Climate change - Creating the new normal
Dynamic backdrops of human experience

Technological advancement-Human ingenuity
Politics-Leadership-Public policy
Conflicts -Wars-Disease-Plagues
Economics-depression-disparity-prejudice
Human ineptitude
Environment-Where we live, work, play
Climate and Weather extremes
Turning back the years

Forecasting the future by examining the past – blending measured, observed data with historical proxy information
Minnesota Territory
The Worst Hard Time

The Untold Story of Those Who Survived the Great American Dust Bowl

TIMOTHY EGAN

“This is can’t-put-it-down history.” — Walter Cronkite

“A classic disaster tale.” — NEW YORK TIMES

National Book Award Winner
The extremes in the 1930’s

• What a field day the local and national media would enjoy with the wild weather – that would formulate the *average*.

• Experts believe that landscape use played a large roll in the Dust Bowl era.
# Farmington MN 1931

<table>
<thead>
<tr>
<th>Month</th>
<th>Ave. MAX</th>
<th>Ave. MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>February</td>
<td>43.8</td>
<td>23.0</td>
</tr>
<tr>
<td>July</td>
<td>89.4</td>
<td>62.5</td>
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Farmington MN  1936

<table>
<thead>
<tr>
<th>Month</th>
<th>Ave. MAX</th>
<th>Ave. MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>February</td>
<td>9.7</td>
<td>-10.8</td>
</tr>
<tr>
<td>July</td>
<td>95.2</td>
<td>65.6</td>
</tr>
</tbody>
</table>

12 Days 100 degrees or warmer
Weather vs. Climate

• There is an important distinction between weather and climate.

• *Weather* pertains to occurrences from hour to hour, or day to day, in a specific location.

• *Climate* pertains to average weather over an extended period of time, in a specific region or on a larger scale. Climate can correspond to averages over a season, year, or century and over a county, state, country, or the globe.
Climate Conundrum

- Landscape abuse...Dust Bowl era
- Industrial revolution
- Urbanization
- Agricultural revolution
- Solar cycle
- Ozone hole
- El Nino
- Greenhouse gases... water vapor, carbon dioxide, methane
Minnesota…First think snow and cold

Blizzards….unabated winds…wind chill…whiteouts…travelers stranded …commerce shut down…schools closed…survival.

A For the rest of the Story…

Snow Storm November 10-11, 1940

By the time the blizzard tapered off the Twin Cities had received 16.7 inches of snow, Collegeville 26.6 inches, and twenty-foot drifts were reported near Willmar. Forty-nine Minnesotans lost their lives in this storm.

History records the rapidly changing weather caught many off guard.
Great Storm of 1975

In Willmar, Minnesota, 168 passengers were stranded on a train for hours, unable to walk to shelter because of dangerously low wind chill values. In Omaha, Nebraska a foot of snow fell, Sioux Falls saw 7 inches, Duluth, MN measured 8 inches, and International Falls recorded 24 inches.
Snow 1996-1997 Red River Valley
Snowfall 2008/2009

International Falls 123.0
Minneapolis 51.1
Madison 70.0
Milwaukee 76.0
Urban vs. nearly rural

Winter 2008/2009

• Dec 
  Airport  13.5
  Chanhassen  11.7

• January 
  Airport  8.3
  Chanhassen  7.0

• February 
  Airport  20.8
  Chanhassen  19.4
Winter 09/10

December 2009

MSP Airport 17.3
NWS Chanhassen 16.0

January 2010

MSP Airport 13.0
ave. max 20.0  ave. min 6.1

NWS Chanhassen 11.5
ave. max 19.0  ave. min 3.9
World Population Growth
Doppler radar - a great tool
Flooding in Southeast Minnesota
Rainfall Totals for Southeastern Minnesota
June 7 and 8, 2008

State Climatology Office - DNR Waters
Cedar Rapids Iowa Flood
Excessive rains in Iowa

After more than 15 inches of rain fell across the Maquoketa River watershed, floodwater overflowed the banks and overtopped an 88-year-old dam washing away about 200 feet of the earth-over-concrete portion. The concrete dam remains intact, according to the Iowa Department of Natural Resources, but the nine-mile lake on the Maquoketa River drained away once the privately-owned and operated dam was breached.
Flooding Summer 2008

Water began flowing under the 4-foot-high barrier around 4:30 a.m. An alarm sounded and the few residents remaining in the flood plain were ordered to get out.

"It was a valiant effort," said Chris Azar of the Winfield-Foley Fire Department. "It's unfortunate that we couldn't do more but Mother Nature won. Now, just give it time for the water to recede."

Winfield MO June 28, 2008.
Record rainfall for the month of June 2010 in Lanesboro – 11.63 inches

Nearly four inches of rain in Waseca on June 18th
Lake Delphi, Iowa
Reported three day rainfall – July 2010
July 21-24 estimated rainfall

Q2 [Radar Only]
72hr QPE Accumulation

Valid Period:
07/21/2010 13:00:00 - 07/24/2010 13:00:00 UTC

Min=0.00, Avg=1.39, Max=24.04
August 11, 2010 Twin Cities metro rainfall

Target Field doused with 3.5 inches of rain. From Dr. Mark Seeley…. on the St Paul Campus we received 2.97 inches between 9:45 pm and 10:45 pm (1 hour) which is roughly a once in 100 year rainfall rate.
August 13, 2010

• Flooding struck Ames, Iowa after three nights of heavy rain caused creeks and rivers in central Iowa to swell earlier in the week. Hundreds of residents have had to leave their homes in Ames, Des Moines and Colfax, and a 16-year-old girl was killed when a flooded creek swept her car off a road near Des Moines.
Hundred year floods

- Minnesota and Mississippi Rivers 1965
- Mississippi River – Lake Iowa 1993
- Red River of the North Grand Forks 1997
- Minnesota River 2001
- Red River of the North Grand Forks 2009
- Red River of the North Fargo 2010
Climatologist Kevin Trenberth *

What we can say is that certain events would have been extremely unlikely to have occurred without global warming, and that includes the Russian heat wave and wildfires, and Pakistan, Chinese and Indian floods," Trenberth told Yahoo! News.

*head of Climate Analysis at the National Center for Atmospheric Research in Boulder, Colorado.
Our fate is in our hands
Dr. Dennis Mileti, author of Disasters by Design

We are getting more vulnerable to weather mostly because of where we live, not just how we live!