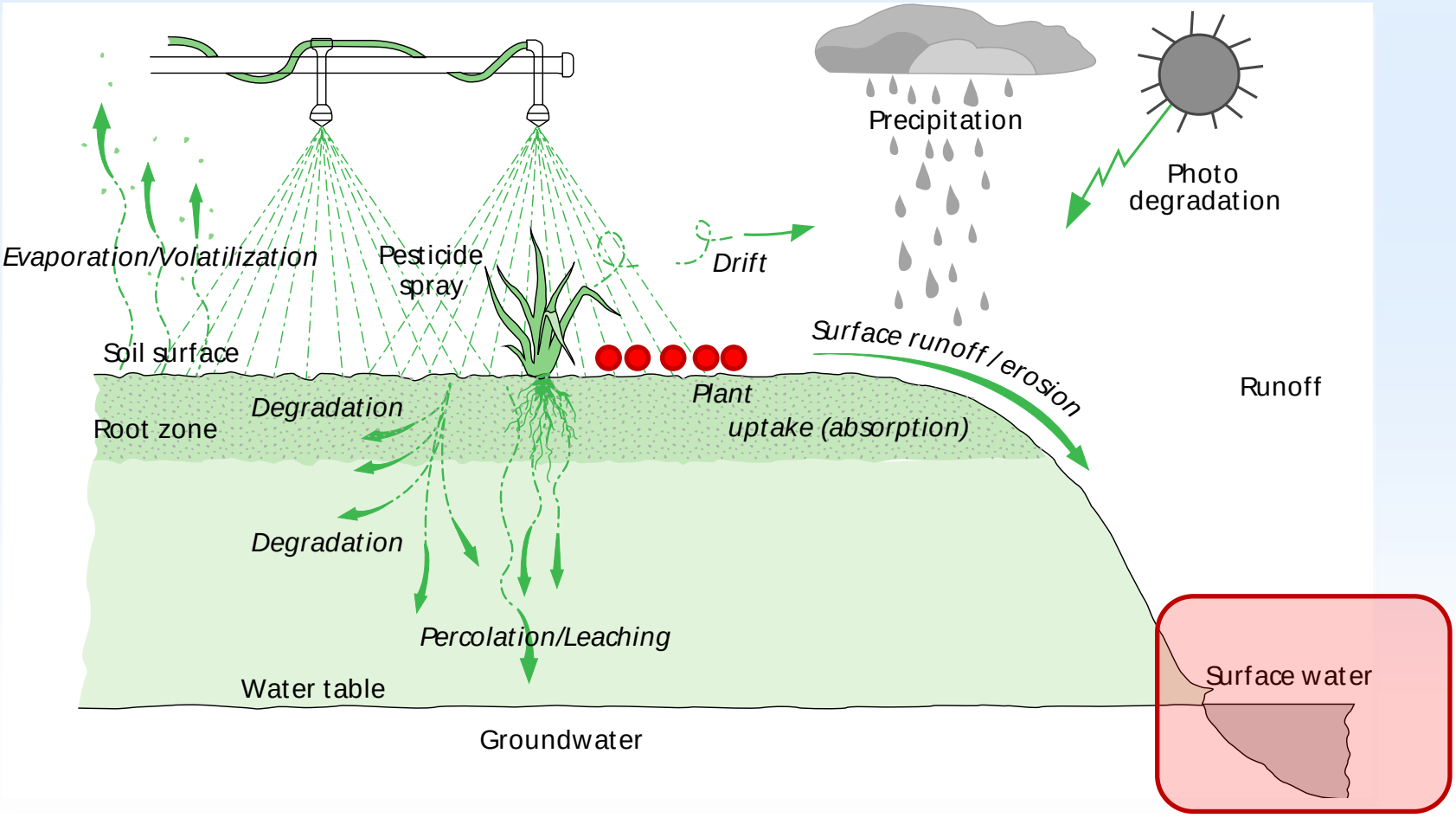
Soil Half-life:

Silty/Loam:	**Sandy:**
292.5 days[6]	576 days[7]

Diagnostic: Binds very well to soil and it is very persistent in the environment. **Pesticide moves where the soil moves** trough **soil erosion** due to Irrigation/rainfall and/or due to drift

Receiving body: Surface water, i.e. rivers and creeks

BMPs: Change the Pesticide?, Monitoring the weather, be conscious of irrigation practices (scheduled and monitoring system), reading and following label instructions



Soil Properties:

Soil Texture: e.g. Silt

Depth to GW: 17 ft. (Shallow)

GW Protection Areas: N/A

Pesticide Properties:

Persistence: Silt – 107 days (Persistent).

Solubility: Is moderately soluble.

Unlikely to reach shallow GW in silty/loam and sandy soils.

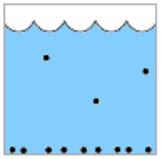
Adsorption: Silt: 100 < 1,000 (Does not bind to soil)

National Pesticide Information Center
http://npic.orst.edu/HPT/#

Atrazine

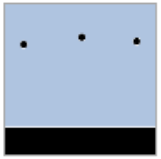
Water Solubility:

Atrazine is moderately soluble in water (33mg/L)[1].



Vapor Pressure:

Atrazine is not very likely to volatilize or become a vapor (0.00000029 mmHg at 25°C/77°F)[2].



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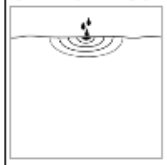
Unknown soil type:



Atrazine is likely to reach shallow groundwater in soils (soil type not specified). (4.06)[6]

Soil Half-life:

Unknown soil type:
106.65 days[5]

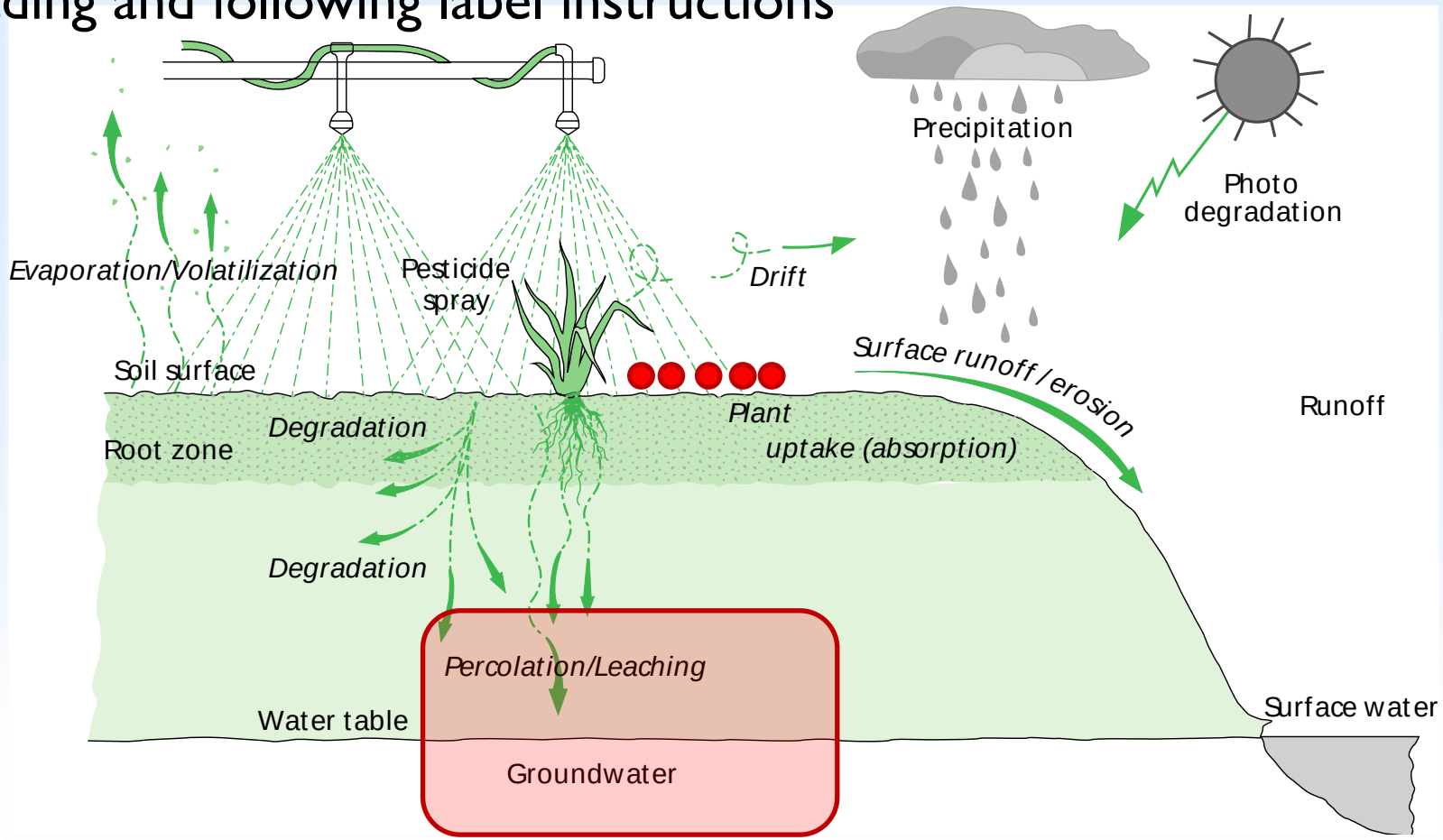
Sorption Coefficient (K_{OC}):

Unknown soil type:
100 [4]

Diagnostic: Binds very well to soil and it is very persistent in the environment. **Pesticide moves where the water moves** trough **infiltration** due to Irrigation/rainfall and/or **runoff** due to over-irrigation or high slopes

Receiving body: aquifer, rivers and creeks

BMPs: Change the Pesticide?, Monitoring the weather, be conscious of irrigation practices (scheduled and monitoring system), reading and following label instructions



PROPER MIXING, LOADING AND STORAGE

Proper mixing, loading and storage of pesticides to make sure they don't end up in water

Figura 3-8. Aprenda la manera de reducir la deriva durante la aplicación de pesticidas.

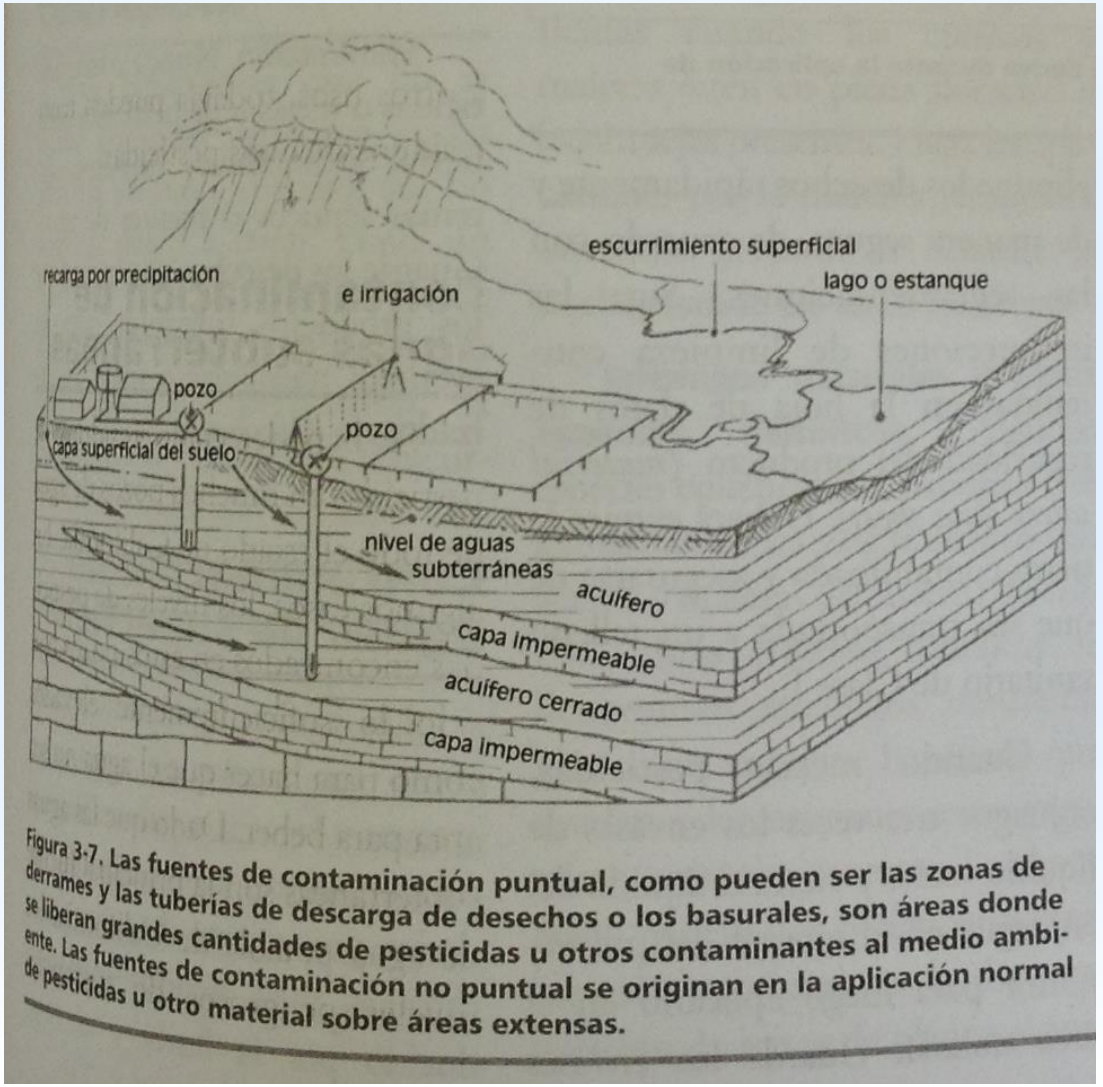


Figura 3-7. Las fuentes de contaminación puntual, como pueden ser las zonas de derrames y las tuberías de descarga de desechos o los basurales, son áreas donde se liberan grandes cantidades de pesticidas u otros contaminantes al medio ambiente. Las fuentes de contaminación no puntual se originan en la aplicación normal de pesticidas u otro material sobre áreas extensas.

WELL HEAD PROTECTION

Well head protection – don't apply pesticides within 100 feet of wells.

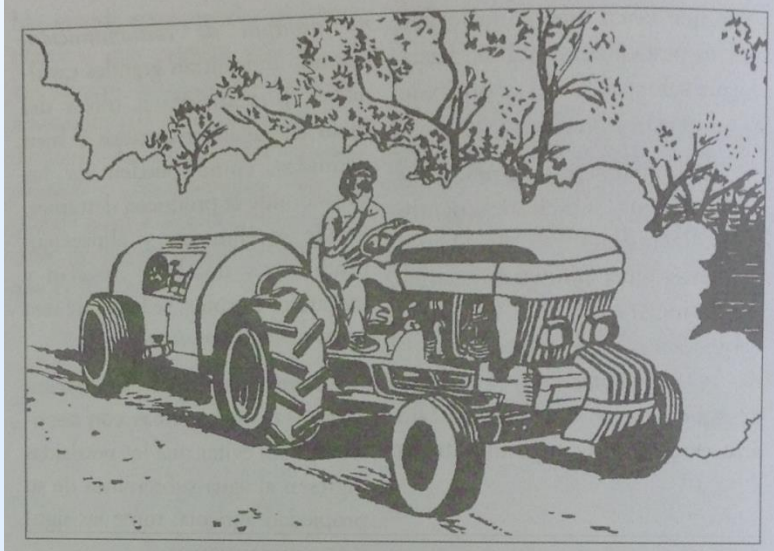


Figura 3-8. Aprenda la manera de reducir la deriva durante la aplicación de pesticidas.

No realice actividades de manejo de pesticidas (mezcla, carga, almacenamiento, enjuague, aplicación de herbicidas de preemergencia) dentro de los 100 pies de distancia de los pozos de agua. En estos lugares, los derrames de pesticidas producidos durante la mezcla y la carga y los residuos provenientes del lavado del equipo y la eliminación incorrecta de pesticidas sobrantes pueden hacer que los pesticidas contaminantes ingresen al agua subterránea a través del encamisado de los pozos.

Si ocurre un derrame, limpie y elimine los desechos rápidamente y de manera segura, de acuerdo con las reglamentaciones. Siga las instrucciones de limpieza contenidas en la hoja de datos de seguridad del producto *(material safety data sheet)*. Deberá extraer la tierra contaminada y asegurarse de que sea transportada a un relleno sanitario de Clase I.

Cuando mezcle pesticidas, enjuague tres veces los envases de líquido vacíos y vierta el líquido del enjuague en el tanque del pulverizador para luego aplicarlo en el área tratada. Guarde los envases

lavados bajo llave hasta que sean reciclados o llevados al lugar designado para su eliminación.

Aplicación. Reduzca la deriva de pesticidas reduciendo la presión de pulverización, utilizando boquillas que produzcan gotas grandes, dejando zonas de contención sin tratar y empleando otras técnicas seguras de aplicación. En lo posible, realice las aplicaciones en condiciones climáticas óptimas para reducir el desplazamiento de pesticidas por deriva y escurrimiento (Figura 3-8).

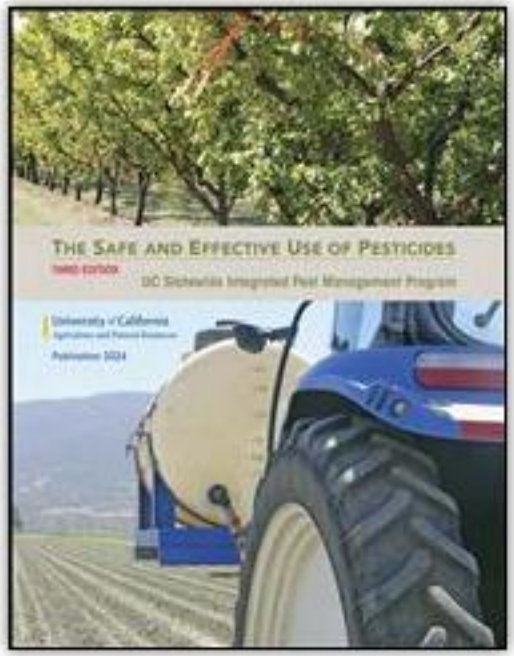
Eliminación. Nunca arroje pesticidas o mezclas de pesticidas en la tierra, alcantarillas, drenajes, sistemas sépticos o fuentes de agua. Guarde los desechos de pesticidas y los productos sobrantes para su eventual transporte a sitios autorizados de desecho.

Contaminación de aguas de superficie

Las aguas de superficie, tales como los canales de riego, los arroyos y lagos son vulnerables a la contaminación con pesticidas por deriva proveniente de aplicaciones cercanas y el escurrimiento producido por la lluvia y el riego

PROPER MIXING, LOADING AND STORAGE

The Safe and Effective Use of Pesticides, 3rd Edition



Publication Number: 3324
Copyright Date: 2016
Length: 386 pp.
Language: English
ISBN-13: 978-1-60107-895-7
Author: S WHITHAUS (AU) L BLECKER (TECH ED)
Inventory Type: Paperback

Availability: Available

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RESOURCES

Video w/this info available: https://youtu.be/z6N5g5W9JrQ

Soil texture: https://casoilresource.lawr.ucdavis.edu/ca-soil-properties/

Depth to Groundwater: https://gis.water.ca.gov/app/gicima/

Herbicides properties tool (National Pesticide Information Center) http://npic.orst.edu/HPT/#

Ground Water Protection Area
https://www.cdpr.ca.gov/docs/emon/grndwtr/gwpa_maps.htm

National Weather service
https://www.weather.gov/

Safe and Effective Use of pesticides (3rd Edition)
http://ipm.ucanr.edu/IPMPROJECT/ADS/manual_safeeffectiveuse.html

Local Ag. Commissioner's office

Hydrology 101
http://watermanagement.ucdavis.edu/cooperative-extension/hydrology-and-climate-change

- **UC IPM –Pest Management Guidelines**

https://www2.ipm.ucanr.edu/agriculture/

Reference Evapotranspiration (https://cimis.water.ca.gov/)

"Use the water that you need, but not a drop more"

"Usa el agua que necesites, pero ni una gota mas"

THANKS

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