

# Sustainable Agriculture to Combat Climate Change

~ Looking for success in US and China ~

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# 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





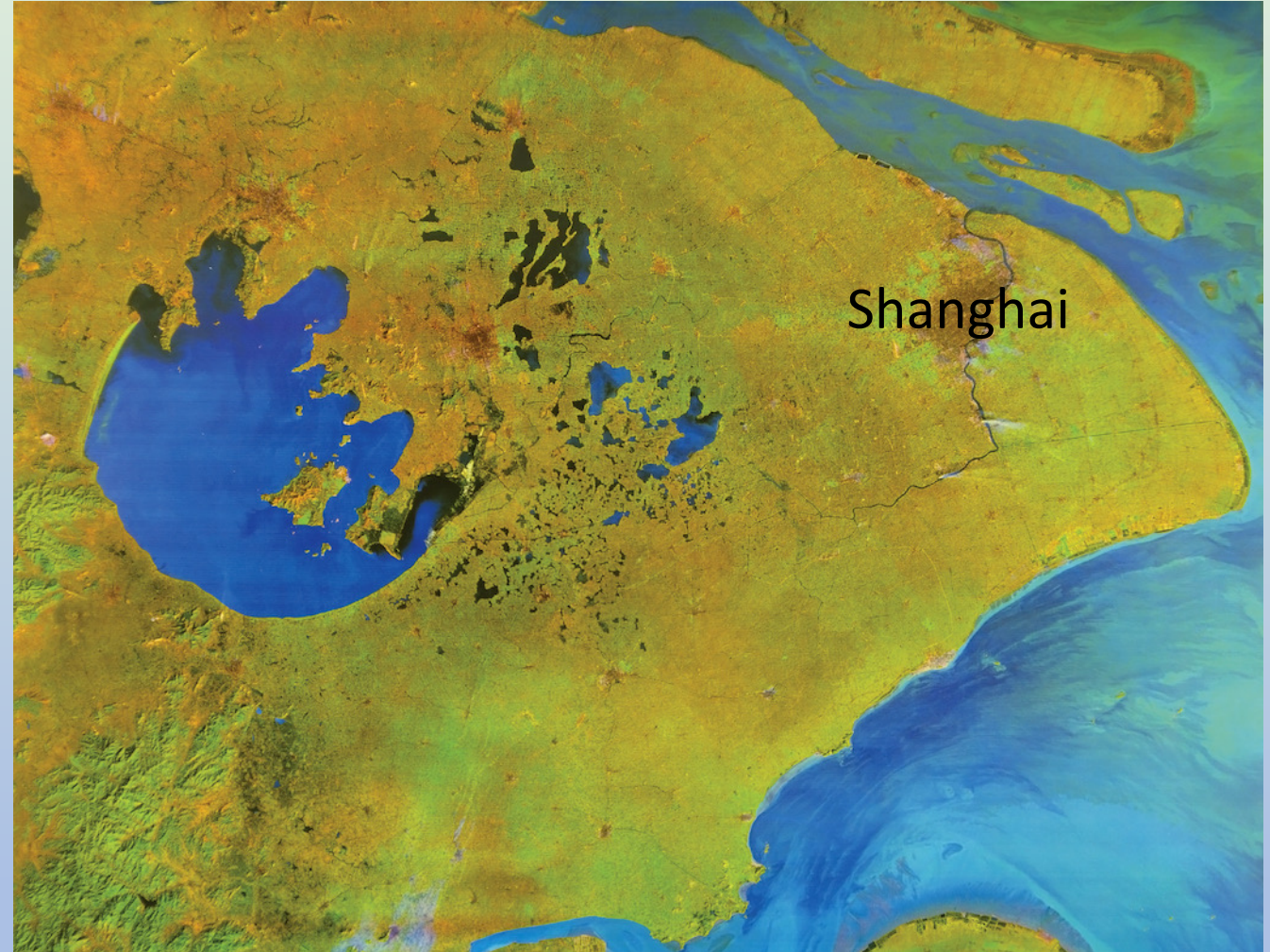
# Successful Example

- Organic fertilizer
- Crop rotation
- Agroforestry
  
- Feed 10 people per hectare
- 900 years



# Where?

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



# How?

## 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.”

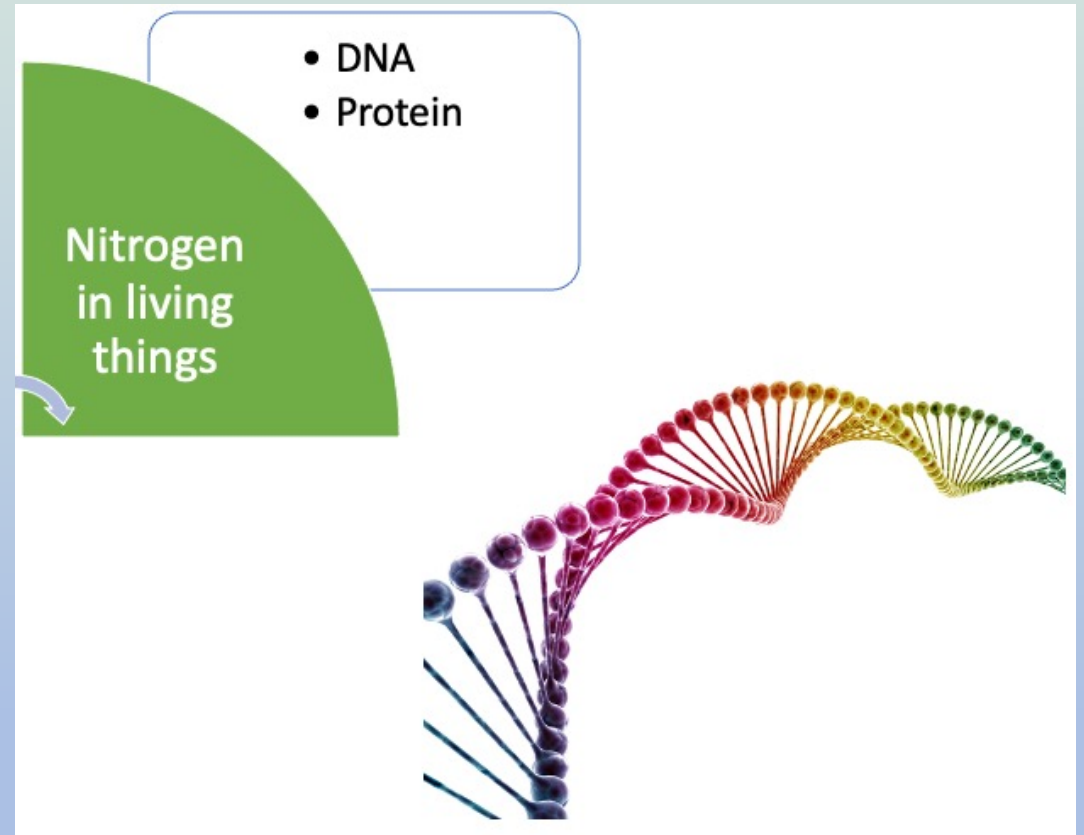


# US Ag. Scientist

- 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

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- Nobel Prize – Norman Borlaug
- World Food Prize – Yuan Longping

# Hybrid seeds and Nitrogen - Yield



Source: Paul Prescott, Shutterstock.com

Nitrogen  
in living  
things

- DNA
- Protein

Nitrogen  
fertilizer

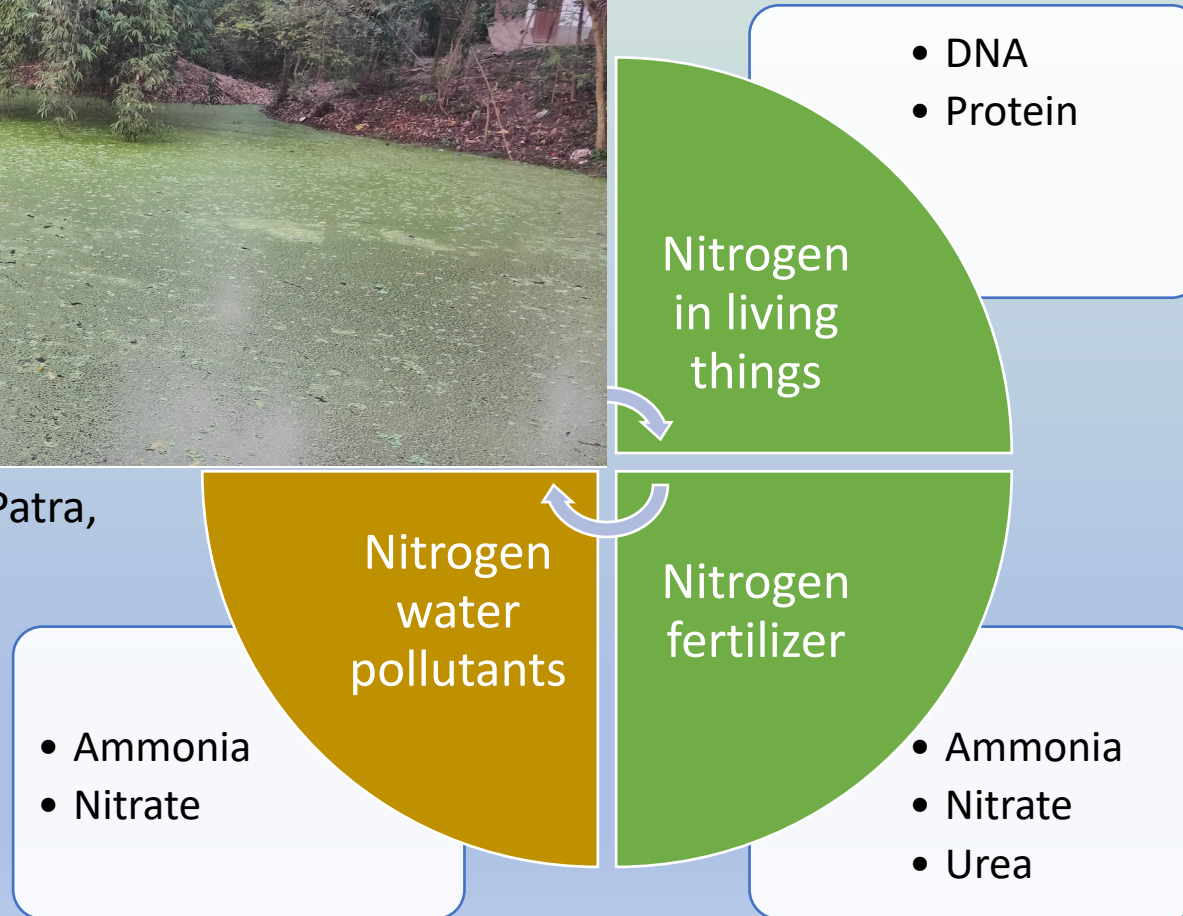
- Ammonia
- Nitrate
- Urea



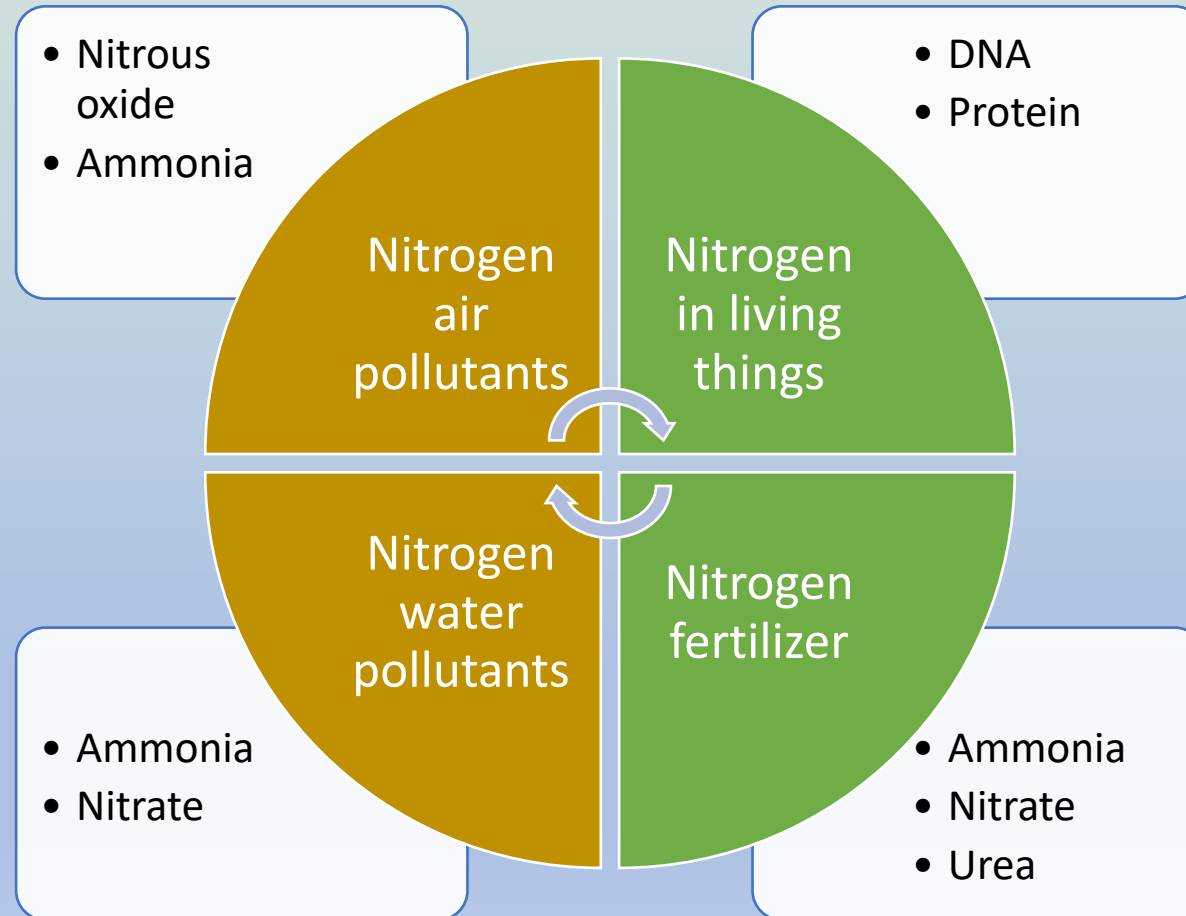
# Excess Nitrogen – Pollution



Source: Manishankar Patra,  
Shutterstock.com



# Excess Nitrogen – Greenhouse Gas ↑



# Greenhouse Gases from Agriculture

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$\text{CO}_2$

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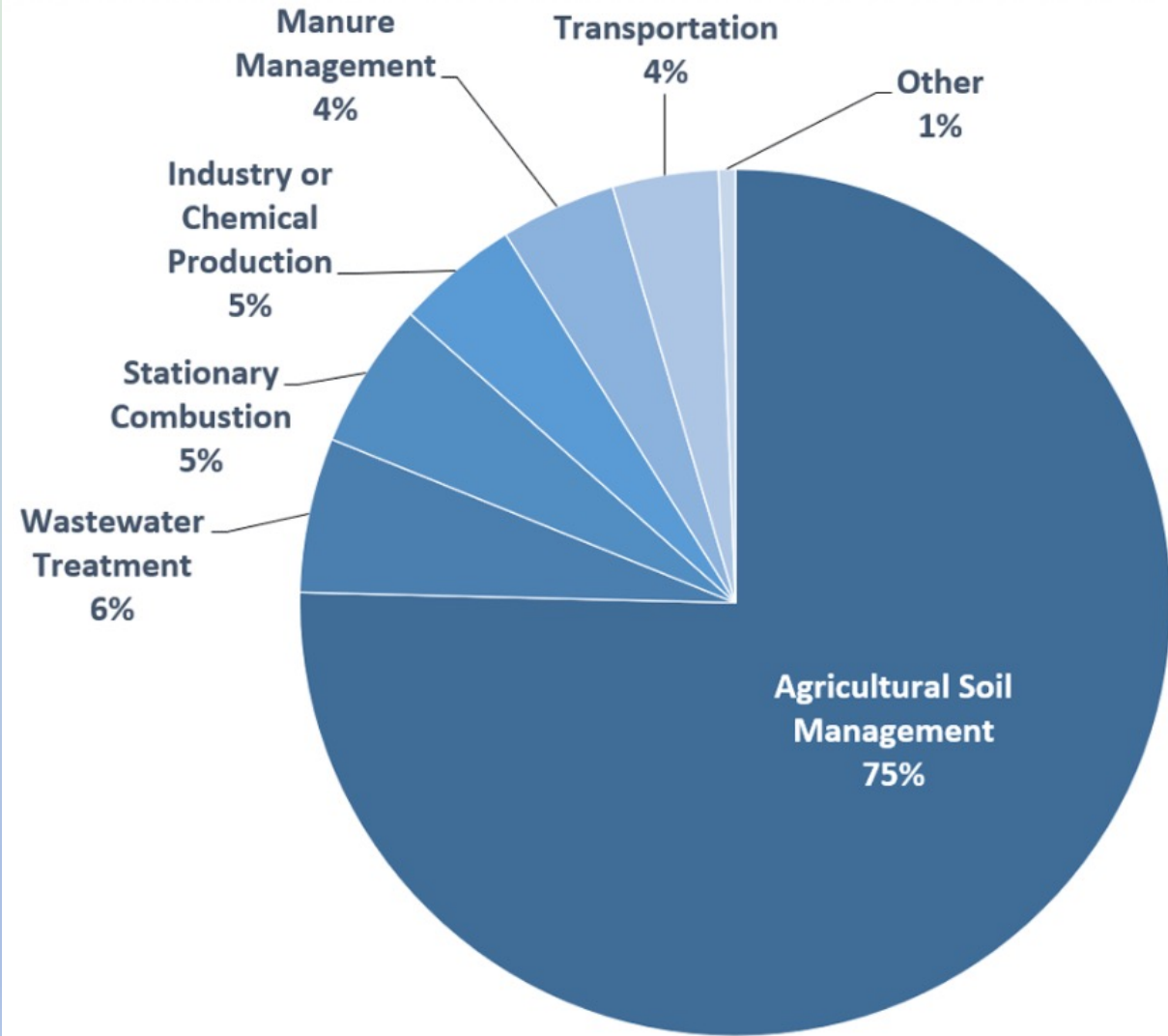
Methane =  $\text{CO}_2 \times 80$

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Nitrous Oxide =  $\text{CO}_2 \times 300$

Nitrous Oxide -  
Agriculture  
major source

## 2019 U.S. Nitrous Oxide Emissions, By Source



U.S. Environmental Protection Agency (2021). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019



# 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 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

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

Source: Junrong, Shutterstock.com





# Setll.osu.edu

## SETLL

Soil Environment Technology Learning Lab



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,  
AND ENVIRONMENTAL SCIENCES



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Created in 2000, Drs. Karen Mancl and Brian Slater have offered educational programs and conducted research in onsite...

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