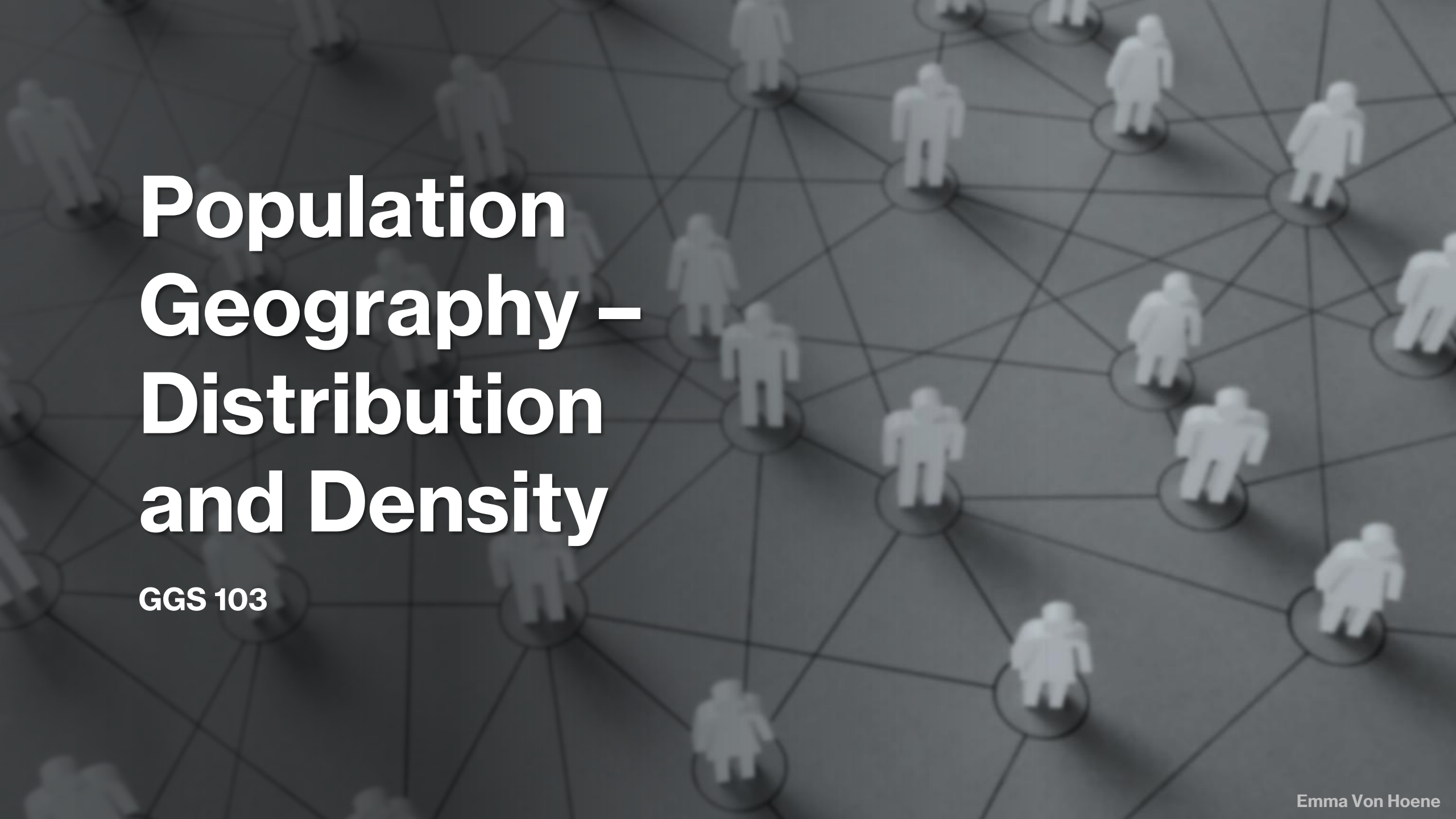


Population Geography – Distribution and Density

GGS 103

Emma Von Hoene



Lecture Outline

1. Demography: The Study of Populations
2. Measuring Populations – Census & Surveys
3. Population Distribution & Clusters
4. Factors Influencing Population Patterns
5. Population Density & Types
6. Population Structure: Sex & Age Composition
7. Dependency & Sex Ratios

Learning Objectives

By the end of this lecture, students should be able to:

1. **Define** key demographic concepts.
2. **Describe** the hierarchy of U.S. census geography.
3. **Interpret** maps and visualizations of population distribution and density.
4. **Explain** the major factors influencing where people live and why.
5. **Analyze** population pyramids to infer demographic trends and challenges.
6. **Discuss** how dependency and sex ratios affect economic and social systems.

Demography: The Study of Populations

Demography is the *scientific study of population characteristics.*

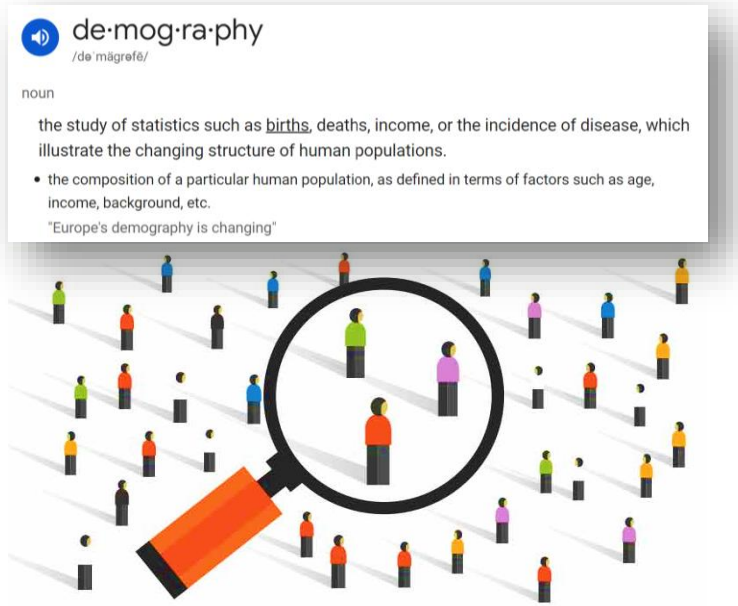
- It focuses on how people are distributed across space and how populations change over time.

Questions *Demographers* ask:

- Where are people located, and why?
- How are populations distributed by *age, gender, health, occupation,* and *ethnicity*?
- How do population structures and trends differ between countries or regions?
- How do migration and globalization shape population patterns?

Why is it important?

- Understanding population size, structure, and distribution helps us:
  - Plan for infrastructure, housing, and healthcare.
  - Analyze development and inequality.
  - Understand environmental and resource pressures.



Measuring Populations



- To study population characteristics, we need accurate data about people
- This enables small-area analysis at different geographic levels

Census:

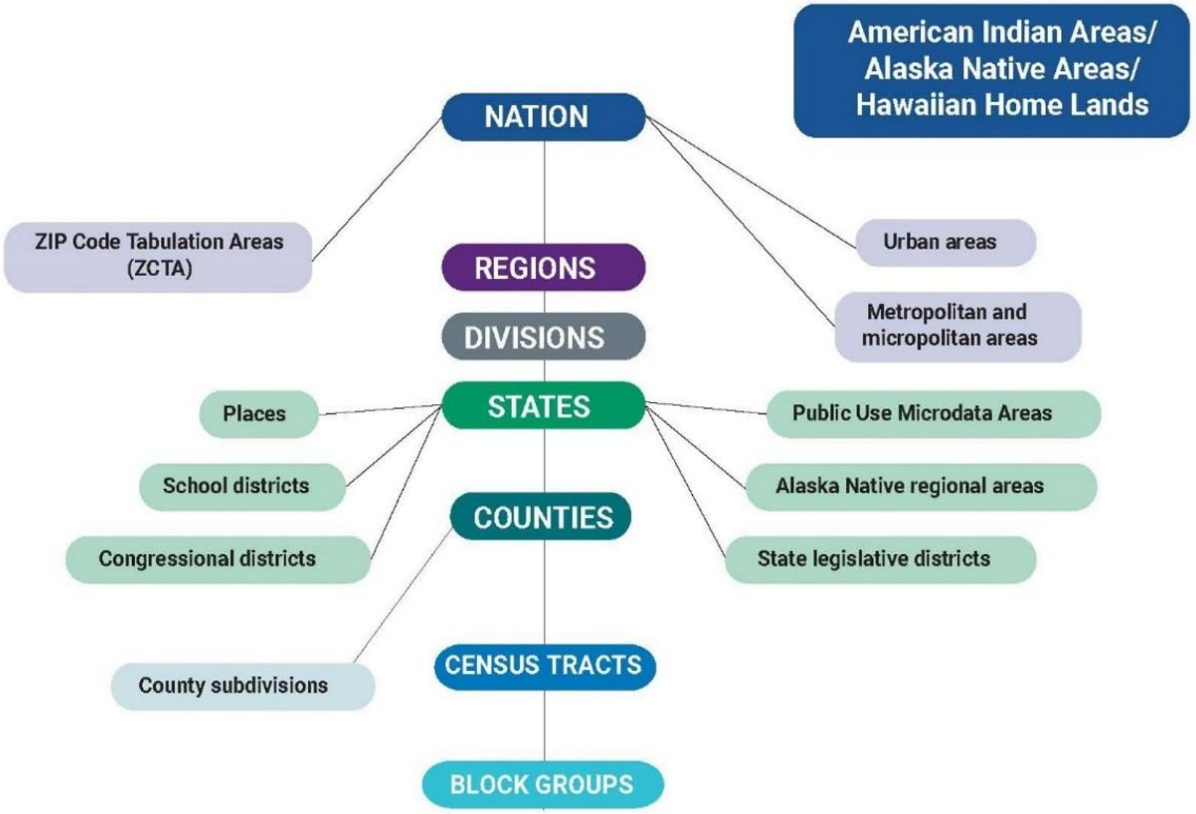
- A *complete count* of every person in a geographic area.
- Conducted periodically (e.g., every 10 years in the U.S.).
- Provides data on basic characteristics like age, sex, and race.
- Challenges: expensive, time-consuming, political sensitivity, undercounting marginalized groups.

Sample Surveys:

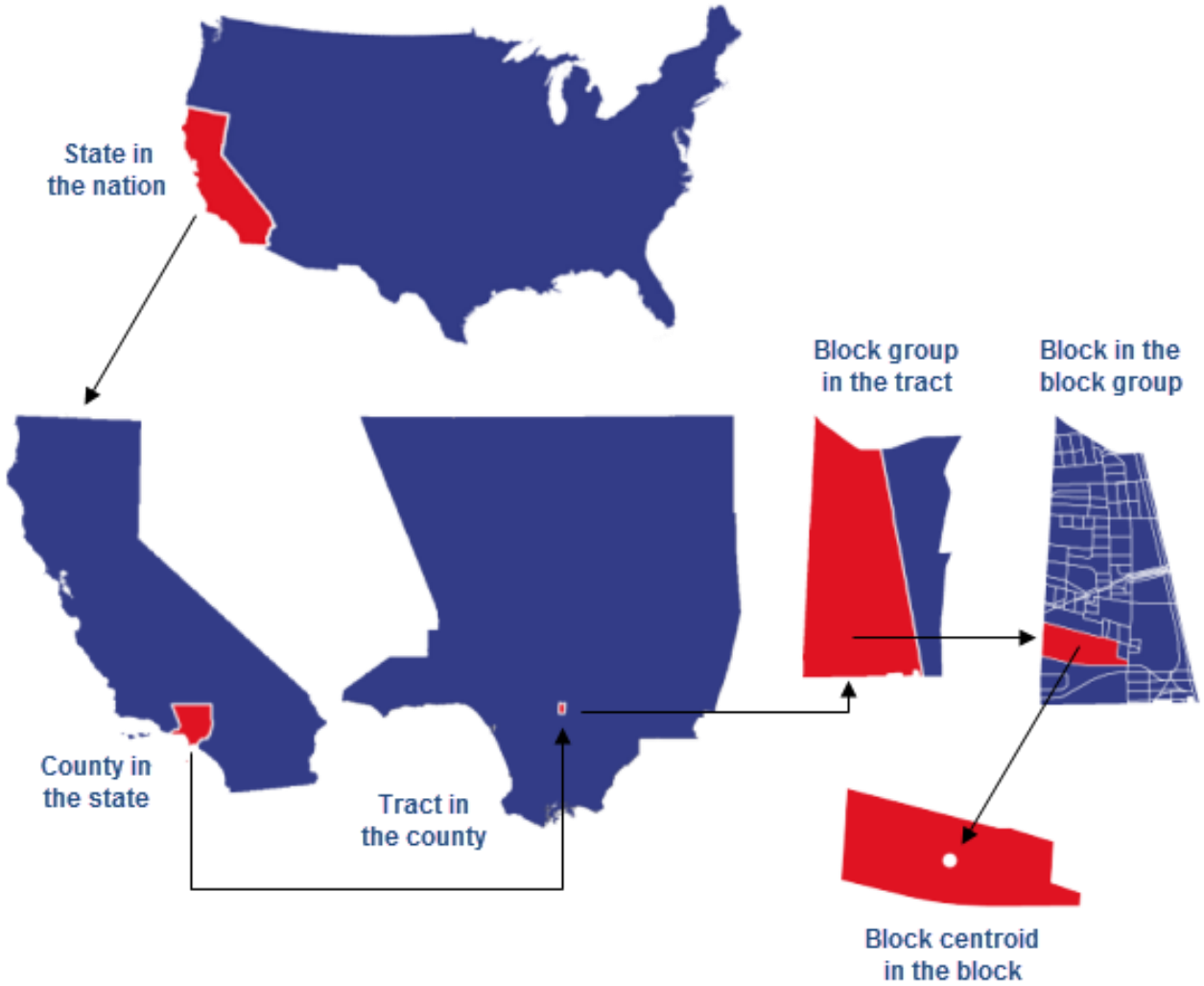
- A *subset* of people is surveyed to estimate characteristics of the larger population.
- Conducted more frequently than censuses.
- Provides more comprehensive data like income, education, health insurance, occupation, etc.
- Useful for monitoring trends between census years.
- Examples: U.S. American Community Survey (ACS), Demographic and Health Surveys (DHS)
  - View ACS 2019-2023 internet access estimates in ArcGIS online:

    https://arcgis.com/home/item.html?id=5a1b51d3c6374c3cbb7c9ff7acdba16b

United States Census Geography



Hierarchy of US census geographies.

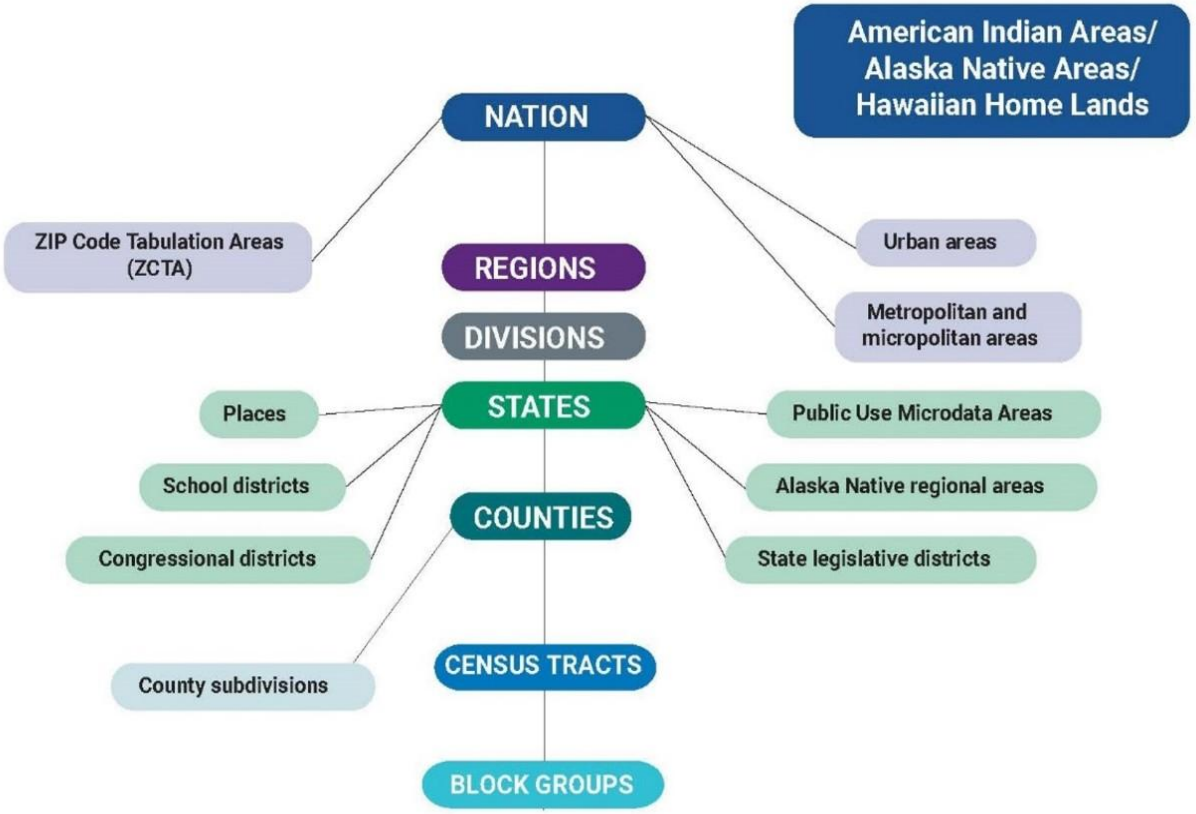


Visual map of different levels of US census geographies.

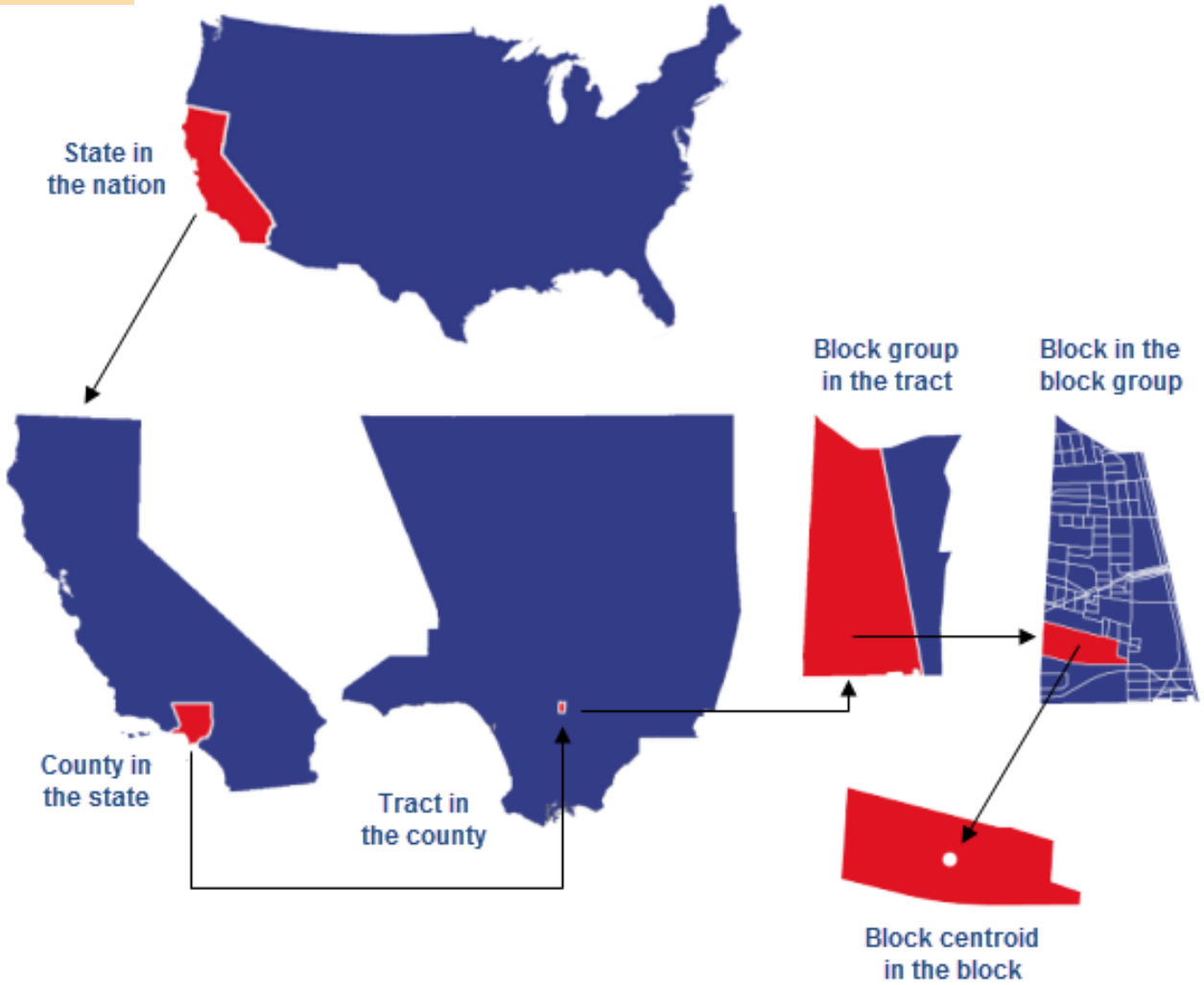
United States Census Geography

What are the different level of geographies for George Mason University?

https://geocoding.geo.census.gov/geocoder/geographies/address?form



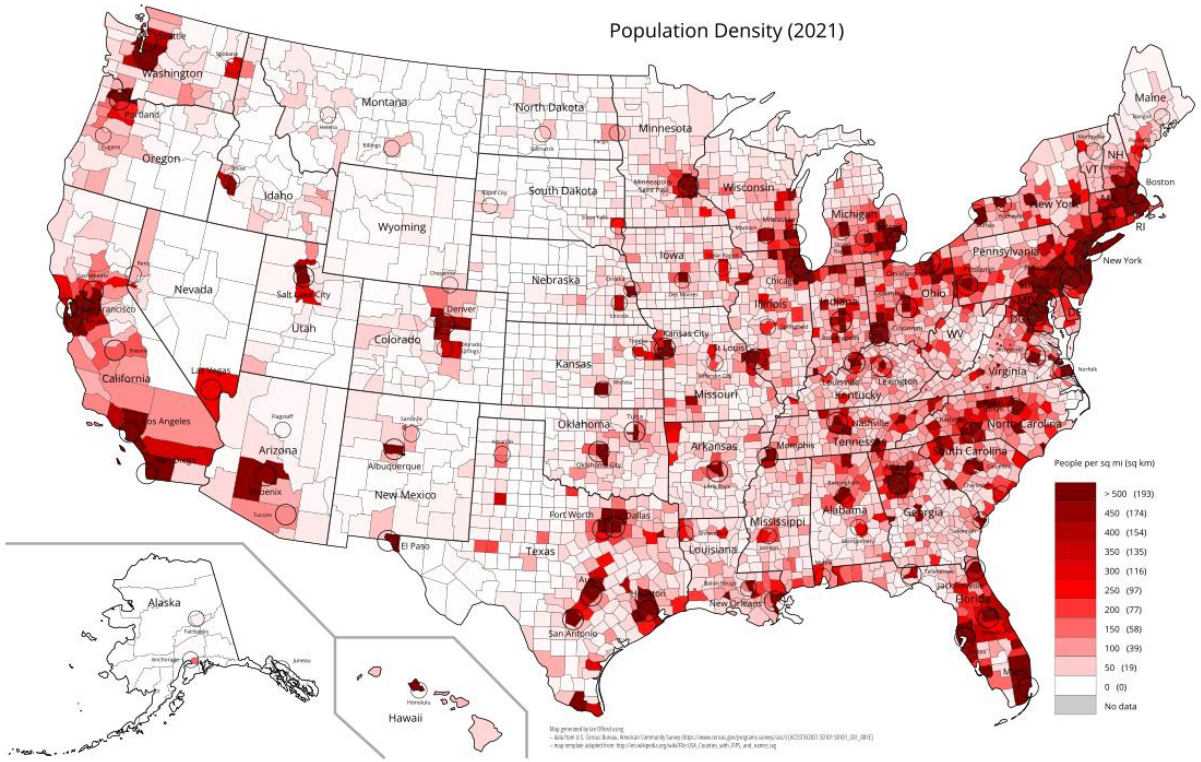
Hierarchy of US census geographies.



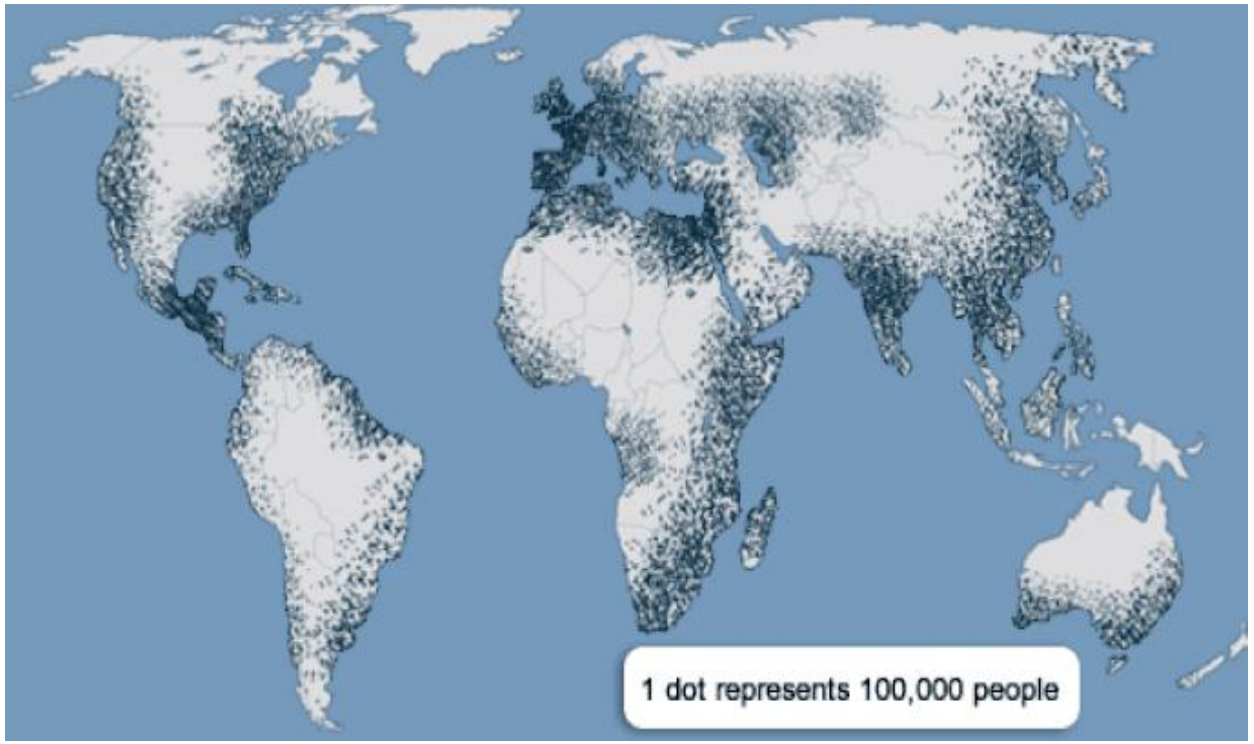
Visual map of different levels of US census geographies.

Population Distribution

- **Population distribution** refers to the pattern of where people live on Earth.
- It shows how people are spread out or **concentrated** across space.
- People are *not evenly spread* across the planet → most live in a few concentrated areas.



U.S. population distribution.



Global population distribution.

Global Population Clusters

- Nearly **two-thirds of the world's population** lives in just **four major regions**.

1. East Asia

- Includes *China, Japan, Korea, Taiwan*.
- High densities along *coastal plains* and *river valleys* (e.g., Yangtze, Yellow River).
- Mix of *urban megacities* (Shanghai, Tokyo) and *rural agricultural areas*.

2. South Asia

- *India, Bangladesh, Pakistan, Sri Lanka.*
- Concentrated along the *Ganges and Indus River plains* and coastal lowlands.
- Rapid population growth and high rural densities.

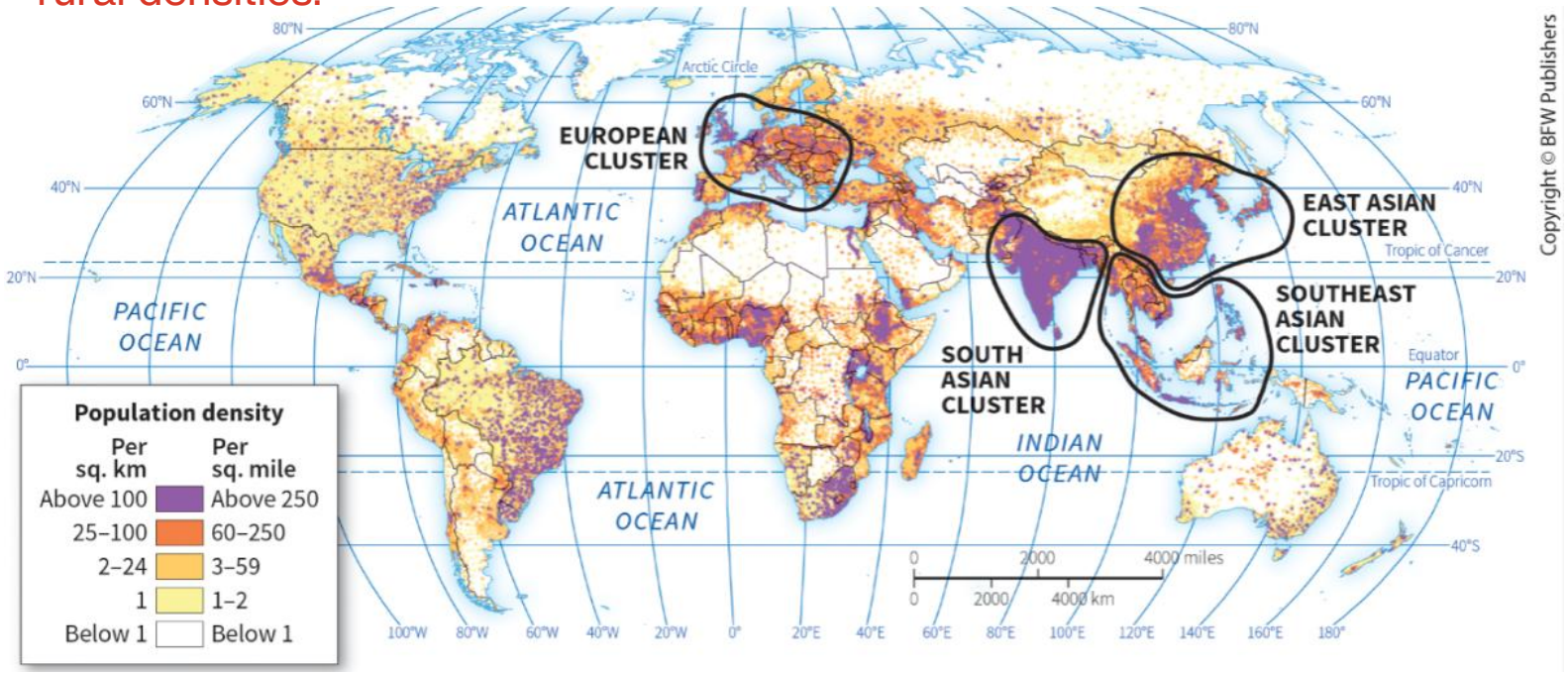
3. Europe

- High concentrations in *Western Europe* (UK, Germany, Netherlands).
- Populations cluster around *coalfields, ports, and cities*.
- Less tied to agriculture – more urban/industrial density.

4. Southeast Asia

- Populations centered on *islands and river deltas* (e.g., Indonesia, Philippines, Vietnam, Thailand).
- Often along fertile volcanic soils and coastal lowlands.

These four regions account for ~63% of the world's population, but only 20% of Earth's land area!



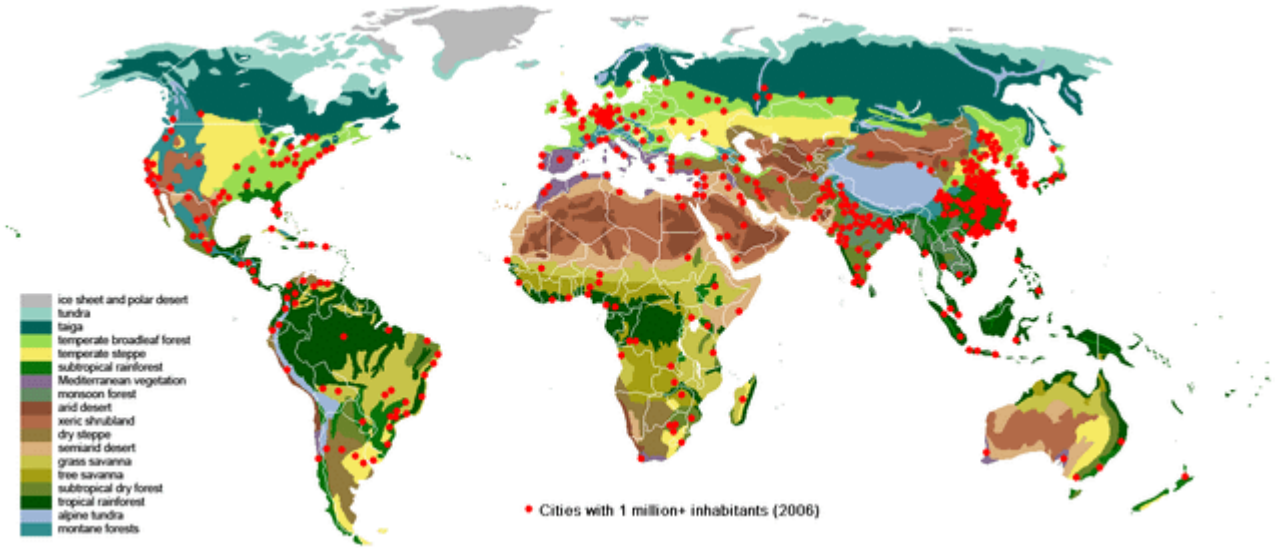
The four major global population clusters.

Factors Influencing Population Distribution

- *Why do people live where they do?*

Physical Factors

- **Climate:** Moderate temperatures and reliable rainfall attract settlement (temperate or, monsoon regions).
- **Relief (Topography):** Flat, low areas are easier to farm and build on; mountains discourage settlement.
- **Soils:** Fertile land supports agriculture (river valleys, volcanic soils).
- **Water Supply:** Access to rivers, lakes, or coasts supports agriculture, trade, and daily life.
- **Natural Resources:** Minerals, forests, or energy sources can spur population growth (mining or, oil regions).



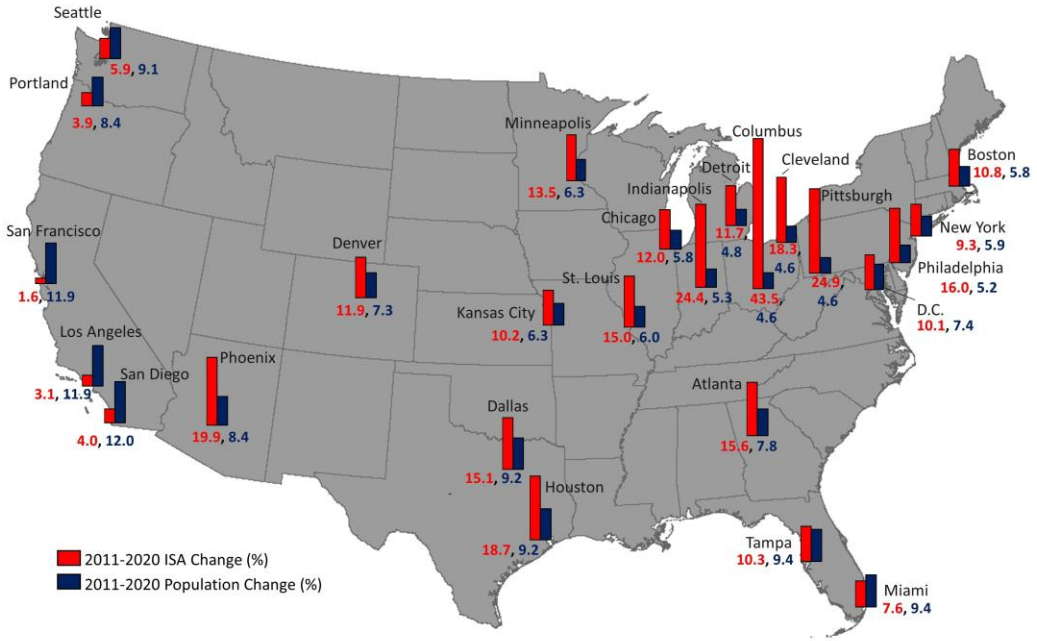
World biomes overlaid with cities with at least one million population.

Factors Influencing Population Distribution

- *Why do people live where they do?*

Human and Cultural Factors

- **Economic Opportunities:** Jobs in cities, industries, and ports attract migrants.
- **Political Stability:** Conflict or insecurity can push people away; peace and governance attract settlement.
- **Infrastructure & Technology:** Roads, irrigation, and urban services support higher density.
- **Government Policies:** Population policies, zoning, or incentives (e.g., Brazil's interior development).



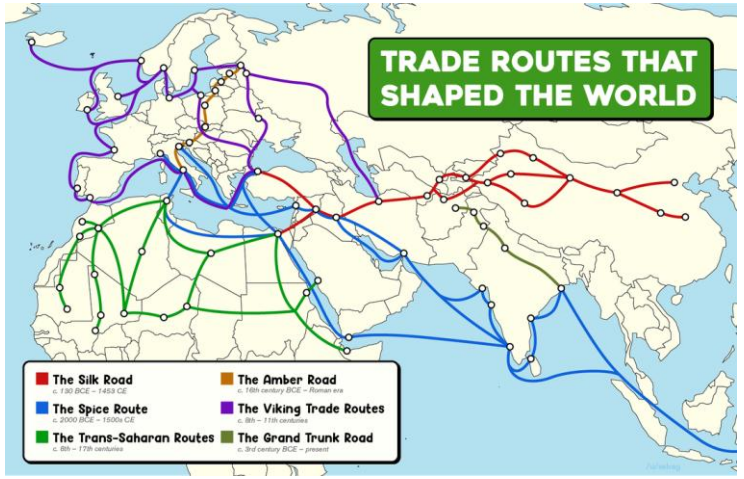
Growth rates in U.S. cities.

Factors Influencing Population Distribution

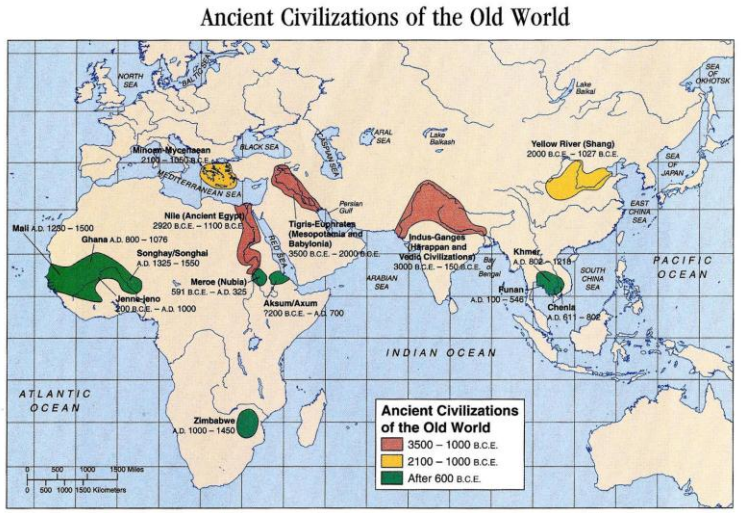
- *Why do people live where they do?*

Historical Factors

- **Early agricultural hearths:** the earliest dense populations emerged in river valleys and fertile plains, serving as foundations for lasting population centers (Nile, Egypt or Yellow River, China)
- **Industrialization:** the industrial revolution shifted populations toward manufacturing regions, especially in Europe and U.S. Northeast
- **Trade routes and colonial patterns:** Ancient trade routes (Silk Road, Indian Ocean trade) encouraged settlement along these routes



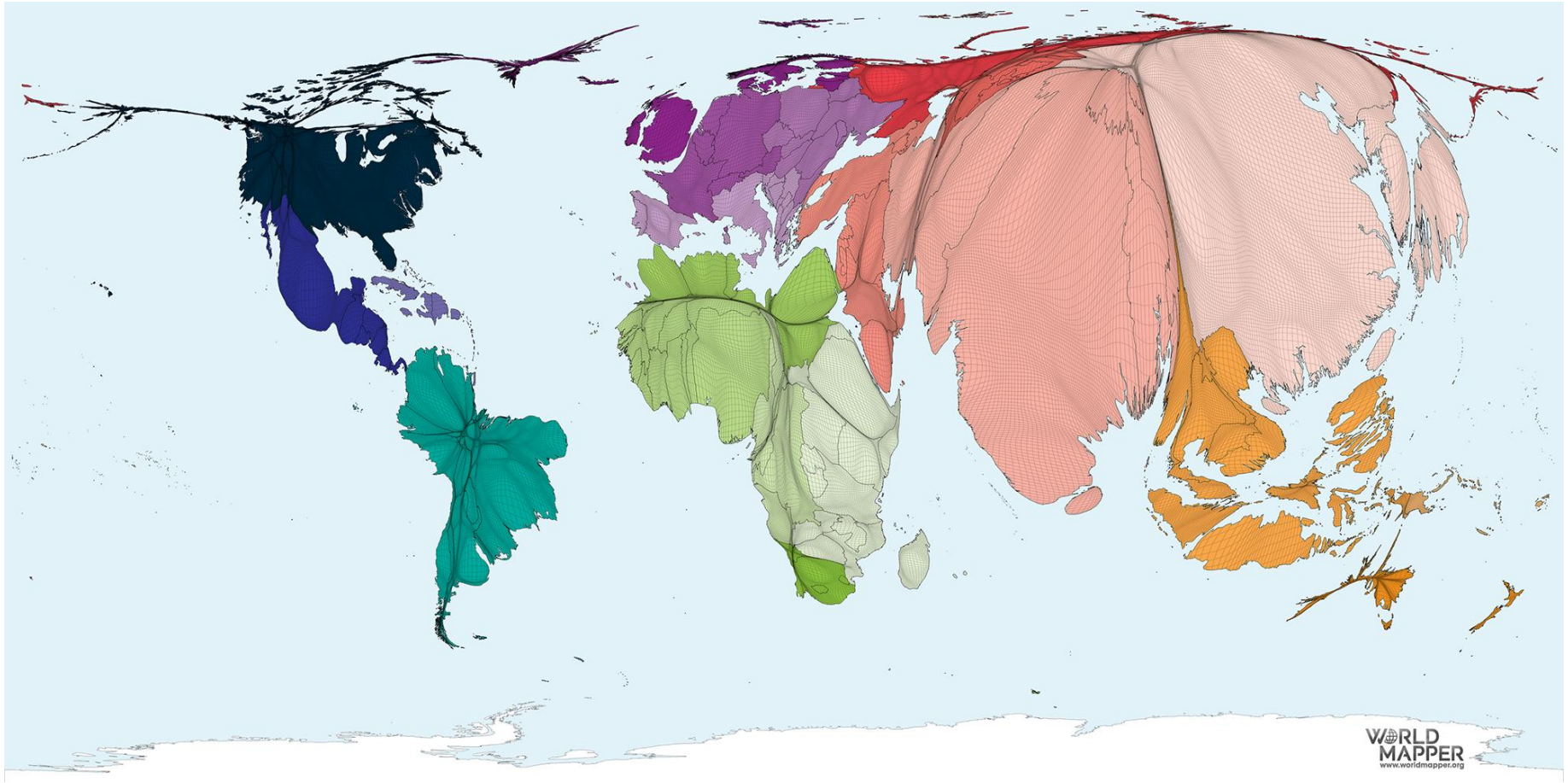
Map of major trade routes.



Spatial and temporal trends throughout ancient civilizations.

Cartograms

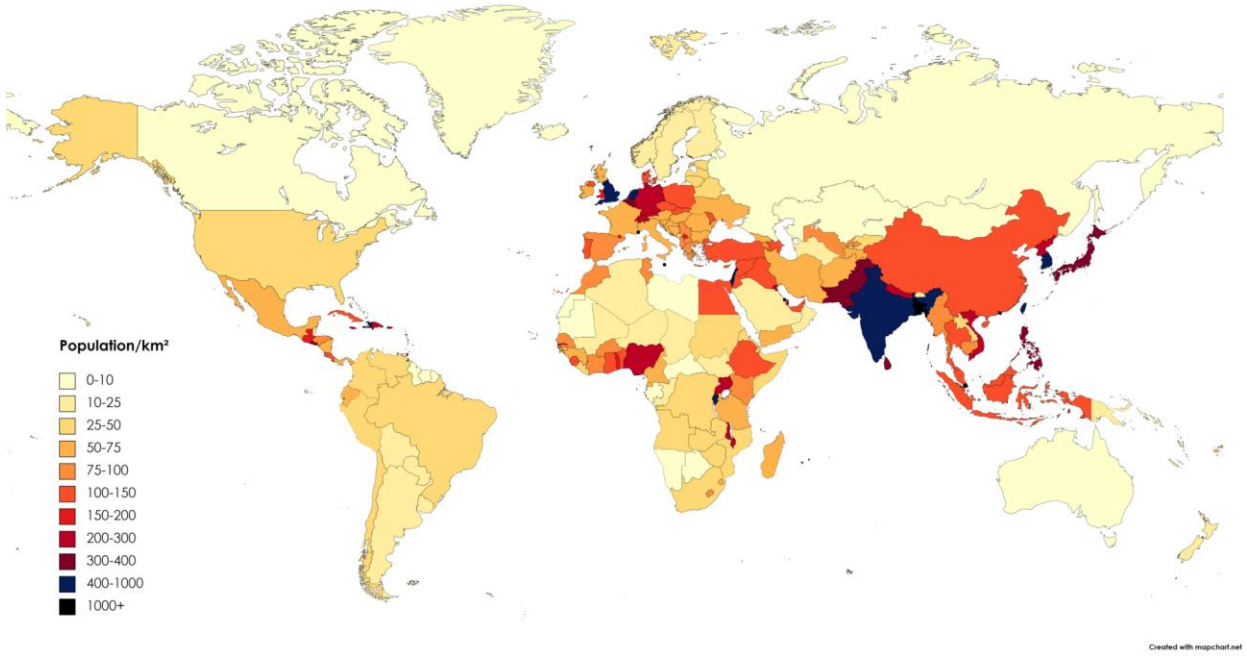
- A **cartogram** is a map where the size of each geographic area is scaled according to a specific variable (often population) rather than actual land area.
  - Purpose: to visualize data in a way that emphasizes human presence rather than physical space.



Cartogram based on 2020 population rates across the globe.

Population Density

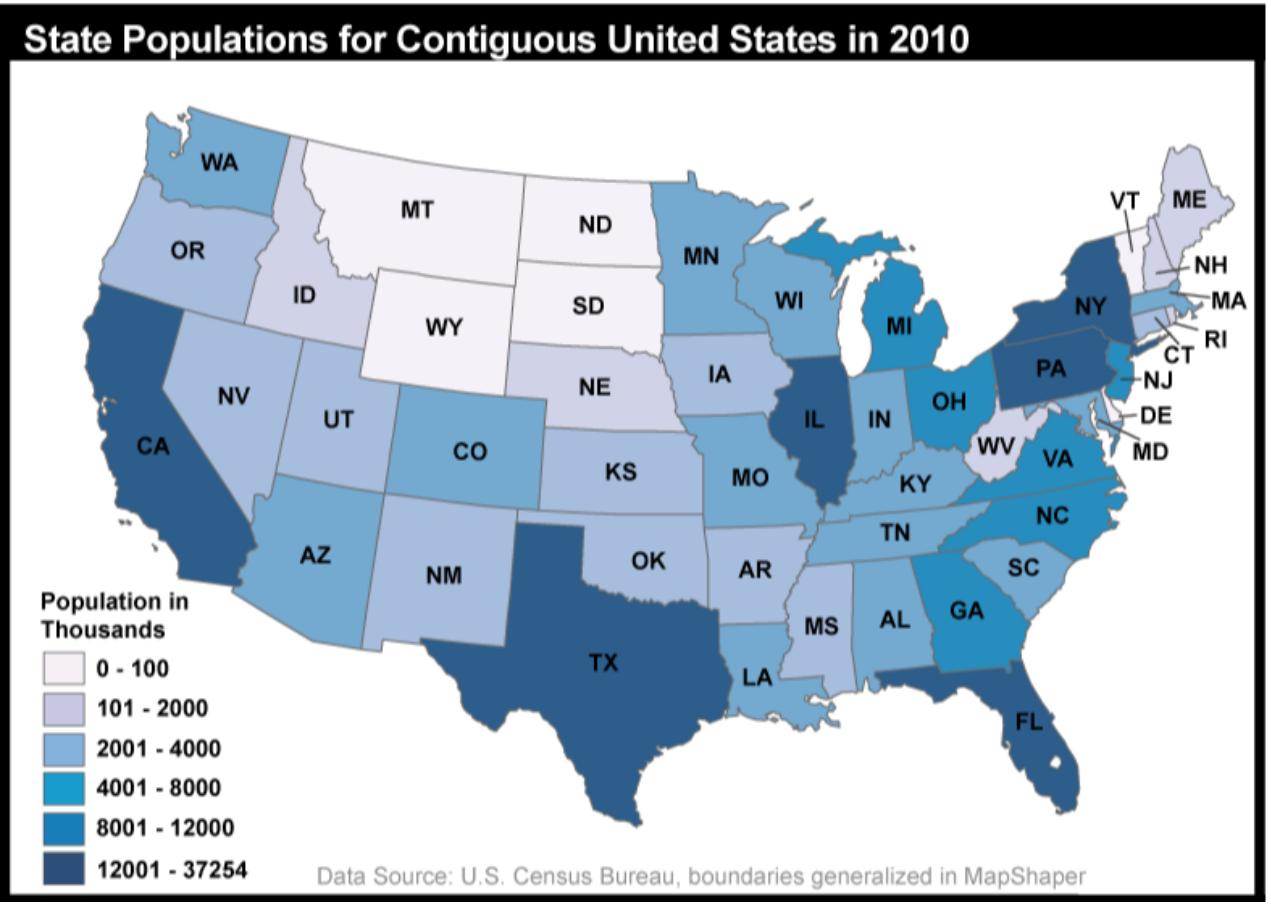
- Geographers study how populations are distributed spatially, not just the total number of people.
- **Population density** = the number of people in an area divided by the total land area.
- Helps measure and quantify how people are spread across space.
- It **normalizes** population to account for differences in land size.
    - Example: Two countries may have the same population, but if one is twice as large, the people are spread differently.
- Allows *comparisons* within countries, between countries, or over time.

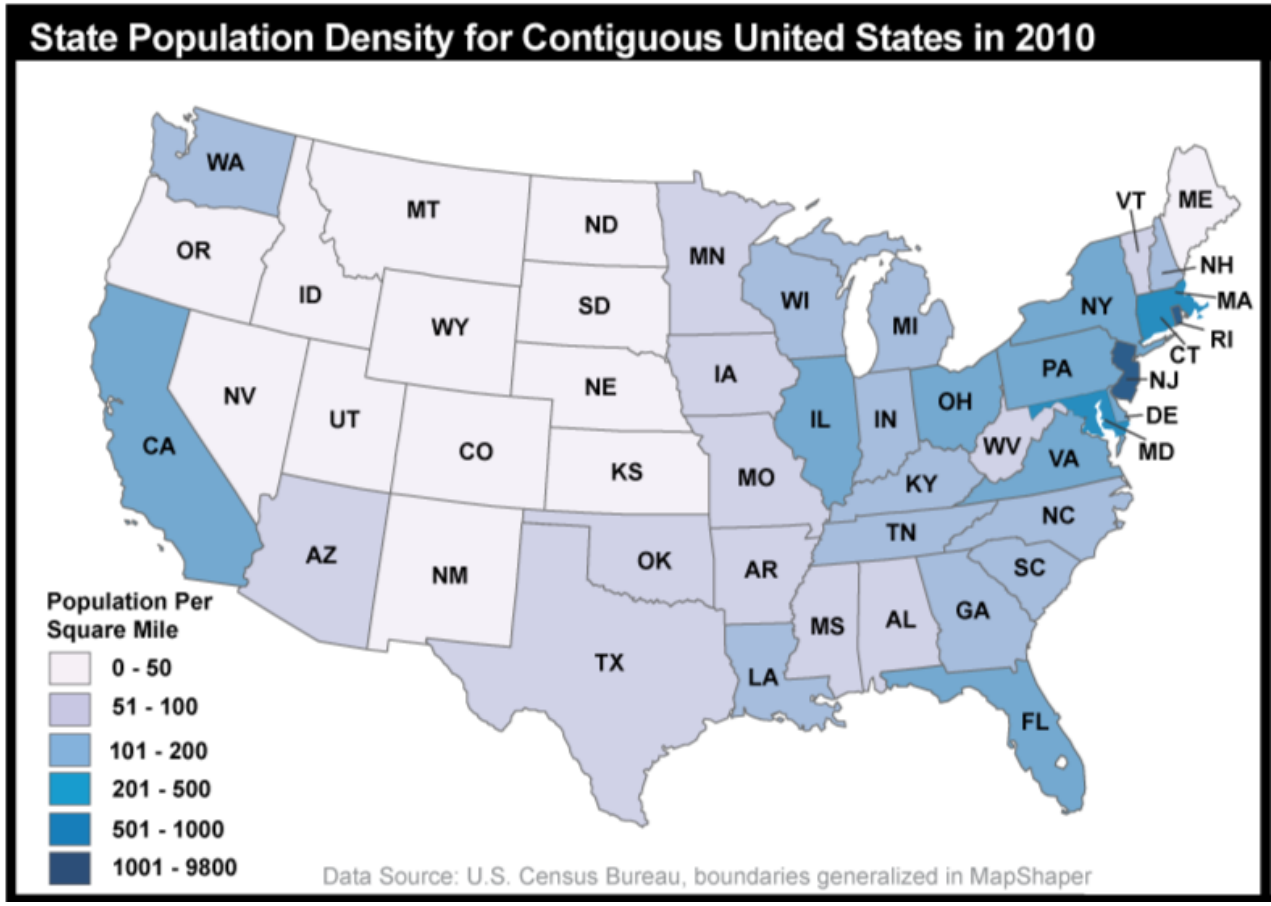


World population density map.

Population Density vs. Population Counts

- *How do raw population counts visually differ from population density? What does this tell us?*





U.S. States mapped with raw population counts vs. density rates.

Types of Population Density

1. Arithmetic Density

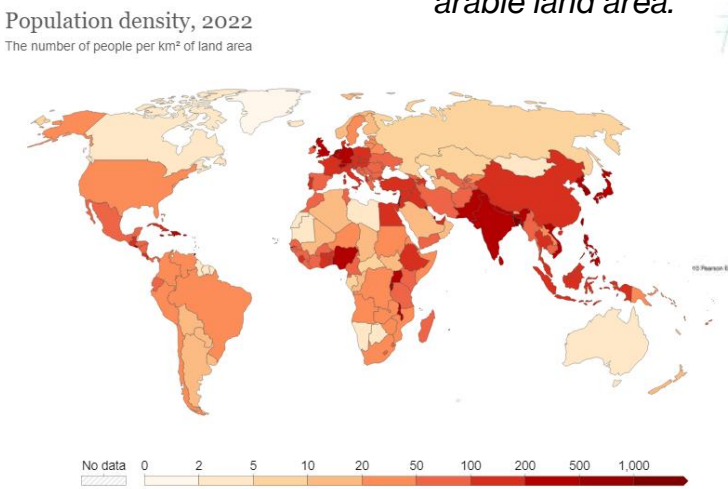
- Definition: Total population ÷ Total land area
- Purpose: Simple measure of population spread, or how crowded a location is.
- Example: Bangladesh vs. Canada

2. Physiological Density

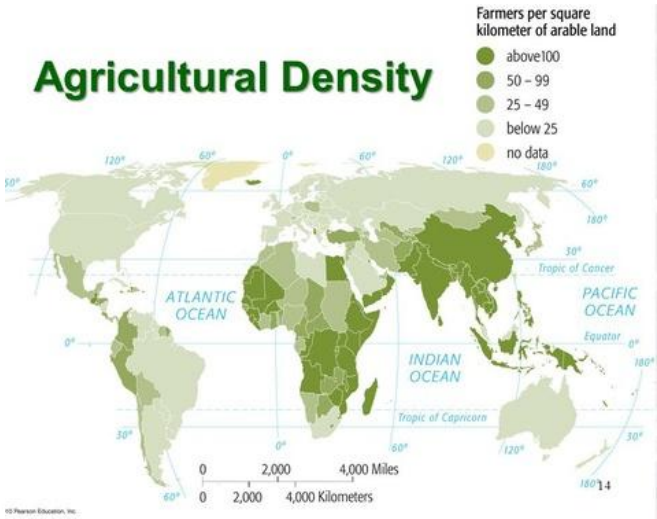
- Definition: Total population ÷ Arable land area
- Purpose: Measures pressure on productive land
- Example: Egypt (population concentrated on Nile River, but total land area of country is large)

3. Agricultural Density

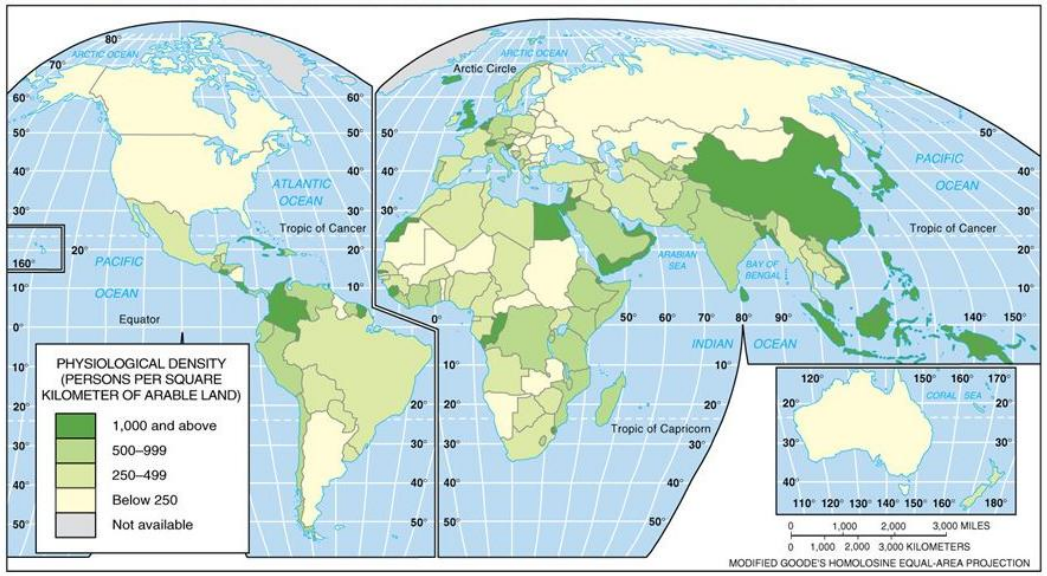
- Definition: Rural population ÷ Arable land area
- Purpose: Measures efficiency of farmers and technology use.
- Example: Lower in U.S (mechanized farming)., higher in parts of Asia and Africa (labor-intensive farming)



***Agricultural density**: number of farmers per square-kilometer of arable land area.*



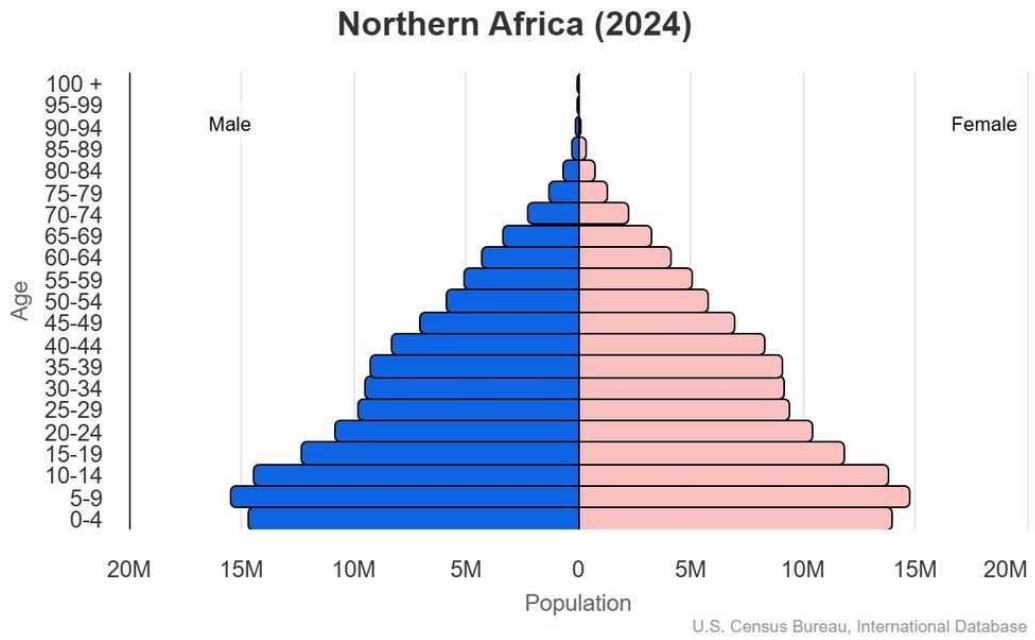
***Arithmetic density:** number of people per square-kilometer of land area.*



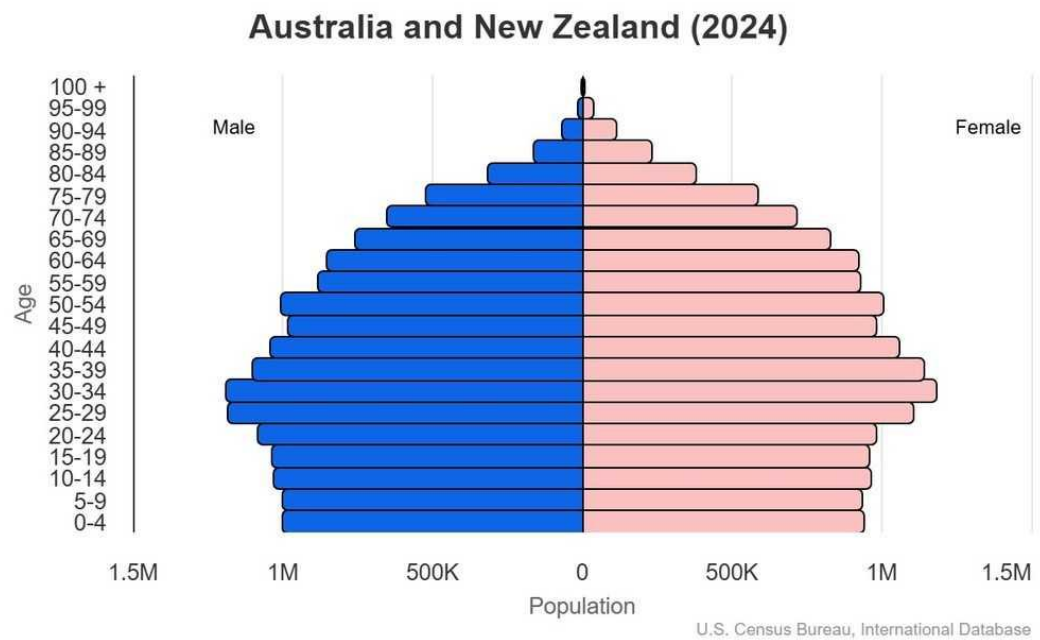
***Physiological density**: number of people per square-kilometer of arable land area.*

Population Pyramids

- **Population Pyramid:** A graphical representation of a population's age and sex structure
- Shows males on the left, females on the right
- Each bar represents the percentage (or number) of people in a specific age group
- Helps geographers understand a country's growth trends, dependency, and development stage



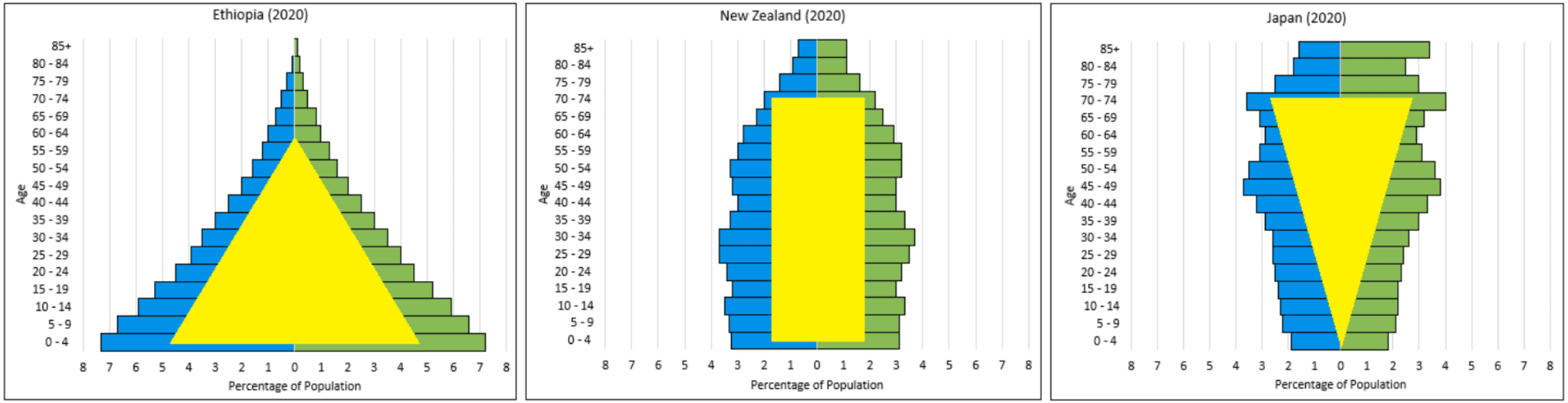
Population pyramid for Northern Africa.



Population pyramid for Australia and New Zealand.

Interpreting Population Pyramids

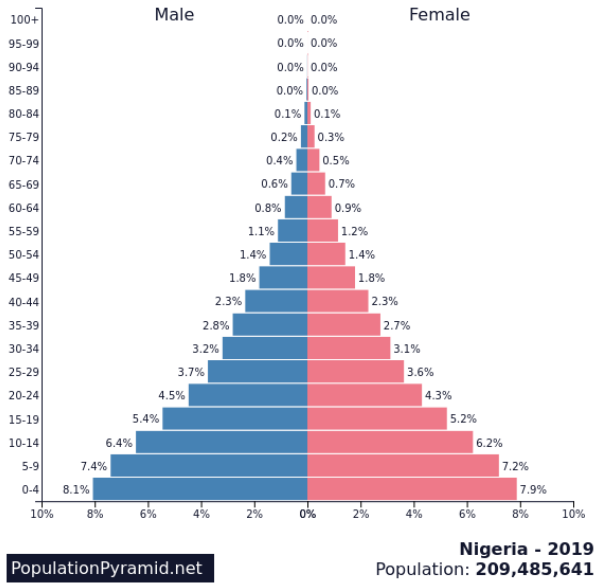
Shape	Description	Example
Wide base, narrow top	High birth rate, high death rate	Nigeria, Afghanistan
More rectangular	Declining birth rate, longer life expectancy	Mexico, India
Narrow base, wider top	Low birth rate, aging population	Japan, Germany



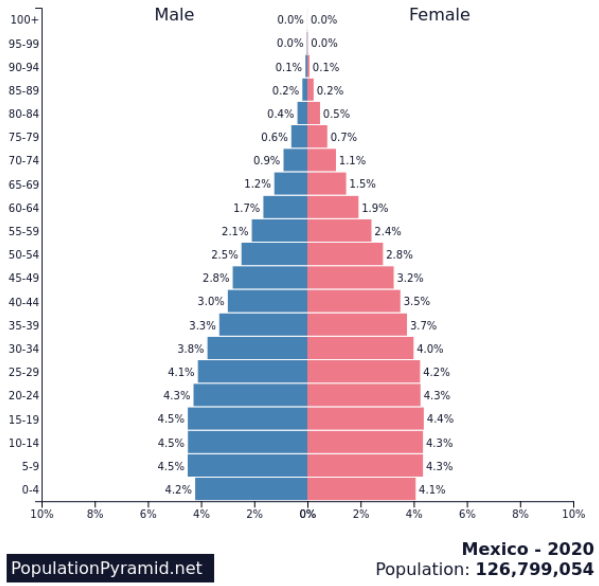
Differences in population pyramid shapes for different countries.

Interpreting Population Pyramids

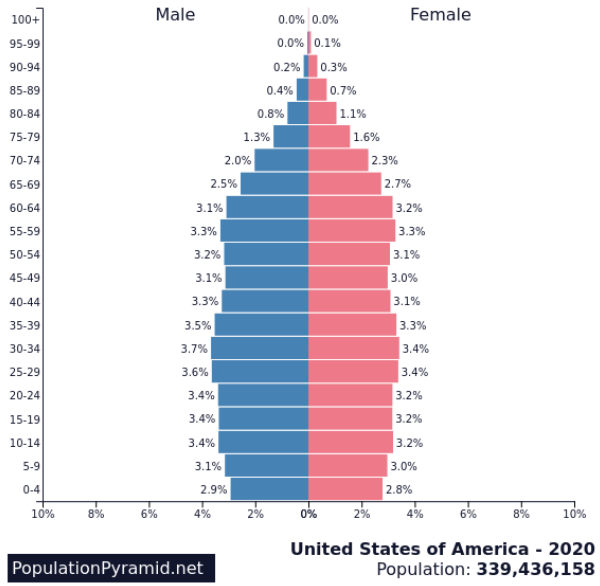
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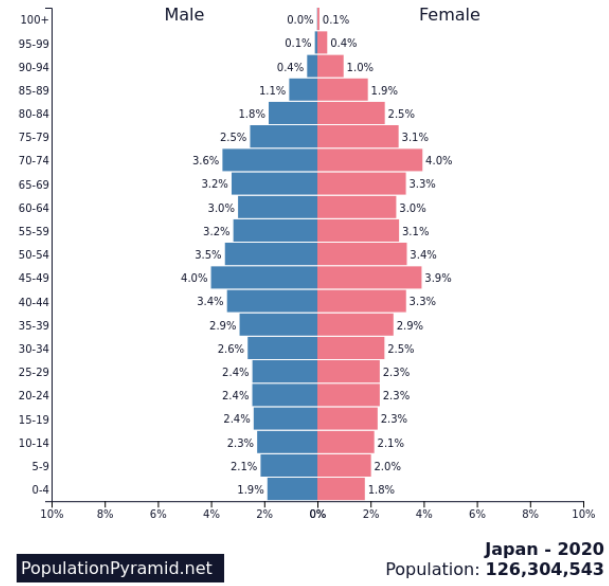
Population pyramid for Nigeria.



Population pyramid for Mexico.



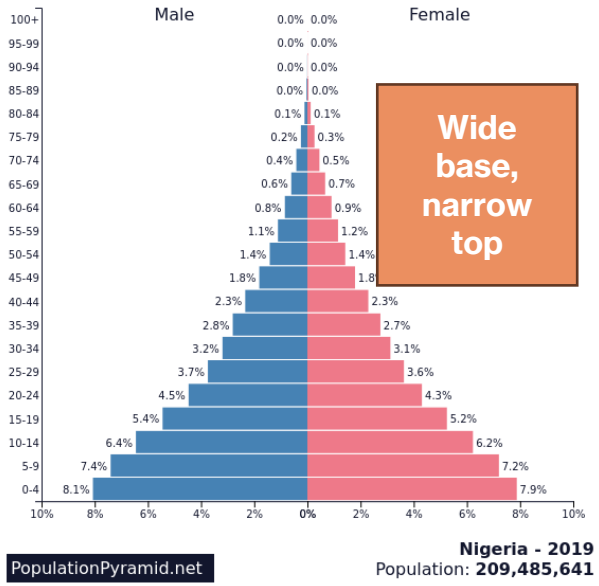
Population pyramid for U.S.



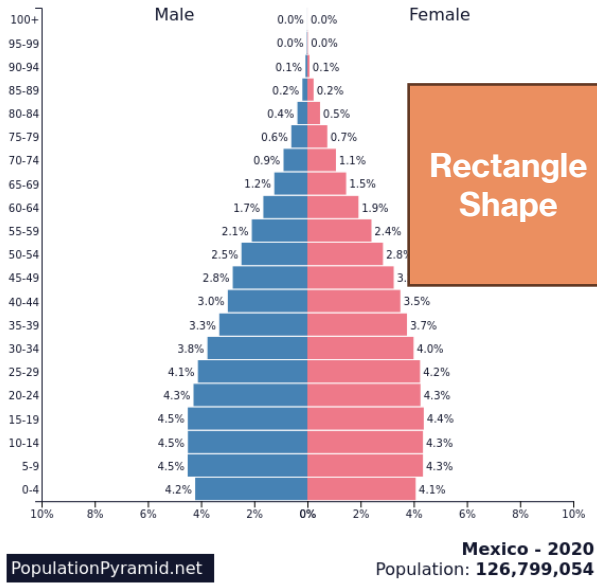
Population pyramid for Japan.

Interpreting Population Pyramids

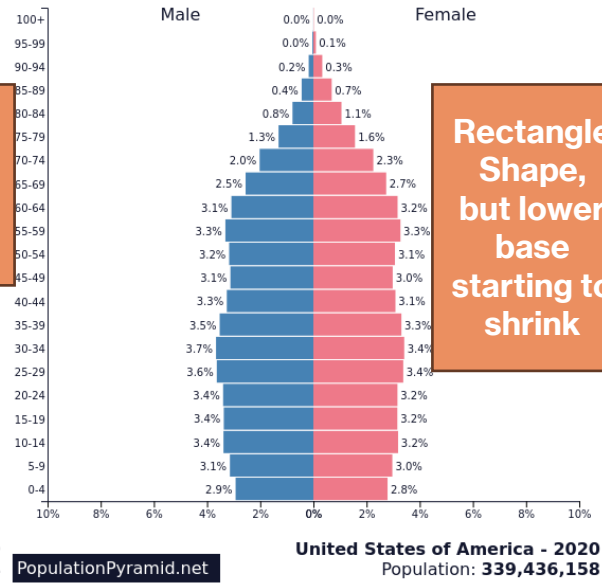
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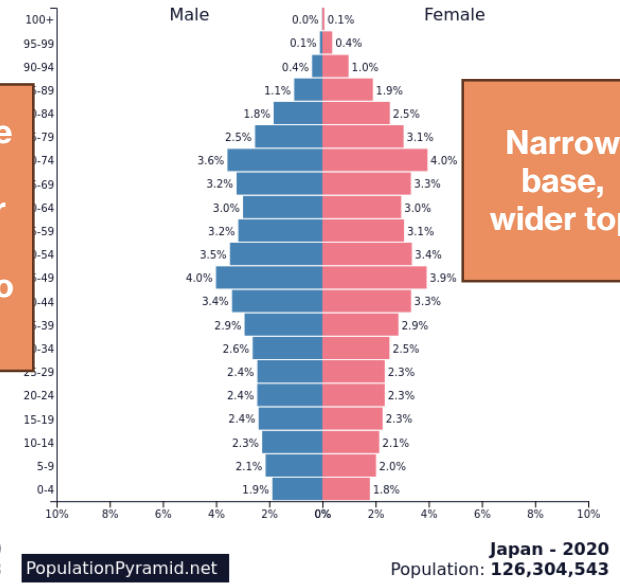
Population pyramid for Nigeria.



Population pyramid for Mexico.



Population pyramid for U.S.

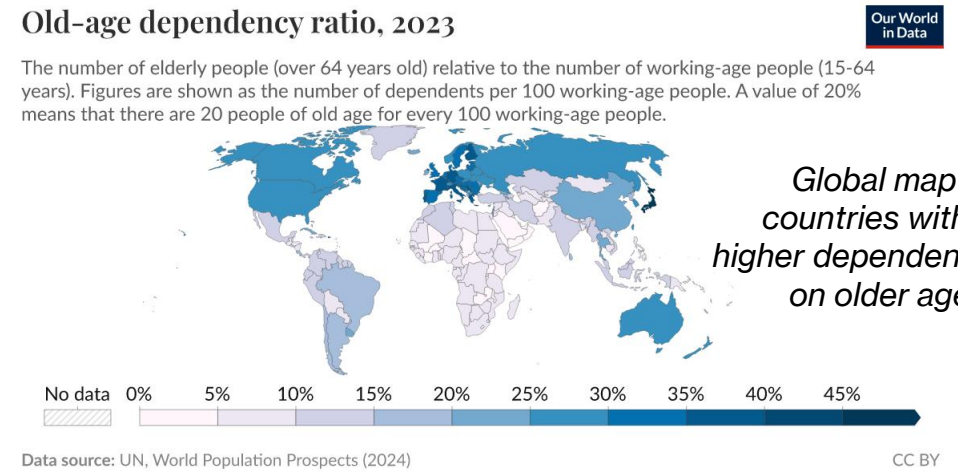


Population pyramid for Japan.

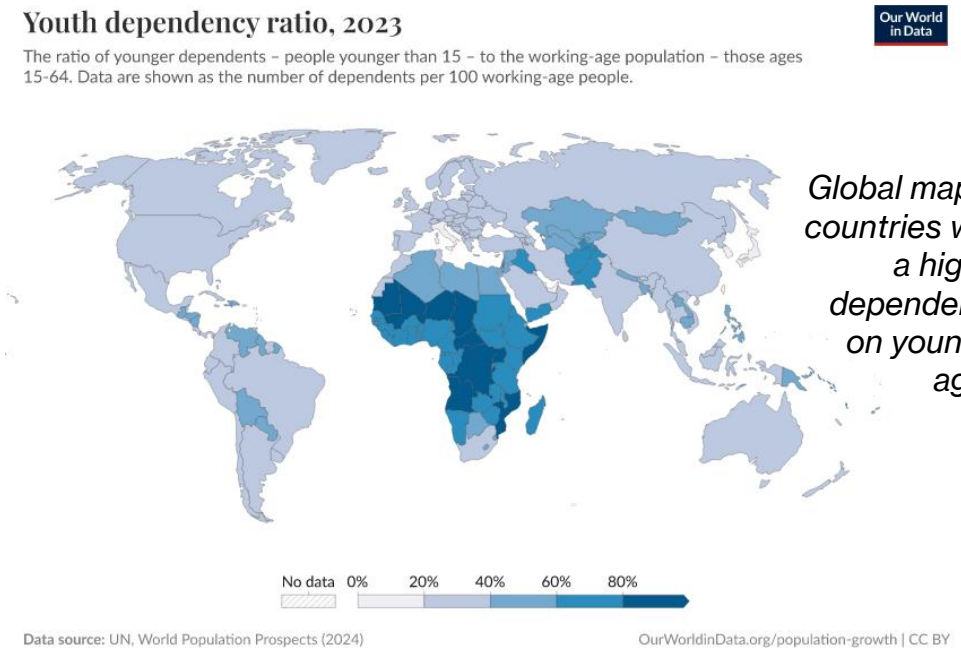
Dependency and Sex Ratios

- **Dependency Ratio:** Measures the number of dependents (young + old) compared to the working-age population
- A ratio of the economically unproductive to the economically productive
- Indicates economic pressure on the productive population
- Higher ratios = fewer workers supporting larger numbers of people, which can hurt economic stability (e.g., more stress on schools, healthcare and pensions)
- Examples:
  - Sub-Saharan Africa → high youth dependency
  - Europe, Japan → high elderly dependency

$$Total\ Dependency\ Ratio = \frac{children\ 0-14\ y.age + population\ more\ than\ 65\ yr.of\ age}{population\ of\ 15-65\ yr.}\ X\ 100$$



Global map of countries with a higher dependency on older ages.

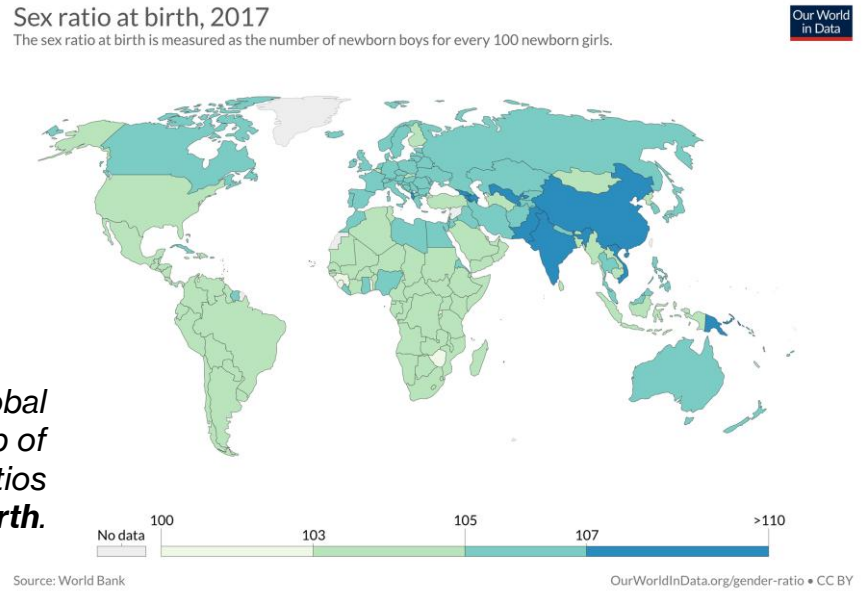


Global map of countries with a higher dependency on younger ages.

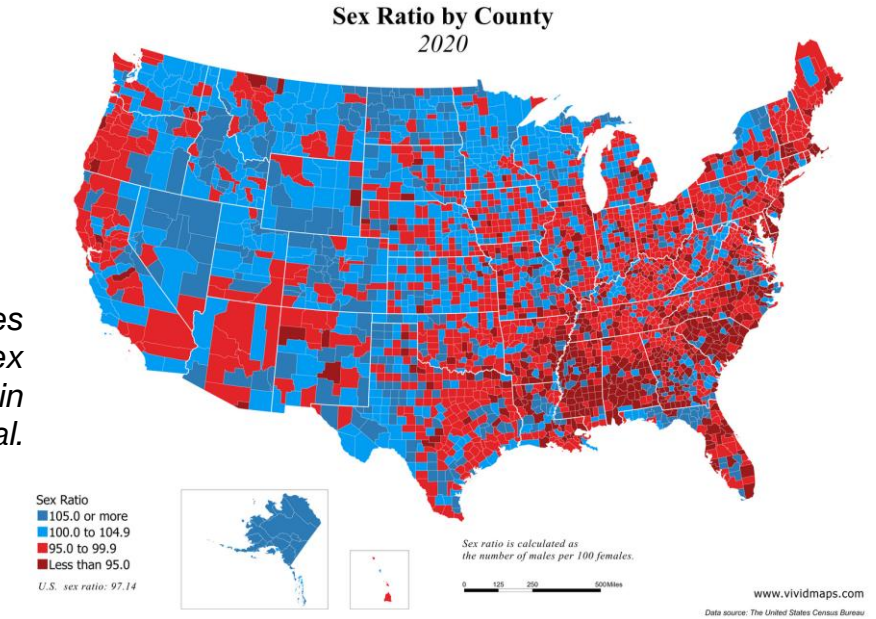
Dependency and Sex Ratios

- **Sex Ratio:** The number of males per 100 females in a population
- At birth, about 105 males per 100 females, but males have higher mortality rates
- Examples:
  - China & India: more males due to cultural preference and past policies
  - Europe: more females due to longer female life expectancy
- Understanding a country's sex and dependency ratio helps human geographers analyze fertility rates and natural increase

$$\text{Sex Ratio} = \frac{\text{number of males}}{\text{number of females}} \times 100$$



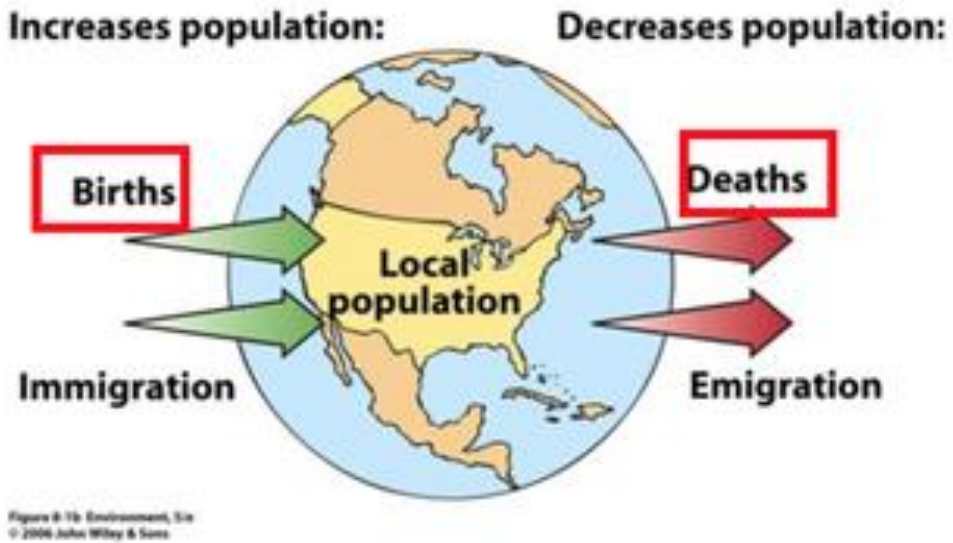
*Global map of sex ratios **at birth**.*



U.S. counties map of sex ratios, in general.

How Do Populations Really Change?

Population Change = Previous Population + Births – Deaths + Immigration – Emigration



Flow of population change.