

The Effect of Climate Change On Wetlands

Wetland Environments Conference May 16, 2011

Rose Paul, The Nature Conservancy

OVERVIEW

- Climate Change in the Champlain Basin
- Implications for wetlands and people
- What can you do to help wetlands adapt?





Climate Change in the Champlain Basin

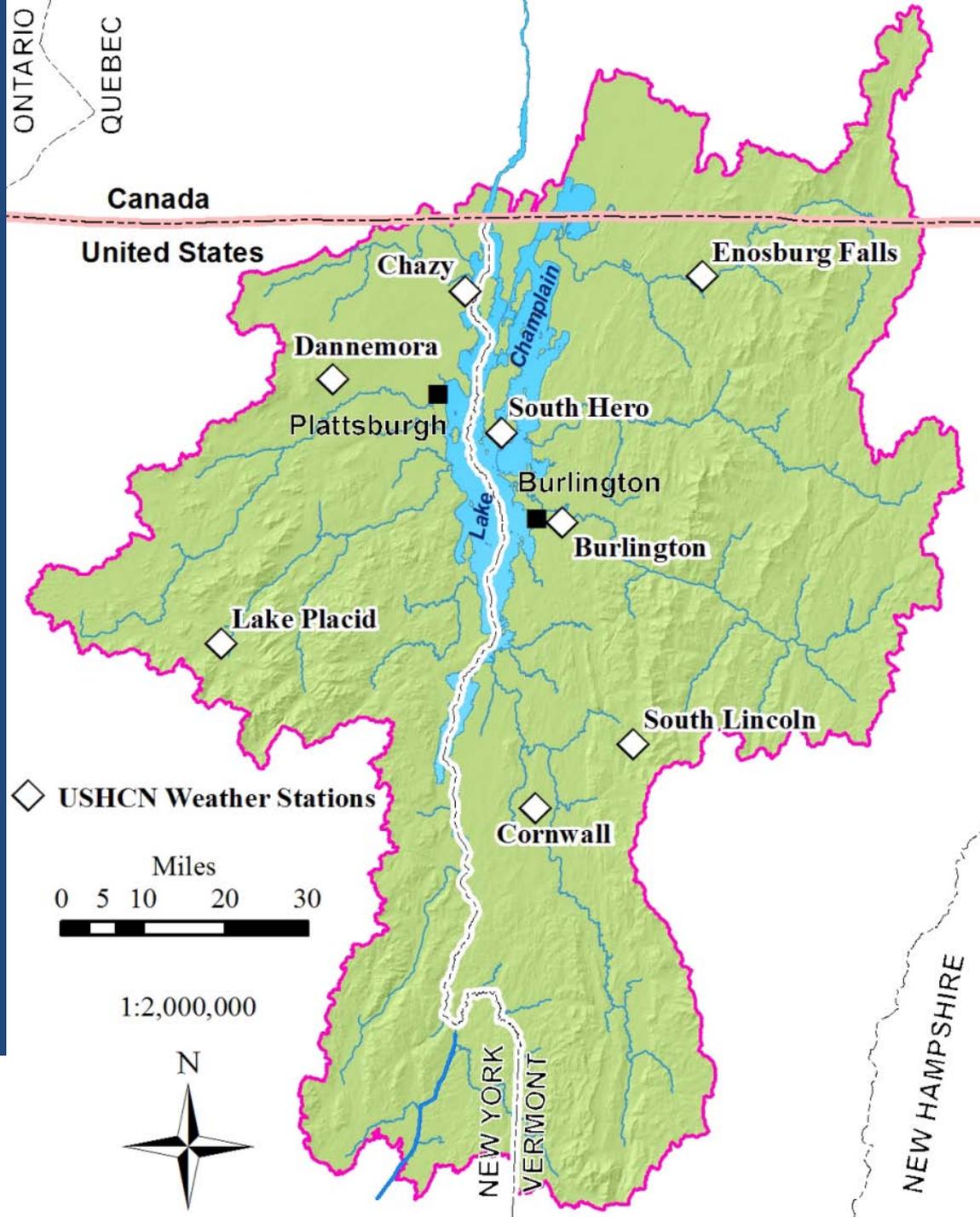
- With support from Argosy Foundation and Kelsey Trust
- Researched & written by Dr. Curt Steger, Mary Thill
- Assisted by TNC Vermont and Adirondack Chapter staff

Climate Change in the Champlain Basin

General Approach

1. **How has climate changed in the Champlain Basin so far?**
2. **How is it likely to change in the future?**
3. **How is this likely to affect aquatic habitats and species, shorelines, property?**





Climate Change in the Champlain Basin

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ClimateWizard

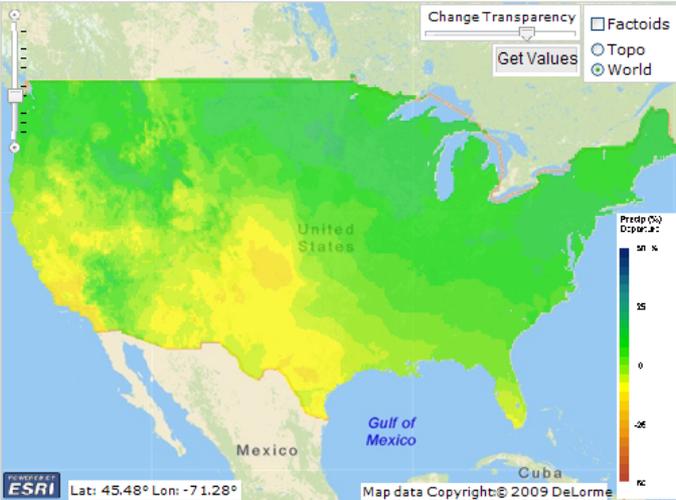
UNIVERSITY OF WASHINGTON
THE UNIVERSITY OF SOUTHERN MISSISSIPPI

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Analysis Area	Time Period	Map Options	Measurement	Resources
<input checked="" type="radio"/> United States <input type="radio"/> Global United States	<input type="radio"/> Past 50 Years <input type="radio"/> Mid Century (2050s) <input checked="" type="radio"/> End Century (2080s)	<input type="radio"/> Map of Average <input checked="" type="radio"/> Map of Change Compare & Animate Models	<input type="radio"/> Average Temperature <input checked="" type="radio"/> Precipitation Annual	Case Studies Documentation Data and Map Image Download ClimateWizard Custom Analysis Printer Friendly Version

Future Climate Model
IPCC Fourth Assessment
Emission Scenario: High A2
General Circulation Model: Ensemble Average

Change in Annual Precipitation by the 2080s
Model: Ensemble Average, SRES emission scenario: A2



Change Transparency
Get Values
Factoids
Topo
World

50%
25
0
-25
-50
%
Precip (%) Change

50% : This map shows the precipitation change projected by the middle model. Areas that are blue are projected to increase by at least half of the models, and areas that are yellow to red are projected to decrease in precipitation by at least half of the models.

ESRI Lat: 45.48° Lon: -71.28° Map data Copyright: © 2009 DeLorme

Data Source: Base climate projections downloaded by [Maurer, et al.](#) (2007) Santa Clara University. For more information see [About Us](#).

www.climatewizard.org

Climate Change in the Champlain Basin

Add Area to Map

Pre-Defined Area
 Upload Shapefile

Upload Zipped Shapefile
Zip all files associated with a shapefile on your disk. Your shapefile must be in WGS84 coordinates. Your zipped file must be under 2 MB.

Z:\GISData\PersonalFolders\Dff\ClimateWizard\Other_GISD

Choose Climatology

Current (Past Data) Climatology
 Future Modeled Climate

Region and Scale Options

United States (Lower 48 - 12 km resolution)
 Global (50 km resolution)

Output Options

English Units (metric is default)

Climate Variables
(Choose one or more)

Precipitation (Absolute Change)
 Precipitation (Percent Change)
 Mean Monthly Temperature

Climate Model Options
(To download model documentation, click the model labels)

General Circulation Model:
@IPCC 2007: WG1-AR4
(Choose one or more)

BCCR-BCM2 0
CGCM3 1 T47
CNRM-CM3
CSIRO-Mk3 0
GFDL-CM2 0
GFDL-CM2 1
GISS-ER

Greenhouse Gas Concentration (CO₂)
@IPCC 2007: WG1-AR4
(Choose one or more)

A2 (High) A1B (Med) B1 (Low)

Analysis Options

Departure Analysis (from 1961-1990)
 Linear Trend Analysis

Time Options

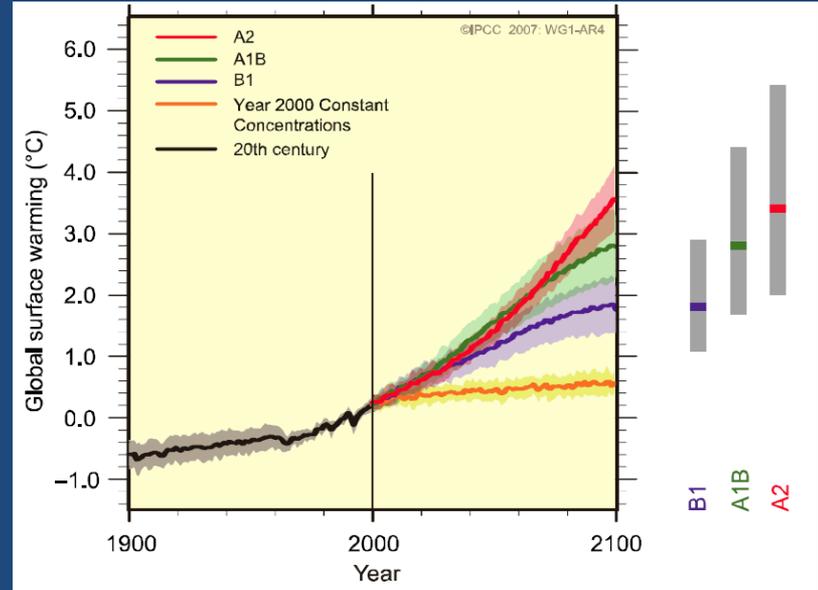
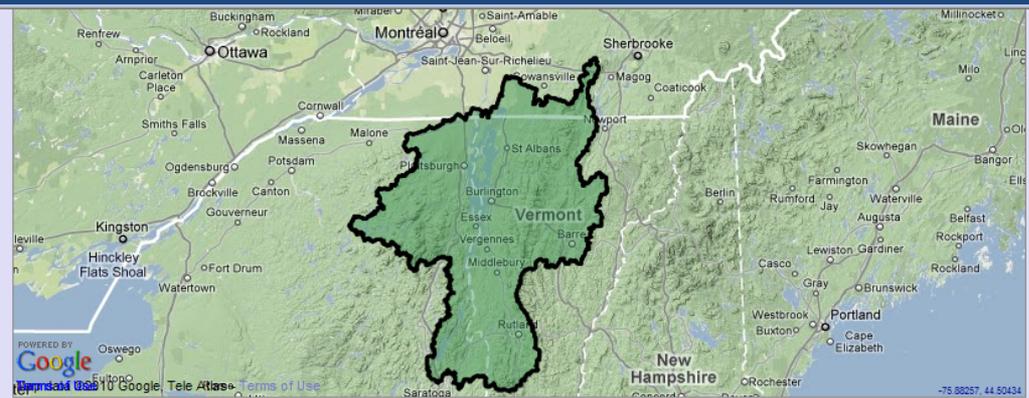
Start Year: 2000 End Year: 2099

Annual Seasonal Monthly

Enter Email Address:
(Your results will be emailed to you)

BCCR-BCM2 0
CGCM3 1 T47
CNRM-CM3
CSIRO-Mk3 0
GFDL-CM2 0
GFDL-CM2 1
GISS-ER
INM-CM3 0
IPSL-CM4
MIROC3 2 medres
ECHO-G
ECHAM5 MPI-OM
CCSM3
PCM
UKMO-HadCM3

Climate Wizard Emission Scenarios



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Greenhouse Gas Concentration (CO₂)

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A2 (High) A1B (Med) B1 (Low)

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(Your results will be emailed to you)



Climate Change in the Champlain Basin

Climate Variables

- Average **Annual** T and Total **Annual** P
- Average **Seasonal** T and Total **Seasonal** P
- Average **Monthly** T and Total **Monthly** P

Time Periods

- Past Climate: 1901 - 2002
- Modeled Data: 1950 - 2099



Climate Change in the Champlain Basin

Observations (Weather Stations)

Average Annual Air Temperature → Warmed 1.7 °F 1895 to 2008
Warmed 2.1 °F 1976 to 2005

Annual Precipitation → Average for 1976-2005 3" greater than the average for 1900 to 1950

Seasonal → Warmer during fall and winter



Climate Change in the Champlain Basin

Predictions

Average Annual
Air Temperature

→ 1-11 F warmer by 2100

Annual Precipitation

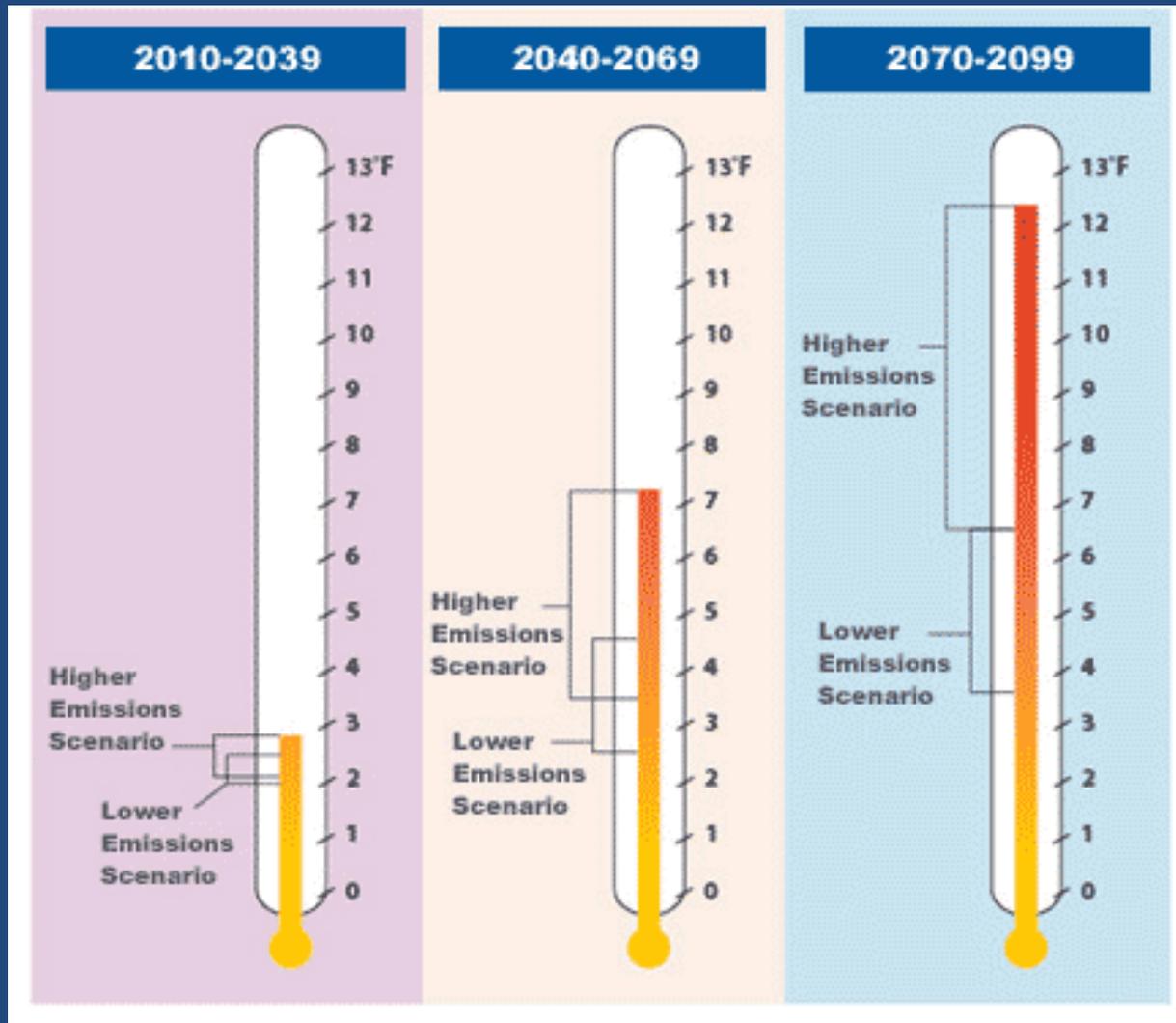
→ 4-6" more by 2100
(10-15%)

Annual & Seasonal
Patterns

→ More heavy storms,
less snow,
more warming in winter?

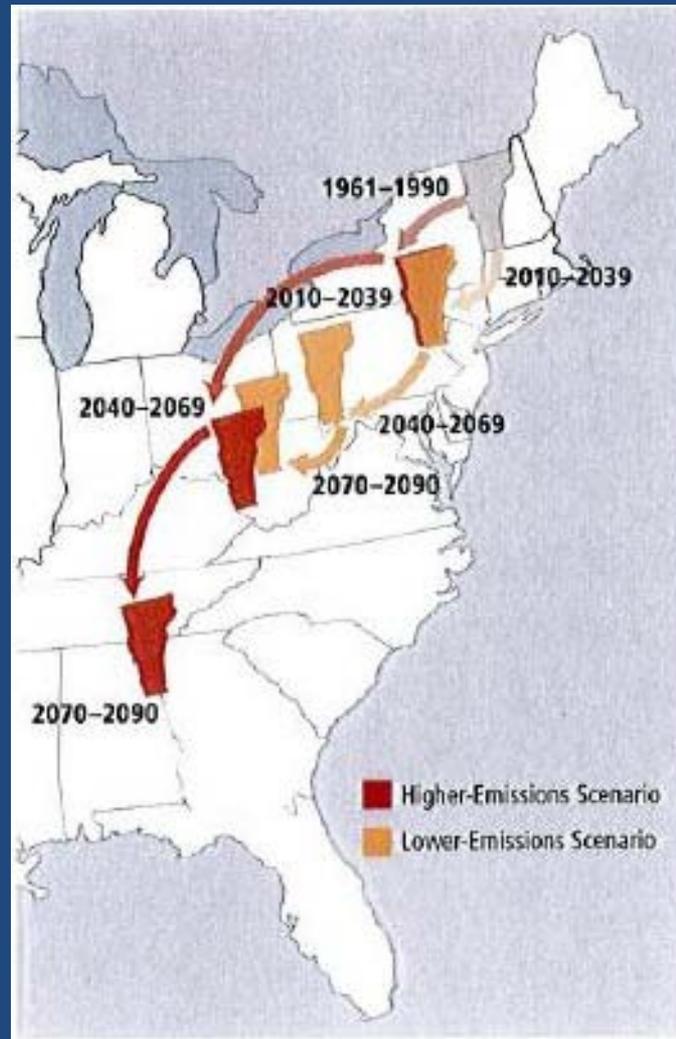


Predicted Changes in Northeast Average Summer Temperature



Courtesy of Union of Concerned Scientists. Confronting Climate Change In the U.S. Northeast. Synthesis Report of the Northeast Climate Impacts Assessment. 2007

Climate Change in the Northeast 2010 - 2100



Courtesy of Union of Concerned Scientists. Confronting Climate Change In the U.S. Northeast. Synthesis Report of the Northeast Climate Impacts Assessment. 2007

Lake Champlain Wetlands

166 wetlands >50 acres



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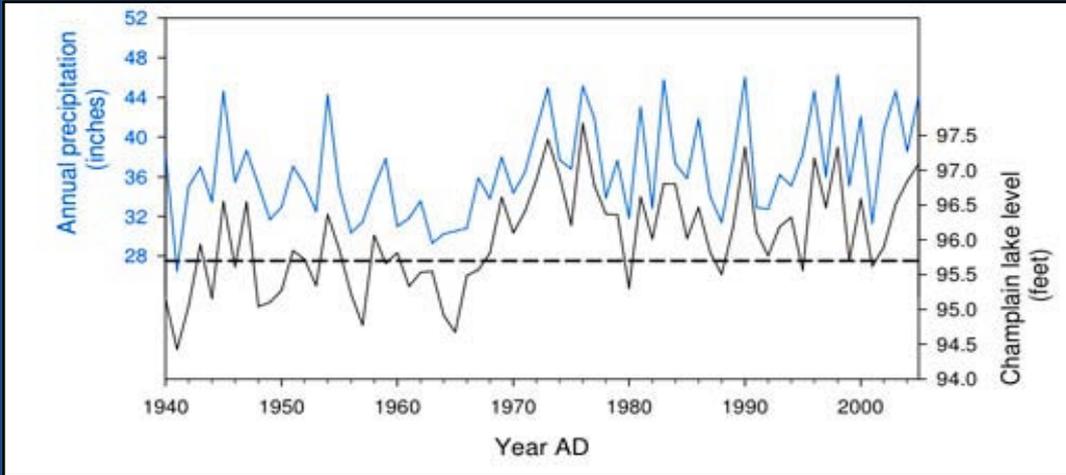


Potential Lake Changes

- Lake Level
- Ice Cover
- Lake Water Temperature
- Nutrient Loading



Lake Level



Total annual precipitation:

3" higher after ca. 1970

Lake Champlain level:

1 foot higher after ca. 1970



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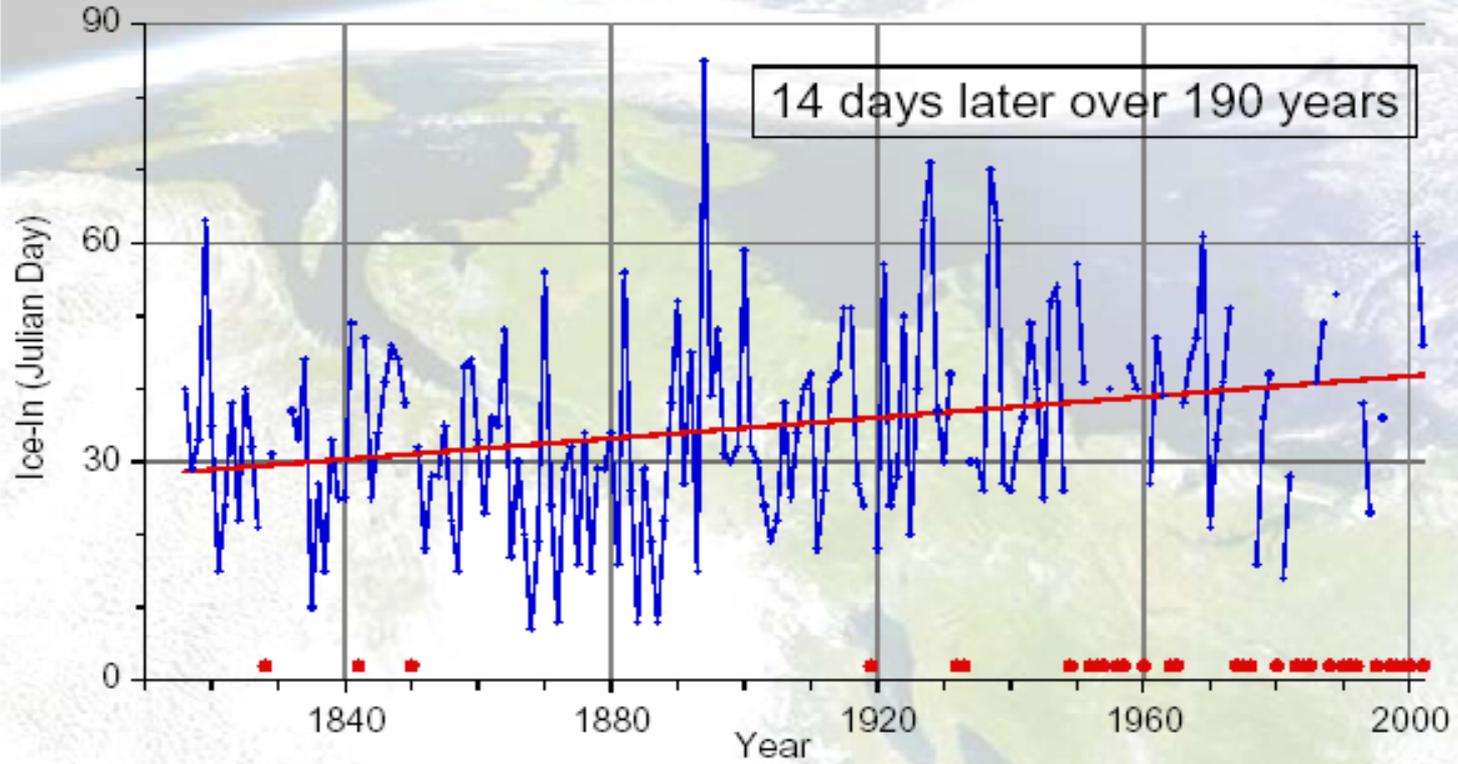


Potential Effects on WETLANDS from lake level rise

- Greater shoreline hardening?
- Where can wetlands migrate to?
- Net loss of wetland acres?
- Shoreline development regs....



Lake Champlain Ice-In Dates: 1816-2005



33 times lake has not frozen over (•)
78% since 1950; 54% since 1970

Data from NWS Burlington, <http://www.erh.noaa.gov/er/btv/climo/lakeclose.html>

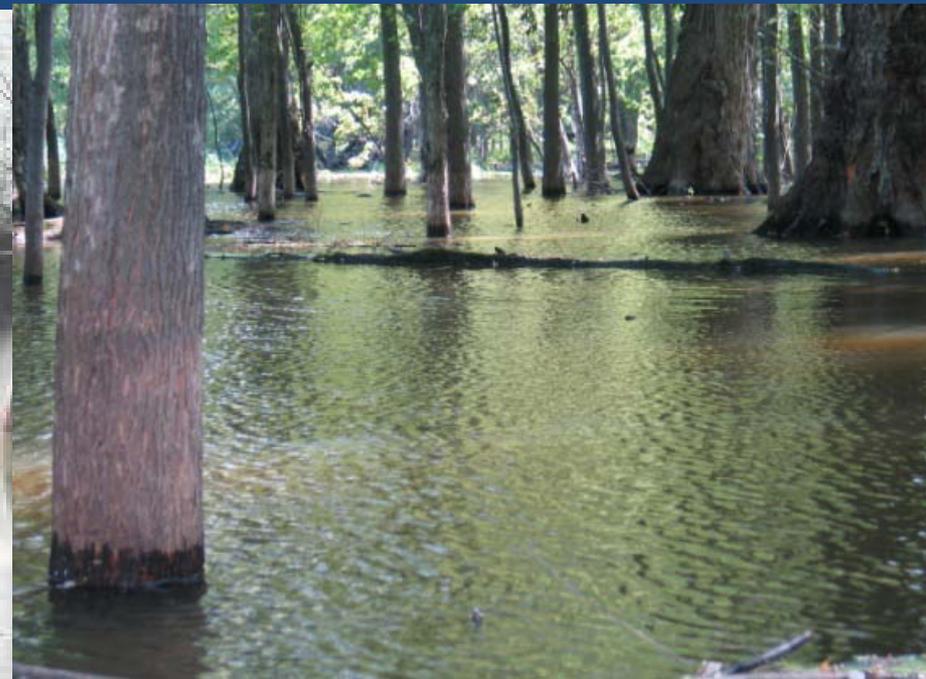


Potential Effects on WETLANDS from less ice cover

- Greater wave action in winter?
- Lakeshore wetlands can help mitigate erosion



Burlington Free Press



Potential Effects on **RIVERINE** Wetlands

- Earlier ice out, ice jams
- Winter flooding?
- Greater bank erosion, sedimentation, turbidity



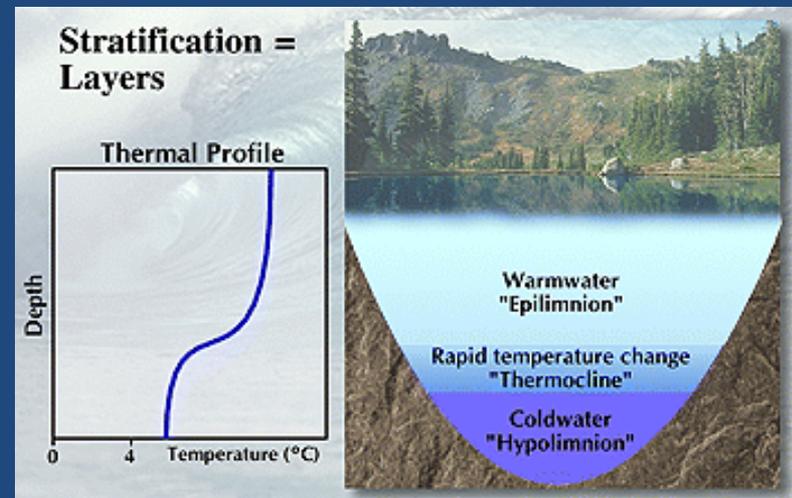
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Potential effects on wetlands from increased temperatures and nutrients

- Warming temps and less ice cover = longer period of summer stratification
- Stratification favors buoyant cyanobacteria (bluegreen algae)
- Warming, higher precipitation may lead to increased nutrient loading
- This combination may lead to increased algal blooms



Will new invasive wetland plants gain a foothold?



© Tom Peterson 2004



ACTIONS YOU CAN TAKE

- Plant trees along shorelines! shade, CWD, food, bank stabilization, nutrient filtering, wildlife travel corridors....
- Conduct river geomorphic assessments & culvert assessments
- Allow rivers to move freely! Flooding the floodplains = less erosive energy
- Re-connect rivers and wetlands for aquatic animals
- Floodplain and shoreline regulations? setbacks, shoreline hardening
- Capture stormwater, sediment



ACTIONS YOU CAN TAKE

- This is not new thinking...
- We've been doing this all along...
- We need to accelerate the pace!



[nature.org/vermont](https://www.nature.org/vermont)



Questions?

