



EQCom

An Education and Outreach Simulation Game for
Enhancing Environmental Quality in the Commons

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Outline

- Intro to Conservation Agriculture
- A Tragedy of the Commons
- Game Structure
- Looking Ahead

Intro to Conservation Agriculture

What is conservation agriculture?

- Minimum disturbance
- Maintain living cover
- Rotate crops
- Minimize nutrient and chemical input

Major Concerns in Crop Production

- Soil loss/degradation

- 11% of conservation agriculture adoption globally
(Kassam et al. 2015)
- U.S. and Europe soil erosion rate exceeds sustainable replacement rate
(Pimentel 2006)
- In developing countries, soil erosion is much greater
(Ananda and Herath 2003)

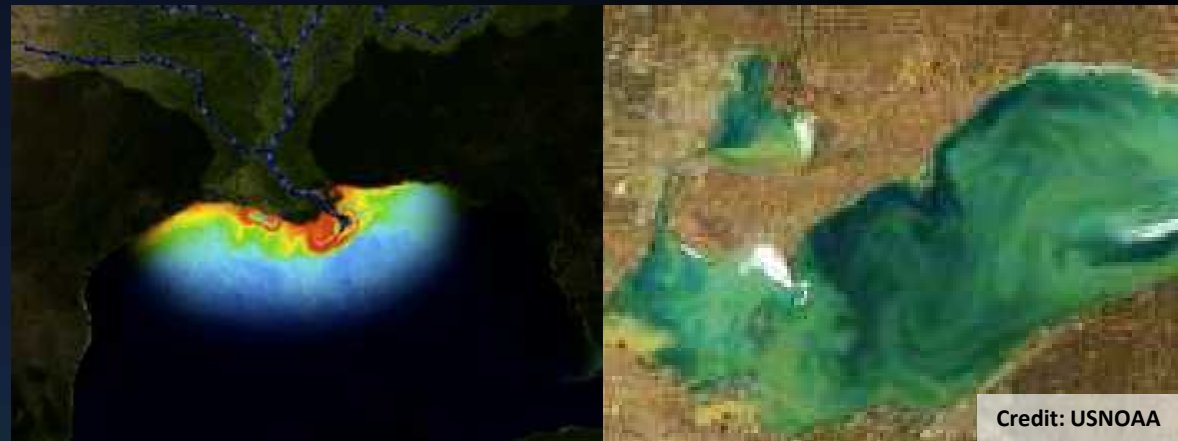


Credit: USDA-ARS

Major Concerns in Crop Production

- Effect on Water Quality

- U.S. states have policies to reduce N and P loss, but loss occurred in 70% and 46% of reporting U.S. watersheds (USEPA 2016; IPNI 2012)
- 2015 Gulf of Mexico dead zone resulting from NO_3^- was above the five-year average (USNOAA 2015a)
- The occurrence of harmful algal blooms in connection with P may be on the rise (USNOAA 2015b)



Major Concerns in Crop Production

- Effect on Climate/Effect of Climate

- Direct N_2O emission from agricultural soils represents 20-30% of total global emissions (Mosier 1994)
- Negative effects of climate increased over the last 40 years and are projected to continue over the next 25 years. (Hatfield et al. 2014)

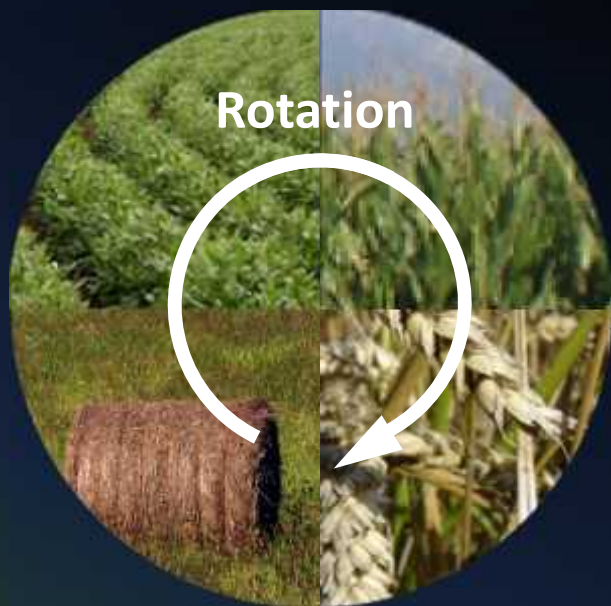


Credit: Dept. of Energy



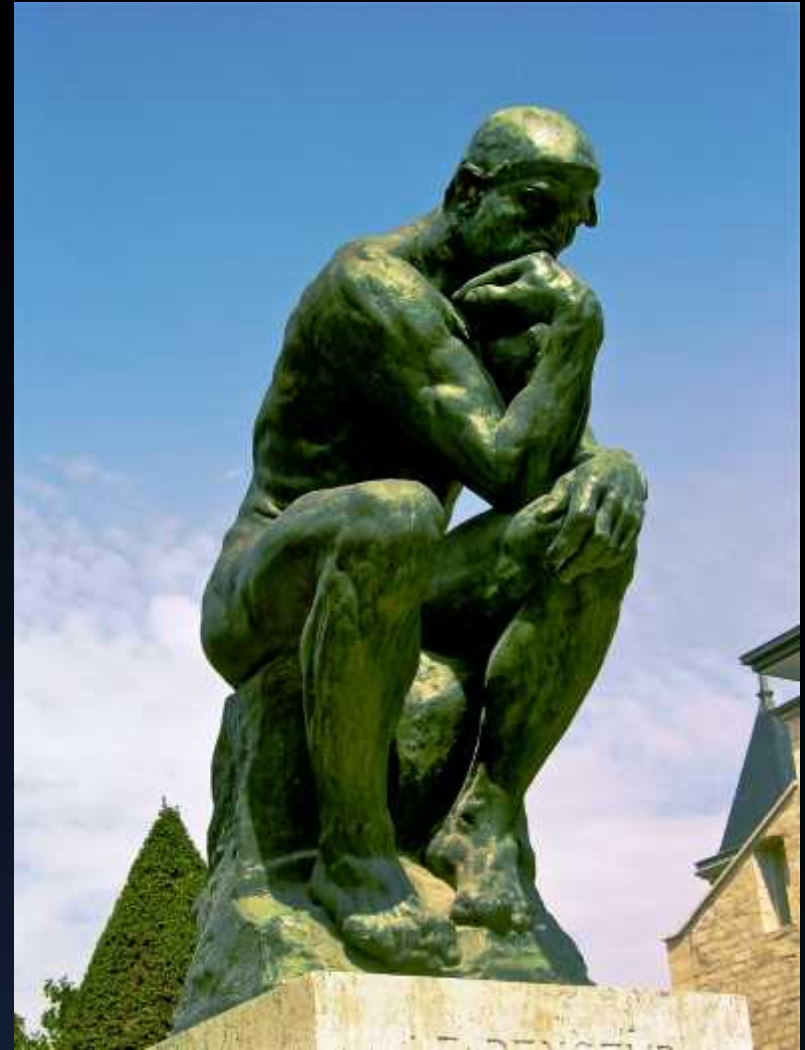
Credit: NRCS

Why is conservation agriculture adoption slow?



What is the solution?

Is there a solution?





Almost 70 years ago Aldo Leopold stated:

“Despite nearly a century of propaganda, conservation still proceeds at a snails pace; progress still consists largely of letterhead pieties and convention oratory. On the back forty we still slip two steps backward for each forward stride. The usual answer to this dilemma is ‘more conservation education’ No one will debate this, but is it certain that only the *volume* of education needs stepping up? Is something lacking in the *content* as well?”

A Sand County Almanac

A Tragedy of the Commons

A Tragedy of the Commons



Water and Air?
Yes:
value reduction
non-exclusivity

A Tragedy of the Commons

- William Forster Lloyd
- Garrett Hardin
- Elinor Ostrom



Game Structure

Conservation Cropping Systems: Game Assumptions

- Basic assumption – conservation practices have a short-term economic disincentive.

Game Structure

Farmer i

Farmer n

Input i (tillage, crop rotation, cover crop, N and P fertilizer, manure)

Input n (tillage, crop rotation, cover crop, N and P fertilizer, manure)

Economic Score i

Environmental Score i

Economic Score n

Environmental Score n

Relative Economic Score i

Relative Economic Score n

Global Economic Score

Global Environment Score

Looking Ahead

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EQCom: Enhancing Environmental Quality in the Commons

Synopsis

EQCom is a simulation game for teaching the effects of conventional farming on natural resources and the social challenges involved in implementing solutions. Players are "farmers" who make a series of choices about farming practices, either conservation or conventional. Outcomes result based on those choices and they include aesthetic and economic consequences. Farmers and society prosper if farmers collectively implement conservation practices and protect common resources, but a farmer's natural economic incentive is to make choices based on short-term private economics benefits instead of long-term private and public benefits. The natural progression in this game is for soil, air, and water resources to degrade and socio-eco-systems to suffer. Farmers will find over time that short-term economic gain must be sacrificed to achieve long-term sustainability and success. Farmers must regulate themselves or be regulated by

EQCom Game

Game id

<p>Tillage</p>  <p><input type="button" value="Conservation"/></p>	<p>Crop Rotation</p>  <p><input type="button" value="Yes"/></p>	<p>Cover Crop</p>  <p><input type="button" value="Yes"/></p>
<p>Nitrogen Rate</p>  <p><input type="button" value="Conservation"/></p>	<p>Nitrogen Timing</p>  <p><input type="button" value="Spring"/></p>	<p>Nitrogen Placement</p>  <p><input type="button" value="Sub-surface"/></p>
<p>Phosphorus Rate</p>  <p><input type="button" value="Soil Test Based"/></p>	<p>Phosphorus Timing</p>  <p><input type="button" value="Spring"/></p>	<p>Phosphorus Placement</p>  <p><input type="button" value="Sub-surface"/></p>
<p>Manure Rate</p>  <p><input type="button" value="P-based"/></p>	<p>Manure Timing</p>  <p><input type="button" value="Spring"/></p>	<p>Manure Placement</p>  <p><input type="button" value="Sub-surface"/></p>
<input type="button" value="Run"/>		

Env Score: Econ Score:

Game 0 : 7 games played, avg env score: 9.43, avg econ score: 2.57

Game design: [Ashley Hammag](#), Programming: [Tim McGraw](#), 2016

Goals for the future

- Improve user interface
- Incorporate more decisions
- Incorporate model-based outcomes
- Incorporate multiple scenarios in time and space
- Track player decisions
- Test numerous hypotheses



Thank you

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