

ASSESSING WETLAND SENSITIVITY TO CLIMATE CHANGE



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Canadian Wildlife Service – Ontario Region



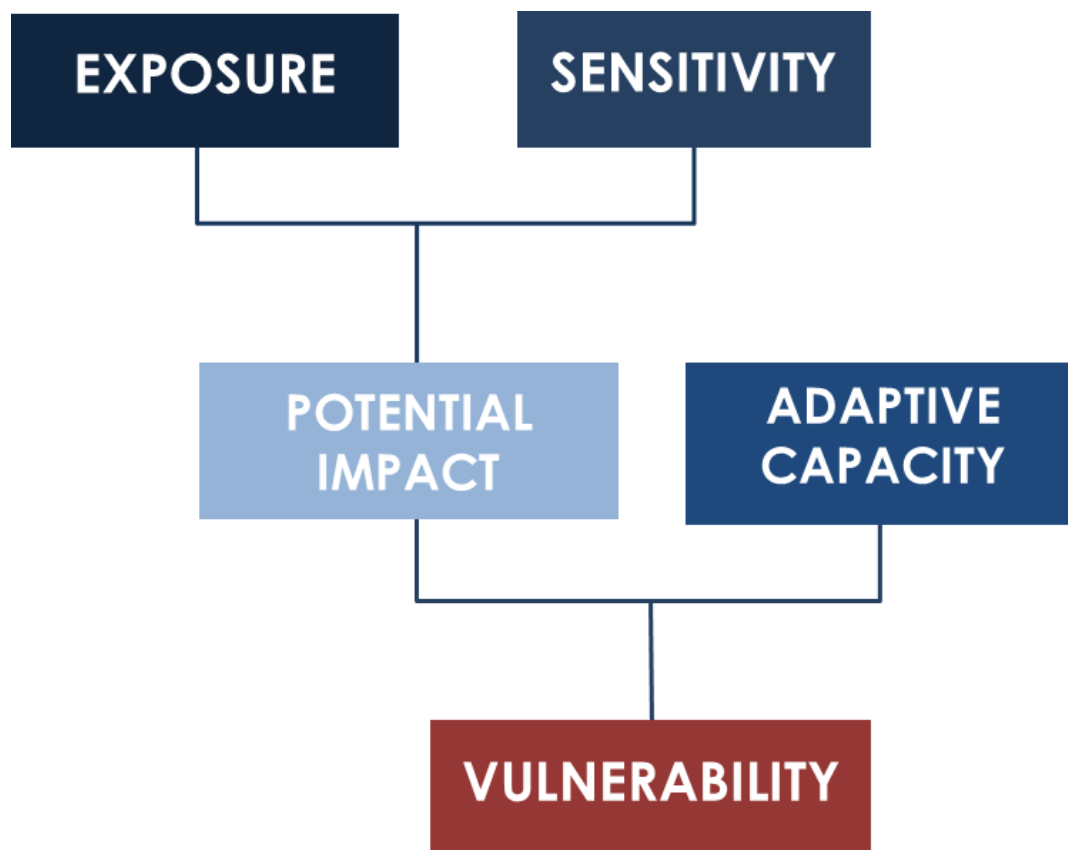
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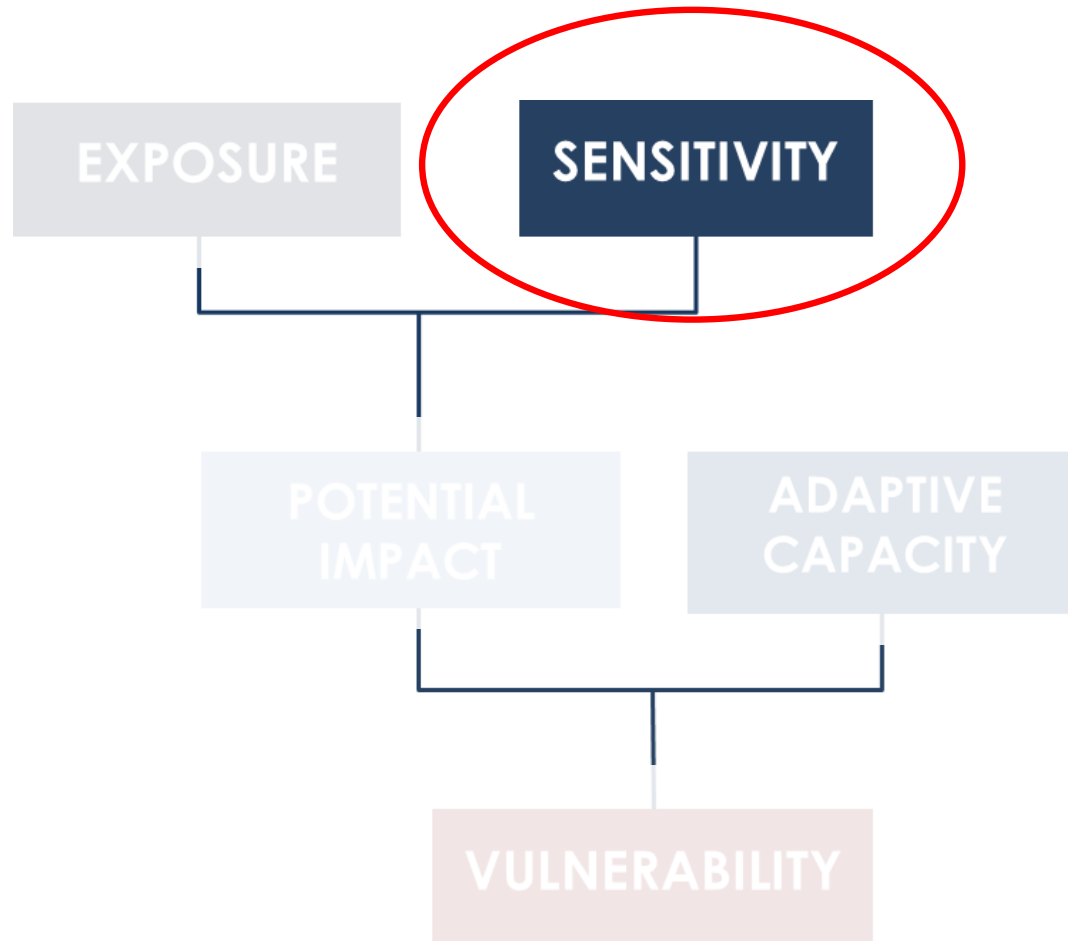


Vulnerability Assessment Framework





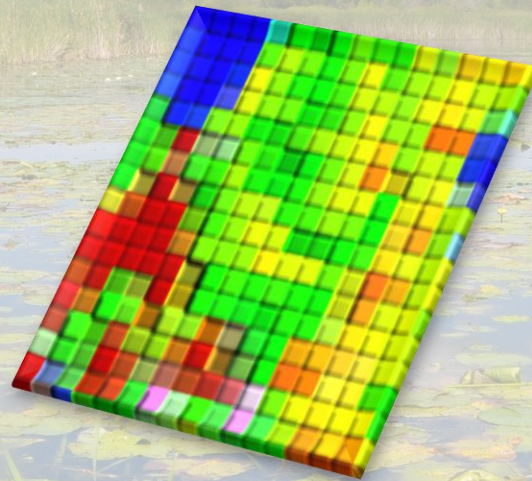
Vulnerability Assessment Framework



Wetland Sensitivity

1. Definition

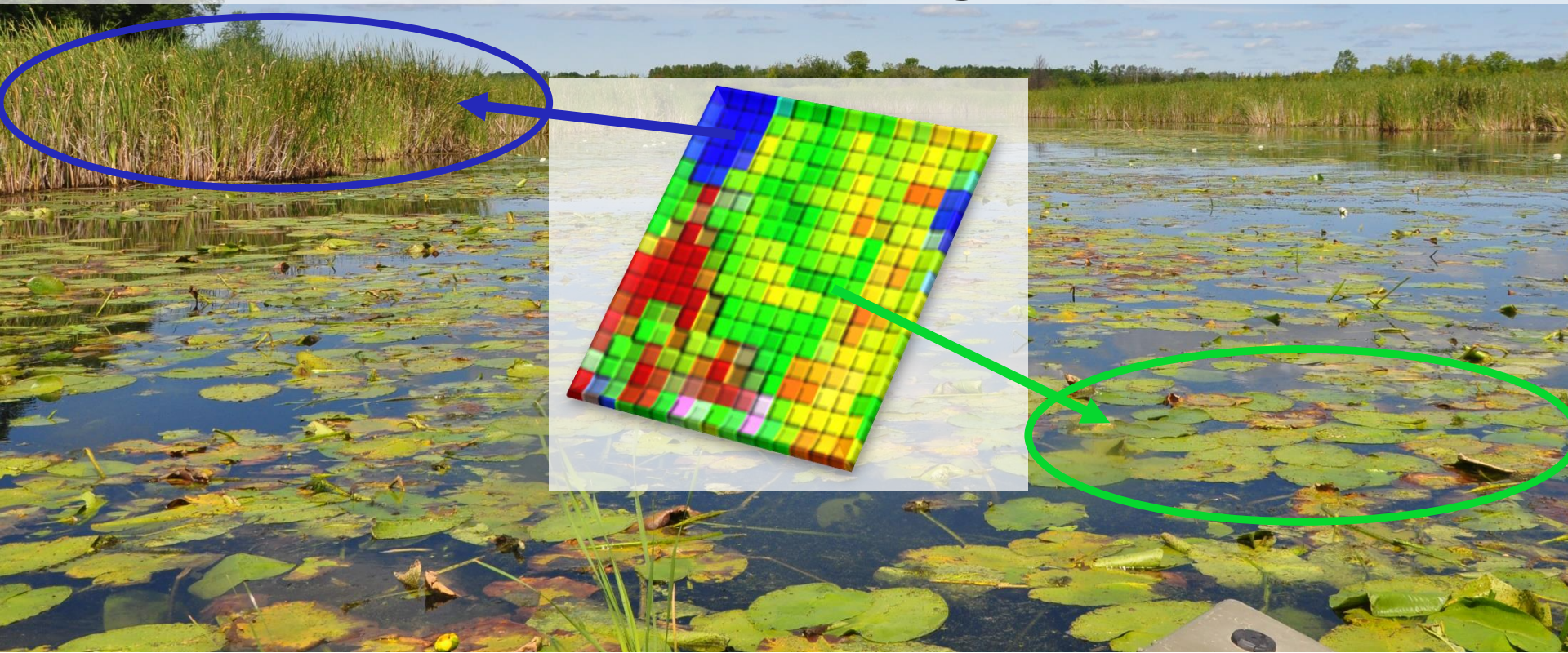
**The degree to which a wetland responds to
climate change**



Wetland Sensitivity

1. Definition

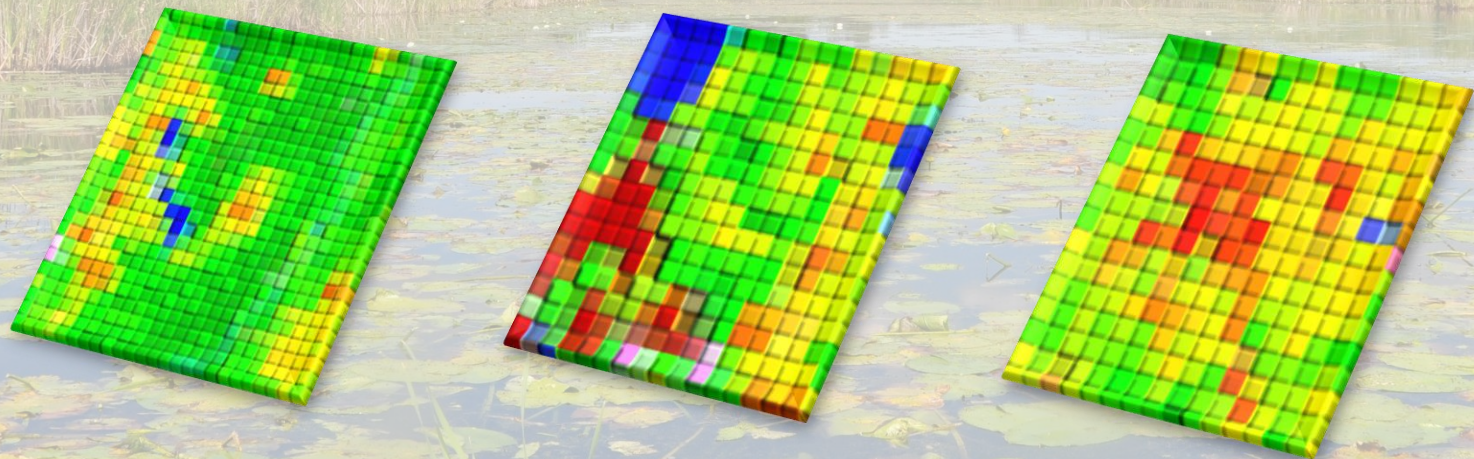
The degree to which a wetland responds to climate change



Wetland Sensitivity

1. Definition

**The degree to which a wetland responds to
climate change**



time

1980

2100



Wetland Sensitivity

1. Definition

The degree to which a wetland responds to climate change

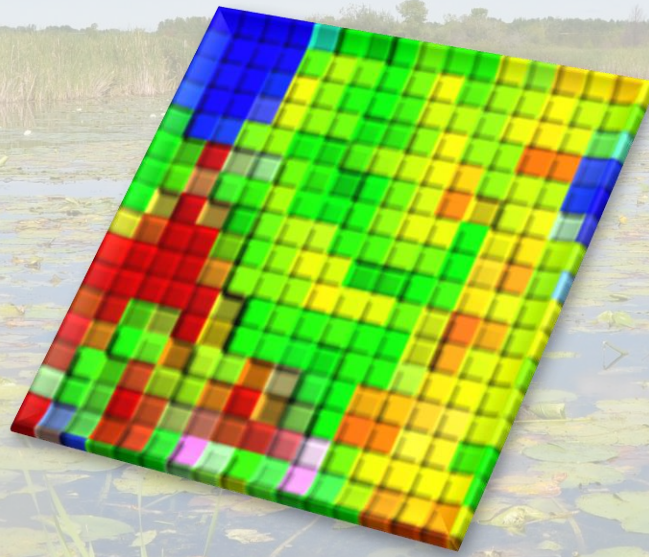
The degree to which the abundance and distribution of wetland vegetation communities respond – either increasing, decreasing or no change – to the physical variables in the CWRM projected under climate change relative to a recent hindcast

Wetland Sensitivity

2. Select Indicators

What are we measuring to answer our question?

→ Wetland Indicators



Wetland Sensitivity

2. Select Indicators

What are we measuring to answer our question?

→ **Wetland Indicators**

Selection Criteria

- Ecological basis and importance
- Management relevance
- Independent (low collinearity)
- Sensitive to CWRM physical variables (e.g. water levels)
- Reliably extracted from CWRM raster outputs

Wetland Sensitivity

2. Select Indicators

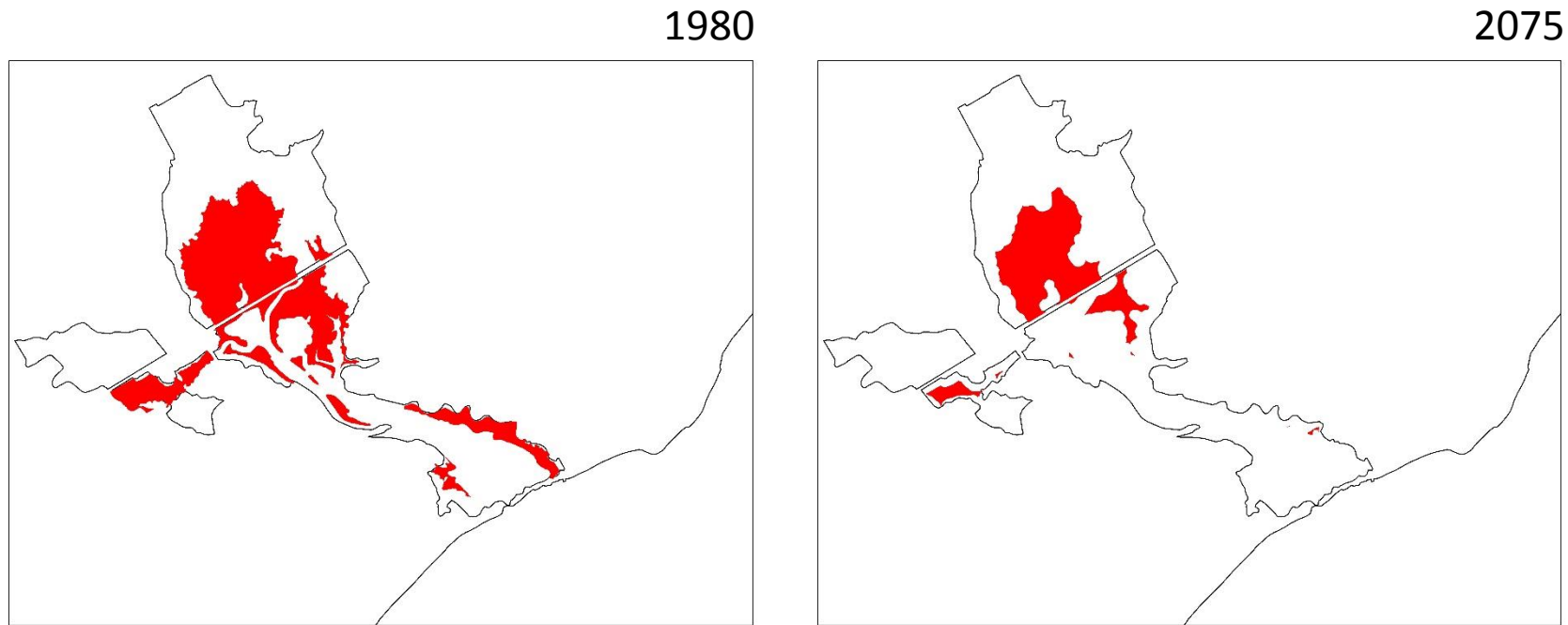
What are we measuring to answer our question?

→ Selection of 4 Wetland Indicators

1. Wetland size
2. Area of floating and submerged vegetation community
3. Wetland interspersion (hemi-marsh index)
4. Wetland diversity

1. Wetland Size = Total surface area of wetland

Metric = sum of all wetland vegetation class pixels



Wetland Sensitivity Indicators

1. Wetland Size = Total surface area of wetland

species richness
species abundance
habitat diversity
productivity
function
ecosystem services

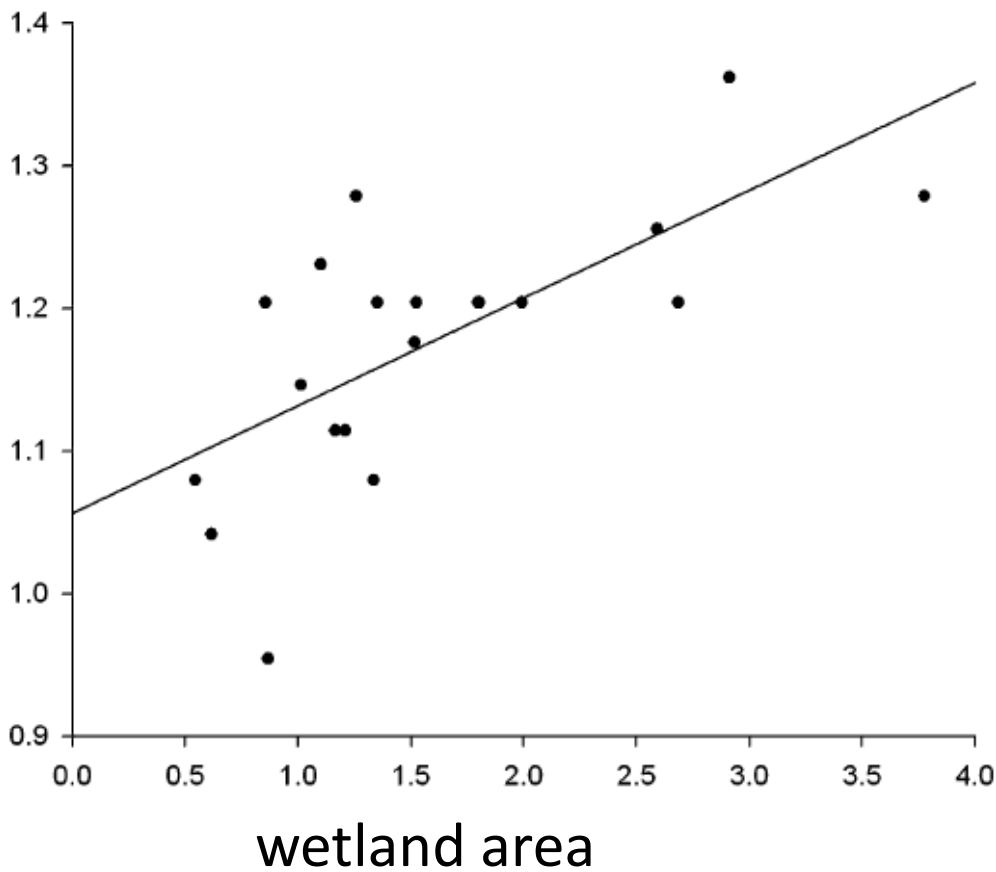
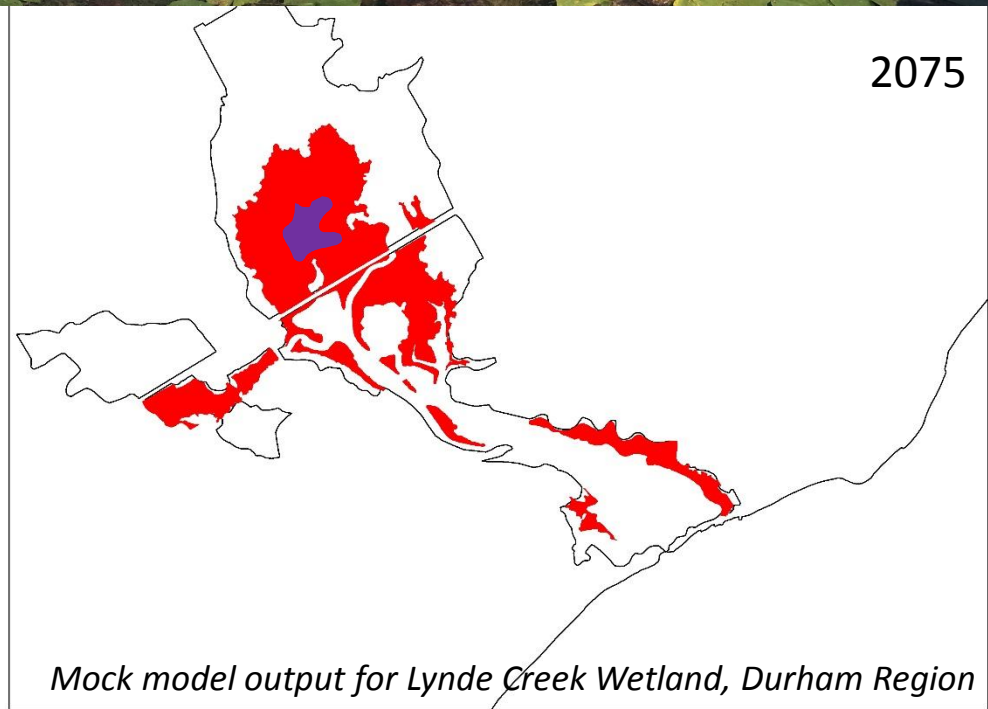
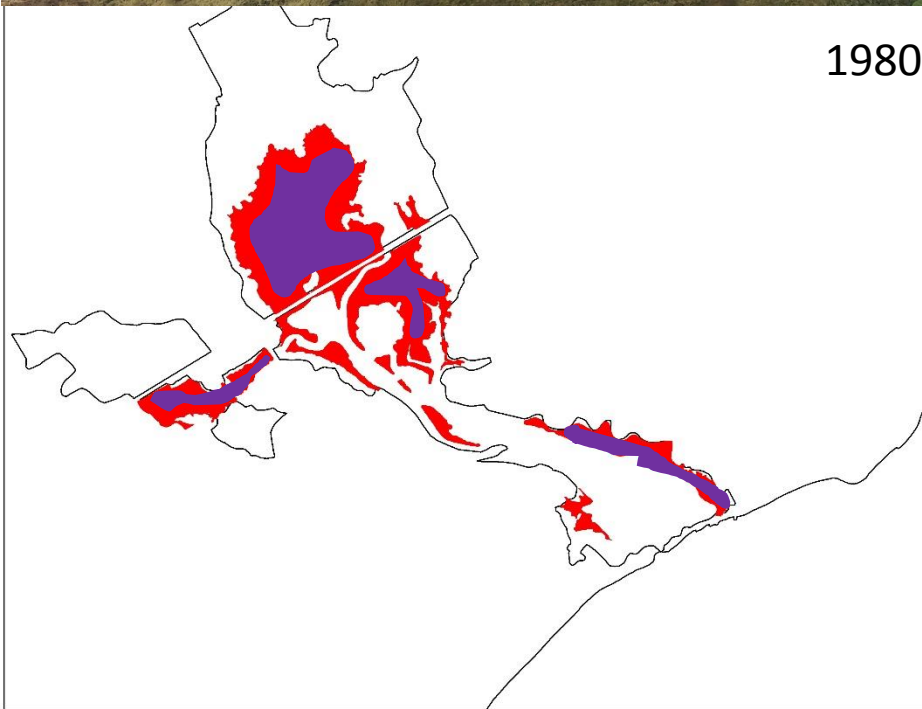


Figure source: Smith and Chow-Fraser 2010; wetland birds

2. Total surface area of submerged and floating vegetation class (shallow open aquatic marsh)

Metric = sum of all submerged and floating vegetation class pixels



Mock model output for Lynde Creek Wetland, Durham Region

Vegetation Class Size = Total surface area of submerged and floating vegetation class (shallow open aquatic marsh)

- Strong link to water levels
- Volume metric
- Sensitive signal
- Greater delineation accuracy



3. Wetland Interspersion = Hemi-marsh index

Metric = interface (m/ha) between submerged and floating vegetation class and all emergent vegetation classes (i.e. edge density)








- Hemi-marsh is an important structural component of habitat for wetland wildlife

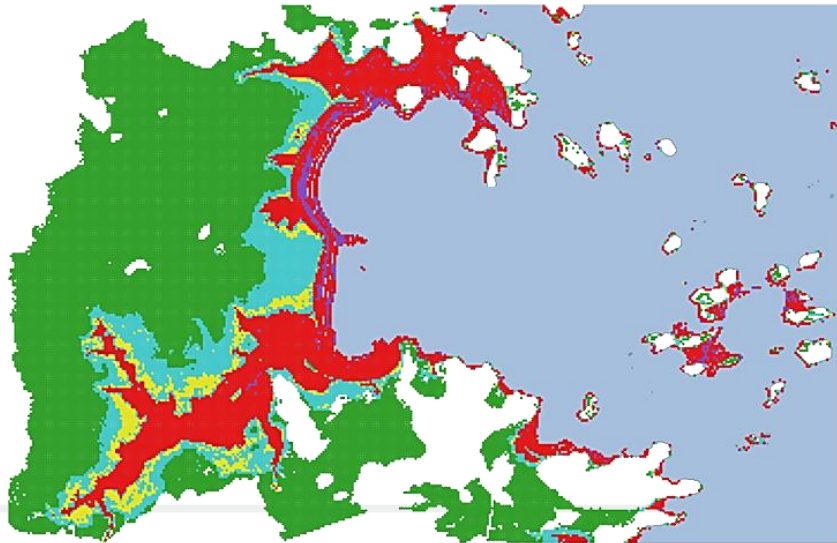


4. Wetland Diversity = Vegetation Class Diversity

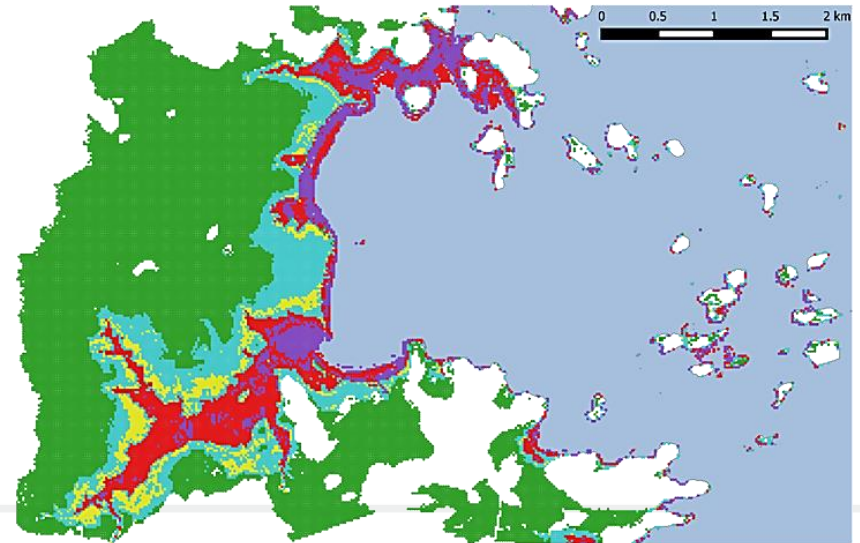
Metric = Shannon Diversity = # of wetland vegetation classes and their relative abundance

-  *Submerged and floating vegetation*
-  *Emergent marshes*
-  *Wet meadows*
-  *Shrub marshes*
-  *Forest marshes*

1980



2075



4. Wetland Diversity = Vegetation Class Diversity



↑ water level fluctuations

↑ vegetation community class diversity

↑ biodiversity

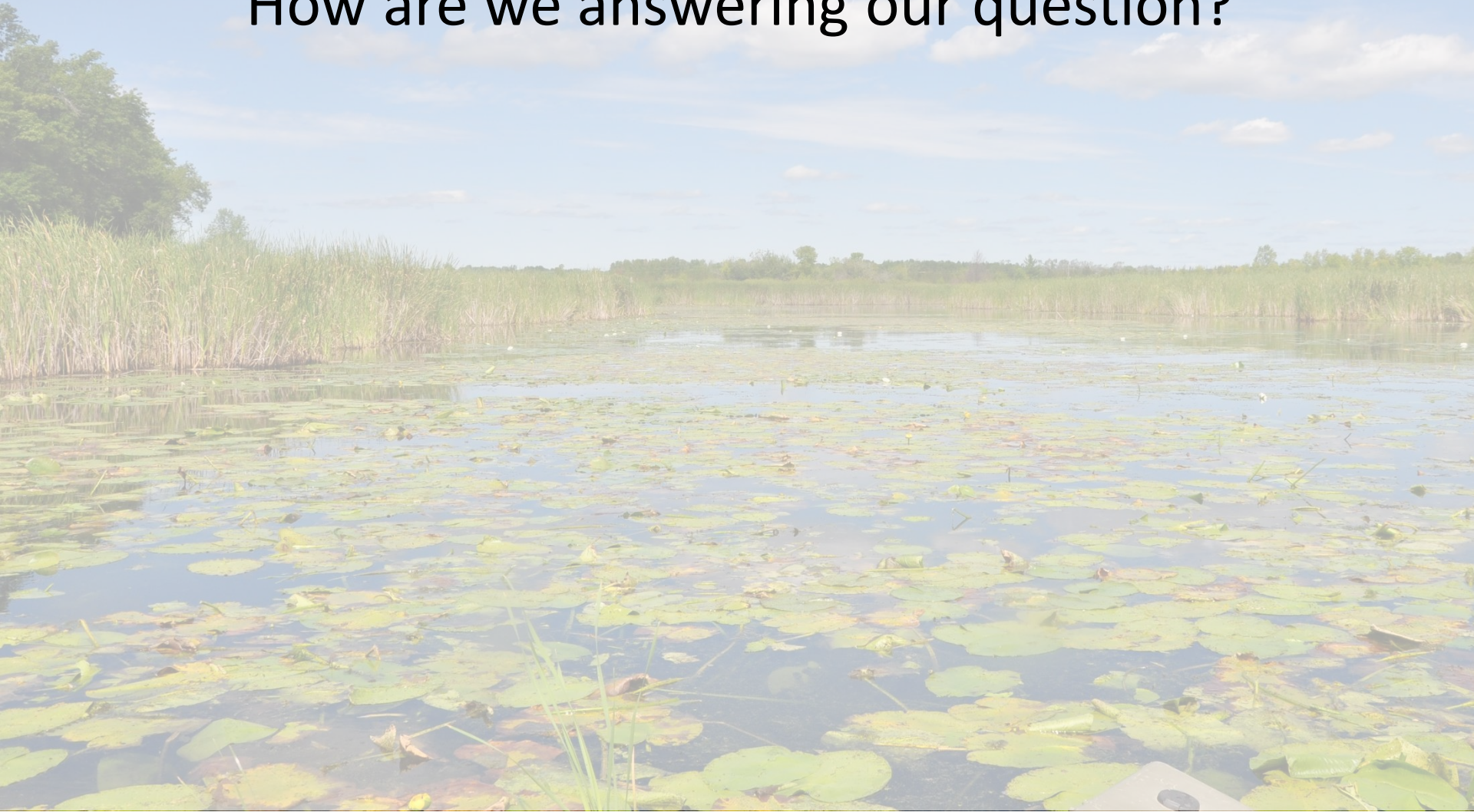


e.g. Chin, Tozer and Fraser 2014; Wilcox et al. 2008

Wetland Sensitivity

3. Analysis

How are we answering our question?

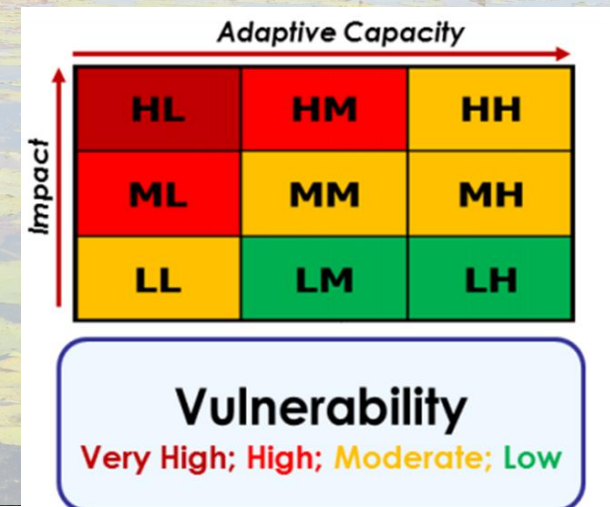
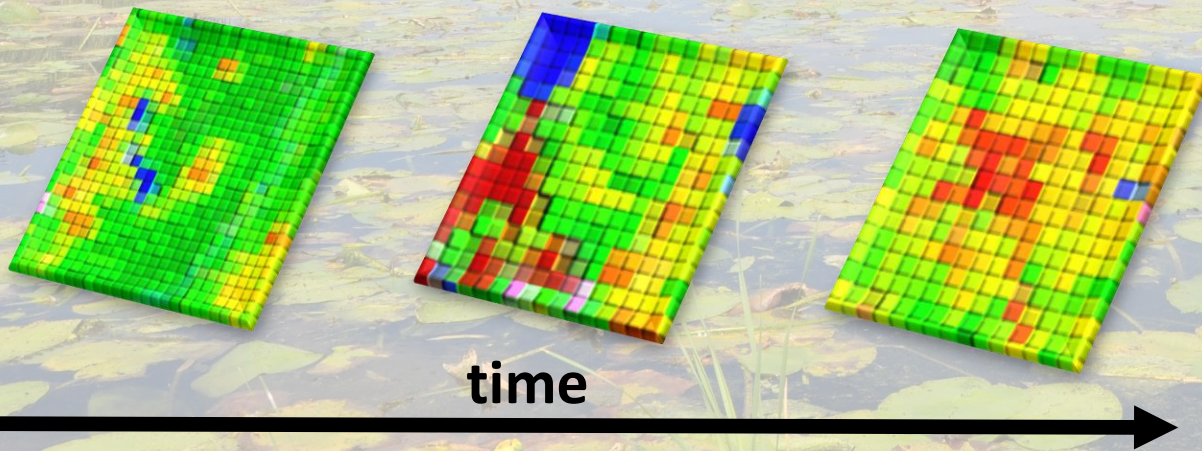


Wetland Sensitivity

3. Develop change-detection analysis

Analysis Goals:

- Detect change
- Quantify change
- Score change

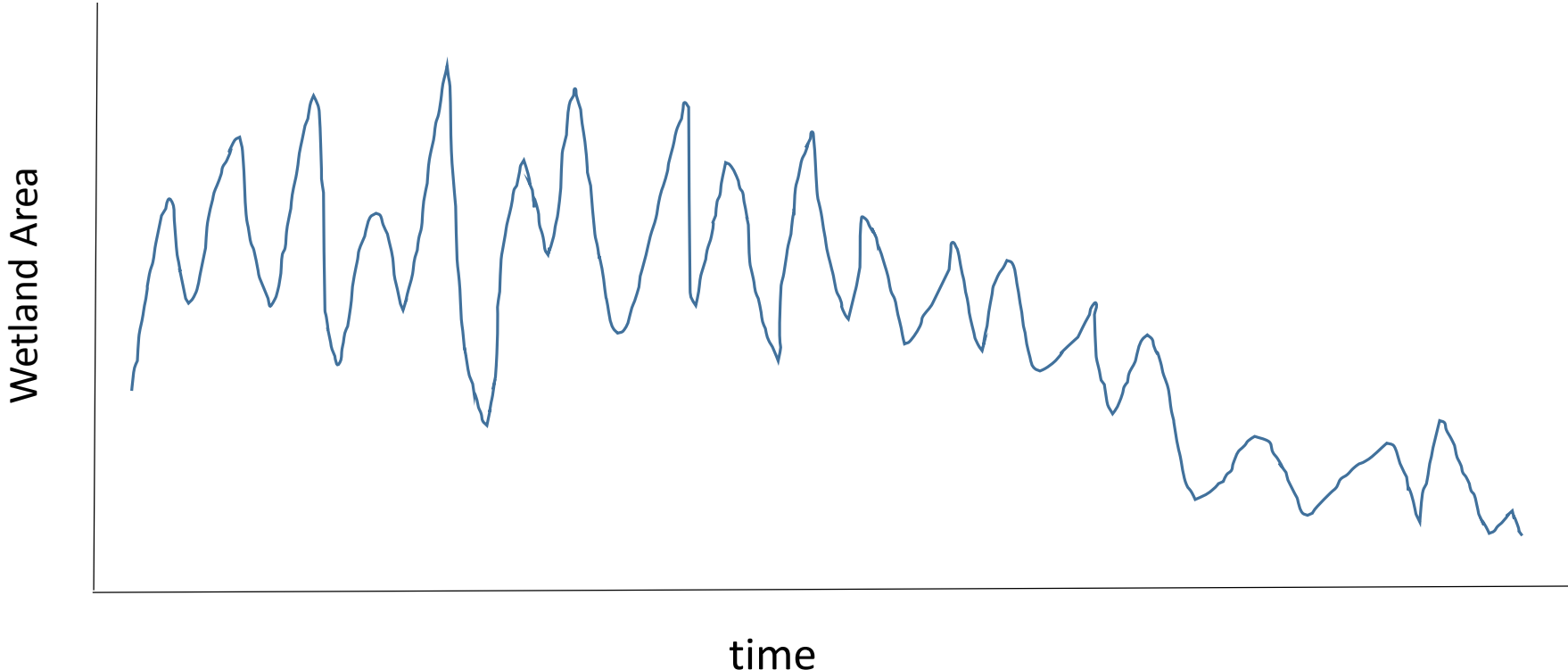


Change-Detection Analyses

Approach: Develop Response Thresholds

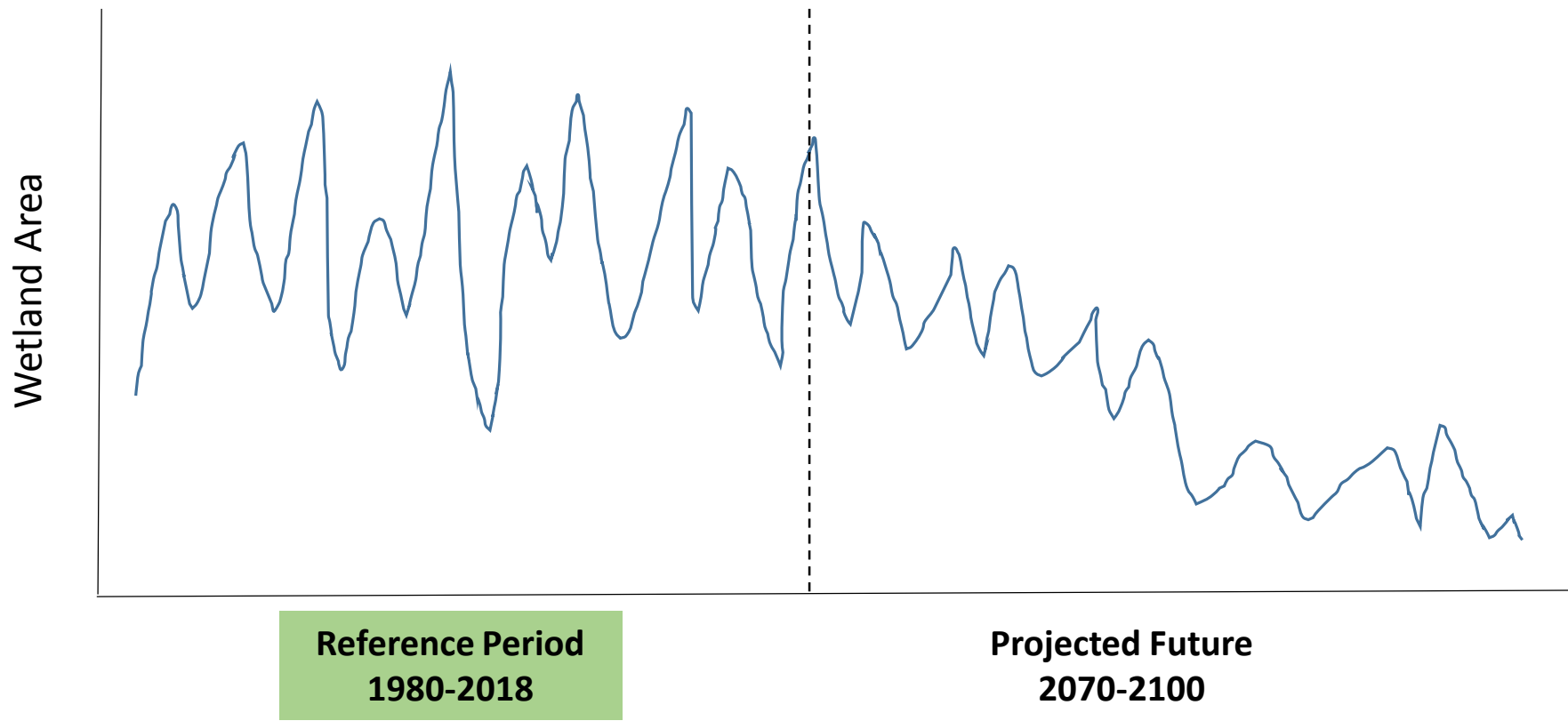
Change-Detection Analyses

Approach: Develop Response Thresholds



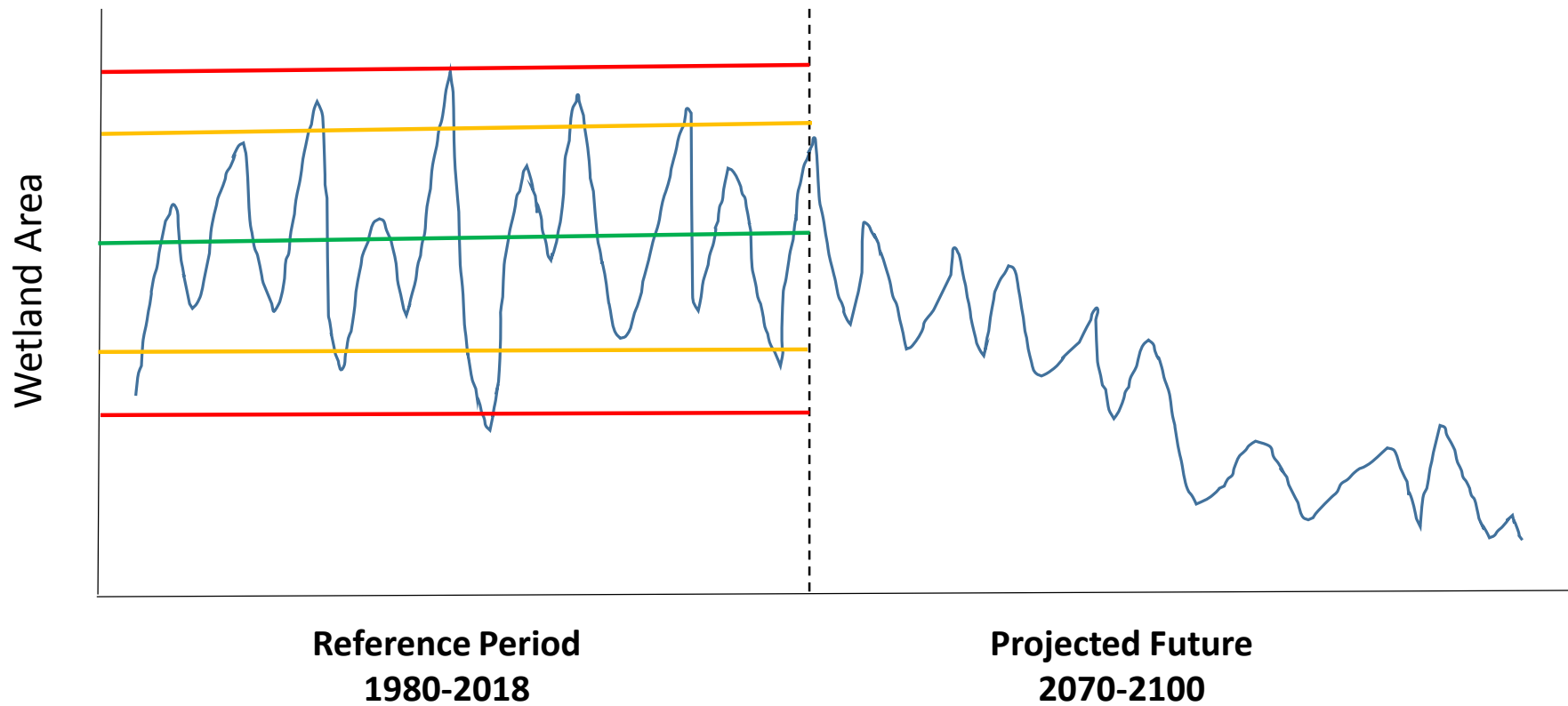
Change-Detection Analyses

Approach: Develop Response Thresholds



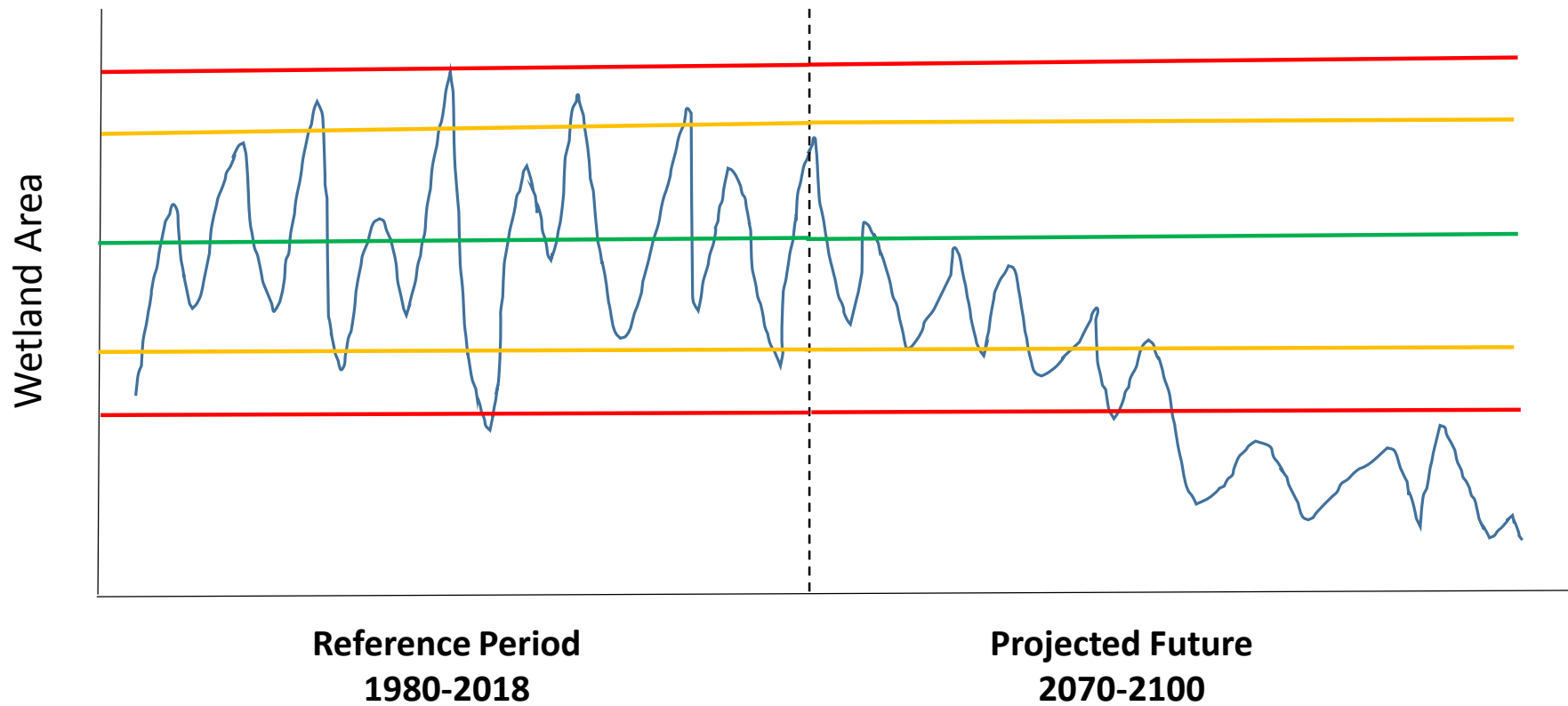
Change-Detection Analyses

Approach: Develop Response Thresholds



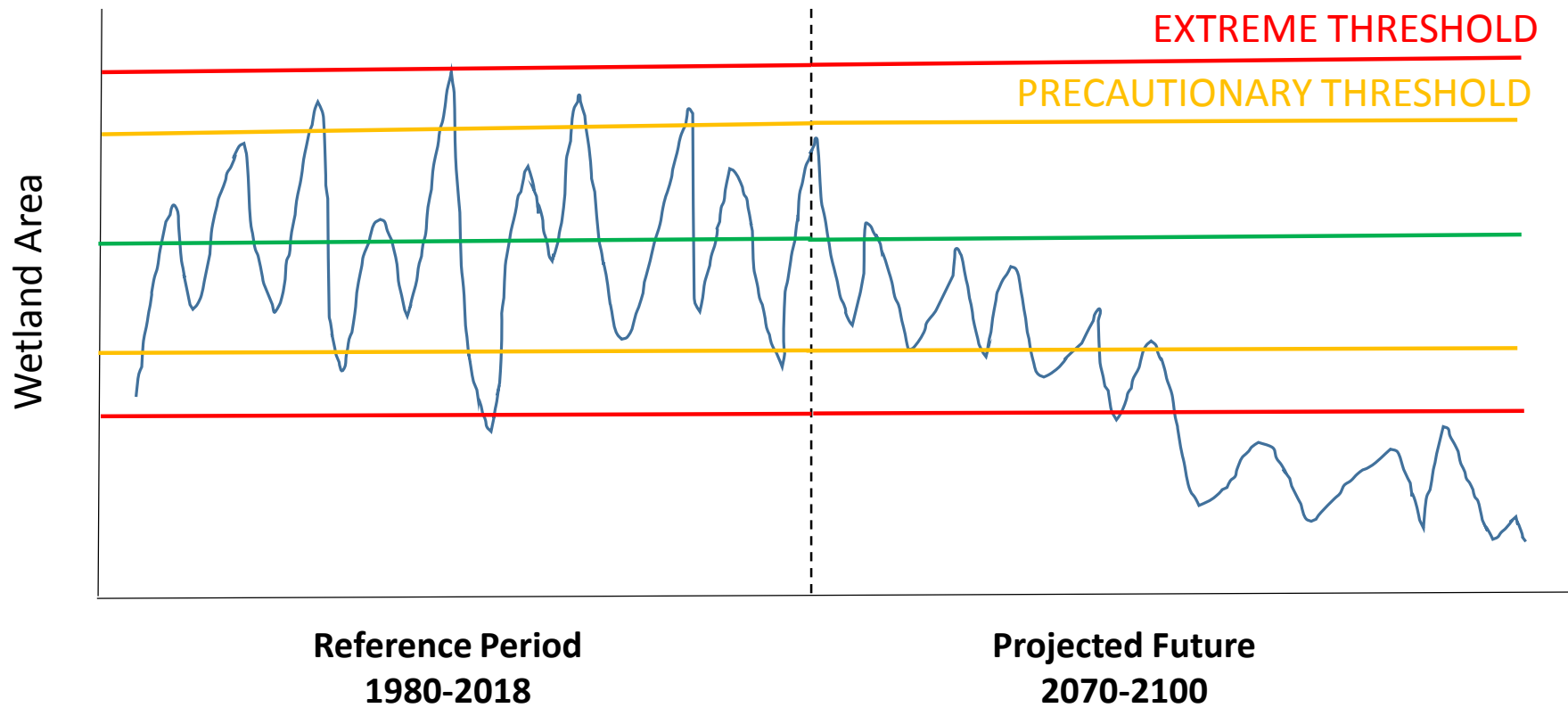
Change-Detection Analyses

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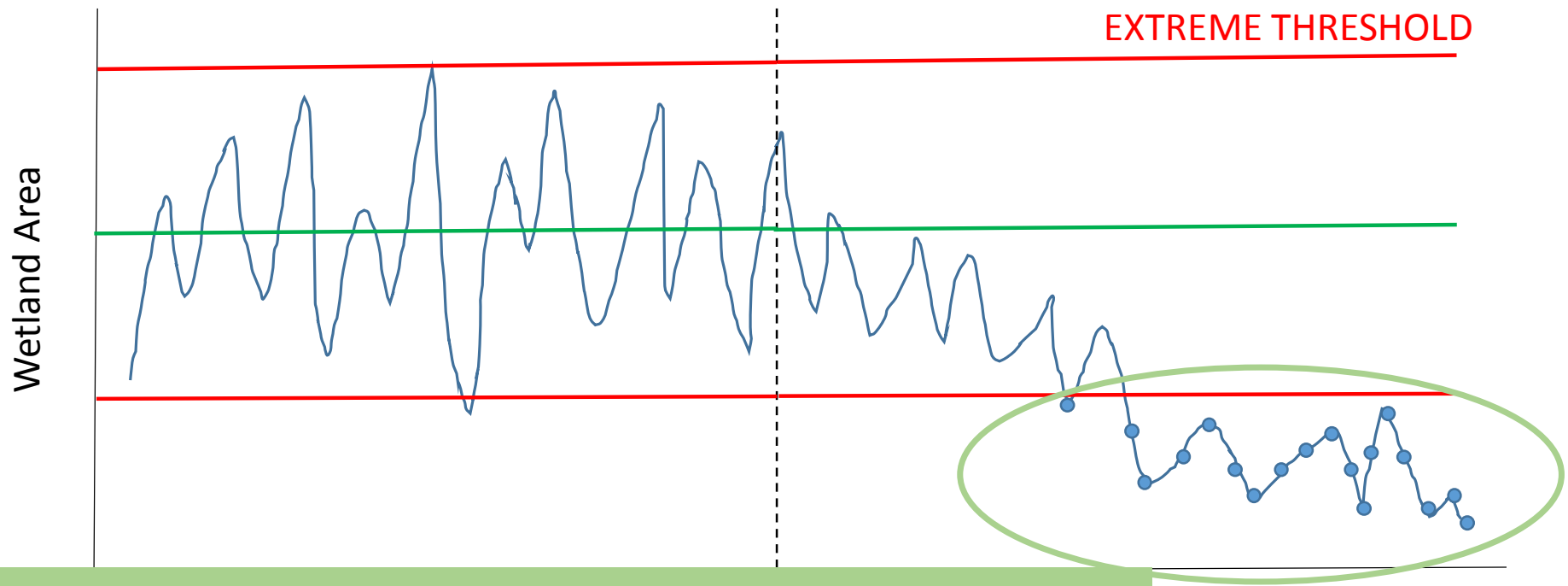
Change-Detection Analyses

Approach: Develop Response Thresholds



Change-Detection Analyses

Approach: Develop Response Thresholds



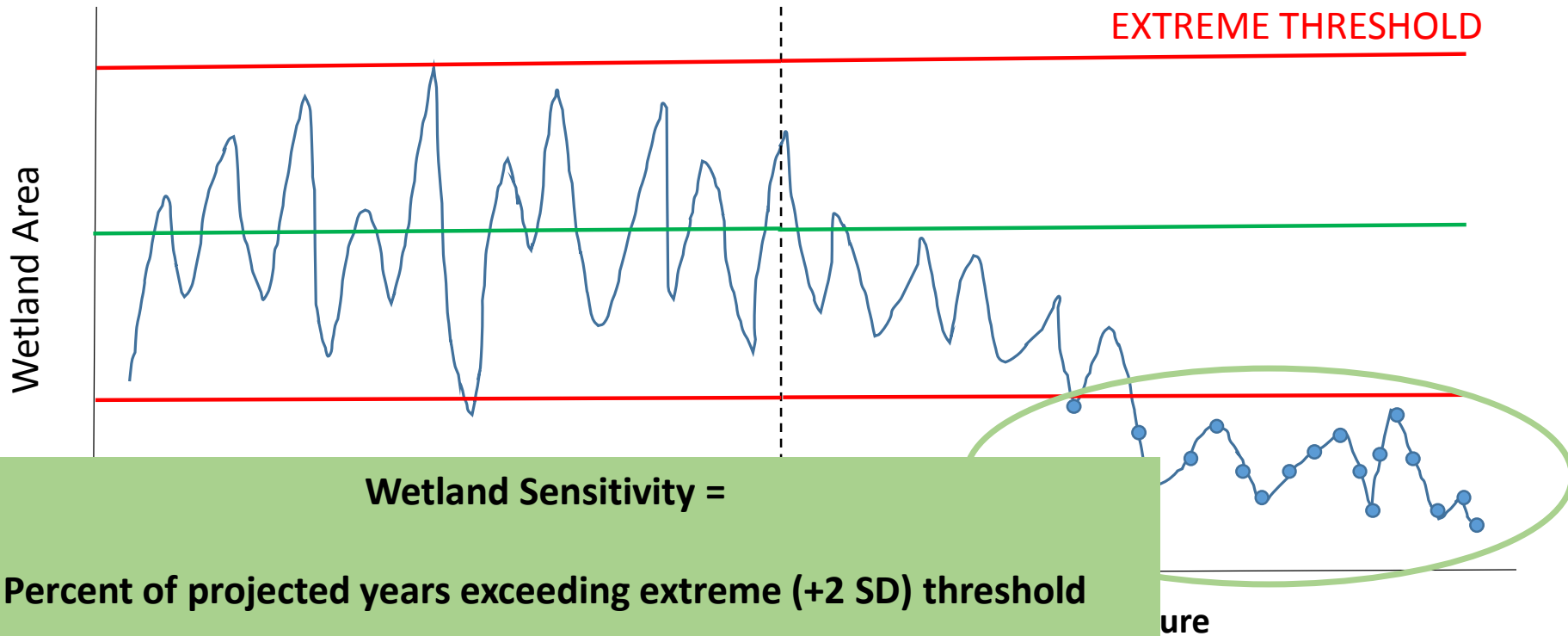
Wetland Sensitivity =

Percent of projected years exceeding extreme (+2 SD) threshold

$$= \frac{\text{\# extreme forecast years}}{\text{\# total forecast years}} \times 100$$

Change-Detection Analyses

Approach: Develop Response Thresholds

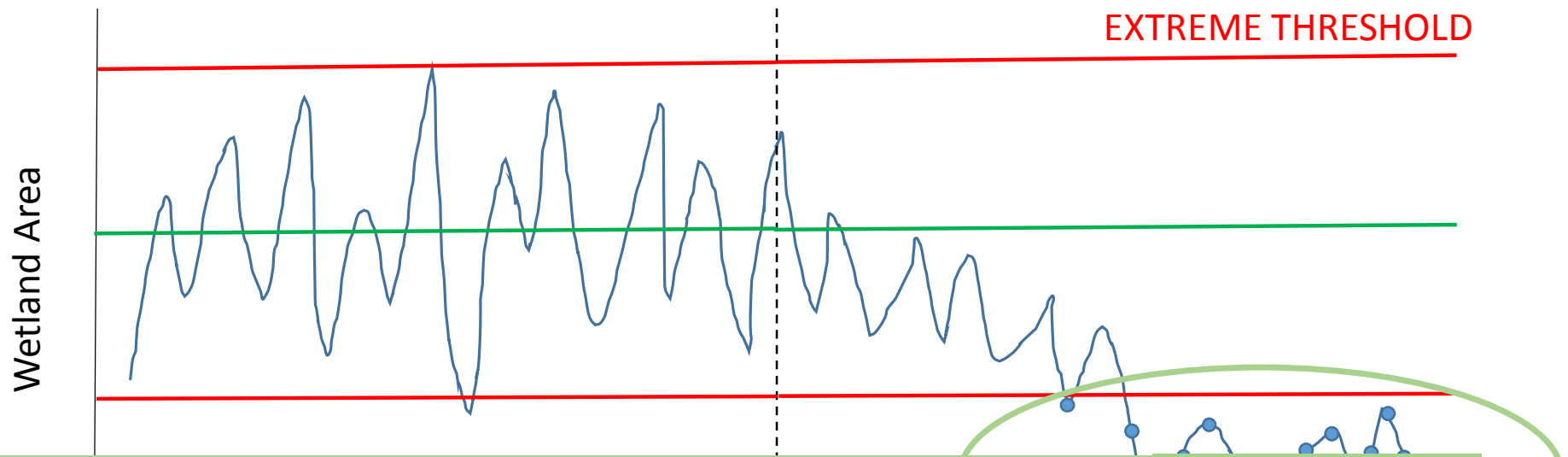


$$= \frac{\# \text{ extreme forecast years}}{\# \text{ total forecast years}} \times 100$$

= 62%

Change-Detection Analyses

Approach: Develop Response Thresholds



Wetland Sensitivity =

Percent of projected years exceeding extreme (+2 SD) threshold

$$= \frac{\text{\# extreme forecast years}}{\text{\# total forecast years}} \times 100$$

= 62 %



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- 70 – 100%
- 66 – 33%
- 0 – 33%

NEXT STEPS

- Scoring in development
 - NatureServe CCVA > 50% = High Sensitivity
 - Expert opinion
- Analysis approach currently under external scientific review



Questions?



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