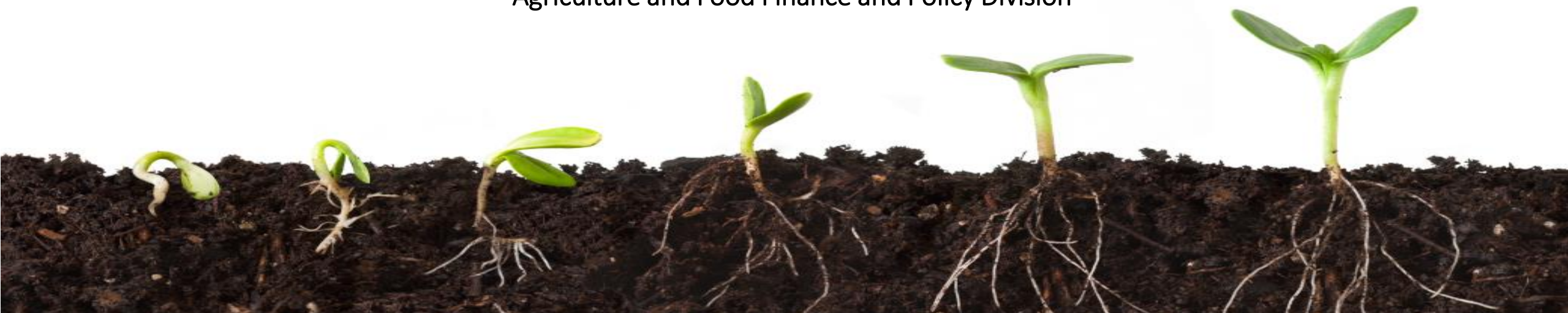


Agriculture, Innovation and Changing Climate

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February 28, 2019

Minnesota House of Representatives
Agriculture and Food Finance and Policy Division



Farming Matters to Minnesota, billions US\$

Animal and products			Crops			All commodities		
Rank	State		Rank	State		Rank	State	
1	Texas	14.3	1	California	39.0	1	California	50.2
2	Iowa	13.4	2	Illinois	13.7	2	Iowa	26.5
3	Nebraska	12.5	3	Iowa	13.1	3	Texas	23.0
4	California	11.2	4	Minnesota	9.5	4	Nebraska	21.3
5	Kansas	9.5	5	Nebraska	8.9	5	Minnesota	17.1
6	Wisconsin	8.0	6	Texas	8.6	6	Illinois	16.3
7	North Carolina	7.7	7	Washington	7.7	7	Kansas	15.7
8	Minnesota	7.6	8	Indiana	6.9	8	North Carolina	11.5
9	Georgia	5.8	9	North Dakota	6.6	9	Wisconsin	11.4
10	Arkansas	5.3	10	Kansas	6.2	10	Indiana	10.6
	United States	176.0		United States	196.3		United States	372.3

Sources: USDA, ERS (2019) and BEA (2019)

Notes: Cash receipts from farming, 2017, and state GDP, 2016

The Nature of Agricultural Production

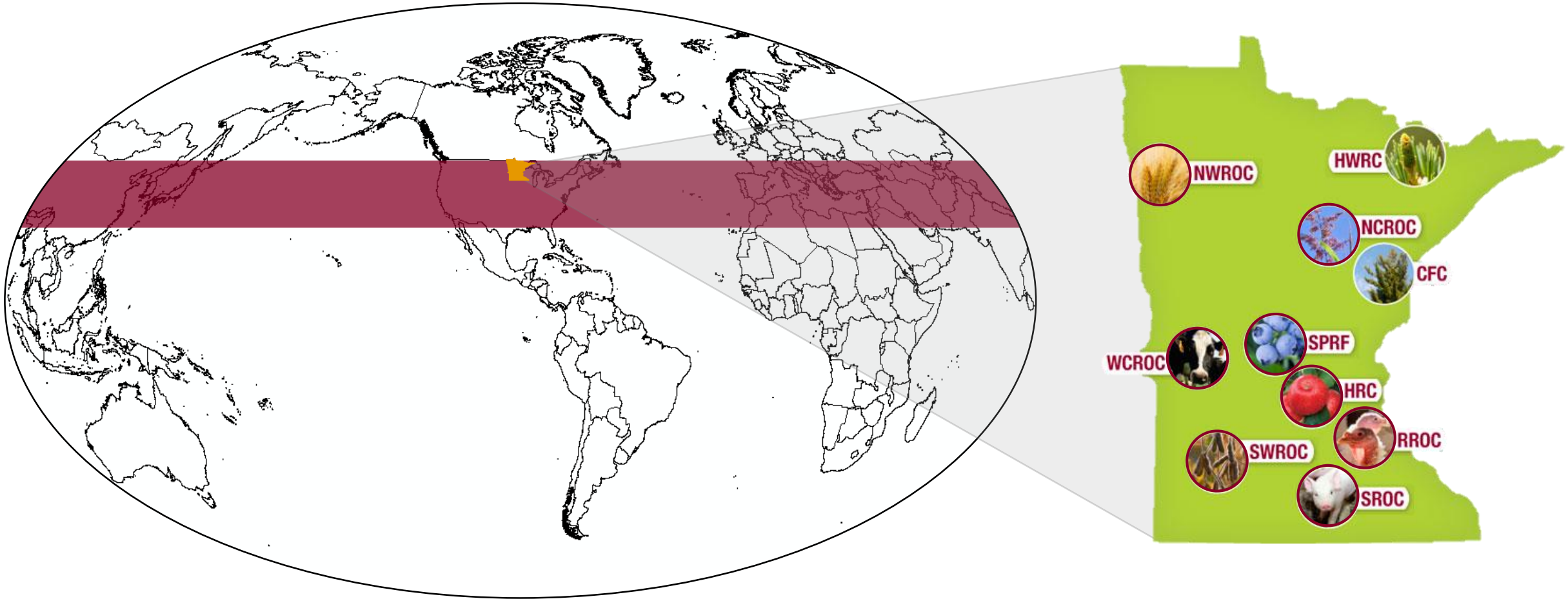
- Agriculture is a biological production process
- This means agricultural output relies on:

Land, Labor, Seed, Machinery, Energy, Fertilizer (and other chemicals) **and weather**

- The nexus of weather/climate and agricultural has two distinctive attributes
 - Timing
What crop is planted when (and how)
 - Location
What crop is planted where

Minnesota: Ground Zero for Global Agricultural & Climate Change

- 50% of the world's value of crop production is produced within the latitudinal bands from California to Minnesota



- The University of Minnesota has 10 Research and Outreach Centers (ROCs) located in critical agro-ecologies

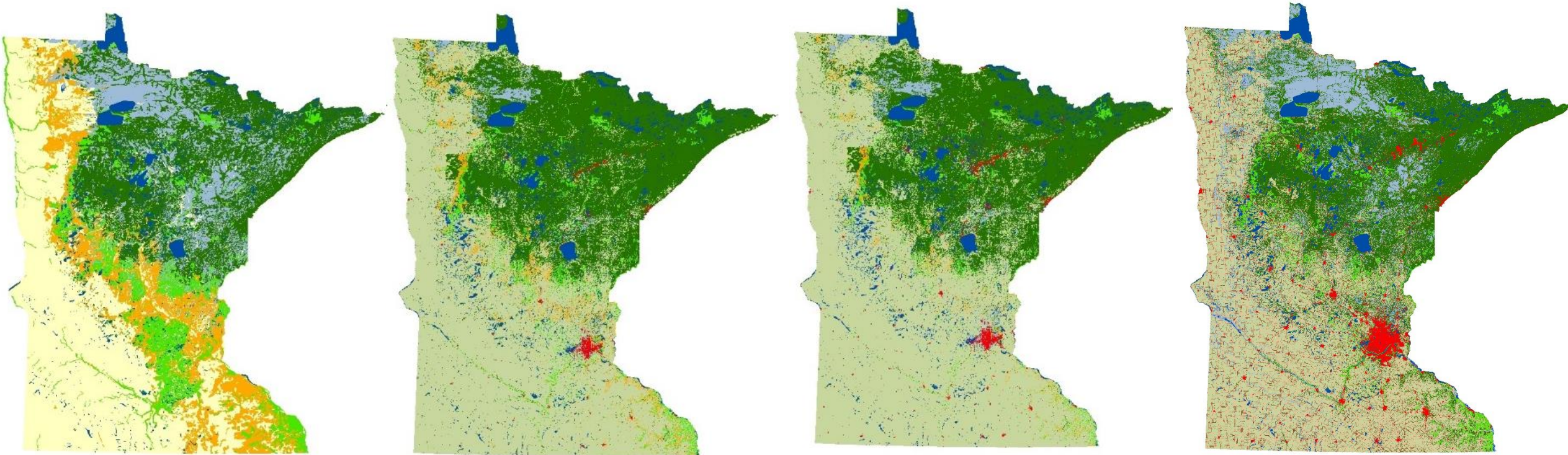
Minnesota Land Use: Pre-Settlement to Present

Pre-settlement

1910

1949

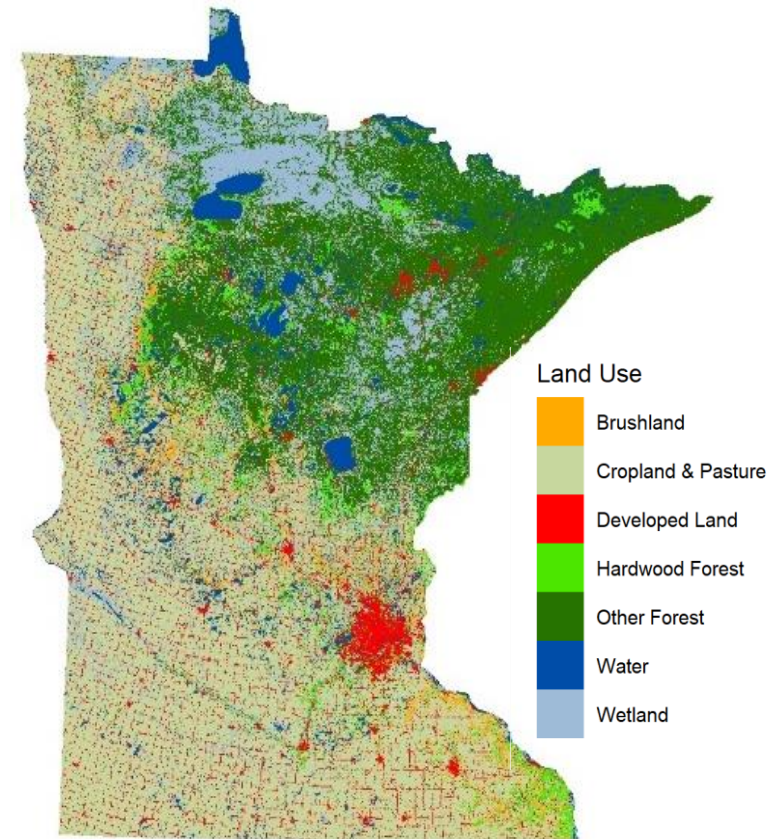
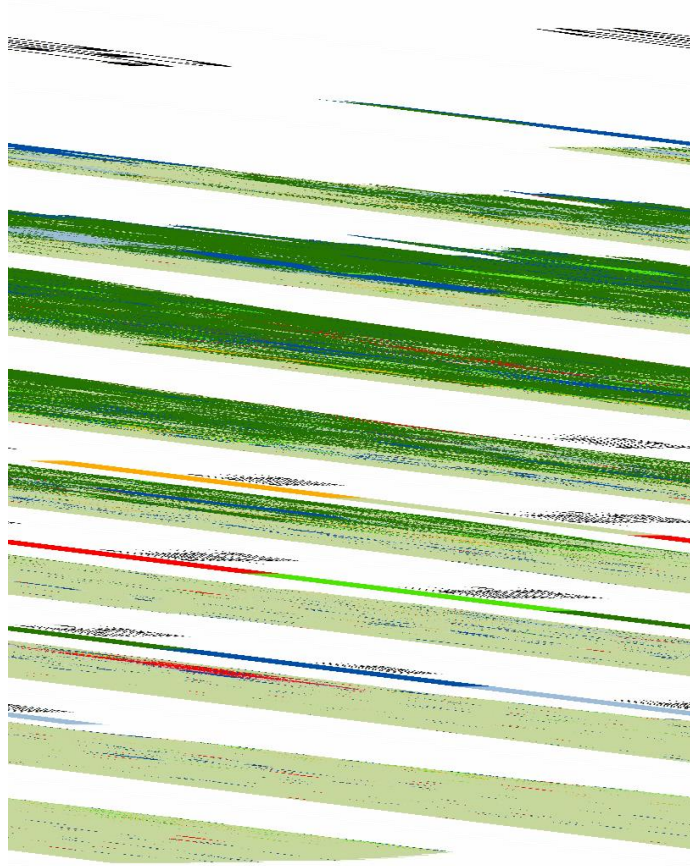
2016



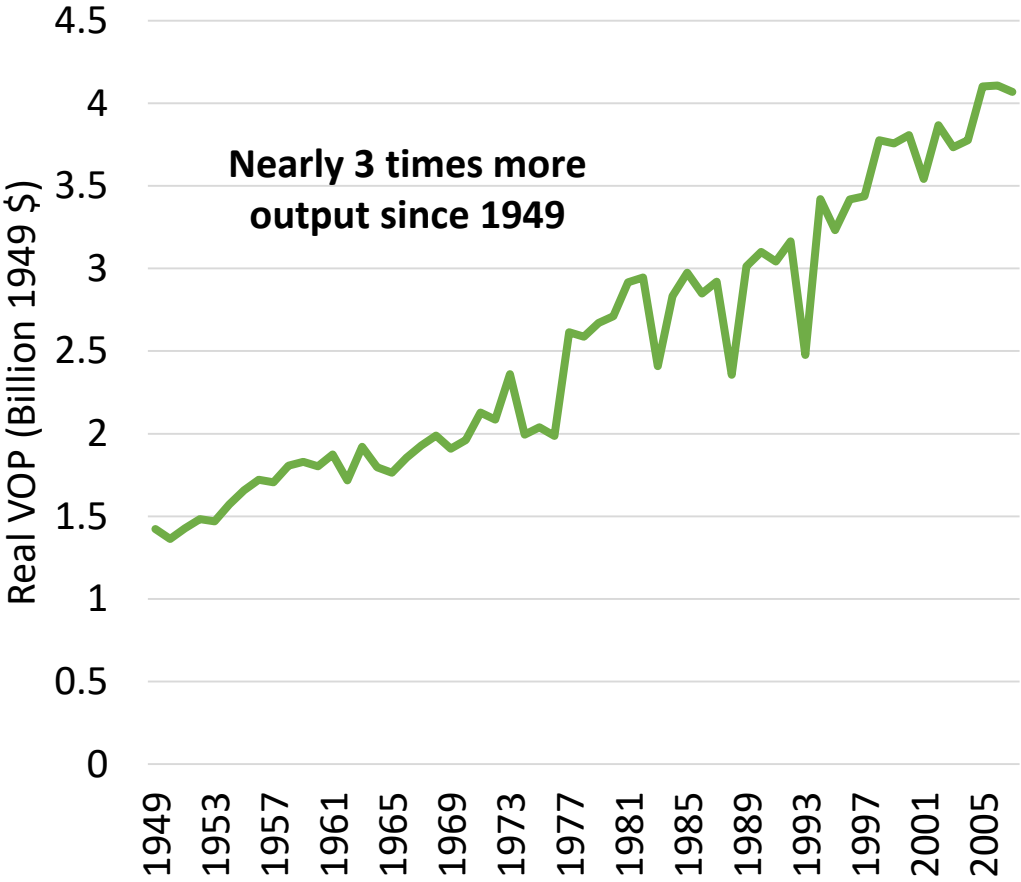
 Prairie  Brushland  Hard Forest  Other Forest  Wetland  Water  Crop_Pasture  Developed land

Minnesota Absent Agricultural Innovation, 1949-2007

2007

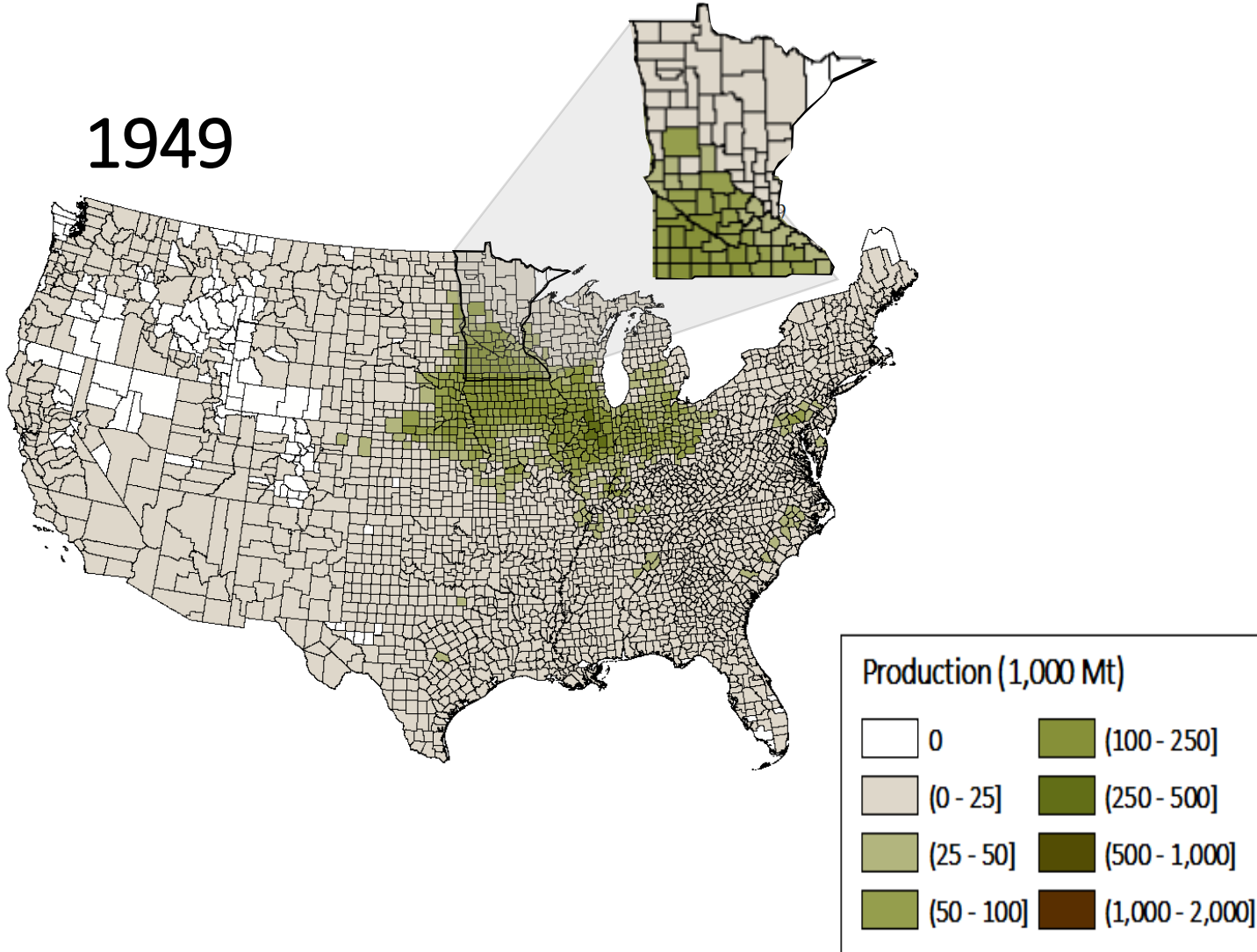


Real Value of MN Agricultural Output

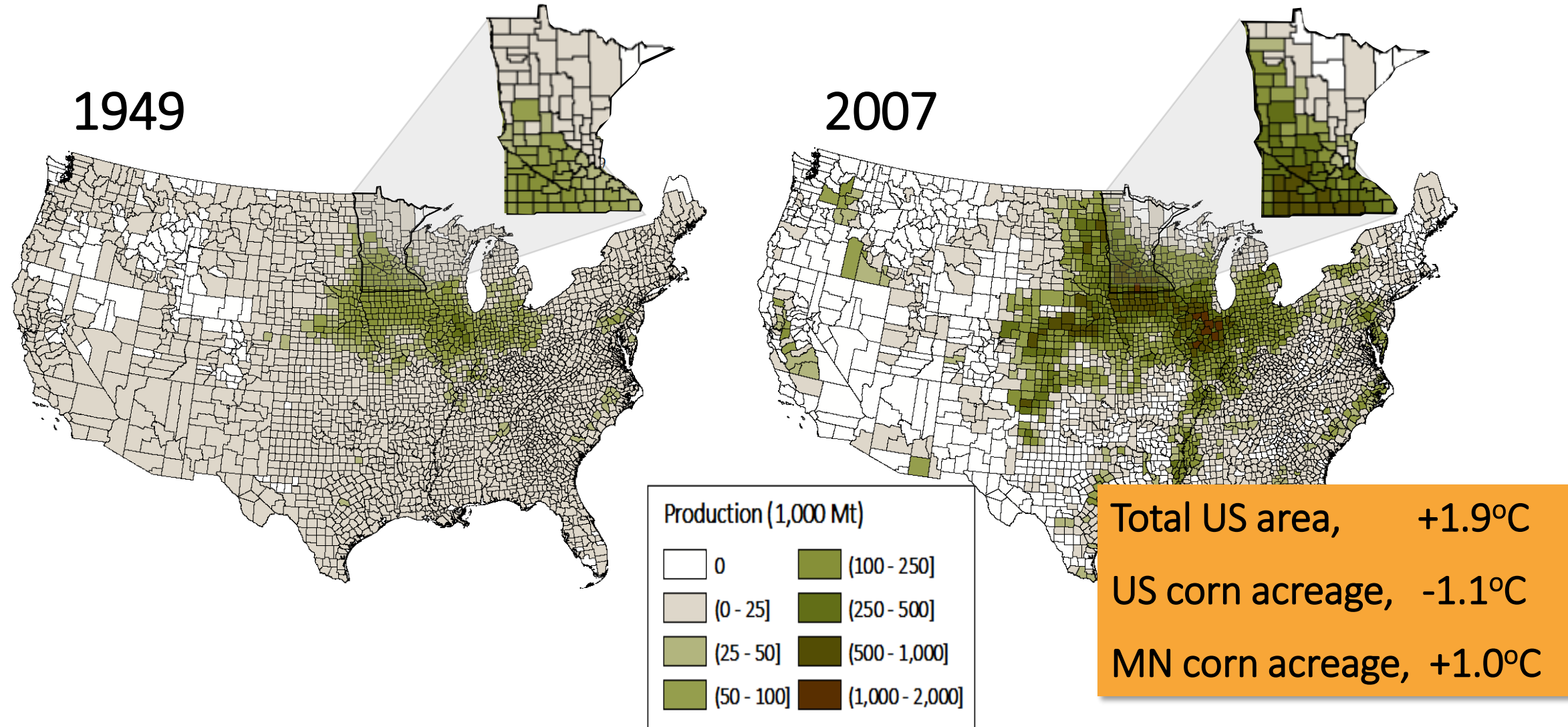


Changing Corn Location and Climate

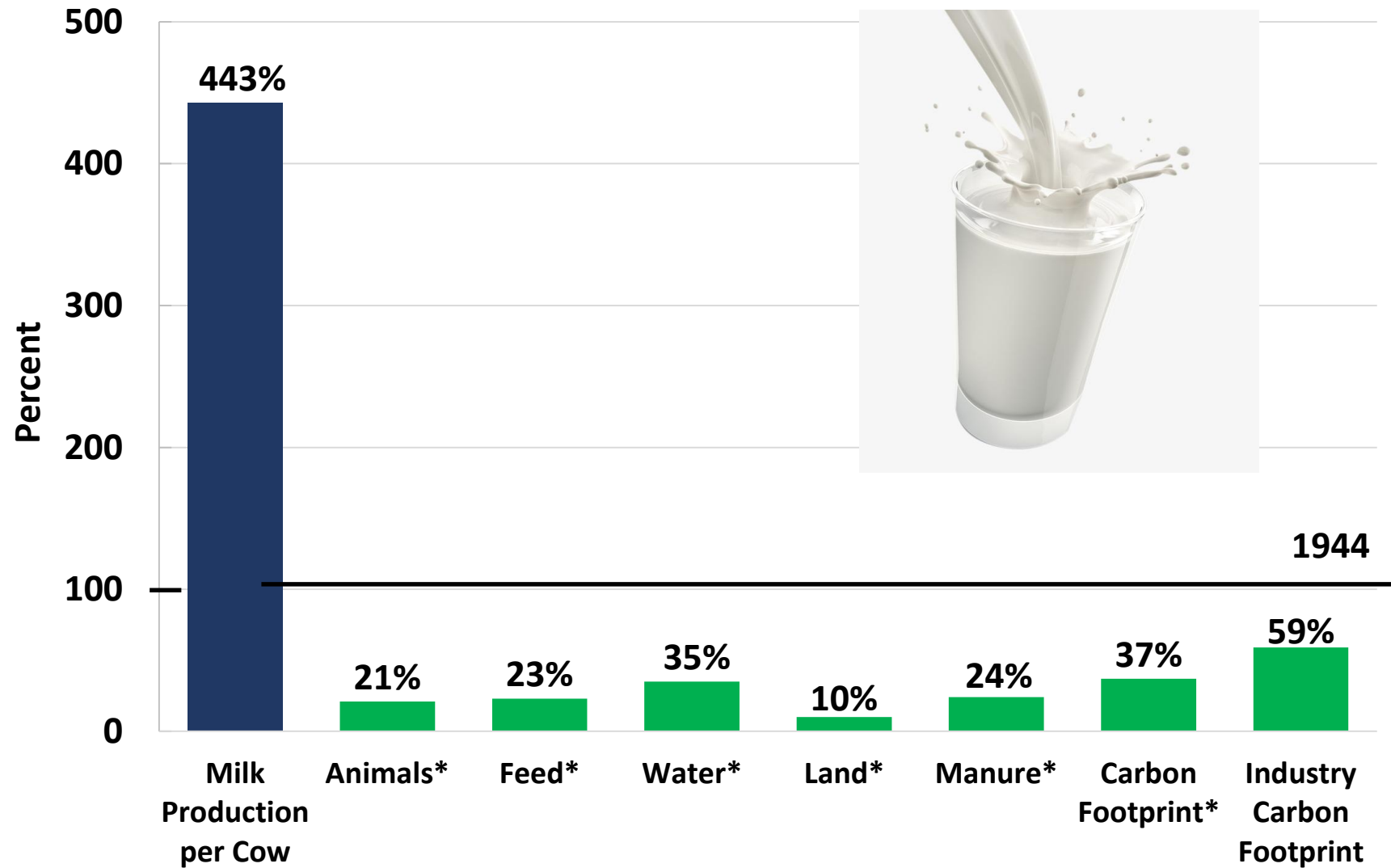
1949



Changing Corn Location and Climate



Innovation in U.S. Milk Production—2007 relative to 1944



* As measured per unit of milk as it leaves the farm gate

Farm Innovations to Deal with Climate/Weather Risk

- Climate change vs uncertainties
 - Parsing **structural trend** vs cyclical vs transitory changes (**Scientific Consensus**)
 - Magnitude and timing of change
 - Local vs state vs global change
- Farmers have been dealing with fluctuations in weather since ag was invented
- Equivalency of innovations to deal with climate vs weather risk
- Investing in ag innovations to deal with climate risk vs investing in crop insurance
 - Preparing for the possibility of an adverse event
 - R&D yields a handsome economic return on taxpayer investment
(ROI = 24.7%py, Benefit-Cost Ratio = 40.6:1)

A close-up photograph of dark, jagged, and porous rocks. Numerous thin, vertical lines of rain are falling across the entire scene, creating a sense of motion and texture. The lighting is soft, highlighting the wet surfaces of the rocks.

Absent these investments in agricultural innovation we will simply be adding to the riskiness of farming, the downstream supply chains (food processing etc), and the jobs that depend on agriculture in future decades.

An aerial photograph of a large agricultural field. The field is divided into a grid of rectangular strips, alternating between a vibrant yellow-green and a darker green. This pattern suggests a precision agriculture or conservation tillage practice. The strips are arranged in a regular, repeating pattern across the entire field.

Thank You