

# Farming After the Flood-Soil Fertility and Management Considerations



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# Flood Events

- With climate change, flood events are becoming more common from the Midwest to Mid-South
- Lost a research crop in 2011 Yazoo City
- Types of flooding:
  - Levee breaches- scouring of valuable topsoil needing extensive earth movement and debris removal and from shallow to deep deposits of silt or sand needing tillage or removal as well as flooded soil effects.
  - Backwater flooding-short to long-term inundation influencing soil chemical, biological, and physical properties.

# Flooded rice, wetland soils, and row crops

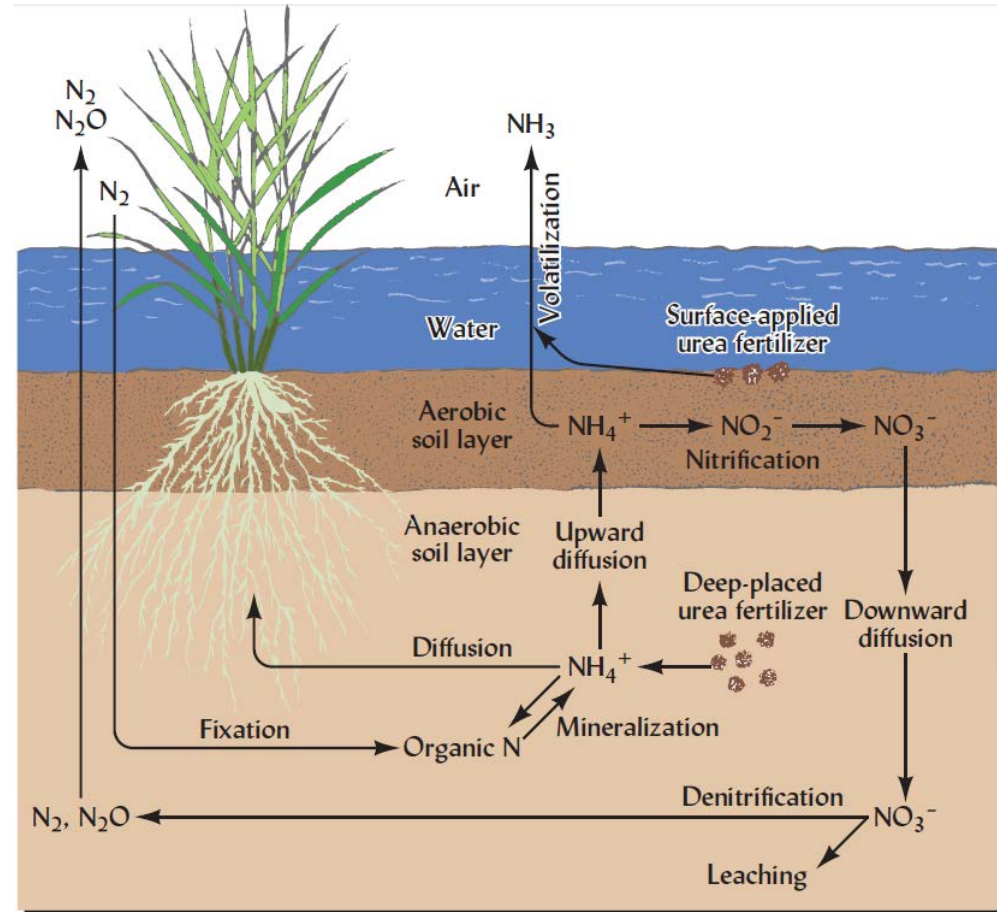
For an existing non-tolerant crop-reduced photosynthesis and respiration due to closed stomates; Chloroplasts and cellular membranes begin to degrade after 3 days.

Specific soil processes affected:

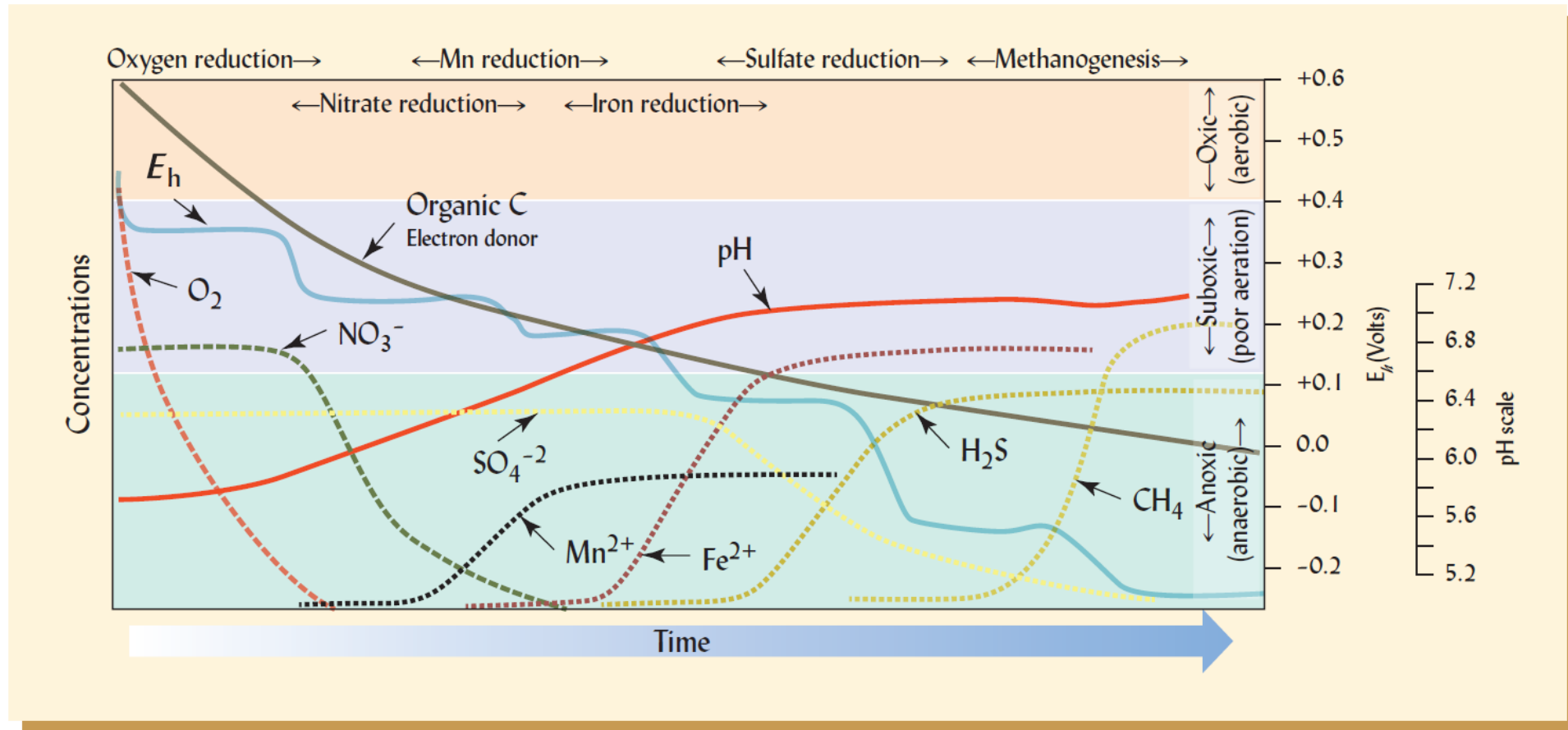
Carbon and nitrogen transformations; influence gas emissions-flux of nitrous oxides, methane, and hydrogen sulfide

Leaching of nitrate ( $\text{NO}_3^-$ ), sulfate ( $\text{SO}_4^{2-}$ ), and borates ( $\text{H}_3\text{BO}_3^-$ )

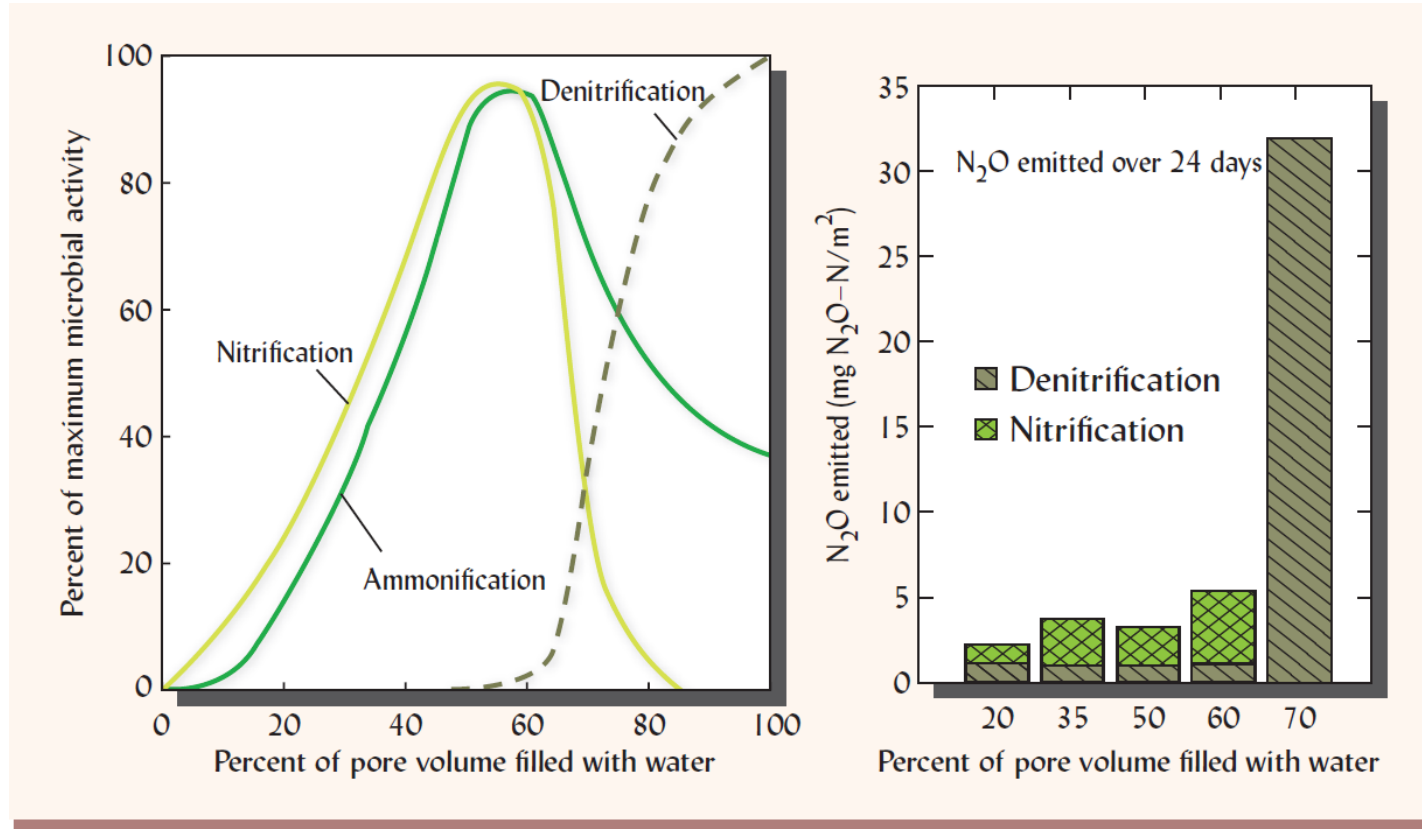
With flood duration acid soil pH increases, while alkaline soil pH decreases. For acid soils, P availability has a tendency to increase but reaction with  $\text{Fe}^{2+}$  can limit this effect



# Changes in soil chemistry



# Understanding soil aeration and moisture content effects on N transformations



Residual soil N losses can be great due to leaching and denitrification; consider spot checking residual soil available N levels and/or tissue testing.

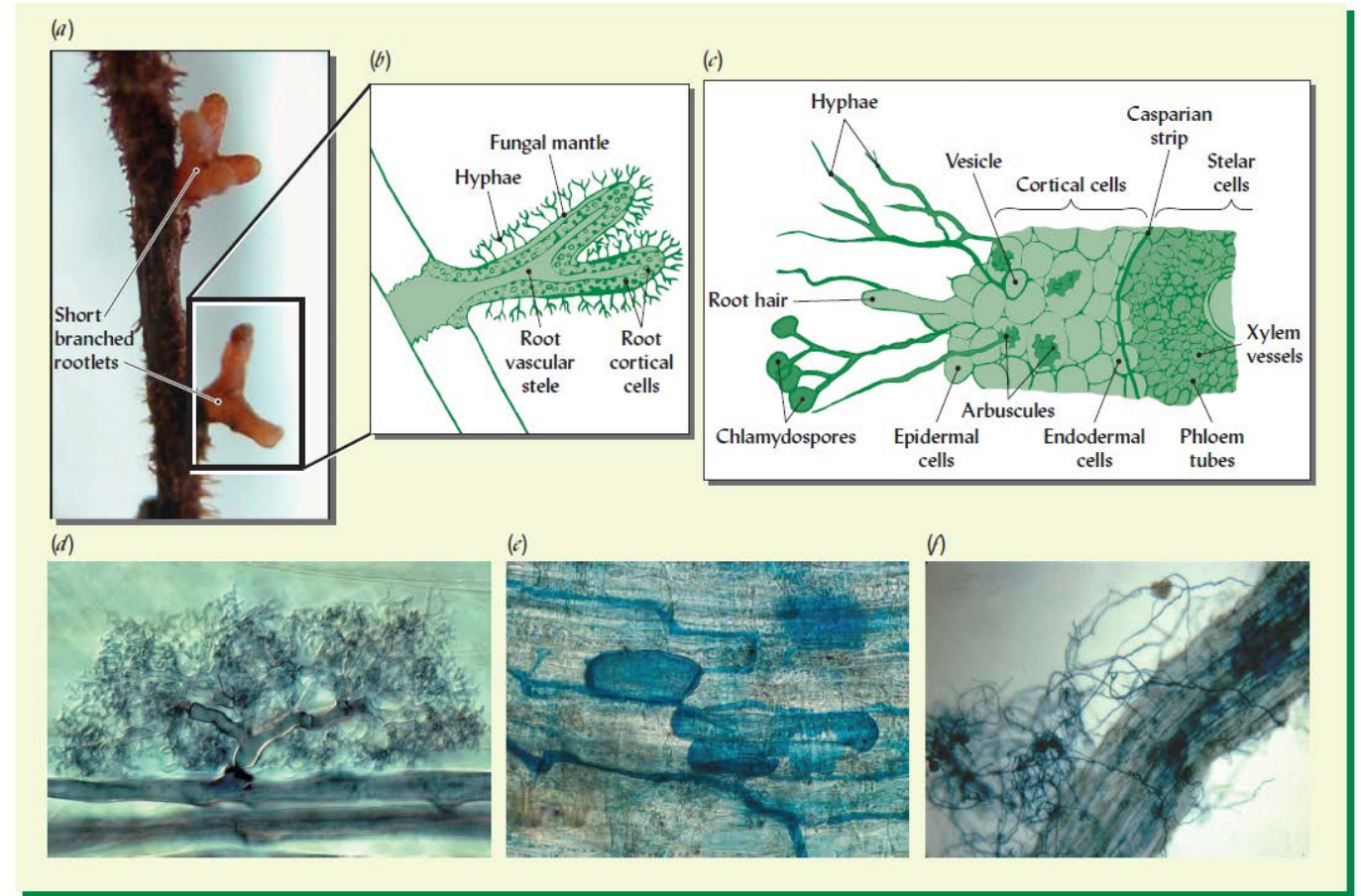
# Flooding Effects on Soil Biology

Obviously soil insects, earthworms etc. can not survive under these conditions, fire ants form floating “logs” to survive.

Microbiome shifts community structure to less fungal species, while bacterial composition increases except for symbionts due to lack of host plants.

Facultative anaerobic bacteria become more dominant.

Loss of Vesicular-Arbuscular Mycorrhizal (VAM) fungi is believed to be a major problem with lower P and Zn availability following a flood. Sometimes referred to as ‘fallow soil syndrome.’



Results of a 'Post Flood Syndrome' study on corn for Iowa and Missouri fields flooded in 1993, (Ellis, 1998. Journal Prod. Agric. 11:200-204.

- Loss of VAM fungi
- P and Zn deficiencies early season
- Corn is susceptible
- Lack of host plant most important-not flood duration
- VAM populations do recover with time and continued cropping
- Fall cover crop should be considered-restart VAM colonization
- Plant crops less dependent on VAM
- 60 to 80 lb P as starter fertilizer needed to maximize corn grain yield, weigh costs:benefits

# What to look for?



Grey to blue colors (gleying) indicate strong reducing conditions,  $\text{Fe}^{3+} \rightarrow \text{Fe}^{2+}$ , lack of oxygen caused by saturation and available C substrates for microbial activity (anaerobiosis). (1993-4 Yazoo City, Morganfield soil)





Greys to blues  
indicate anoxic  
reducing soil  
conditions.  
Malodors are  
usually present also.



# Soil Physical Effects

- Soil structure degradation due to reduced microbial growth and dispersion of aggregates caused by raindrop energy.
- Crusted soil upon drainage and loss of infiltration capacity.

# How to Manage?

- Monitor soil moisture levels when flood waters recede.
- Check oxidative status.
- Be patient and avoid tillage while too wet.
- Soil test as close as feasible to planting a crop to allow for chemical conditions time to recover.
- When feasible and time permits, plant a cover crop to begin to restore soil physical and biological properties or a winter crop such as wheat. Legumes help build rhizobia and mycorrhizal populations. Avoid Brassicas as they are not a host plant for VAM fungi.

- Encouraged to do the following:
  - Utilize a starter fertilizer with P , especially on corn. May be beneficial on early growth of cotton and soybean.
  - Spring applied dry P to allow soil time to normalize.
  - Consider higher rates of P on year 1 post-flood.
  - Consider the need for Zn depending on soil test rating and previous tissue analyses.
  - Utilize early in-season tissue testing, especially for N to allow for sidedress adjustment in rates.
  - Consider planting a crop not as susceptible such as soybean.