

# *Signs of the Seasons: A New England Phenology Program*



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**Phenology** is the study of seasonal biological events observed in plants, animals, or microbes



Timing of migration

# Climate influences the **phenology** of biological processes that affect our daily lives

## HAZARDS



## CULTURE



## HEALTH







*“Phenology... is perhaps the **simplest process** in which to track changes in the ecology of species in response to climate change.” - IPCC 2007*



# Collecting phenological data: hands-on empirical observations

Examples:

- First flowering date
- Timing of animal emergences
- Dates when babies are observed or fledge
- Arrival dates of migratory animals





# Early phenological observations from Thoreau's journals

"I saw this morning for the first time the bobolink, gold robin [most likely a northern oriole], and kingbird." *May 10, 1853*

- Thoreau made **daily** observations about plants animals every spring from **1851-1858**
- The **phenological data** in Thoreau's journals provided the foundation for ongoing long-term studies of phenology!

# WALDEN

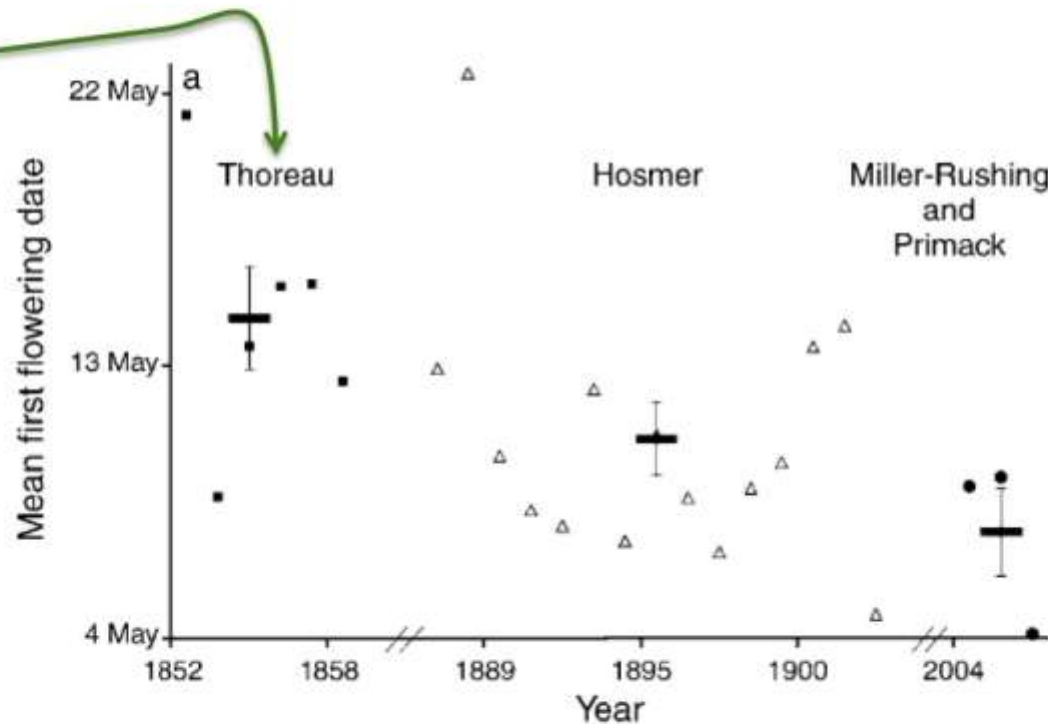


# Henry David THOREAU

## GLOBAL WARMING AND FLOWERING TIMES IN THOREAU'S CONCORD: A COMMUNITY PERSPECTIVE

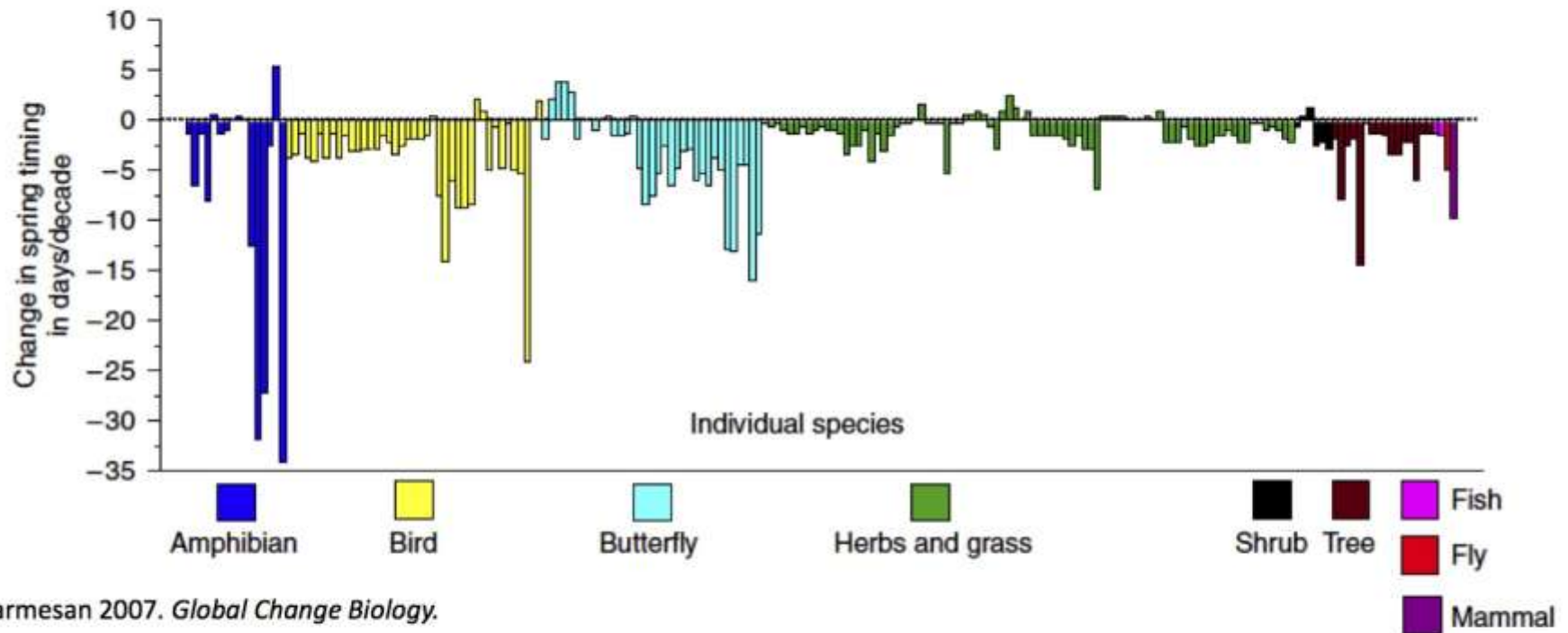
ABRAHAM J. MILLER-RUSHING<sup>1</sup> AND RICHARD B. PRIMACK

*Department of Biology, Boston University, 5 Cunningham Street, Boston, Massachusetts 02215 USA*



Long term data show that, in the northern hemisphere, co-occurring species are flowering earlier in the spring than they did 100 – 150 years ago.

# Phenological Responses to Climate Change



- Changes in the **timing of spring activity** have been observed in several species
- But the **magnitude** of phenological response depends on type of organism



# Phenological responses to climate change



Miller-Rushing et al. 2006. *American J. Botany*

Earlier “leaf-out” at Lowell Cemetery in Lowell, Massachusetts

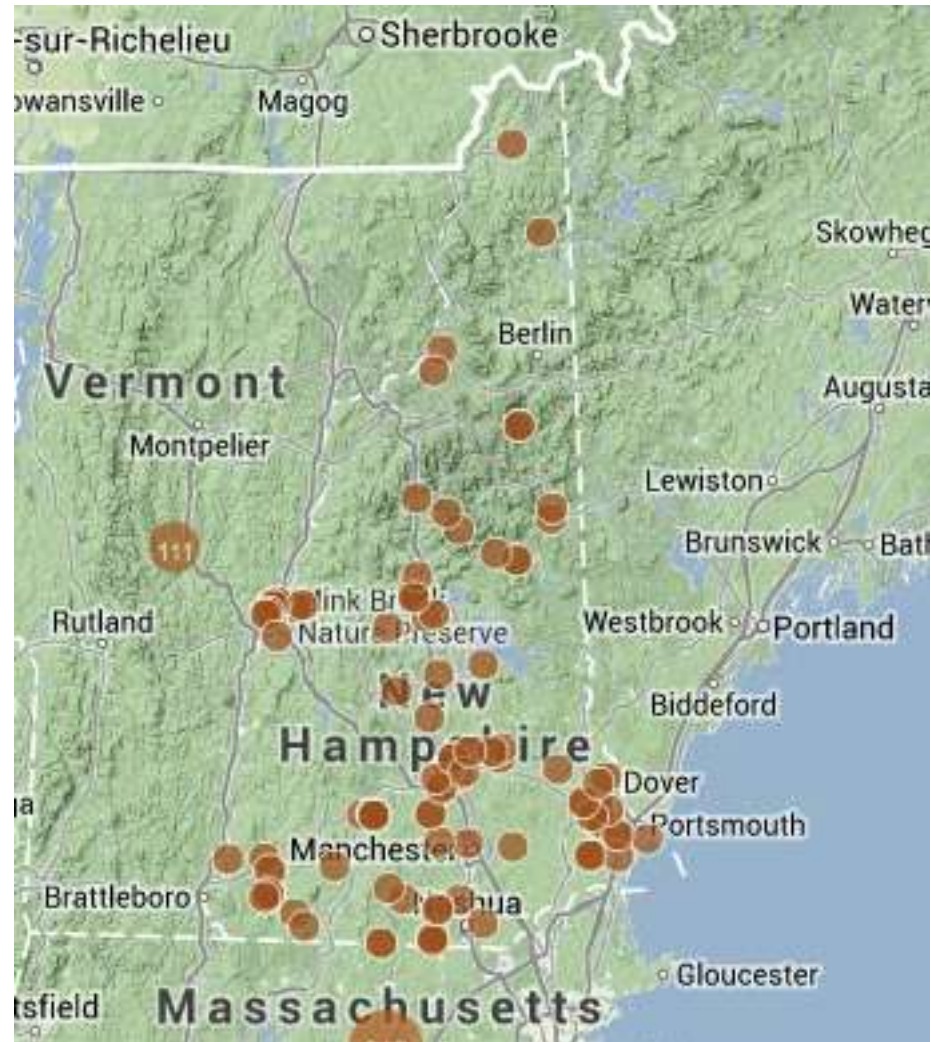


[www.usanpn.org](http://www.usanpn.org)

*Key Goal: To understand how plants, animals, and landscapes respond to environmental variation and climate change*

- A national biological science and monitoring program
- A national phenological data management system
- Standard protocols for plants, animals, landscapes







# nature's notebook

a project of the USA-NPN

Go to **[www.usanpn.org](http://www.usanpn.org)**

- 300+ plant species
- 160+ animal species
- Core protocols





## *Signs of the Seasons*

**A partnership between:**



# Signs of the Seasons

## Focal species



Red maple,  
*Acer rubrum*



Sugar maple,  
*Acer saccharum*



Common dandelion,  
*Taraxacum officinale*



Common lilac,  
*Syringa vulgaris*



Forsythia,  
*Forsythia sp.*



Wild strawberry,  
*Fragaria virginiana*



Common Milkweed,  
*Asclepias syriaca*



Monarch butterfly,  
*Danaus plexippus*



*American eel, Anguilla rostrata*



American robin,  
*Turdus migratorius*



Common loon,  
*Gavia immer*



Ruby-throated hummingbird,  
*Archilochus colubris*



Rockweed,  
*Ascophyllum nodosum*



Beach rose,  
*Rosa Rugosa*



*Eastern white pine,*  
*Pinus strobus*



*Common reed,*  
*Phragmites australis*



# Protocols for 143 animal species in NH



Photo credit: Ken Thomas (KenThomas.us (personal website of photographer))  
[Public domain], via Wikimedia Commons

	Date:	Date:	Date:
Do you see/hear...	Time:	Time:	Time:
Active individuals	y n ? ____	y n ? ____	y n ? ____
Feeding	y n ? ____	y n ? ____	y n ? ____
Fruit/seed consumption	y n ? ____	y n ? ____	y n ? ____
Insect consumption	y n ? ____	y n ? ____	y n ? ____
Calls or song	y n ? ____	y n ? ____	y n ? ____
Singing males	y n ? ____	y n ? ____	y n ? ____
Mating	y n ? ____	y n ? ____	y n ? ____
Nest building	y n ? ____	y n ? ____	y n ? ____
Dead individuals	y n ? ____	y n ? ____	y n ? ____
Individuals at a feeding station	y n ? ____	y n ? ____	y n ? ____
Check when data entered online:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>			

## Activity

### Active individuals

One or more individuals are seen moving about or at rest.

### Feeding

One or more individuals are seen feeding. If possible, record the name of the species or substance being eaten or describe it in the comments field.

### Fruit/seed consumption

One or more individuals are seen eating the fleshy fruits, seeds, or cones of a plant. If possible, record the name of the plant or describe it in the comments field.

### Insect consumption

One or more individuals are seen eating insects. If possible, record the name of the insect or describe it in the comments field.

### Calls or song

One or more individuals are heard calling or singing.

### Singing males

One or more singing males are heard. Singing refers to stereotypical, simple or elaborate vocalizations used as part of a territorial proclamation or defense or mate attraction. It does not include relatively simple calls used for other forms of communication.

# Opportunities

Signs of the Seasons  
Backyard Phenology Monitoring Training

30 July 2013  
Great Bay Discovery Center  
9-11:30am



# Opportunities

Phenology Monitoring at NH Audubon Wildlife Sanctuaries

Deering Wildlife Sanctuary in Deering

Ponemah Bog Sanctuary in Amherst

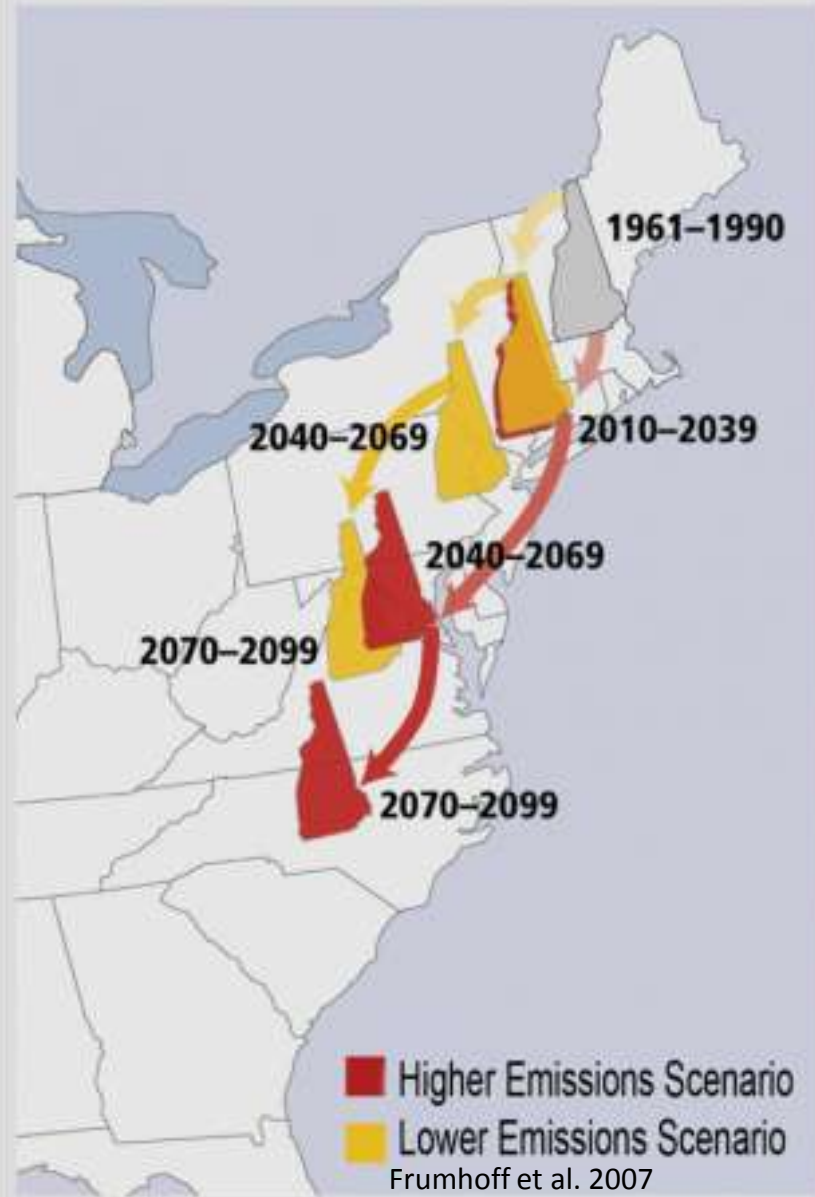
Silk Farm Sanctuary in Concord



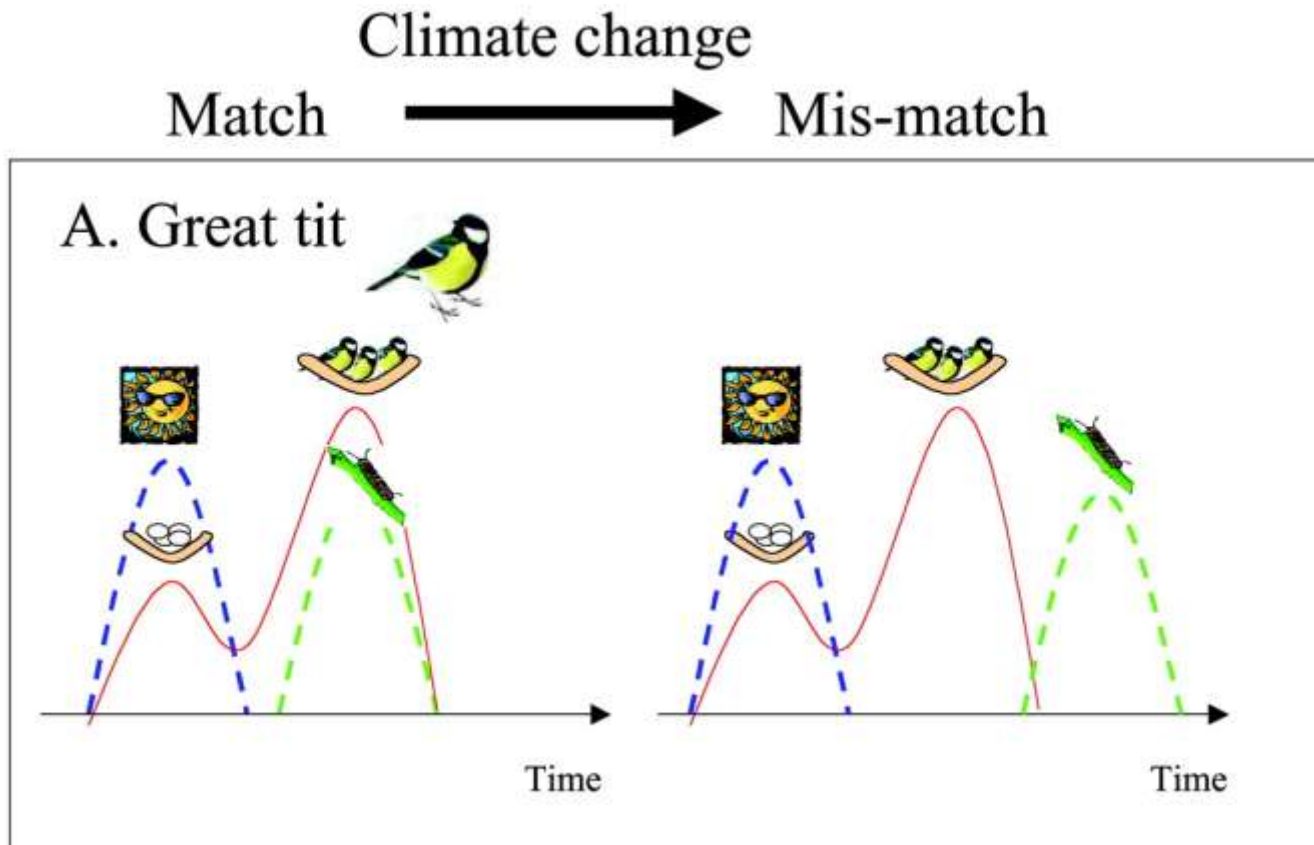


Extra slides

## Climate on the Move: Changing Summers in New Hampshire



# Phenological Mismatch



Stenseth N C , and Mysterud A PNAS 2002;99:13379-13381