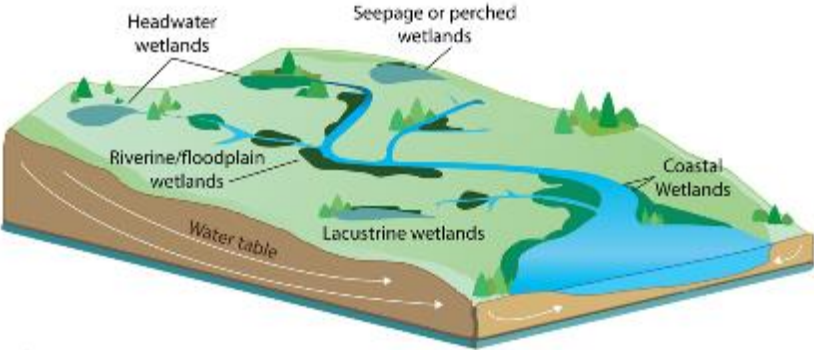
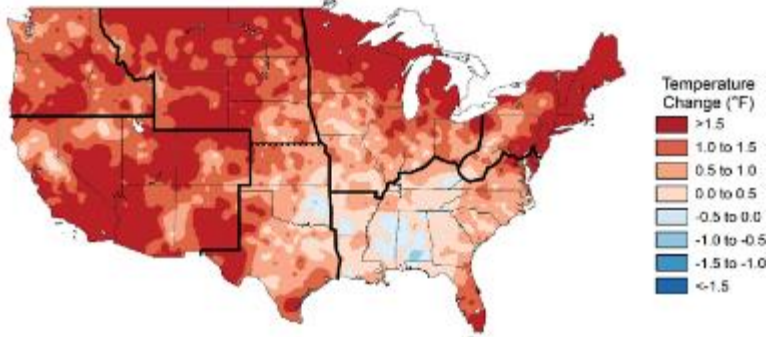


Dealing with Changing Weather Patterns in Wetland Restoration Planning

Part II: Moving from broad climate issues to specific landscapes and sites

Observed U.S. Temperature Change
1991-2012

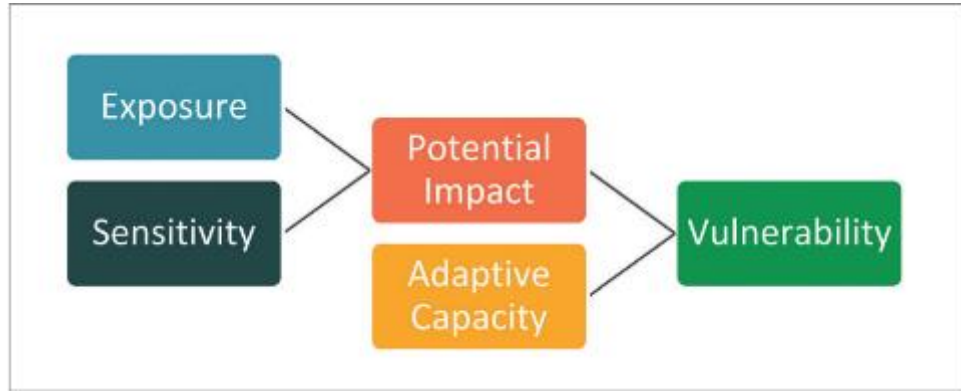


AWSM Presentation May 6, 2019

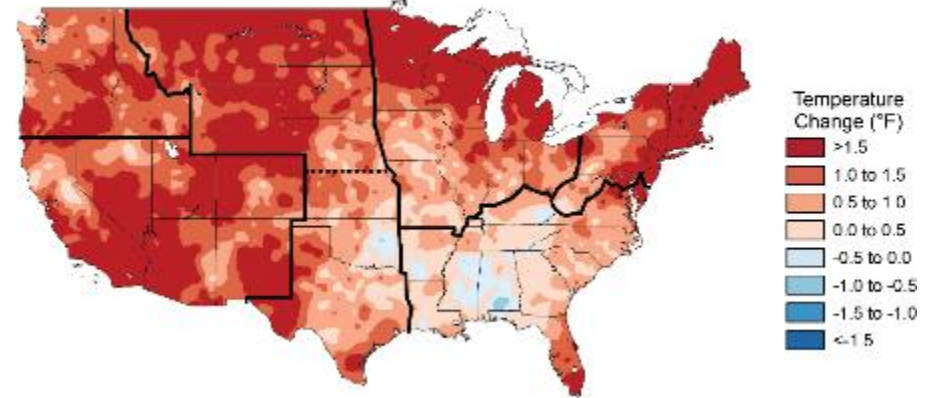


Ryan O'Connor, Wisconsin DNR
Ryan.OConnor at wisconsin.gov

Assessing Impacts

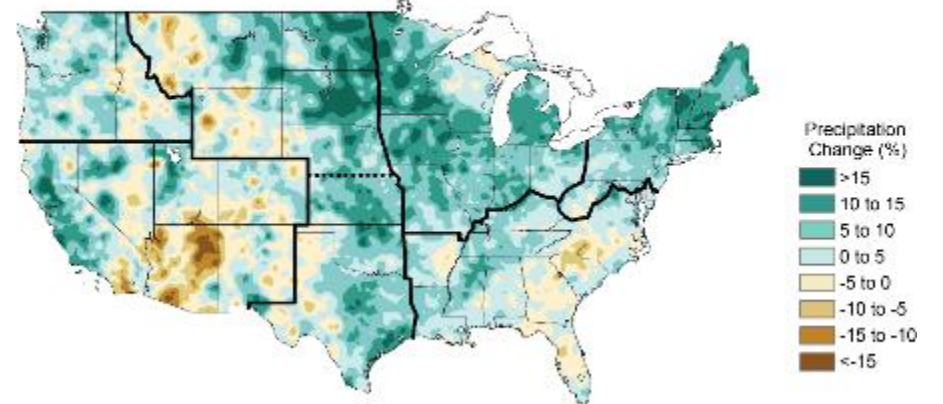


Observed U.S. Temperature Change
1991-2012



U.S. Global Change Research Program 2014

Observed U.S. Precipitation Change
1991-2012



U.S. Global Change Research Program 2014

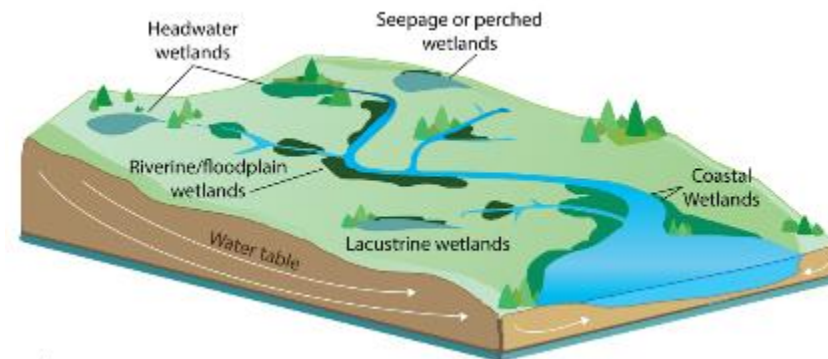
Assessing Impacts

- System drivers/ecosystem processes
- Key species

Depends on:

- 1) Type of wetland
- 2) Location of wetland
- 3) Existing threats

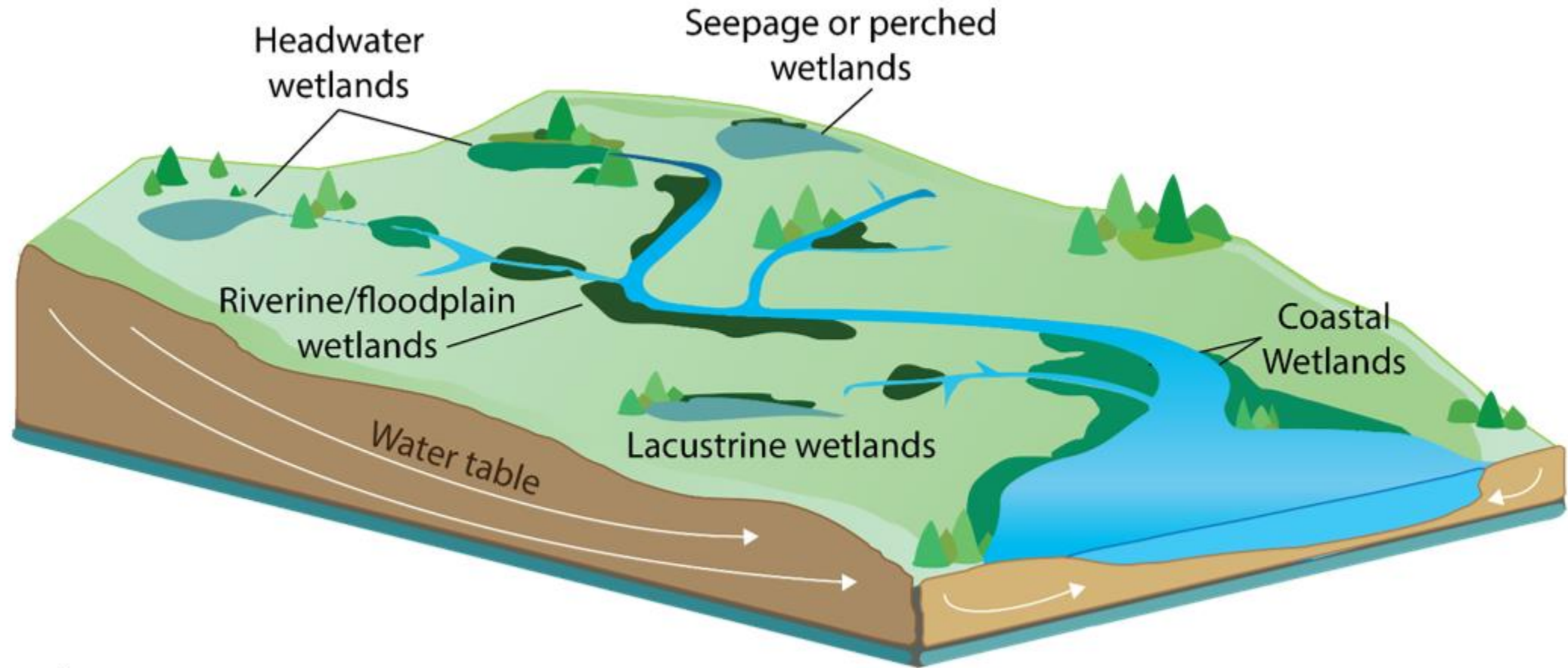
Use YOUR expertise!



Wetland type matters



Location matters: Wetlands in a watershed context



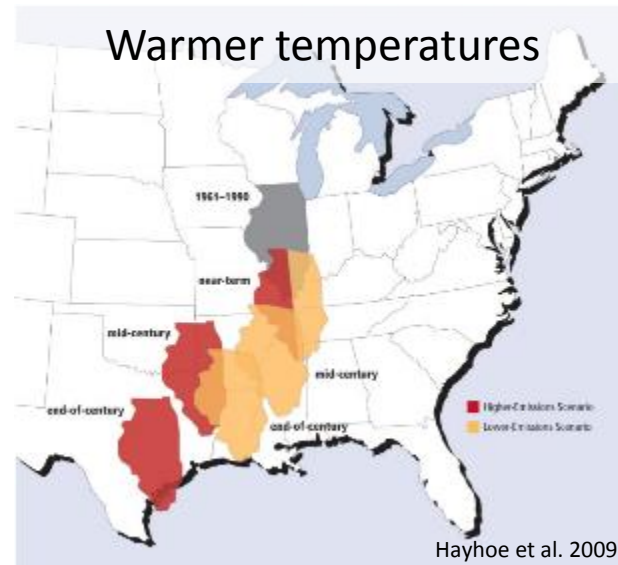
Condition matters: Existing threats

- Invasive species
- Pests and disease
- Hydrologic alteration

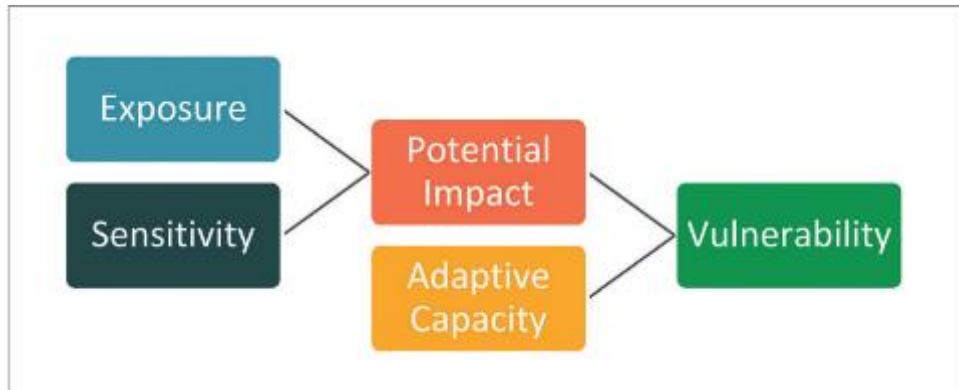


Potential impacts of climate change on wetlands:

- Depends on
- 1) Type of wetland
 - 2) Location
 - 3) Existing threats



Assessing Adaptive Capacity

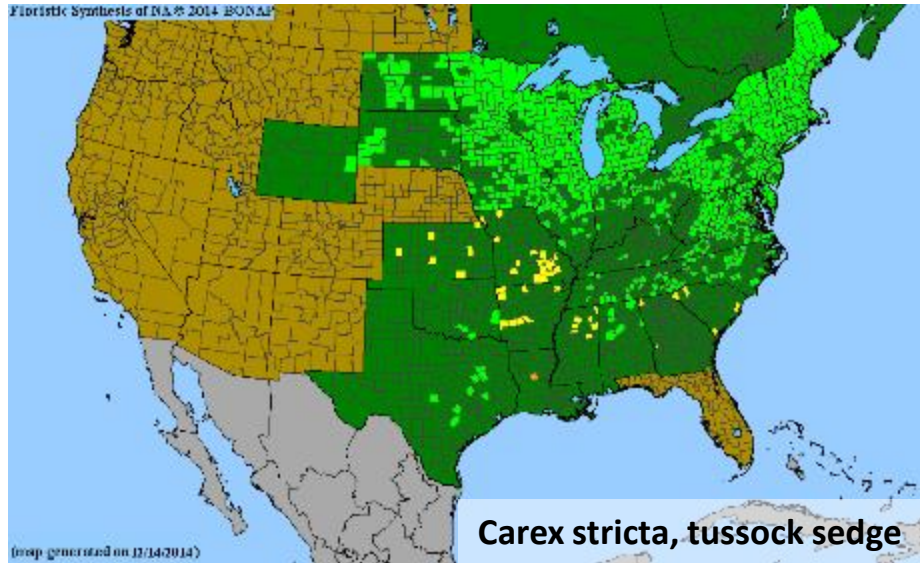


- The ability of a system to cope with changes:
- moderate potential damages
 - take advantage of opportunities
 - cope with the consequences



Adaptive Capacity is a function of:

Species environmental tolerance



Site diversity



Landscape condition and heterogeneity



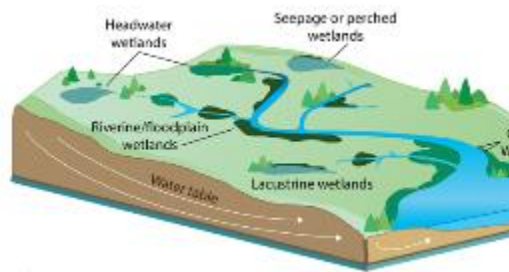
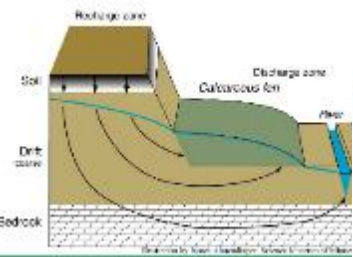
System hydrologic tolerances



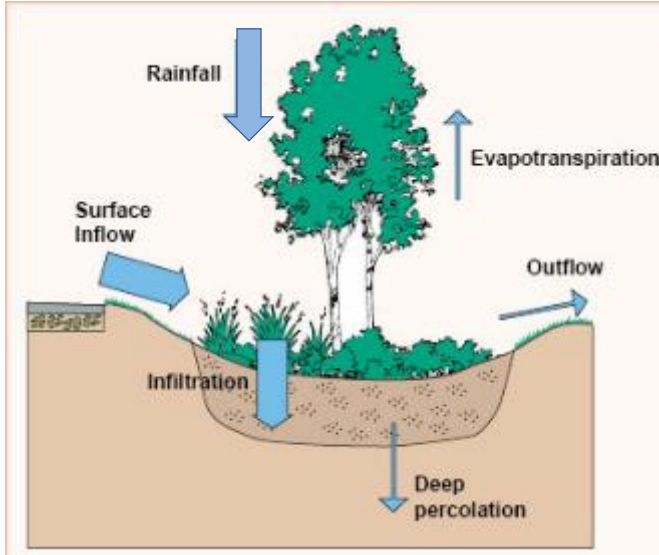
Key Site-specific Questions

Consider local factors when thinking about risk at a particular site

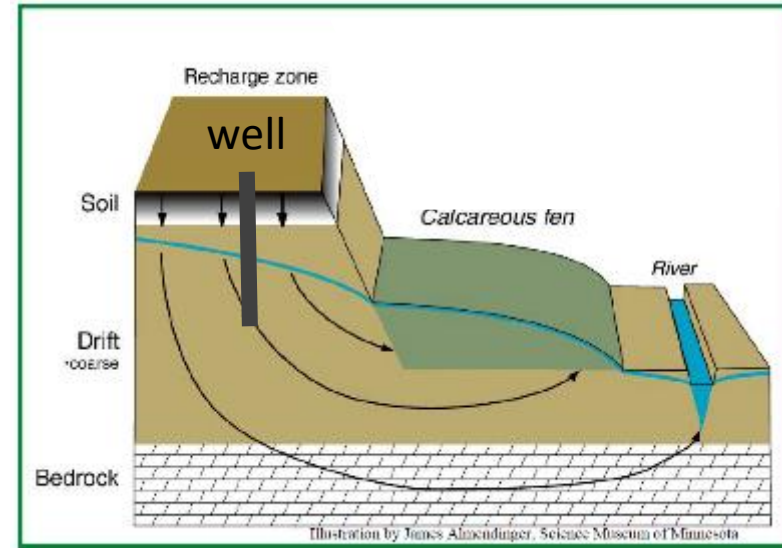
- What are your water inputs and outputs? (precipitation/surface flow vs. groundwater)
- Is hydrology intact or disrupted?
- Who are my upstream neighbors?
- Is your site high or low in the watershed?
- Are you in a coastal system?
- How diverse is your site?
- Are there invasive species threats?
- Does the site have natural buffering capacity for extreme precipitation or warmer temps?
- Are there other existing threats?



Local Factors: What are your water inputs and outputs?



Precipitation-dominated



Groundwater-dominated

Precipitation-dominated wetlands are more vulnerable than groundwater-dominated wetlands

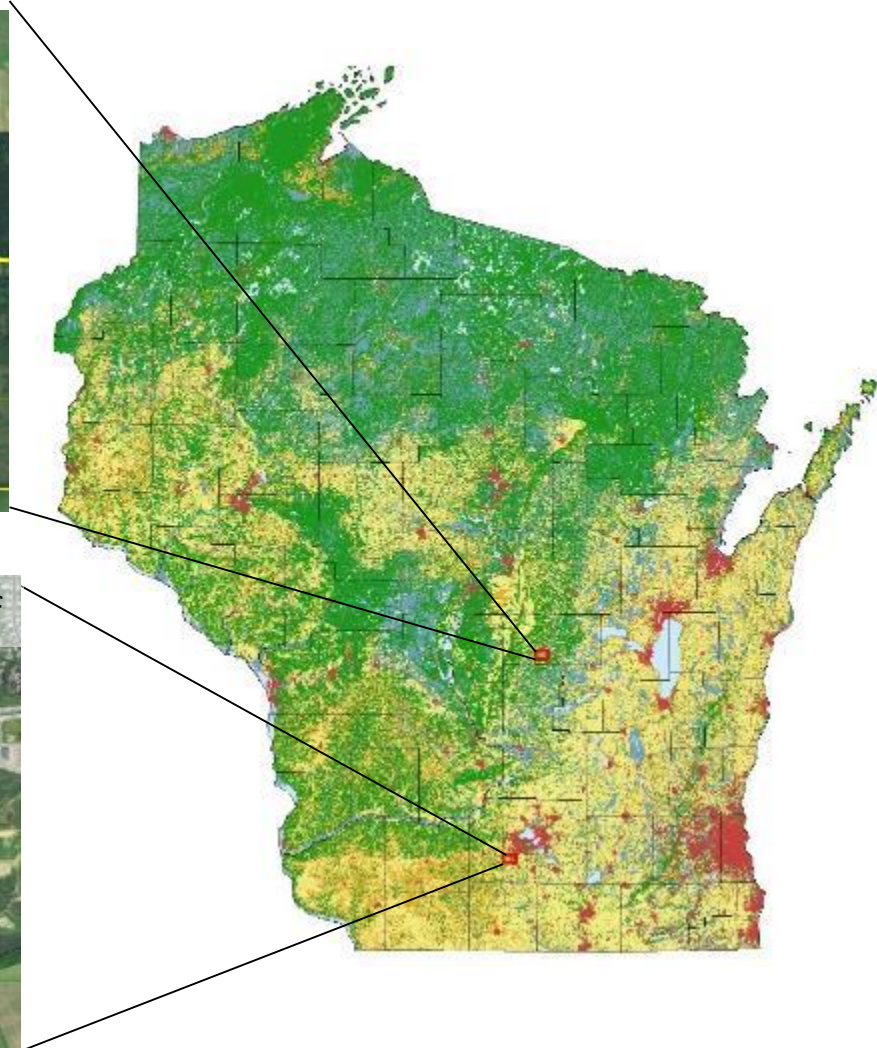
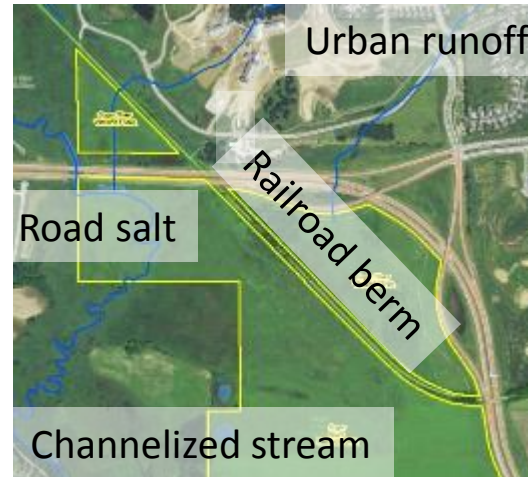
Local Factors: Is Hydrology Intact or Disrupted?



Lunch Creek Wetlands



Sugar River Wetlands



Local Factors: Who are my upstream neighbors?



Ryan O'Connor, WDNR

Lunch Creek Wetlands

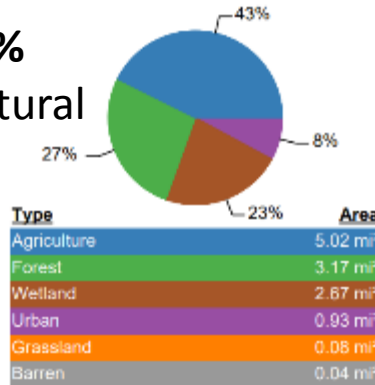


Ryan O'Connor, WDNR

Sugar River Wetlands

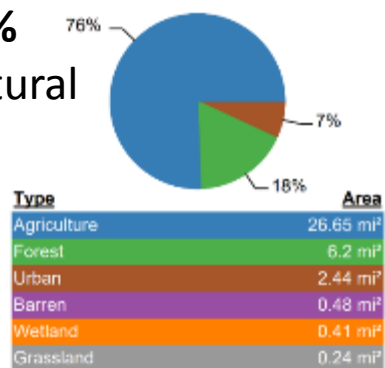
Landcover

50%
Natural

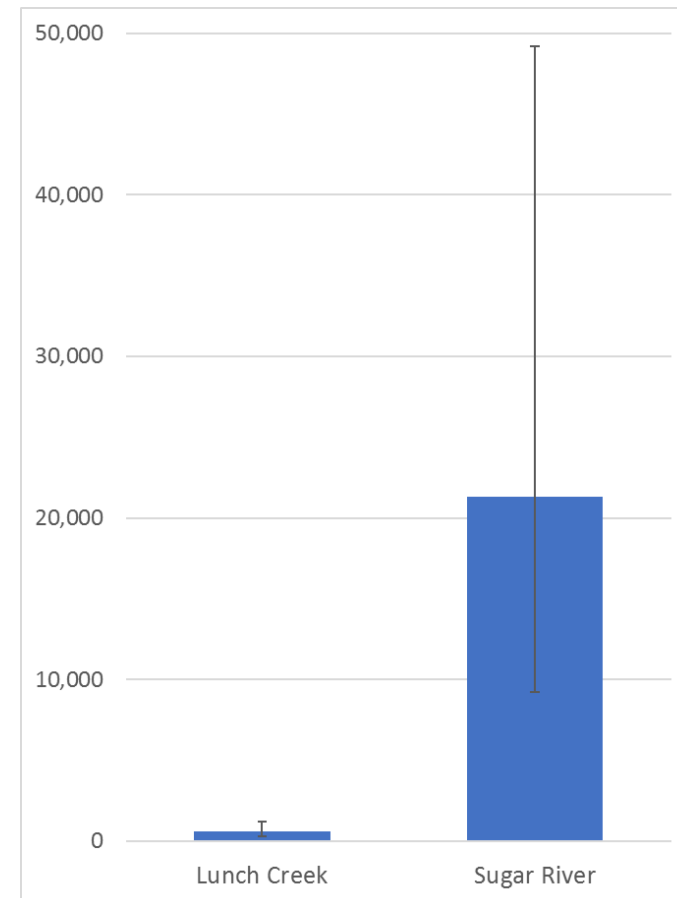


Landcover

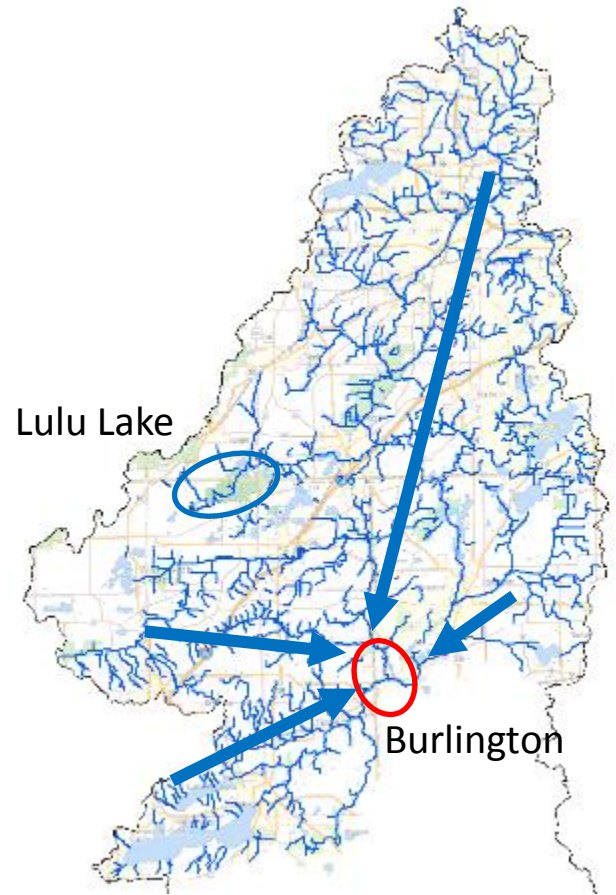
18%
Natural



Pounds of Phosphorus loading/yr



Local Factors: High or Low in the Watershed?



Lulu Lake



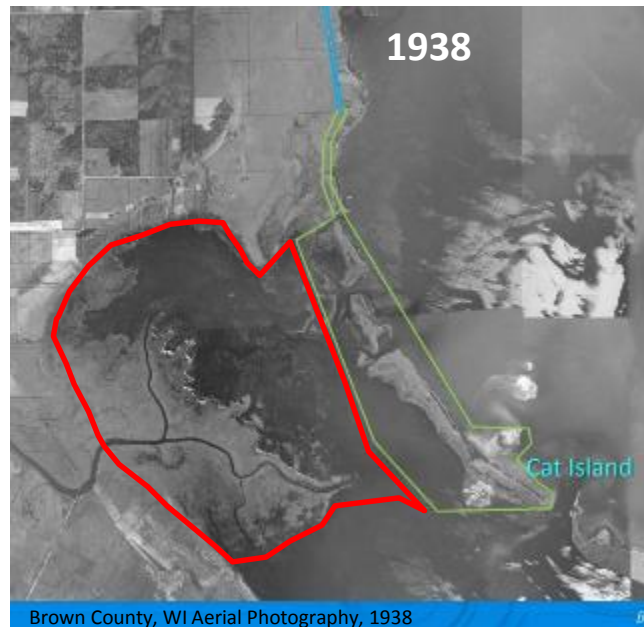
Fox River at Burlington, July 2017

Local Factors: Are you in a coastal system?

Freshwater: Great Lakes, other large inland lakes

- Prolonged higher water levels
- Prolonged lower water levels
- Erosion: storms and waves—especially in winter
- Storms: Runoff and sedimentation

Cat Island & Duck Creek Marsh, Lower Green Bay, Lake Michigan



Local Factors: Are you in a coastal system?

Tidal: Ocean coasts

Sea level rise

Salt water intrusion

Coastal erosion

Vulnerable Habitat: Tidal Marsh advancement blocked as sea level rises



Resilient Habitat: Tidal marsh advances landward as sea level rises



Local Factors: How diverse is your site?

- Genetic diversity
- Species diversity
- Functional group diversity (different plant families, plants with different wetland indicator status—FACW, etc.)
- Physical diversity: tall/short, shrubs/herbaceous, etc.
- Microtopography



Local Factors: Are there invasive species threats?



Local Factors: Are there invasive species threats?



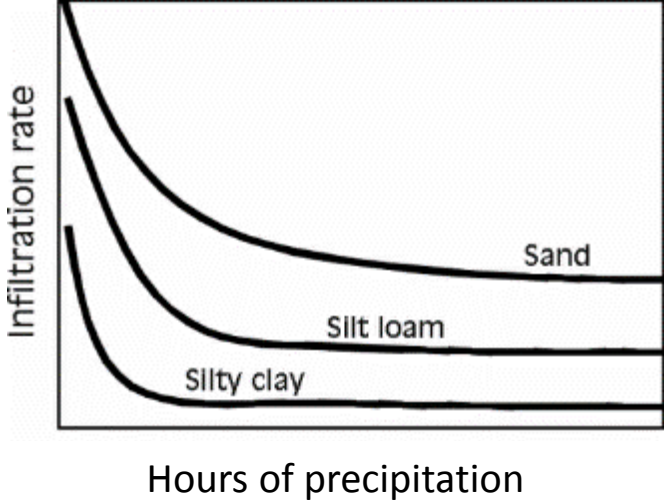
Japanese hops



Eroding river bank

Local Factors: Does your site have natural buffering capacity? Extreme precipitation

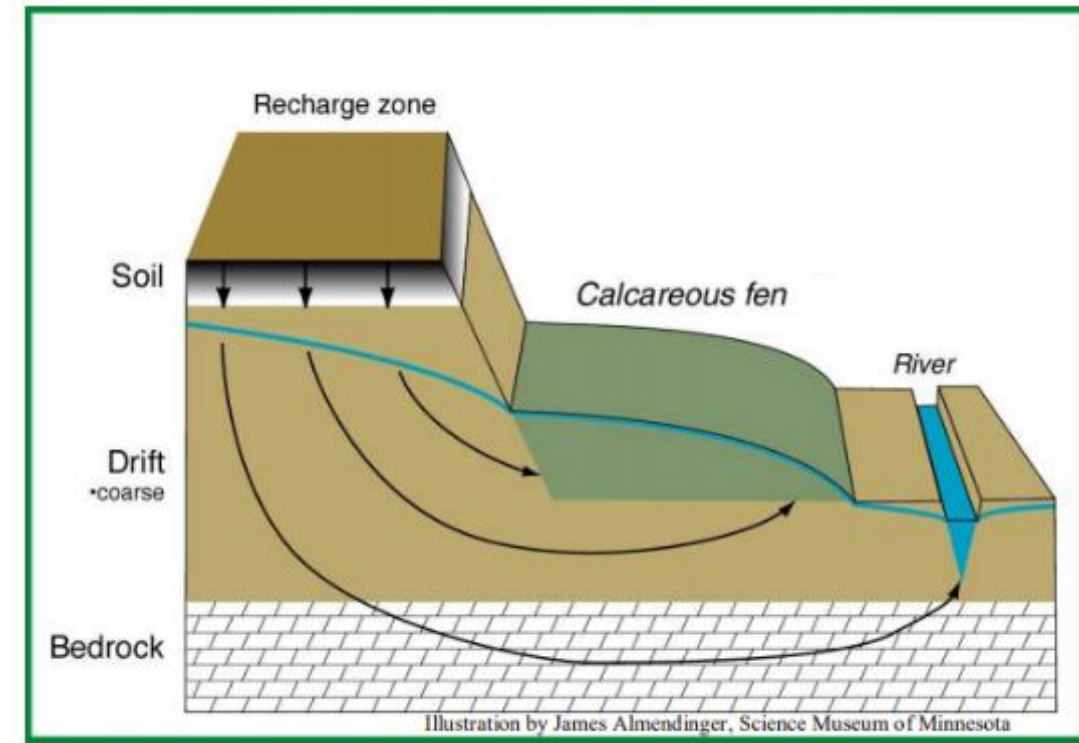
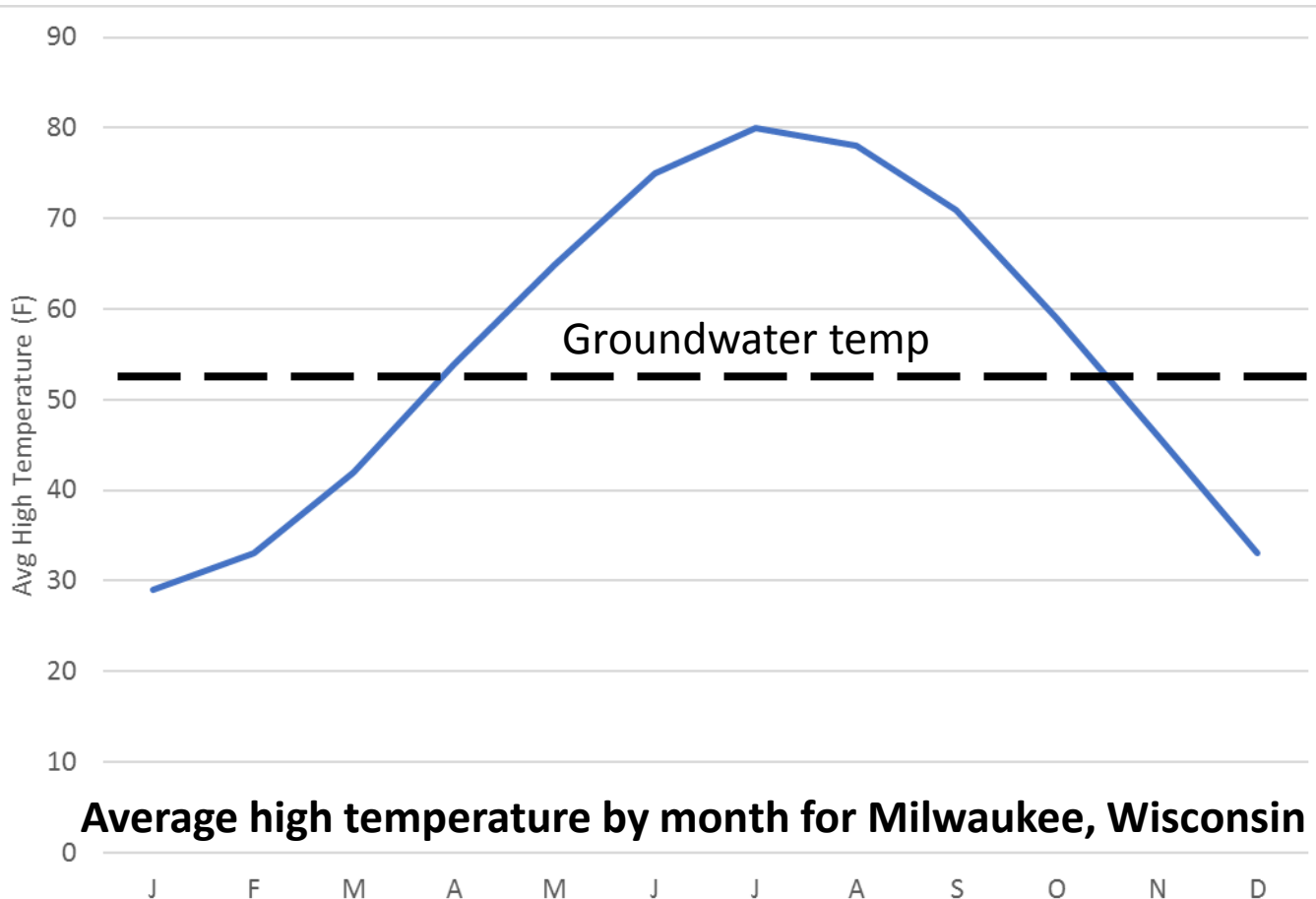
Sites such as large peatlands or sandy landscapes soils may be able to absorb extreme rain



Local Factors: Does your site have natural buffering capacity?

Rising temperatures

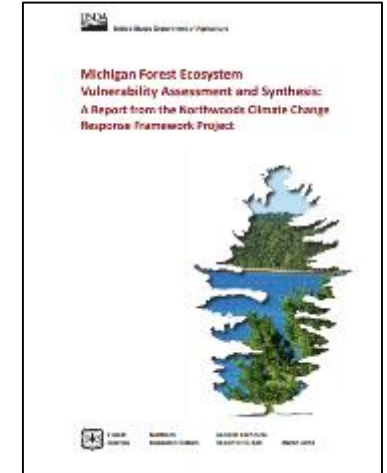
Cool groundwater may help moderate rising air temperature during the growing season



Tools for Assessing Wetland Vulnerability

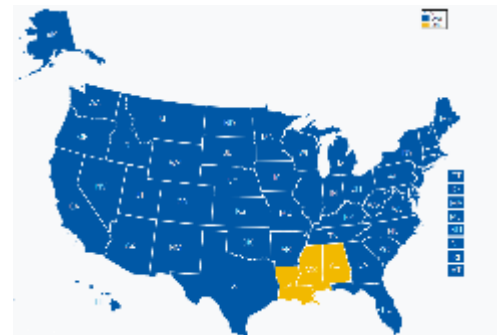
Forest Vulnerability Assessments

forestadaptation.org/assess/ecosystem-vulnerability



Wisconsin Wetland Vulnerability Assessments

www.wicci.wisc.edu/plants-and-natural-communities-working-group.php



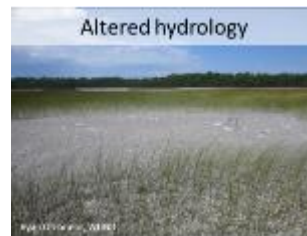
NOAA State Climate Summaries

statesummaries.ncics.org/

Case Study: Clover Valley Fen

Regional Vulnerability of Fens: **HIGH**

- Higher temperatures
- Extreme storms and associated runoff
- Altered hydrology: periodic drought, higher evapotranspiration
- Nutrient enrichment
- Increased risk of invasive species
- Increased invasion by woody species



Case Study: Clover Valley Fen

Site Characteristics

- Water budget? **Constant supply of groundwater**
- Hydrology? **Mostly intact**
- Upstream neighbors? **High % of prairie, forest, and wetland**
- Position in watershed? **High**
- Coastal? **No**
- Diversity? **Diverse microsites and plant species**
- Invasives? **Relatively few, actively managed**
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Regional Climate Vulnerability	Site-specific vulnerability
Higher temperatures	

Regional vulnerability for calcareous fen: High

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Regional Climate Vulnerability	Site-specific Vulnerability
Higher temperatures	Low

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Higher temperatures	Low
Extreme storms and associated run-off	

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Higher temperatures	Low
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Regional Climate Vulnerability	Site-specific Vulnerability
Higher temperatures	Low
Extreme storms and associated run-off	Low
Periodic drought, higher evapotranspiration	

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Regional Climate Vulnerability	Site-specific Vulnerability
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Nutrient enrichment	

Regional vulnerability for calcareous fen: High

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Regional Climate Vulnerability	Site-specific Vulnerability
Higher temperatures	Low
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Periodic drought, higher evapotranspiration	Low
Nutrient enrichment	Moderate

Regional vulnerability for calcareous fen: High

Case Study: Clover Valley Fen

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Increased risk of invasives species	

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Regional vulnerability for Calcareous Fen: High

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Increased woody shrub growth	

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Climate change is a threat multiplier

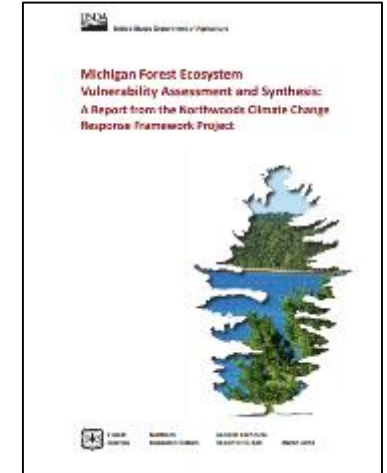
Regional vulnerability for Calcareous Fen: High

Site level vulnerability for Clover Valley Fen: Moderate?

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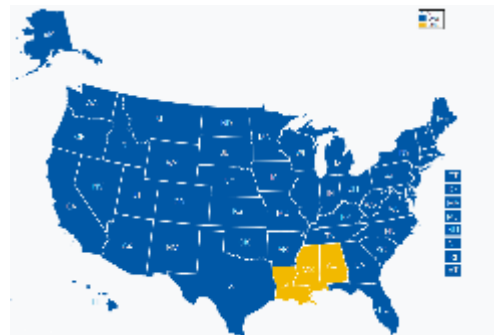
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Summary

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Depends on

- 1) Type of wetland
- 2) Location
- 3) Existing threats

Ryan O'Connor, Wisconsin DNR
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Climate change is often a threat multiplier

