

Ch. 10 Agriculture



Key Issues

- Where did agriculture originate?
- Why do people consume different foods?
- Where is agriculture distributed?
- Why do farmers face economic difficulties?

Where Did Agriculture Originate?

- Invention of Agriculture
 - Prior to the advent of agriculture, all humans probably obtained needed food through hunting and gathering.
 - Origins of agriculture cannot be documented with certainty, because it began before recorded history.
 - *Agriculture* is deliberate modification of Earth's surface through cultivation of plants and rearing of animals to obtain sustenance or economic gain.

History of Agriculture

- Hunter-Gatherers
- Neolithic Revolution
 - Domestication of Plants and Animals
 - Diffusion of Agriculture
- Agricultural Industrialization
- The “Green Revolution”
- Modern Agribusiness

Hunter-Gatherers

- Humanity's only “economic” activity for at least 90% of our existence.
- Low population densities.
- Wide variety of natural foodstuffs eaten.
- What stage of the DTM???????

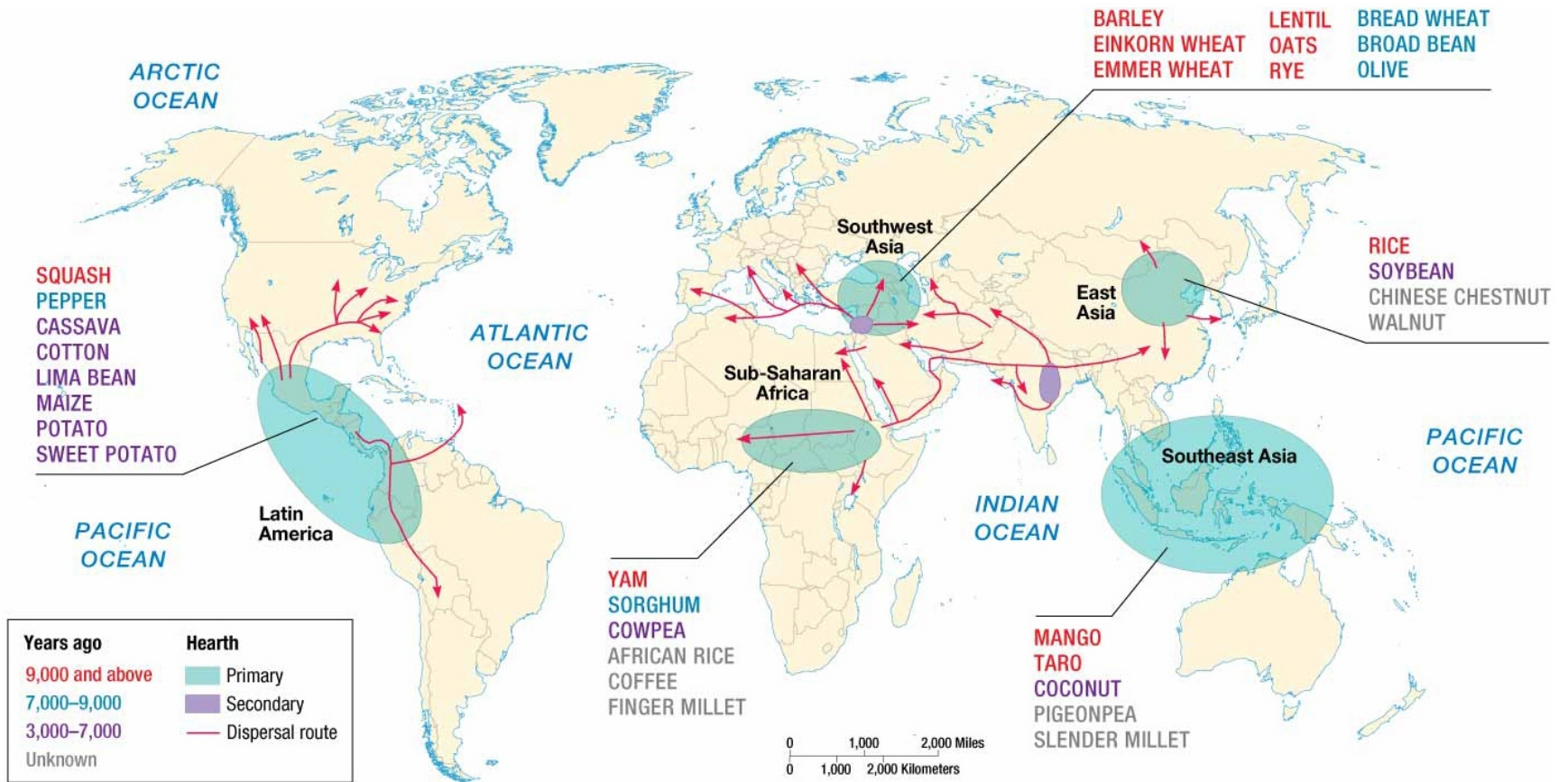


Where Did Agriculture Originate?

- Agricultural Revolution (Neolithic Revolution) – 8,000 BCE
 - The time when humans first domesticated plants and animals and no longer relied entirely on hunting and gathering was known as the *agricultural revolution*.
 - Agriculture originated in multiple hearths around the world:
 - Crop Hearths:
 - Southwest Asia:
 - » Early crops: barley, wheat, lentil, and olive.
 - East Asia:
 - » Early crops: Rice and millet.

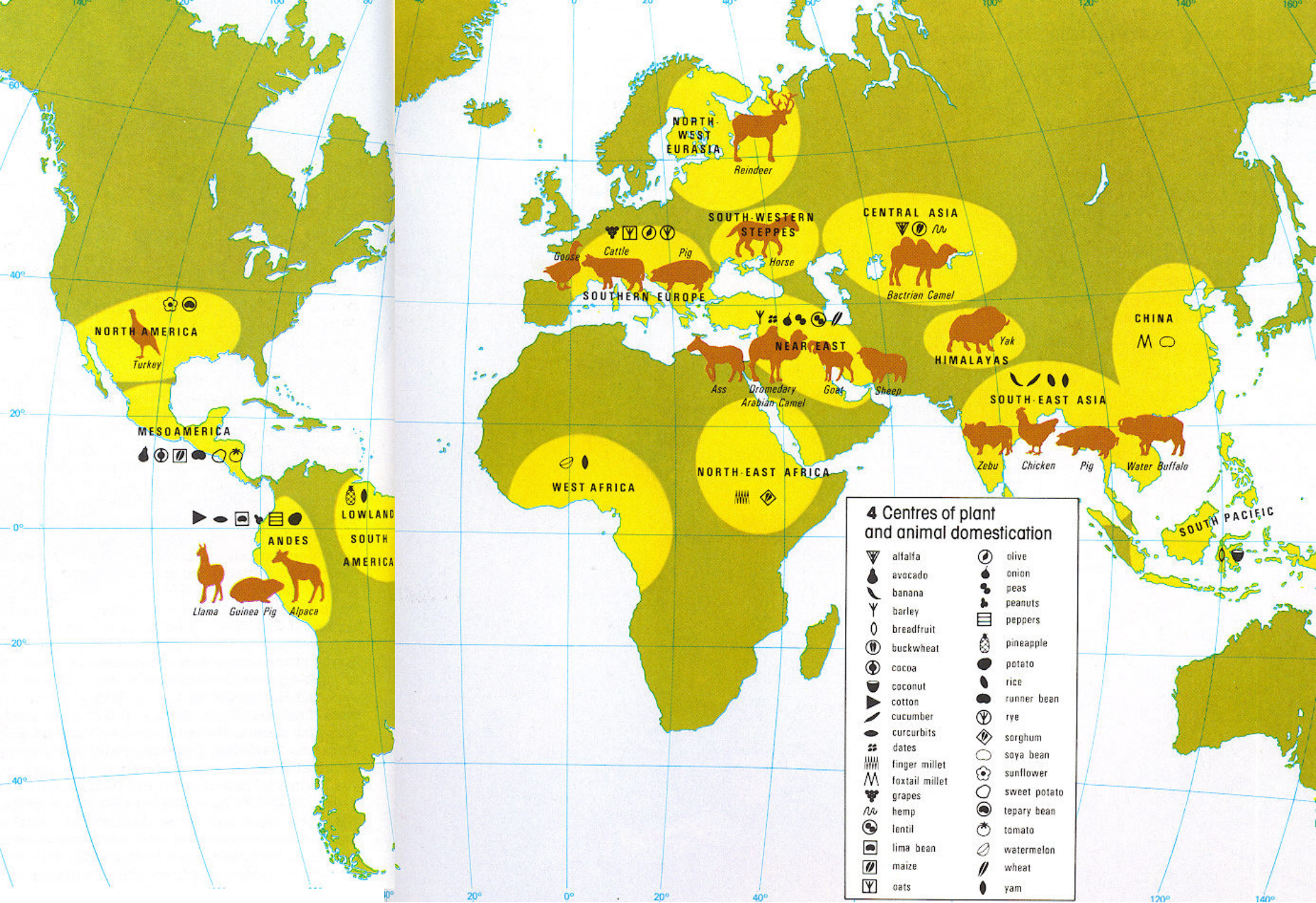
Where Did Agriculture Originate?

- Crop Hearths Cont'd:
 - Sub-Saharan Africa:
 - » Early crops: Sorghum, yams, millet, and rice.
 - Latin America:
 - » Early crops: Beans, cotton, potato, and most importantly maize (corn).



Where Did Agriculture Originate?

- Agricultural Revolution
 - Agriculture originated in multiple hearths around the world cont' d:
 - Animal Hearths:
 - Southwest Asia:
 - » Early domesticated animals: Cattle, goats, pigs, sheep, and dogs.
 - Central Asia:
 - » Early domesticated animals: Horses



Agricultural Revolution (Neolithic Revolution)

Primary effects:

- Urbanization
- Social Stratification
- Occupational Specialization
- Increased population densities

Secondary effects:

- Endemic diseases
- Famine
- Expansionism

Second Agricultural Revolution

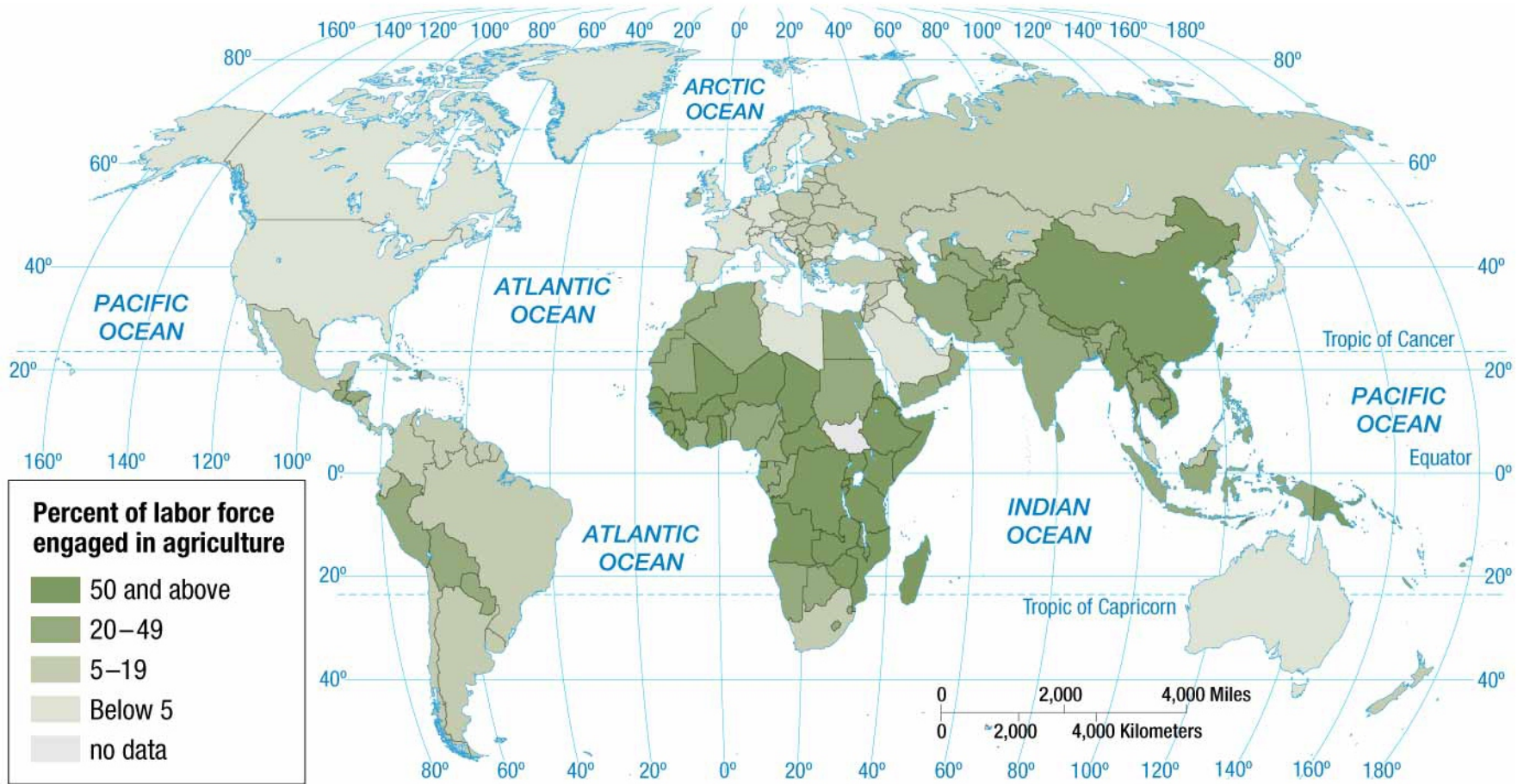
Technology allows much greater production (surplus) with less human labor, but has high social and environmental costs. Less farmers (push/pull).

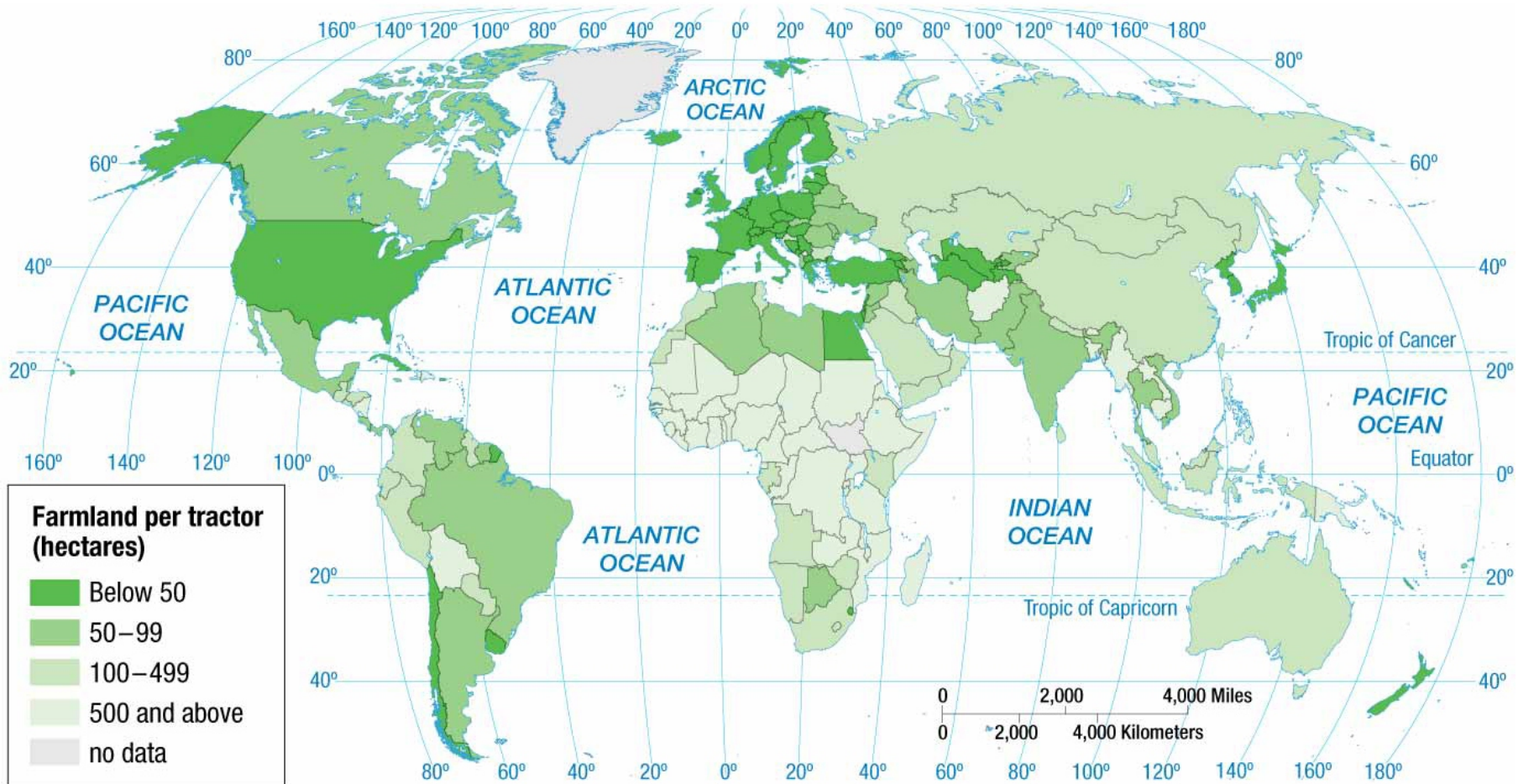
- **Metal plows, Reapers, Cotton Gin, Seed Drill**
- **Tractors (Internal Combustion Engine)**
- **New Crops – Potatoes and Corn**
- **Combines**
- **Chemical Pesticides/Fertilizers**
- **Hybrid and genetically modified crops**



Where Did Agriculture Originate?

- Comparing Subsistence and Commercial Agriculture
 - *Subsistence agriculture* is the production of food primarily for consumption by the farmer's family.
 - Practiced primarily in developing countries
 - *Commercial agriculture* is the production of food primarily for sale off the farm.
 - Practiced primarily in developed countries.
 - Features that distinguish itself from subsistence agriculture include: lower percentage of farmers in labor force, highly mechanized, and larger farm size.







(a)

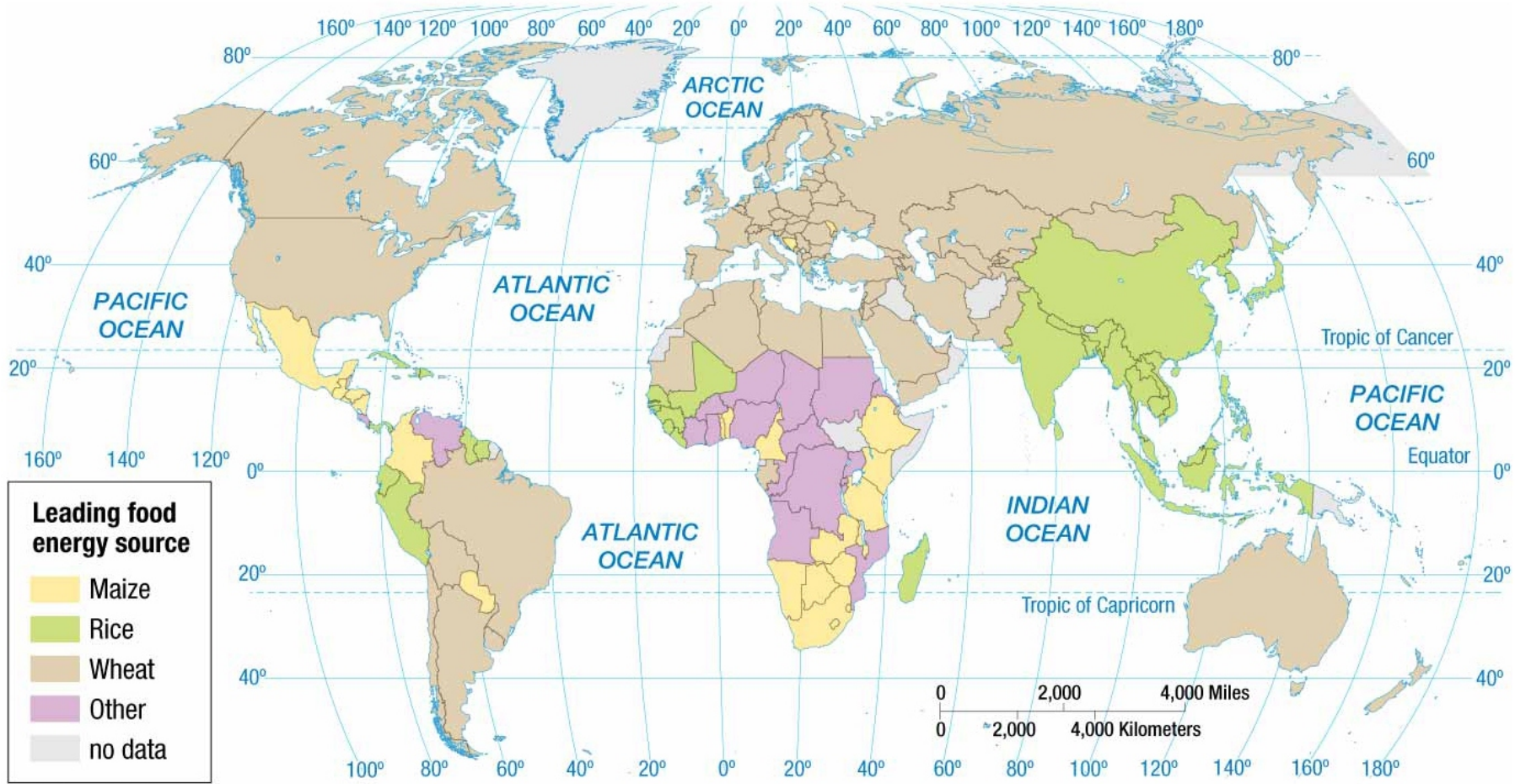


(b)

KI #2 Why Do People Consume Different Foods?

- Diet

- *Dietary energy consumption* is the amount of food that an individual consumes.
- Consumption of food varies around the world, both in total amount and source of nutrients, for two reasons.
 1. Level of development
 2. Physical conditions



Why Do People Consume Different Foods?

- Source of Nutrients

- Developed and developing regions typically differ most in their primary sources of protein consumed.

- Developed Countries

- Leading source of protein is meat products.

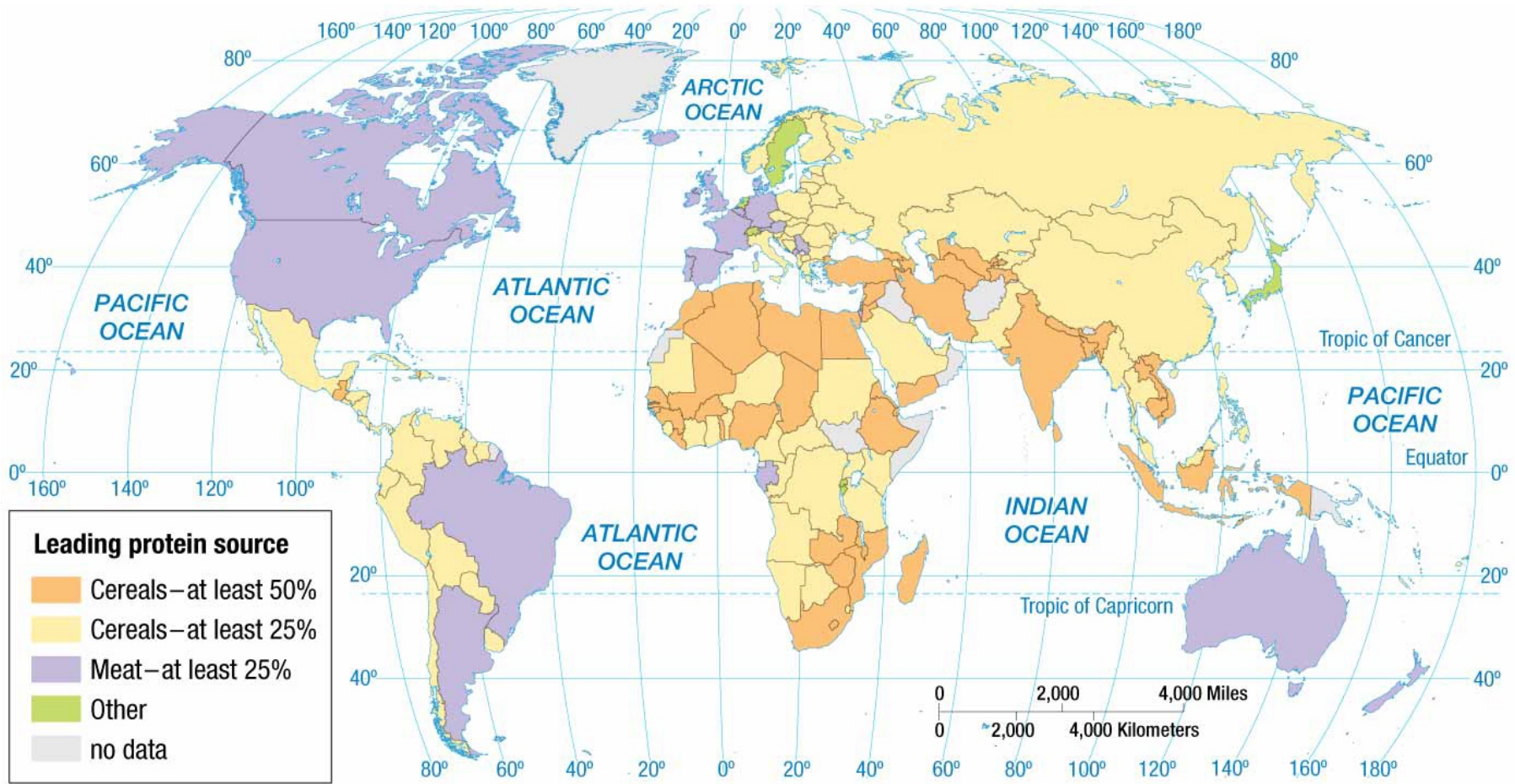
- » Beef

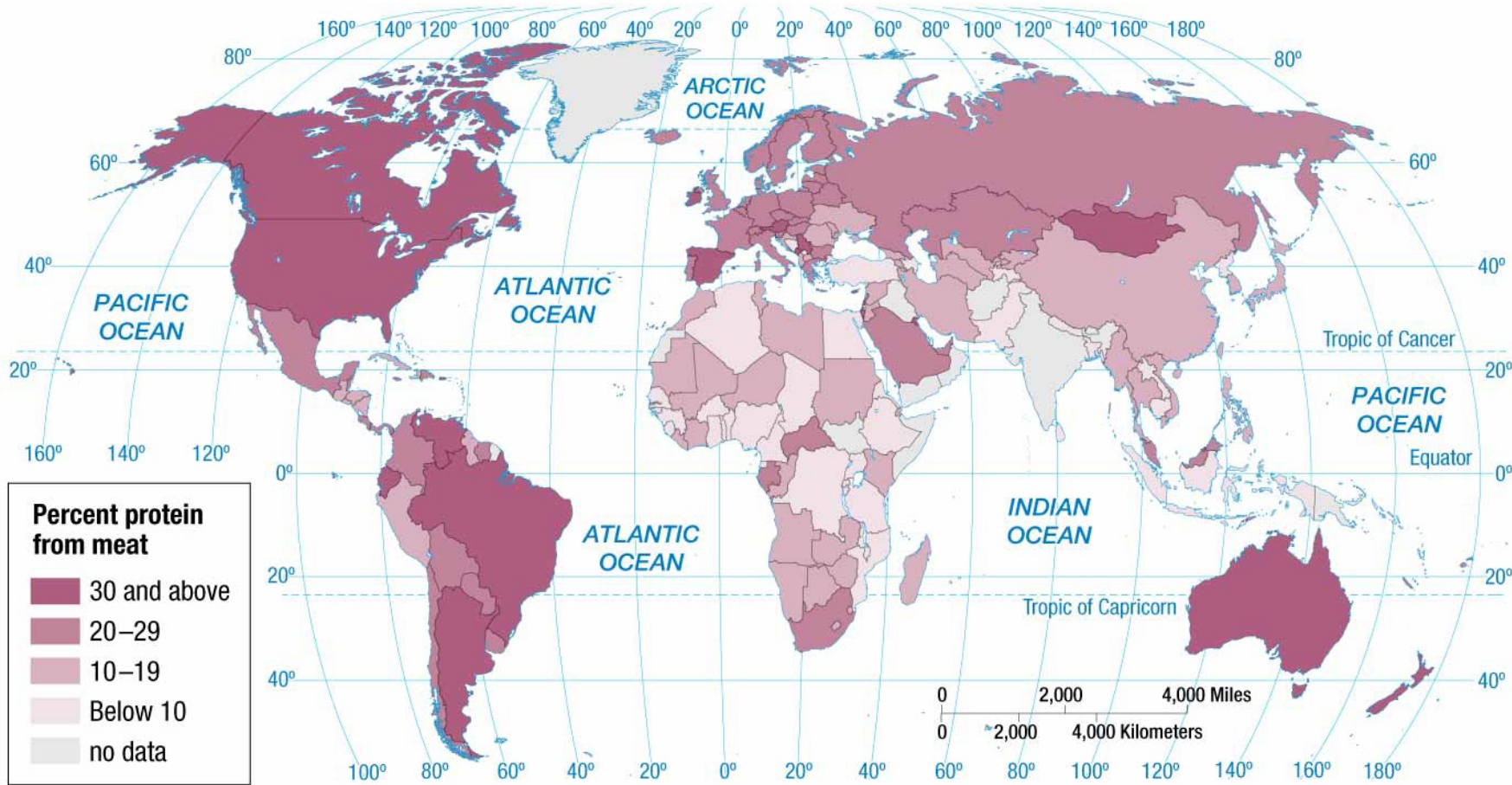
- » Pork

- » Poultry

- Developing Countries

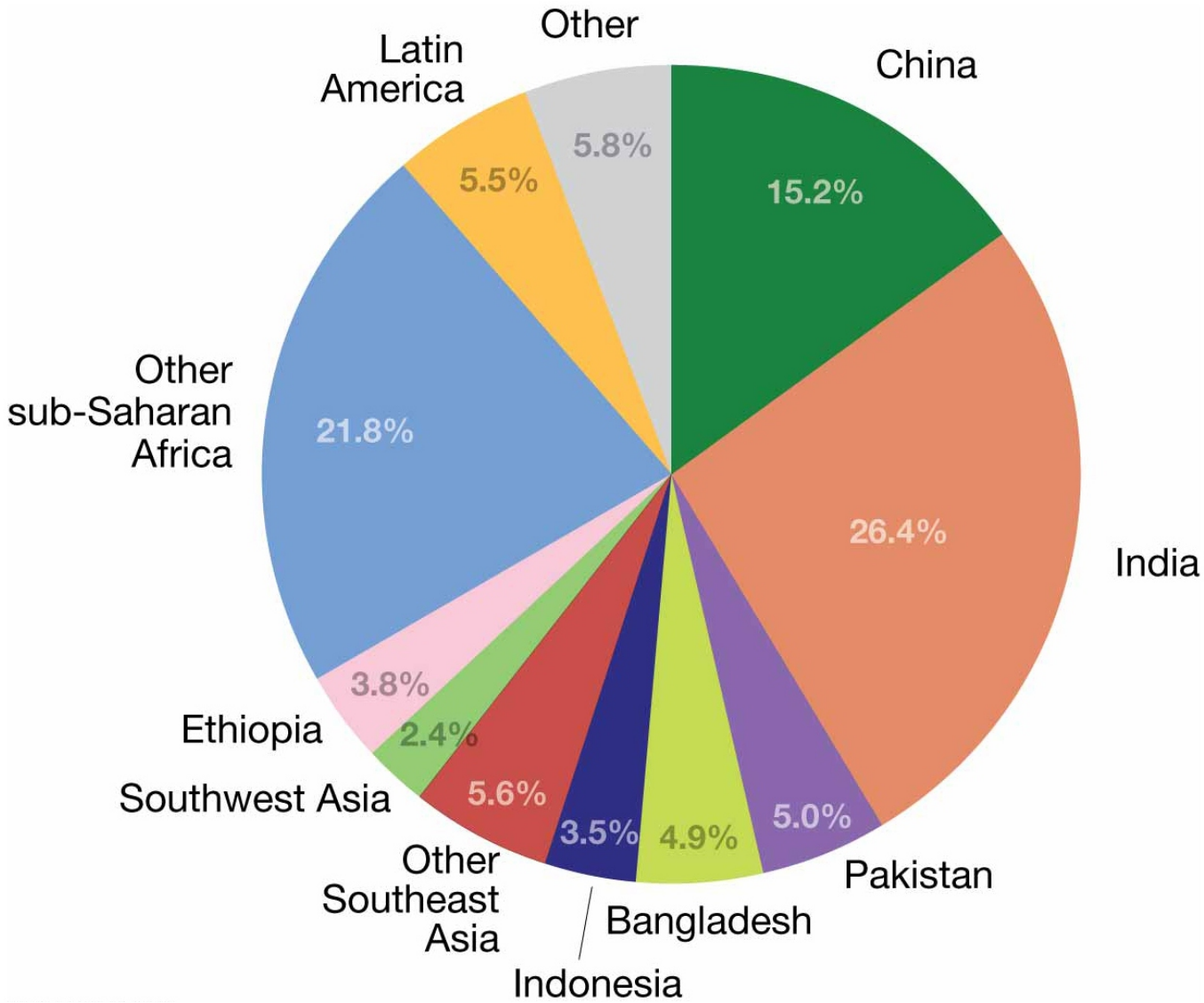
- Leading source of protein is cereal grains.

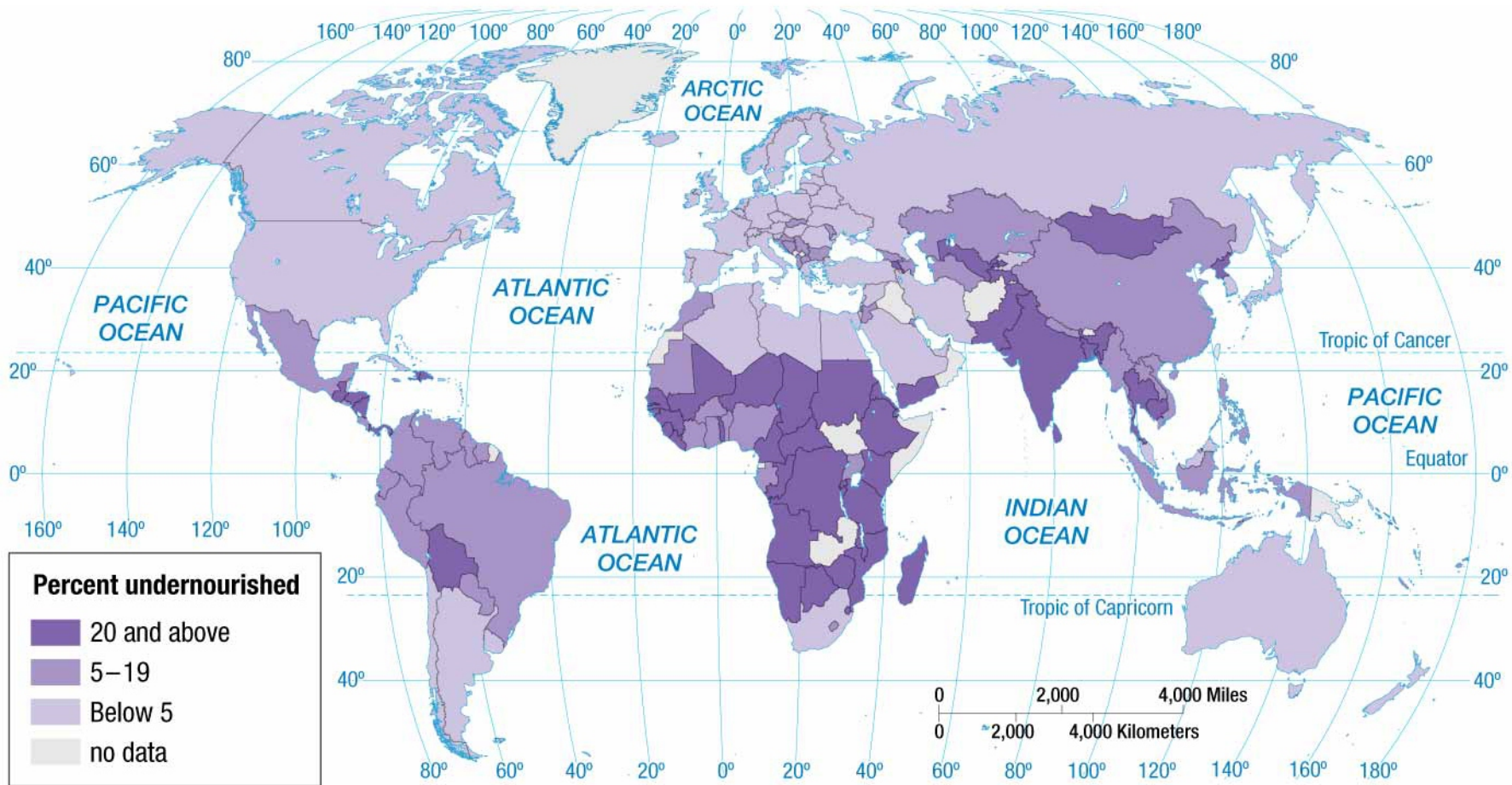


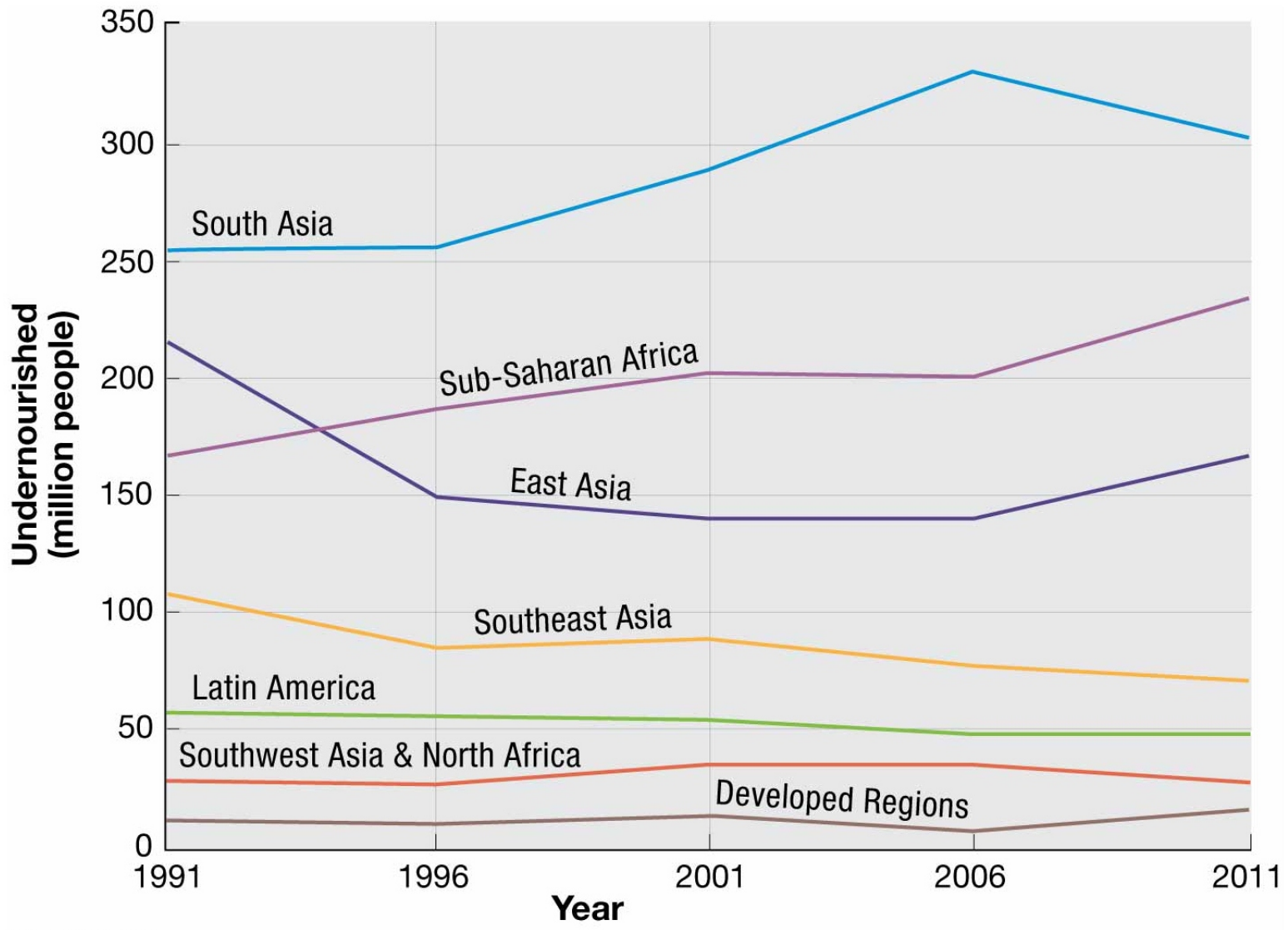


Why Do People Consume Different Foods?

- Nutrition and Hunger
 - *Undernourishment* is dietary energy consumption that is continuously below the minimum requirement for maintaining a healthy life and carrying out light physical activity.
 - UN estimates 850 million people in world are undernourished.
 - 99% located in developing countries
 - Worldwide, the total number of undernourished people has not changed much in several decades.





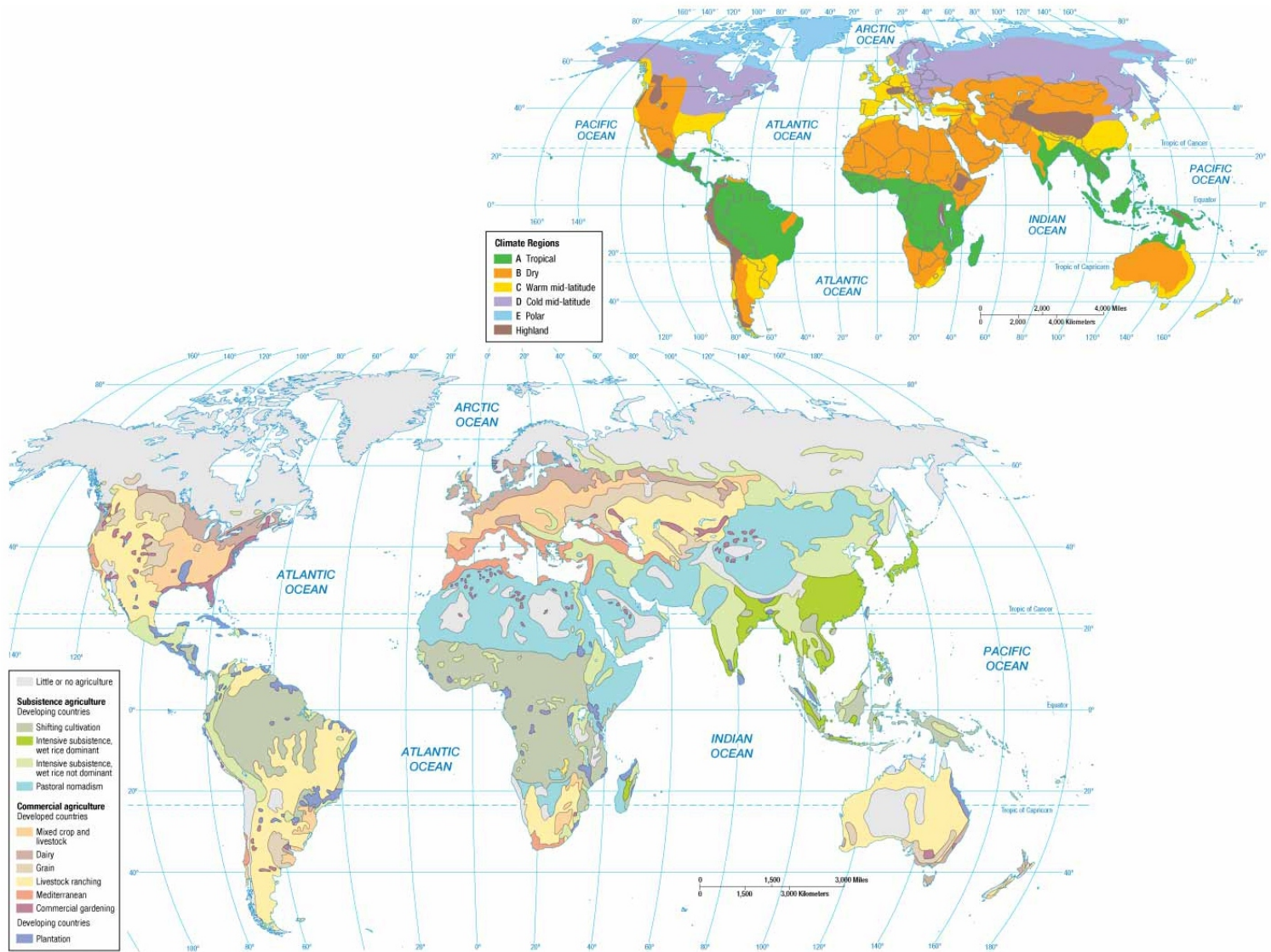


KI #3 Where is Agriculture Distributed?

- Geographer Derwent Whittlesey identified 11 main agricultural regions, plus an area where agriculture was nonexistent.
 - 5 present in **developing** countries
 1. Pastoral Nomadism
 2. Shifting Cultivation
 3. Intensive Subsistence, wet rice dominant
 4. Intensive Subsistence, crops other than rice dominant
 5. Plantation

Where is Agriculture Distributed?

- 6 present in **developed** countries
 1. Mixed Crop and Livestock
 2. Dairying
 3. Grain
 4. Ranching
 5. Mediterranean
 6. Commercial Gardening



Plantation Farming

- large scale **mono-cropping** of profitable products not able to be grown in Europe or U.S.
- **where:** tropical lowland Periphery
- **crops:** cotton, sugar cane, coffee, rubber, cocoa, bananas, tea, coconuts, palm oil.

What are potential problems with this type of agriculture? Environmental? Economic?

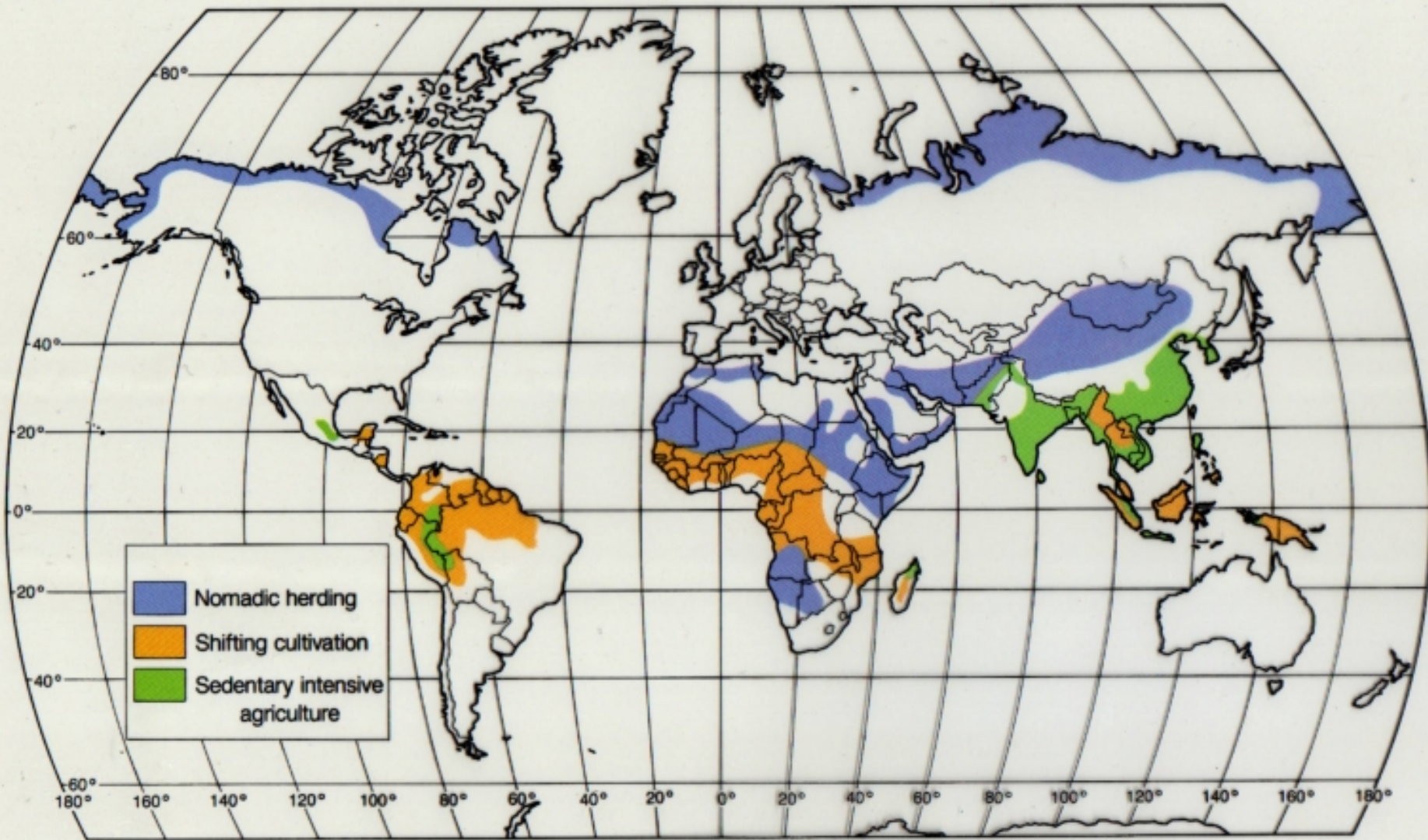
Classifying Agricultural Regions

Subsistence Agriculture

- Shifting Cultivation
- Pastoral Nomadism
- Intensive Subsistence Agriculture



Subsistence Agriculture Regions



Where is Agriculture Distributed?

- Agriculture in Developing Regions

- Pastoral Nomadism

- *Pastoral nomadism* is a form of subsistence agriculture based on the herding of domesticated animals.
 - Various approaches combine some reliance on sedentary agriculture with the herding of livestock.
 - Some pastoral nomads obtain grain from sedentary subsistence farmers.
 - More commonly, women and children of a nomadic group tend to crops at a fixed location.
 - Nomads may hire worker to practice sedentary agriculture.
 - Some nomads will remain in a place and cultivate the land only when rainfall is abundant.

Pastoral Nomadism



- **Where: *arid and semi-arid areas* of N. Africa, Middle East, Central Asia**
- **Animals: Camel, Goats, Sheep, Cattle**
- **transhumance: seasonal migrations from highlands to lowlands**



Most nomads are being pressured into sedentary life as land is used for agriculture or mining.



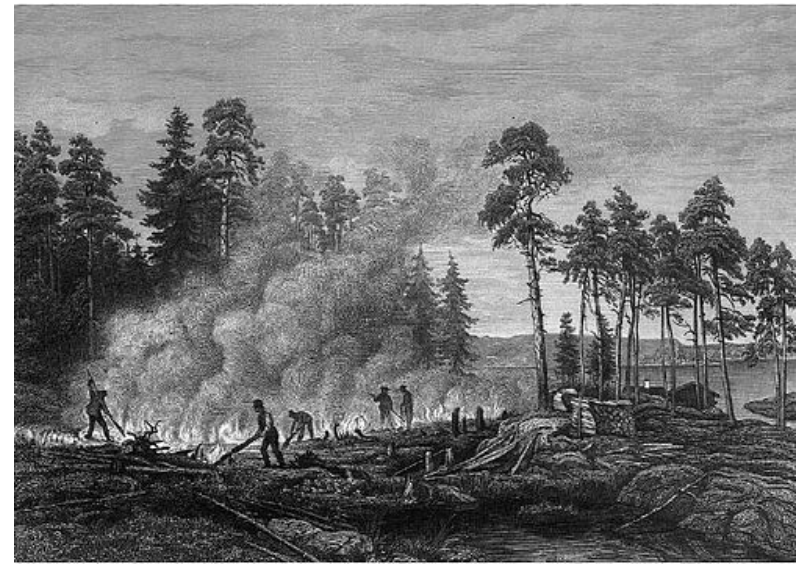
Where is Agriculture Distributed?

- Agriculture in Developing Regions
 - Shifting Cultivation
 - *Shifting cultivation* is characterized by two distinctive features:
 1. Farmers clear land for planting by **slashing** vegetation **and burning** the debris.
 2. Farmers grow crops on a cleared field for only a few years, until soil nutrients are depleted, and then leave it fallow for many years so the soil can recover.
 - » Farmers return to a fallow site as few as 6 years later or as many as 20 years later.
 - Land Ownership
 - Traditionally, land collectively owned by village.
 - Today, private individuals now own land, especially in Latin America.



Where is Agriculture Distributed?

- Shifting Cultivation was sustainable in the past due to ...
 - There were smaller populations and more available land
 - Lower physiological density
 - Lower agricultural density

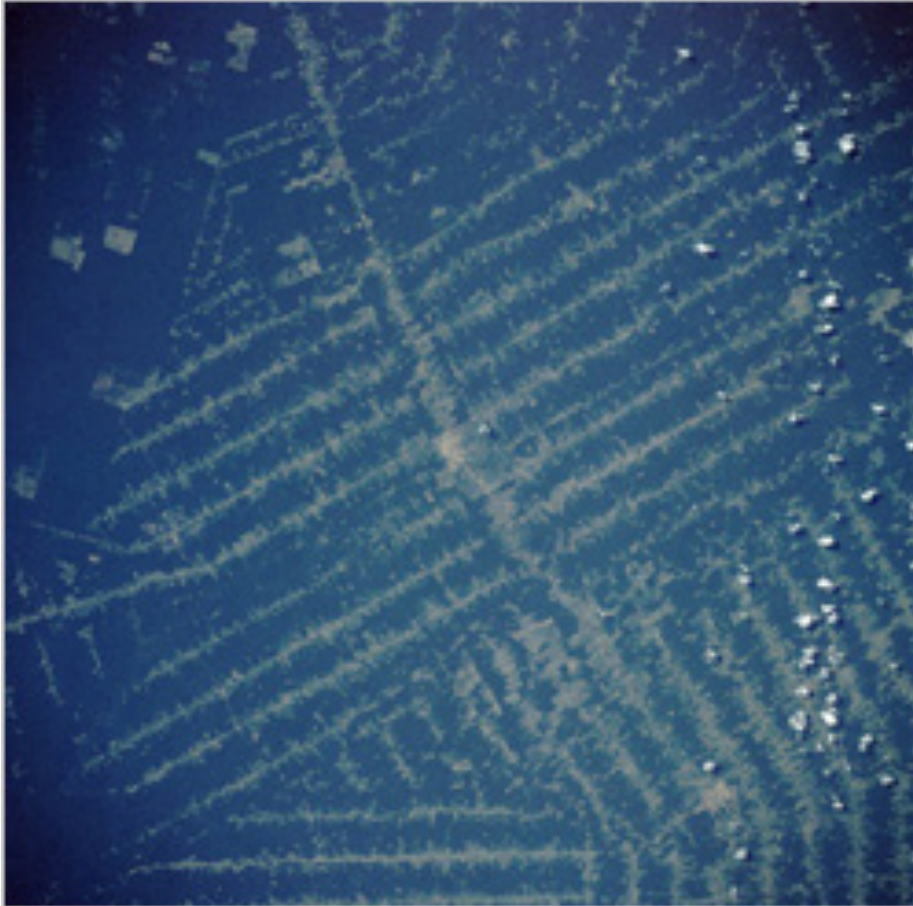


Shifting Cultivation

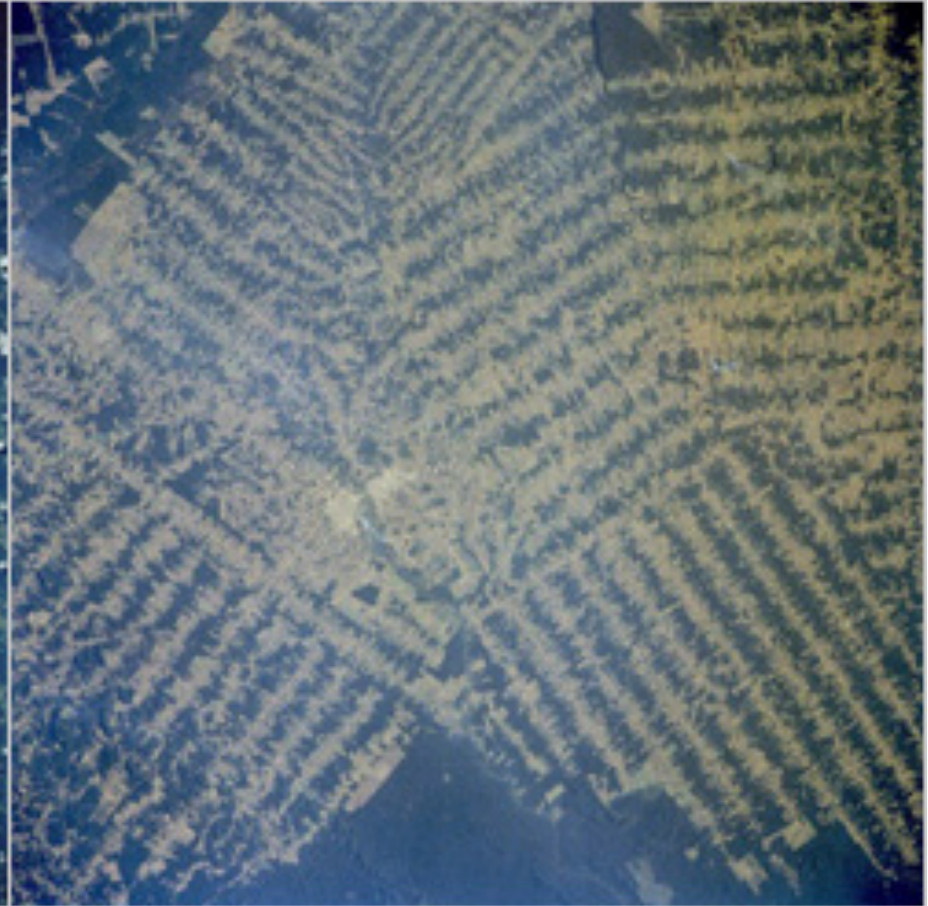
Where: tropical rainforests. Amazon, Central and West Africa, Southeast Asia

- Crops: upland rice (S.E. Asia), maize and manioc (S. America), millet and sorghum (Africa)
- **This form of agriculture occupies the largest percentage of the world's LAND area**
- Declining due to
 - Ranching and logging being more profitable.
 - Commercial Ag. Being more profitable
 - Growing population and less land in a specific area/region of the world.
 - Government policies and regulations
 - Technological advancements



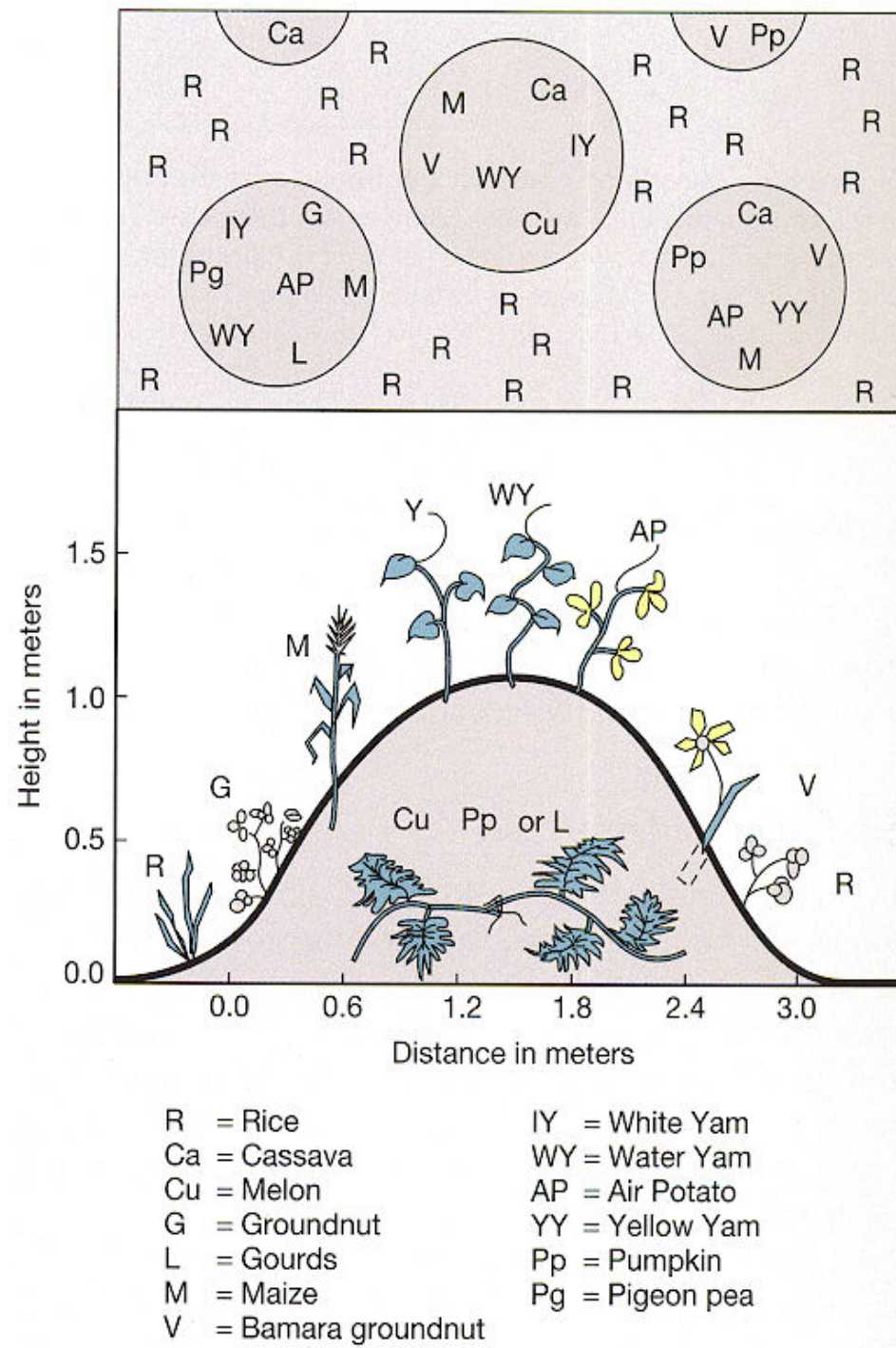


1985



1992

- **Intertillage** - the clearing of rows in the field through the use of hoes, rakes, & other manual equipment.
- spreads food production over the farming season
- It reduces the loss from disease or pests or drought.
- It helps control soil erosion and soil depletion.
- Hill planted crops have deeper root systems and tall stalks while flat earth crops are spreaders.
- No expensive fertilizer, pesticides, herbicides or machines are necessary



Where is Agriculture Distributed?

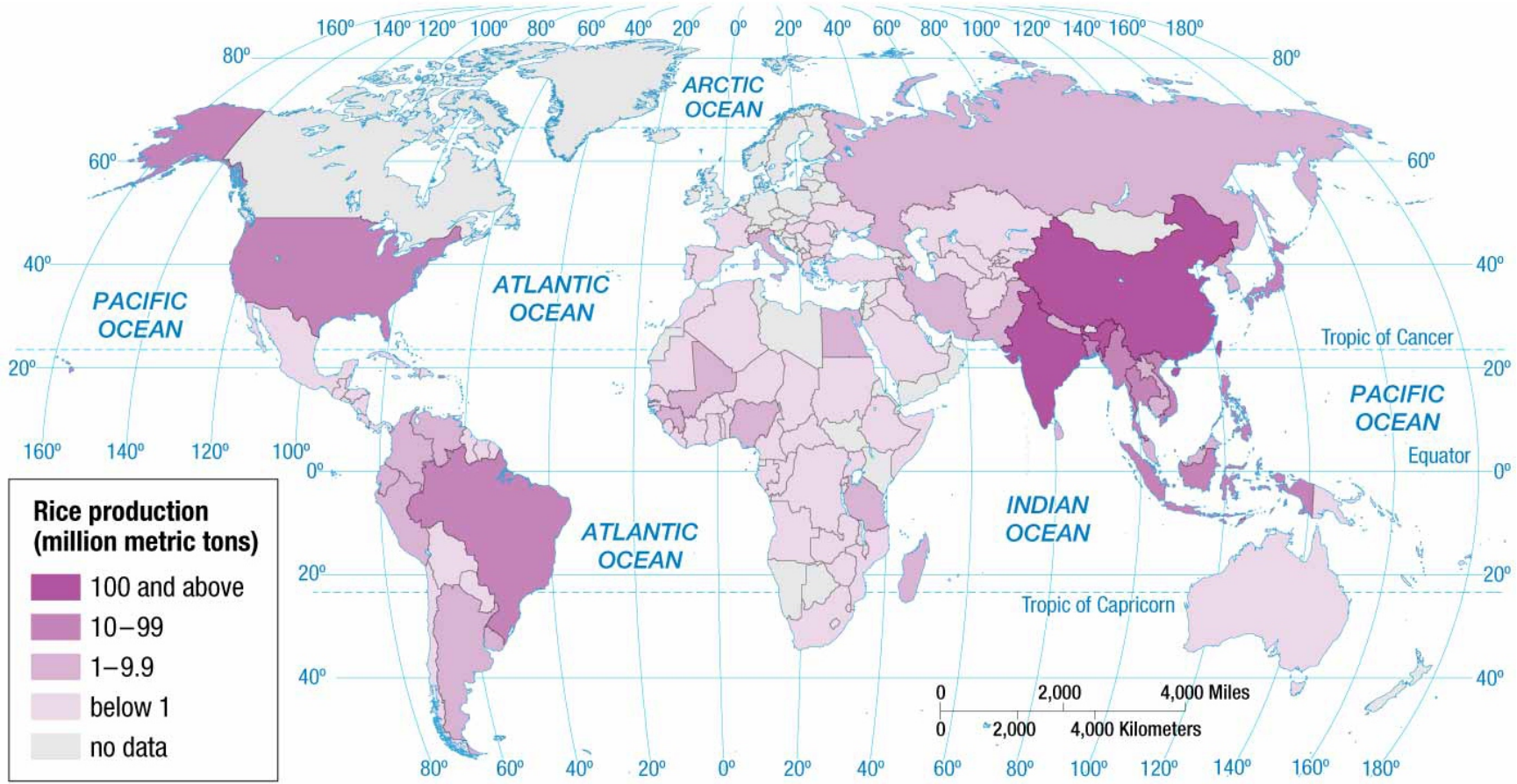
- Agriculture in Developing Regions
 - Intensive Subsistence Farming
 - Feeds most of the $\frac{3}{4}$ of the world's people who live in developing countries.
 - Farmers work intensively to subsist on a parcel of land.
 - Most of the work is done by hand or with animals rather than machines.
 - Virtually all available land is used for production.
 - Parcels of land are much smaller than elsewhere in world.
 - Example
 - *Wet rice*: the process where rice is planted on dryland in a nursery and then moved as seedlings to a flooded field to promote growth.

Intensive Subsistence Agriculture

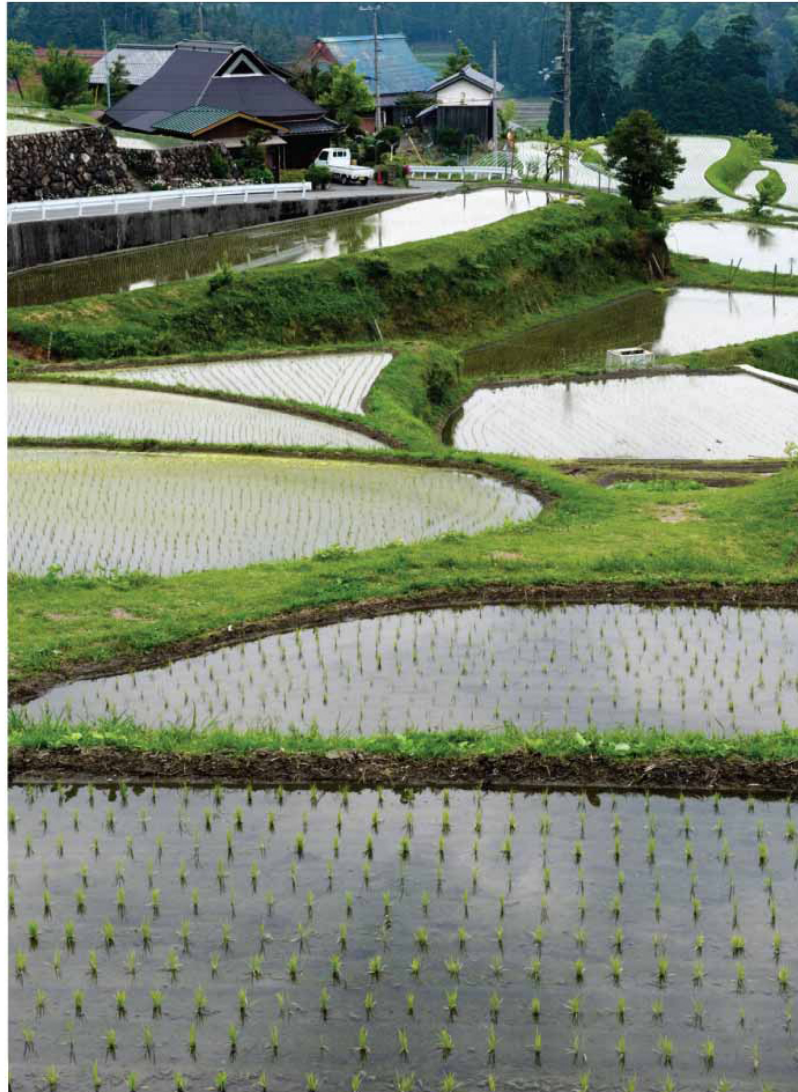


Thai Rice Farmers

- ***Wet Rice Dominant***
 - where: S.E. Asia, E. India, S.E. China
 - very labor intensive production of rice, including transfer to sawah, or paddies
 - most important source of food in Asia
 - This form of agriculture is practiced by the largest percentage of the world's PEOPLE
 - grown on flat, or terraced land
 - **Double cropping** is used in warm winter areas of S. China and Taiwan







Where is Agriculture Distributed?

- Agriculture in Developed Regions
 - Commercial agriculture in developed countries can be divided up into six main types:
 - Mixed Crop and Livestock Farming
 - Dairy Farming
 - Commercial Gardening and Fruit Farming
 - Grain Farming
 - Mediterranean Agriculture
 - Livestock Ranching
 - *Agribusiness* is commonly used to refer to these types of farming listed, because the family farm is not an isolated activity but is integrated into a large food-production industry.

Agribusiness:

The *industrialization of agriculture*

- Modern commercial farming is very dependent on inputs of chemical fertilizer, pesticides, herbicides.
- Oil is required to make fertilizer and pesticides.
- It takes 10 calories of energy to create 1 calorie of food in modern agriculture.
- Small farmer can't buy needed equipment and supplies.
- Fewer than 2% of U.S. population works in agriculture
- Land is harder to come by due to urban sprawl.

Where is Agriculture Distributed?

- Agriculture in Developed Regions
 - Mixed Crop and Livestock Farming
 - Most distinctive characteristic is the integration of crops and livestock.
 - Most of the crops are fed to animals instead of humans.
 - Typical example devotes nearly all land area to growing crops but derives more than $\frac{3}{4}$ of its income from the sale of animal products. e.g. beef and eggs
 - Permits farmers to distribute the workload more evenly through the year, because crops require less attention, aside from planting and harvesting them.
 - Typically involves *crop rotation*, practice of rotating use of different fields from crop to crop each year to avoid exhausting the soil.

Mixed Crop and Livestock Farming

Mixed Crop and Livestock Farming

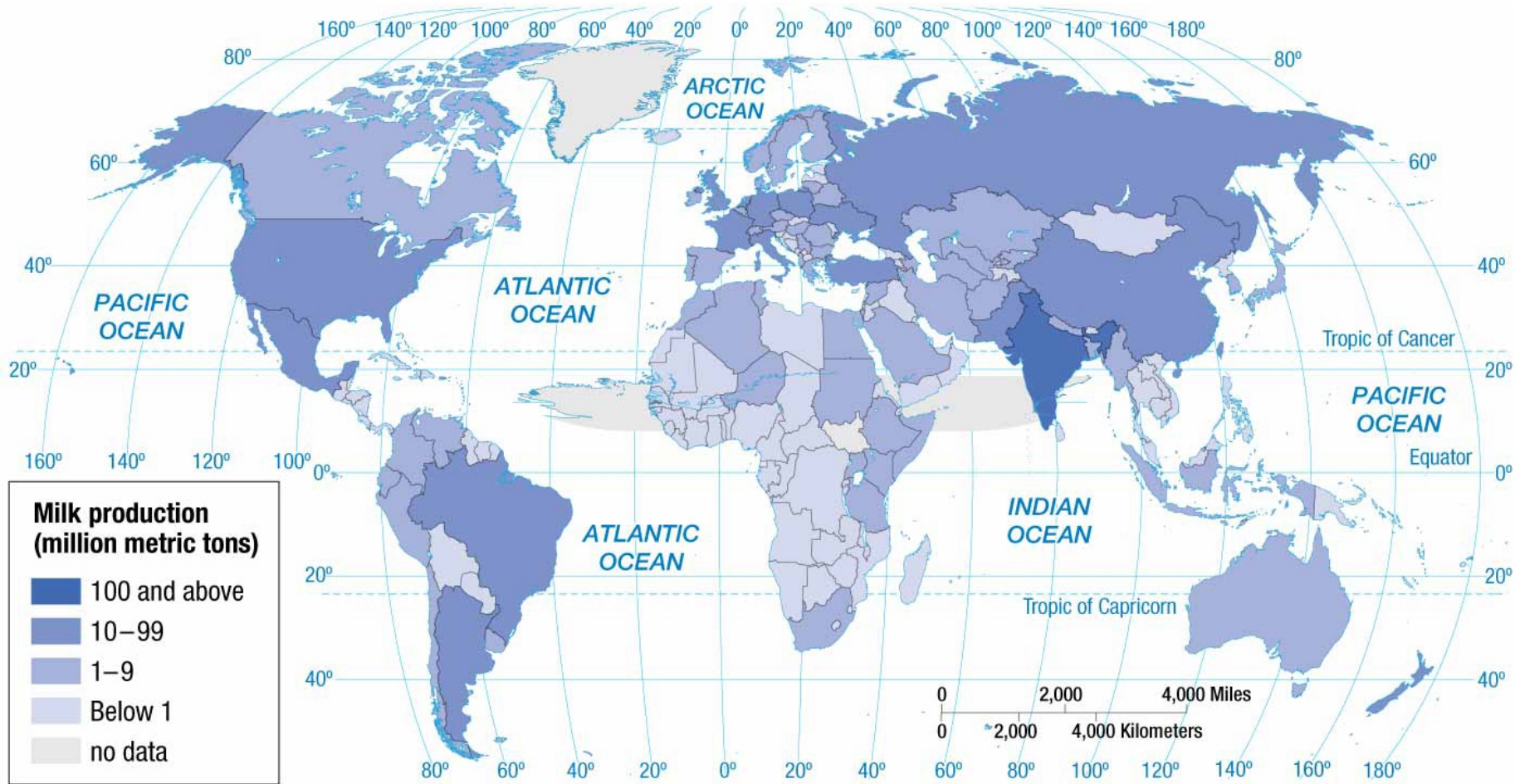
Where: Ohio to Dakotas, centered on Iowa;
much of Europe from France to Russia

- crops: corn (most common), soybeans
- In U.S. 80% of product fed to pigs and cattle
- Highly inefficient use of natural resources
 - Pounds of grain to make 1 lb. beef: 10
 - Gallons of water to make 1 lb wheat: 25
 - Gallons of water to make 1 lb. beef: 2500



Where is Agriculture Distributed?

- Agriculture in Developed Regions
 - Dairy Farming
 - Most important type of commercial agriculture in the first ring outside the large cities because of transportation factors.
 - Ring surrounding a city from which milk can be supplied is known as the *milkshed*.
 - Advancements in modes of transportation have increased the radius of milksheds to 500 km. (300 mi.)
 - Where: NE US, SE Canada, NW Europe
 - Process
 - Dairy farmers typically sell their milk to wholesalers who later distribute it to retailers.
 - Retailers then sell it to consumers in shops or at home.



Where is Agriculture Distributed?

- Agriculture in Developed Regions
 - Commercial Gardening and Fruit Farming
 - Predominant type of farming in southeastern U.S.
 - Commonly referred to as *truck farming* from the Middle English word, truck, meaning “bartering” or “exchange of commodities.”
 - Grow many of the following fruits and vegetables that consumers in developed countries demand:
 - Apples
 - Asparagus
 - Cherries
 - Lettuce
 - Mushrooms
 - Potatoes

Where is Agriculture Distributed?

- Agriculture in Developed Regions
 - Commercial Gardening and Fruit Farming
 - Some of the fruits and vegetables are sold fresh to consumers, but most are sold to large processors for canning or freezing.
 - Truck farms are highly efficient large-scale operations that take full advantage of machines at all stages of the growing process.
 - Labor costs are kept down by hiring migrant farm workers.
 - Specialization in a few crops is common.

Commercial Gardening and Fruit Farming



Where: U.S. Southeast, New England,
near cities around the world



- **Crops:** high profit vegetables and fruits demanded by wealthy urban populations: apples, asparagus, cherries, lettuce, tomatoes, etc.
- **Distribution:** situated near urban markets.

Where is Agriculture Distributed?

- Agriculture in Developed Regions
 - Grain Farming
 - Distinguished from mixed crop and livestock farming, because crops are grown primarily for human consumption.
 - Farms sell their output to manufacturers of food products, such as breakfast cereals and bread.
 - Characteristics of a Typical Grain Farm
 - Heavily mechanized
 - Farms large in areal extent
 - Oriented to consumer preferences

Grain Farming



Where: worldwide, but U.S. and Russia predominant

Crops: wheat

- winter wheat: Kansas, Colorado, Oklahoma
- spring wheat: Dakotas, Montana, southern Canada

Where is Agriculture Distributed?

- Agriculture in Developed Regions
 - Mediterranean Agriculture
 - Every site practicing this form of agriculture borders a sea, and most are on west coasts of continents.
 - Prevailing sea winds provide moisture and moderate the winter temperatures.
 - Farmers derive a smaller percentage of income from animal products.
 - Most crops are grown for human consumption.
 - *Horticulture*, which is the growing of fruits, vegetables, and flowers, and tree crops form the commercial base.
 - Along the Mediterranean Sea, olives and grapes are two most important cash crops.
 - Approximately half of the land here is used to grow cereals.

Mediterranean Agriculture

Where: areas surrounding the Mediterranean, California, Oregon, Chile, South Africa, Australia

Climate has summer dry season.

Landscape is mountainous.

- crops: olives, grapes, nuts, fruits and vegetables; winter wheat
- California: high quality land is being lost to suburbanization; initially offset by irrigation





Where is Agriculture Distributed?

- Agriculture in Developed Regions

- Livestock Ranching

- *Ranching* is the commercial grazing of livestock over an extensive area.
 - Well suited for semiarid or arid land
 - Practiced in developed countries where vegetation is too sparse and soil too poor to support crops.
 - Historically, ranchers sought to move their cattle from Texas to Chicago, because the cattle were worth more money farther north.
 - Today, ranching has become part of the meat-processing industry where new methods of breeding and sources of water and feed are embraced.

Livestock Ranching

Where: arid or semi-arid areas of western U.S., Argentina, Brazil, Uruguay, Spain and Portugal.

History: initially open range, now sedentary with transportation changes.

Environmental effects:

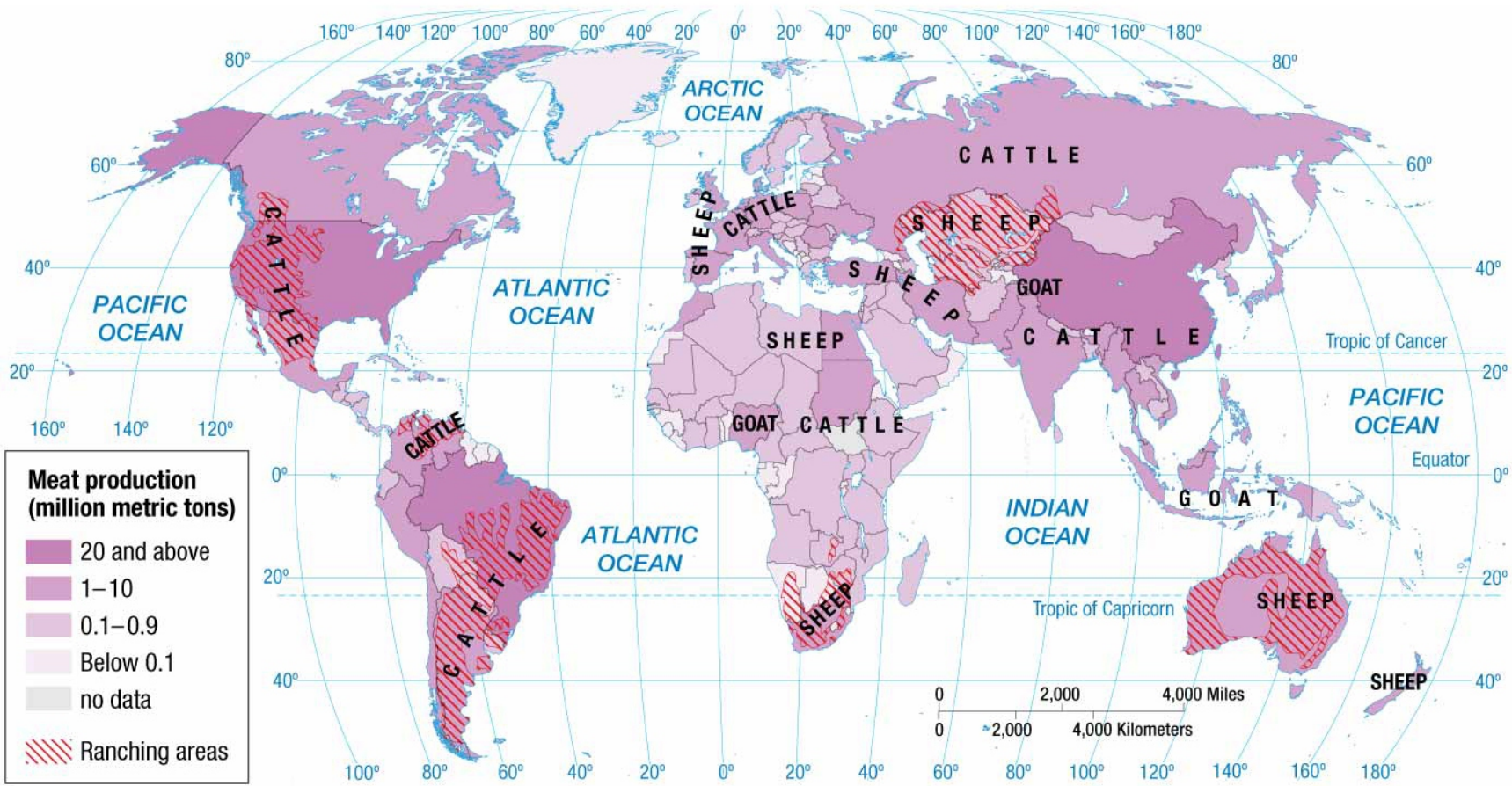
1) overgrazing has damaged much of the world's arid grasslands (< 1% of U.S. remain!)

2) destruction of the rainforest is motivated by Brazilian desires for fashionable cattle ranches









KI #4 Why Do Farmers Face Economic Difficulties?

- Challenges for Farmers in Developing Countries
 - Subsistence farmers must feed an increasing number of people because of rapid population growth in developing countries.
 - Food supply increased through intensification of production via new farming methods and leaving land fallow for shorter periods of time.



Why Do Farmers Face Economic Difficulties?

- Challenges for Farmers in Developing Countries
 - Subsistence farmers must grow food for export instead of for direct consumption due to the adoption of the international trade approach to development.
 - Consumers in developed countries are willing to pay high prices for fruits and vegetables that would otherwise be out of season locally.

Drug Crops

- Grown for export in developing countries
 - High Demand in MDC's = High price
 - Proximity to MDC's

Why Do Farmers Face Economic Difficulties?

- Challenges for Farmers in Developed Countries
 - Overproduction in Commercial Farming
 - Commercial farmers suffer from low incomes, because they are capable of producing more food than is demanded by consumers in developed countries.
 - Demand is stagnant in developed countries because of low population growth.

Why Do Farmers Face Economic Difficulties?

- Challenges for Farmers in Developed Countries
 - Overproduction in Commercial Farming
 - U.S. Government has formed policies that attempt to address excess production.
 - Farmers are encouraged to avoid producing crops that are in excess supply.
 - The government pays farms when certain commodity prices are low.
 - The government buys surplus production and sells or donates it to foreign governments.

Why Do Farmers Face Economic Difficulties?

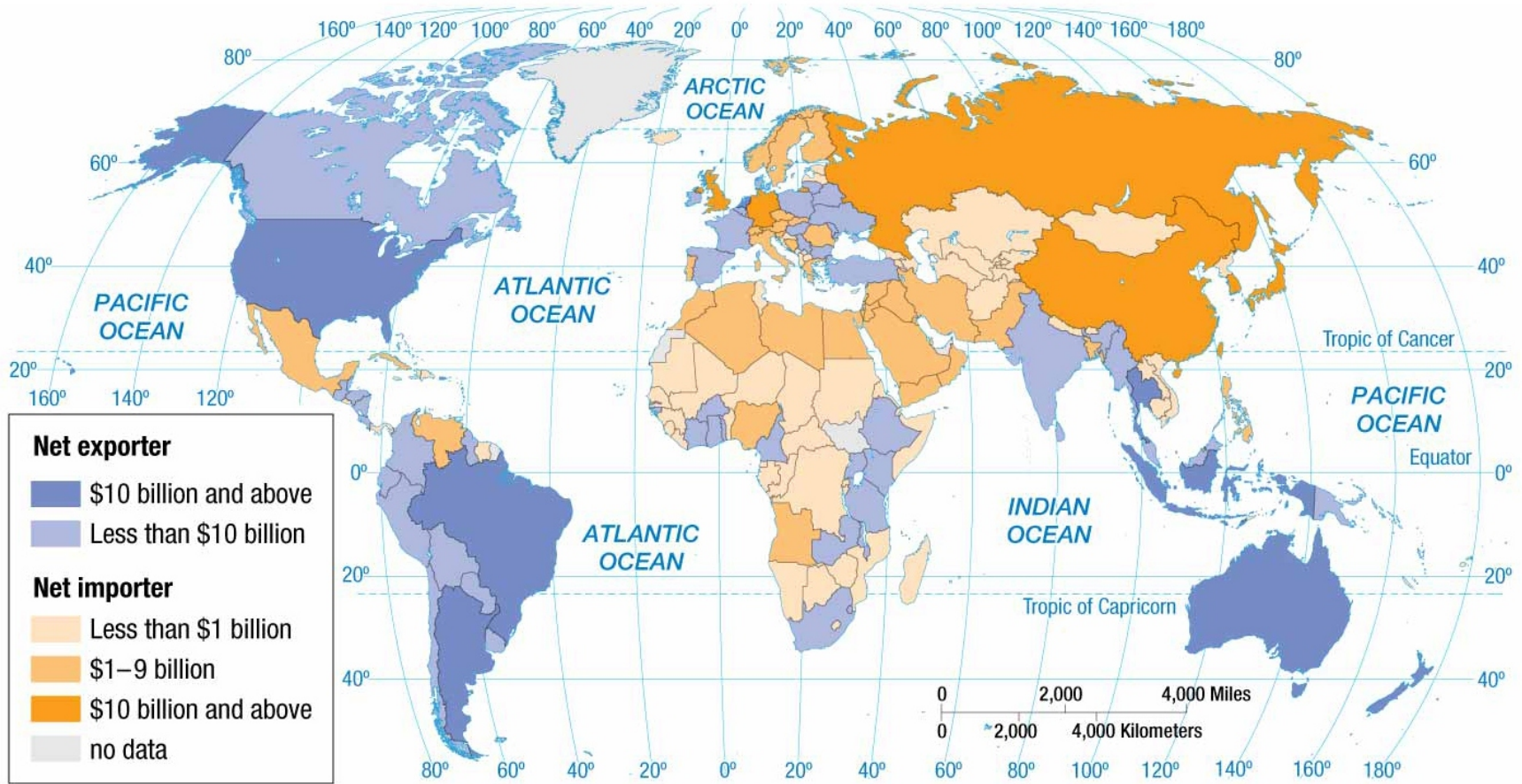
- Challenges for Farmers in Developed Countries
 - Importance of Access to Markets
 - Geographers use the von Thünen model to help explain the importance of proximity to market in the choice of crops on commercial farms.
 - Specific crops are grown in different rings around cities
 - » 1st ring: Highly perishable foods e.g. milk
 - » 2nd ring: Items more difficult to transport e.g. wood
 - » 3rd ring: Various crops and pasture lands
 - » 4th ring: Spacious lands for animal grazing.
 - von Thünen's model can be scaled up for national and global markets.

Why Do Farmers Face Economic Difficulties?

- Strategies to Increase the World's Food Supply
 - Four strategies are being employed to distribute food to everyone in the world:
 - Increasing exports from countries with surpluses
 - Expanding the land area used for agriculture
 - Expanding fishing
 - Increasing the productivity of land now used for agriculture

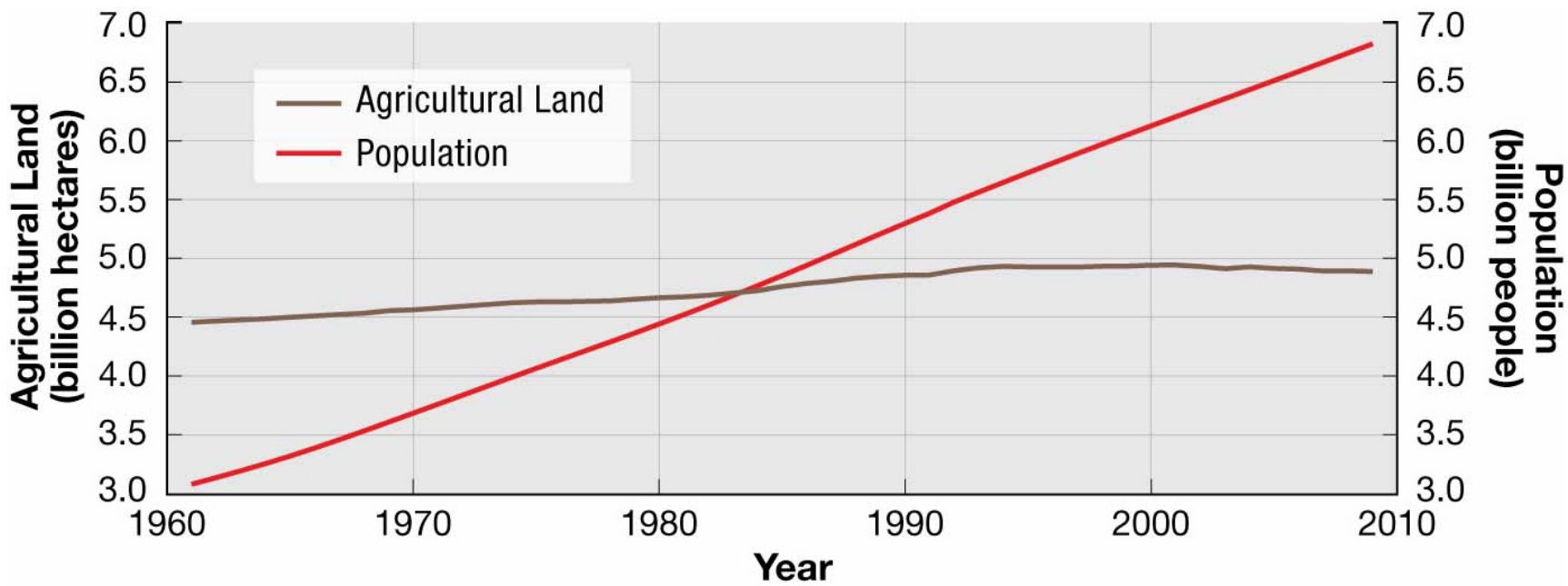
Why Do Farmers Face Economic Difficulties?

- Strategies to Increase the World's Food Supply
 - Increasing Exports from Countries with Surpluses
 - On a global scale, agricultural products are moving primarily from the Western Hemisphere to the Eastern Hemisphere.
 - U.S. remains the world's leading exporter of grain
 - » ½ of the world's maize (corn) exports.
 - » Global share has decreased from 18 to 19 percent in the 1970s to 10 to 11 percent in the 21st century because of more rapid increased in agricultural exports from Latin America and Southeast Asia.



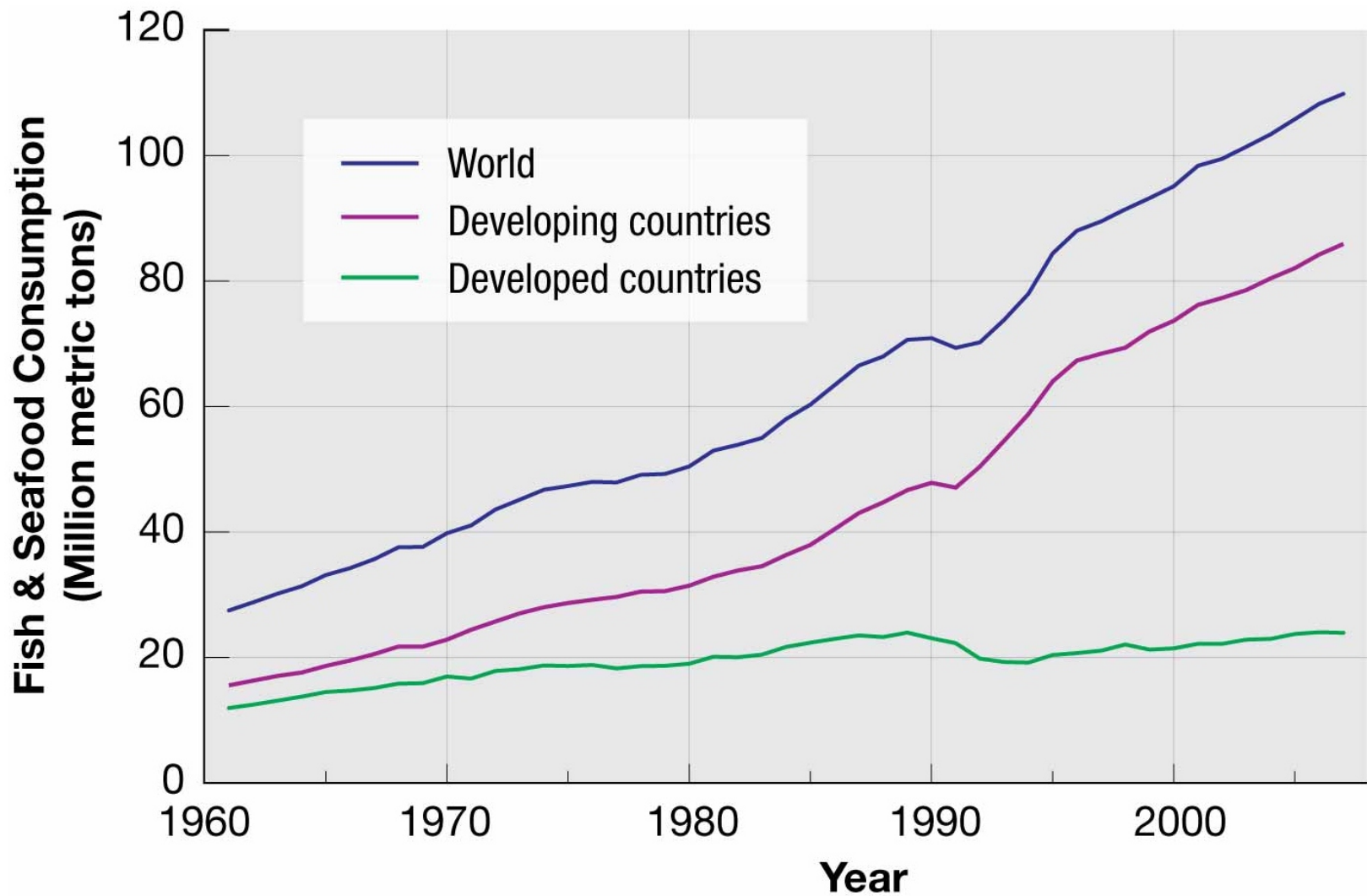
Why Do Farmers Face Economic Difficulties?

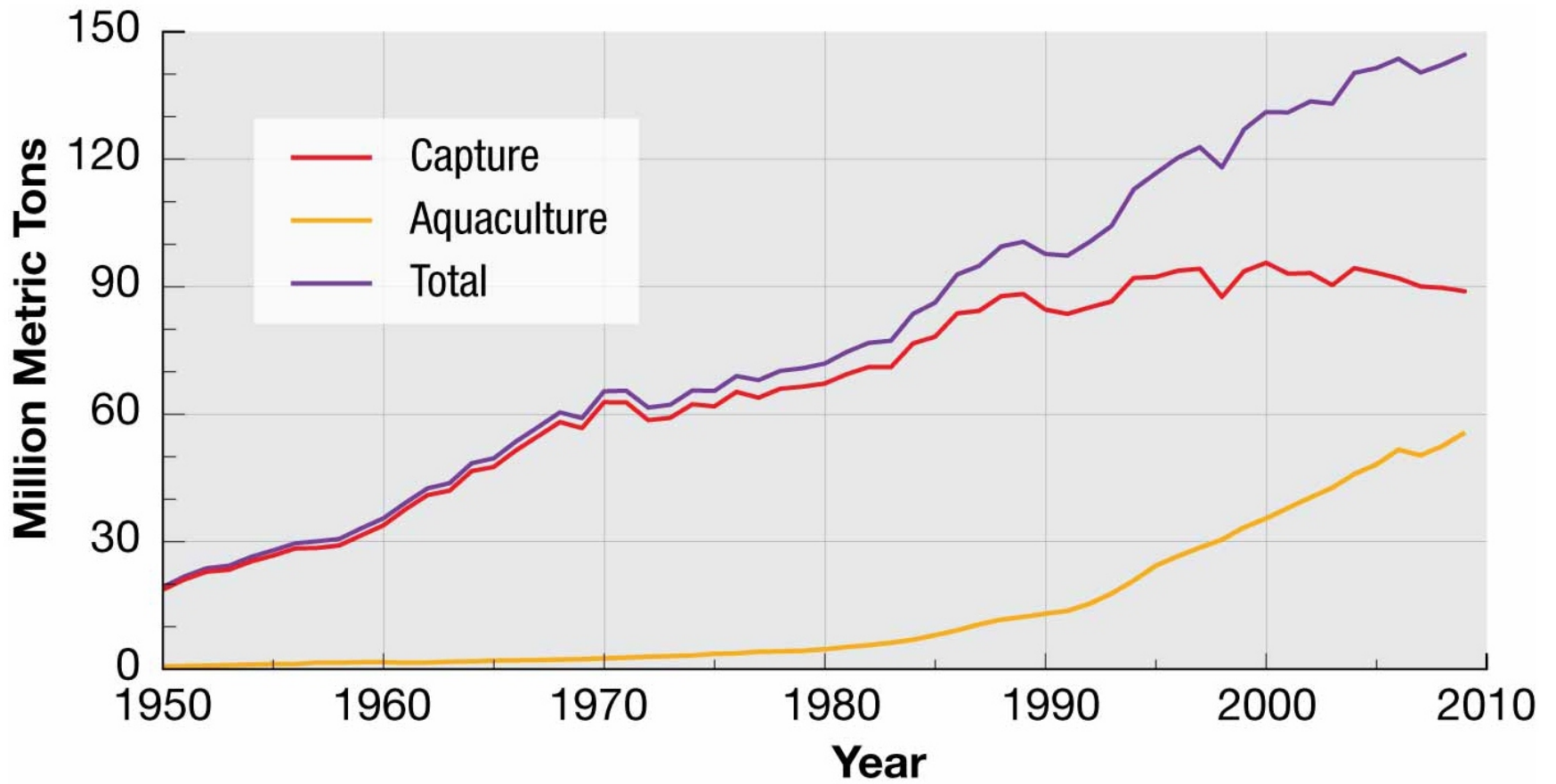
- Strategies to Increase the World's Food Supply
 - Expanding Agricultural Land
 - Today, few scientists believe that further expansion of agricultural land can feed the growing world population.
 - Farmland in some regions is being abandoned for lack of water.
 - Other land degradation that makes land resemble a desert-like state caused by humans is known as *desertification*.



Why Do Farmers Face Economic Difficulties?

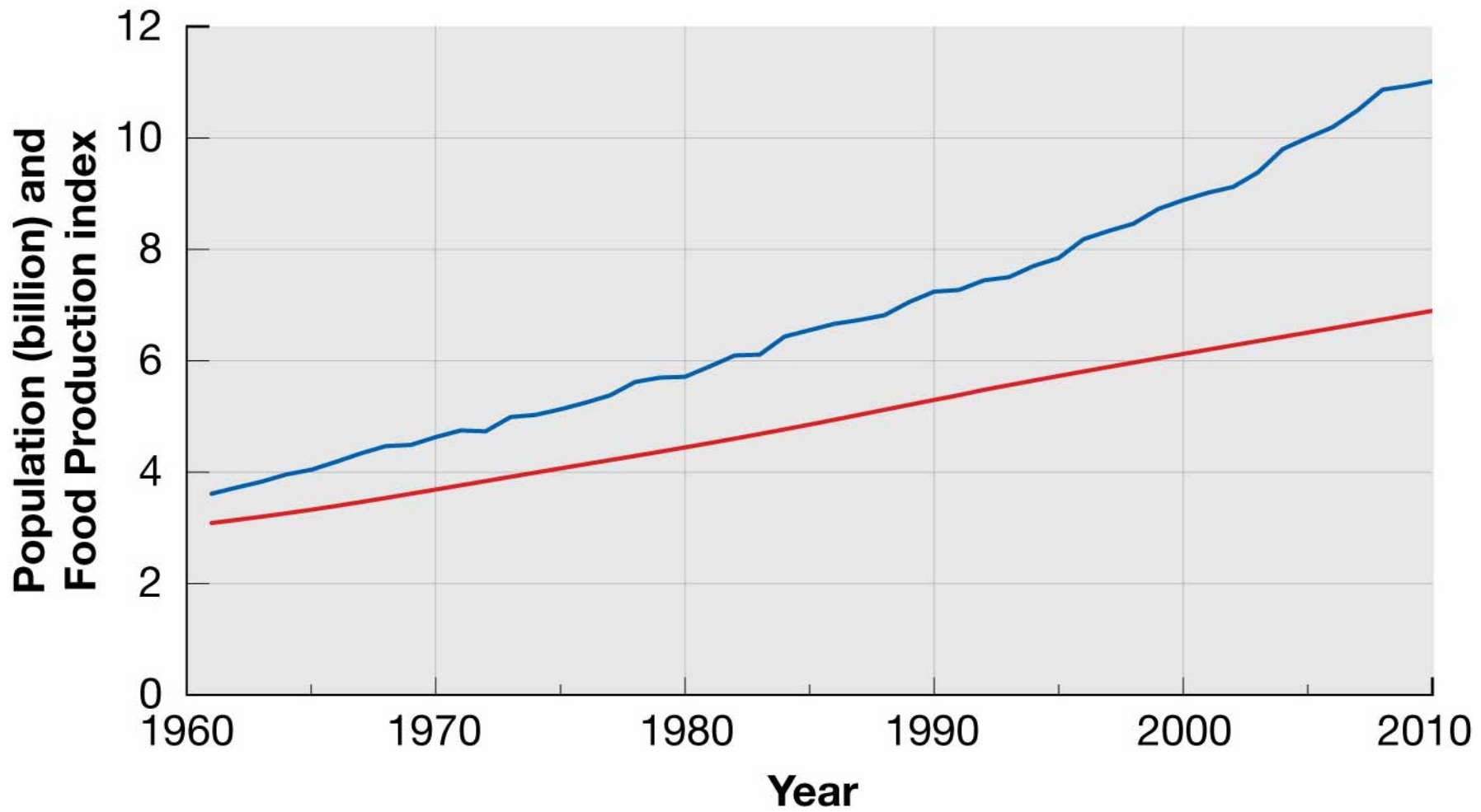
- Strategies to Increase the World's Food Supply
 - Expanding Fishing
 - *Aquaculture*, or *aquafarming* is the cultivation of seafood under controlled conditions, whereas fishing is the capture of wild fish and other seafood.
 - Human consumption of fish and seas has increased from 27 million metric tons in 1960 to 110 million metric tons in 2010.
 - Global fish production has increased from approximately 36 to 145 million metric tons.
 - Only 2/3 of fish caught from the ocean is consumed directly by humans.





Why Do Farmers Face Economic Difficulties?

- Strategies to Increase the World's Food Supply
 - Increasing Productivity
 - Invention and rapid diffusion of more productive agricultural techniques during the 1970s and 1980s is called the *green revolution*.
 - Introduced new higher-yield seeds
 - Expanded use of fertilizers
 - Green revolution allowed agricultural productivity to outpace population growth.
 - “miracle wheat seed”
 - “miracle rice seed”
 - “miracle high-yield maize (corn)”



The Green Revolution in Agriculture



Third Agriculture Revolution (Green Revolution)

- invention of high-yield grains, especially rice, with goal of reducing hunger.
 - increased production of rice
 - new varieties in wheat and corn
 - reduced famines due to crop failure, now most famines are due to political problems
 - impact (in terms of hunger) is greatest where rice is produced

History of Green Revolution

1943 Rockefeller Foundation begins work on short stature hybrid corn in Mexico

1960s Hybrid strains of rice, wheat, and corn show great success in S.E. Asia, and Latin America.

1970 Head of Mexican corn program, Borlaug, wins Nobel Peace Prize

1990s Growth in food supply continues, but slows to below the rate of population growth, as the results of unsustainable farming practices take effect.

Acreeage and Yield Trends

Gains were made by:

- **Dwarf varieties:** plants are bred to allocate more of their photosynthetic output to grain and less to vegetative parts.
- **Planting in closer rows,** allowed by herbicides, increases yields.
- **Bred to be less sensitive to day length,** thus double-cropping is more plausible.
- **Very sensitive to inputs of fertilizer and water.**

Technical and Resource Limitation Problems

- Heavy Use of Fresh Water
- High Dependence on Technology and Machinery Provided/Sold by Core (MDC) Countries
- Heavy Use of Pesticides and Fertilizer
- Reduced Genetic Diversity / Increased Blight (fire, insect, disease) Vulnerability
- Questionable Overall Sustainability

Ethical Issues

- **Starvation of many prevented, but extra food may lead to higher birth rates.**
- **Life expectancy in less developed countries increased by 10 years in less than two decades (43 in 1950' s to 53 in 1970' s).**
- **Dependency on core countries increased; rich-poor gap increased.**
- **Wealthy farmers and multinational companies do well, small farmers become wage laborers or unemployed – dependent.**
- **More at risk? More people malnourished/starving today than in 1950 (but lower as a percentage).**
- **U.S. spends \$10,000,000,000 year on farm subsidies, damaging farmers and markets in LDCs.**

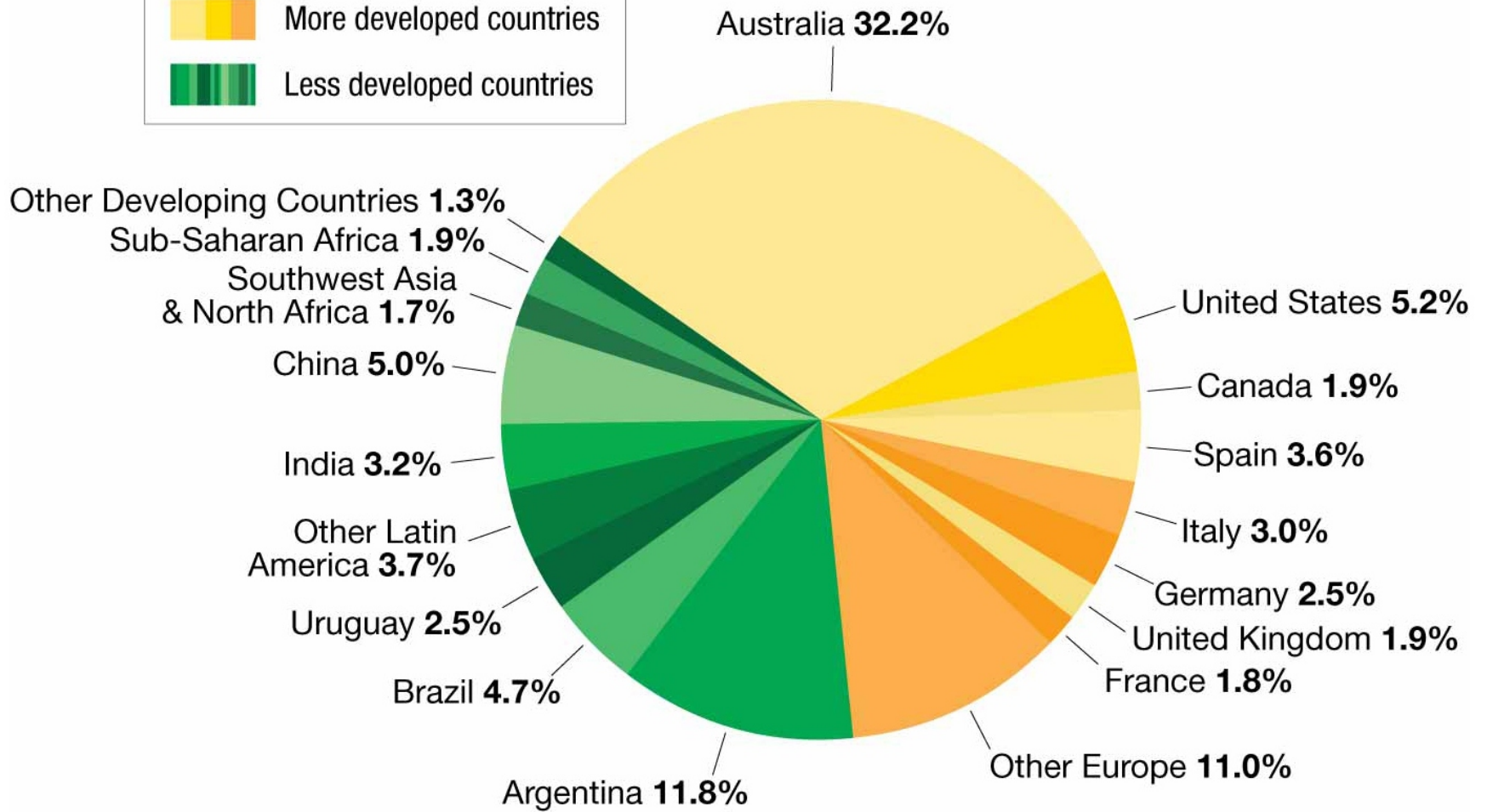
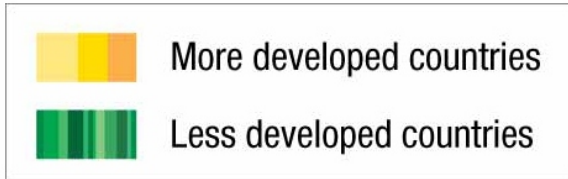
Agricultural ‘Success’ ?

Our incredible successes as a species are largely derived from this choice, but the biggest threats to our existence stem from the same decision.” Jared Diamond, 1999

- Emergence of new human diseases from animal diseases (i.e. smallpox, measles)
 - Dense urban populations allow spread/persistence of disease
- Lower standard of living for many people.
 - Archaeological evidence of serious mal-nourishment among early farmers.
 - Many modern impoverished and malnourished farmers.
 - Famine virtually non-existent in hunter-gatherer societies.
- Increased susceptibility to plant blights and increased dependence on complex economic systems.
- Environmental degradation
 - topsoil loss (75% in U.S.), desertification

Why Do Farmers Face Economic Difficulties?

- Strategies to Increase the World's Food Supply
 - Sustainable Agriculture
 - *Sustainable agriculture* are agricultural practices that preserve and enhance environmental quality.
 - Three principal practices distinguish sustainable picture (and, at its best, organic farming) from conventional agriculture:
 - Sensitive land management
 - Limited use of chemicals
 - Better integration of crops and livestock



Summary

- Prior to the development of agriculture, people survived by hunting animals, gathering wild vegetation, and fishing. Current agricultural practices vary between developed and developing countries.
- Everyone needs food to survive. The amount of food and dietary composition of the food vary between developed and developing countries.

Summary

- Most people in developing countries are subsistence farmers, growing crops primarily to feed themselves. Commercial farming is primarily practiced in developed countries.
- Farmers face many challenges to meeting the dietary needs of a rapidly growing population when they are forced to rely on poorer quality land to farm, as a result of land degradation processes and suburban sprawl taking away prime farmland.