Farmer Management of Risk Associated with Climate Extremes as Indicators of Adaptation to Climate Change

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Outline

- Background and setting
  - Observations and predictions of trends in climate in the Northeast US
- Study motivation and goals
  - Influence of climate perception on risk management
- Survey methods
- Results
  - Survey population
  - Perceptions of extremes
  - Adaptive strategies
- Conclusions

Broad context of the study

- Progress in making and using seasonal forecasts
  - Natural resource managers, including farmers, are using “El Nino” forecasts around the world
  - Progress on how to use uncertain forecasts
- Relevance for climate change?
  - Climate change predictions have large uncertainty
  - Recognition that society will have to adapt to changes even with uncertainty

Evidence of trends in climate in the Northeast

- Northeast shows less warming than the rest of US (Easterling, 2002)
- Still plenty of evidence of warming trend (DeGaetano, 1996;U. NH, 2005)

Figure at right: U. NH, 2005 "Indicators of Climate Change in the Northeast"

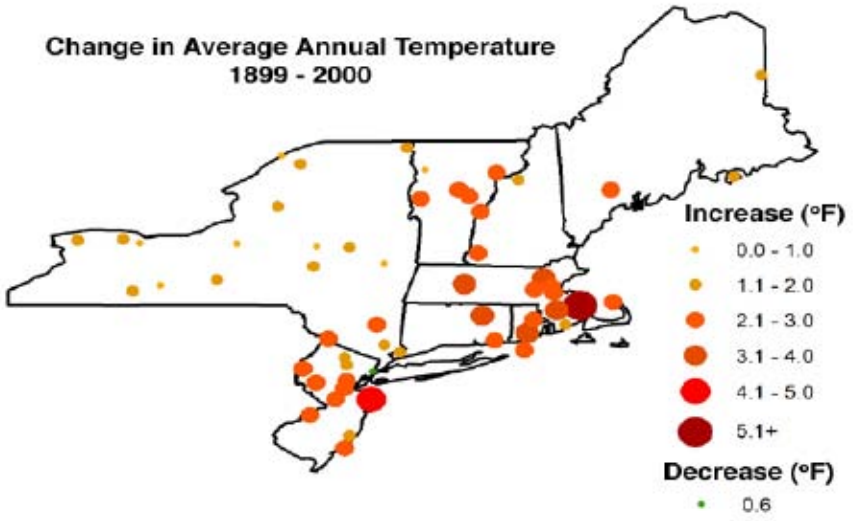
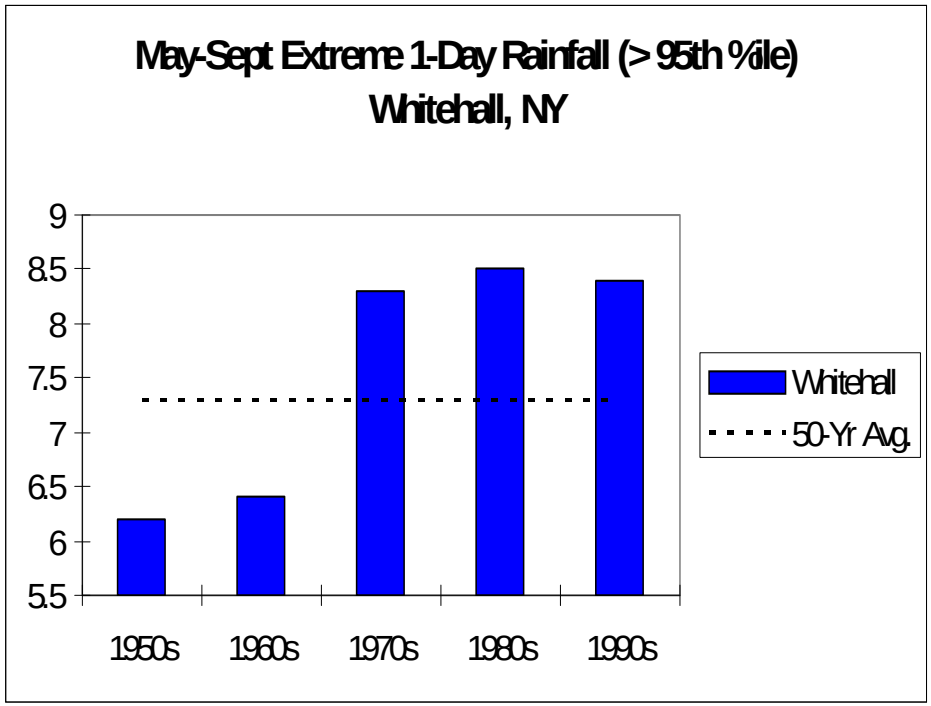


Figure 2: Map illustrating the linear trend in annual temperature (°F) from 1899-2000 for Northeast meteorological data. Cooling trends are shown with blue dots, while warming trends are shown with red dots. The change was estimated from a linear regression ofannual average temperature for each station.

Trends in extremes of precipitation

- Evidence of increased precipitation:
  - 95th percentile responsible for most of increase in rainfall in northeast (Karl and Knight, 1997)
  - Number of rainfall events lasting 7 days or longer has increased in all seasons, particularly summer and fall (Kunkel, 1999)



Model Predictions

- Expectation for Northeast increased precipitation
- Models agree on increase in extreme events (IPCC 2001, IPCC 2007)
- Lots of uncertainty, but if mean of distribution shifts, upper tail also likely to move (Meehl et al., 2000; Katz and Brown, 1992)

Managing climate risk

- Farmers manage climate risk daily
- Extremes of climate are more important than averages
- Understanding current adaptation to climate extremes provides insight into climate change adaptation

Goals of the study

- "Map" mental models of past and present climate among Hudson Valley farmers
  - Do farmers perceive trends?
  - Look for "recency effect" (Kahneman and Tversky, 1979)
- Assess adaptive strategies in response to climate extremes
  - Are farmers adapting, resilient to climate extremes?
  - Is future planning horizon related to adaptive response type?

Methods

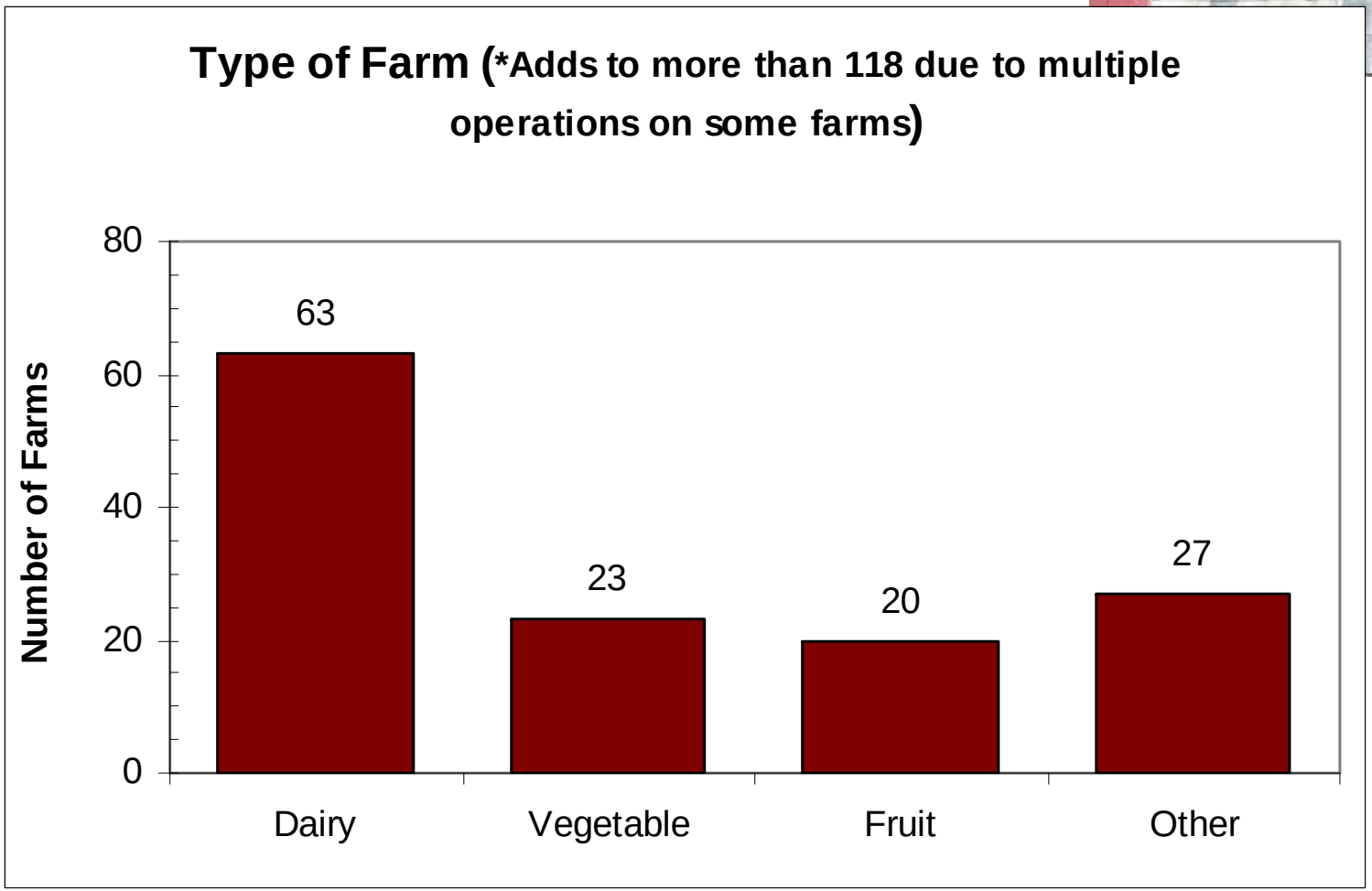
- Mailed survey, through cooperative extension
- 9 counties in mid-Hudson Valley
- Spring 2005:
  - 265 sent / 76 returned
- Spring 2006:
  - 220 sent / 42 returned
- On farm interviews summer 2005, 2006

Sample Area and Distribution of Survey Respondents: Decision Making Under Risk of Extreme Climate Events Among Farmers in the Northeastern United States

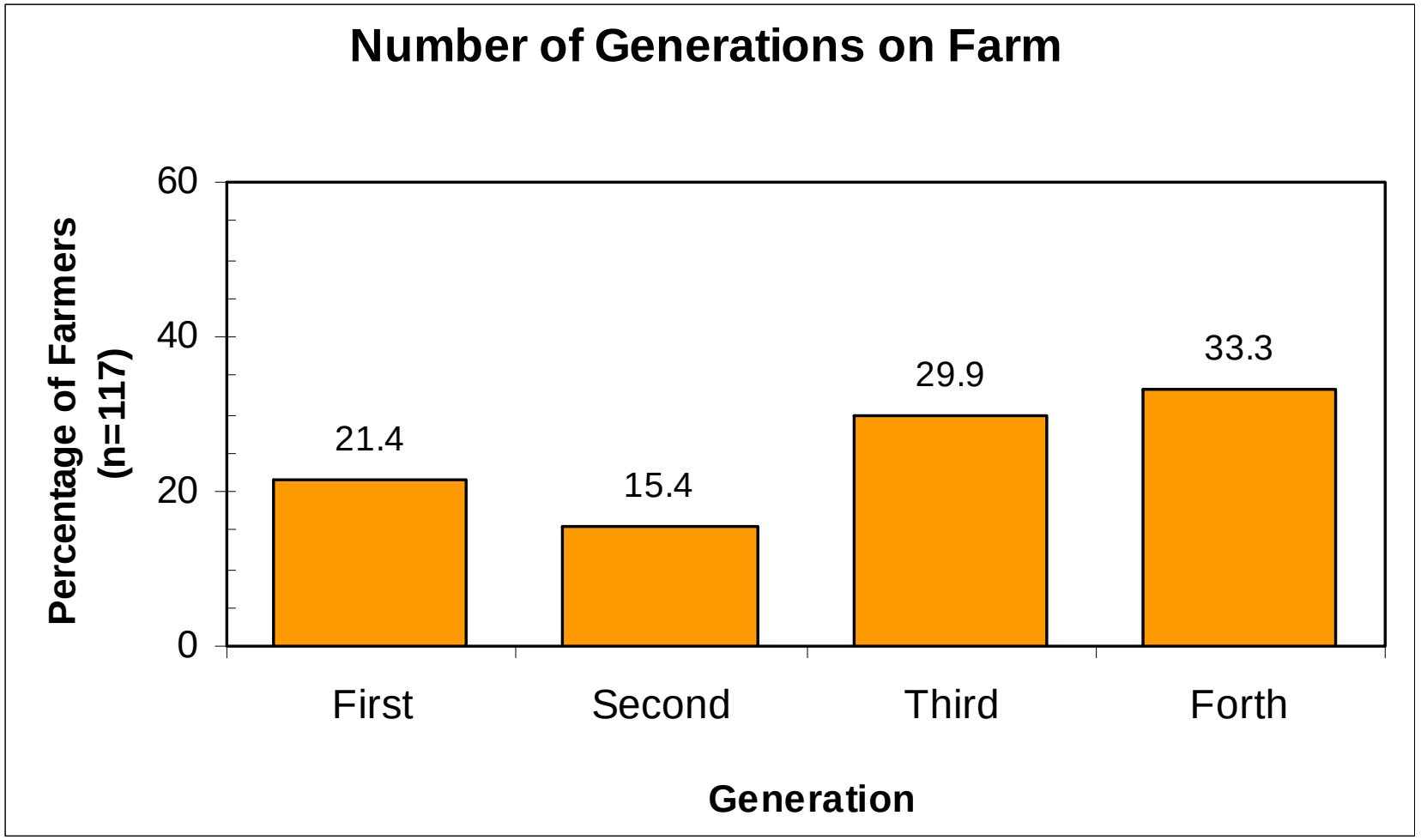
Source: ESRI GIS and Mapping Software, Download Census TIGER 2000/Line Data, Retrieved from http://arcdata.esri.com/data/tiger2000/tiger_download.cfm

Results

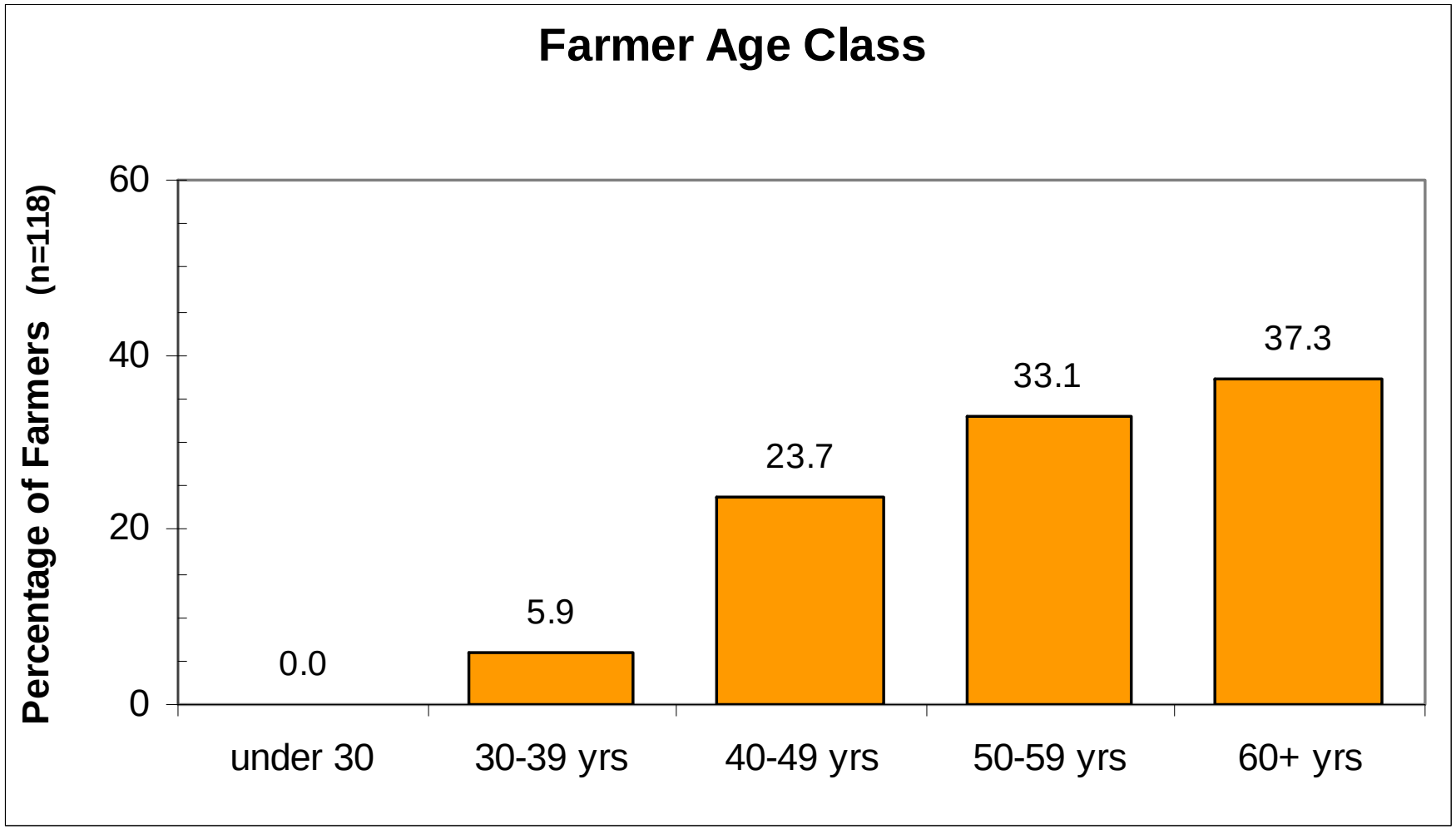
Study Population: Dominated by small dairy



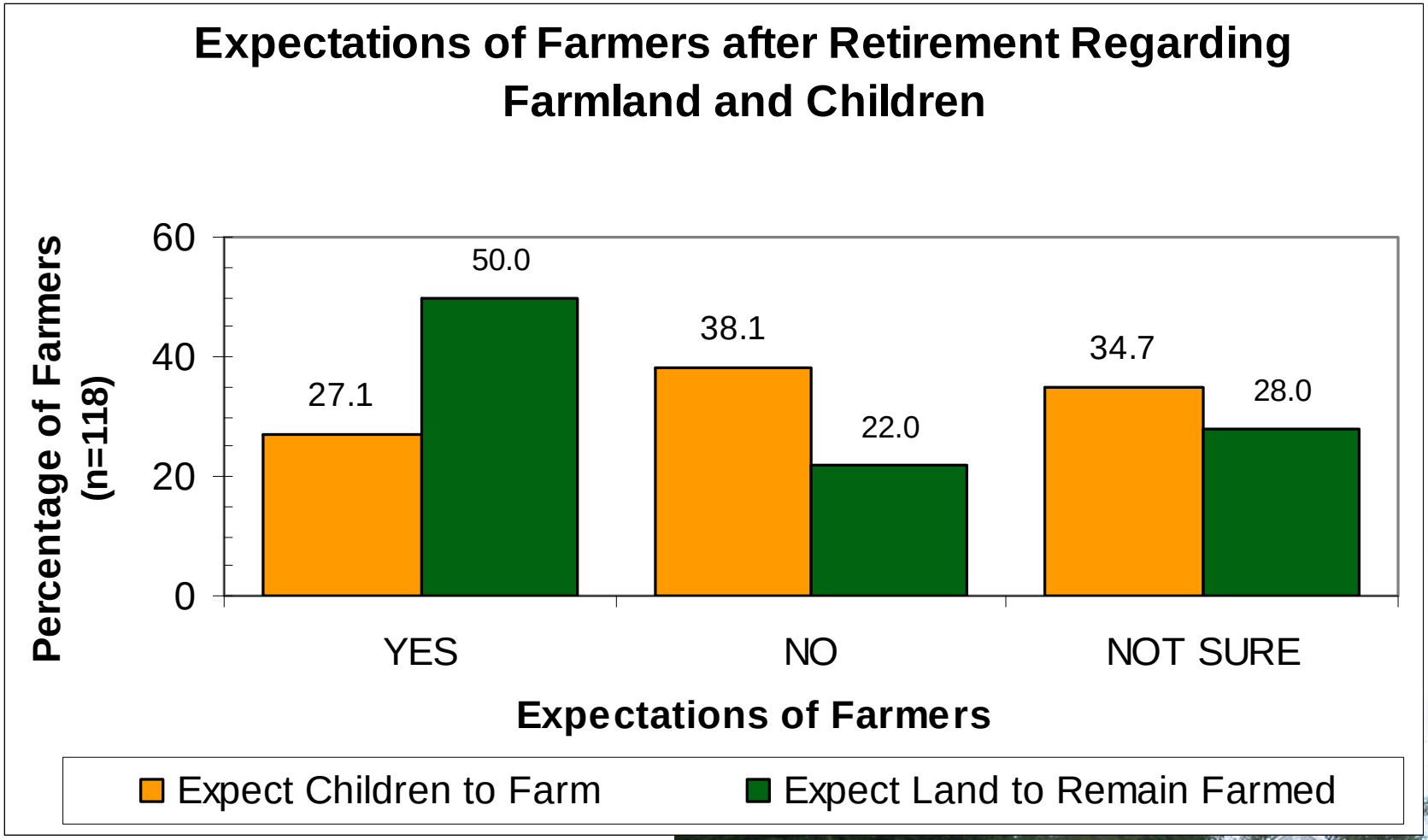
Study Population: More than 60% at least 3rd generation to farm there.

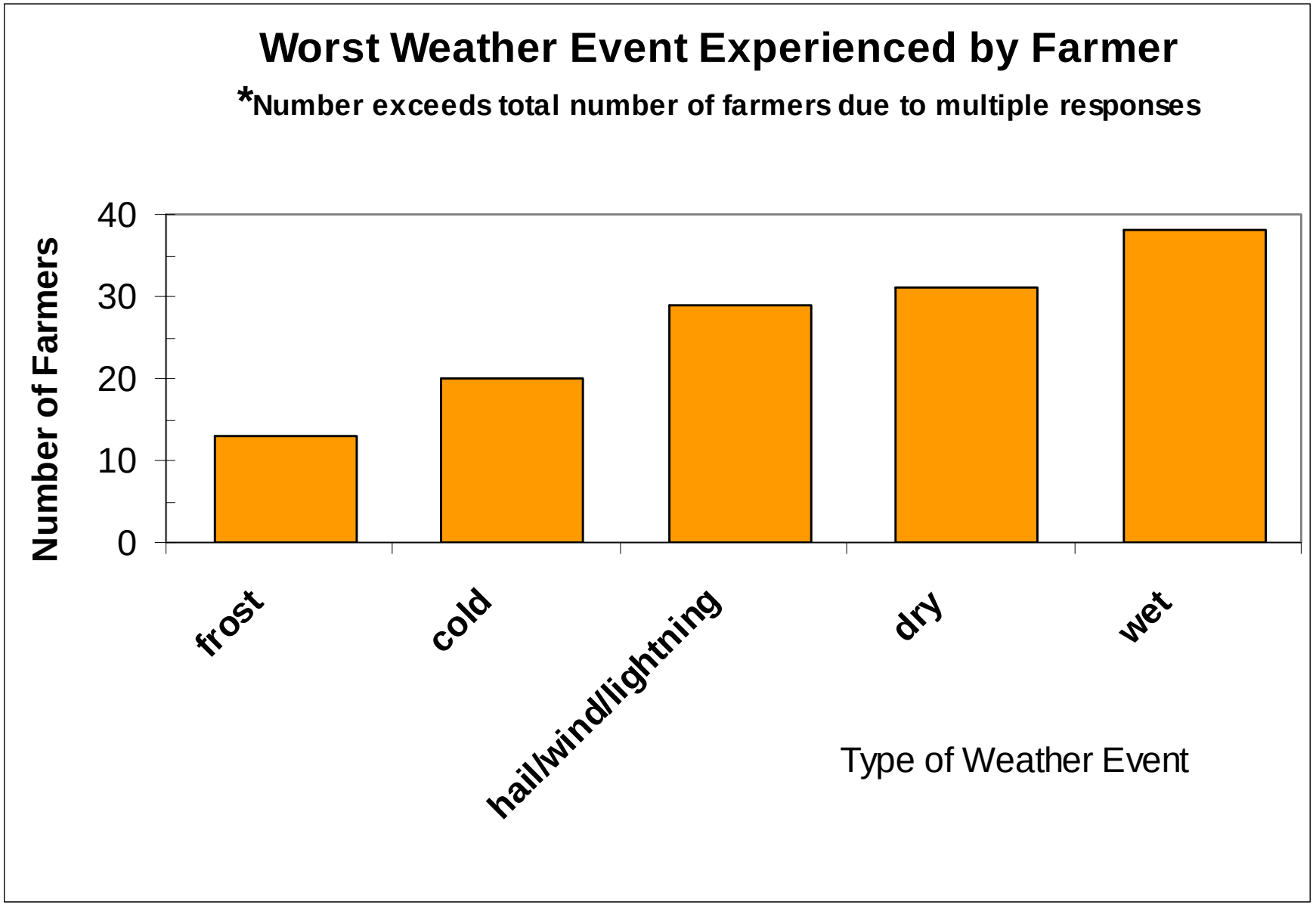


Study Population: 70% over 50 yrs

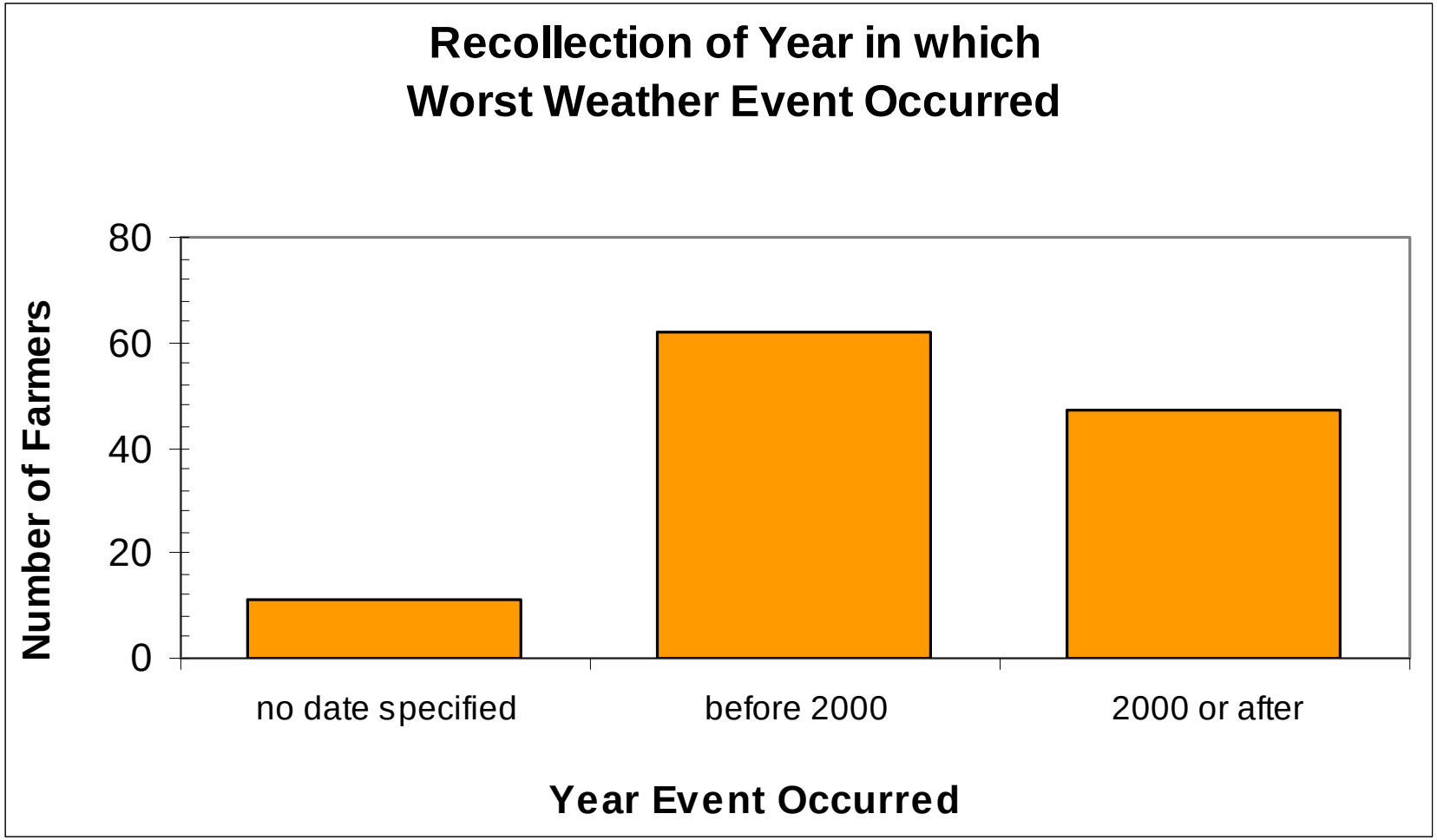


Expectations of Farmers after Retirement Regarding Farmland and Children

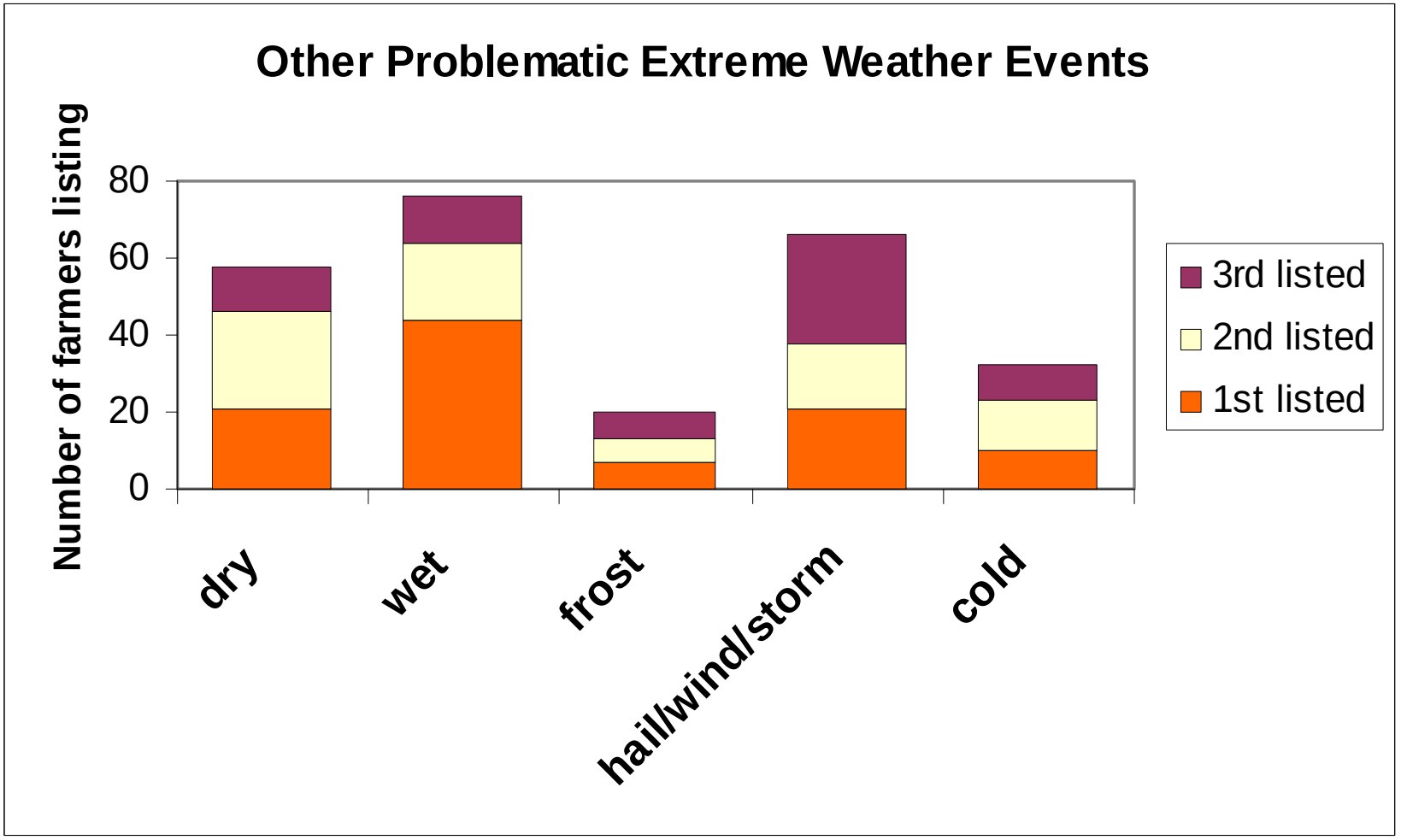



Worst Weather Event Experienced by Farmer
*Number exceeds total number of farmers due to multiple responses
Number of Farmers
40
30
20
10
0
frost
cold
hail/wind/lightning
dry
wet
Type of Weather Event

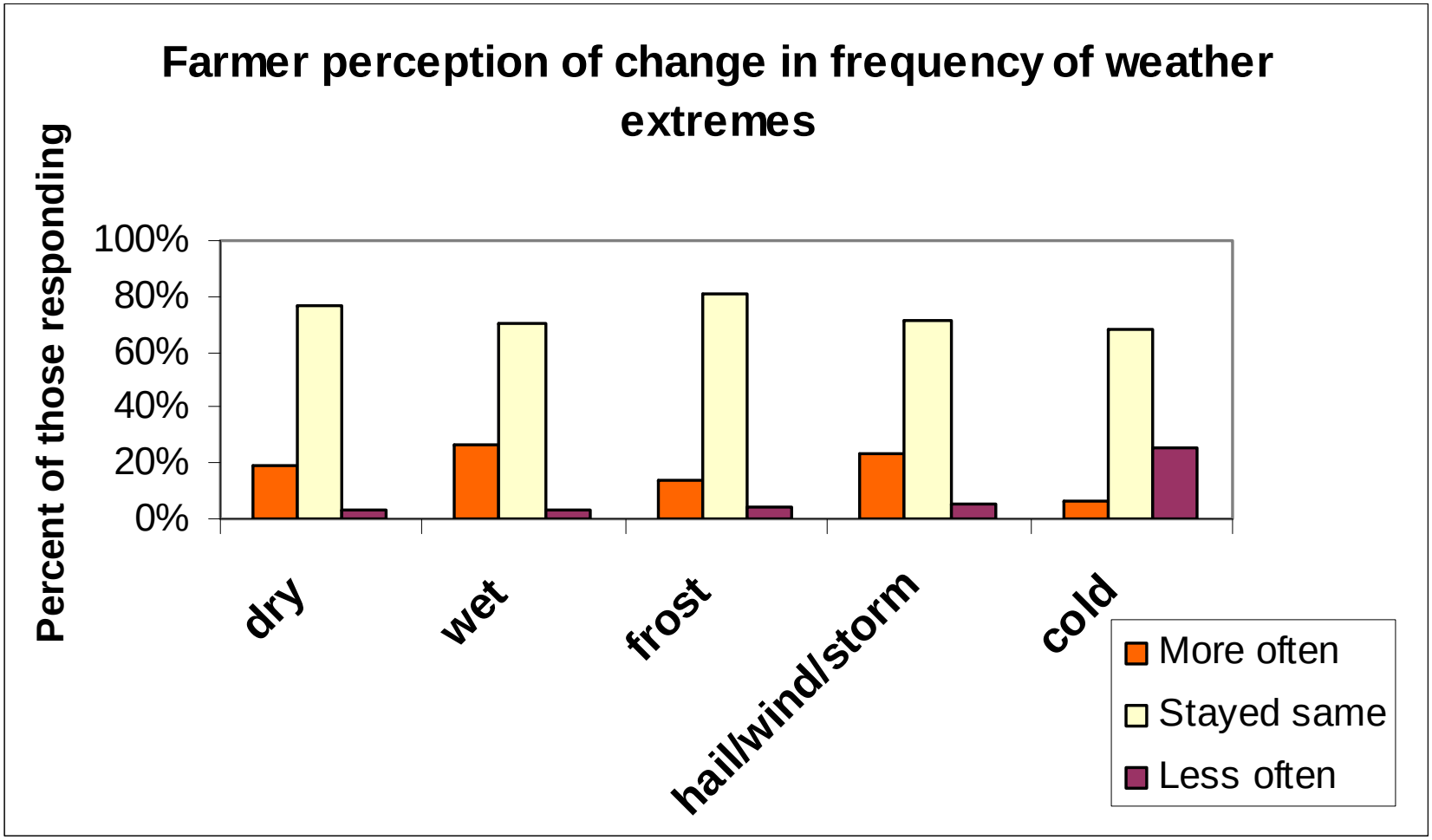
Some evidence of memory bias ("recency effect")



Wet weather, floods, most often noted recurring problem



Only ~20% of farmers see trends in weather extremes



Adaptation strategies for handling wet, flooding (n)

‘Nothing can be done’	30
Improve drainage	17
Change variety or diversify crops	11
Speed up harvest cycle (hay, silage)	6
Take advantage of spatial variability on farm	4
Increase pasture / decrease tillage	4

Adaptation strategies for handling drought (n)

Increase irrigation / upgrade water supply	29
‘Nothing can be done’	8
Store / buy more feed	8
Increase land base	7
Rely more on forages/pasture	5
Improve ventilation in the barn	4
Increase soil organic matter	3
Destock	2
Use spatial variability of land	1

- No relationship found between risk management strategies and expectations for the future of the farm
- May be related to predominantly older, traditional farmers in population

- Strategies that confer resilience should buffer against both ends of the extremes, e.g.
  - Increase soil organic matter
  - Decrease tillage/increase pasture
  - Diversify crops
  - Use spatial variability of land
- Some strategies observed may increase vulnerability (increase energy consumption)
- Other factors to consider, e.g. markets, economic feasibility

Conclusions

- Farmers in the HV under pressure on many fronts
  - Risk management strategies must address market *and* climate risk
- Few perceive of changes in climate but evidence of bias toward recent extremes
- Lots of adaptive responses, some more sustainable than others
- Potential for building on those efforts

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