

# Revolutions in Agriculture

The background features a dark blue gradient with faint, light-colored graphics. On the left side, there is a compass rose with the letters 'N', 'S', 'E', and 'W' visible. On the right side, there is a faint line graph showing a fluctuating upward trend.

# Agriculture Defined

- The deliberate modification of Earth's surface through cultivation of plants and rearing of animals to obtain sustenance or economic gain.
  - Intentional planting of crops and raising of domesticated animals



# Agricultural Revolutions

- First Agricultural Revolution
  - 10,000 year ago – The initial domestication of plants and animals
- Second Agricultural Revolution
  - 250 years ago - Mechanization of agriculture with improved practices of cultivation, harvesting, and storage of farm produce.
- Third Agricultural Revolution
  - In progress – Centered around development of Genetically Modified Organisms

# Geography of Agricultural Origins





# Hunter-Gatherer Societies

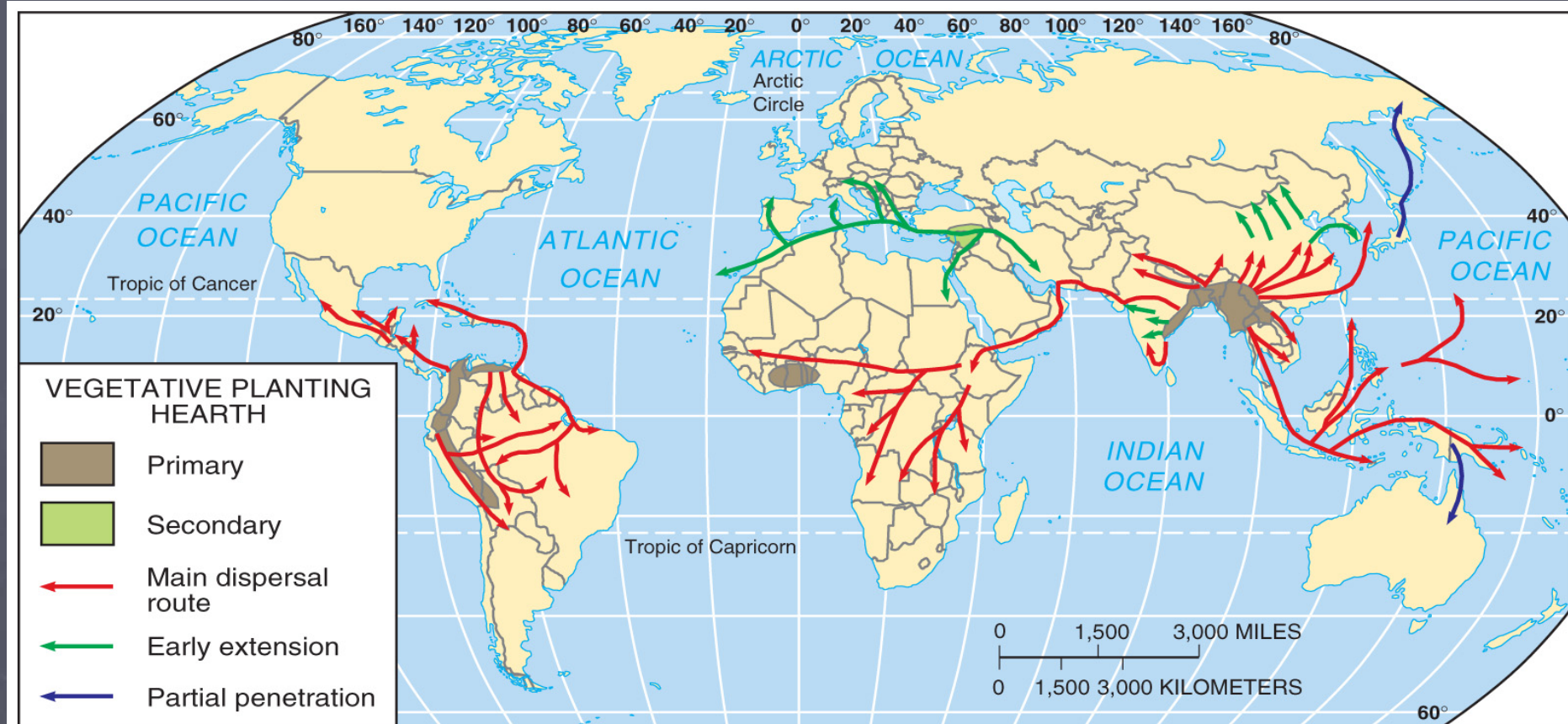
- Before the Neolithic revolution humans hunted for animals, fish, and wild fruits and vegetables
  - Hunters and gatherer groups were small
  - The men hunted game or fished, and the women collected berries, nuts, and roots.
- Where they traveled, and how often, depended on seasonal growths of plants and migratory patterns of animals



# Neolithic Revolution

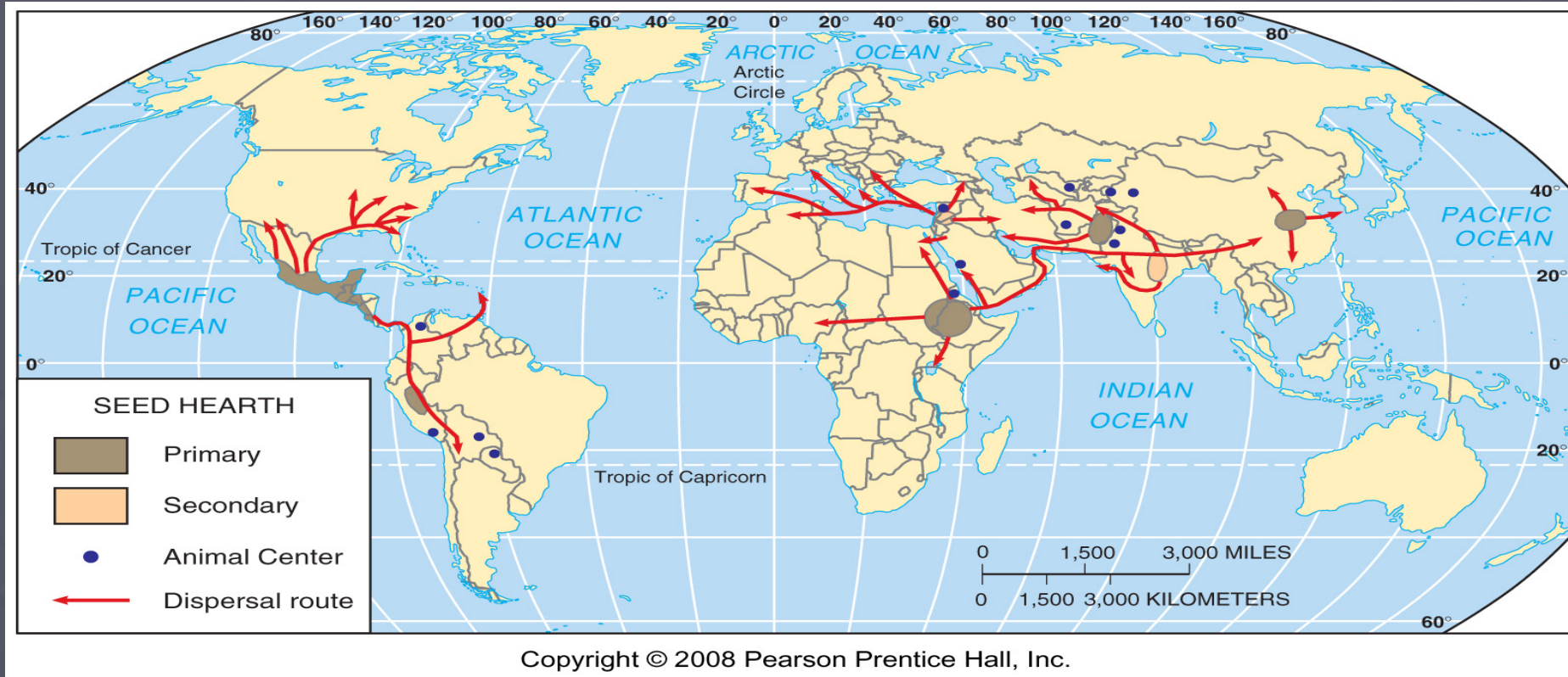
- Eventually plant cultivation evolved from a process of trial and error, and accidental experiment.
  - The earliest form of plant cultivation, according to Carl Sauer, was vegetative planting, direct cloning from existing plants, such as cutting stems and dividing roots.
    - Seed agriculture came later
- Domestication of animals probably originated in Southeast Asia
  - Dogs, pigs, and chickens

# Vegetative Planting Hearths



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# Seed Planting Hearths





# Second Agricultural Revolution

- Lasted from 1700s to early 1900s
- Coincided with the Industrial Revolution
  - New technologies developed to improve crop yields
  - Produced surplus to feed factory workers
- Supported by governments of Europe
  - Ex. Enclosure Act of Great Britain



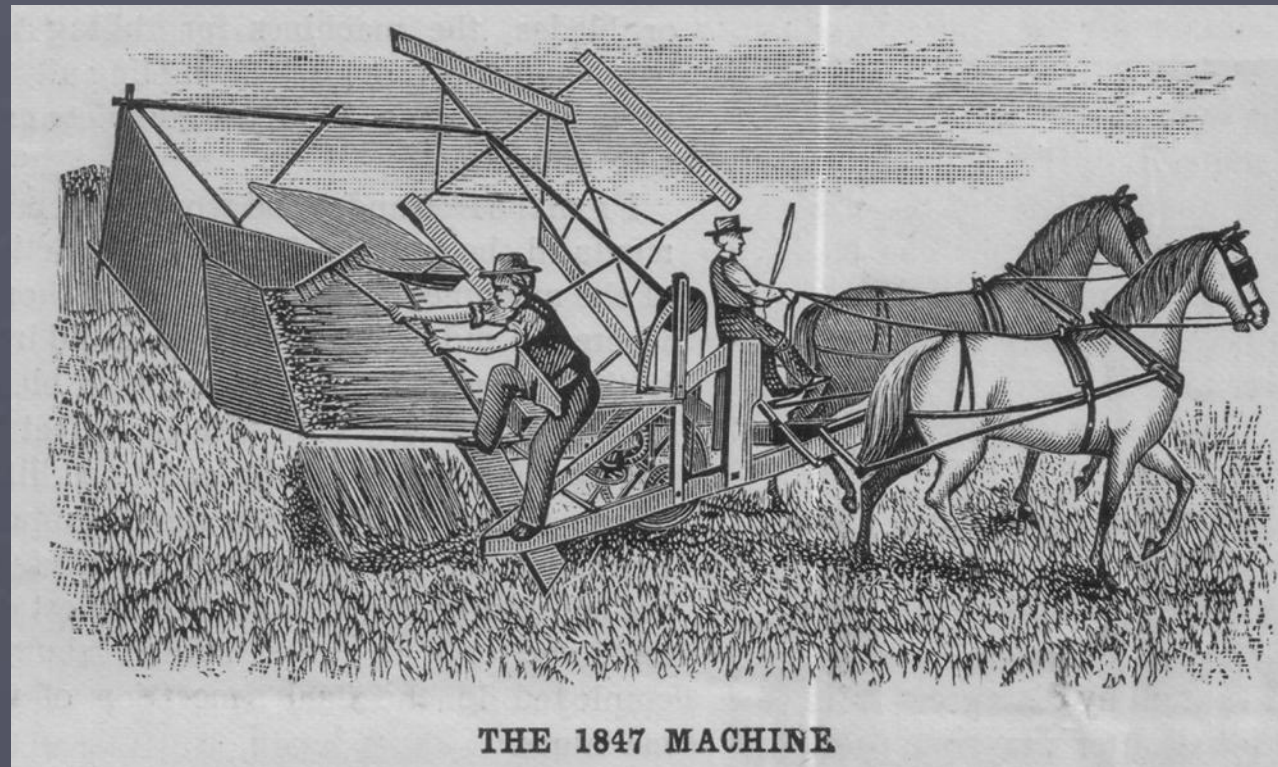
# Developments of Second Agricultural Revolution

- New fertilizer and artificial feed
- Selective breeding of livestock
- Planting of crops in rows
  - Easier to manage
  - Use of machines in planting
- Railroads decreased transportation time



# Cyrus McCormick's Reaper

- Increased harvesting speed of wheat
  - Required less people for harvest
    - Led to urbanization and smaller family sizes



# Third Agricultural Revolution

- Began in 1930s in United States
- Shift in roles of farmers
  - Primary Sector – Cultivation and harvesting of produce
  - Secondary Sector – Processing crops
  - Tertiary Sector – Marketing and advertising products



# Developments in Third Agricultural Revolution

- Increase Mechanization
  - Increasingly replacing draft animals with machines
  - Spread of Mechanization outside of United States after World War II
  - Machines get larger, more powerful, and more efficient



# Developments in Third Agricultural Revolution

- The Biotechnological Phase

- Inorganic fertilizers and manufactured products replace manure and humus to increase soil fertility
- Increasing use of herbicides, pesticides, and fungicides to increase yields
- Began in United States in 1950s, spread to Europe in 1960s, and then the rest of the world in 1970s to 2000s

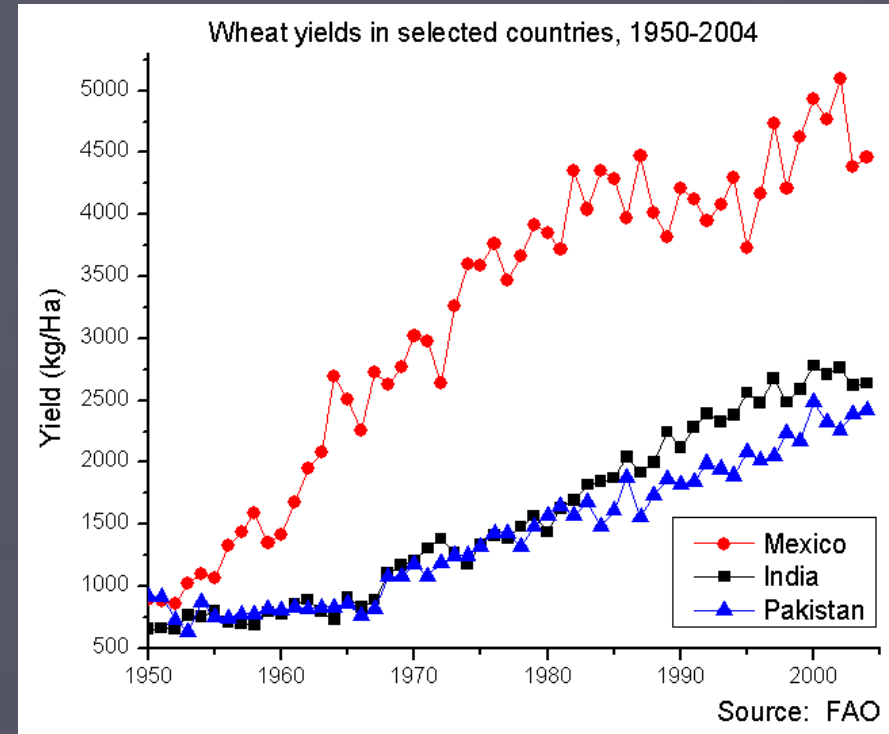
# Developments in Third Agricultural Revolution

- Agri-Business
  - Development of business side of farming resulting in branding referred to as “value added”
  - Increasing connectedness of farming and business
    - Blending of rural and urban



# The Green Revolution

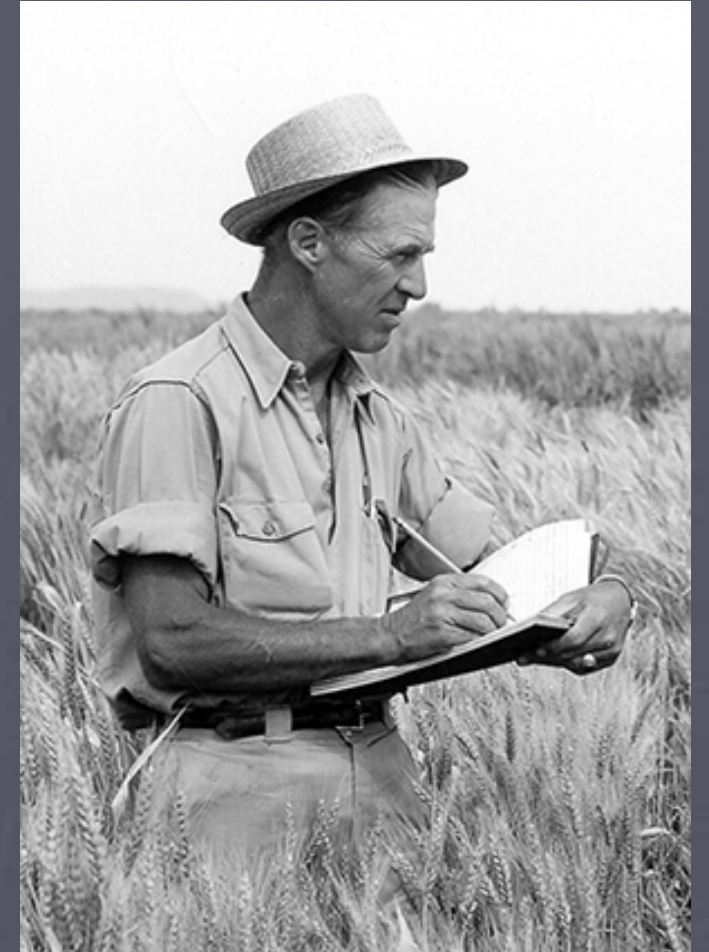
- The diffusion of agricultural technologies and practices to less developed areas
  - Specifically Mexico and Asia (India)
  - First practiced in 1940s in Mexico by Rockefeller Foundation
    - Sent agricultural experts to attempt to increase wheat yields
  - Primarily associated with 1960s
    - Norman Borlaug received 1970 Nobel peace prize for helping reverse famine of India and Pakistan





# Impacts of the Green Revolution

- Increased production
  - Rice production of Asia increases 66% between 1965 and 1985
  - India became self sufficient in some areas for wheat production
    - Paid back debts and became exporter of surplus
- Led to increased gaps between MDCs and LDCs
  - Areas that could not afford technology left behind
  - Lost competitiveness

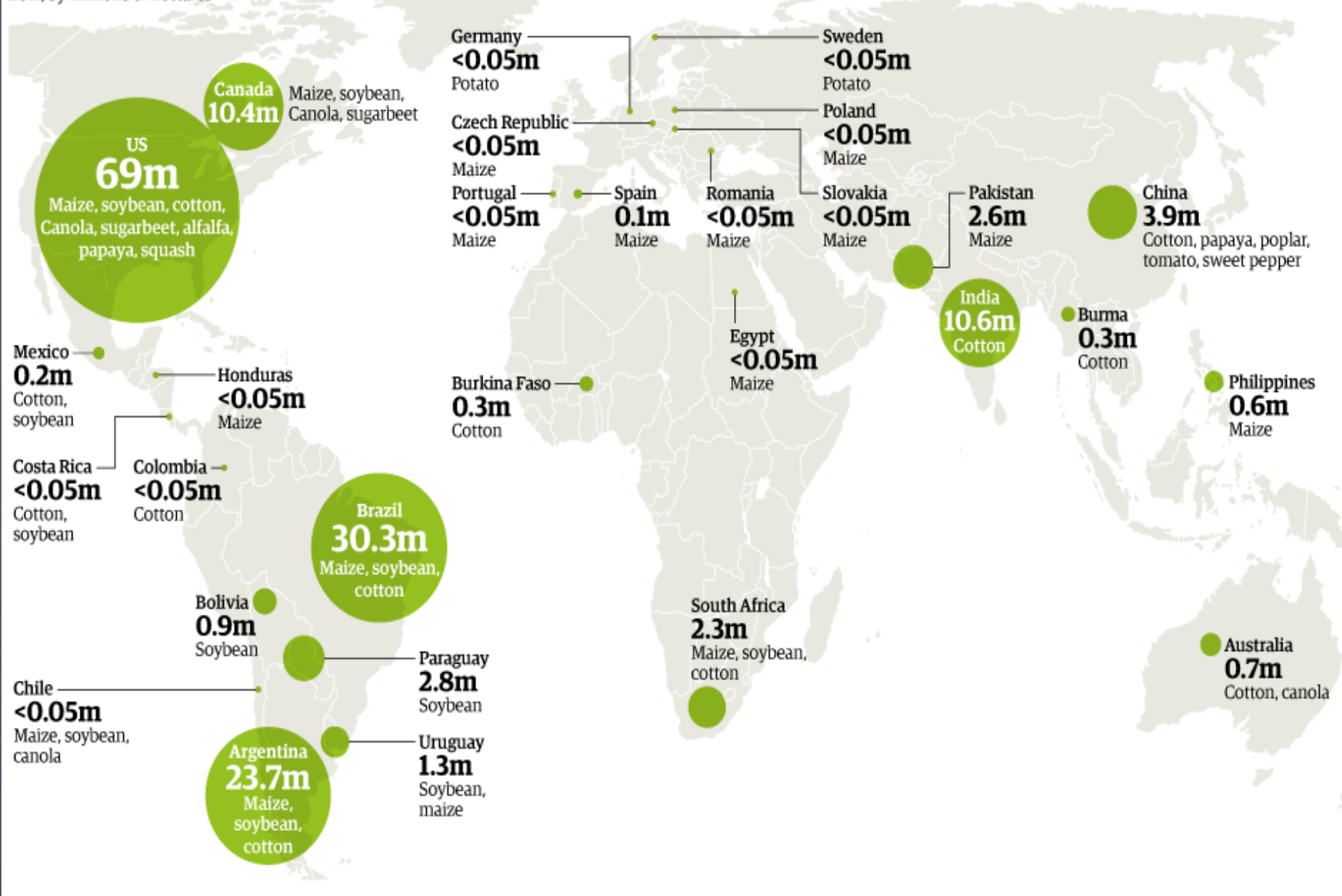


# Current Agricultural Practices

- Genetically Modified Crops – Crops that carry new traits that have been inserted through advanced genetic engineering methods
- Organic Agriculture - Approach to farming and ranching that avoids the use of herbicides, pesticides, growth hormones, and other similar synthetic inputs

## Global status of commercial GM crops

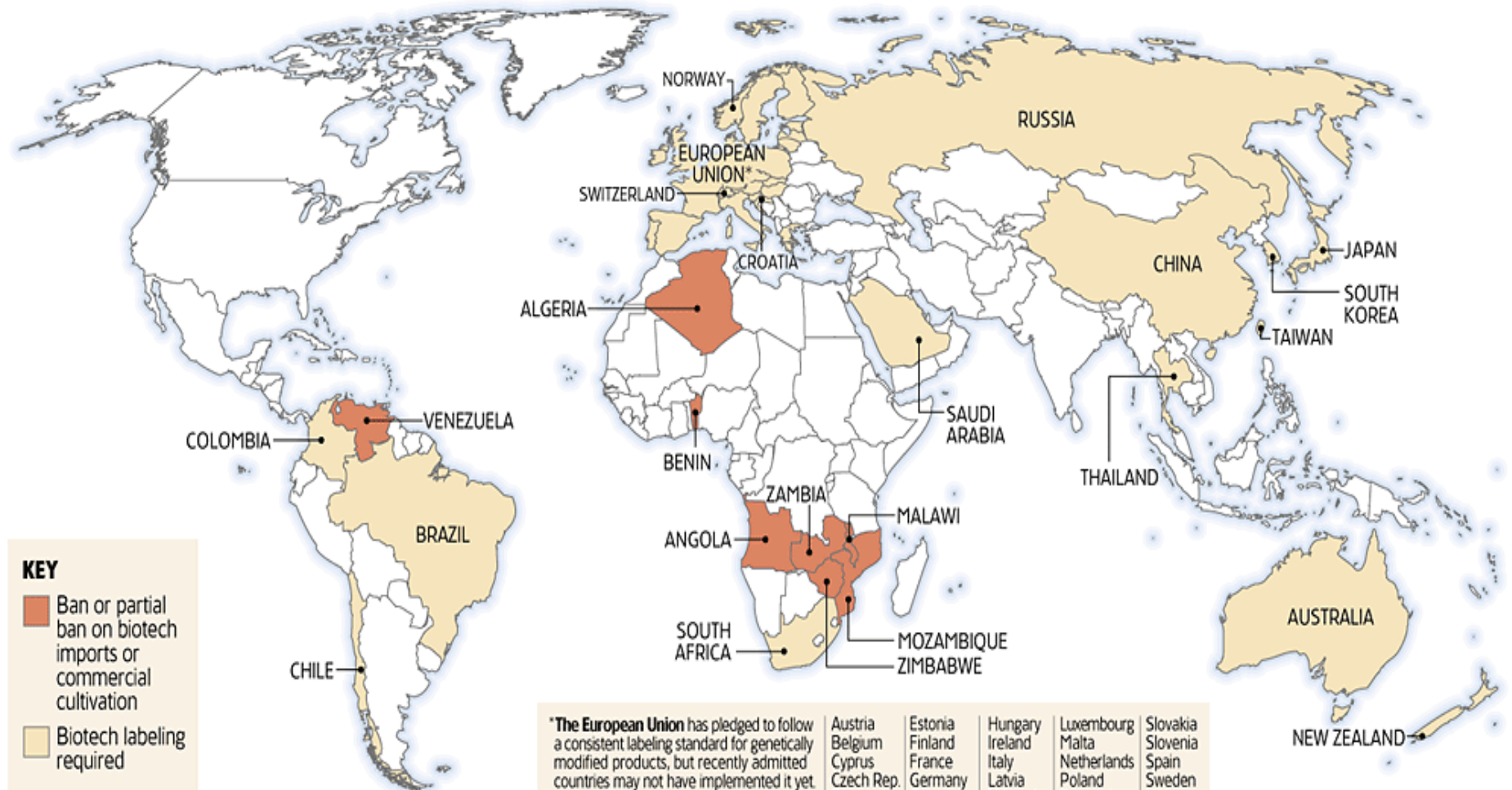
2011, by millions of hectares



# Restrictions on GMOs

## Look for the label

These countries ban or require the labeling of foods that contain biotech ingredients.

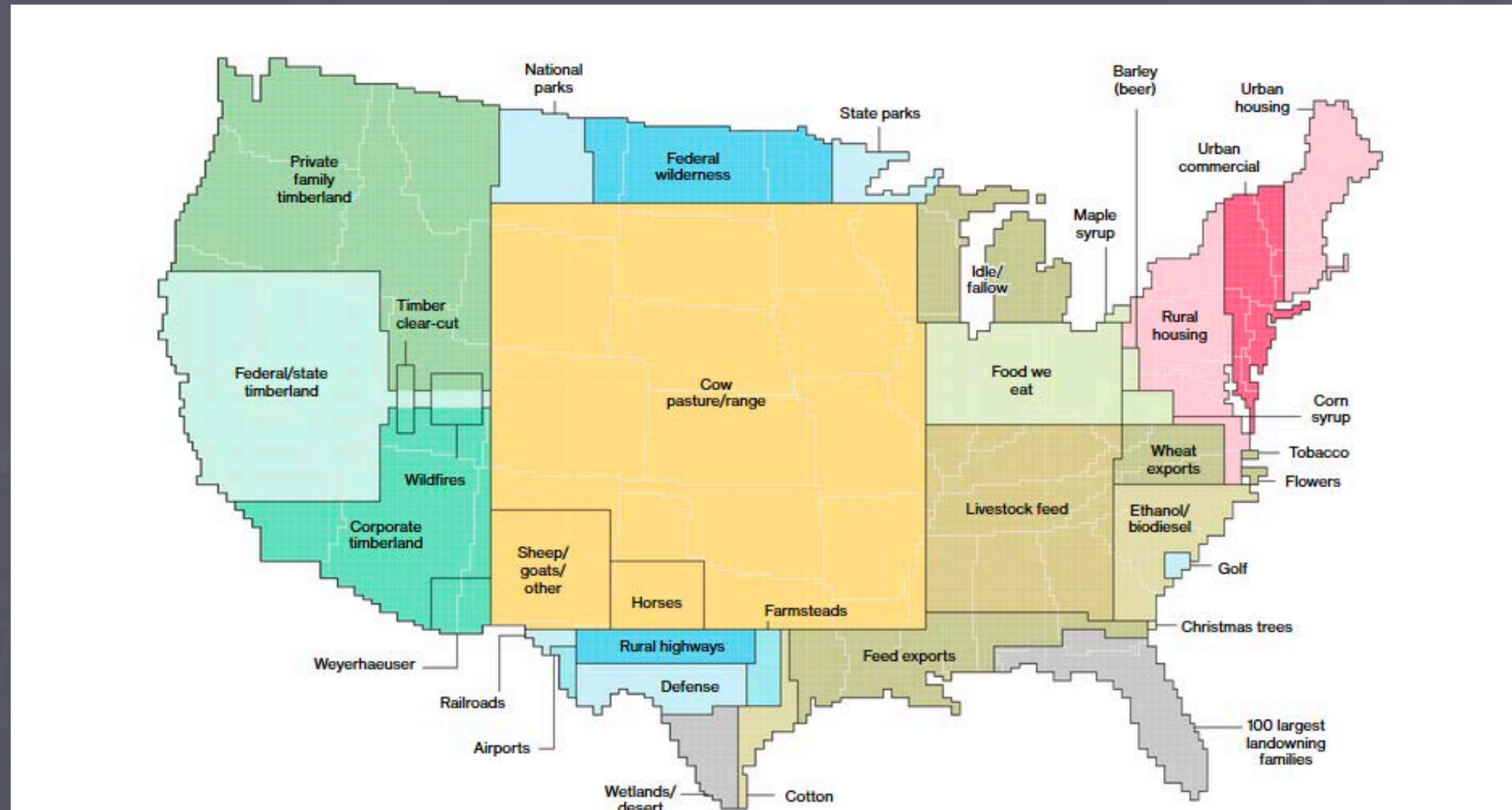


Sources: Professor Colin Carter, UC Davis; Bee research

Sacramento Bee/Nathaniel Levine



# Land Usage in the U.S.



# A 4<sup>th</sup> Agricultural Revolution?

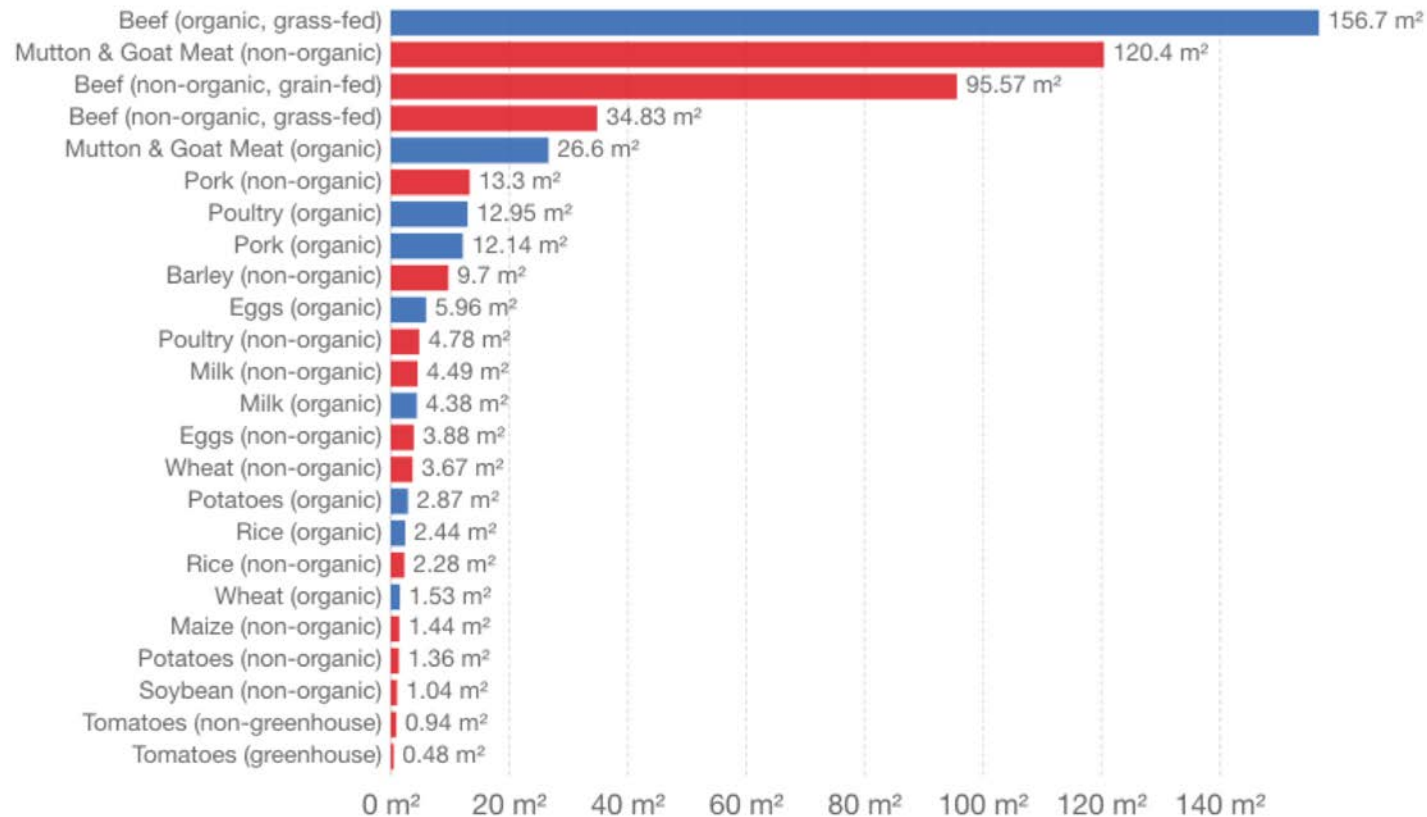
- Shift to natural chemical free agricultural practices
- Popularity of grass-fed and free range products
- Popularity of meat-less diets and vegan choices



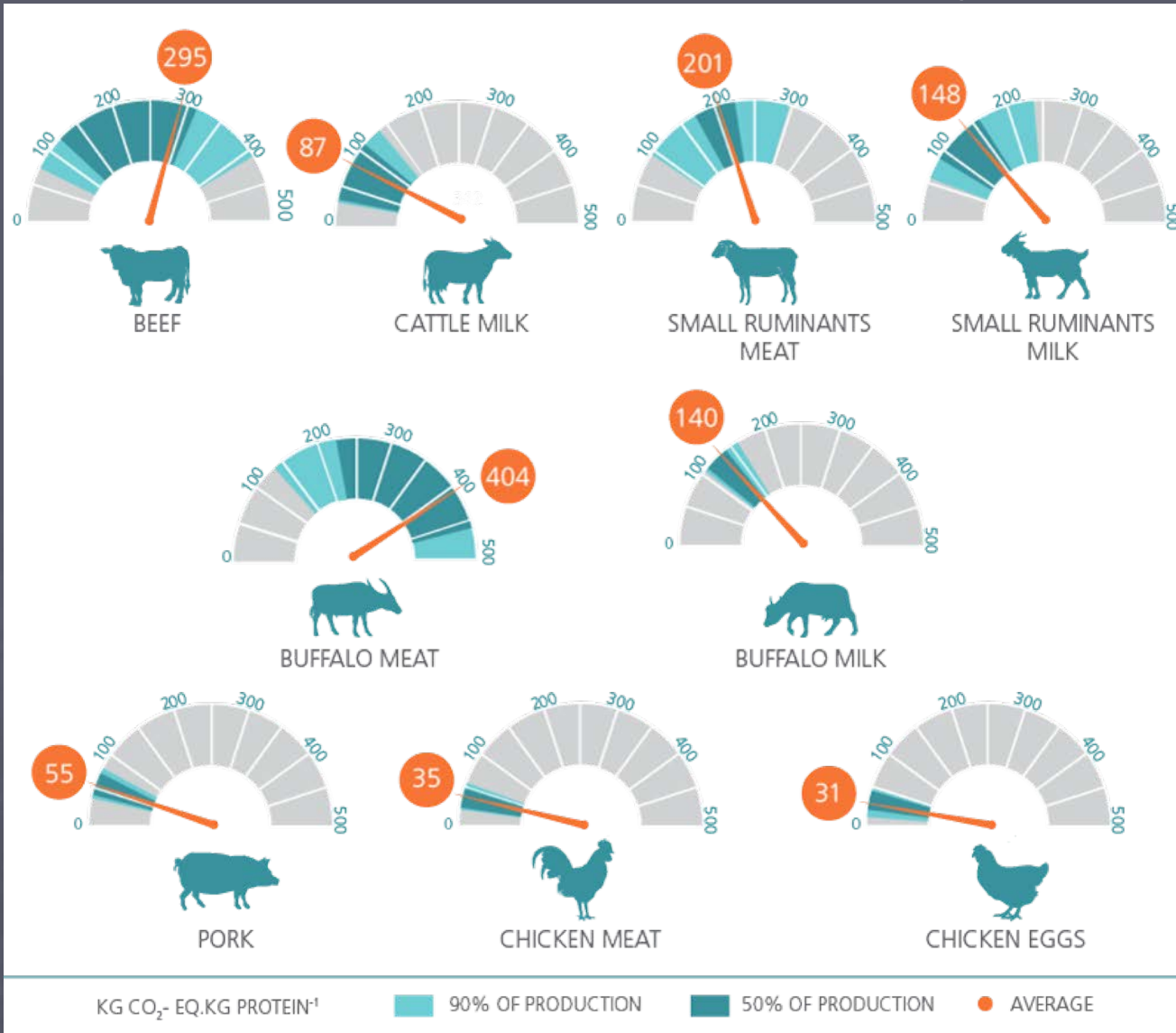
# Implications of Agriculture in Climate

## Land use per unit protein by food and production system

Average land use per 100 grams of protein of food production, by food type and production system measured in metres squared ( $m^2$ ) per 100 grams of protein. Average values are based on a meta-analysis of studies across 742 agricultural systems and over 90 unique foods.



# KG of Co2 Emissions per KG of Protein



Source: Food and Agriculture Organization of the U.N.