Population Growth and the Impact on Resource Availability ©

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World Population (current) – 6.6 billion people

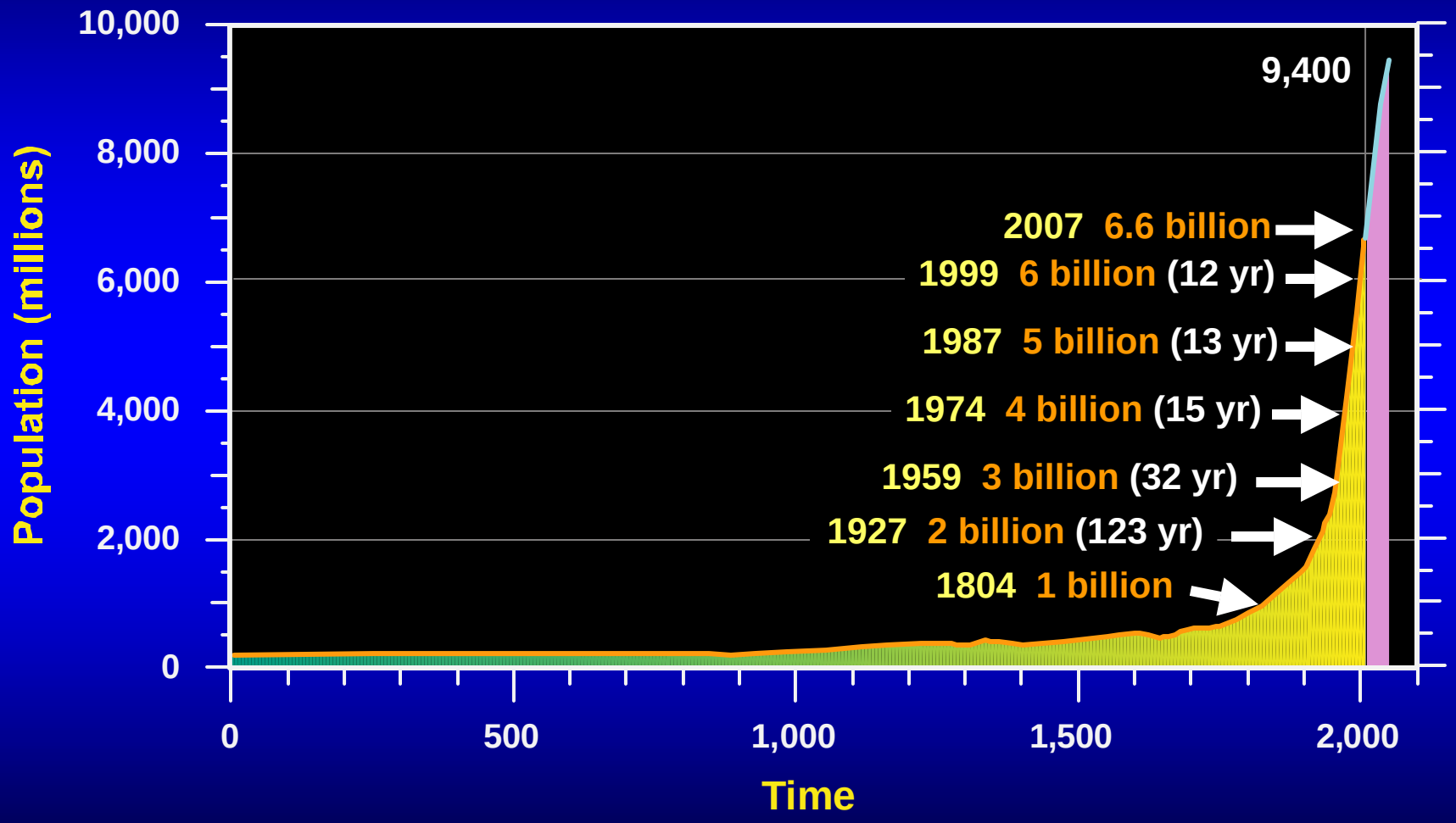
Historical perspective:

- **10,000 years ago (dawn of agriculture) – fewer people worldwide than live in the San Francisco Bay area today (< about 6 million)**

- **2000 years ago (time of Christ) – the entire world population (about 170 million) was a little more than half the U.S. population today**

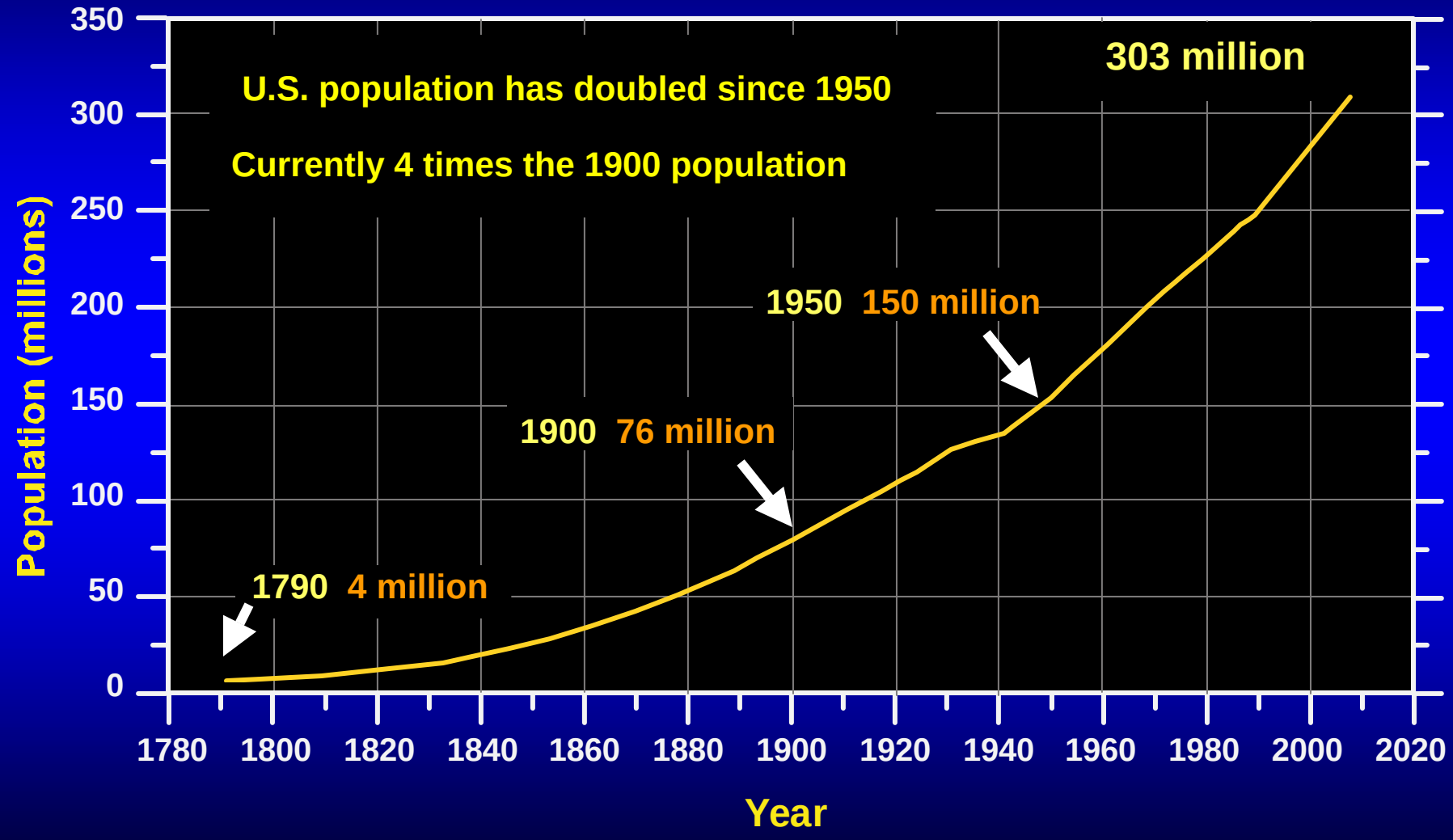
- **500 years ago (Columbus landed in Americas) – world population was only about 425 million (only about 40% more than the U.S. population today)**

WORLD POPULATION GROWTH



US Census Bureau
http://www.census.gov/ipc/www/worldhis.html
http://www.census.gov/ipc/www/idb/worldpop.html

UNITED STATES POPULATION GROWTH



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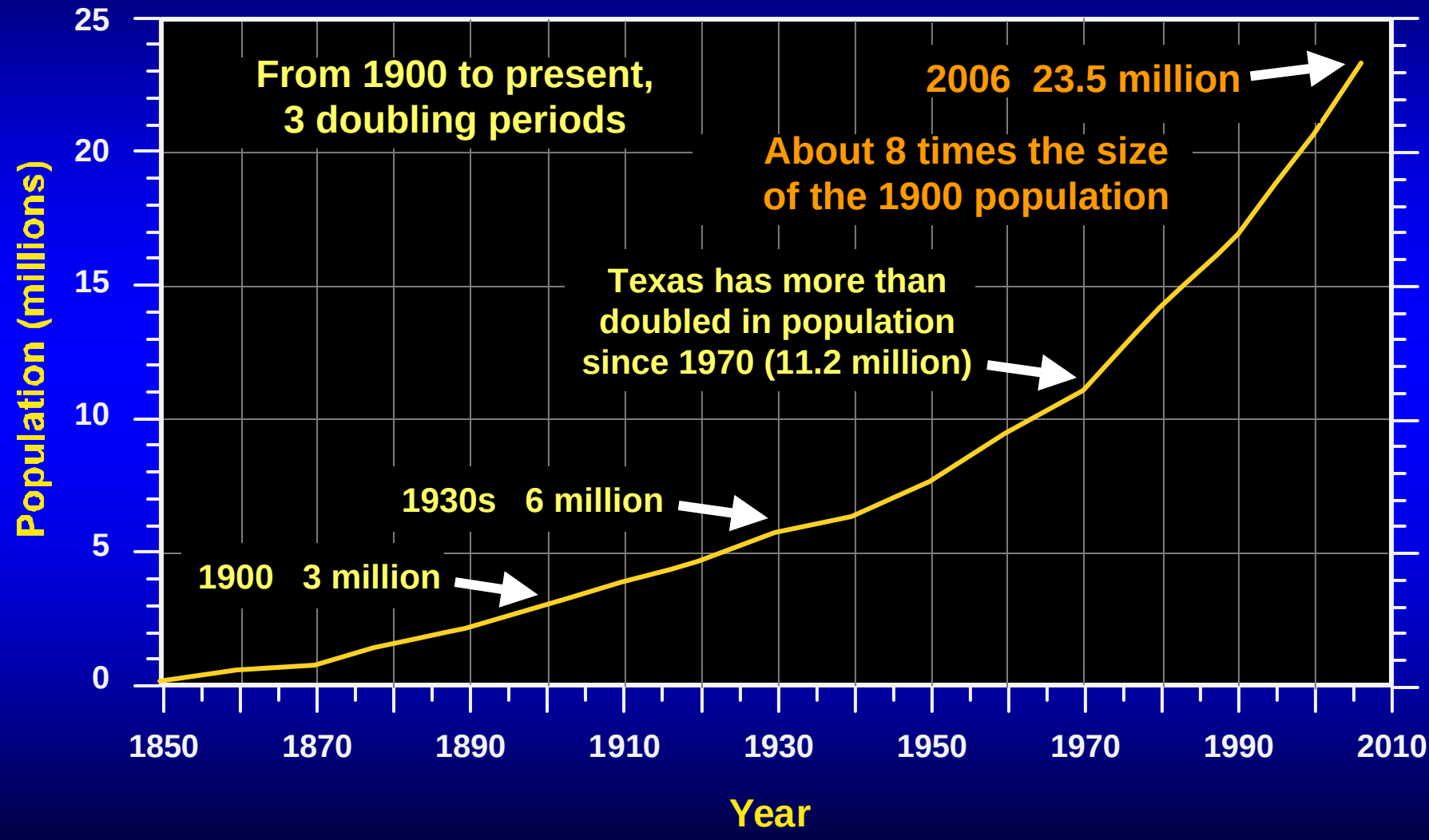
http://www.census.gov/

TEXAS POPULATION GROWTH



US Census Bureau
http://www.census.gov/ipc/www/worldhis.html

MICKEY'S ALLOWANCE

Day 1:	0.01
Day 2:	0.02
Day 3:	0.04
Day 4:	0.08
Day 5:	0.16
Day 6:	0.32
Day 7:	0.64
Day 8:	1.28
Day 9:	2.56
Day 10:	5.12
Day 11:	10.24
Day 12:	20.48
Day 13:	40.96
Day 14:	80.92
Day 15:	163.84
Day 16:	327.68
Day 17:	655.36
Day 18:	1,310.72
Day 19:	2,621.44
Day 20:	5,242.88
Day 21:	10,485.76
Day 22:	20,971.52
Day 23:	41,943.04
Day 24:	83,886.08
Day 25:	167,772.16
Day 26:	335,544.32
Day 27:	671,088.64
Day 28:	1,342,177.28
Day 29:	2,684,354.56
Day 30:	5,368,709.12
Day 31:	10,737,418.24

TOTAL:

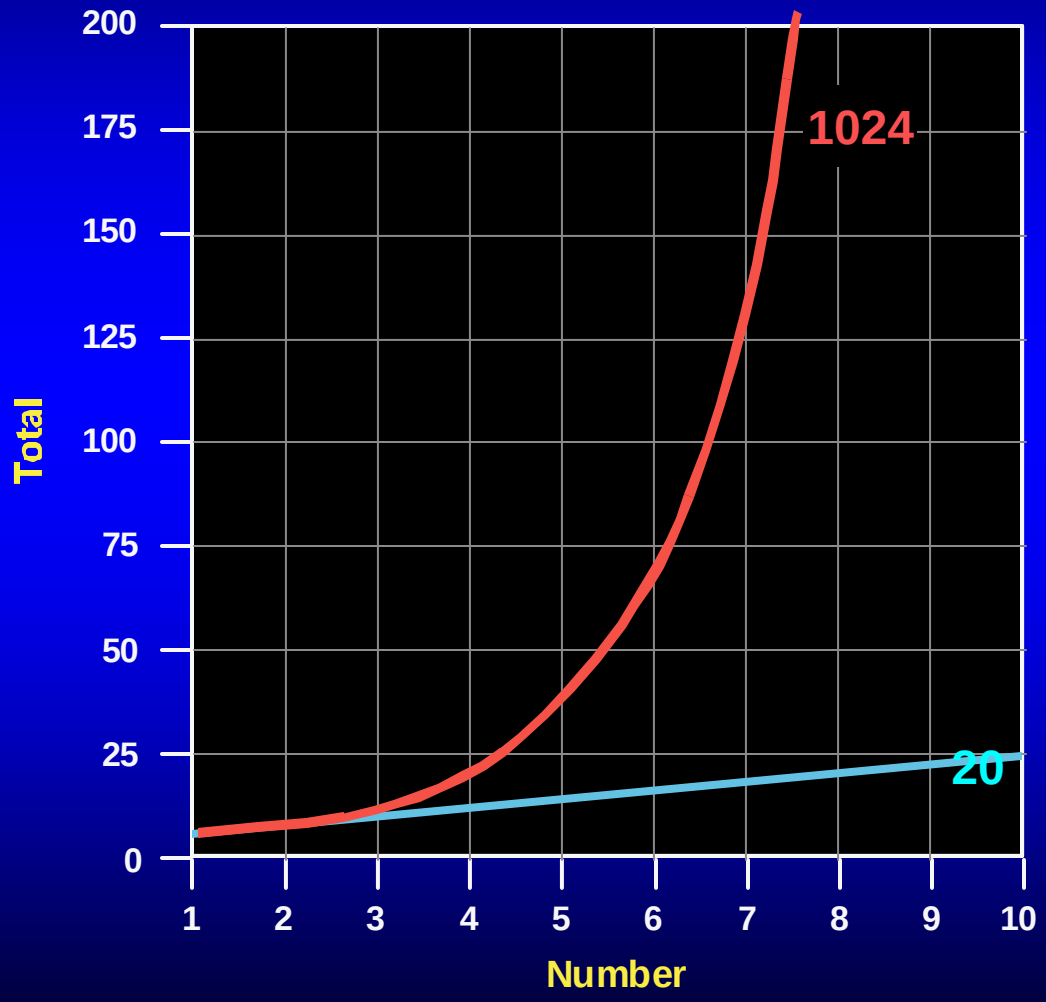
$21,474,836.47

“The greatest shortcoming of the human race is our inability to understand the exponential function.”

Prof. Albert Bartlett

LINEAR vs. EXPONENTIAL GROWTH

Implies that for any exponentially growing quantity, the larger the quantity gets, the faster it grows. Compound interest and world population growth are examples.



Linear growth **adds** at a constant rate:

2 + 2 + 2 + 2 + 2……

Exponential growth **multiplies** at a constant rate:

2 x 2 x 2 x 2 x 2……

e.g., $2^{10} = 1024$

Calculating Annual Growth Rates

- **To calculate annual growth rate (example):**

  birth rate (b) = 25.3/1000 = 2.53%
  - death rate (d) = 8.8/1000 = 0.88%

- **If talking about a country, state, city, then also add net migration:**
  + net immigration = 3.5/1000 = 0.35%
  (or subtract if net emigration)

- **SUM = 2.00% annual growth rate**

Calculating Doubling Times

Let's say a country/state maintains a 2% annual growth rate.

How long will it take for the population to double?

Td = 70/r years

Td = doubling time in years

r = growth rate expressed as a percentage per year

So for a 2% annual growth rate: 70 ÷ 2 = 35
get a doubling time (Td) of 35 years.

Annual world growth rates currently are about 1.16% per year:
Td = 60 years.

10,000 years ago, Td = about 1500 years

By 1800 (Industrial Revolution) => improved living conditions => decrease in death rates

WORLD POPULATION GROWTH

- **Every DAY there are over 210,000 more people than the day before.**

It only takes 10 days to "add another Houston" to the Earth.
(2.1 million; 2006 est.)

It only takes about 18 days to add another Los Angeles
(3.8 million; 2006 est.)

- **Every YEAR there are over 77 million more people than the previous year.**

Every YEAR adding:

9 more New York Cities (8.2 million, 2006 est.)

20 more Los Angeles

37 more Houstons

TEXAS' & SAN ANTONIO'S GROWTH

- **Texas (23.5 million) has an average annual growth rate of 2.0%.**

  If this rate is maintained, the population of Texas will double to > 47 million people in 35 years – close to the entire U.S. population in 1880.

  Equivalent to adding about 11 more Houstons to the state (2.1 million; 2006 Census Bureau est.)

- **San Antonio (1.3 million) has the second fastest growing population in the country, second only to Phoenix.**

  With a current 2.1% annual growth rate, Td = 33 years.

  (33 years to exceed the current size of Houston by half a million people)

  At 1.3 million today, 39% increase over the 1990 population (935,933)

CONSEQUENCES

- More demand for water and food, oil and natural gas, other energy sources, mineral resources
- Increased traffic, air & water pollution
- Economic & social consequences: More stress, more crime, more prisons, more schools (more overcrowding), more landfills
- More $$ infrastructure: more water & sewer lines, more dams and flood control structures, more electrical-generating plants, more highways & roads, more parking lots
- Less land for agriculture & food production
- Less wilderness, less open space

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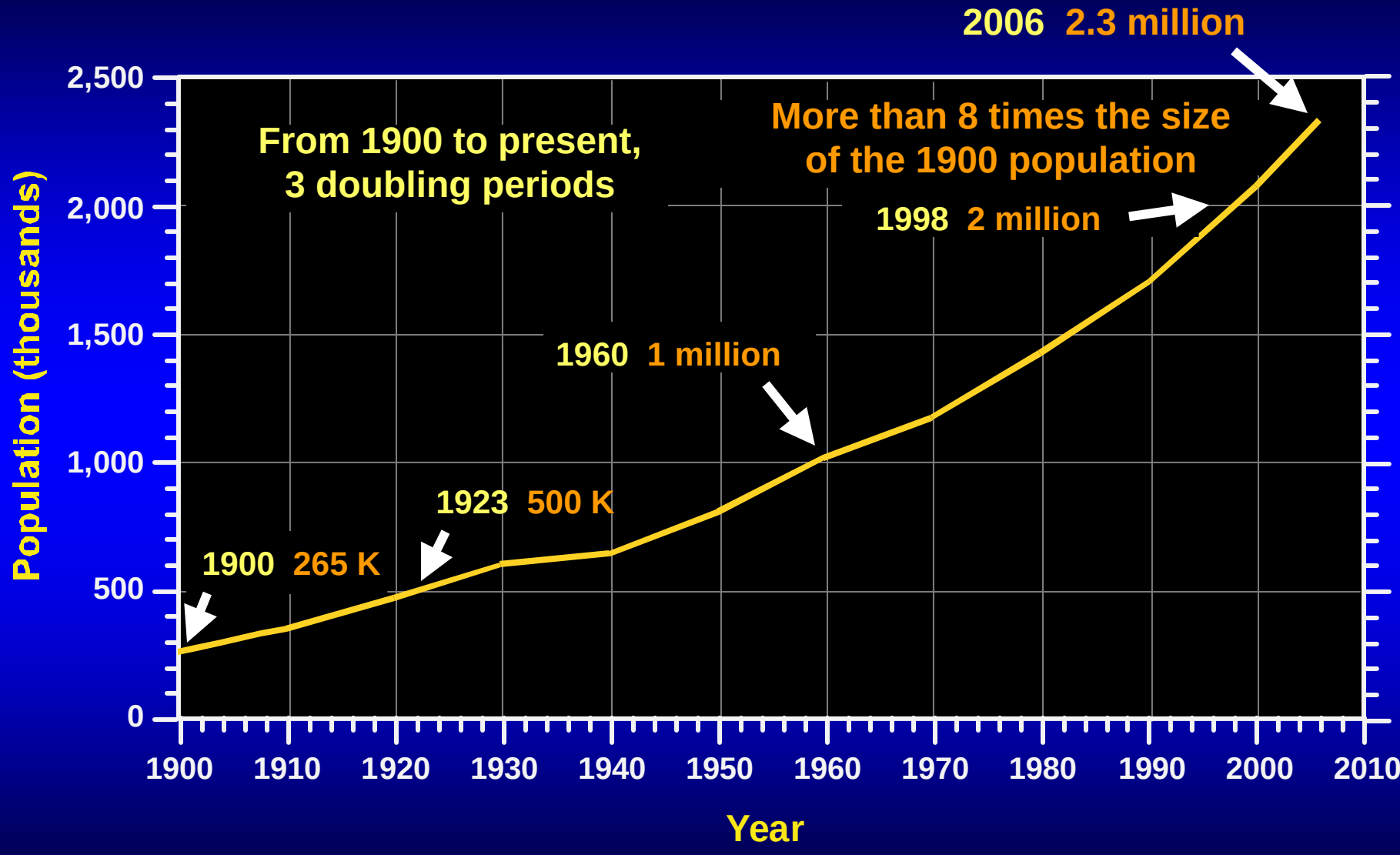
Day 30:	5,368,709.12
TOTAL Through Day 30	$10,737,418.23
Day 31 Alone:	$10,737,418.24

The growth in any doubling period is greater than the total of all the preceding growth!

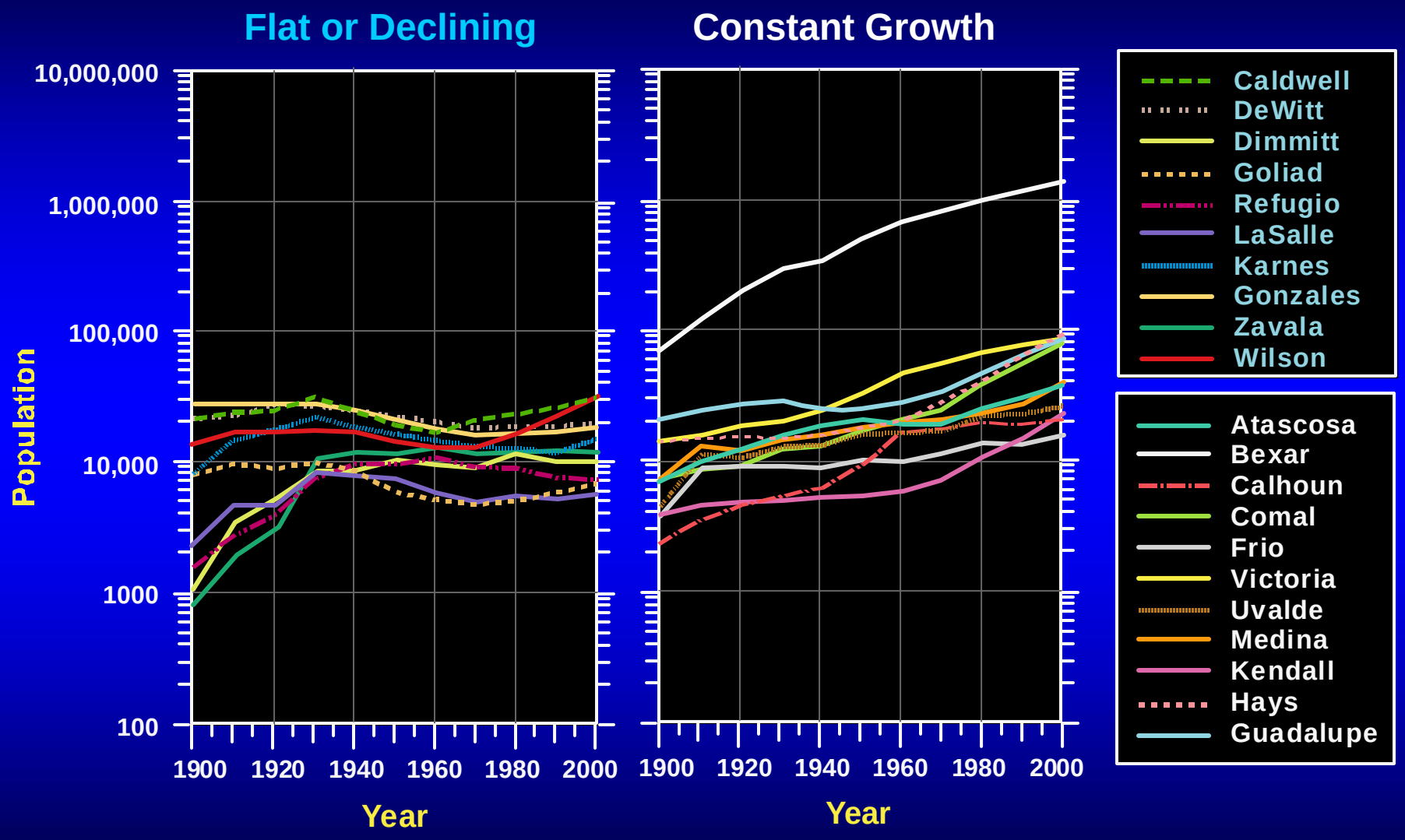
Whatever resource you need to distribute (money, water, oil, electricity, etc.), you're going to need an amount equal to all of that resource that has ever been consumed in all of history to satisfy the demands of the next doubling period.

REGION L POPULATION GROWTH



Data from TWDB & U.S. Census Bureau

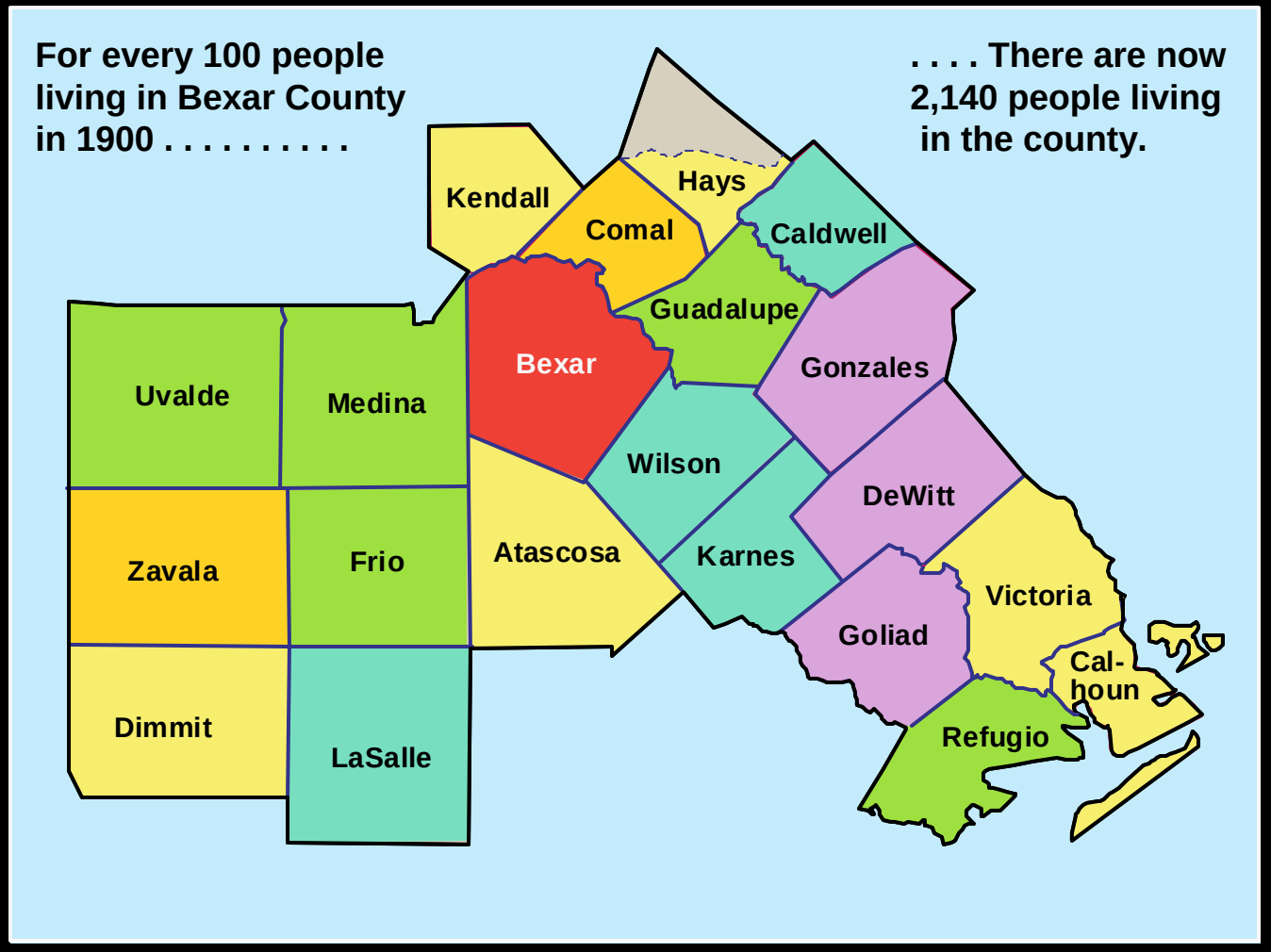
HISTORIC POPULATION GROWTH REGION L



Texas Water Development Board and Region L Data

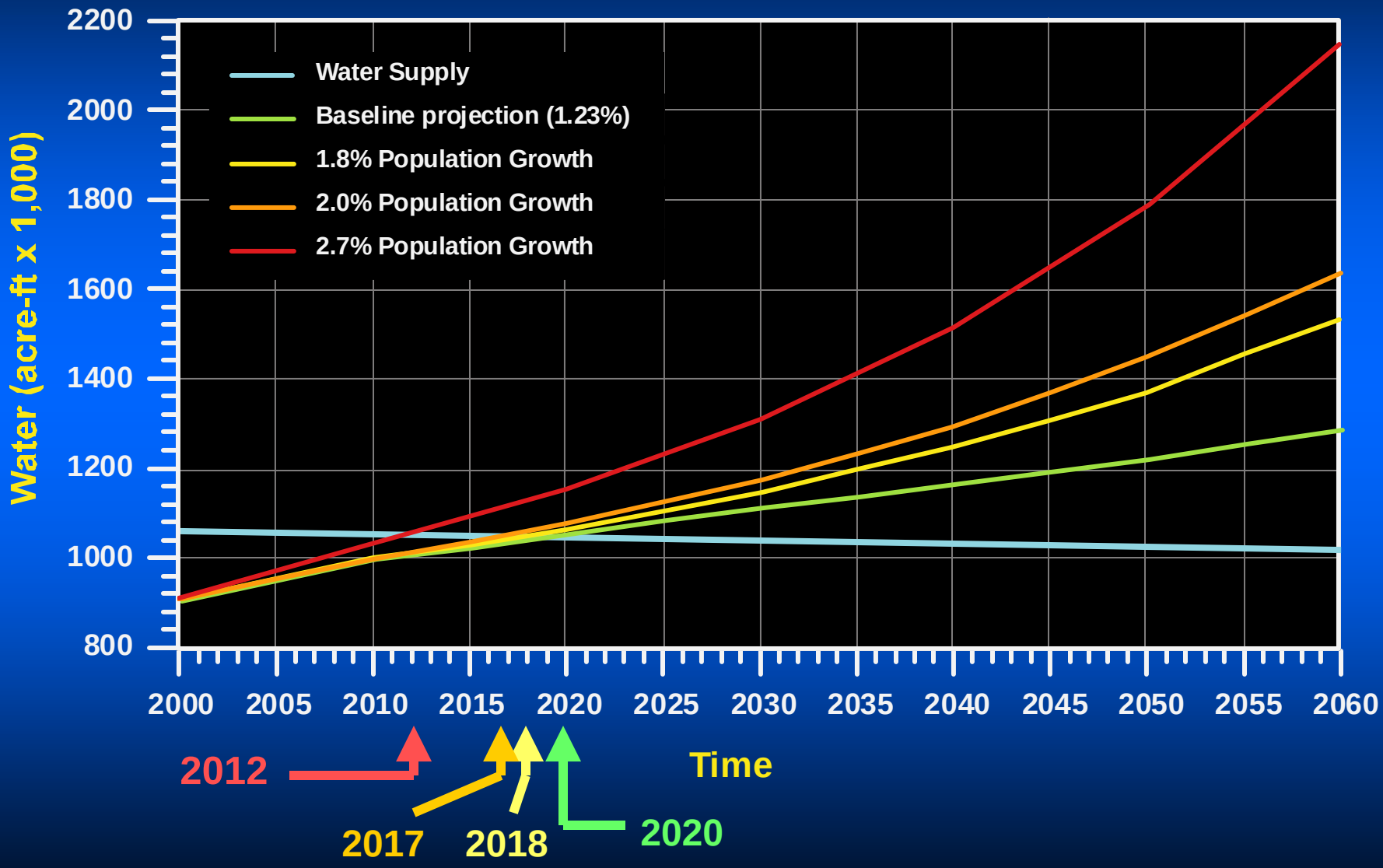
REGION L HISTORIC POPULATION GROWTH

Percent Growth 1900 to 2006



POPULATION IMPACT ON SUPPLY & DEMAND IN REGION L

The only variable from 2006 Plan is the number of people, affecting municipal demand.



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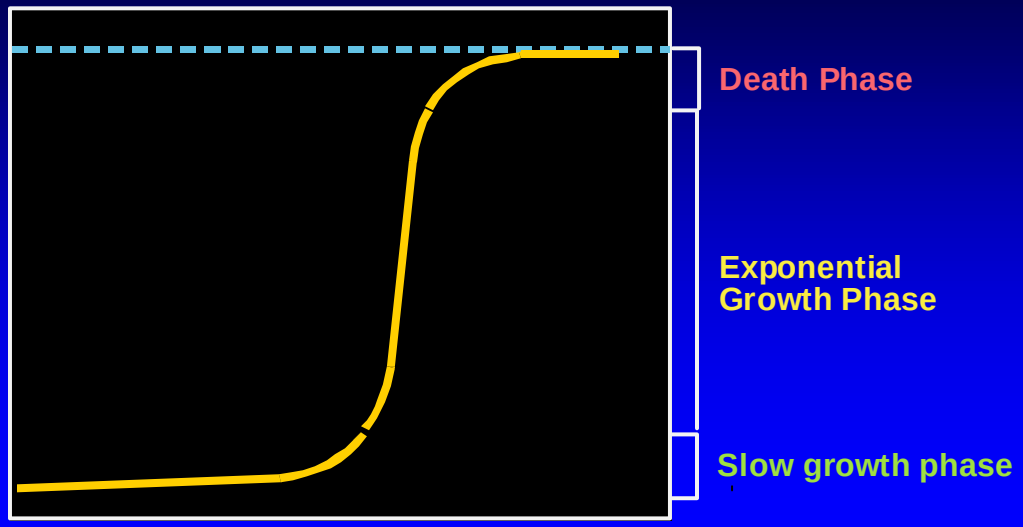
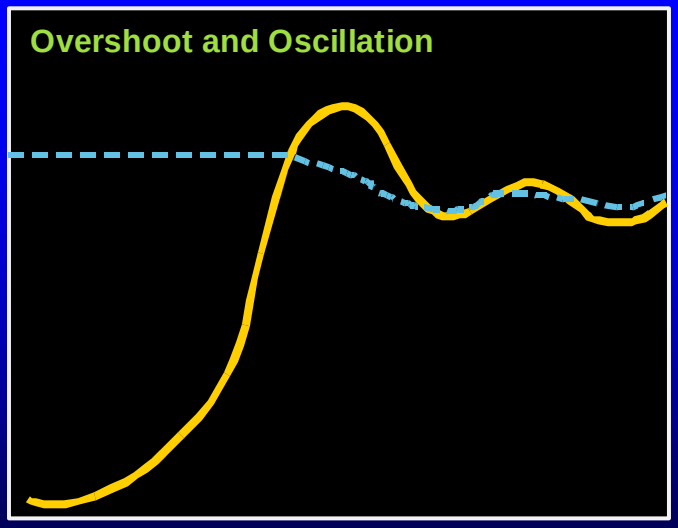
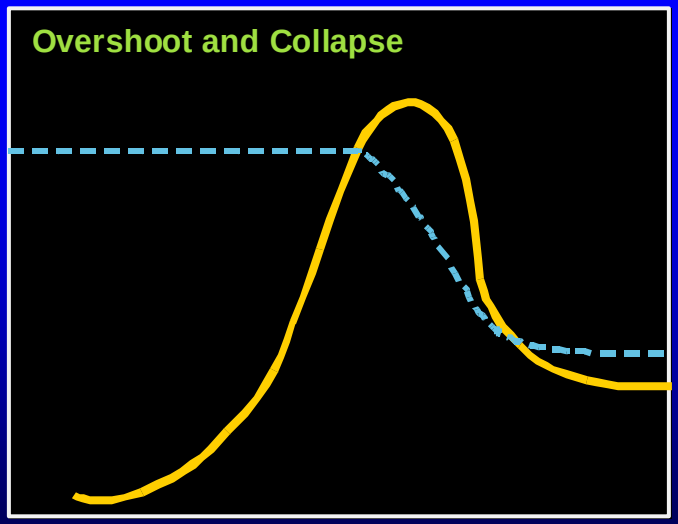
POPULATION GROWTH AND CARRYING CAPACITY

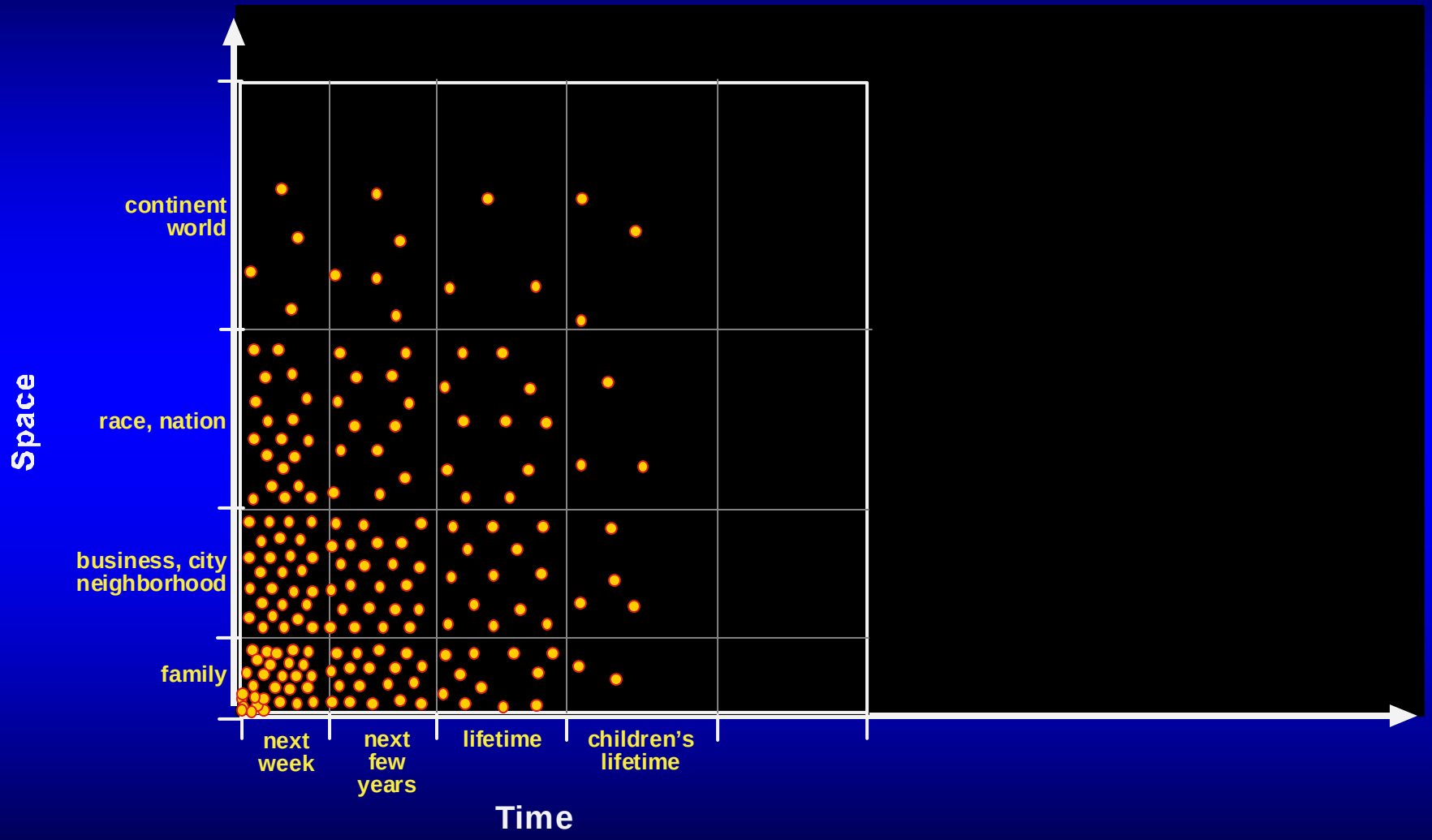






Adapted from Meadows et al. (2004)

HUMAN PERSPECTIVE IN SPACE AND TIME



Population is THE Problem!