Sustainable Agriculture to Combat Climate Change

~ Looking for success in US and China ~

Karen Mancl (马可人)
Professor Food, Agricultural & Biological Engineering
The Ohio State University
Sustainable Agriculture

• capable of maintaining productivity and usefulness to society indefinitely
Sustainable Agriculture

• capable of maintaining productivity and usefulness to society indefinitely
  • resource-conserving,
  • socially supportive,
  • commercially competitive,
  • environmentally sound.
Farming systems

- Organic fertilizer – manure, sewage, compost
- Crop rotation – multiple crops per year
- Perennial crops & agroforestry
Found Example

- Organic fertilizer
- Crop rotation
- Perennial crops

- Feed 10 people per hectare
Successful Example

- Organic fertilizer
- Crop rotation
- Agroforestry

- Feed 10 people per hectare
- 900 years
Where?

China’s Tai Lake region
From 1100s – 1980s


Source: Vladislav Gunfinkel, Shutterstock.com
Farmer Shen – Early 1600s

- Hauling sewage from the city

“As for nightsoil, Hangzhou is the best place to go.”

“The effect of human waste is strong, and that of ox waste lasts long. They must be balanced in their application.”

Yong Xue, Treasure Nightsoil as if it were Gold. Late Imperial China 2005
US Ag. Scientist

- F.H. King, US Department of Agriculture
- Early 1900s
- Framers of Forty Centuries – Organic Farming in China, Korea and Japan
  - Published 1911
Ag productivity – Nitrogen limited

Why work?

Source: Jezper, Shutterstock.com
Why stop?

China moved away from sustainable farming

Source: Jef Thompson, Shutterstock.com
Green Revolution – end world hunger

- Nobel Prize – Norman Borlaug
- World Food Prize – Yuan Longping
Hybrid seeds and Nitrogen - Yield

Source: Paul Prescott, Shutterstock.com
Excess Nitrogen – Pollution

- Ammonia
- Nitrate

Nitrogen water pollutants

Nitrogen fertilizer
- Ammonia
- Nitrate
- Urea

Nitrogen in living things
- DNA
- Protein

Source: Manishankar Patra, Shutterstock.com

https://www.shutterstock.com/image-photo/eutrophication-hazardous-plants-water-1615786774
Excess Nitrogen – Greenhouse Gas

- Nitrous oxide
- Ammonia

Nitrogen in living things
- DNA
- Protein

Nitrogen water pollutants
- Ammonia
- Nitrate

Nitrogen fertilizer
- Ammonia
- Nitrate
- Urea
<table>
<thead>
<tr>
<th>Greenhouse Gases from Agriculture</th>
<th>CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane = CO₂ x 80</td>
<td></td>
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<tr>
<td>Nitrous Oxide = CO₂ x 300</td>
<td></td>
</tr>
</tbody>
</table>
Nitrous Oxide - Agriculture major source

Can farmers go back?

- Hauling manure and sewage
  - Increased workload

- Limit nitrogen
  - Risk low yields

- Multiple crops
  - Lack of markets

Source: RikoBest, Shutterstock.com
Policies are needed to restore ag. soils

- Hauling manure and sewage
  - Research & technology
- Limit nitrogen
  - Regulations & insurance
- Multiple crops
  - Incentives & market development

Source: RikoBest, Shutterstock.com
Who will teach the farmers?

• US – 2 million
• China – 200 million
• Global – 368 million
Agricultural education

- Vocational agriculture
- Colleges of agriculture
- Extension to working farmers

Source: Junrong, Shutterstock.com