

Impacts of Changing Winter Weather on Harvesting Operations and Snowmobiling in Wisconsin

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Human Dimensions of Ecosystem Management

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Forest Ecosystem Services and Changing Weather/Climate

Provisioning

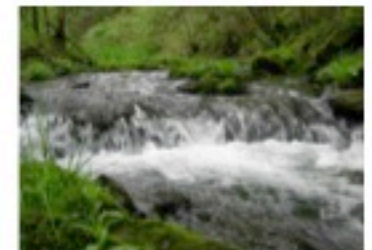
- Wood and fiber
- Recreation, cultural



- Snowmobiling

Regulating

- Hydrology



Supporting

- Nutrient cycling
- Wildlife habitat

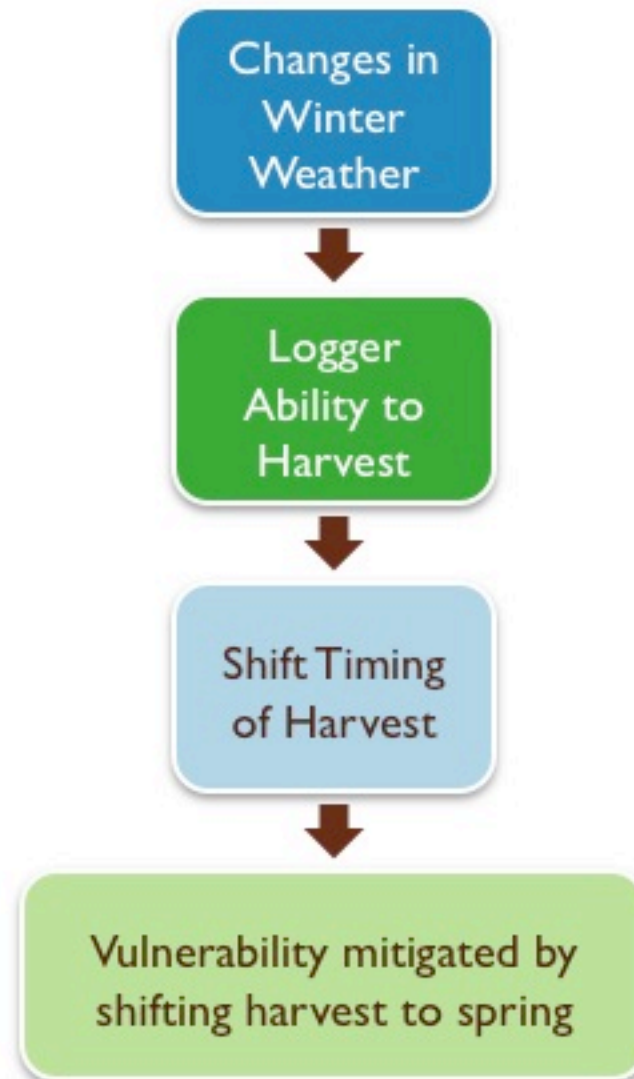




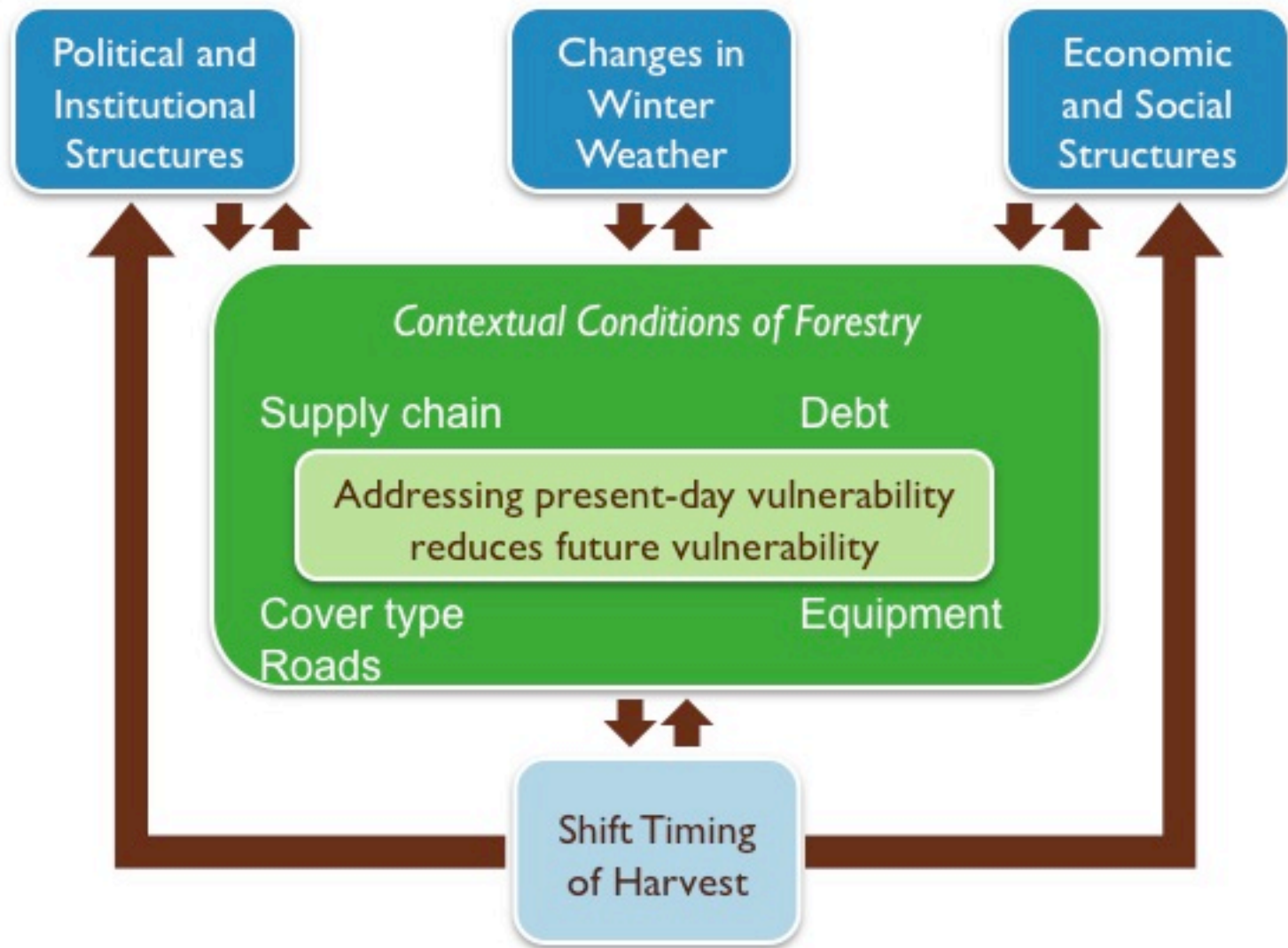
Key Questions

1. Are winter weather conditions, like frozen ground and snow, changing in WI?
2. How are forest operations impacted?
 - a) How are people adapting?
3. How is snowmobiling impacted?
 - a) How are people adapting?

Linear Approach to Impacts and Adaptations



Contextual Approach





Study Design

Selected counties based on historical weather data and importance

Multiple methods:

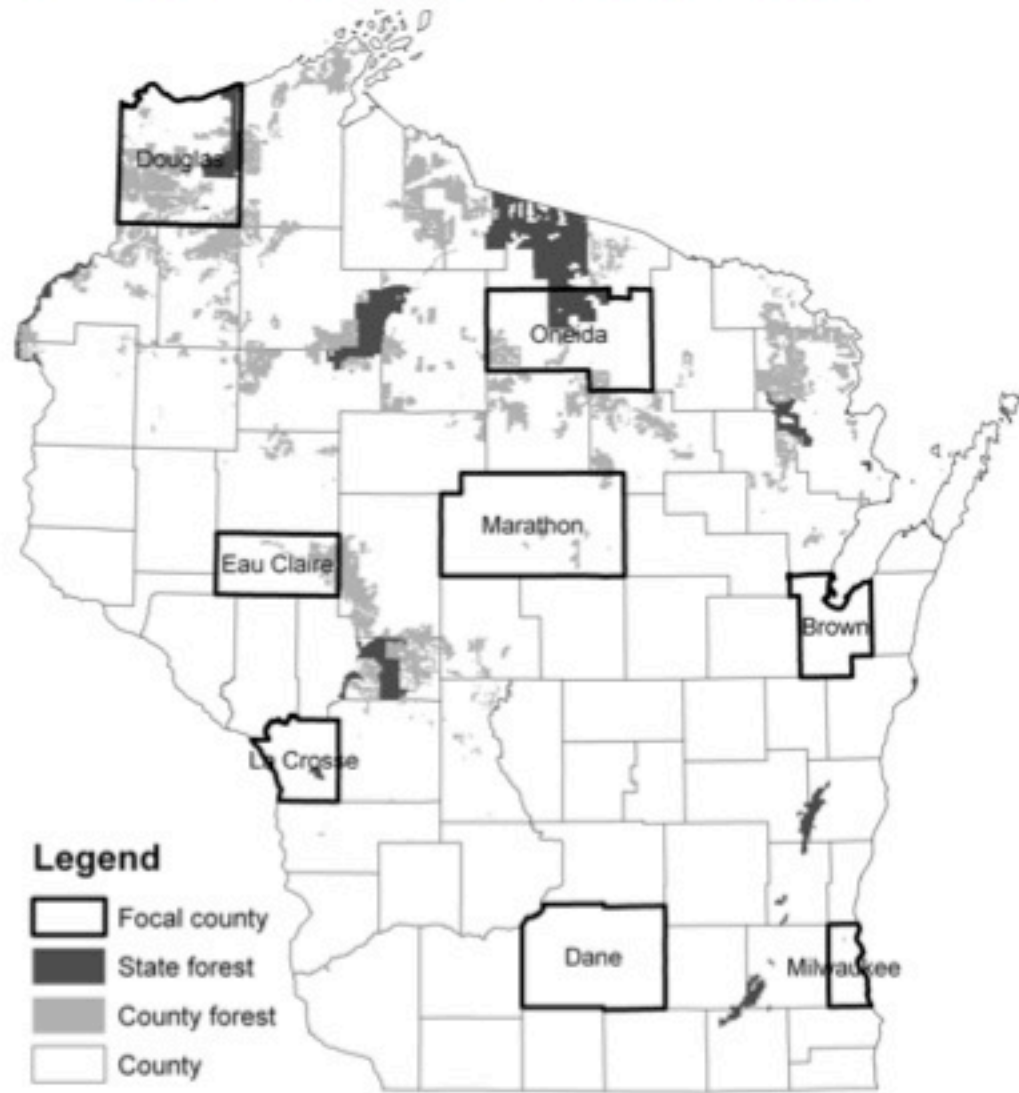
1. Statistical models of harvest and weather
2. Interviews with foresters, highway commissioners, and loggers
3. Interviews with snowmobile coordinators



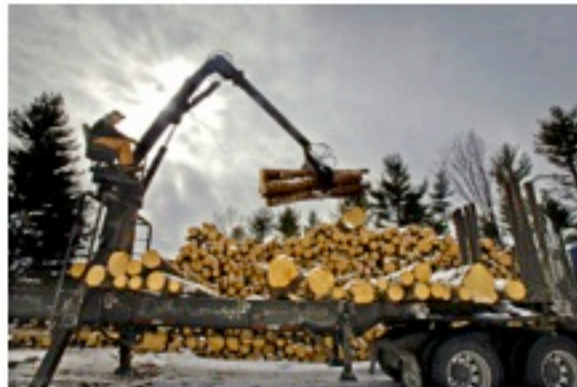
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Focal Areas in Wisconsin



Relating Weather to Harvest



Focal groups and interviews with forest managers and scientists

Identified frozen ground as key factor for access, harvest, and transport



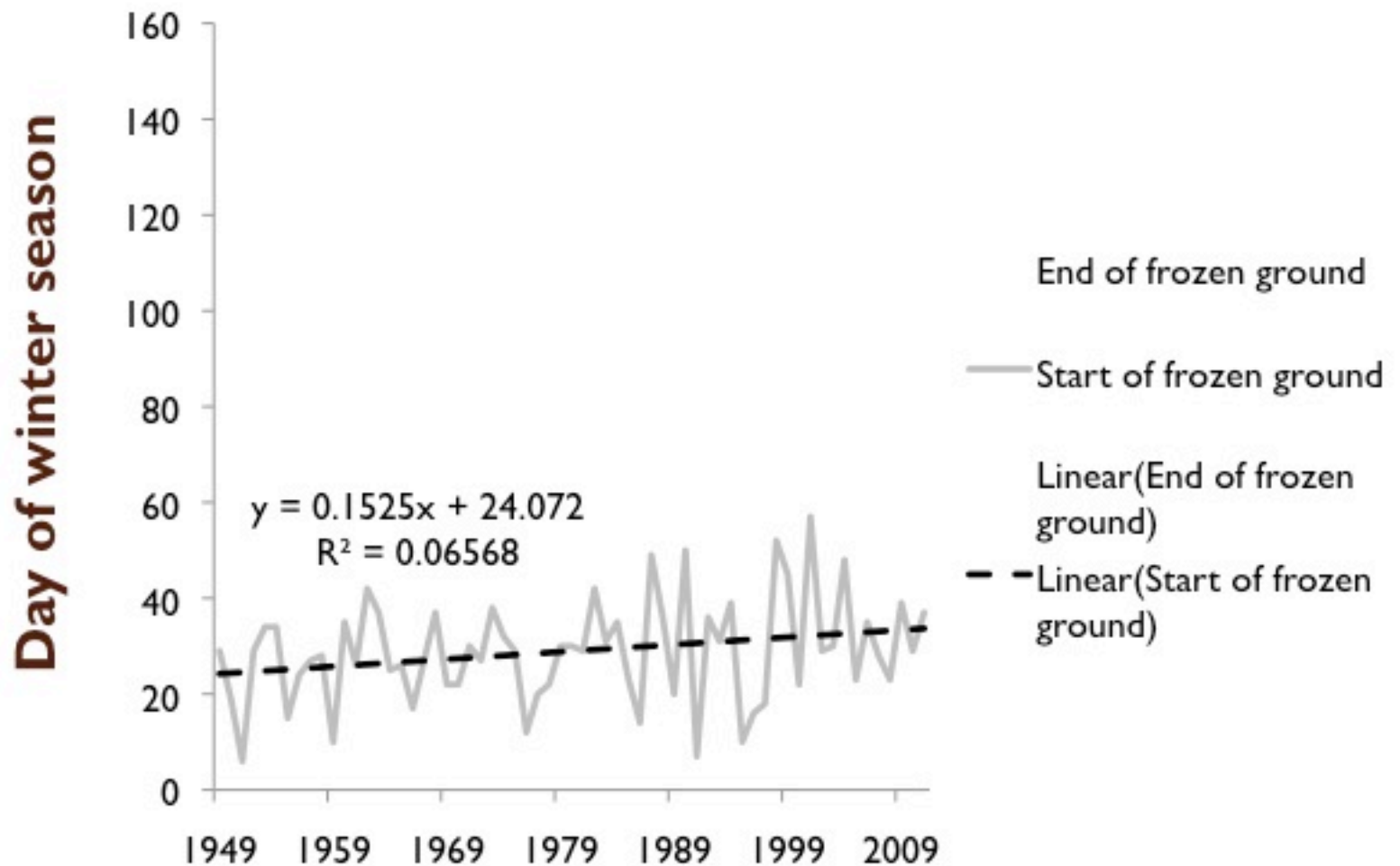
Methods for Weather Analysis

Daily weather from Climate Data Online

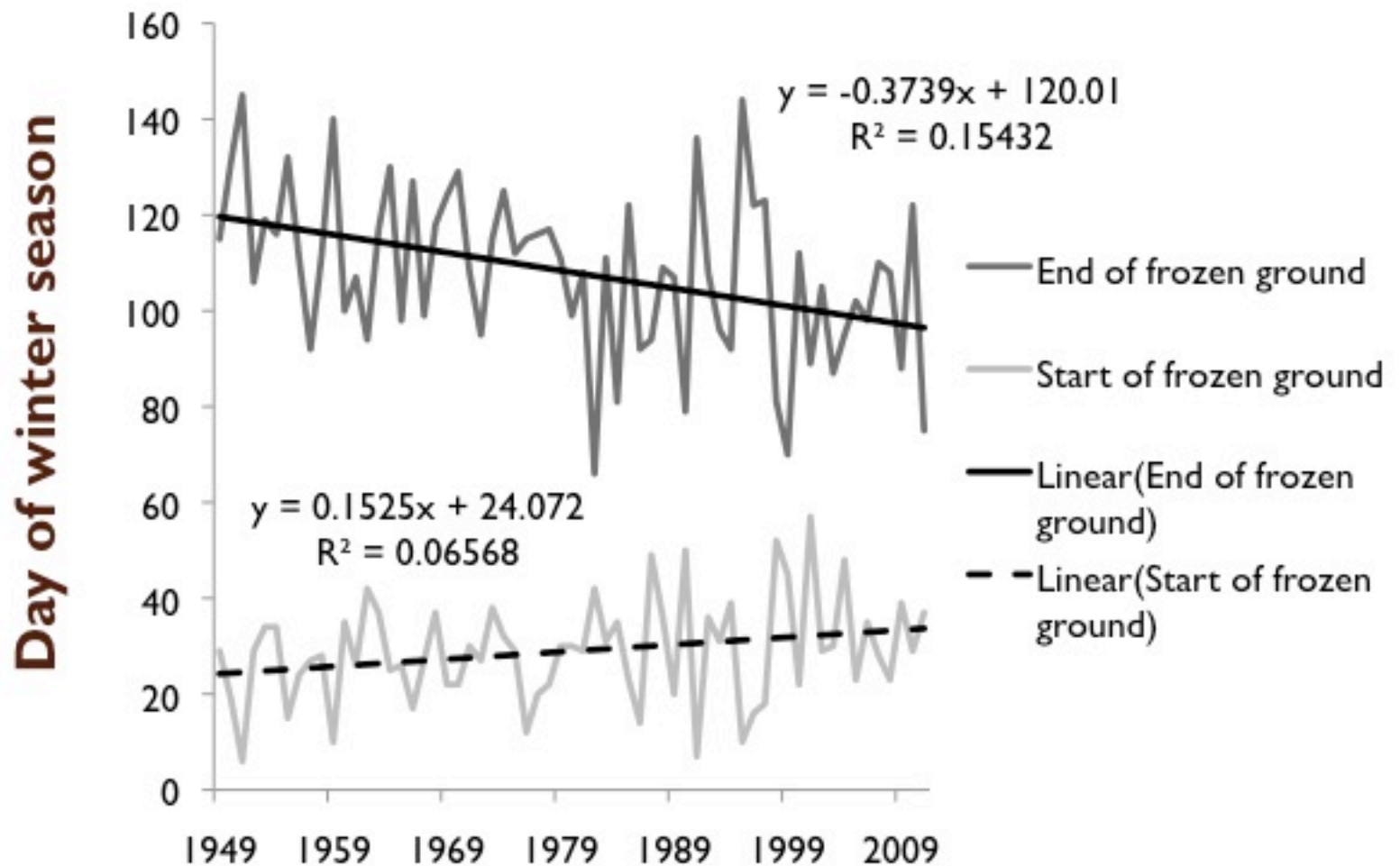
Winter season begins November 1

Frozen ground day: 0° C at 10 cm soil depth

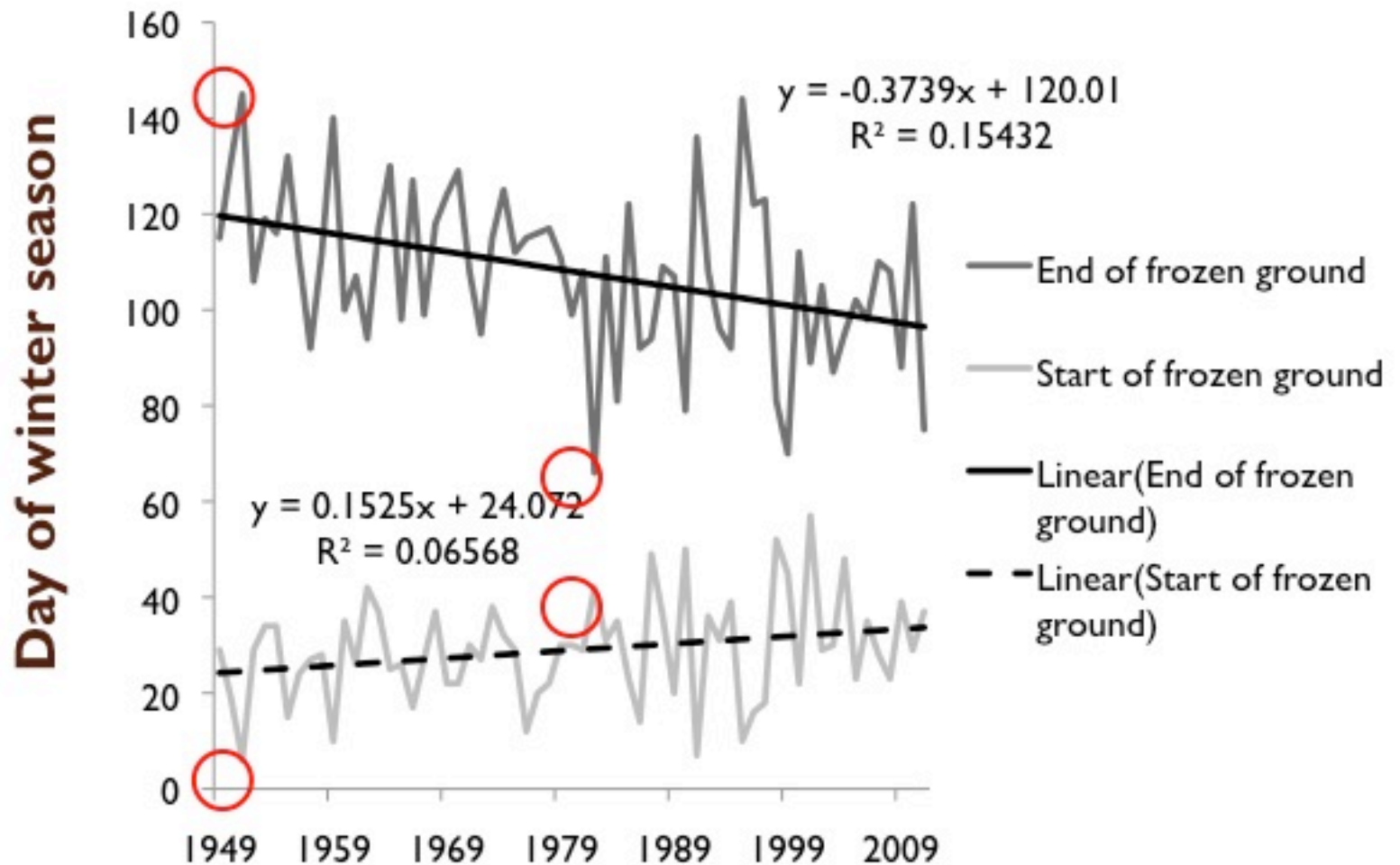
Later Start of Frozen Ground Eau Claire County, WI



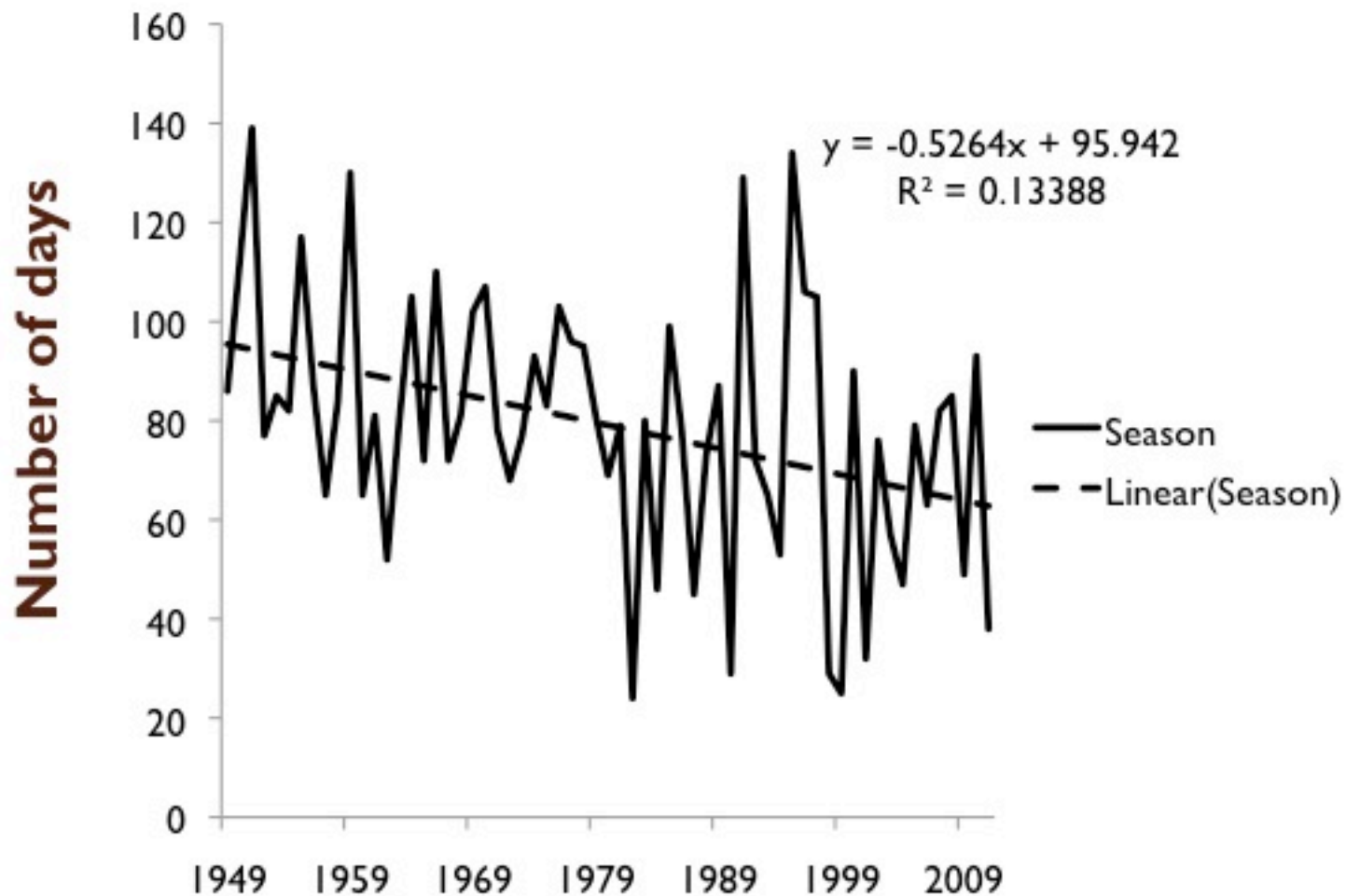
Later Start and Earlier End of Frozen Ground



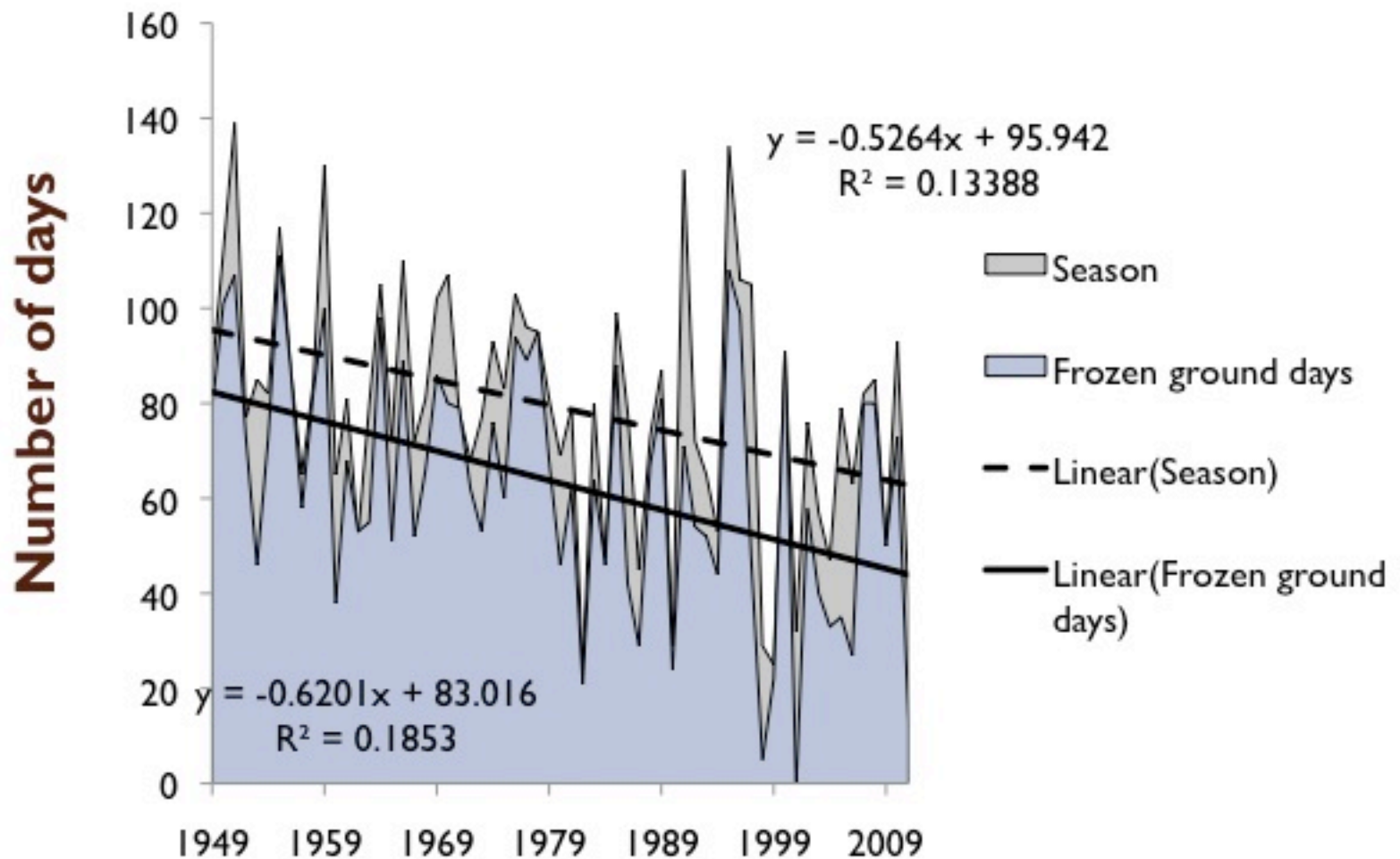
Annual Variability in Start and End of Frozen Ground



Shorter Season of Frozen Ground



Losing Frozen Ground Days within the Season

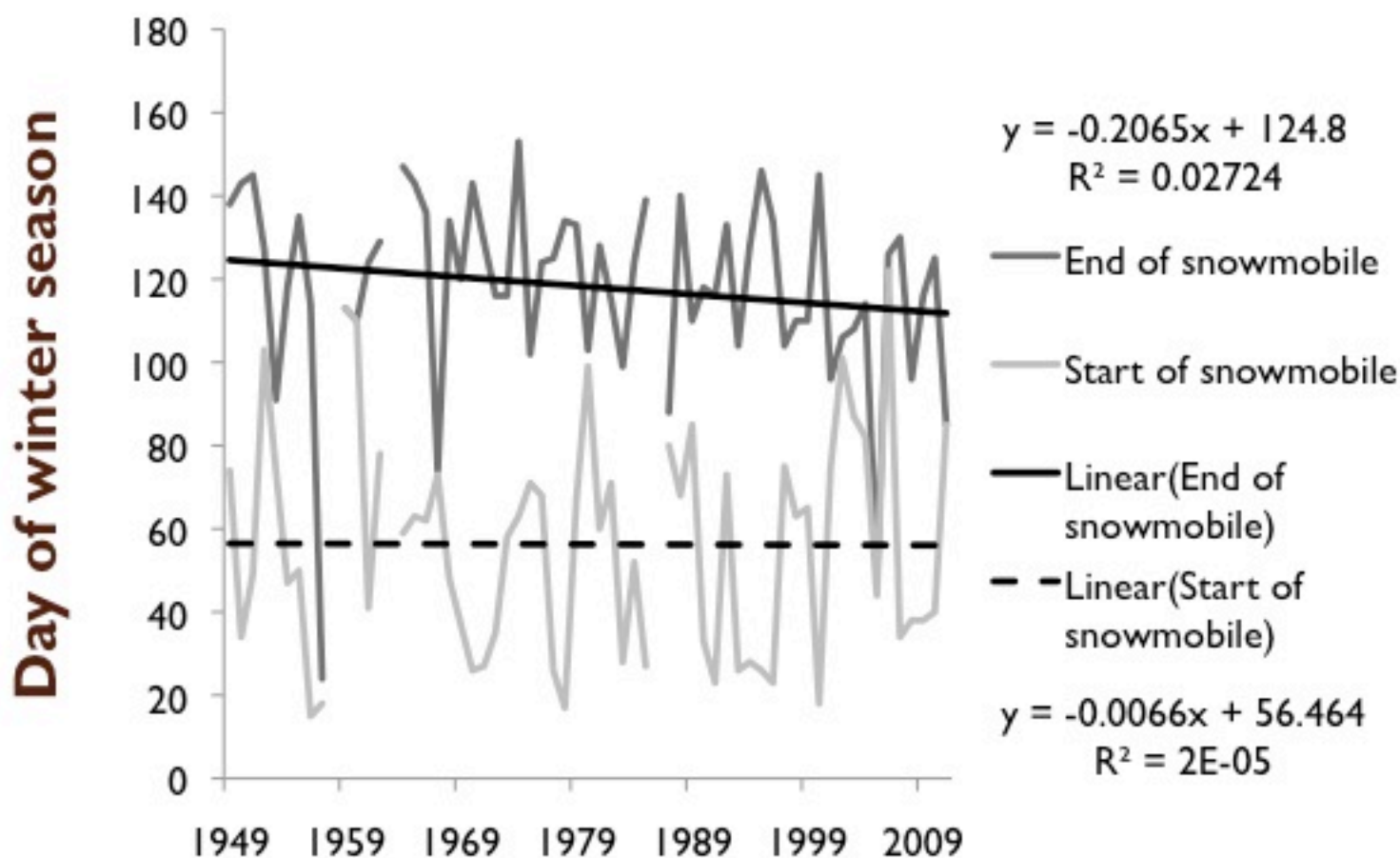




Trends in Frozen Ground

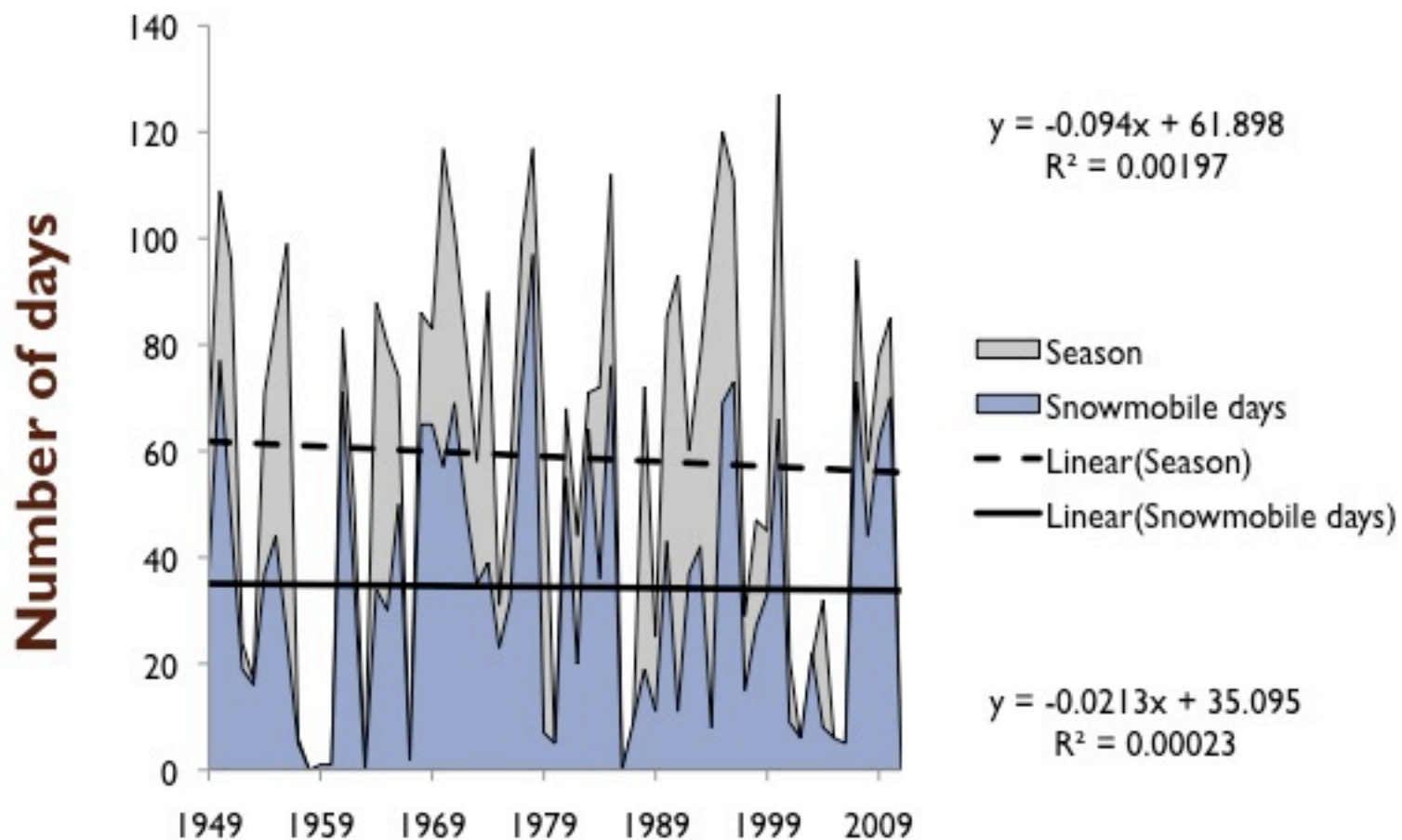
County	Start (day/yr)	End (day/yr)	Season (total)	Frozen Ground Days (total)	Since (yr)
Oneida	+0.05	-0.08	-14 days	-14 days	1908
Douglas	+0.06	-0.13	-19 days	-25 days	1909
La Crosse	+0.10	-0.21	-23 days	-27 days	1938
Dane	+0.13	-0.15	-17 days	-18 days	1948
Brown	+0.14	-0.17	-19 days	-31 days	1948
Marathon	+0.07	-0.14	-15 days	-24 days	1949
Eau Claire	+0.15	-0.37	-32 days	-38 days	1949

Start and End of 6" Snow Depth*: Eau Claire County, 1949 to 2011



* 6" Snow depth proxy for snowmobile day

6" Snow Depth Days: Eau Claire County, 1949 to 2011





Trends in 6" Snow Depth

County	Start (day/yr)	End (day/yr)	Season (total)	Snow days (total)	Since (yr)
Oneida	-0.10	+0.06	+21 days	+20 days	1908
Douglas	+0.06	+0.03	+4 days	+39 days	1909
La Crosse	-0.14	-0.06	+9 days	+6 days	1938
Dane	-0.06	+0.23	+21 days	+9 days	1948
Brown	-0.29	-0.05	+27 days	+14 days	1948
Marathon	-0.07	+0.07	-1 day	+1 day	1949
Eau Claire	-0.01	-0.21	-6 days	-1 day	1949



Winter Weather is Changing

Frozen ground:

Later start

Earlier end

More thaw

Strong trend

Snow cover:

Earlier start

Same to later
end

Less melt

Weak trend



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Modeling Harvest and Weather

Annual harvest \sim weather + year + (forest)

Harvest:

WisFIRS database by WI DNR

Weather:

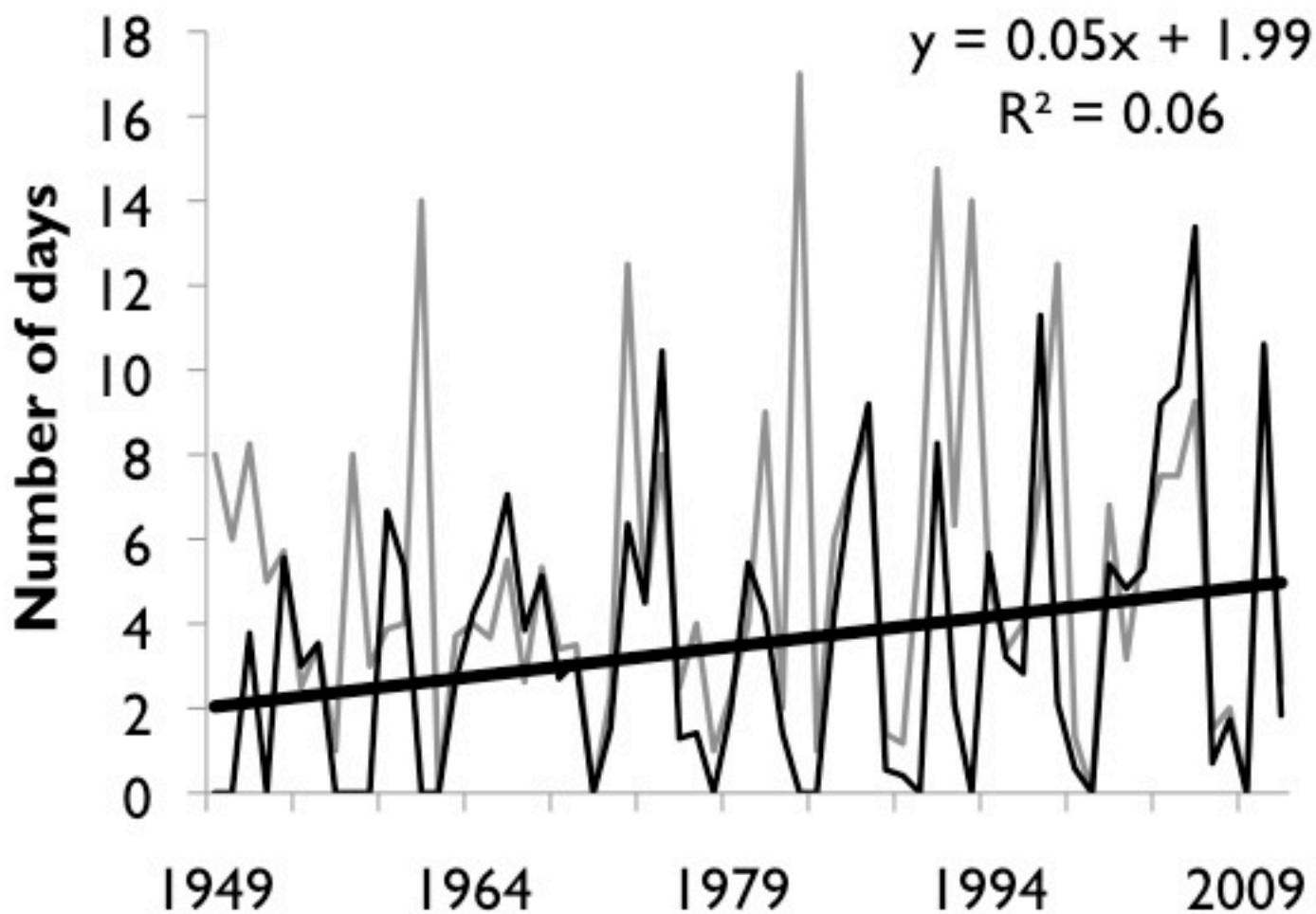
Start, end, season, frozen ground days

Soil thaw duration (average, std. dev.)

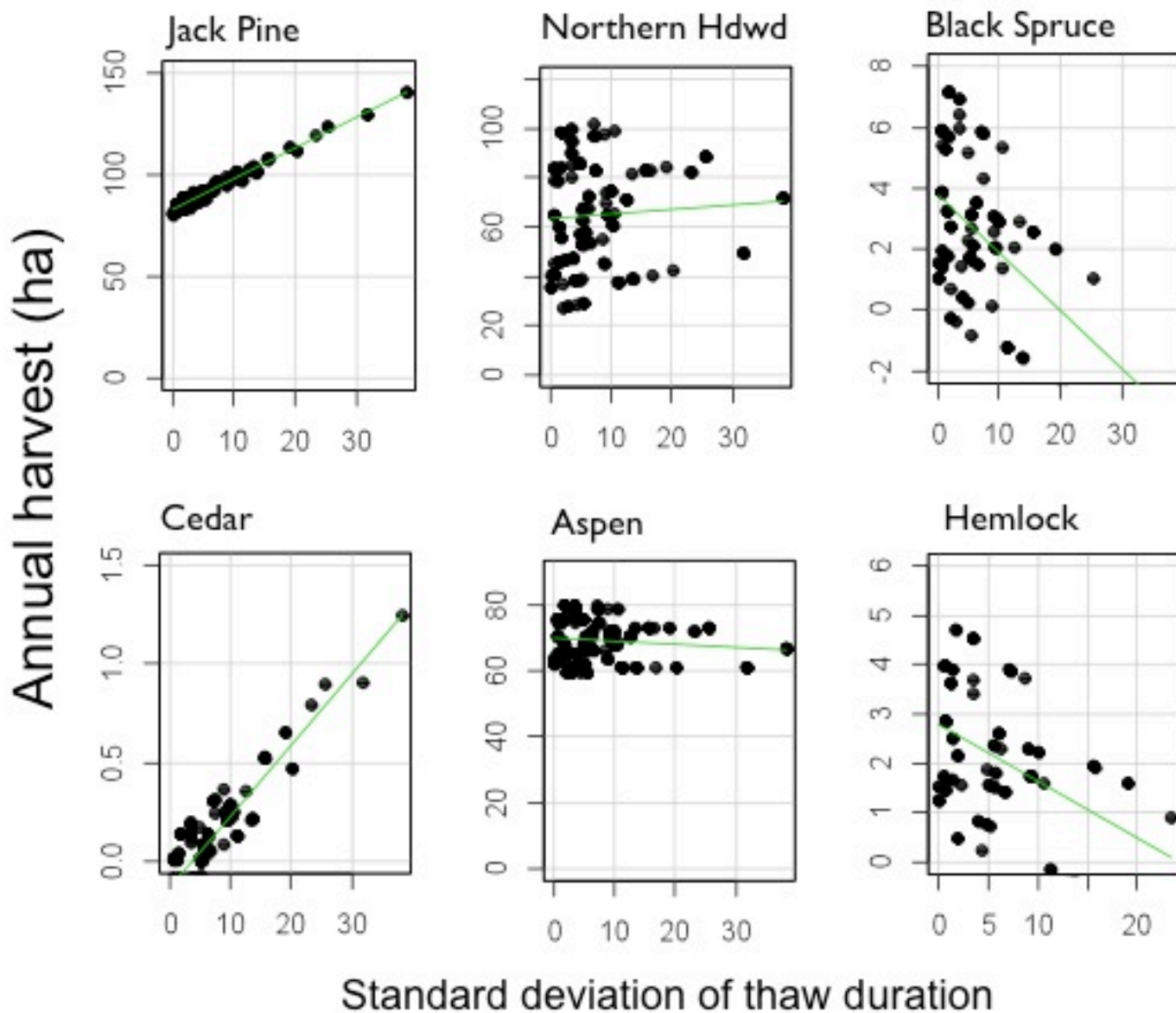
Soil temp (avg., std. dev., min. max.)

Snow melt duration (avg., std. dev., max)

Variability in Thaw Duration



Variability in Thaw Drives Harvest





Perspectives on Harvest

Access to sites limited when ground thawed

- Opt-out of wet-ground contracts
- Competition for dry ground contracts

“I never had to work spring breakup.

Nowadays, guys are running hard. The [insurance, loans] bills don't stop because it's spring.”

Over-capitalization and debt put financial stress on loggers



Types of Adaptations

- 1) Production, harvest, transport practices
- 2) Technological developments
- 3) Financial management
- 4) Government programs and insurance




Adaptations in Forest Management

Address uncertainty in timing of harvest:

1. Extend contract length, no. of entries
2. Shift harvest to dry conditions
3. Opt-out of contracts on wet ground

Address uncertainty in transport:

1. Store trees until transport possible
2. Adjust capacity (harvest, transport, processing) to meet variable demand



Frozen ground, water quality and wildlife habitat

Potential for greater environmental impact when harvesting on wet soils

Potential for shifts (pros and cons for different species) in wildlife habitat if jack pine is harvested more frequently



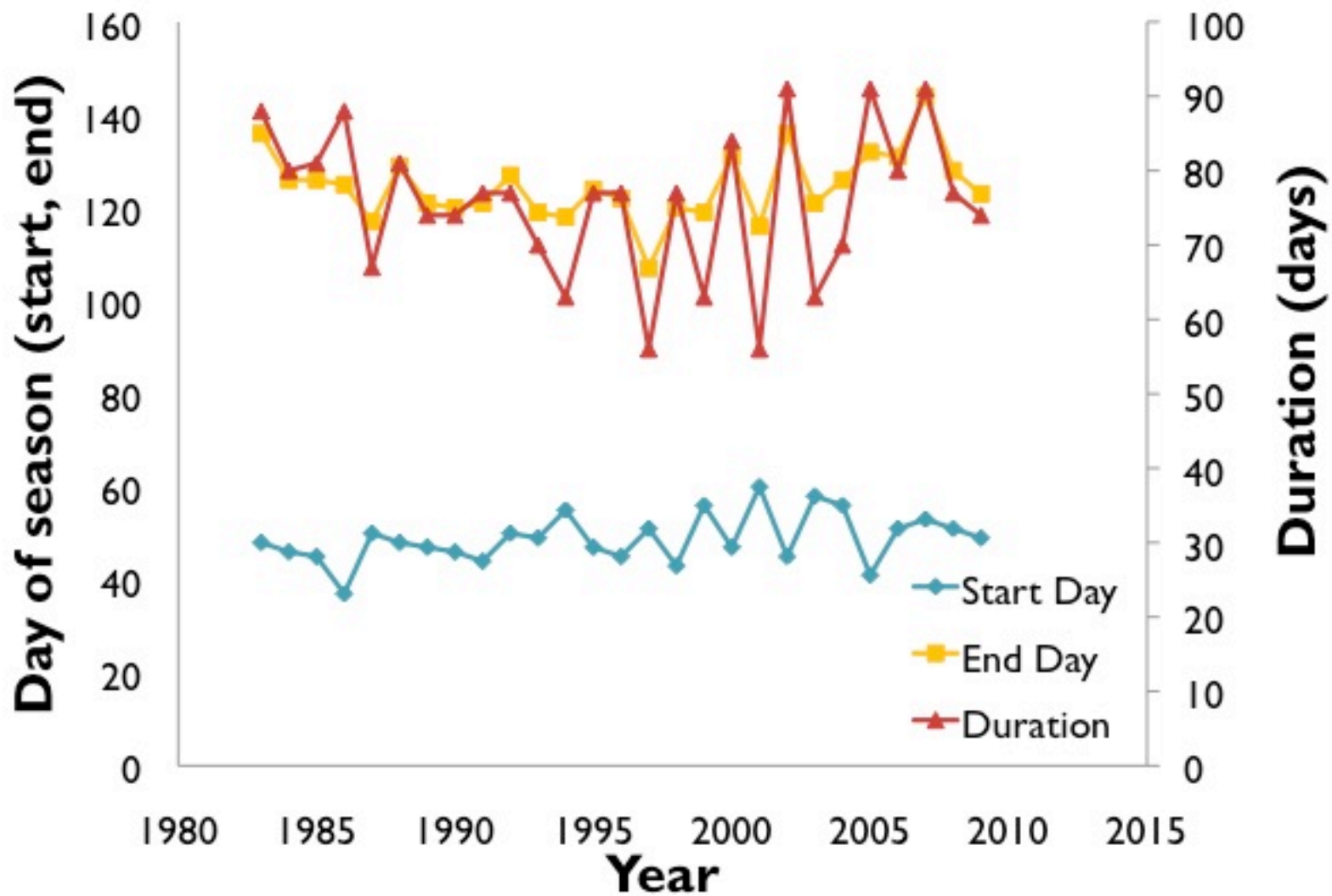
Connection to Roads

“I have little doubt that there are trucks running on those roads that shouldn't be there according to the weight limits.”

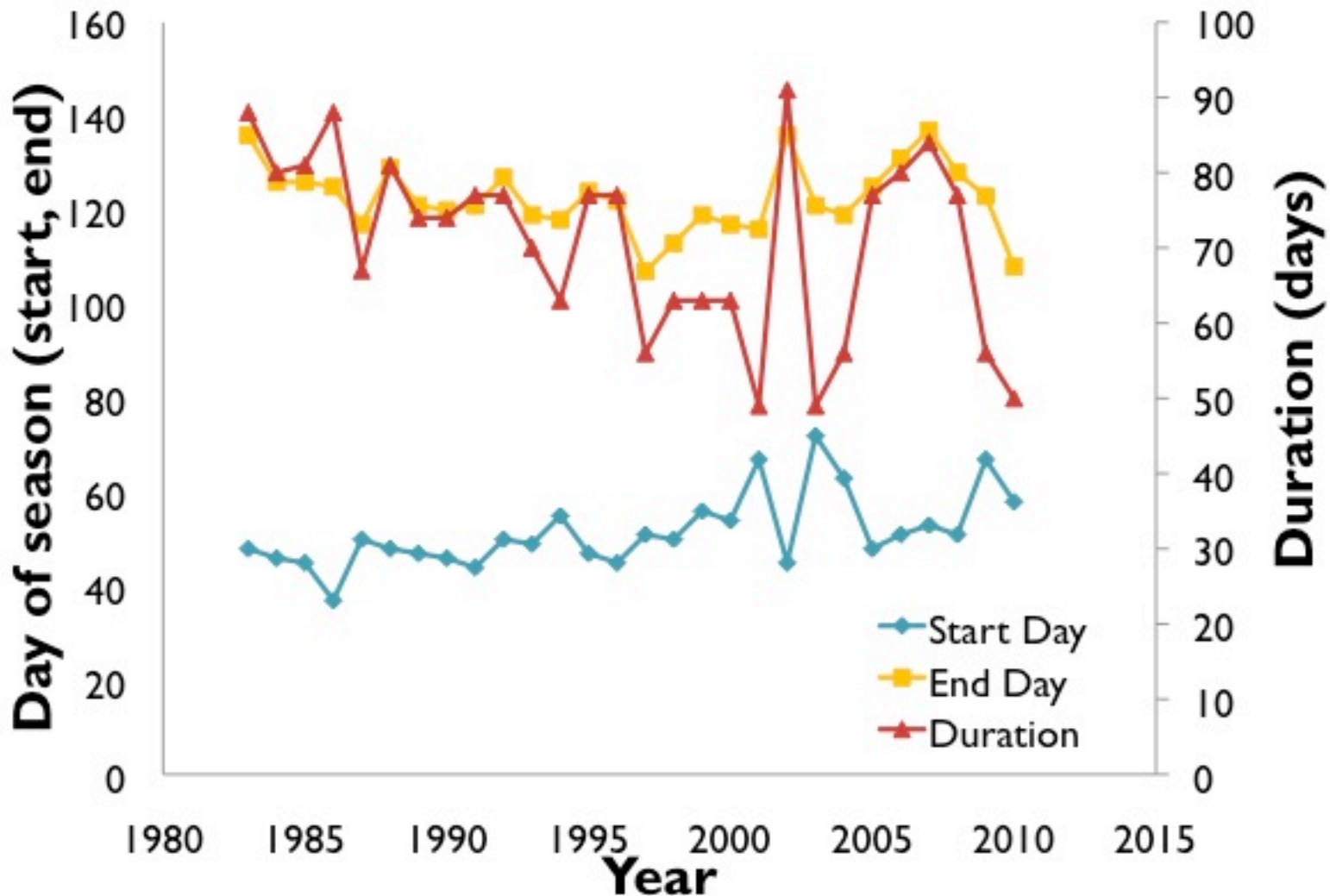
“Fuel costs used to be 20 – 30% of my costs. Now it's 50%.”

Mill receipts show some trucks are overweight

Frozen Road Declarations: Marathon County, 1983 – 2010



Frozen Road Declarations: Dane County, 1983 – 2010





Increase Weight per Trip

Highway: “Especially as fuel costs go up, the transportation industry is going to be looking to increase the weights of their vehicles that are transporting goods and services (especially goods) on county highways.”

Logger: “We’ve moved to 6-axle trucks.”

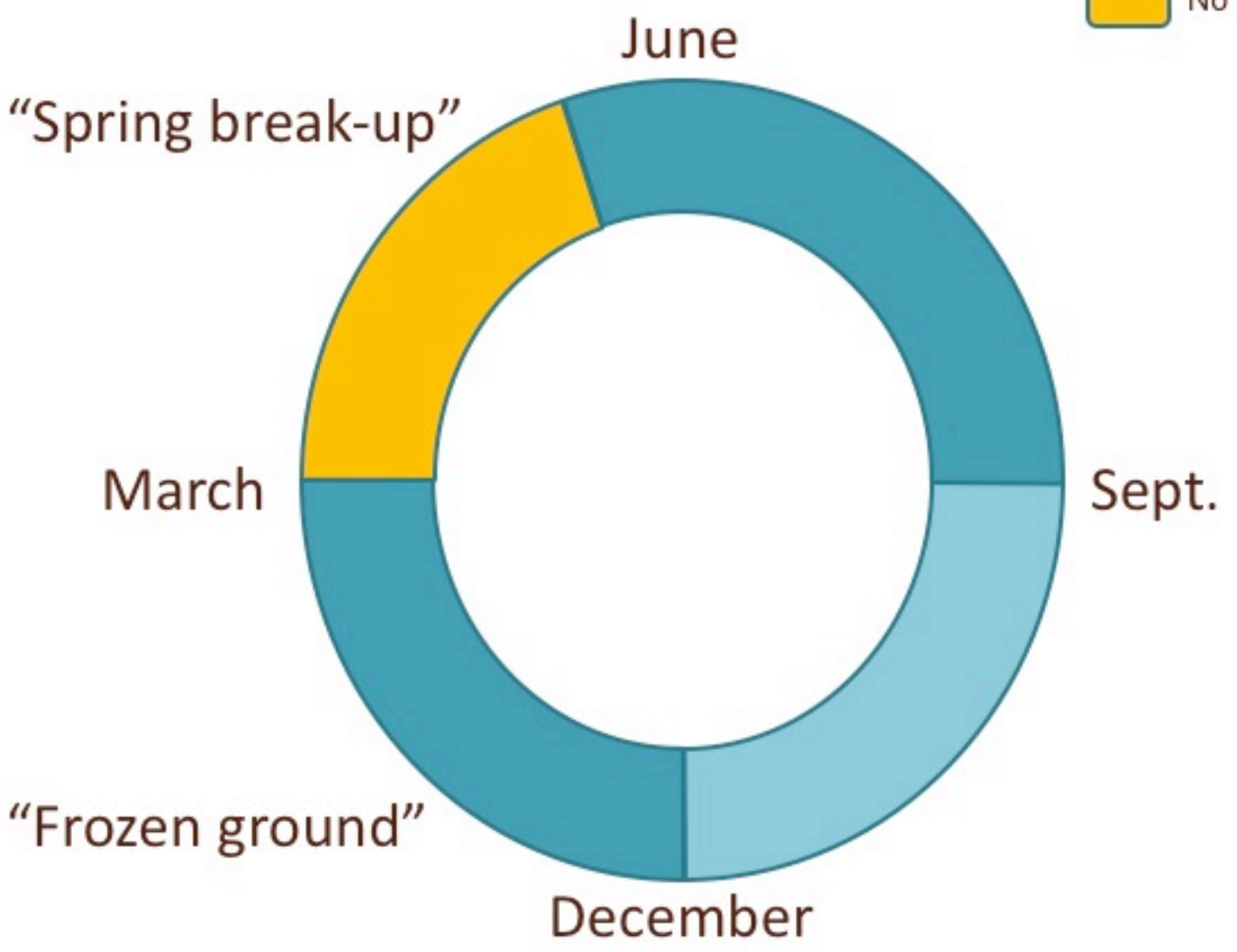


Weight Capacity of Road System

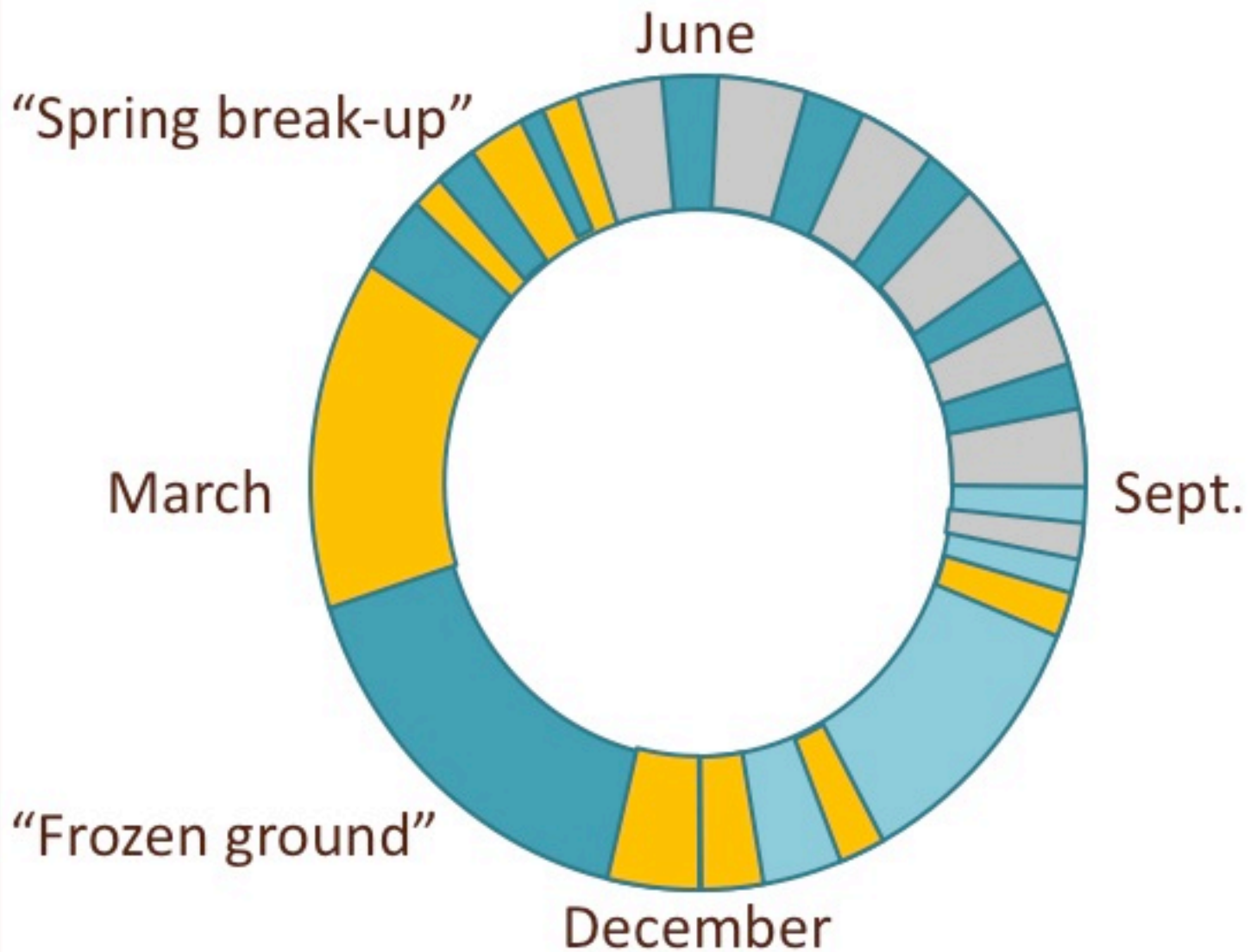
Highway: “The biggest push is increasing in weight for vehicles using the roads. In Minnesota there has been a big push to get a nice backbone of county roads that are able to handle up to 10 tons per axle. I haven’t seen that push here in counties in Wisconsin, but that seems to be the biggest.”

Historical Harvest Timing?

- Harvest
- Upland
- No harvest



Future analysis: what factors affect current harvest timing ?





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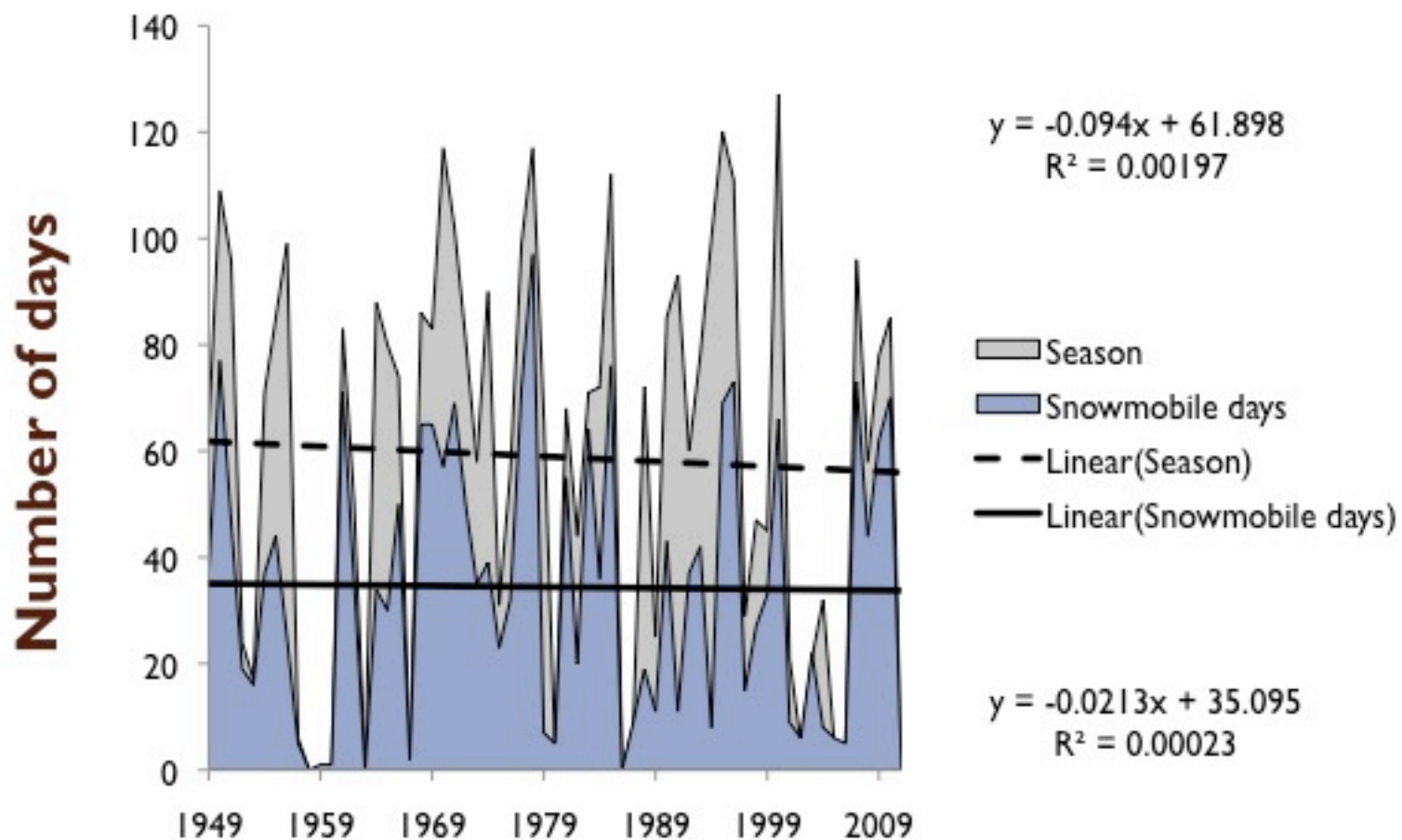
Snowmobiling



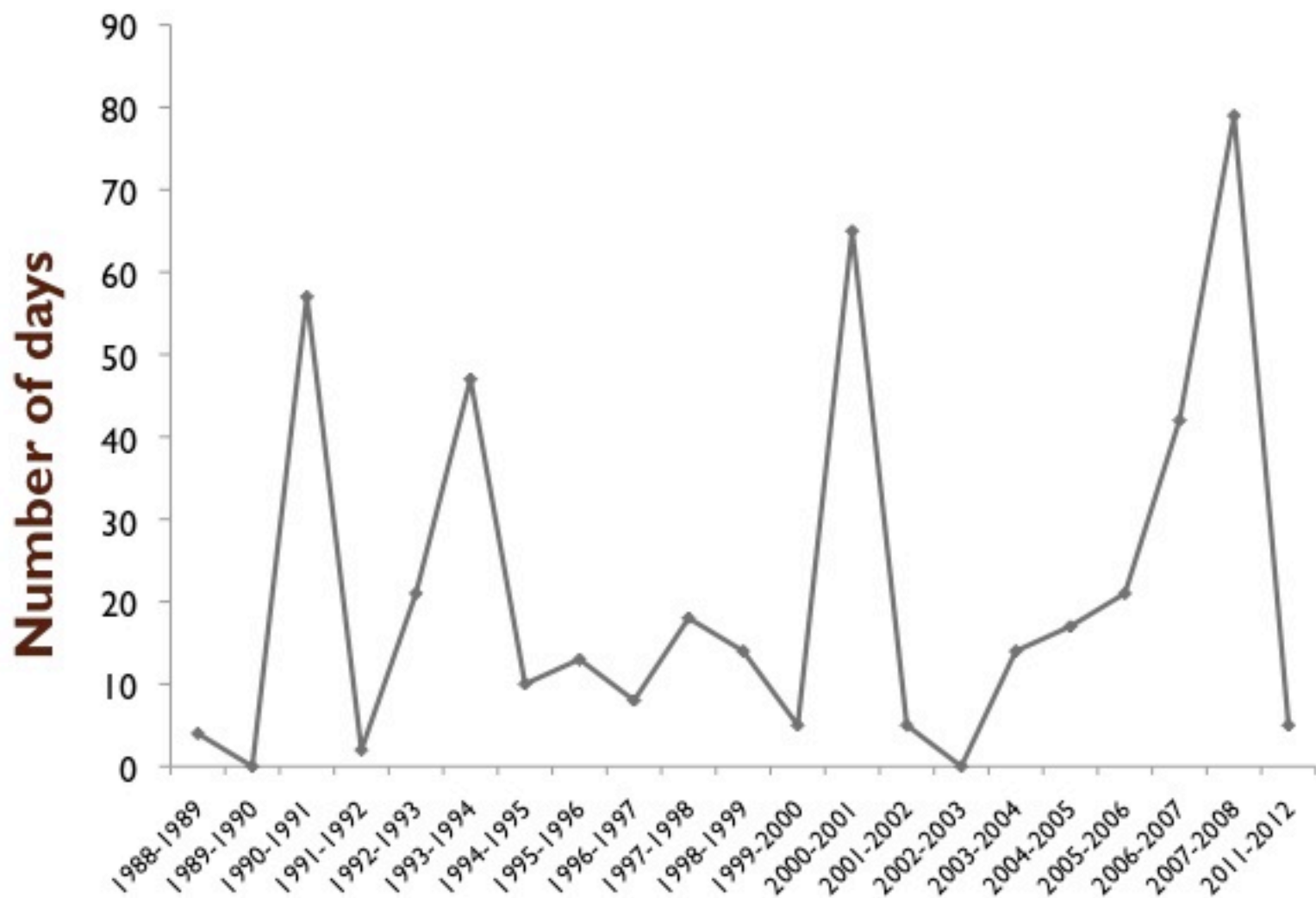
January 2012

Snow variability

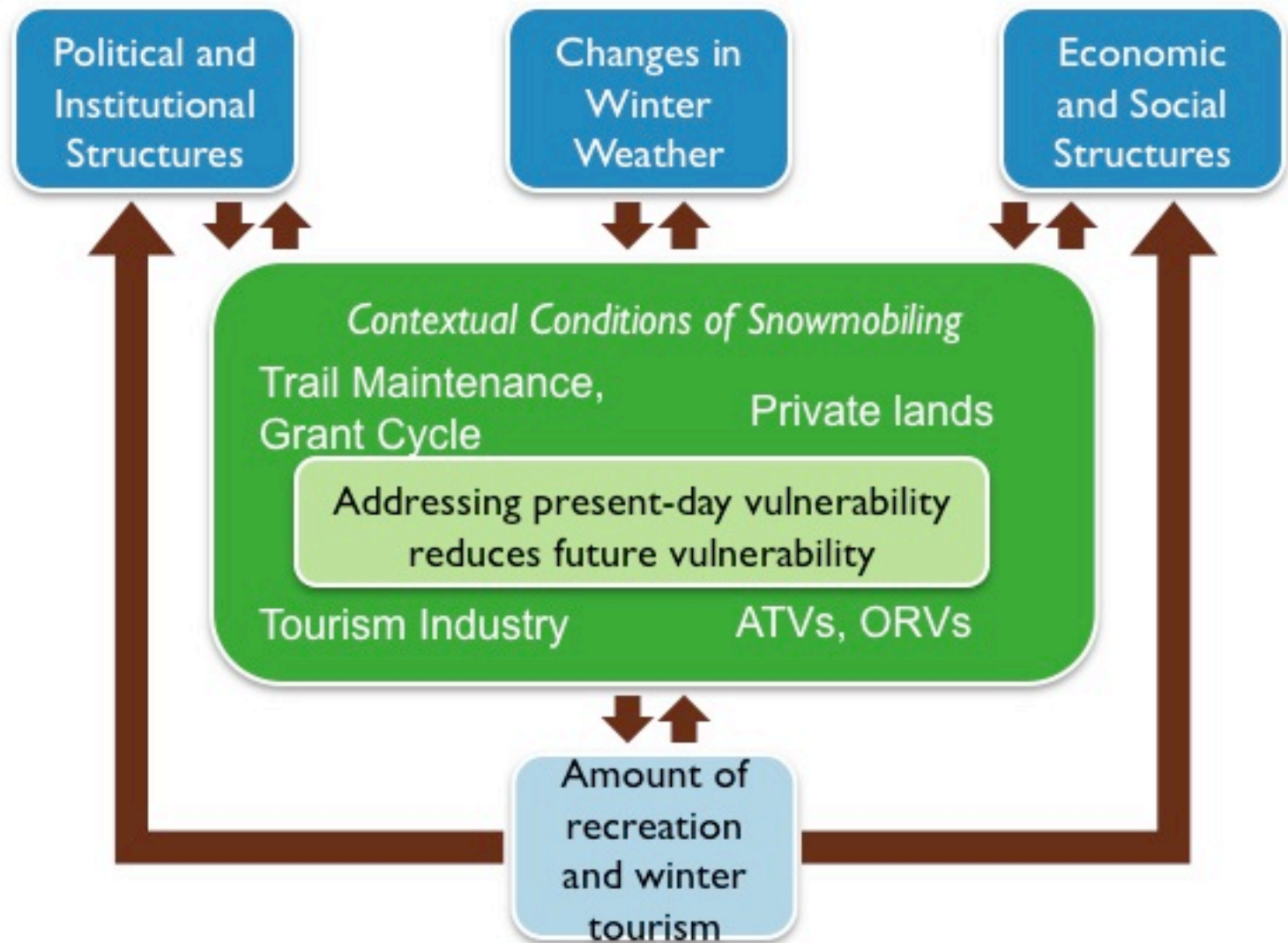
6" Snow Depth Days, Eau Claire



Open snowmobile trail days Dane County



Contextual Vulnerability: Snowmobiling





Types of Adaptations

- 1) Trail grooming – earlier, more efficient
- 2) Technology developments – better gear
- 3) Shift in space – recreators can follow the snow, but hotels and restaurants cannot
- 4) Government programs and insurance
- 5) Shift to other sports



Summary

1. Winter weather is changing and variable, with less frozen ground, uneven snow impacts
2. Winter conditions and variability impacts timber harvest, but less impact than other factors
3. Snowmobiling has always managed variable winter weather



Summary

3. Frozen ground may facilitate compromise
 - between economic and environmental goals for forest management
 - between trucking and road maintenance
4. Adaptation by harvesting on sandy soils and in muddier conditions may alter the balance among multiple-use objectives of public forest management



What to do? Some ideas...

1. Reduce existing vulnerabilities
 - Ex: logger business training in financial management
 - Maintain relations with private landowners for snowmobile trails
2. Need for communication among sectors in adaptation planning
 - Ex: forestry and town roads
3. Work to ensure balance of sustainable forest uses under changing conditions



Next Steps

A graduate student, Ellen Geisler, is working on documenting annual calendars

- Stories of impacts on livelihoods and of adaptation strategies
- Link between governance and climate change impacts on forestry
 - Roads and local government
 - Forest policies and programs
- USDA funded



Hearing about your experiences

1) This past winter was unusually warm. Did this impact timber management or snowmobiling in your county? If so, please describe an example of these impacts and how people responded to them.

2) What else should we keep in mind in this or future research?



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Interviewees

Questions or comments?

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