Monarchs and Margaritas

Presented by:

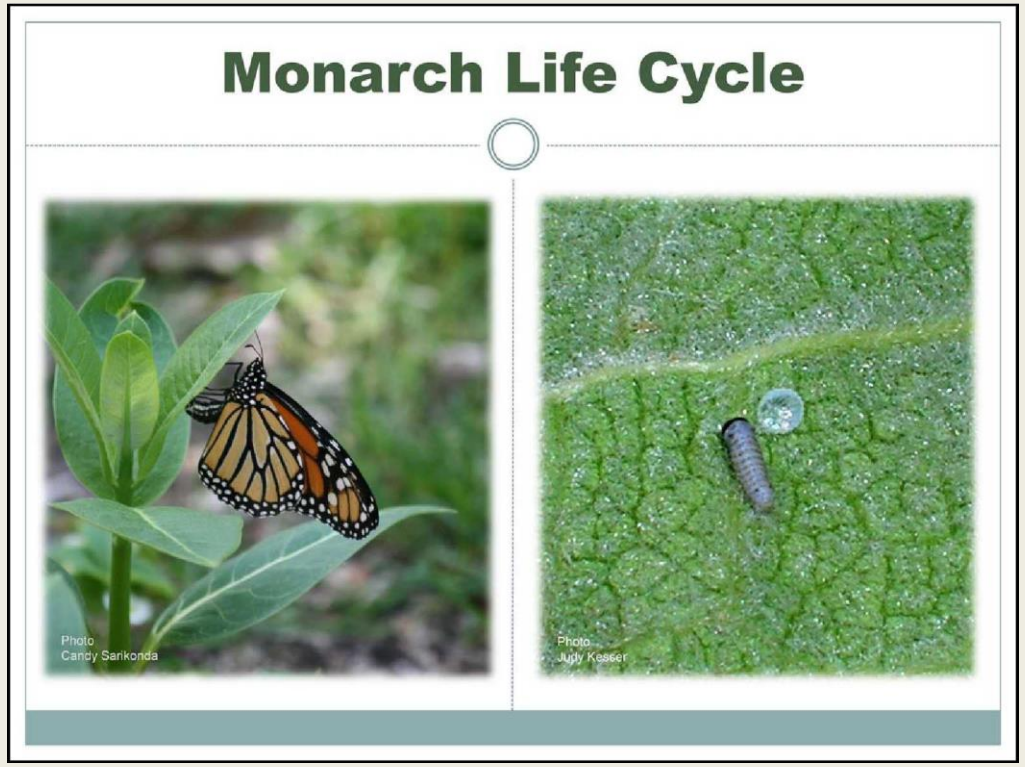
Vince Mosca
Senior Principal Ecologist

Presented for:

Fox River Ecosystem Partnership

January 8, 2025

Monarch Biology



Complete Metamorphosis

- Egg
- Larva (caterpillar)
- Chrysalis
- Adult

Completely different look at the various stages

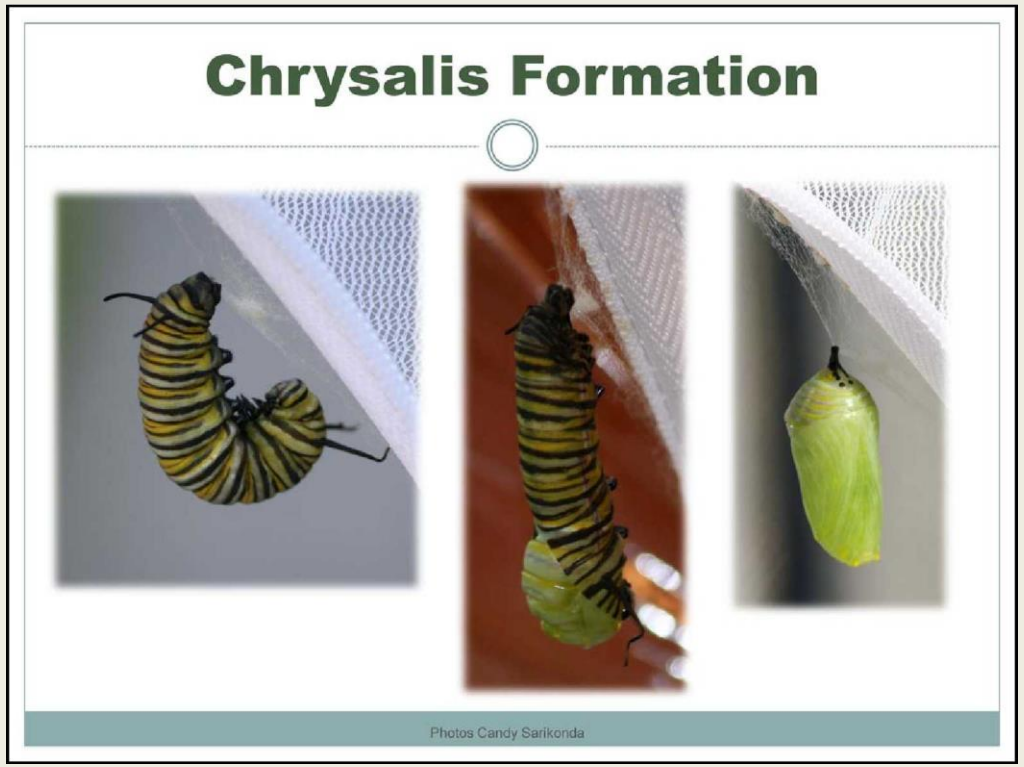
Dependent on Milkweed Plants

Classic caterpillars

“Tolerates” milkweed sap but probably doesn’t require it

“Glycosides” in sap are a problem for many species

Chrysalis - Transformation

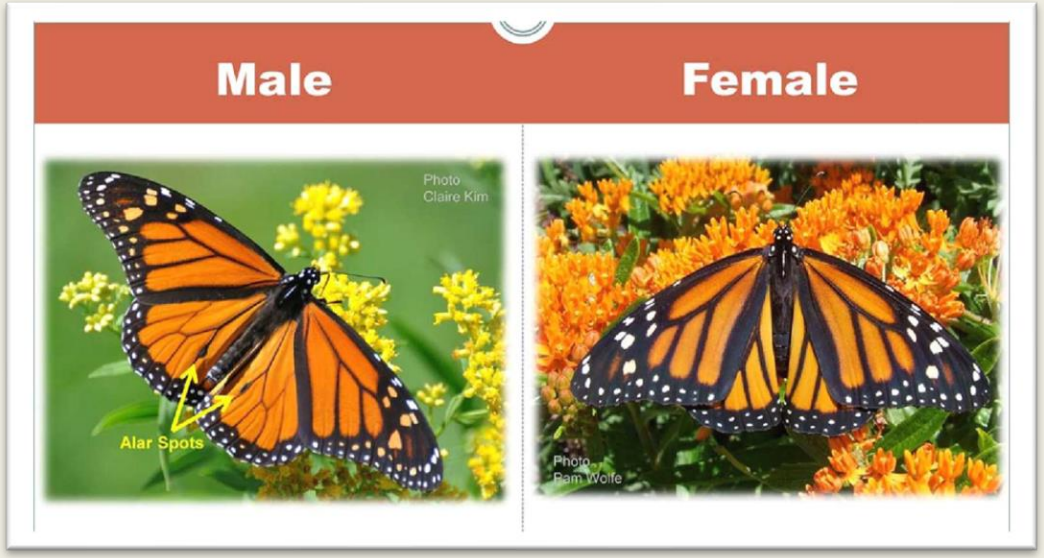


Emergence

Amazing transformation

“Complete metamorphosis”

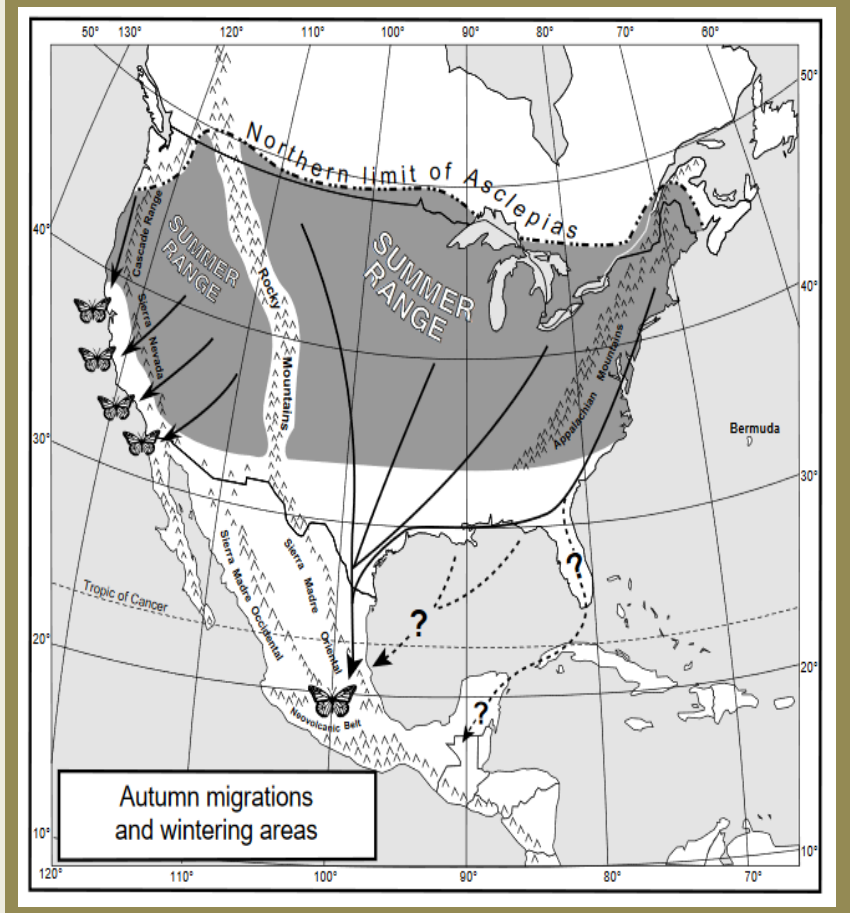
Adults


Male
Female
Photo
Claire Kim
Alar Spots
Photo
Pam Wolfe

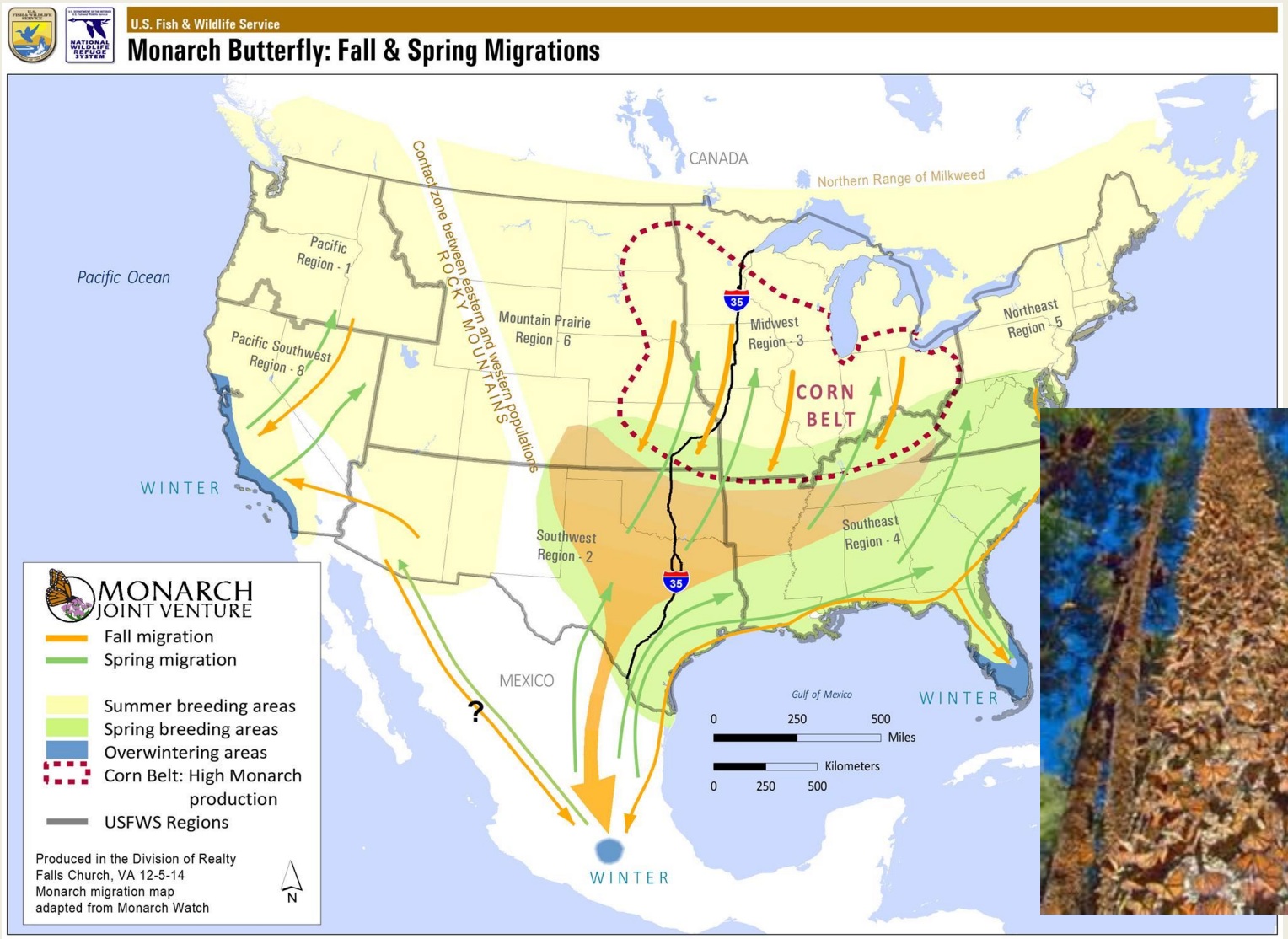

The Monarch does NOT have
the black line crossing the veins.
The Viceroy has the black line
crossing the veins.

Where do the monarchs go every fall?

- Tagging was first used by Fred and Norah Urquhart to find out where Monarchs overwintered
- Kenneth Brugger and Catalina Trail located the first Mexican sanctuaries in January 1975
- Very few insects migrate, especially such long distances

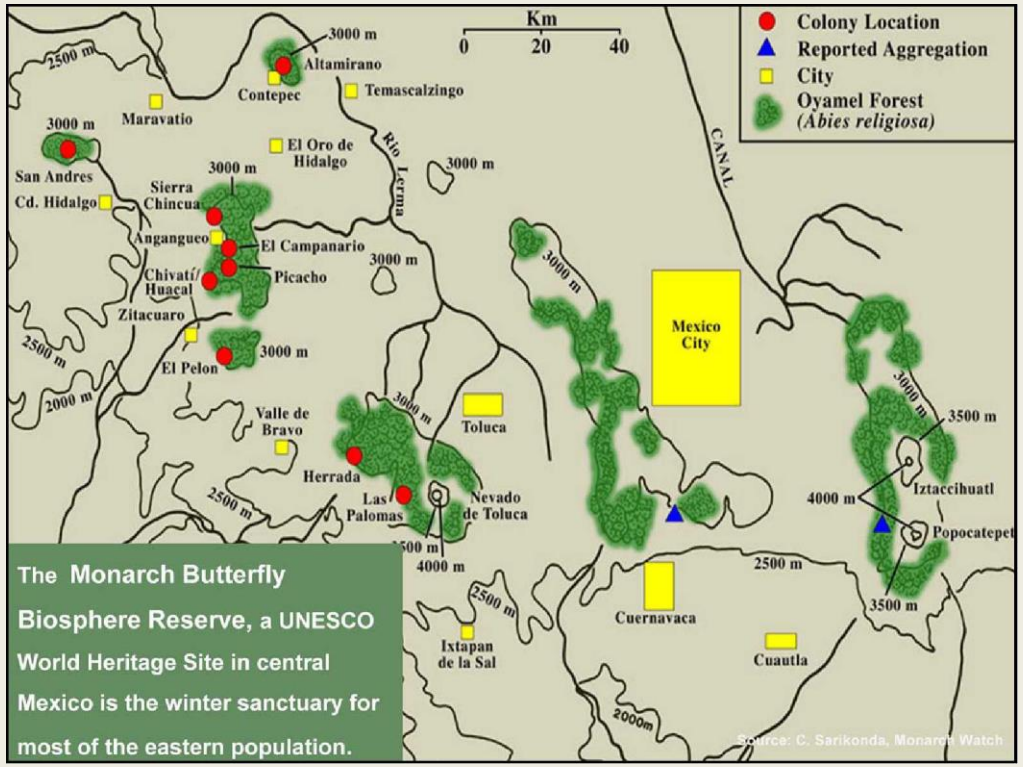


Migration



- Amazing journey
- "Super Generation" butterflies makes the trip to the Sierra Madre Mountains
- Multiple generations on the northern trip
- Probably use Earth's magnetic field and orientation of the sun for navigation

Winter Vacation

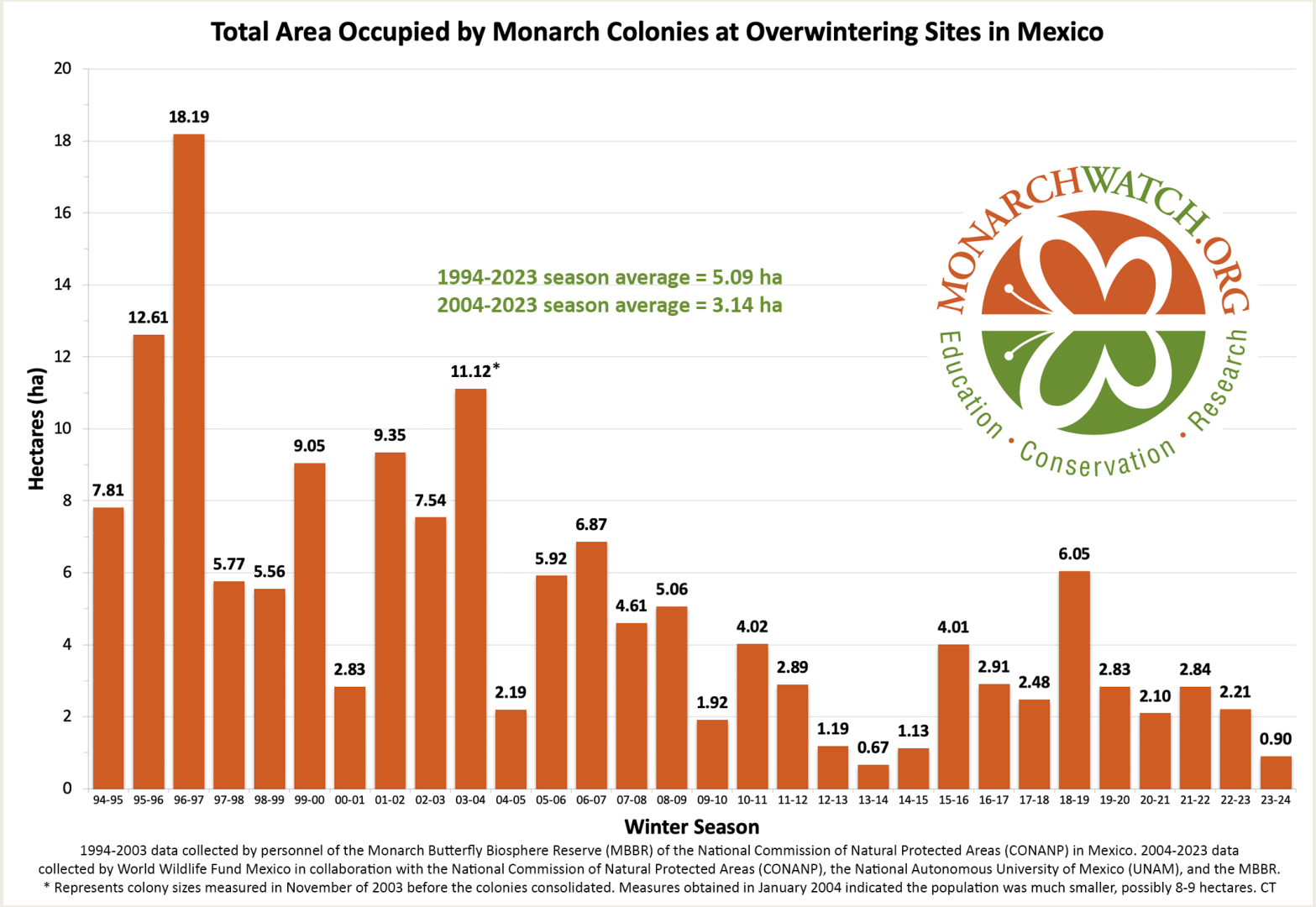


- Approx. 12 major colonies
- Monarch Butterfly Biosphere Reserve
  Core=32,000 ac
  Buffer=104,000 ac
- Communally owned by local farmers
- Changes to Reserve requires permission from many parties
- Illegal logging is a big threat

Overwintering

- Overwintering Monarchs cluster on trunks of oyamel fir trees (*Abies religiosa)* in their cool, moist habitat using southwest facing mountain slopes at around 10,000 feet in altitude
- Oyamel means "*threshing agave*"
- Known as the "*sacred fir*"
- Oyamel fir grows at high altitudes of 6,900–13,500 ft in cloud forests with cool, humid summers and dry winters in most of its habitat regime

Population Declines

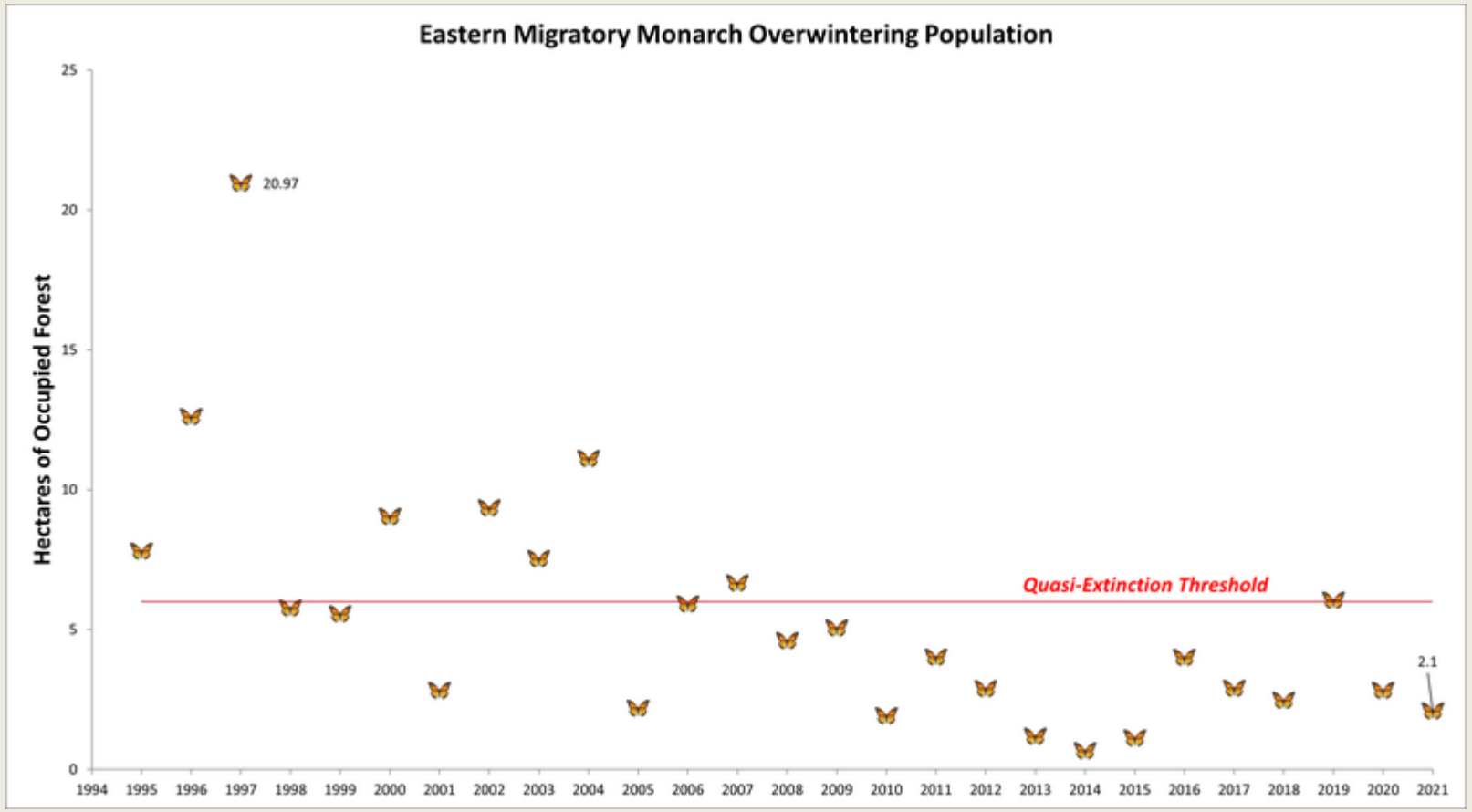


1994-2003 data collected by personnel of the Monarch Butterfly Biosphere Reserve (MBBR) of the National Commission of Natural Protected Areas (CONANP) in Mexico. 2004-2023 data collected by World Wildlife Fund Mexico in collaboration with the National Commission of Natural Protected Areas (CONANP), the National Autonomous University of Mexico (UNAM), and the MBBR.
* Represents colony sizes measured in November of 2003 before the colonies consolidated. Measures obtained in January 2004 indicated the population was much smaller, possibly 8-9 hectares. CT

El Rosario, first week of February 2023. Photo by Estela Romero

El Rosario, last week of January 2023. Photo by Estela Romero

Population is in decline



Center for Biological Diversity

Population is warranted to be listed on the T/E Species List

Threats

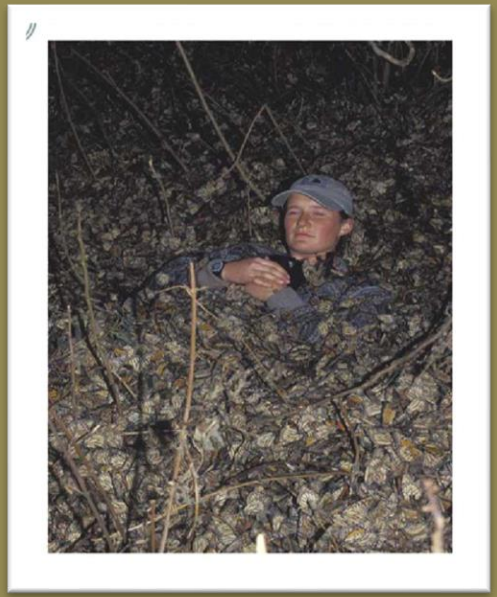
- Breeding habitat losses
- Overwintering habitat losses
- Climate Change
- Agricultural chemicals
- Natural predators
- “Lifestyle”

Vulnerable

- Very vulnerable to bad weather cycles – massive die offs from natural events
- Compounds summer habitat issues and low population numbers
- Monarchs need protection and assistance because the threats they face are so large in scale that it has declined by over 90 percent from the 20-year average since the mid-1990s
-

Vulnerable

- A single winter storm in 2002 killed up to 500 million monarchs in their Mexican overwintering grounds
- 14 times the entire current population
- The “super generation” (can live up to 8 months) is particularly vulnerable to uncontrolable events
- Current drought in SW USA is not helpful either



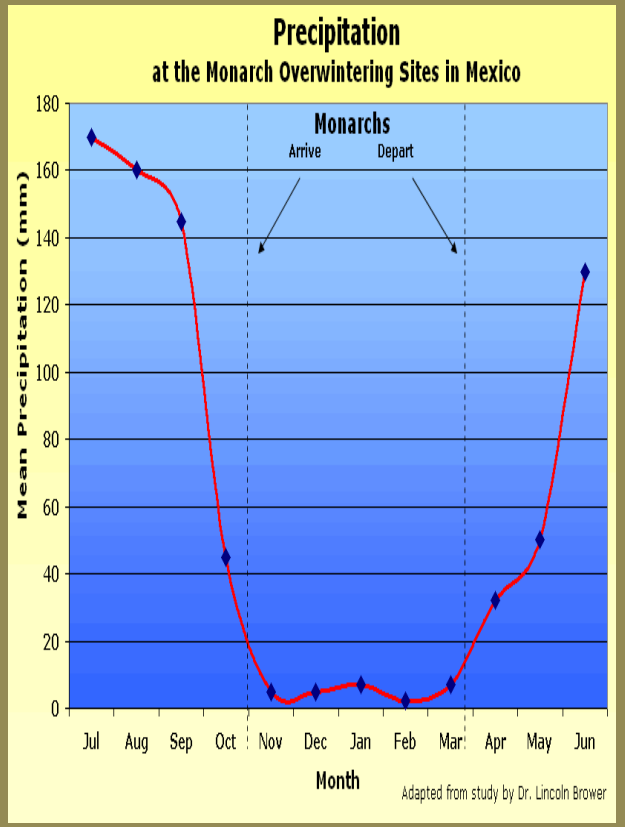
Lying in dead Monarchs

Vulnerable

- Scientists predict that climate change will increase the frequency of drought, heat waves and severe storms that cause high levels of monarch mortality
- Could knock population below “Minimum Viable Population” numbers
- Makes overwintering grounds susceptible to new pests

VULNERABLE - DROUGHT

"Puddling"



GMO Crops and Glyphosate

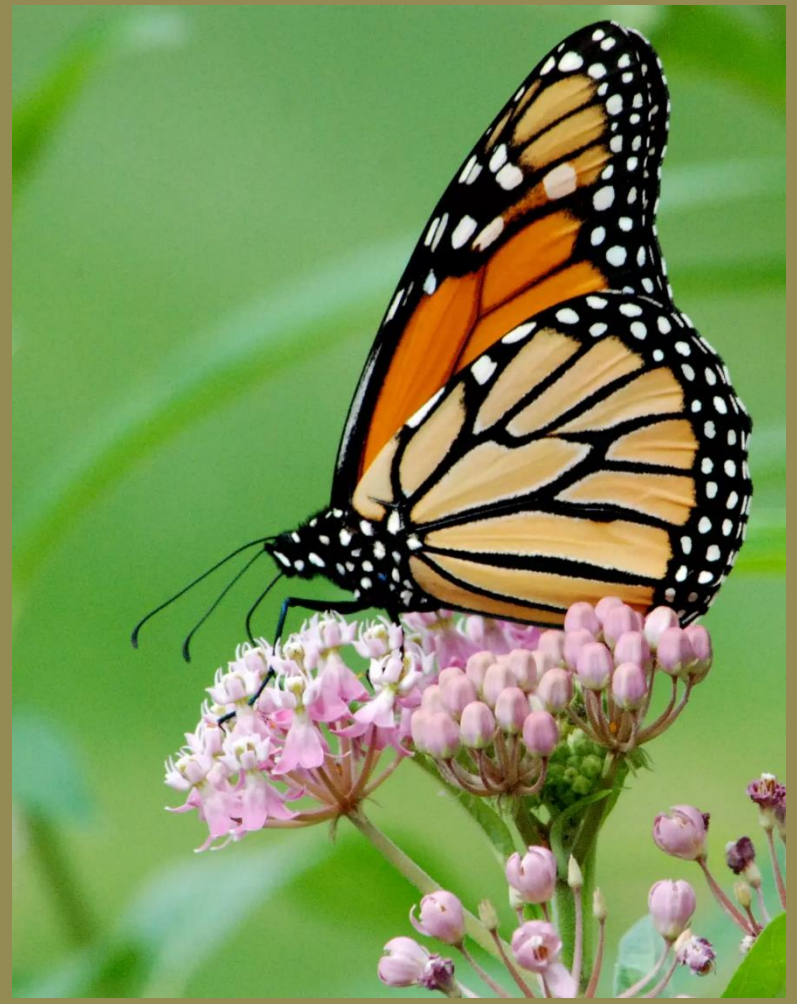
- Genetically modified crops allowed for wholesale spraying of fields with glyphosate – killing much of the milkweeds along hedgerows
- Crop prices and ethanol production encouraged more clearing
- Lost “refugia” for larval food and adult nectar plants

Emerging Threats

- Systemic agrochemicals like neonicotinoids
- Spraying for other insect pests like gypsy moths and mosquitoes
- Bt corn pollen
- New invaders

Federal Listing

- USFWS recently proposed to list the Monarch as a “threatened species” under the ESA
- The listed states probability of extinction for eastern monarchs ranges from 56 to 74%, worst for the Western Population (CA)
- Designating “critical habitat” will be tricky
- It’s a “generalist” species so habitat is sort of everywhere unlike other listed species



Tequila?

- Perfect “partner” for the monarch
- Well known and very regional
- Opportunity for ecotourism and land preservation priorities
- Interesting connection between human culture and Mother Nature

TEQUILA AND MONARCHS

Interesting Tequila Facts

- Similar to the name “champagne”
- Must be from just a few Mexican states surrounding Jalisco to be called “tequila”
- All tequilas are mezcals but not all mezcals are tequila
- Only use blue agave plant (*Agave tequilana*) for tequila

Interesting Tequila Facts

- "Agave Landscape and Ancient Industrial Facilities of Tequila", a UNESCO World Heritage Site
- History with tequila production since the 1500's
- Region of Pre-Columbian Teuchitlan traditional lands
- Red volcanic soils
- Highland and lowland areas

Interesting Tequila Facts

- Take about 8-12 years to produce harvestable plants
- About 300 million plants a year are processed
- Pollinated by bats
- Blue agave contains “aquamiel” which is in the agave syrup used as a table sugar substitute

Monarchs and Mexican Culture

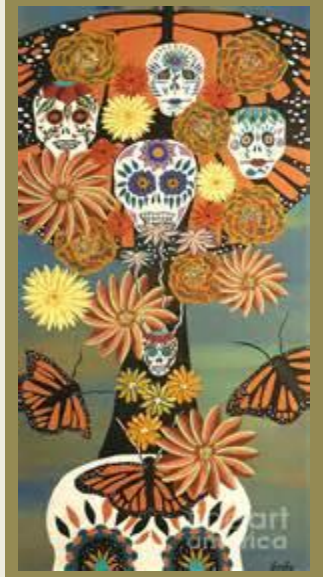
- The native Purépecha Indians, call the ***monarch butterfly*** the ***harvester butterfly***, because monarchs appear when it's time to harvest the corn.
- The Mexican holiday Day of the Dead (*Dia de los Muertos)* occurs when the monarchs appear for wintering
- According to traditional belief, the monarchs are the souls of ancestors who are returning to Earth for their annual visit.

Monarchs and Mexican Culture

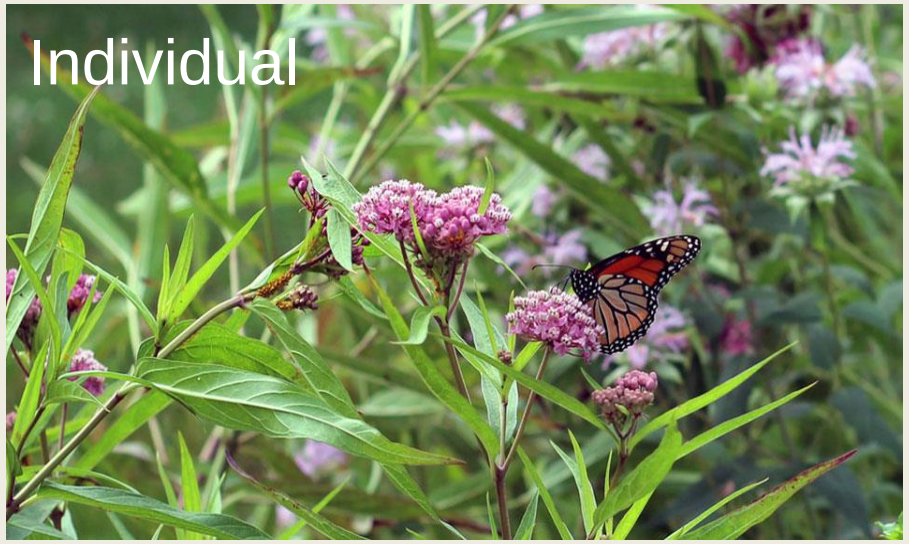
- Day of the Dead coincides with the Christian holy days, All Hallows Eve, All Saint's Day, and All Souls days which are celebrated October 31 through November 2.

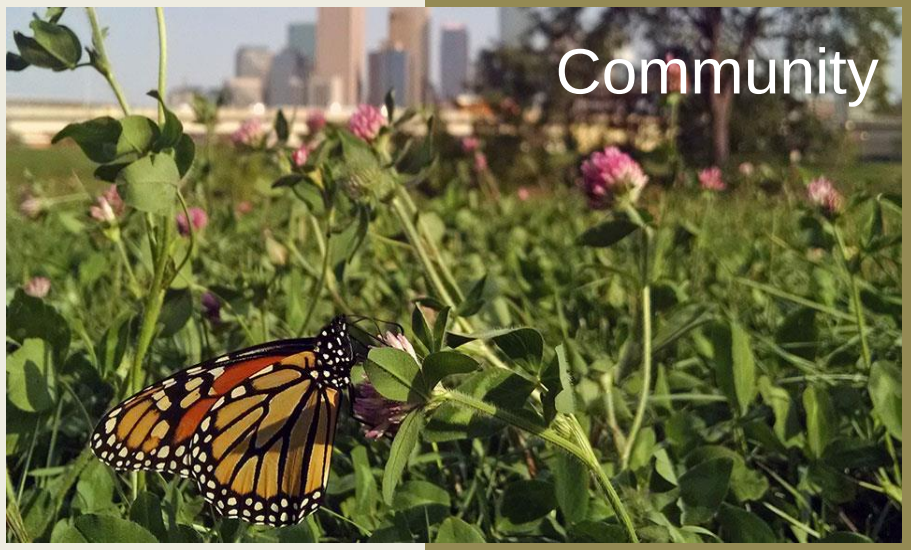
- As Catholic traditions and indigenous cultures mixed, monarchs have come to represent the souls of loved ones returning to visit each year.

Monarchs and Mexican Culture



Approaches - USFWS





North American Initiatives

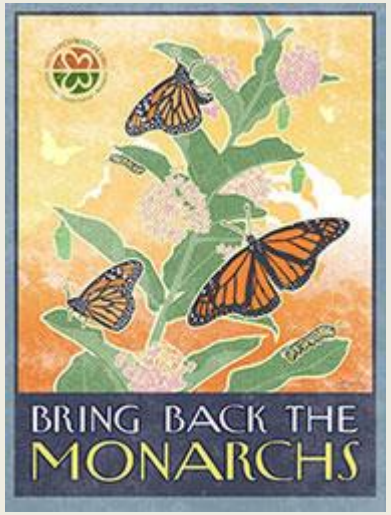
MONARCH JOINT VENTURE

NATIONAL WILDLIFE FEDERATION

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

The Nature Conservancy
Protecting nature. Preserving life.™

National Fish and Wildlife Foundation



POLLINATOR PARTNERSHIP

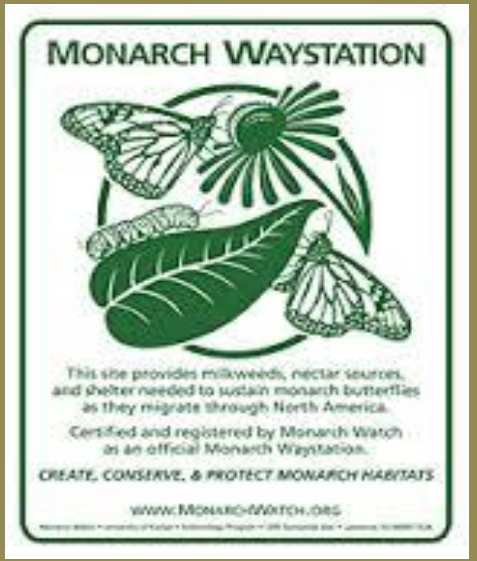
Wild Ones
NATIVE PLANTS, NATURAL LANDSCAPES

PHEASANTS forever

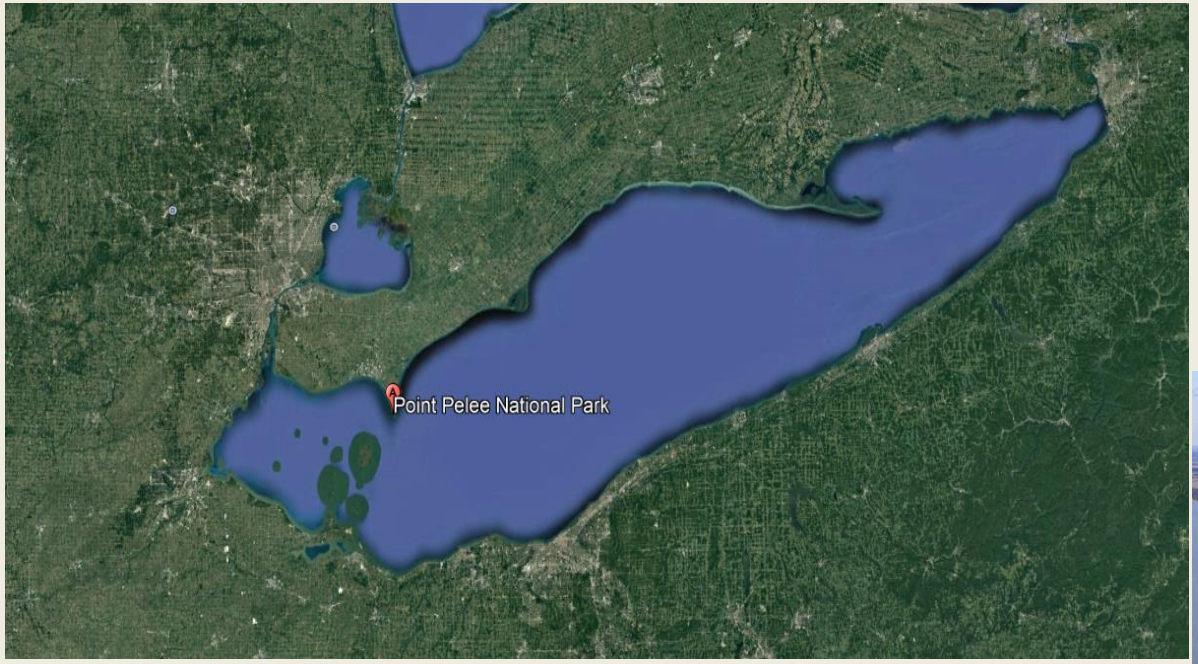
Monarch Watch.org
Education • Conservation • Research

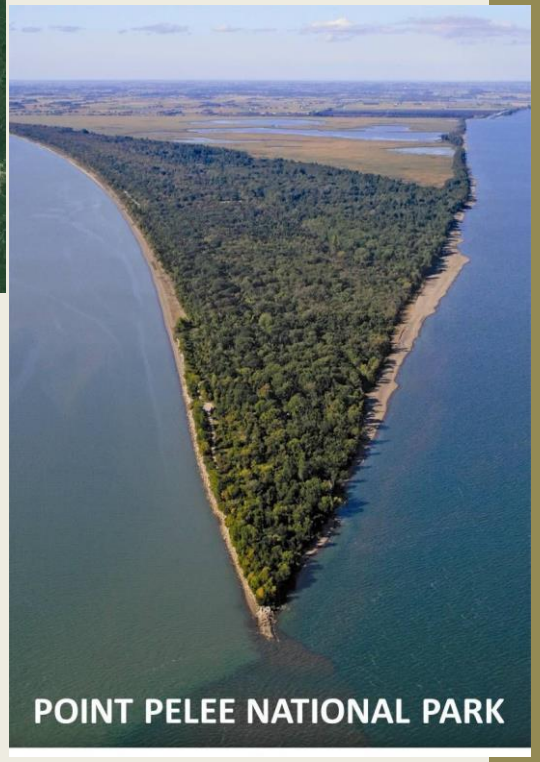
Who doesn't like butterflies?

- Great opportunity for PR at prominent locations
- Very tangible for normal people
- Less esoteric than "carbon sequestration"
- Good for corporate sustainability reports
- Implement plantings almost anywhere



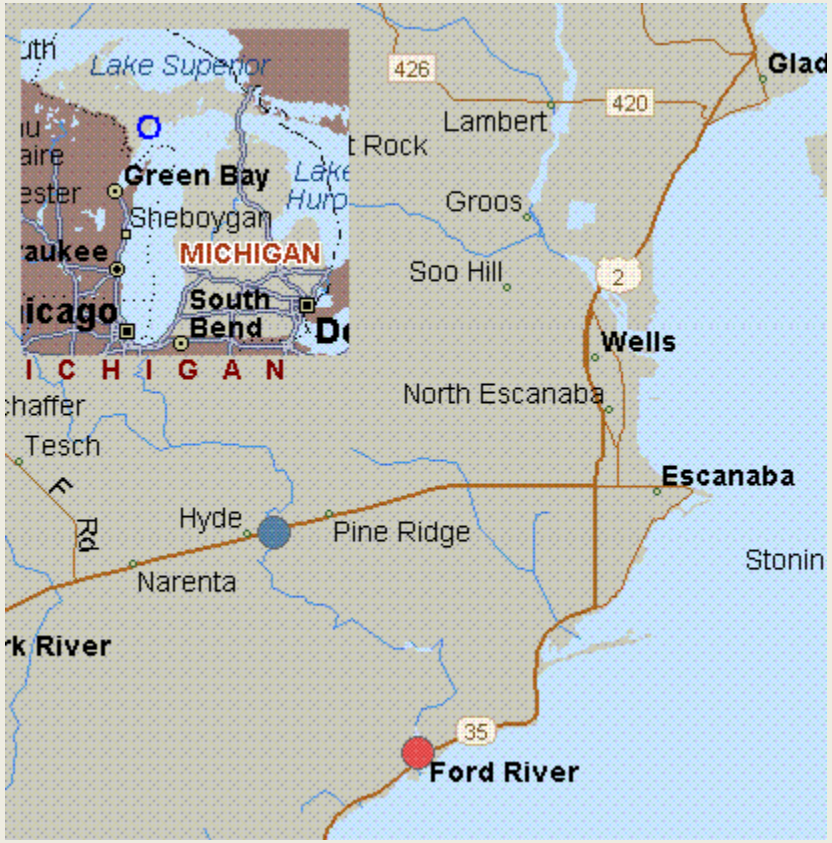
Hot Spots for Migration Viewing





- Southernmost point of Canada
- Last piece of land before butterflies (and birds) have to fly over Lake Erie
- Animals get concentrated along peninsula and makes for great viewing
- 6 hour drive from Lake Forest

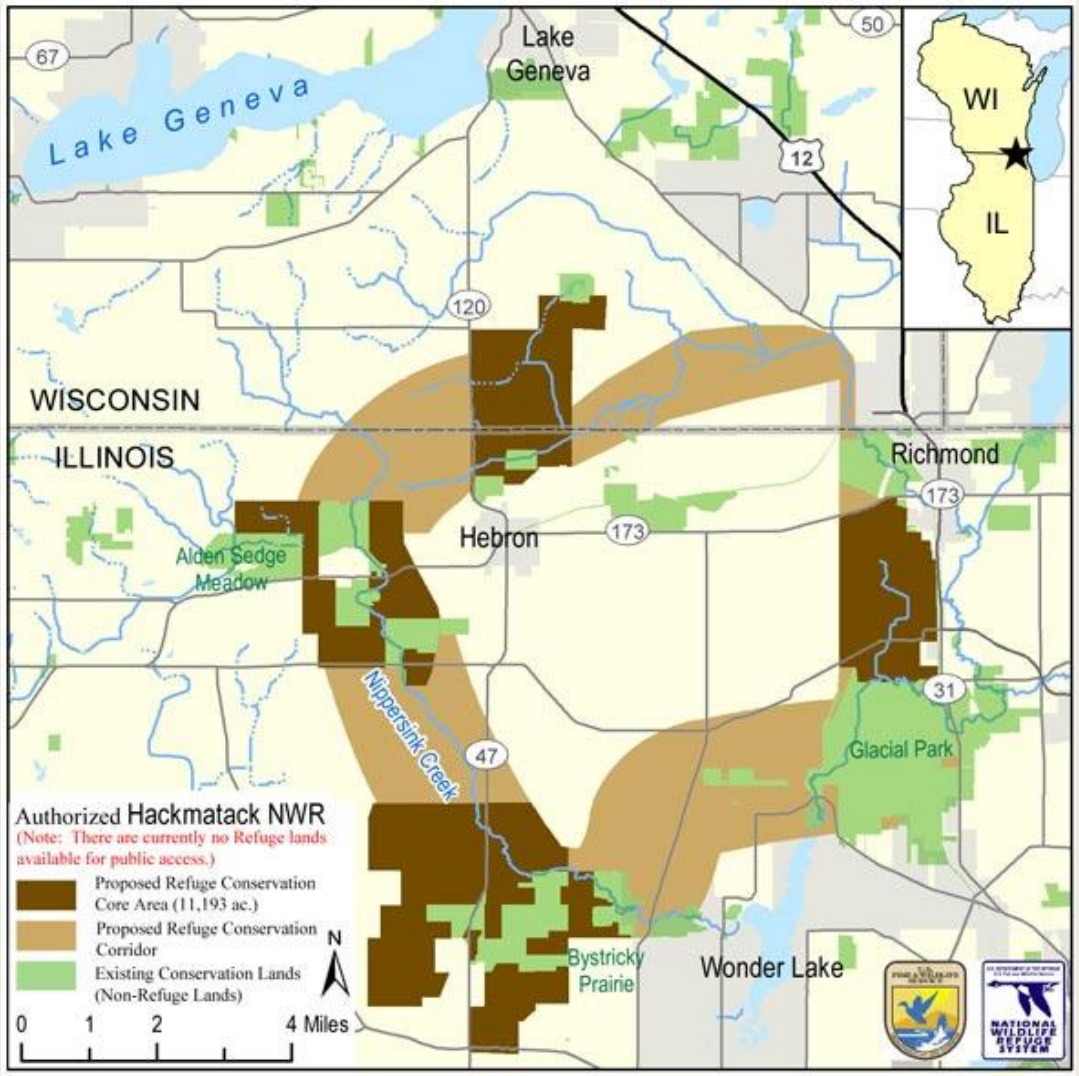
Hot Spots for Migration Viewing

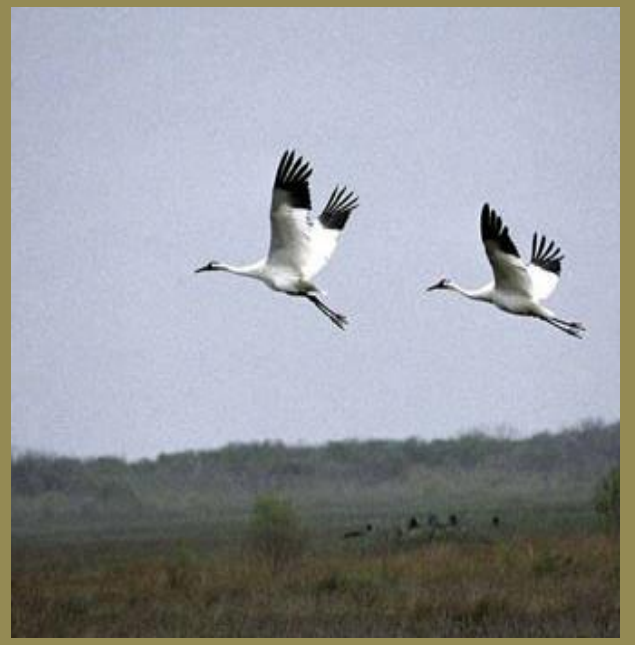


- Tawas Point State Park near Escanaba, MI
- Sticks out of coastline of Lake Michigan
- Stonington Point
- 4.5 hours drive from Lake County

Hackmatack NWR

http://www.hackmatacknwr.org





Hey and Associates, Inc.

Goals of Hackmatack NWR

1. Protect and enhance habitats for grassland-dependent migratory birds and protection of wetlands and grasslands.

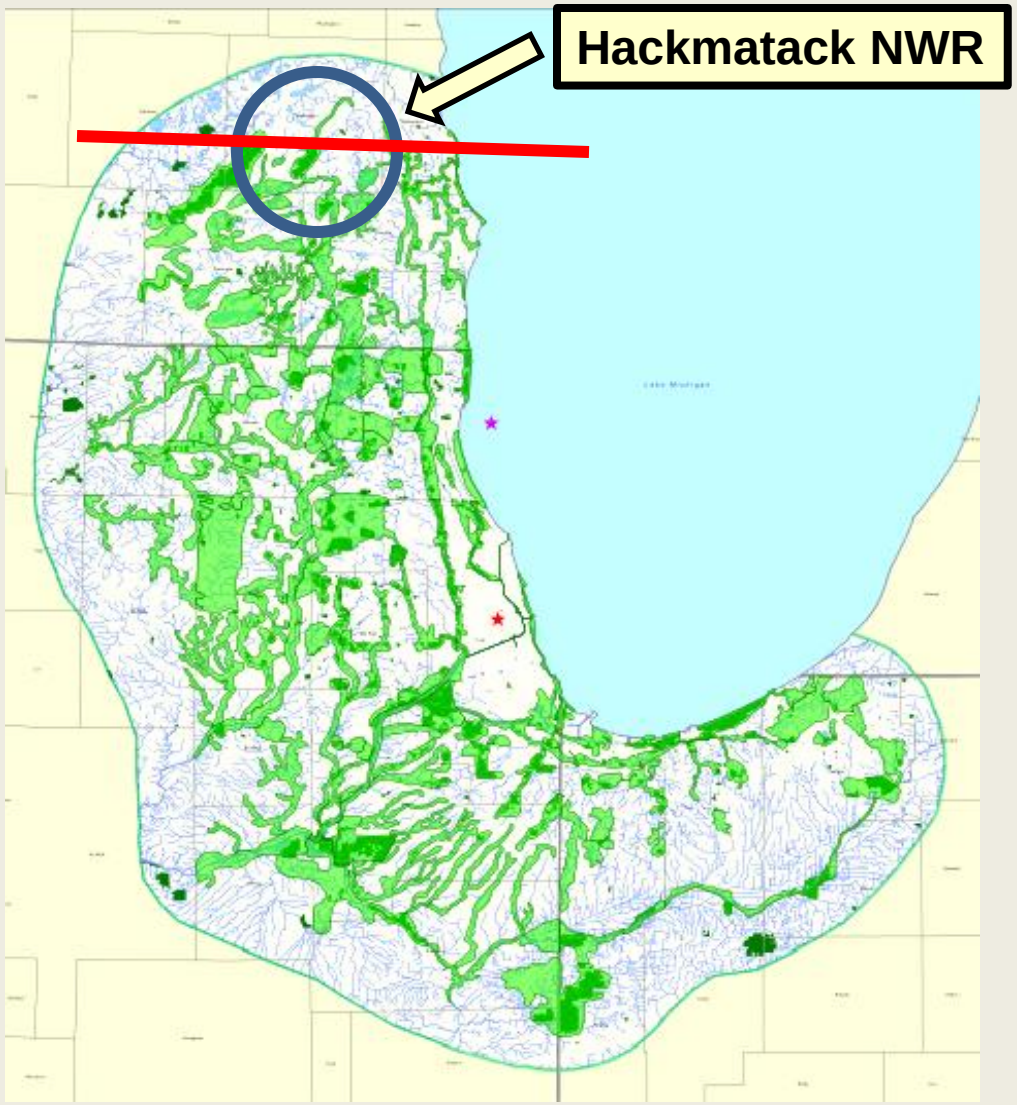
Goals of Hackmatack NWR

2. *Create opportunities for hunting, fishing, wildlife observation and photography, and environmental education and interpretation.*

Goals of Hackmatack NWR

3. Promote science, education, and research to encourage responsible stewardship of our natural resources.

Hackmatack NWR



12 million people are within 1.5 hour drive of HNWR

Fits within the Chicago Wilderness Green Infrastructure Plan

The Green Infrastructure Vision represents a protected landscape totaling 1.8 million acres that implements the goals of the CW Biodiversity Recovery Plan.

CW – alliance of over 300 organizations pledged to support the region's biodiversity.

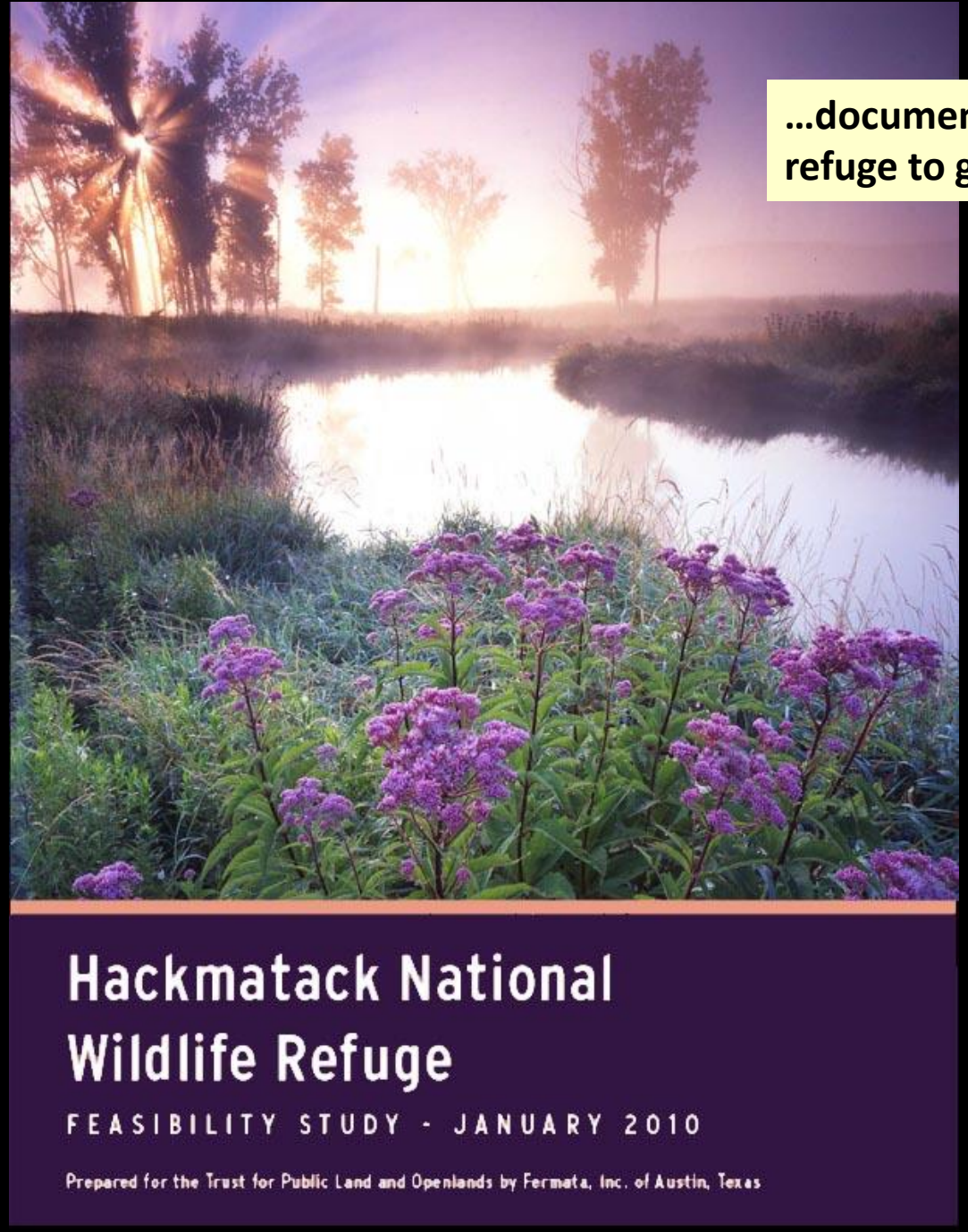
Hackmatack NWR

- Grassland bird habitat priority
- Multiple species, terrestrial and aquatic benefit by retiring row crop agriculture to perennial cover
- Non-point pollution controls for Nippersink Creek/Fox River
- “Urban” NWR that is accessible to 12 million people


Mosaic of natural communities (from the INAI Inventory):
- black soil savanna G1 critically imperiled globally
- dry-mesic forest
- oak barrens G1 critically imperiled globally
- mesic prairie G2 imperiled globally
- wet prairie
- sedge meadow
- marsh
- graminoid fen
- low shrub bog
- low gradient stream

Hackmatack is designed for a variety of species

Hackmatack is for *People too*!!



…documenting the economic value of a refuge to gateway communities…

Economic Engines of Hackmatack NWR:

Agricultural Heritage

Existing Trails, Grand Illinois trail system

Gateway Communities

Complimentary Recreational opportunities

U.S. Fish and Wildlife Service - Urban Refuge Policy:

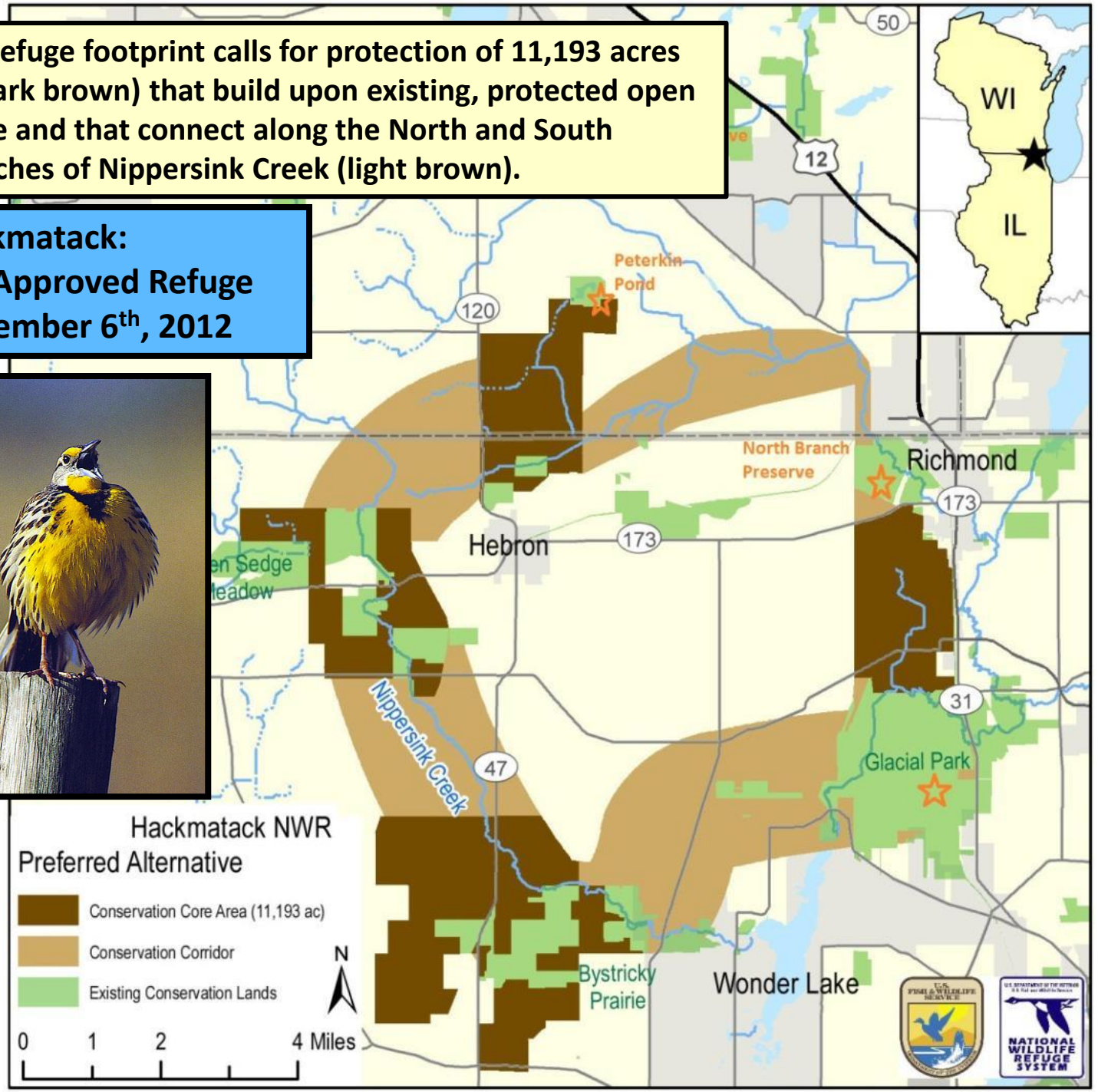
…it shall be the policy of the USFWS to acquire land and waters…that will provide the public wildlife oriented recreation, education and interpretation opportunities…(and) to foster environmental *awareness…to develop an informed and involved citizenry that will support fish and wildlife conservation.*

Refuge Oriented Tourism

- ✓ <u>Nationally</u> National Wildlife Refuges
  - ✓ 40 million people visit annually
  - ✓ Generating $ 2.4 billion in sales for local economies
  - ✓ creating 37,000 private sector jobs and
  - ✓ producing $793 million in employment income.
- ✓ <u>Regionally</u> Chicago area birding community generates more than $*356 million* per year into local economies.
- ✓ <u>Locally:</u> Fermata study estimated 200,000 visitors spending $7 - $25 million annually at Hackmatack

The refuge footprint calls for protection of 11,193 acres (in dark brown) that build upon existing, protected open space and that connect along the North and South Branches of Nippersink Creek (light brown).

Hackmatack: the Approved Refuge November 6th, 2012



Hackmatack Conservation Partnership
Land Protection Plan (MOU)

Six original partners, including USFWS, signed on to a corresponding MOU that defines roles of partnership members – and four new partners have signed on since 2014

U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

DUCKS UNLIMITED

McHenry County Conservation FOUNDATION

Friends of HACKMATACK National Wildlife Refuge

KETTLE MORAINE LAND TRUST

The Land Conservancy of McHenry County
Preserving Land Forever

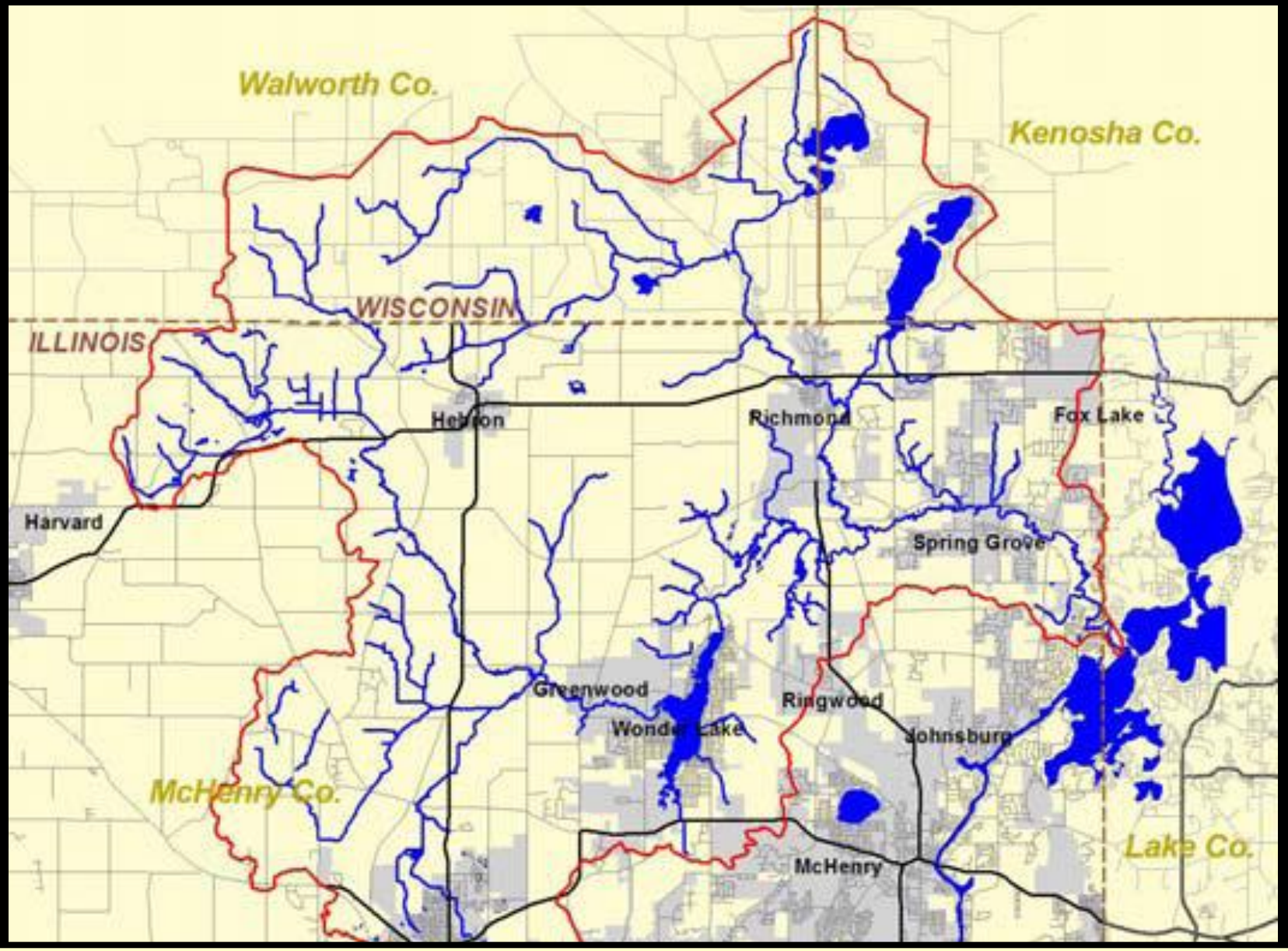
openlands
conserving nature for life

McHenry County CONSERVATION DISTRICT

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

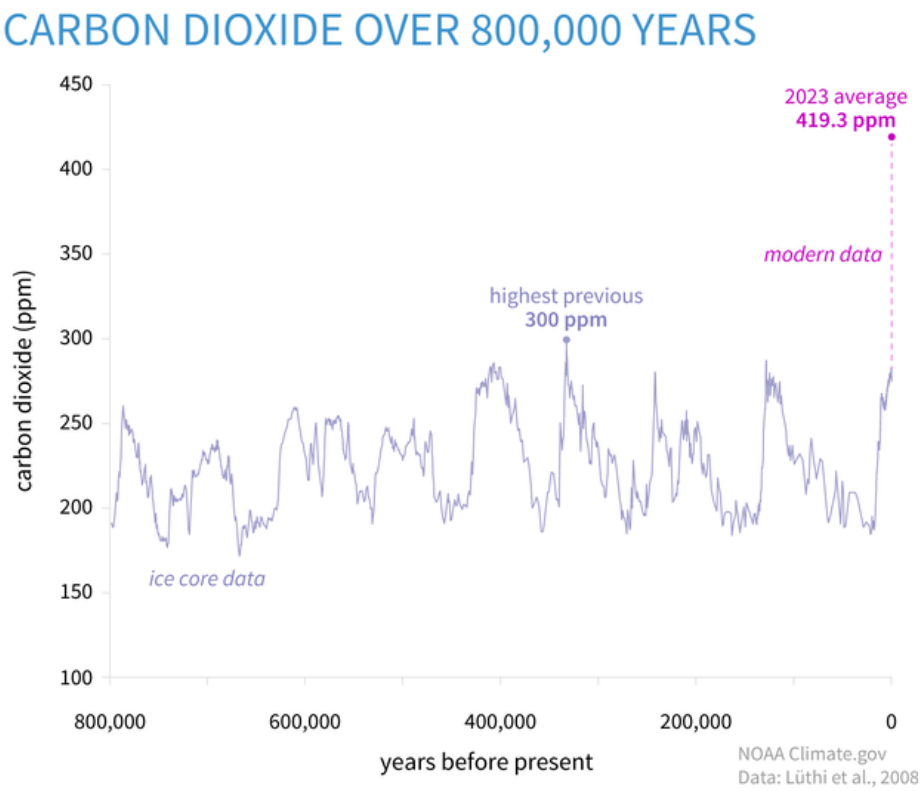
Geneva Lake Conservancy

Nippersink Watershed Association



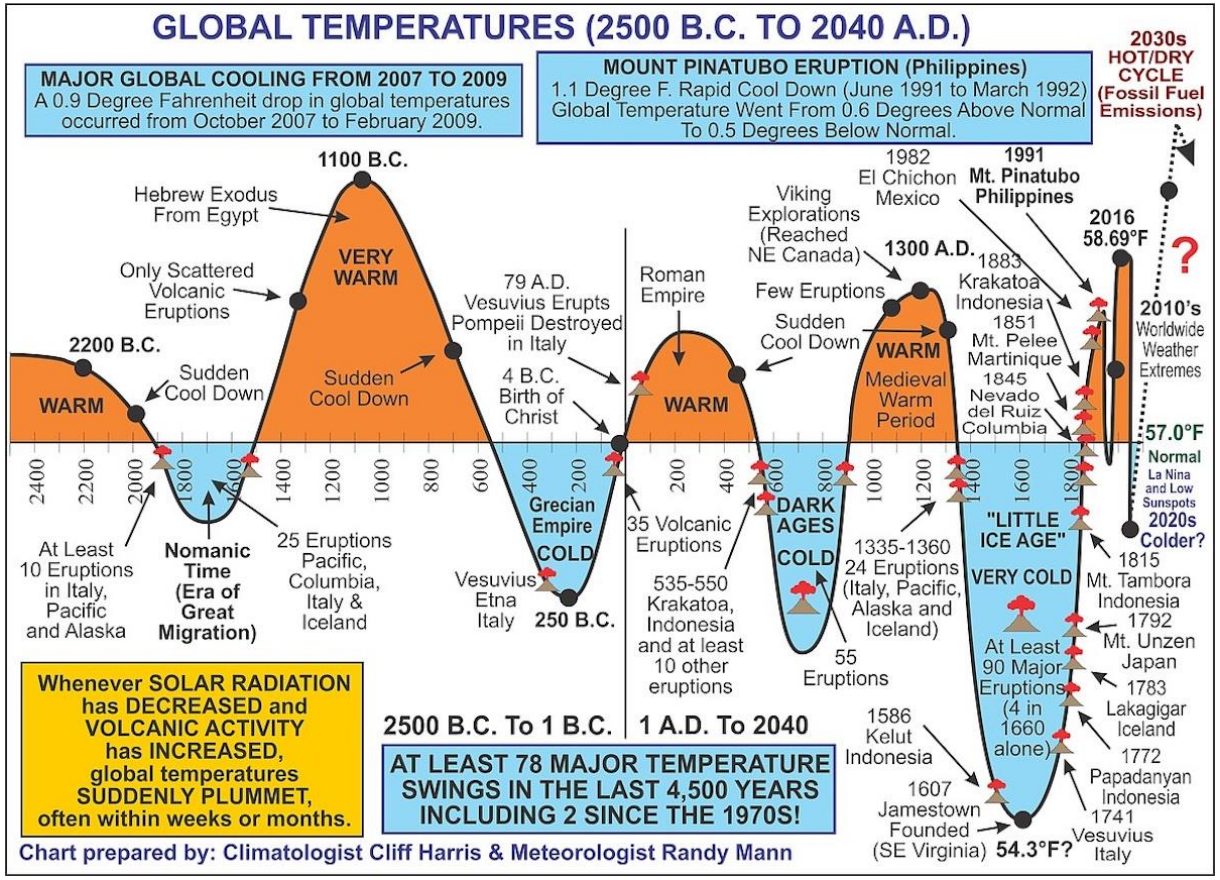
Nippersink Creek watershed is 202 square miles and includes an elevational change of 453 ft, from 1189 ft above msl to 736 ft above msl.

CO2 Levels - Cyclical over time, and then….



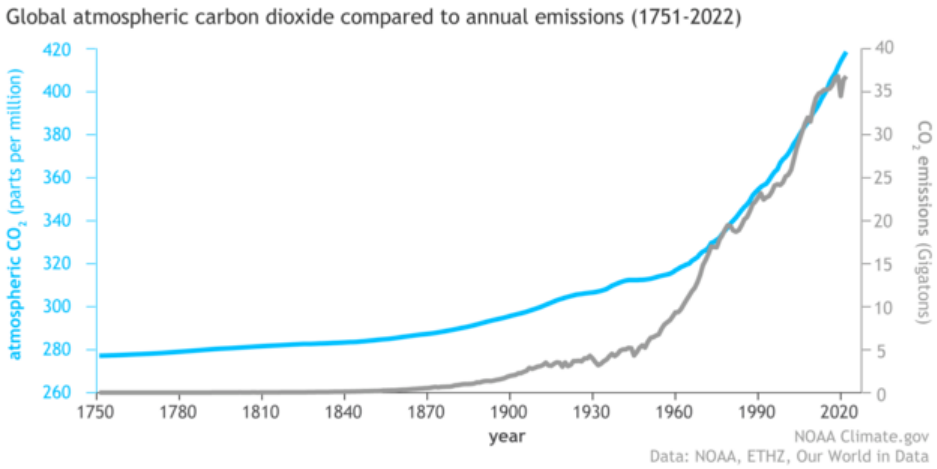
“Safe level of atmospheric carbon dioxide = 350 ppm”

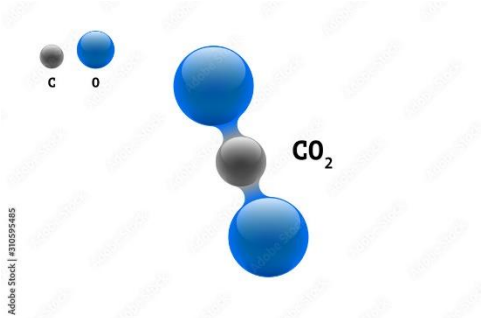
Weather and Climate Trends



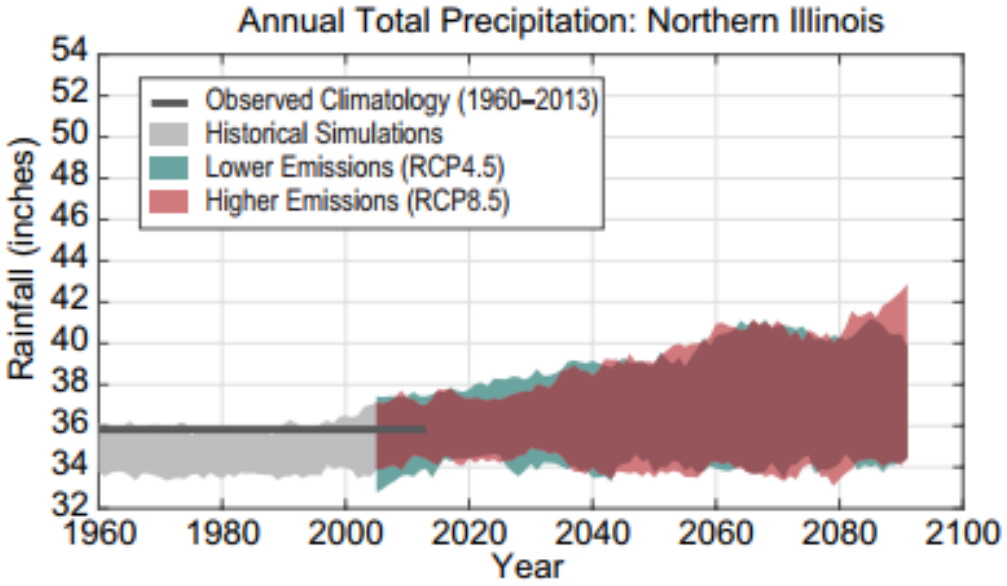
Certainly, weather has been a moving target and has influenced human history in many ways and events

Correlation is clear





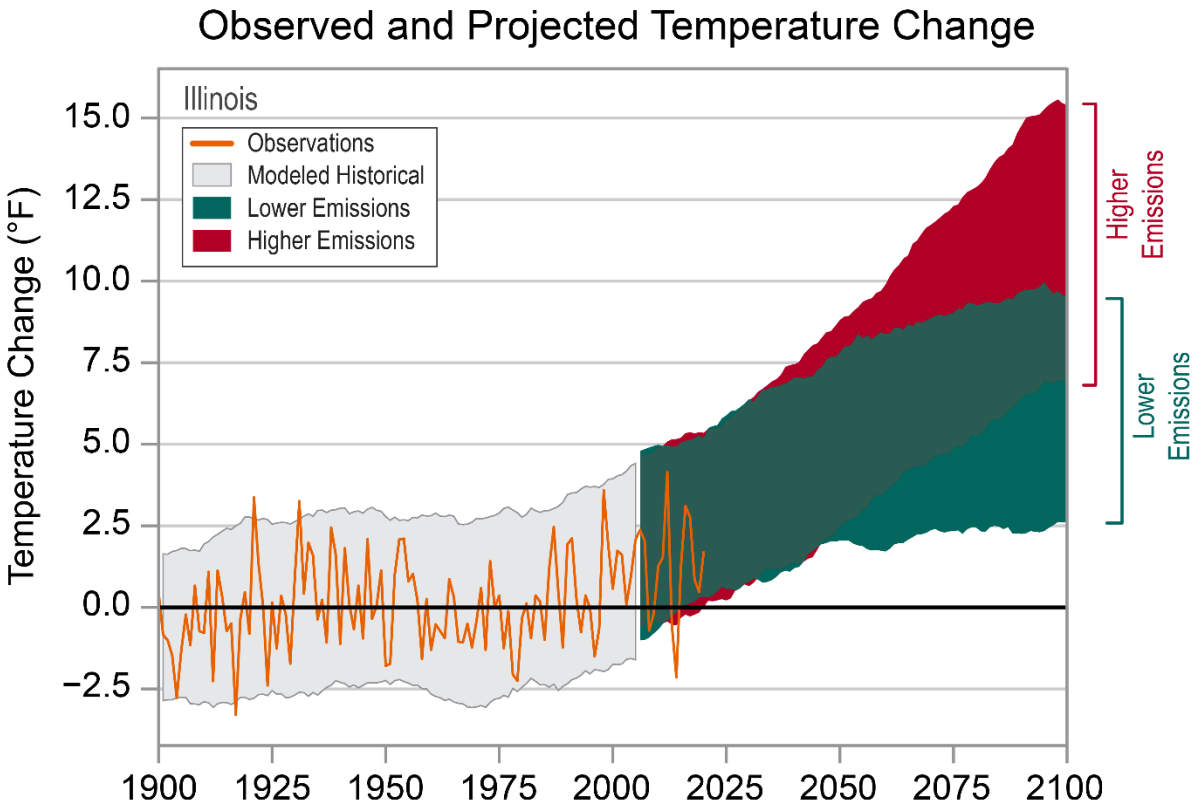
Through what mechanisms?



Weather patterns:

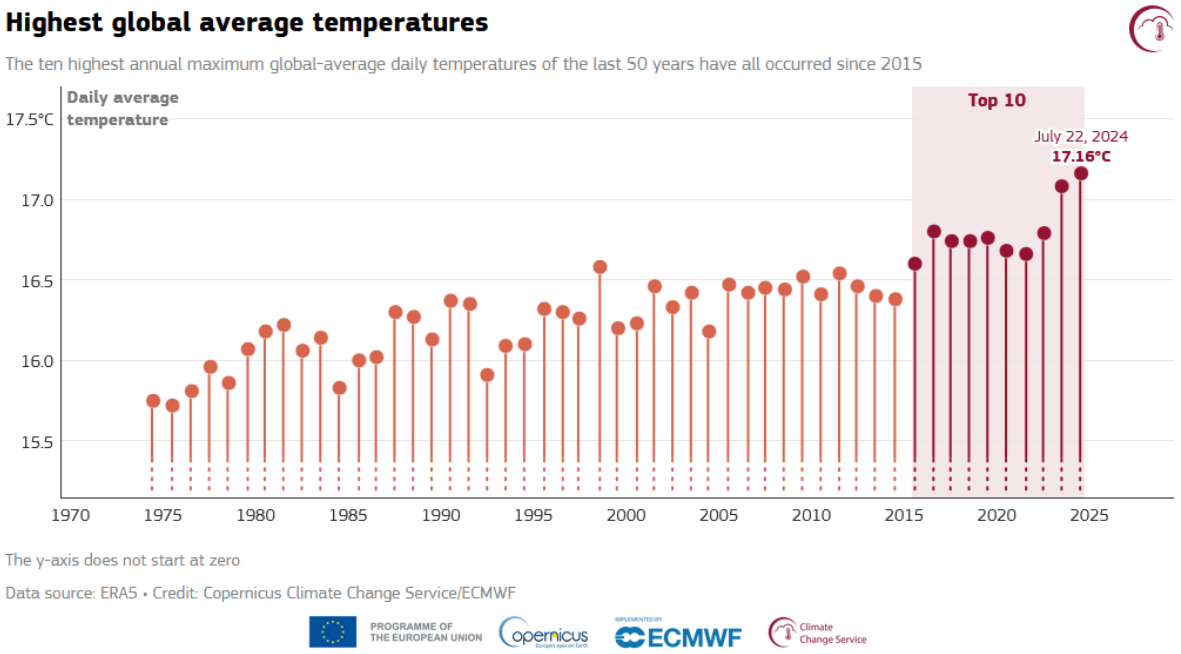
- Wetter winter and springs
- Hotter summers
- Warmer nights
- More heavy rainfall
- More droughts

Illinois temperature change



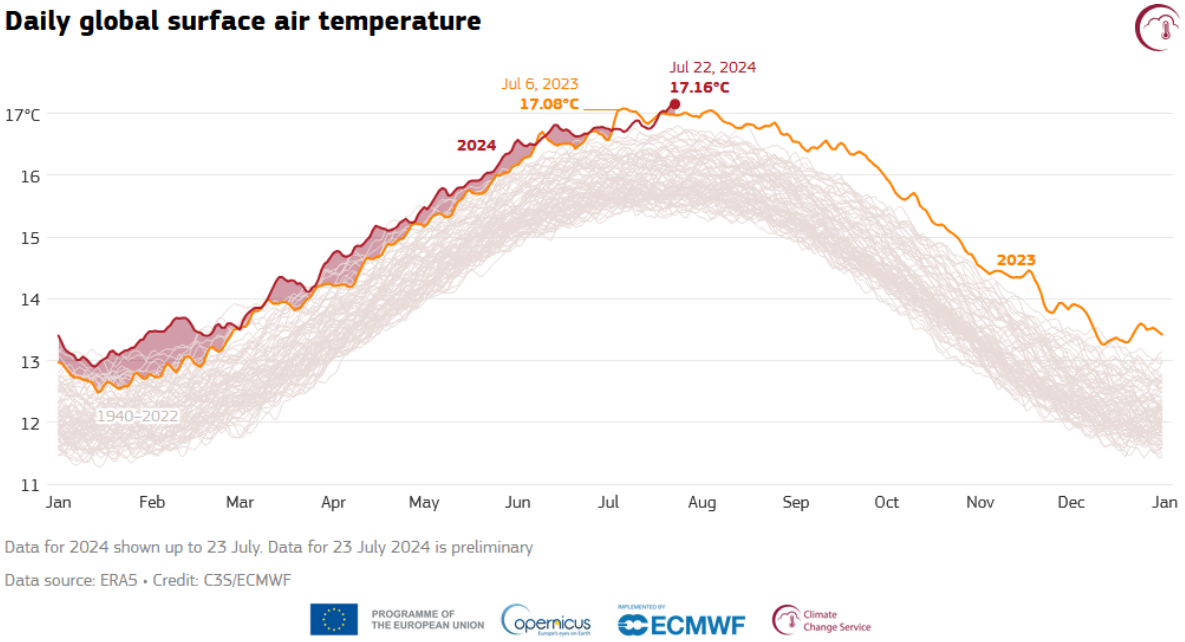
Trend is clear but the extent depends on the amount of emissions mitigation is implemented

Hotter planet



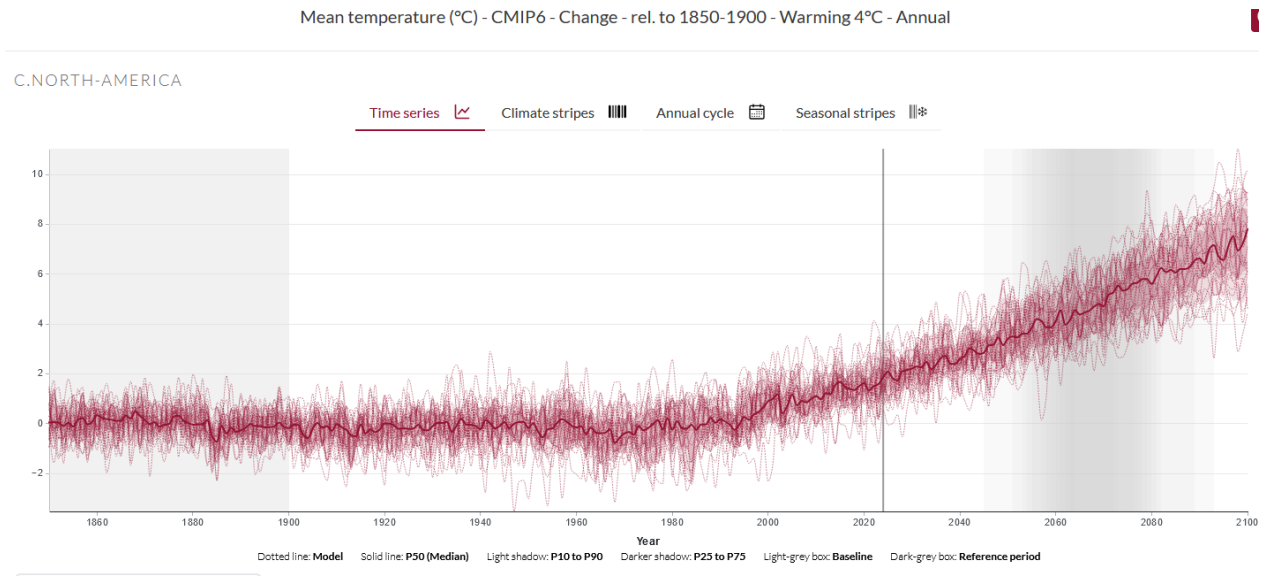
- Pattern is pretty obvious

Hotter planet



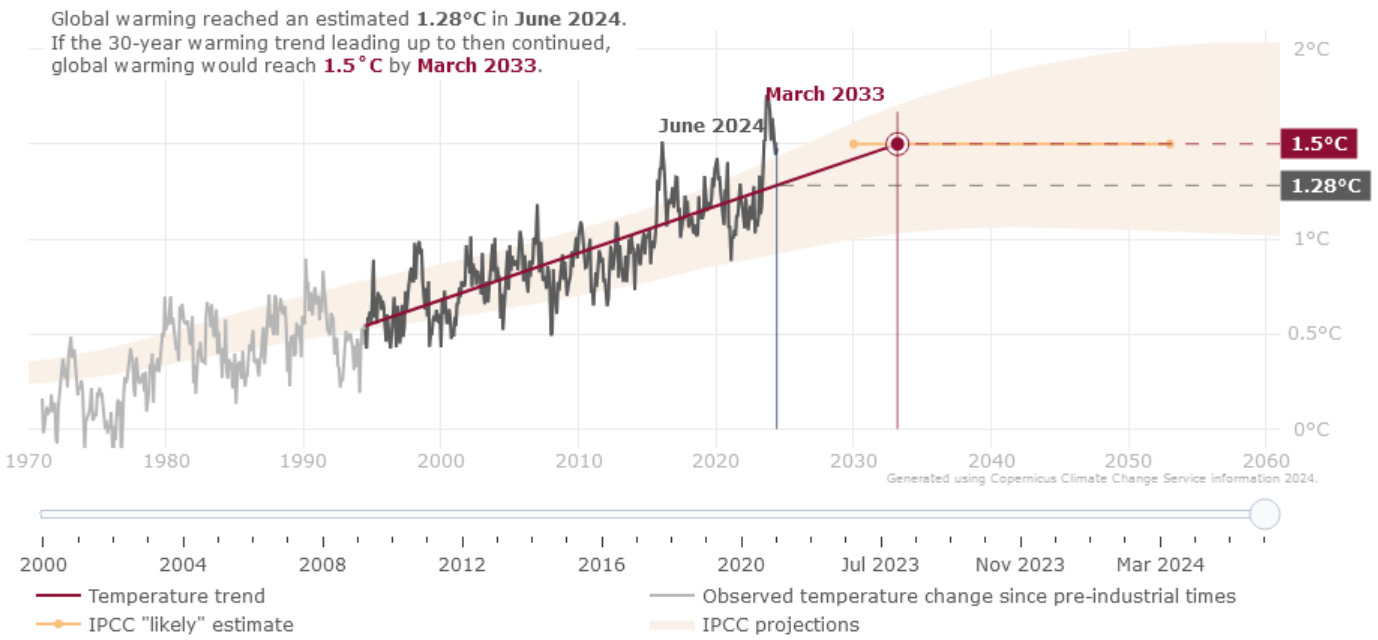
- Hottest global temperature ever recorded on July 22, 2024 at 17.16 C
- Previous high temp was recorded in 2023

Hotter planet

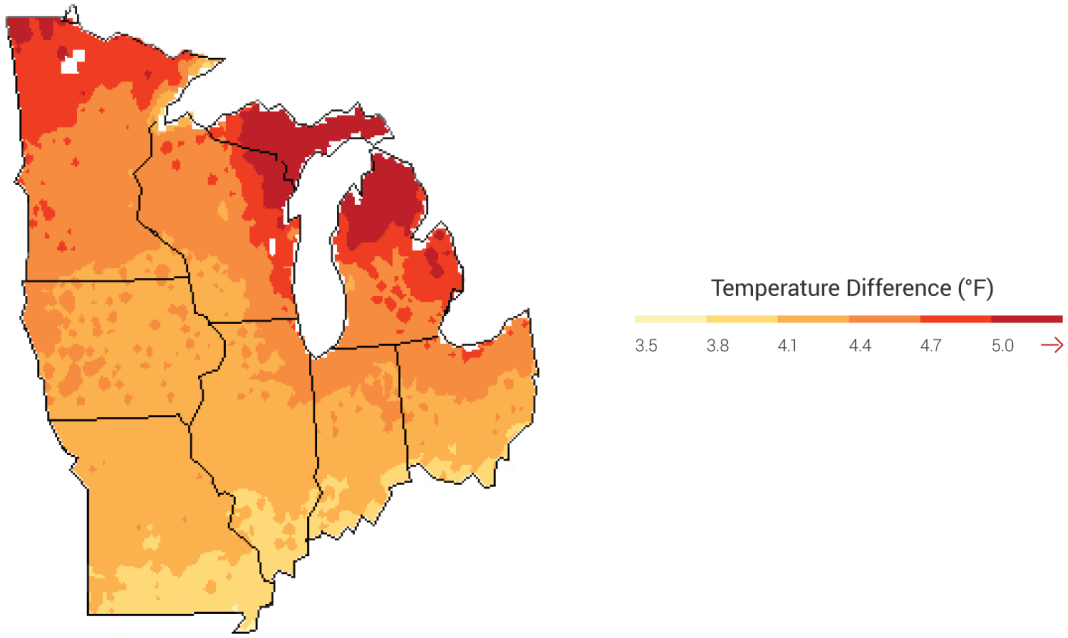


- Current record is 17.16 degrees C for global temperature
- 2100 global temperature would be around 19-21 degrees C, if present trends continue

Trending

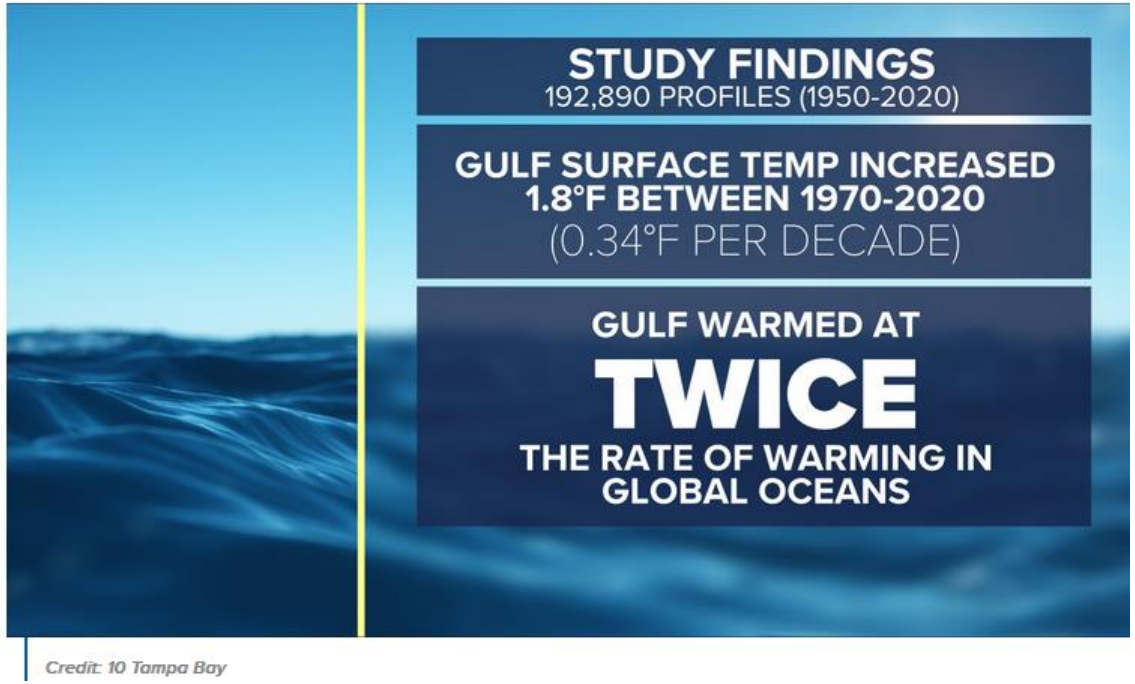

Global warming reached an estimated 1.28°C in June 2024.
If the 30-year warming trend leading up to then continued, global warming would reach 1.5°C by March 2033.
March 2033
June 2024
1.5°C
1.28°C
2°C
1°C
0.5°C
0°C
1970
1980
1990
2000
2010
2020
2030
2040
2050
2060
Generated using Copernicus Climate Change Service information 2024.
2000
2004
2008
2012
2016
2020
Jul 2023
Nov 2023
Mar 2024
Temperature trend
IPCC "likely" estimate
Observed temperature change since pre-industrial times
IPCC projections

Hotter



Projected increase in annual average temperatures by mid-century (2041-2070) as compared to the 1971-2000 period.

Gulf of Mexico

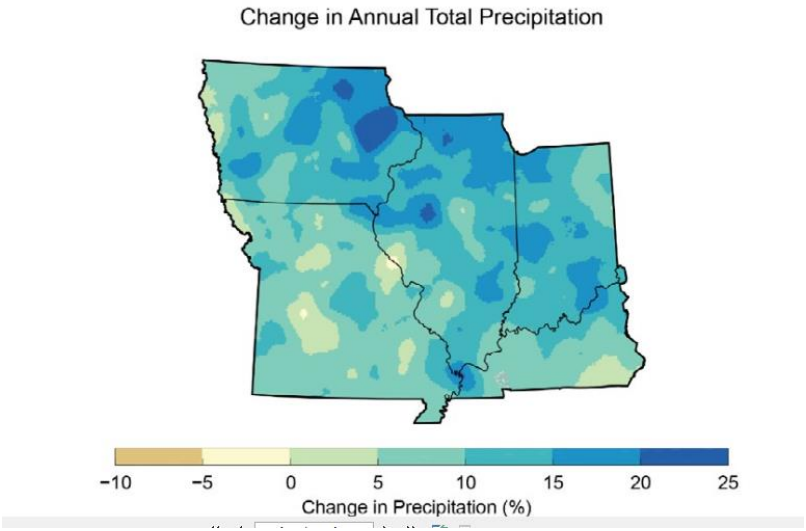


Credit: 10 Tampa Bay

- Water temperature and energy from Gulf of Mexico fuels hurricanes and tornadoes
- Gulf Stream impacts to Europe could be significant
- Atlantic Meridional Overturning Circulation is changing and would influence the entire Northern Hemisphere and Europe
- Europe may actually get colder due to changing energy transport from Gulf Stream due to disruption of subtropical winds

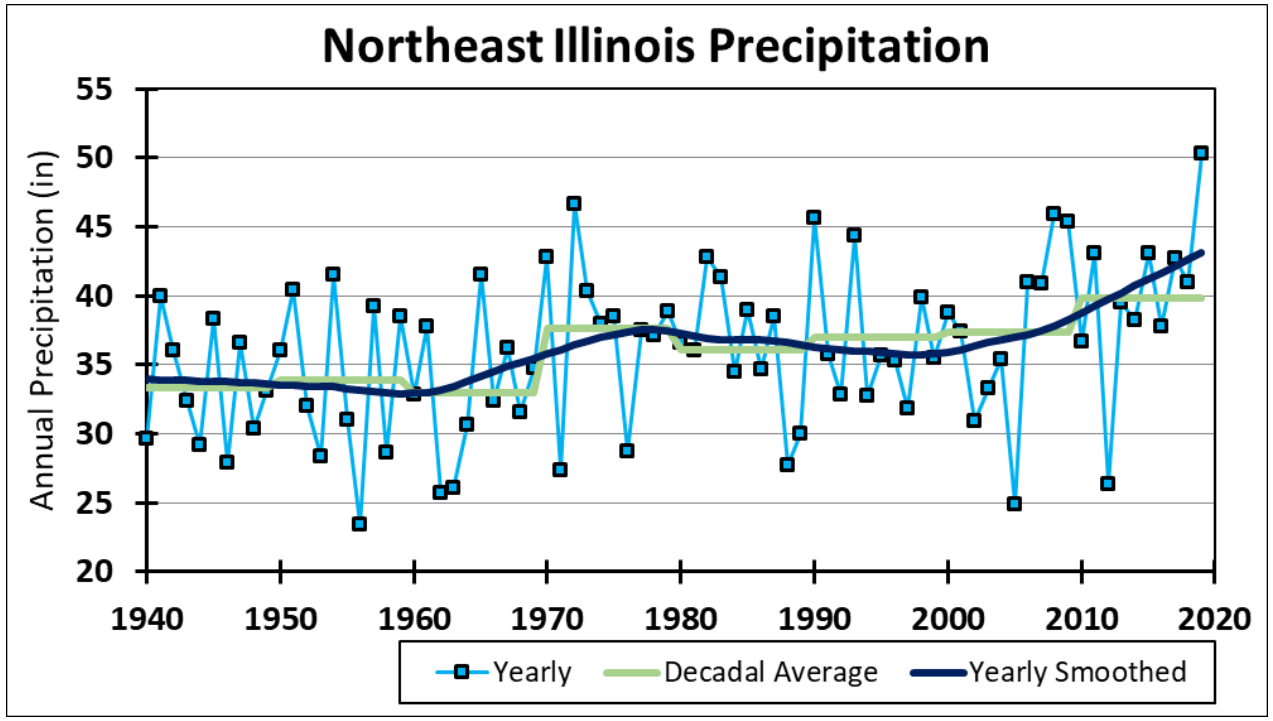
Midwest precipitation

Season	Precipitation (inches)	Precipitation (% Change)
Winter	+0.54	8.5%
Spring	+1.33	12.5%
Summer	+1.55	14.3%
Fall	+1.33	15.9%



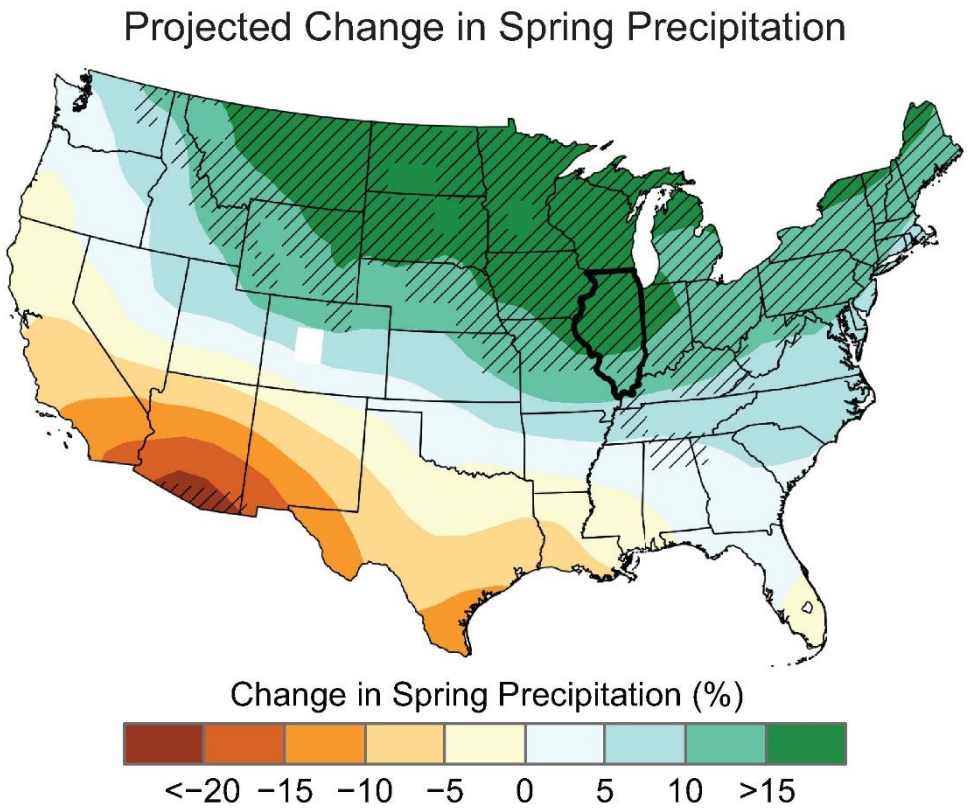
- Most of the Midwest will receive more rainfall
- Northern IL will undergo more change more than southern IL
- Changes spread throughout the season

Midwest Annual Precipitation



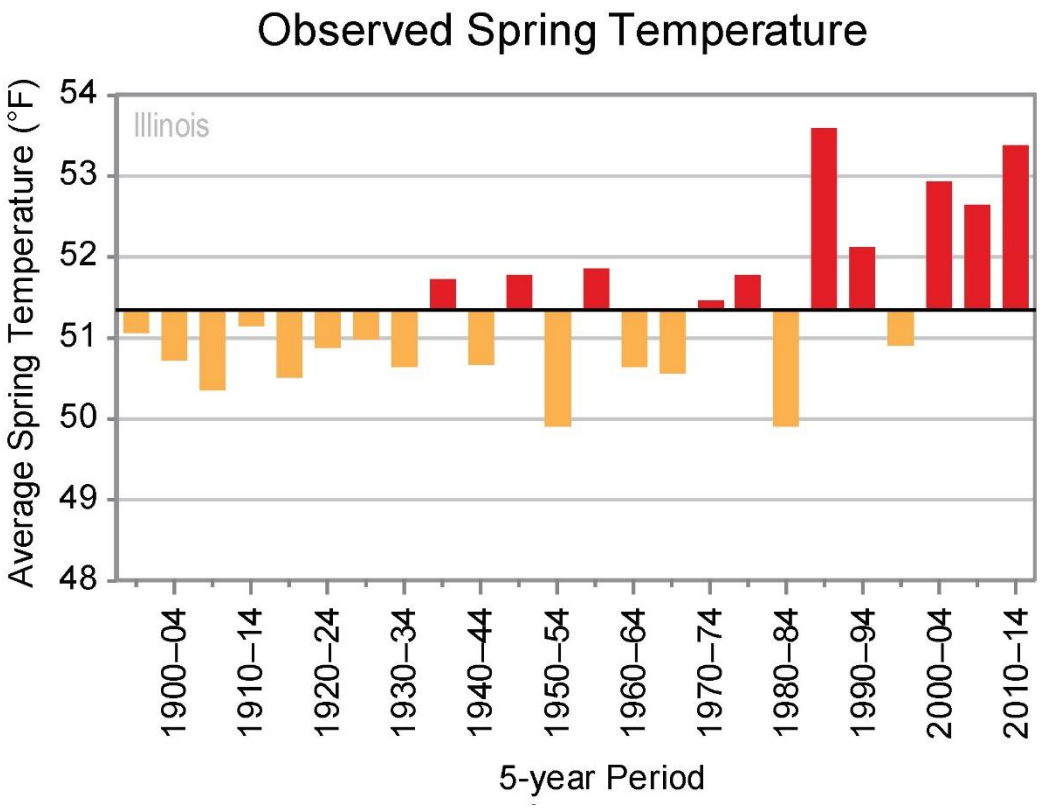
- More overall precipitation – snow and rainfall
- Trends have already been observed in the statistics, not theoretical
- Statewide update in design parameters for stormwater management requirements (Bulletin 75)

Midwest Spring Rains



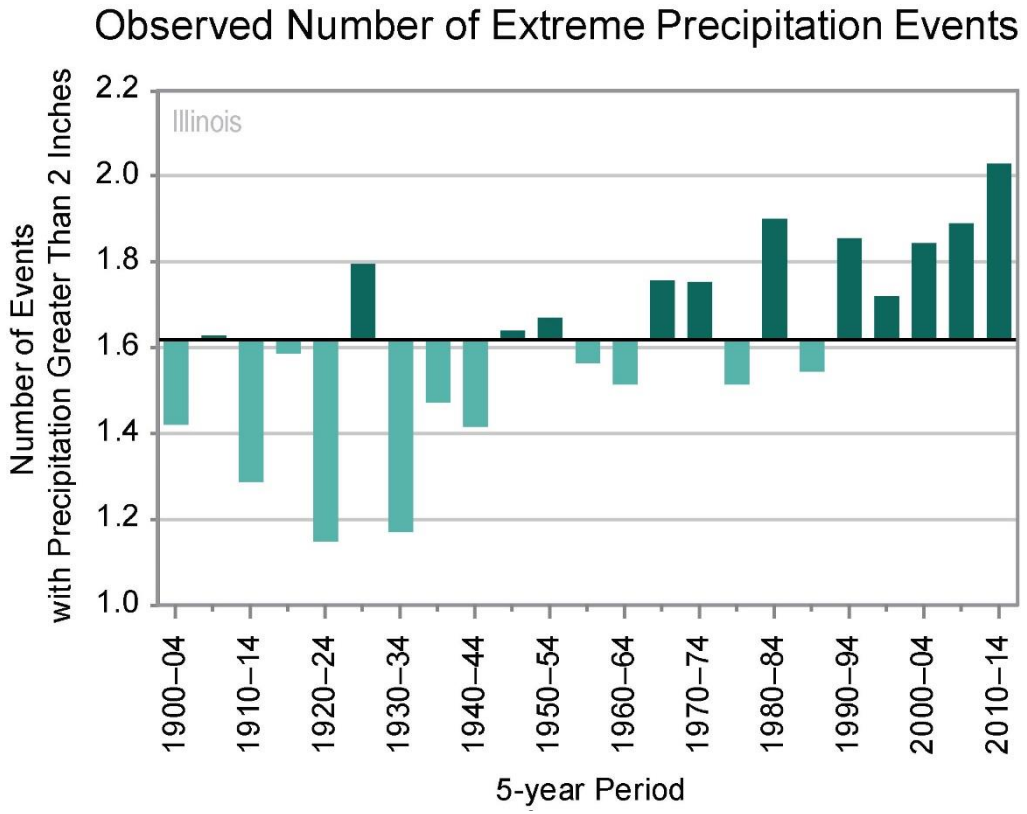
- Spring rains are good for wetlands, right?
- Upper Midwest and Plains will have wetter winters and springs
- But, wetlands will dry out faster!

Midwest Higher Spring Temps



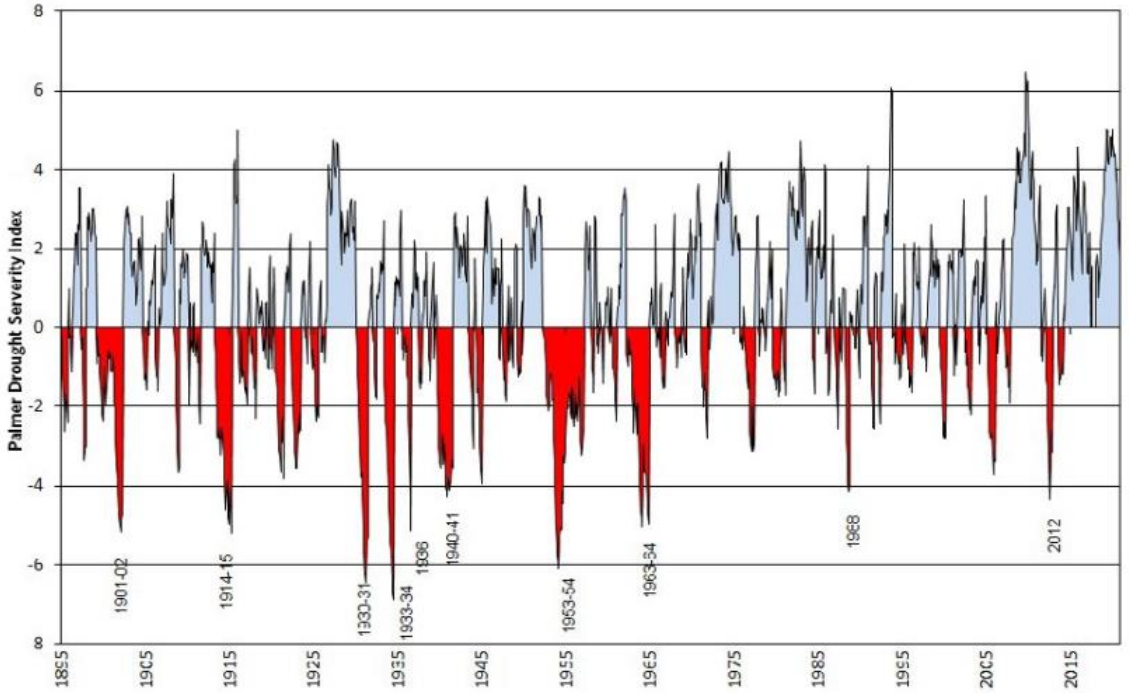
- Warmer temperatures will result in more evapotranspiration
- Wetlands will be wetter in the spring but will dry out faster

Extreme events



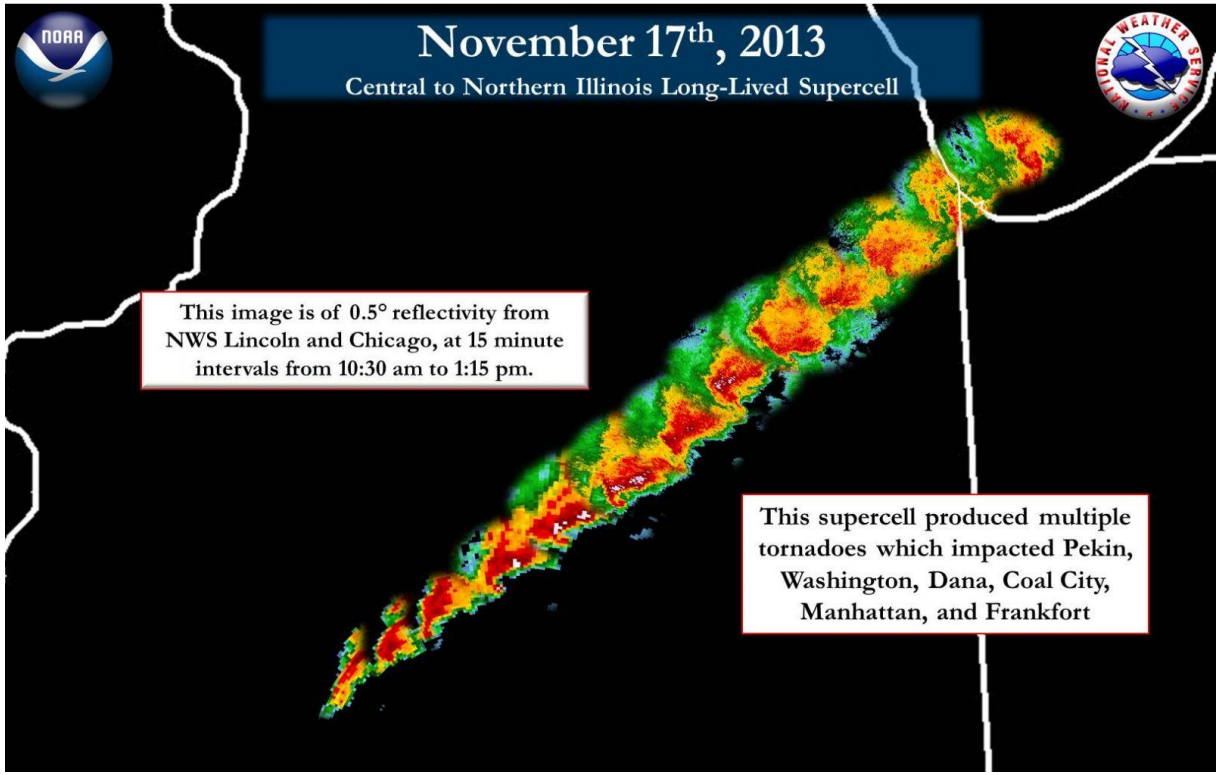
- Heavier rains more often
- High intensity, short duration storms will be more common
- Will strain gray and green infrastructure
- More non-point source pollution likely

More Drought periods

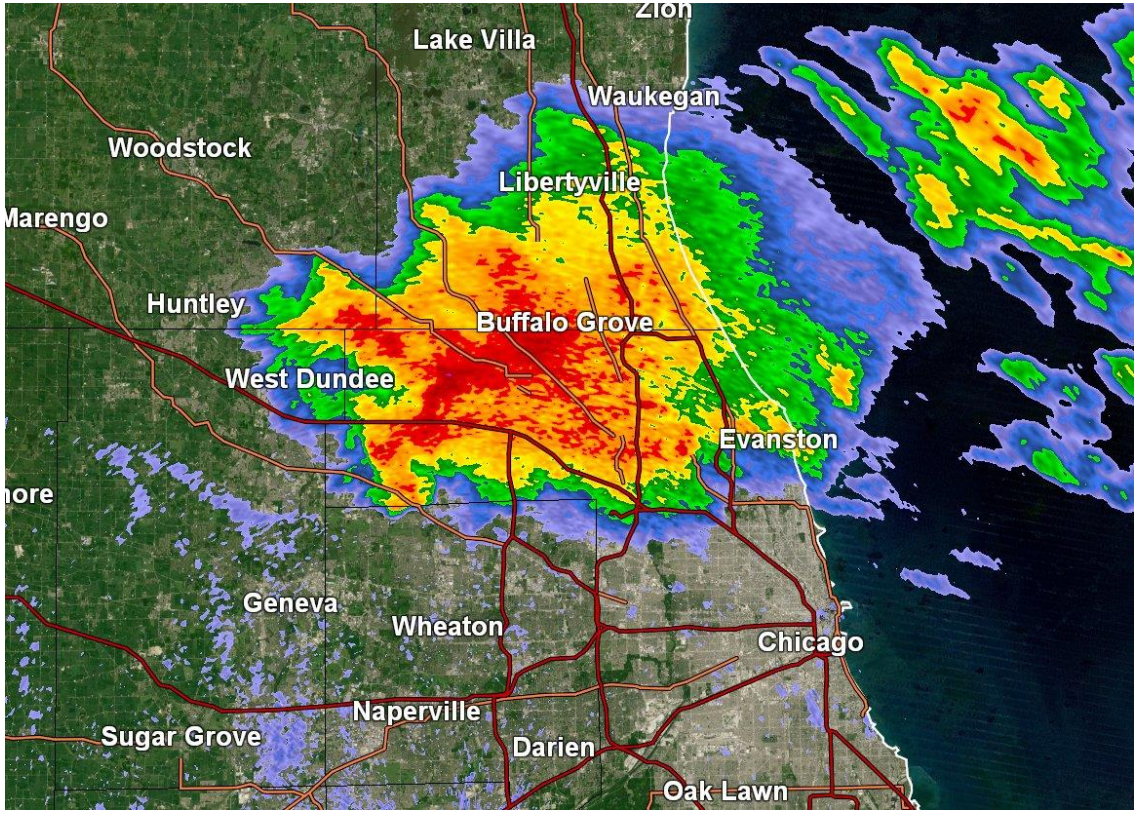


- Feast or famine cycling
- Wetter and drier periods in erratic patterns
- Stress on plant communities will be hard to predict
- Midwest wildfires?

Intense weather patterns



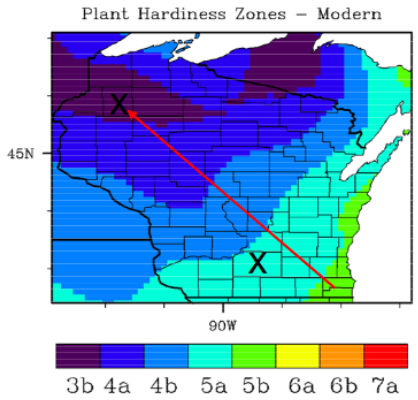
Super cells more common



Fueled by warm air

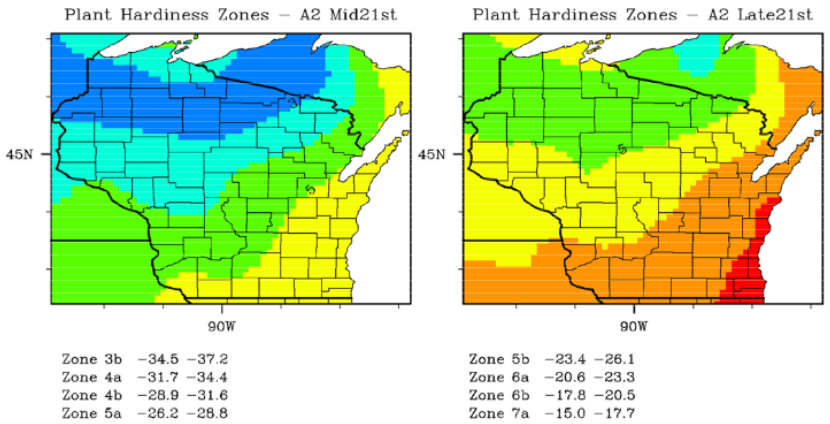
Plant zones

Northward Shift in Plant Hardiness Zones



Dane County
5a -> 6b

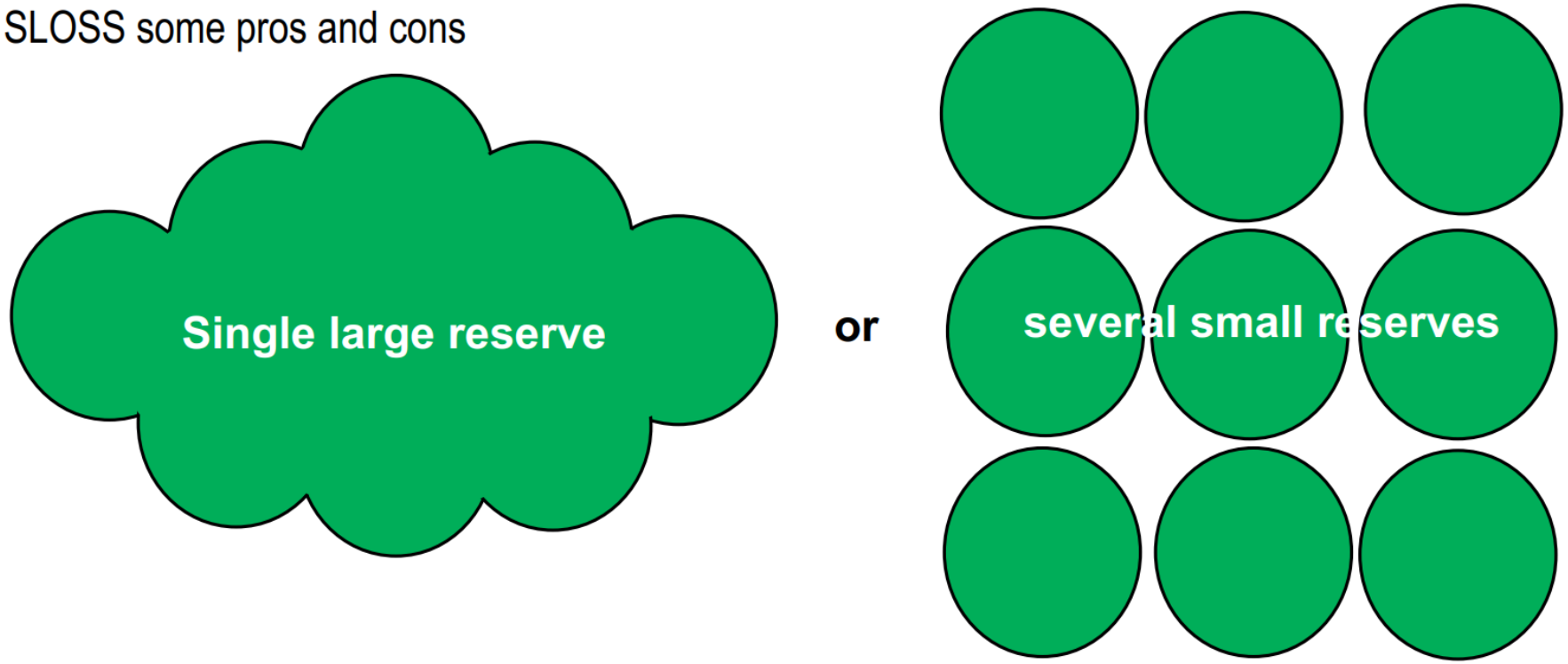
Washburn
3b -> 5b



- Trend will likely have implications for natural ecosystems and gardening
- Winters with more moisture may fuel more lake effect snowfalls
- More new invaders from the south likely

SLOSS

SLOSS some pros and cons



Landscape Ecology Perspective
SLOSS CONCEPT

Large Preserves

- Important for area dependent species
- Mosaic of habitats mimics natural patterns
- Likely more resilient than smaller parcels
- Less “edge effects” and more “core habitats”
- Hard to accomplish due to parcel availability, funding, political opposition, etc.
- Could be susceptible to a catastrophic event

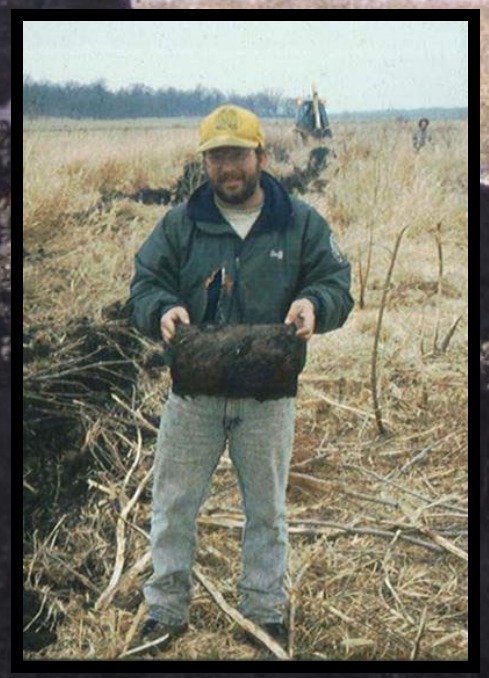
SLOSS CONCEPT

Small Preserves

- Easier to preserve
- Can target specific rare habitats such as fens, savannas
- Can be targeted at the species level (e.g., butterfly)
- Greater availability and opportunity
- Act as refugia and sources for larger preserves
- Edge effects and border disturbances common

LARGE PRESERVES:

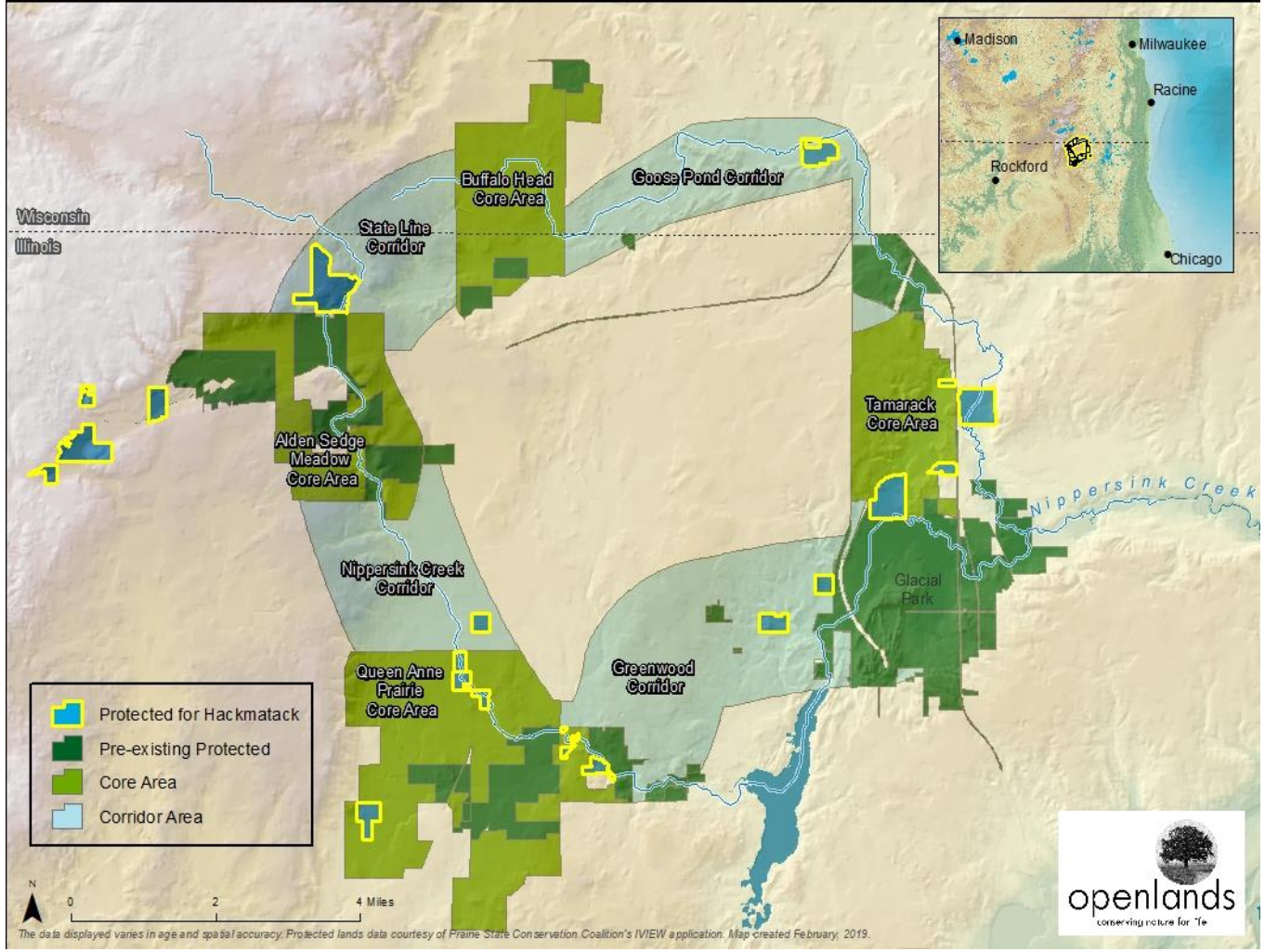
Large-scale restoration (including controlled burning and restoration of surface and groundwater hydrology by removing field drain tiles) feasible. This type of restoration not always possible in smaller sites.



Island Biogeography Principles at Play

- Refugia during hard times
- Colonization and dispersal opportunities
- Genetic resources (hopefully!)
- Source-sink dynamics
- Research generally shows that patch size does matter for many species
- Edge effects are real

Lands Protected for Hackmatack National Wildlife Refuge



The data displayed varies in age and spatial accuracy. Protected lands data courtesy of Prairie State Conservation Coalition's IVIEW application. Map created February, 2019.

HNWR Metrics

- Change in elevation: 320 feet
- Number of habitats: 10
- Width north to south: 12 miles
- Width east to west: 14 miles
- Current acreage: >3,000 acres protected through partnerships

Resiliency

- HNWR should have more inherent tolerance to climate change than small reserves
- Elevational diversity (453 ft of elevational change in watershed) will provide “flood free zones”
- Functional corridors along the North and South Branches of Nippersink Creek
- Preserve should gain biological momentum as parcels are assembled
- Should be a better “source” than “sink” for genetic materials and biota

Where the North Branch and South Branch of Nippersink Creek meet.


"Nothing happens unless first a dream."
Carl Sandburg
HNWR started with a 12 acre Conservation Easement
Celebrating our 12th Anniversary
Hackmatack National Wildlife Refuge
A bi-state refuge
The 561st National Wildlife Refuge, established 2012

Friends of Hackmatack NWR
info@hackmatacknwr.org

Follow on FACEBOOK
http://www.hackmatacknwr.org/
http://www.fws.gov/midwest/planning/hackmatack/

Questions?

Membership driven!!

http://www.hackmatacknwr.org

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