Resilient farming systems in the face of climate change—Practical Farmers of Iowa Conference 2020

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Photosynthesis and Respiration tell us much about climate change

- **Photosynthesis**: \( CO_2 + H_2O \rightarrow H_12-0_6 + 0^2 \) (in the presence sunlight)

- **Respiration**: Carbon dioxide plus water yields sugars plus oxygen

\[ C_6-H_{12-0_6} + 0^2 > C0^2 \text{ plus } H_20 \] – (\( C0^2 \) is a by-product of cellular respiration and the burning of fossilized plants for our energy use) Heat and gases are released that trap heat in the earth’s atmosphere
Where are the CO2 emissions coming from?

• About 28% from burning of fossil fuels in transportation vehicles and 28% as well from electrical generation
• Industrial use-22%
• Agriculture-9%-estimates vary
• Commercial and Residential-11%

Where are greenhouse gases coming from?
• Carbon Dioxide-76%
• Methane-16%
• Nitrous Oxide-6%
• Took billions of years to create all of this stored carbon-used much if not most of it in just less than 400
It’s a delicate balance of infrared light absorption that keeps us from plunging into an icy state

- CO\textsuperscript{2} amounts to about 20\% of the greenhouse effect
- Water Vapor and clouds- 75\%
- Minor gases and aerosols- 5\% (NO\textsubscript{2}, methane, Ozone, fluorocarbons)
- Water vapor quickly precipitates out and would turn us to ice (feedback mechanism)
- CO\textsuperscript{2}- ice ages-180ppm
- Warmer periods-280 ppm
- Today-415 ppm
- Future-600 ppm and beyond
HOW IS WEATHER CHANGING IN WESTERN IOWA?

- Extreme weather and precipitation events
- Warmer and wetter overall
- Cold wet springs
- Warmer nights and winters
- Increased summer precipitation

- Longer growing seasons
- Less 100 degree days
Principles of Regenerative Agriculture and Resiliency

- Providing eco-system services (let nature do the heavy lifting)
- Sequestering carbon
- Community based
- Economic Stability through adding value
- Innovation and on-farm research
- Being content with what you have

- Diversity
- Soil Quality
- Water Retention
- Perennials
- Microbes, Insects, wildlife
- Composting
- Livestock
- Recycling of Nutrients
- Conservation
- Agroforestry
What we do on our farm = Diversity, over 50 fields, plant more than 20 species every year
Early spring annuals-oats, barley, wheat, field peas, cool season grasses
Late Spring Annuals Corn - Soy

Ridge Till Cultivation
Controlling weeds without pesticides & reducing tillage

Taking the longer view-crop rotations and curbing spread of weed seeds- don’t assume new herbicides-Frisvold and Adams
Practical Farmers of Iowa and on-farm research-over 40 trials on our farm since 1987
Winter annuals, rye, triticale, hybrid rye-no-till drilling soybeans in rye stubble

Cutting rye for hay on June, 9, 2014

What about complete no-till in organics? Planted on June 13, 2014
Late Summer annuals-turnips, millet, Sorghum-Sudan, vetch, radish, buckwheat, etc.
Composting: role of microbes to feed soil & improve soil health, produce stable carbon, no purchased N for 37 years
Trees and shrubs provide so many services besides storing CO$_2$—wind protection, wildlife habitat, pollinators, etc.
Adaptation versus Mitigation

• Agriculture could lower C02 emissions by as much as 150 ppm
• Melting of the perma-frost could raise it by 150 ppm

• **Challenges:**
  • Fear
  • Can we and will we be able to change?
  • Demand policy changes:
  • Tell the truth about agriculture and food production
  • How much suffering before we say enough is enough
  • Will we rapidly develop a new ice age?