Food, fiber, and fuel: Providing society's needs while addressing climate change

Minnesota Environmental Congress

December 3, 2019

Minnesota State University—Mankato

Climate trends

Hazard	Observed Trend	Confidence Change is Occurring
Extreme cold	Rapid decline in severity & frequency	**Highest**
Extreme rainfall	Becoming larger and more frequent	
Heavy snowfall	Large events and more frequent	**High**
Severe thunderstorms & tornadoes	Overall numbers not changing but tendency toward more "outbreaks"	**Moderately low**
Heat waves	No recent increases or worsening	**Lowest**
Drought		

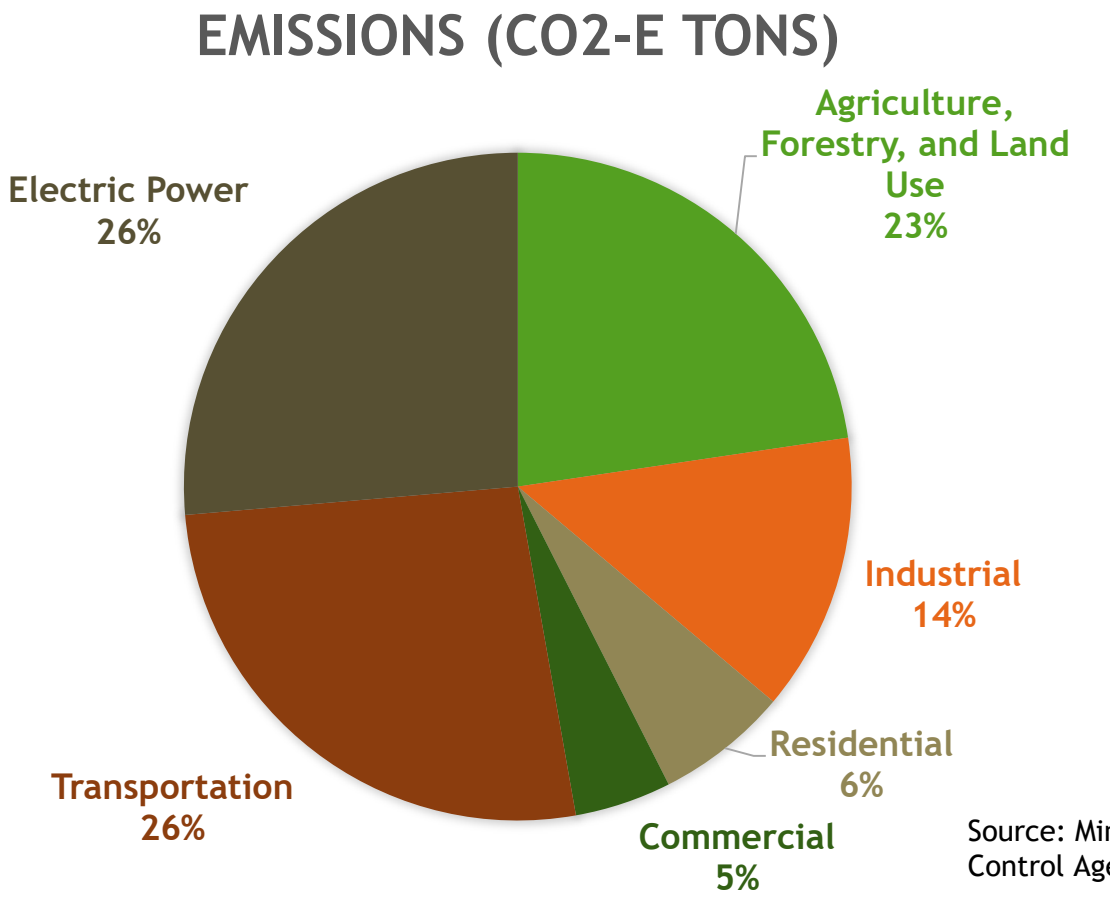
Snapshot of observed trends among common weather hazards in Minnesota, and confidence that those hazards are changing in response to climate change. Graphic based on information from 2014 National Climate Assessment and data analyzed by the Minnesota DNR State Climatology Office.

Climate projections

Hazard	Projections through century	Confidence in projected changes
Extreme cold	Continued loss of cold extremes and dramatic warming of coldest conditions	**Highest**
Extreme rainfall	Continued increase in frequency and magnitude; unprecedented flash floods	
Heat waves	More hot days with increases in severity, coverage, and duration of heat waves	**High**
Drought	More days between precipitation events, leading to increased drought severity, coverage, and duration	**Moderately High**
Heavy snowfall	Large events less frequent as winter warms, but occasional very large snowfalls	**Moderately low**
Severe thunderstorms & tornados	More "super events" possible, even if frequency decreases	

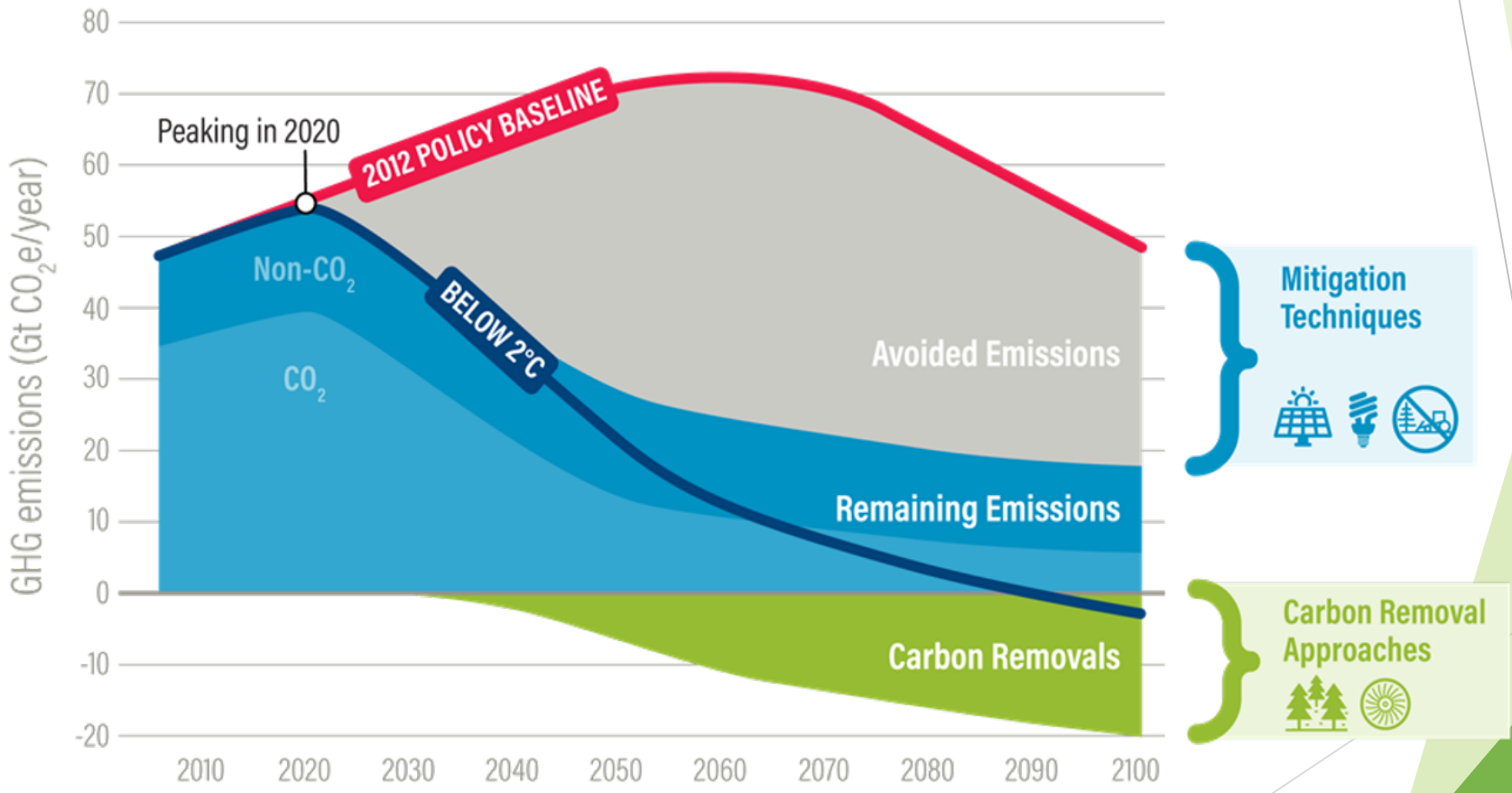
Snapshot of projected and expected trends among common weather hazards in Minnesota, and confidence that those hazards will change (further) through the year 2099 in response to climate change. Graphic based on information from 2014 National Climate Assessment, and data analyzed by the Minnesota DNR State Climatology Office.

GHG sources by sector (2016 data)

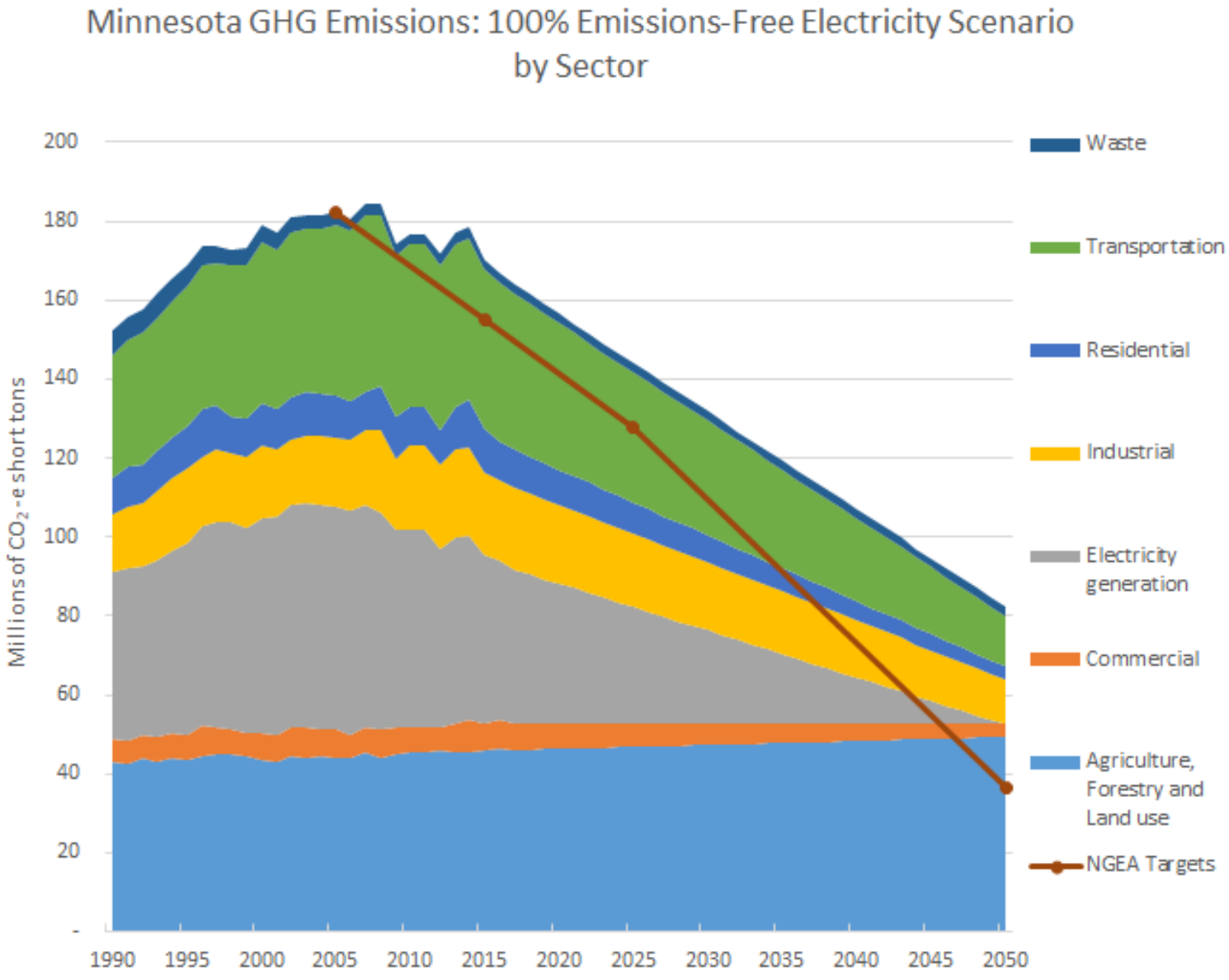


Source: Minnesota Pollution Control Agency

Natural climate solutions



Source: World Resources Institute
Used by permission



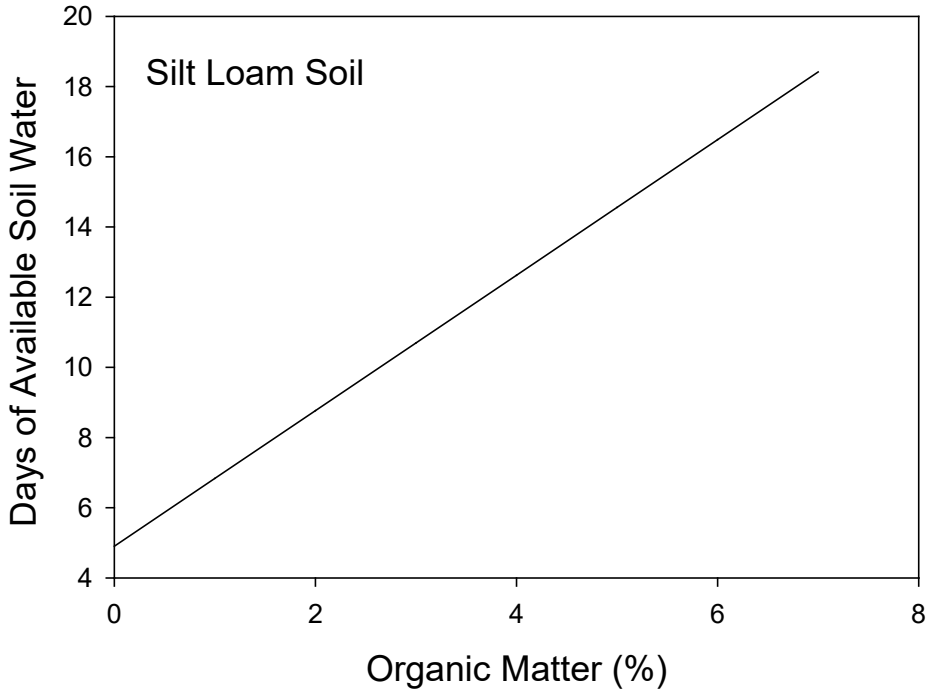
Citation: analysis and figure by Barb Jacobs, Institute on the Environment (2019)

Most effective BMPs for reducing GHGs

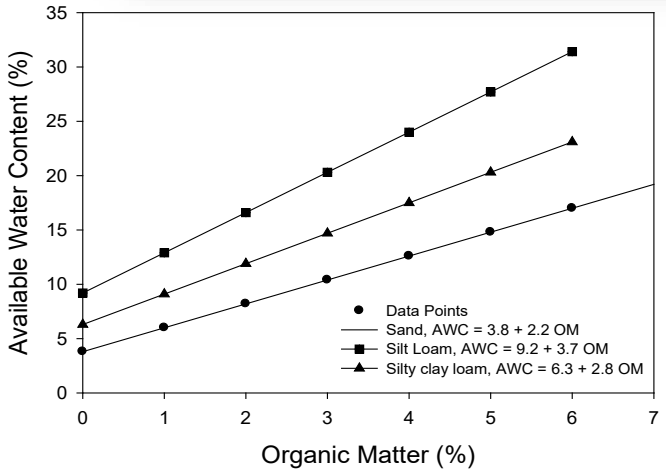
- Greatest reduction per acre but limited acreage:
  - Field borders, filter strips, grass waterways
  - Hedgerows, shelterbelts (trees and shrubs)
  - Riparian buffers (forested or herbaceous)
- Less reduction per acre but broader acreage:
  - Adding a perennial grass to crop rotation
  - Cover crops
  - No till or reduced tillage
  - Various nutrient management practices, particularly split fertilizer applications, controlled release fertilizers

Source: MPCA report, *Greenhouse Gas Reduction Potential of Agricultural Best Management Practices, 2019*

Improved soil health also improves crop production resilience



Assuming an average rate of crop water use during the grain-filling period for corn



Hudson, 1994

Source: USDA National Laboratory for Agriculture and the Environment, Ames, IA

Panel discussion


CASE INTERNATIONAL
7250