

# ***Same Job, New Challenges: Coastal Forests and Climate Change***



*Stephen Handler  
North Shore Forest Collaborative  
June 2017*



# Northern Institute of Applied Climate Science



Climate

Carbon



ncasi



Michigan  
Technological  
University



The  
UNIVERSITY  
of VERMONT



College of Food, Agricultural  
and Natural Resource Sciences  
UNIVERSITY OF MINNESOTA



[www.nrs.fs.fed.us/niacs/](http://www.nrs.fs.fed.us/niacs/)

NIACS = Northern Institute of Applied Climate Science

What is NIACS? Hybrid organization focused on climate, carbon and bioenergy projects

Getting knowledge into practice and action!

A collaborative approach among federal and non-federal organizations

The Northern Institute of Applied Climate Science (NIACS) has been designed as a collaborative effort among the Forest Service, universities, and forest industry to provide information on managing forests for climate change adaptation, enhanced carbon sequestration, and sustainable production of bioenergy and materials. As a regional, multi-institutional entity, NIACS builds partnerships, facilitates research, and synthesizes information to bridge the gap between carbon and climate science research and the information and management needs of land owners and managers, policymakers, and members of the public.

## Products

Synthesis products on climate change adaptation, carbon cycle science and management, and bioenergy production.

Seminars, workshops, webinars, and educational materials about climate change science, forest response, and management strategies for adaptation, mitigation, and carbon cycle science for land managers in the region.

Enhanced communication and collaboration between land managers, policy-makers, and scientists.

# Why should I care?



Many values of forests....this is why we love them, this is why they're worth the struggle and the headache, this is why they're a public benefit that's usually underappreciated by the mainstream.

Whatever particular values you have for your property, you have an interest in maintaining the health and sustainability of that forest for future years and generations – this is our role as stewards of the land. Embrace that role.

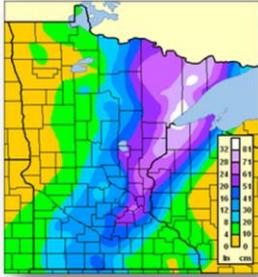
And now....climate change is entering the scene. That's what I'm here to talk to you about today. But if there's one take-home message from today, it's that factoring climate change into your forest management decisions is now an **ADDITIONAL** responsibility for wise land stewardship. Same Job, New Challenges.

## The Take-Home Messages

- Climate change is real, and Minnesota's forests will feel the effects.
- The future is always uncertain, but we know enough to begin preparing.
- Private landowners have a big role to play!

Climate change is real and we are already living with the effects. There is, and always will be, uncertainty about the future. But we know enough now to begin preparing. Climate change might not be the biggest threat to our forests, but it's something that we all should stop and consider as we do our jobs and manage our woods.

# Climate vs. Weather

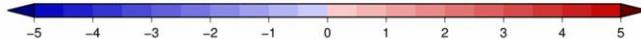
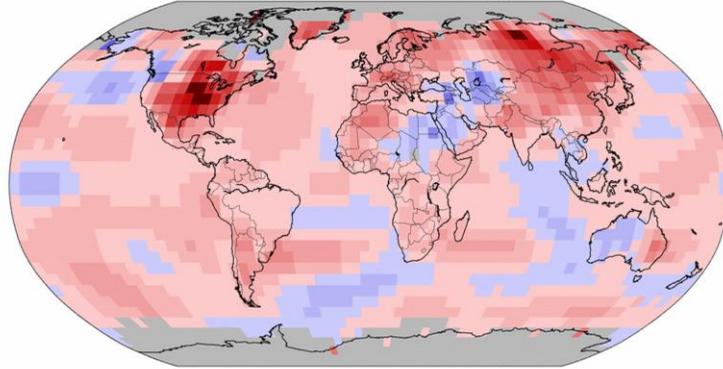


Mood vs. Personality

# Weather

Land & Ocean Temperature Departure from Average Feb 2017  
(with respect to a 1981–2010 base period)

Data Source: GHCN–M version 3.3.0 & ERSST version 4.0.0



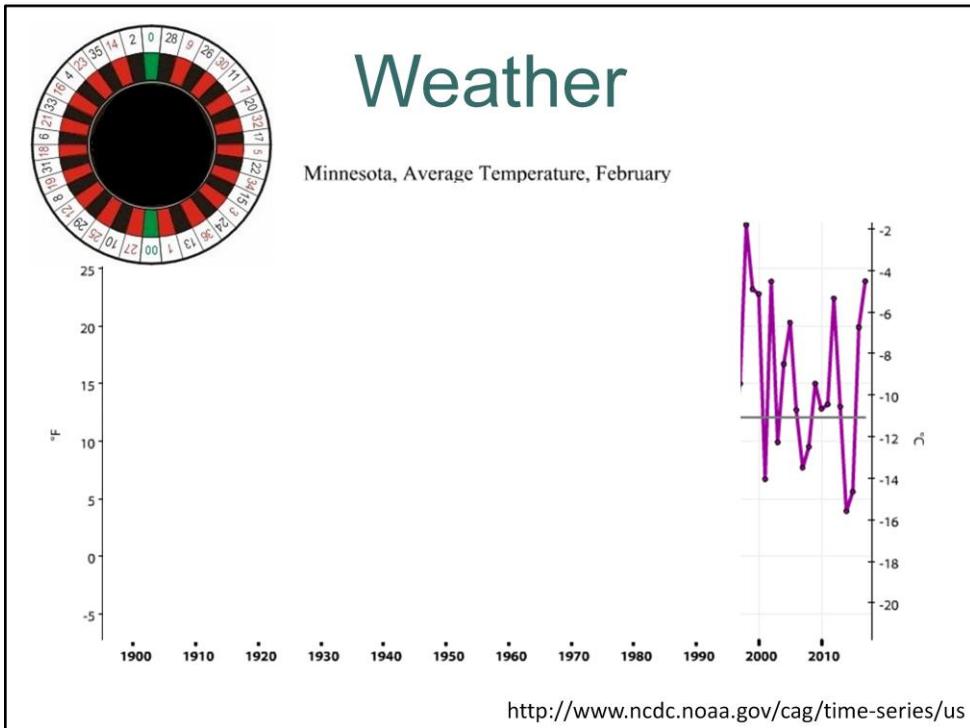
National Centers for Environmental Information  
Sun Mar 12 07:32:41 EDT 2017

Degrees Celsius

Please Note: Gray areas represent missing data  
Map Projection: Robinson

<http://www.ncdc.noaa.gov/cag>

MN FEB 2017 = +12, 6<sup>th</sup> warmest

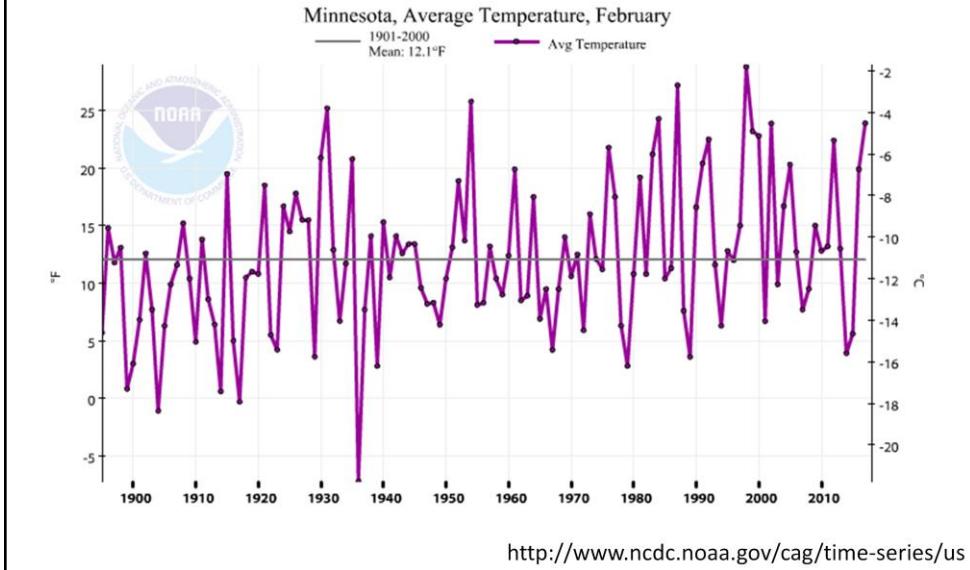


High point – el nino 1997-1998.

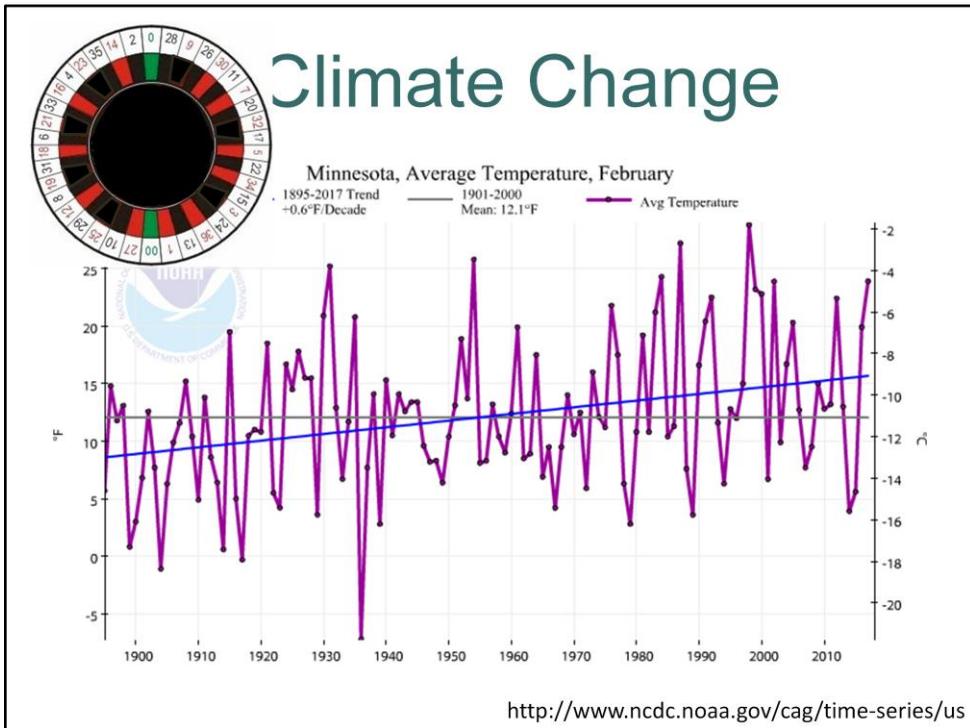
Black = warm

Red = cold

# Weather + Time = Climate



Michigan Feb 2014 = 15<sup>th</sup> coldest since 1895

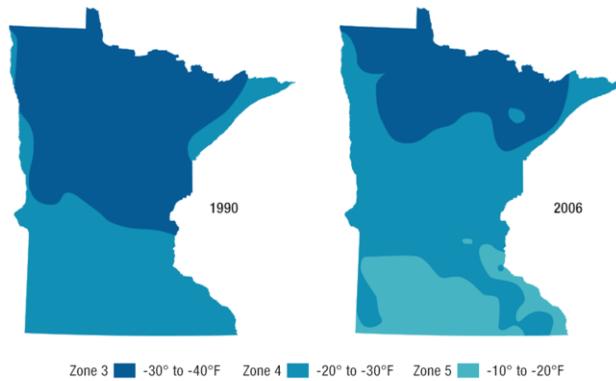


Warming 6F per century. Just for the month of Feb.  
 The effect is actually stronger for north-central MN – it’s not just urban heat island effect.

# Observations from Minnesota

- Longer growing seasons & shifting hardiness zones

Hardiness zone changes in Minnesota



Source: U.S. Department of Agriculture

Sources: MPR News, Midwest Regional Climate Center, USDA

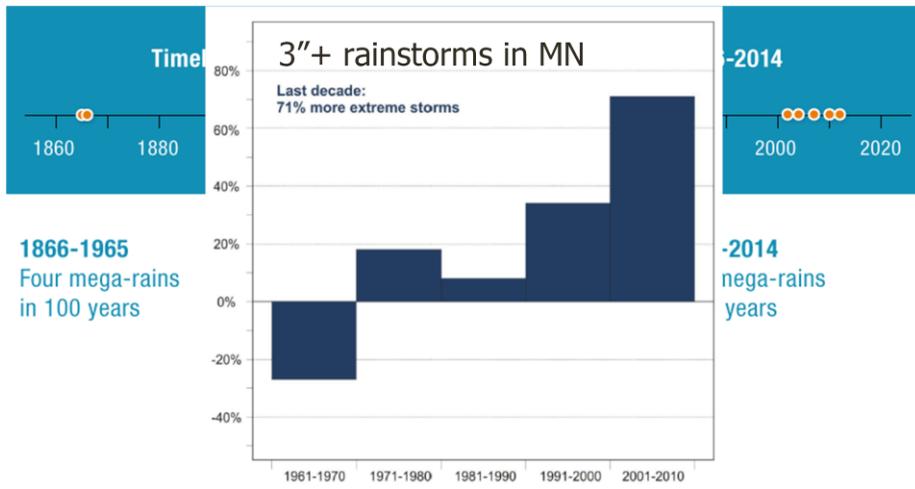
1.4 – annual

2.2 winter

3.0 – winter min

# Observations from Minnesota

- More heavy rainfall



Sources: Saunders et al 2012, Minnesota State Climatology Office

Mega-rains = 6 inches of rain fall over an area of 1,000 or more square miles and the core of the storm generates at least 8 inches of rain

# Current Events



Most areas of the globe were warmer than the long-term average. THIS alone is not climate change.

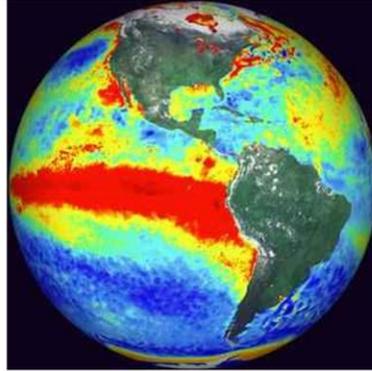
Have to keep scale in mind – space and time.

When I tell you that this month was the 29<sup>th</sup> consecutive february above the 20<sup>th</sup>-century average, that is really telling you something. When I tell you that this month was the 348<sup>th</sup> consecutive month with a global temp above the 20<sup>th</sup> century average, that is really telling you something.

## A pumped-up climate?



=

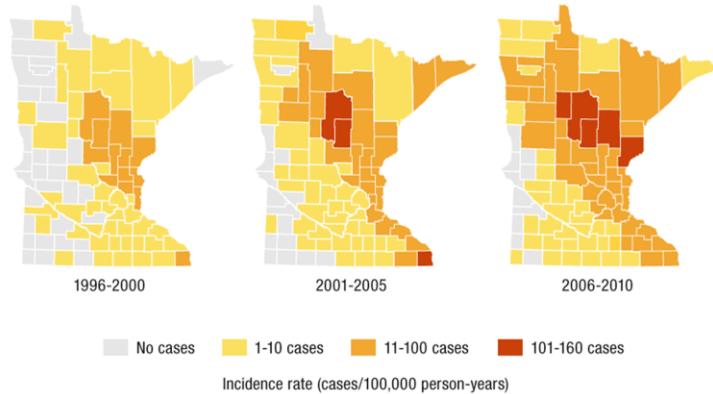


4.57 inches of rain on Monday, record-breaking rainfall. Some towns like Dearborn reported over 6 inches. Average rainfall for the entire month of August is just 3 inches. 30-50% of homes and businesses damaged.

# Observations from Minnesota

- Lyme disease expands

Distribution of Lyme disease cases by county of residence



Sources: Minnesota Dept of Health, [www.health.state.mn.us](http://www.health.state.mn.us), [www.mprnews.org](http://www.mprnews.org)

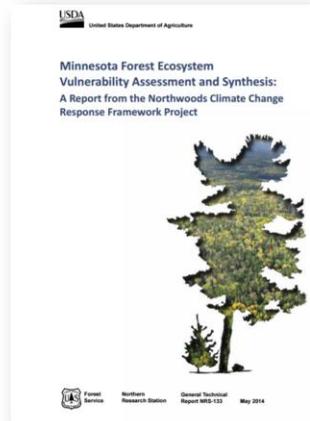
Deer ticks moving northward

Powassan disease, rocky mtn spotted fever,

# More Information



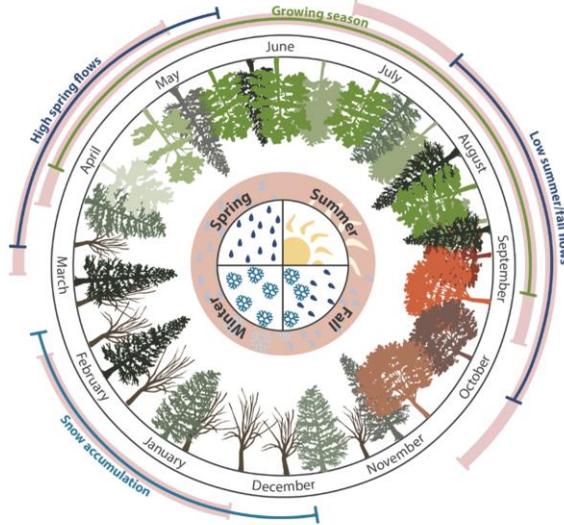
- Examine a **range** of future climates
- **Do not make recommendations**
- Sources of information:
  - Models
  - Published research
  - Local managers and experts



Download: [www.nrs.fs.fed.us/pubs/45939](http://www.nrs.fs.fed.us/pubs/45939)

# Impacts on Forests

Northeast and Midwest seasonal patterns

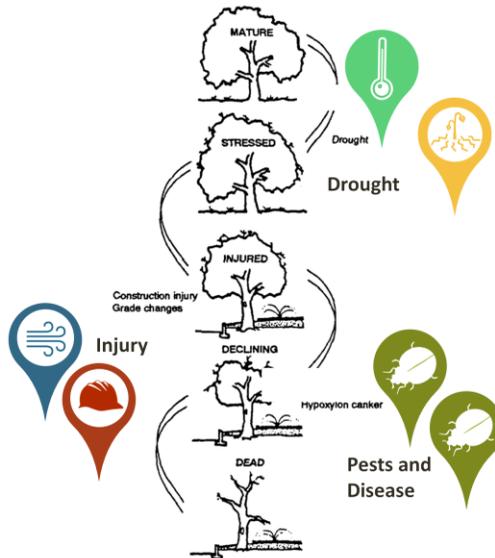


■ Shifted season projected from increasing temperatures and precipitation changes

Source: [necsc.umass.edu/news/drought-northeast-and-implications-ecosystems](http://necsc.umass.edu/news/drought-northeast-and-implications-ecosystems)

# A “Threat Multiplier”

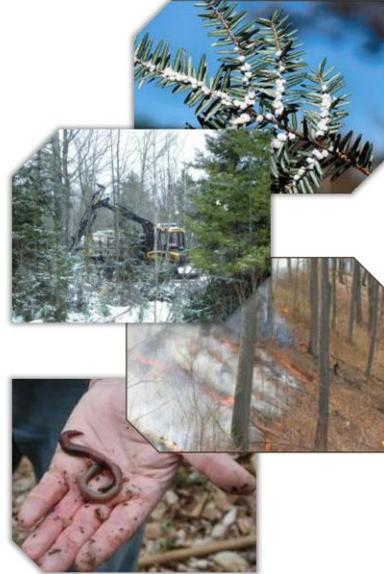
- Interactions can trigger big changes
  - Stress
  - Disturbance
  - Invasive species
  - Insect pests
  - Forest diseases



Source: Bartlett Tree Experts

# Impacts on Forests

- Longer growing season
- CO<sub>2</sub> fertilization
- Increased drought risk
- Extreme weather events
- Less frozen ground
- Increased fire risk
- Species range shifts
- Increased stressors



Handler et al. 2014

# Longer Growing Season

## Benefits:

- More time for growth!



## Limits:

- Early bud break/loss of cold hardening
- Frost damage with spring frosts



Ainsworth and Long 2005, Ainsworth and Rogers 2007, Norby and Zak 2011

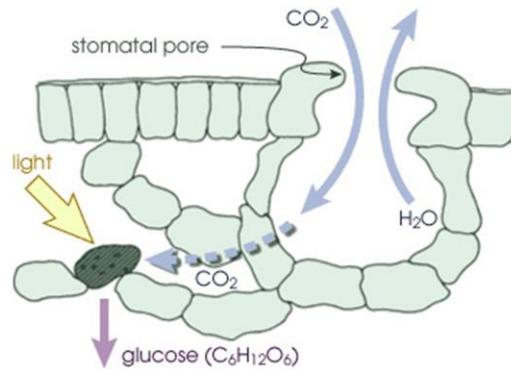
# CO<sub>2</sub> Fertilization

## Benefits:

- Increased growth
- Water-use efficiency

## Limits:

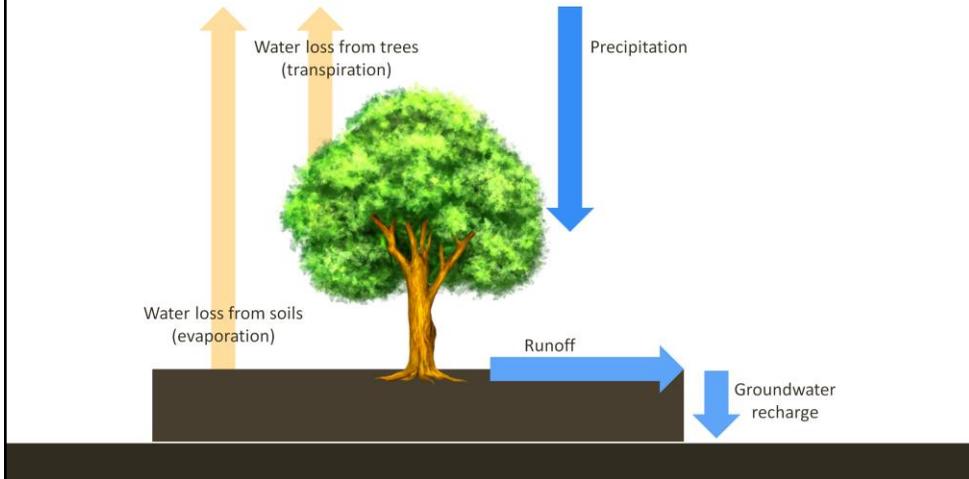
- Other nutrients or water
- Stressors or disturbance



Ainsworth and Long 2005, Ainsworth and Rogers 2007, Norby and Zak 2011, Coture et al. 2015

# Increased Drought Risk

Greater uncertainty about future precipitation,  
but great risk of summer moisture stress



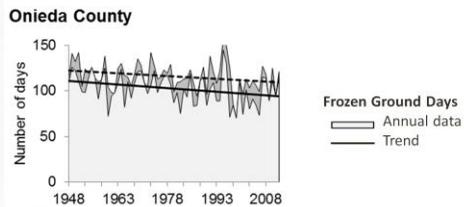
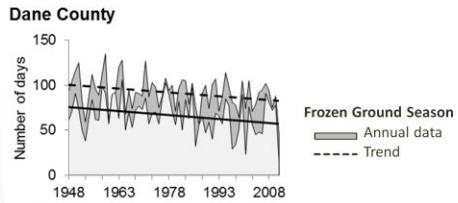
# Extreme Weather Events

Extreme events are rare and hard to model.



# Less Frozen Ground

Frozen ground conditions have decreased across over the last 60+ years – WI example



Source: C. Rittenhouse (UConn) and A. Rissman (UW-Madison), in review

# Wildfire Risk

## Fire may increase, because:

- Warmer/drier summers
- Increased mortality from stress, pests, events
- More frequent weather conditions that promote large fires



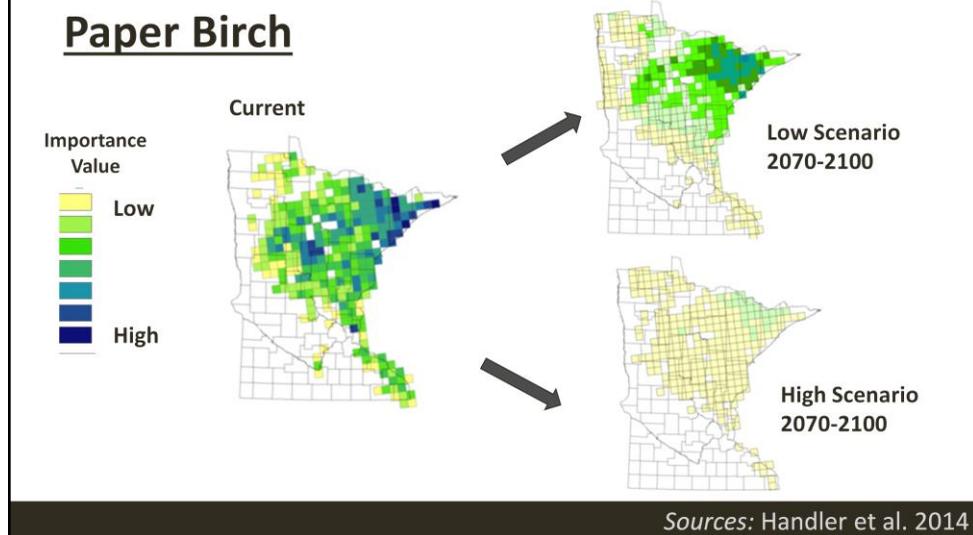
## ...or maybe not, because:

- Fire suppression will continue
- Spring/early summer moisture
- Current regeneration of more mesic species
- Spatial patterns of land use and fragmentation



Source: Guyette et al. 2014, Tang et al. 2014, Miranda et al. 2012, Moritz et al. 2012, Nowacki et al. 2014

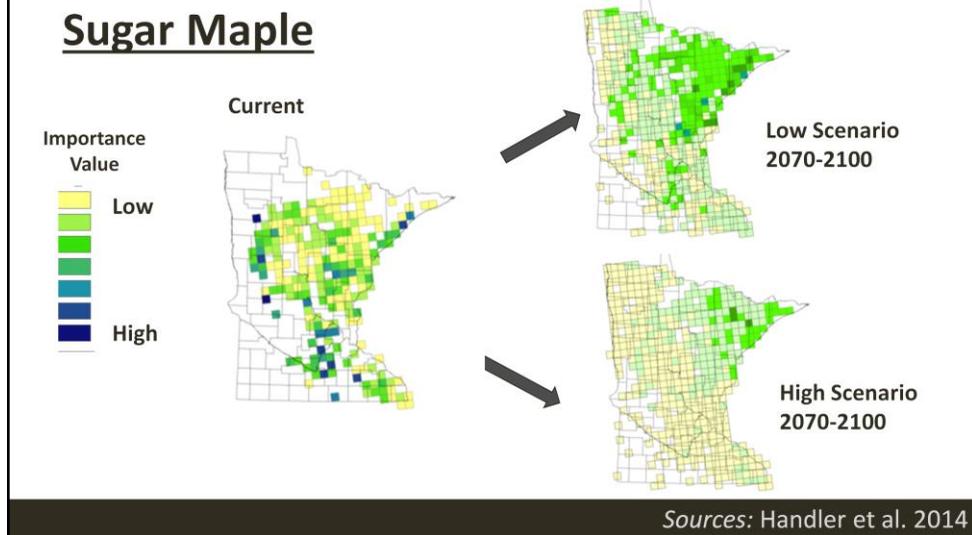
# Species Range Shifts



Deer ticks moving northward

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# Increased Stressors

Many forests are already under stress from other causes.

Climate change could make forests more susceptible to existing or new stressors.



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# Twin concepts for responding to climate change

- Mitigation = actions that reduce the human contribution to the greenhouse gas effect.



- Adaptation = actions to prepare for and adjust to new conditions.



[www.nca2014.gov](http://www.nca2014.gov)

# We don't need certainty

- Risk management is a good place to start

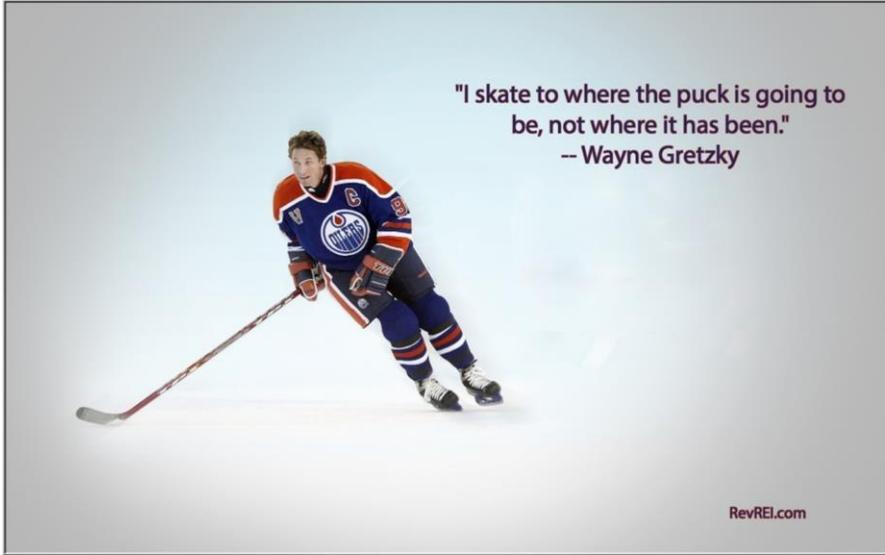


# An uncertain future

- Don't wait for a crystal ball



# Be like Wayne



"I skate to where the puck is going to be, not where it has been."  
— Wayne Gretzky

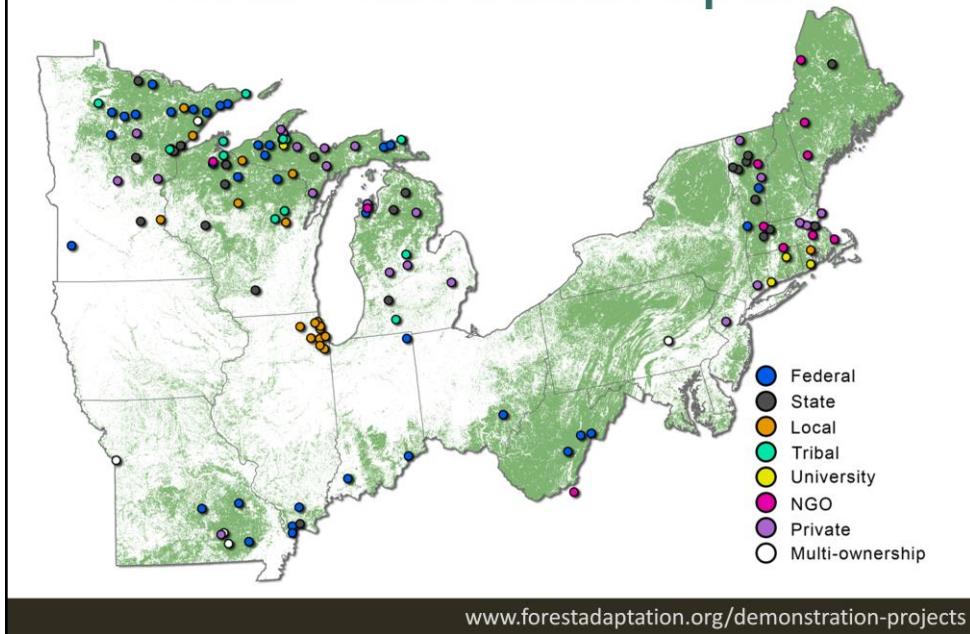
RevREI.com

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# Real-world Examples



*Get things done*

*Work with individuals, organizations, rarely groups of organizations*

*Scales*

*Never any commitment or threat of on-going networking and collaboration.*

## Keep Doing the Good Stuff

- Plant white pine  
(*cedar, spruce, tamarack*)
- Install deer fences
- Remove invasive plants
- Coordinate across the landscape



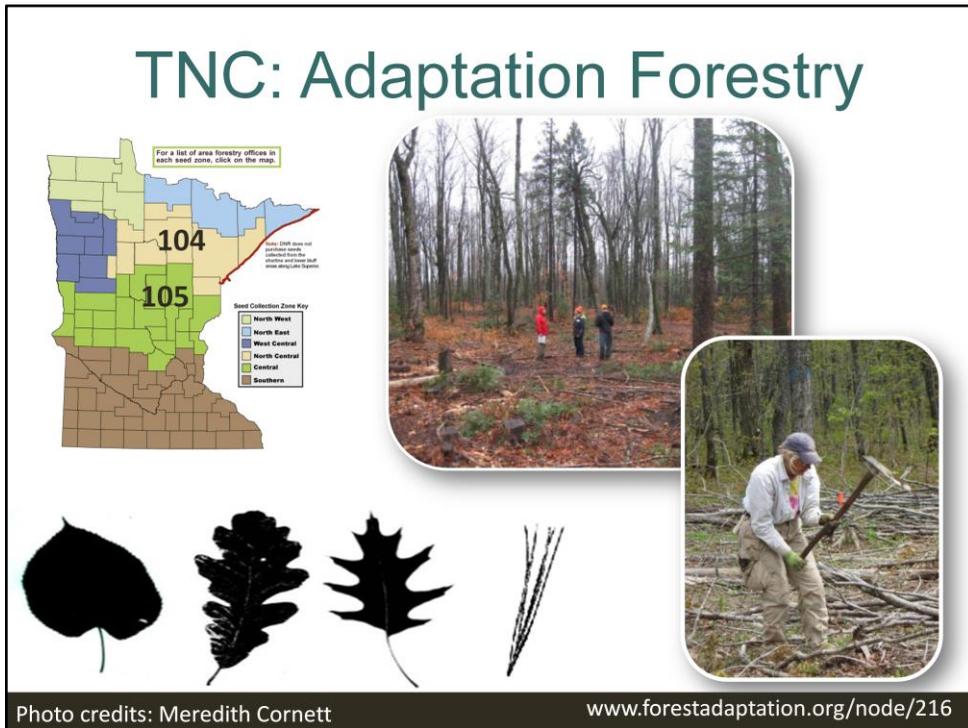
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## Go a Little Further...

1. Test other tree species (future winners) and southern seed sources
2. Identify “refuge” areas and “transition” areas
3. Think about water
4. Include climate change in your management plans

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# TNC: Adaptation Forestry



TNC project: plant climate-adapted species from different seed zones.  
Species that already exist in the area and are projected to do better: WP, BO, RO, Bass  
Do these plantings in areas that have also been managed to increase structural complexity – gaps, shelterwood w/ reserves, clearcut w/ reserves.  
Overall = can we improve the “response diversity” of these stands.  
Partners = SNF, UMD, Lake Co. St. Louis Co., WCS & Doris Duke Charitable Foundation

This is the outcome of several conversations and an in-person meeting with project ID team on the SNF Tofte and Grand Marais districts.

## PROPOSED MANAGEMENT

Regenerate paper birch

Underplant to increase diversity (white pine, white spruce, yellow birch, cedar)

## POSSIBLE ADAPTATION ACTIONS

Choose wetter, north-facing sites

Prioritize healthier, younger sites

Increase % of white pine, decrease % of white spruce

Plant additional spp (bur oak, red oak, jack pine, red maple)

# TNC: Conifer Strongholds

- Identify potential “refuge areas” for northern conifers



# DNR: Knife River Watershed



- Jason Bushmaker
- declining aspen and paper birch, marginal for maple. Spruce budworm impacts on balsam fir, too
- School trust lands
- Regenerate birch and aspen, plant white pine and spruce
- Rapid snowmelt = overland flow = erosion = bad for trout . Steelhead!
- Planting conifers, but also strategically working to reduce erosion potential

# Nelson Family Stewardship Plans



[www.forestadaptation.org/node/391](http://www.forestadaptation.org/node/391)

Ohio buckeye, bur oak, white oak, black cherry, Kentucky coffeetree

Swamp white oak, hackberry

# Thank You!

Let's keep in touch:

[sdhandler@fs.fed.us](mailto:sdhandler@fs.fed.us), (906) 482-6303

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

