United States Department of Agriculture

Soil Science Division

Natural Resources Conservation Service

Wetland Functions and Land Use

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Natural Resources Conservation Service

nrcs.usda.gov/

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United States Department of Agriculture

1. Wetland Functions

2. Land Use Effects on Wetlands

Natural Resources Conservation Service

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"Types" of "Wetlands"…

Cowardin (FGDC, 2013)

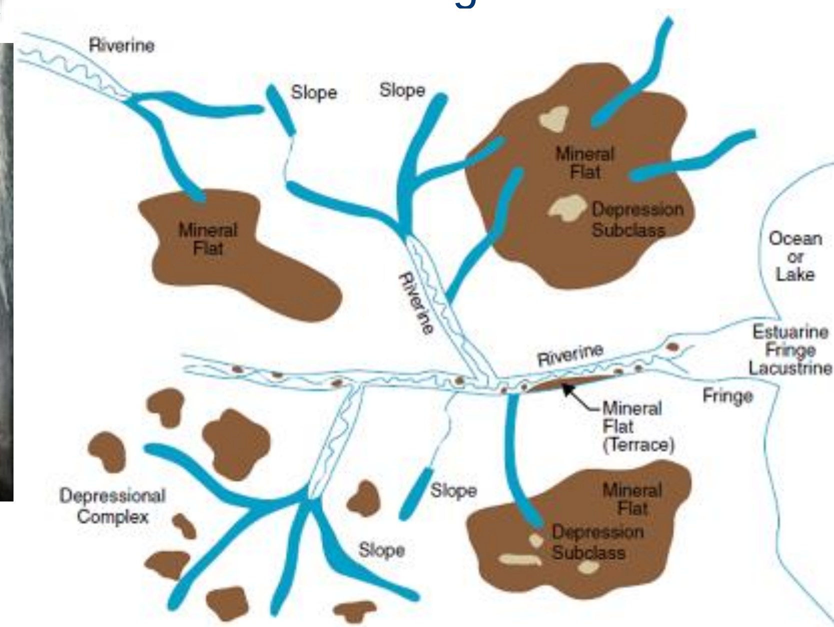
- Marine
- Estuarine
- Riverine
- Lacustrine
- Palustrine

Portland, OR

Carolina Bay

HGM (Brinson, 1993)

- Depressional
- Riverine
- Slope
- Organic Flat
- Mineral Flat
- Estuarine Fringe
- Lacustrine Fringe



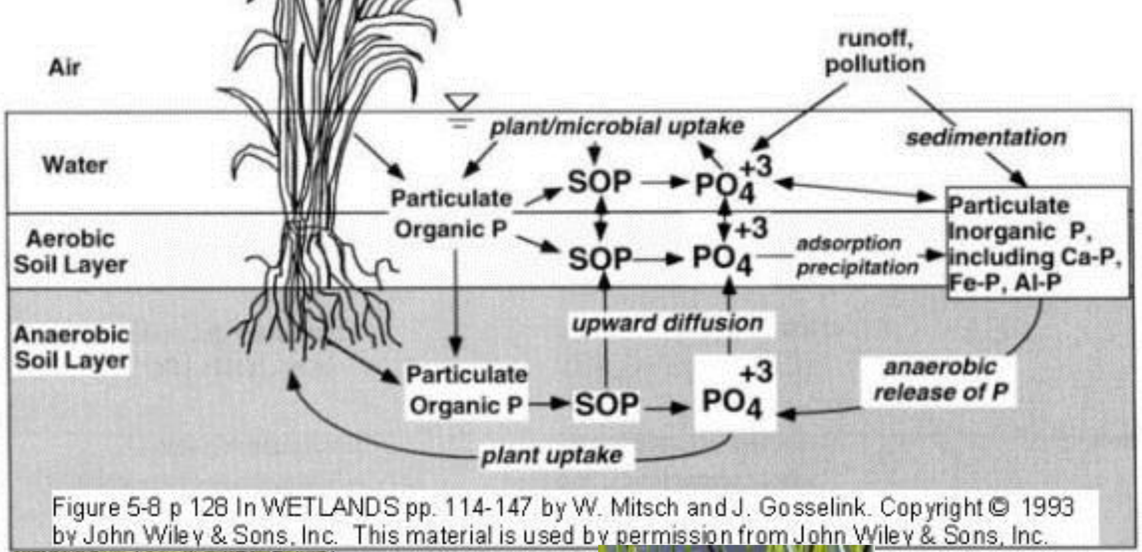
To tree or not to tree…

Images courtesy of Richard Weber

Wetland Functions

- Floodwater Storage
- Aquifer recharge
- Carbon sequestration (peatlands—organic soils)
- Nutrient Cycling
- Nitrogen Fixation
- Water Filtration
- Wildlife Habitat
- Recreation (birding, hunting, canoeing)

Phosphorus transformation in wetland sediments (from Mitsch and Gosselink 1993).



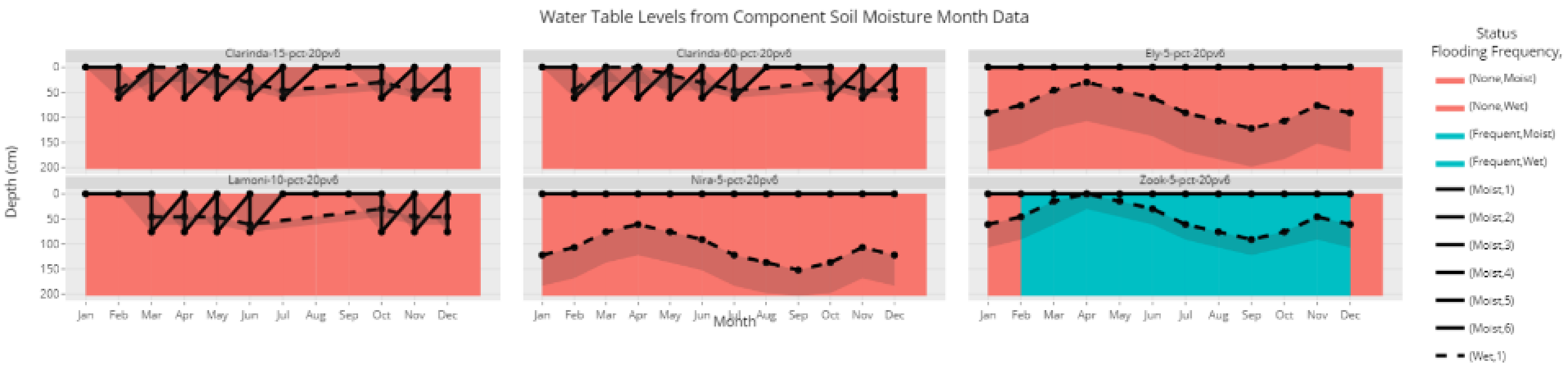
Water Storage

Where in the soil profile is the water?

- For wetland soils, the soils must be **saturated** for certain lengths of time, and the water table is usually present within the top 25 cm during the growing season.
- Soils can have textural changes or dense layers that "perch" water
- Water can accumulate above the surface of the soil, "ponding"

Episaturated

Endosaturated



https://usda.shinyapps.io/r11_app/

Three types of soil saturation are defined:

a. ***Endosaturation***.—The soil is saturated with water in all layers from the upper boundary of saturation to a depth of 200 cm or more from the mineral soil surface, or to paralithic or lithic contact, whichever is shallower.

b. ***Episaturation***.—The soil is saturated with water in one or more layers within 200 cm of the mineral soil surface and also has one or more unsaturated layers, with an upper boundary above a depth of 200 cm, below the saturated layer. The zone of saturation, i.e., the water table, is perched on top of a layer of relatively low hydraulic conductivity impermeable layer, including non-cemented discontinuities, pedogenic horizons, and densic contacts.

c. **Anthric**

Keys to Soil Taxonomy, 12th ed.

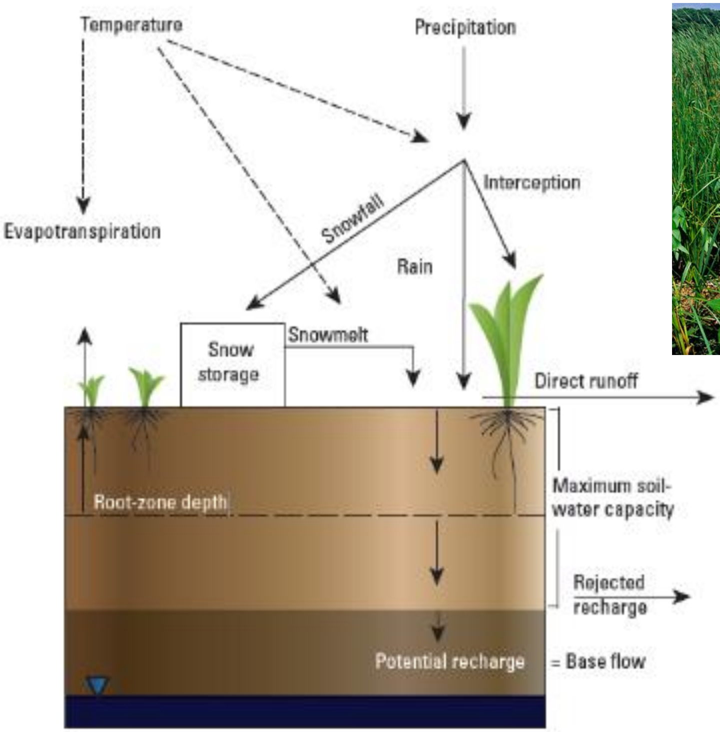
What Influences a Wetland?

Onsite (within the wetland)

- **Soils**
- **Water source**
  - Water magnitude
  - Water frequency
- **Plants**
  - Presence/absence of hydrophytes (water-loving plants)
- **Management/Use**

https://soils4teachers.org/wetlands

https://cfpub.epa.gov/watertrain/moduleFrame.cfm?parent_object_id=1253



Trost et al. 2018

Eggers & Reed, 1997

What Influences a Wetland?

Offsite (lands adjacent to the wetland), or within the **watershed—the area of land that contributes water to the wetland**

Water Source, Quality, Magnitude, and Frequency

Valley Shape, Surrounding Landscape, Slope, and Parent Material

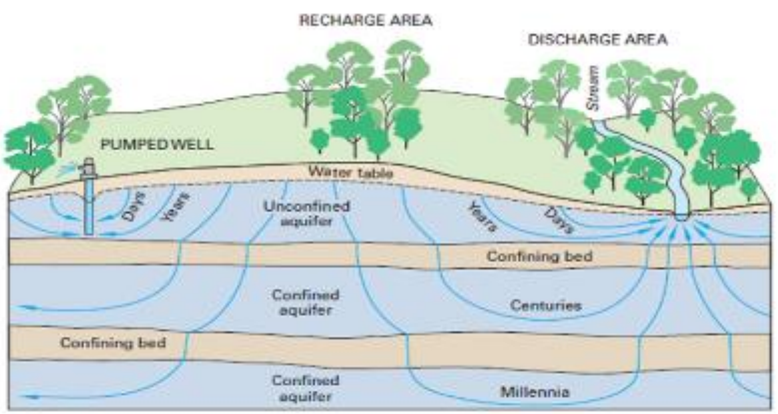
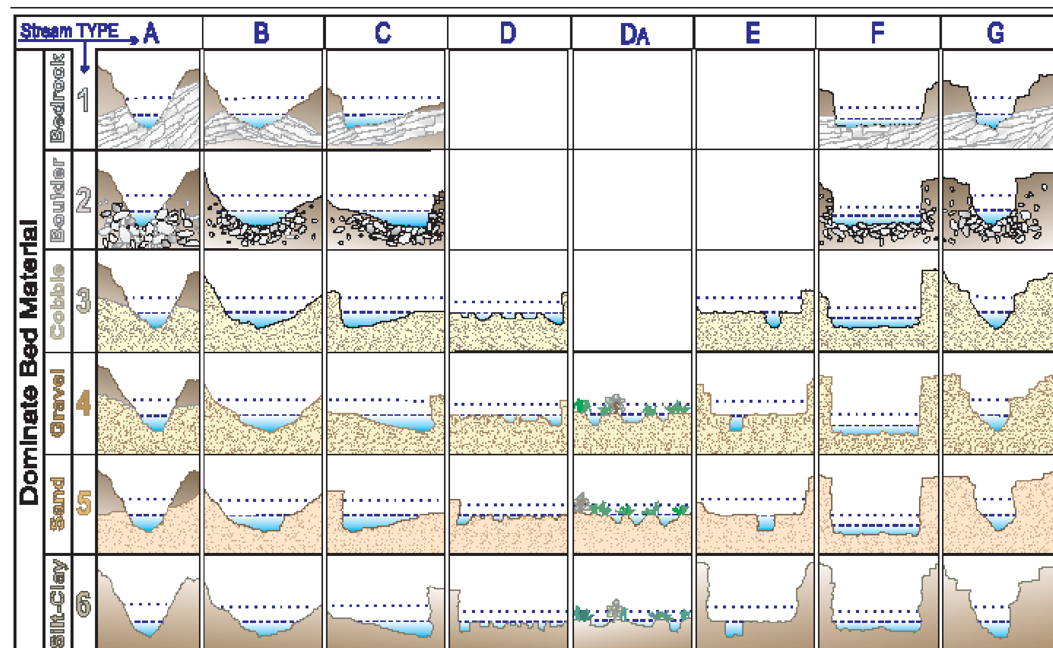


Figure 12. Ground-water flow paths vary greatly in length, depth, and traveltime from points of recharge to points of discharge in the ground-water system.



Stream TYPE	A	B	C	D	DA	E	F	G
Entrchmnt.	< 1.4	1.4 - 2.2	> 2.2	n/a	> 4.0	> 2.2	< 1.4	< 1.4
W/D Ratio	< 12	> 12	> 12	> 40	< 40	< 12	> 12	< 12
Sinuosity	1 - 1.2	> 1.2	> 1.2	n/a	variable	> 1.5	> 1.2	> 1.2
H_2O Slope	.04-.099	.02-.039	< .02	< .04	<.005	<.02	< .02	.02-.039

What Influences a Wetland?

Offsite (lands adjacent to the wetland), or within the **watershed—the area of land that contributes water to the wetland**

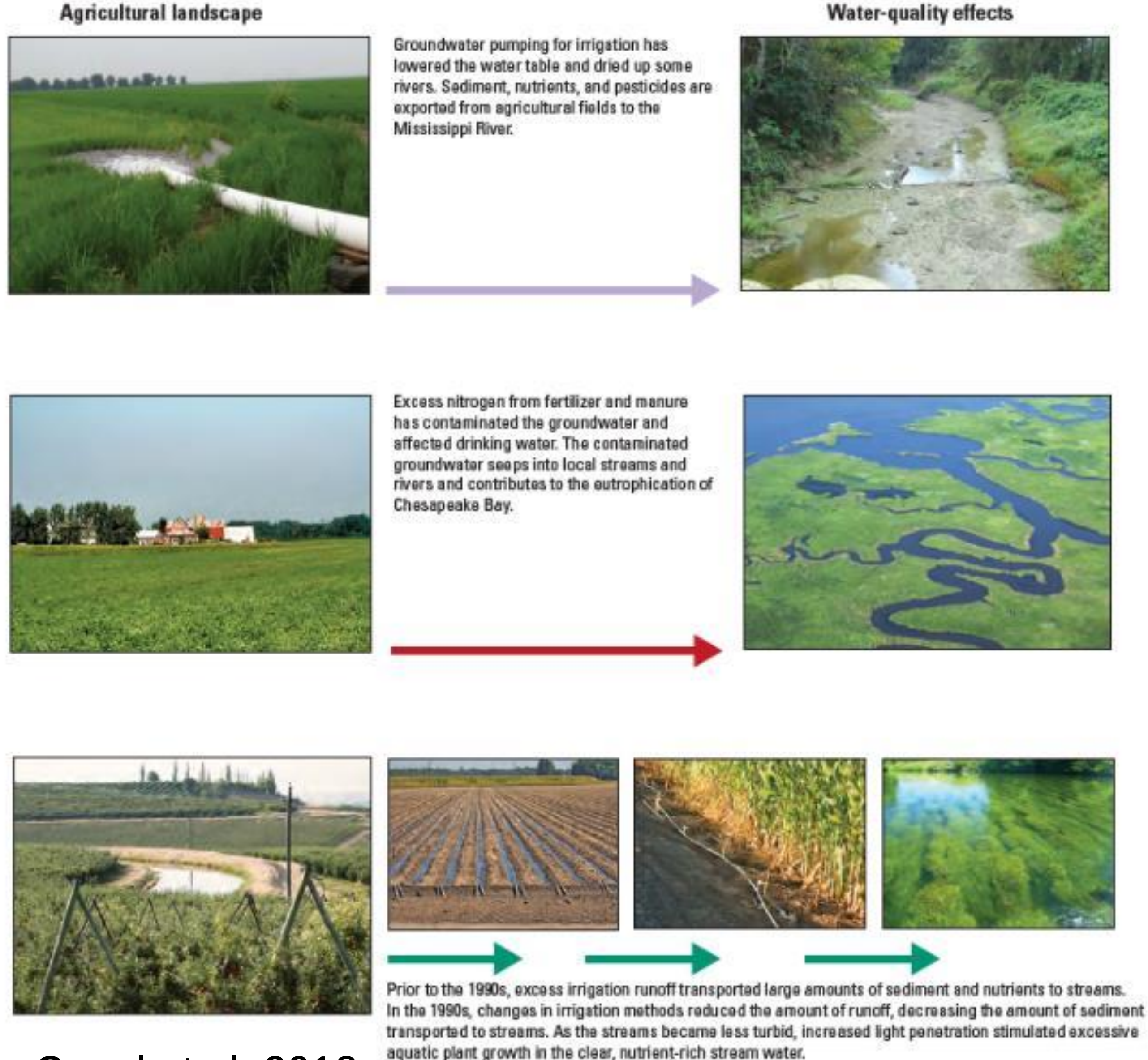
- **Climate Change**
- **Land Use**
- **Time**
- **Reservoirs**
- **Locks and dams**
- **Channelization**
- **Agriculture**
- **Erosion**
- **Municipal water use/Aquifer drainage/Water diversion**
- **Deforestation**

Oaks Bottom Wildlife Refuge, Portland, OR

Land Use

Most historical and current water-quantity and water-quality impacts from agriculture are the result of the modification of the natural water flowpaths and (or) the use of chemicals.

- Groundwater pumping
- Agricultural drainage
- Agricultural irrigation



Capel et al. 2018

Land and Water Use—
Groundwater pumping and irrigation

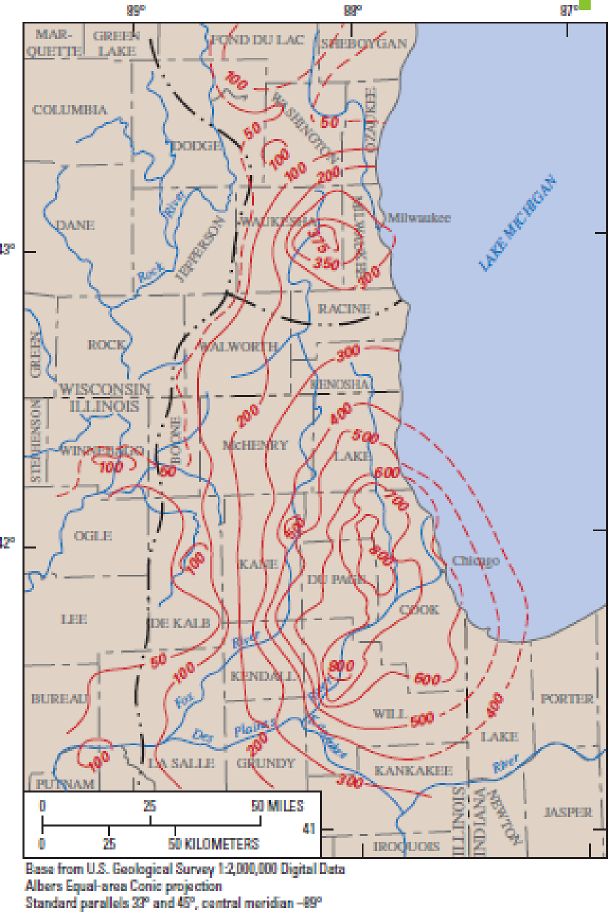
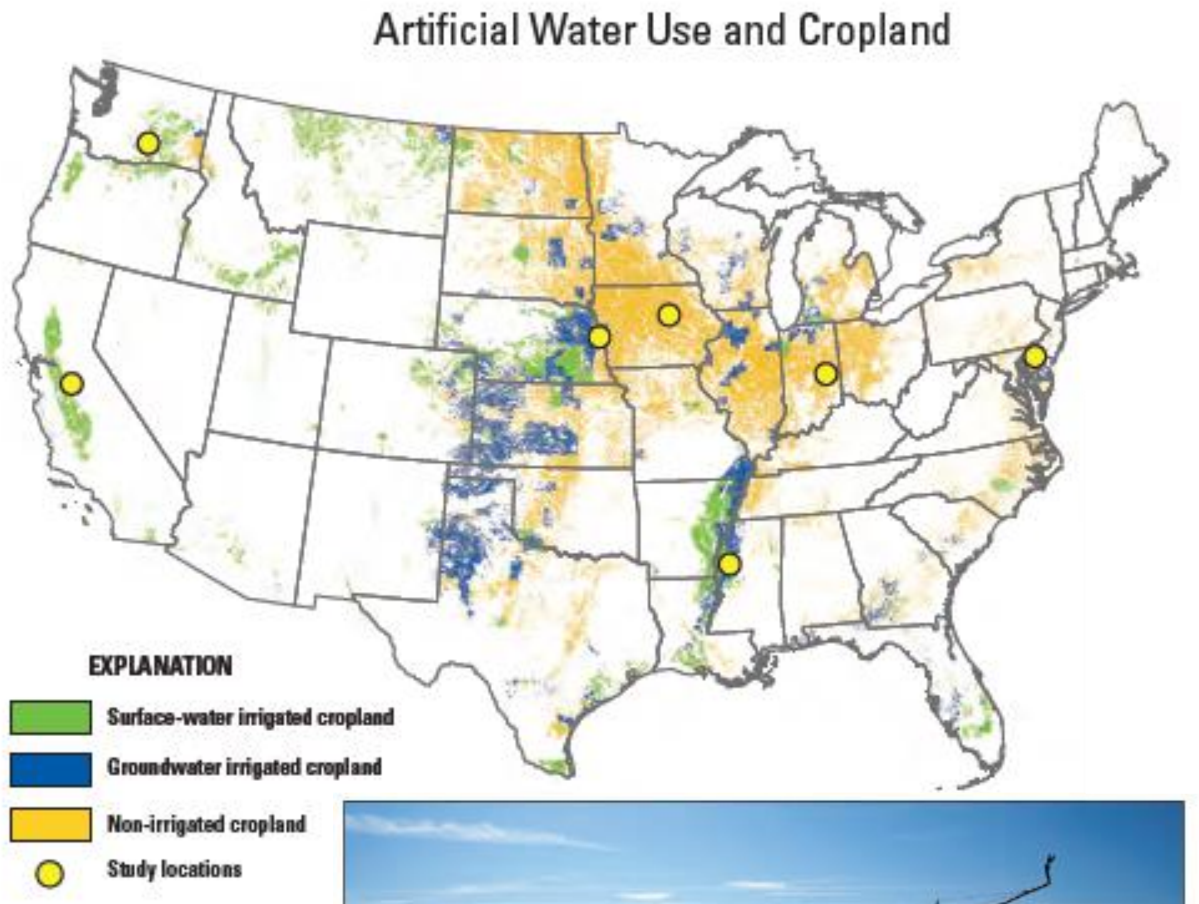


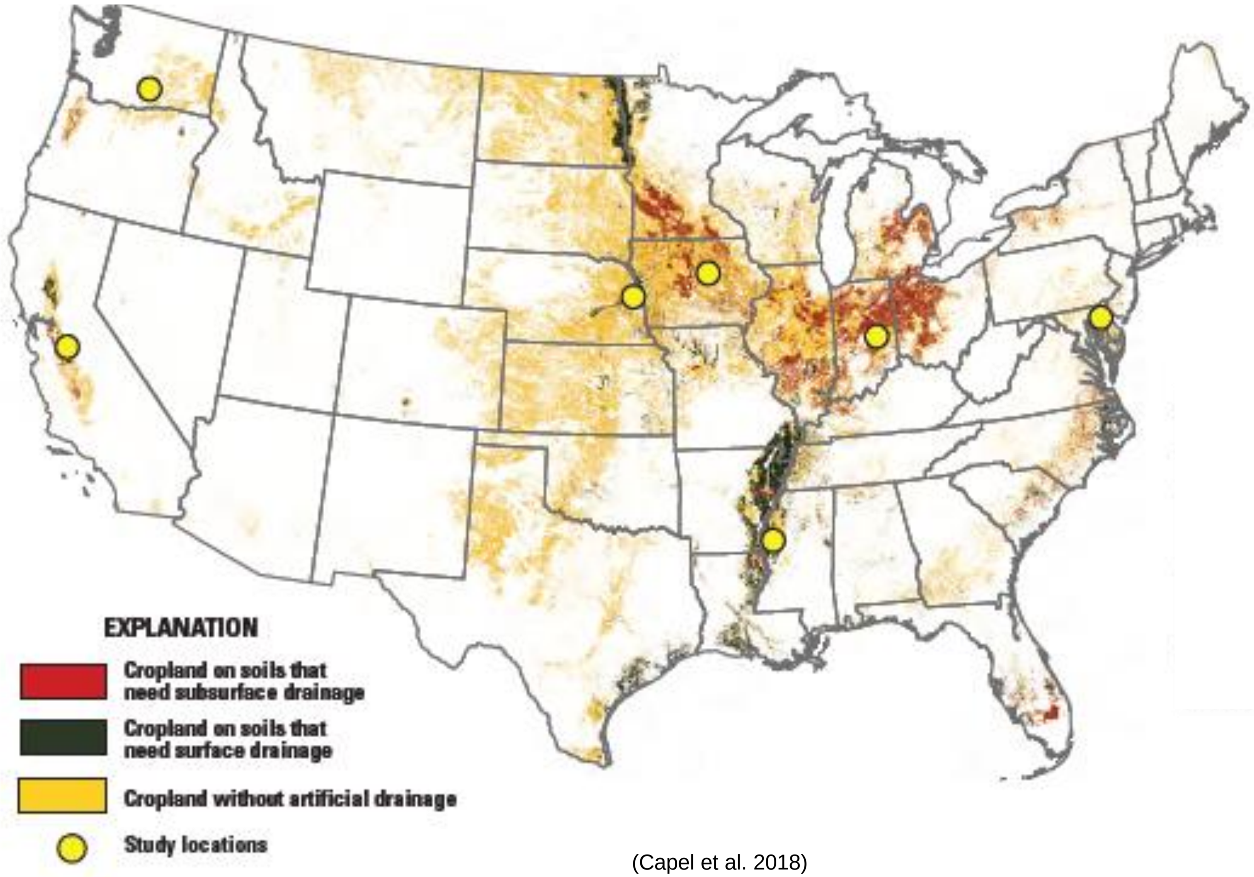
Figure 51. Ground-water level declines from 1864 to 1980 in the Cambrian-Ordovician aquifer system, Chicago and Milwaukee areas (Alley and others, 1999). (Healy et al. 2007)



(Capel et al. 2018)

A center-pivot irrigator sits idle in Wisconsin during winter. Although this area receives adequate rainfall, supplemental irrigation is used to maintain good levels of soil moisture in the quickly draining sandy soils.

Land and Water Use—Agricultural Drainage

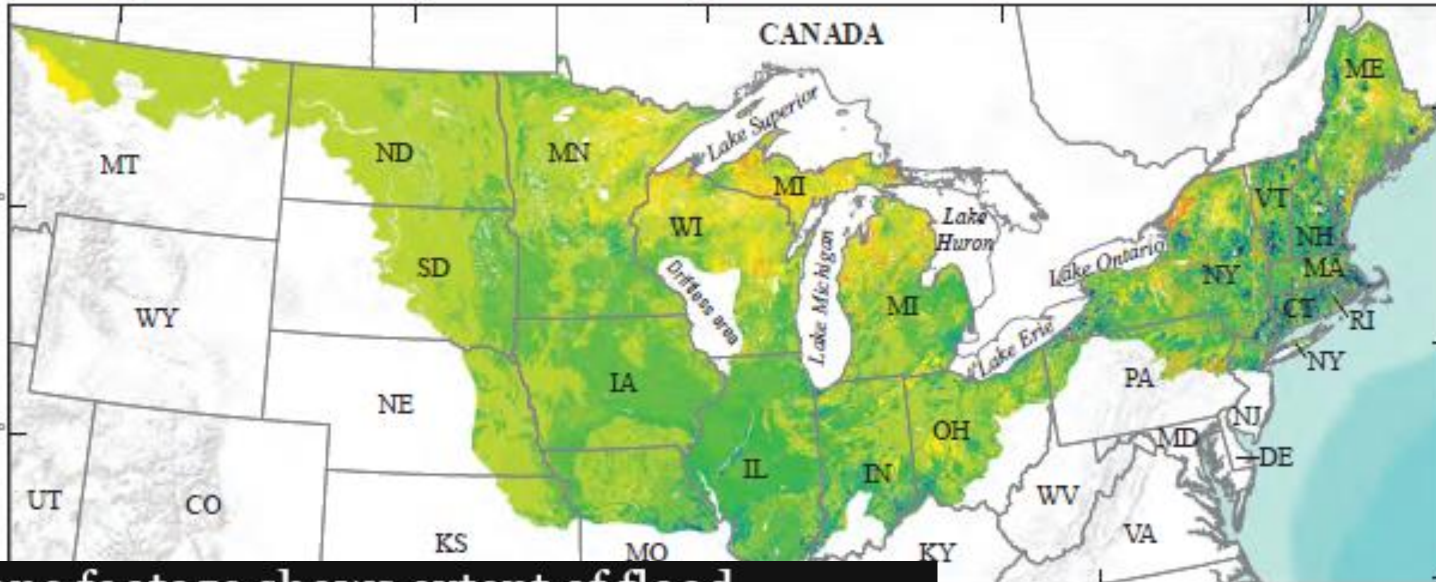


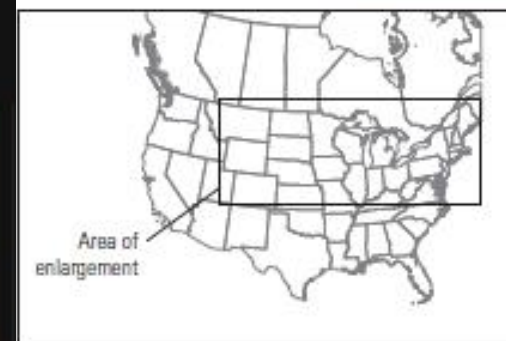
(Capel et al. 2018)

Temporary ponds form on the landscape, like this field in Iowa, when rainfall intensity exceeds the soil's ability to infiltrate water. One method that is used to minimize the damage to the crops by ponded water is the installation of surface inlets to the subsurface drainage. An orange inlet can be seen near the left edge of the pond. The surface inlets, open conduits to the subsurface drains, quickly move water along with sediment and chemicals from the pond to the stream.

USDA United States

Land and Water Use





Trost et al. 2018

Drone footage shows extent of flood damage to Maryland city – video

Aerial footage of Ellicott City, Maryland, shows the devastation the area suffered less than two years after a similar flood. Howard County executive Allan Kittleman said his immediate priorities were finding the missing man and assessing the condition of damaged buildings that housed shops, restaurants and families.

https://www.theguardian.com/us-news/video/2018/may/29/drone-footage-shows-extent-of-flood-damage-to-maryland-city-video

Conversion of Land for Agriculture

Runoff from an almond orchard after a heavy rain (California).
Photograph by Joseph Domagalski, U.S. Geological Survey, 2004.

A wetland within a cropped field in
Kenosha County, Wisconsin.

A farmed wetland in Ottertail County, Minnesota.

Changes to Soil

c. Anthric saturation.—This term refers to a special kind of aquic condition that occurs in soils that are cultivated and irrigated (flood irrigation). Soils with anthraquic conditions must meet the requirements for aquic conditions and in addition have both of the following:

(1) A tilled surface layer and a directly underlying slowly permeable layer that has, for 3 months or more in normal years, both:

(a) Saturation and reduction; and

(b) Chroma of 2 or less in the matrix; and

(2) A subsurface horizon with one or more of the following:

(a) Redox depletions with a color value of 4 or more, moist, and chroma of 2 or less in macropores; or

(b) Redox concentrations of iron and/or manganese; or

(c) 2 times or more the amount of iron (extractable by dithionite-citrate) than is contained in the tilled surface layer.

Keys to Soil Taxonomy, 12th ed.

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