Global Change The Conflict: Short Term Goals vs. Long Term Impacts

Jeff Gaffney

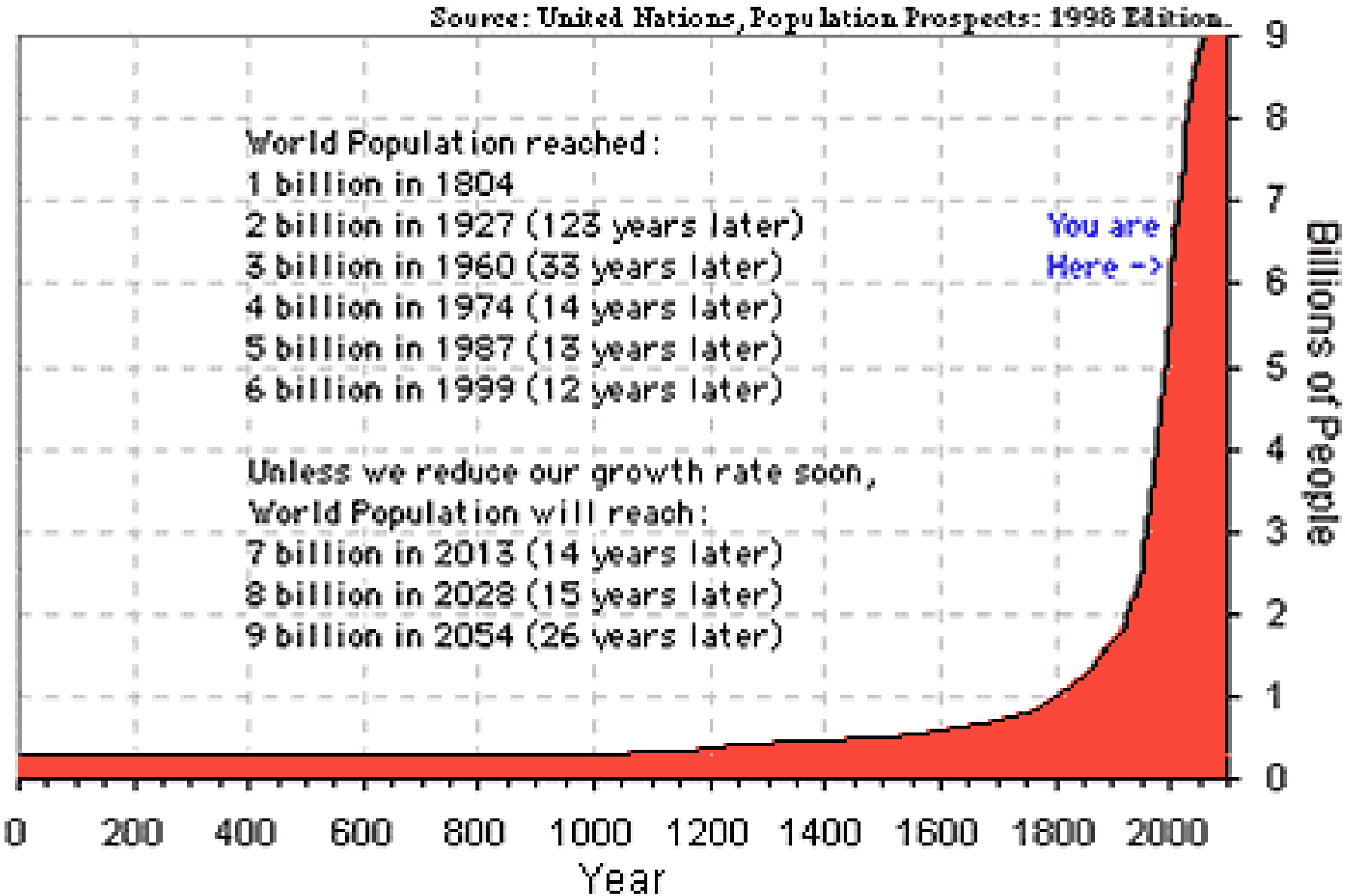
Global Change Education Program

GLOBAL CHANGE EDUCATION PROGRAM

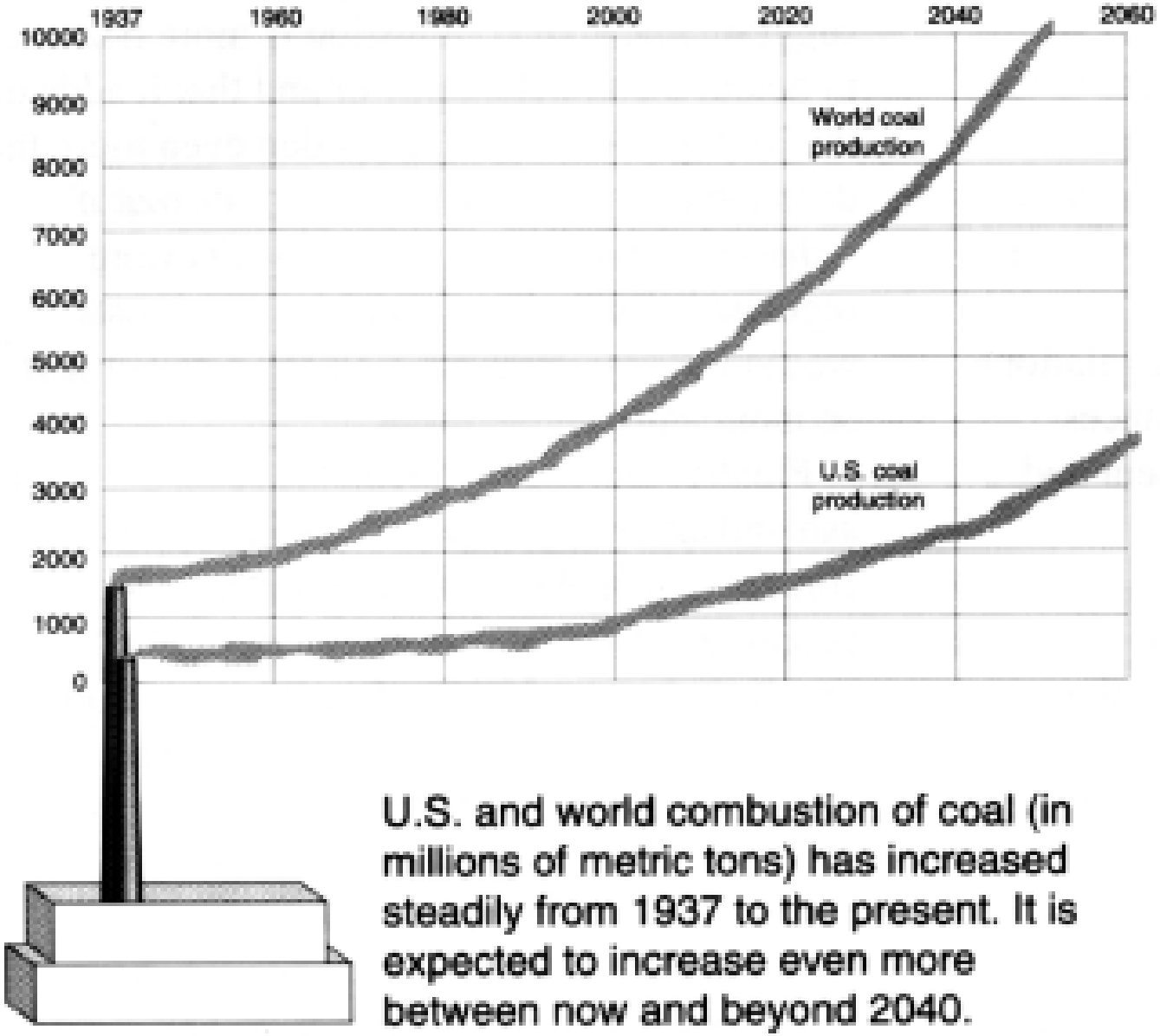
SERVING SCIENCE AND SOCIETY · DOE Biological and Environmental Research Program

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

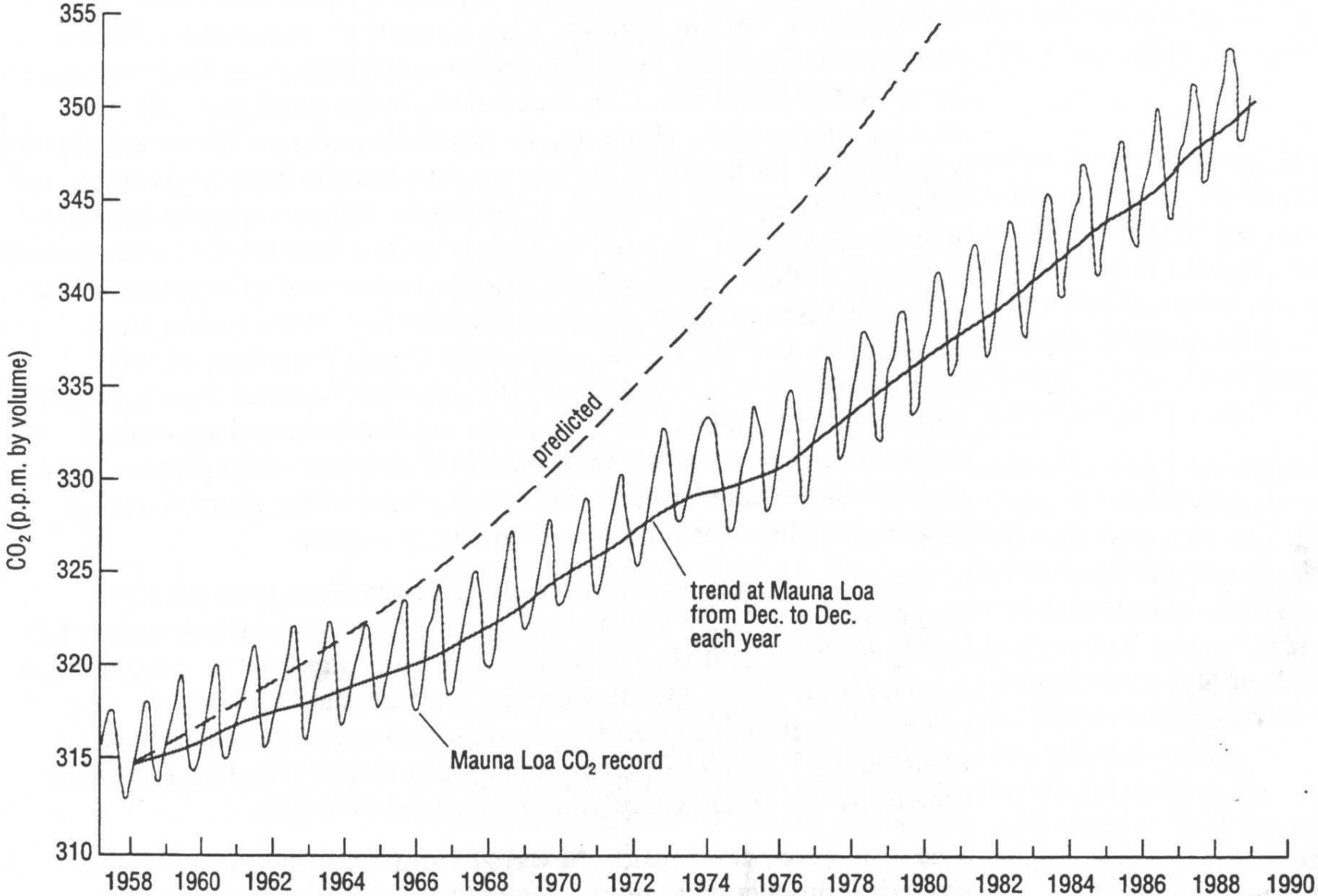
ARGONNE NATIONAL LABORATORY
operated for the U.S. Department of Energy by The University of Chicago


Source: United Nations, Population Prospects: 1998 Edition.
World Population reached:
1 billion in 1804
2 billion in 1927 (123 years later)
3 billion in 1960 (33 years later)
4 billion in 1974 (14 years later)
5 billion in 1987 (13 years later)
6 billion in 1999 (12 years later)
Unless we reduce our growth rate soon,
World Population will reach:
7 billion in 2013 (14 years later)
8 billion in 2028 (15 years later)
9 billion in 2054 (26 years later)
You are
Here ->
Billions of people
0
1
2
3
4
5
6
7
8
9
0
200
400
600
800
1000
1200
1400
1600
1800
2000
Year

U.S. AND WORLD COAL COMBUSTION (millions of tons)

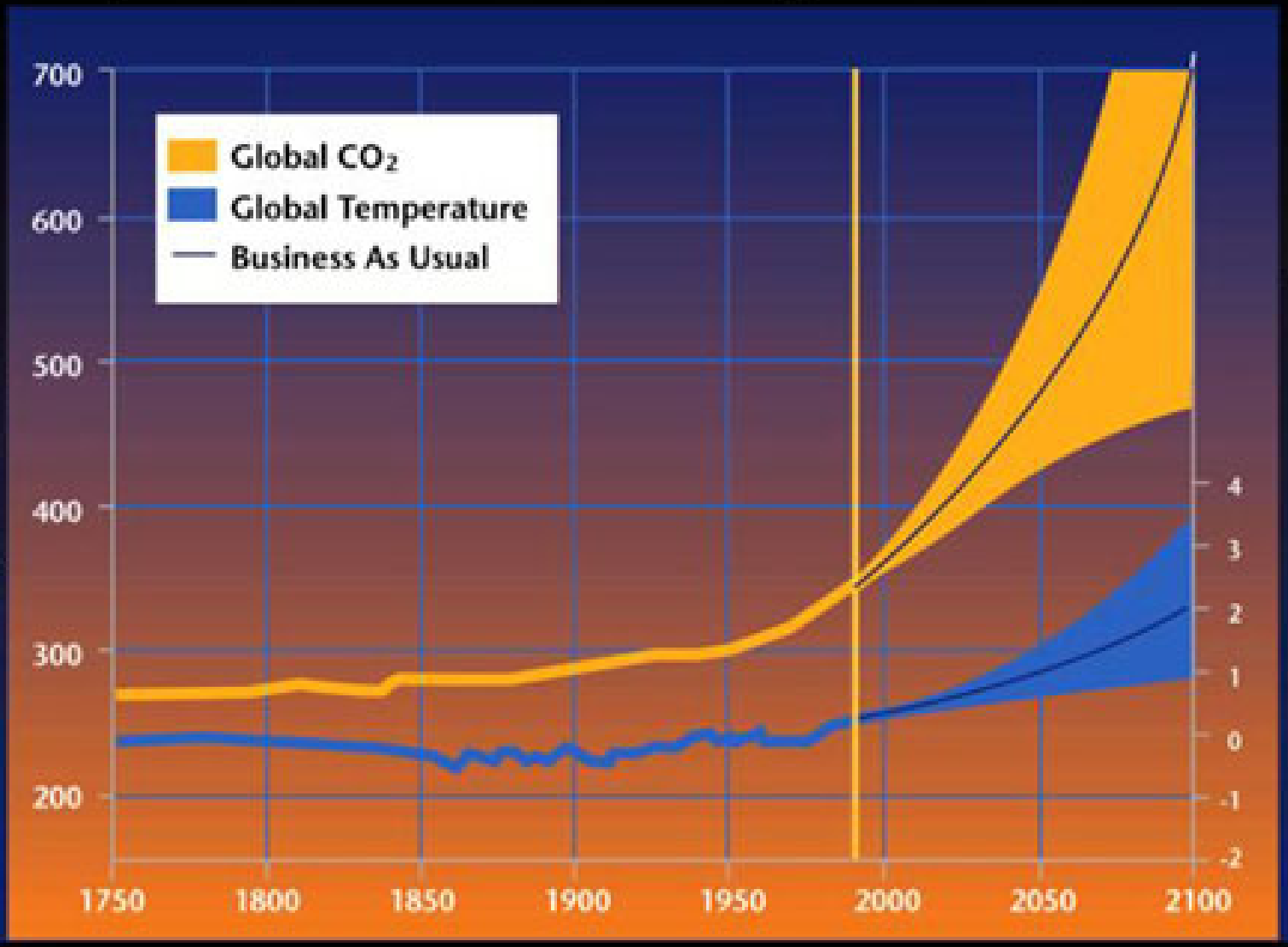


U.S. and world combustion of coal (in millions of metric tons) has increased steadily from 1937 to the present. It is expected to increase even more between now and beyond 2040.

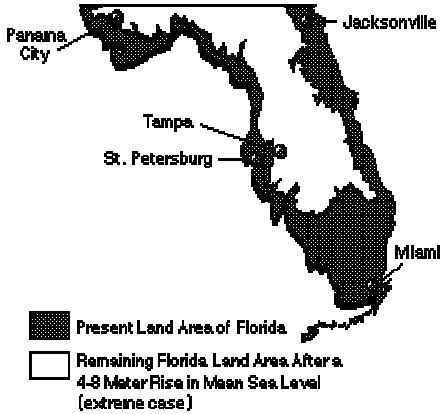

355
350
345
340
335
330
325
320
315
310
CO_2 (p.p.m. by volume)
predicted
trend at Mauna Loa
from Dec. to Dec.
each year
Mauna Loa CO_2 record
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990

(b)

Projection of CO_2 and Temperature to 2100

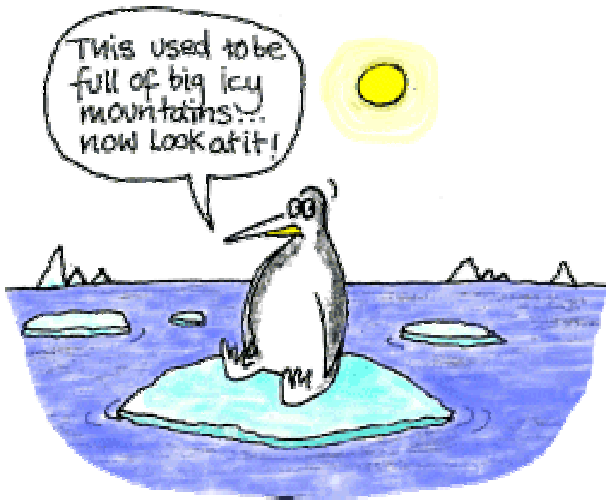


Our Planet is not HOMOGENEOUS



Wetter!

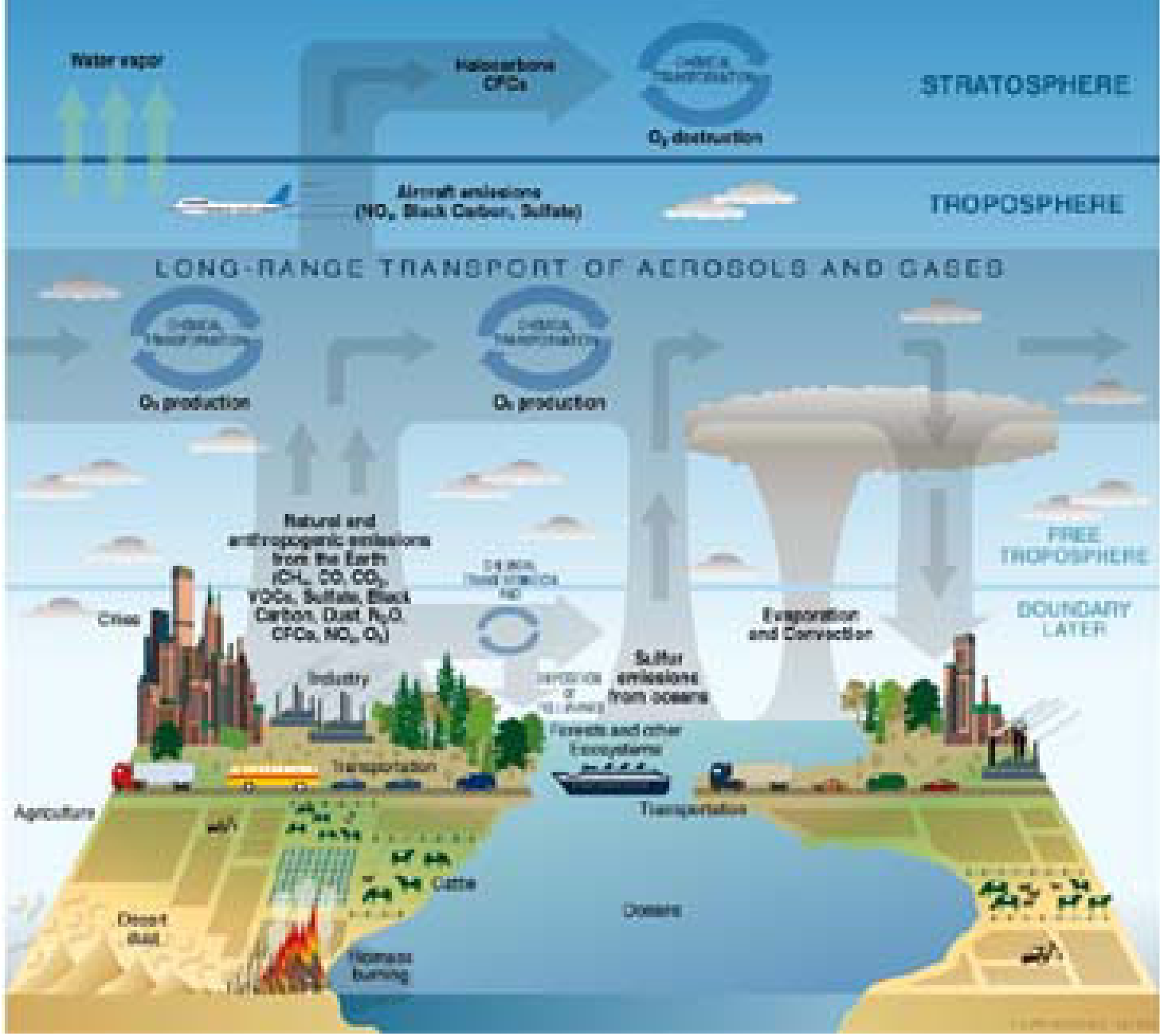
Drier!



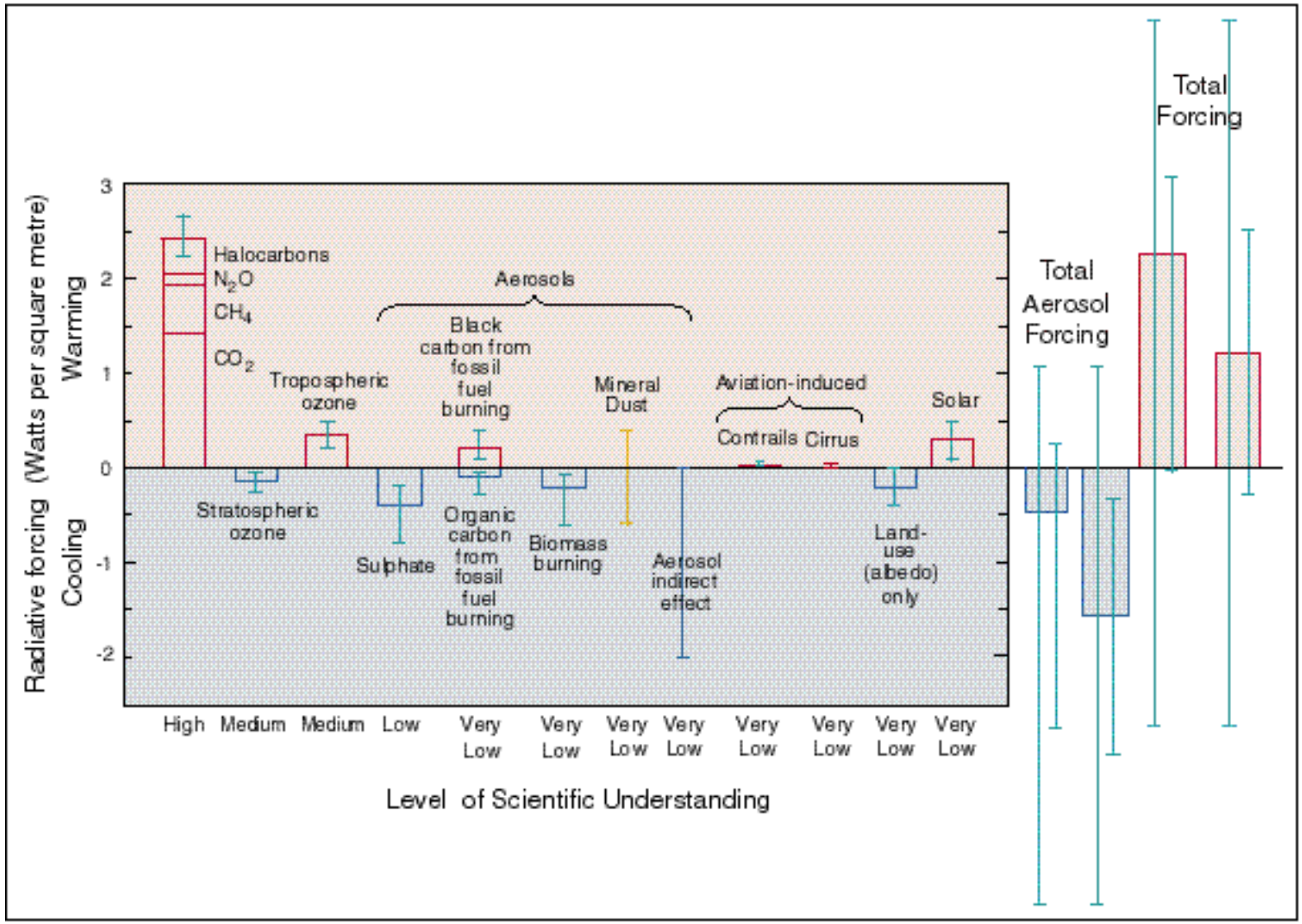
Hotter!

Colder!

Strategic Plan for the Climate Change Science Program
Final Report
July 2003
Chapter 3. Atmospheric Composition



AEROSOL IMPACTS – NEW DOE/ASP FOCUS



MEGACITIES

➢ *10 Million*

1950 – 1 (NYC)

1995 – 14

2015 – 21

Mini – MEGACITIES

5 Million – 10 Million

1995 – 7

2015 – 37

ASIA – AFRICA

2/3 rural to ½ urban by 2025

MEXICO CITY

Black Carbon

i.e. Diesel Soot

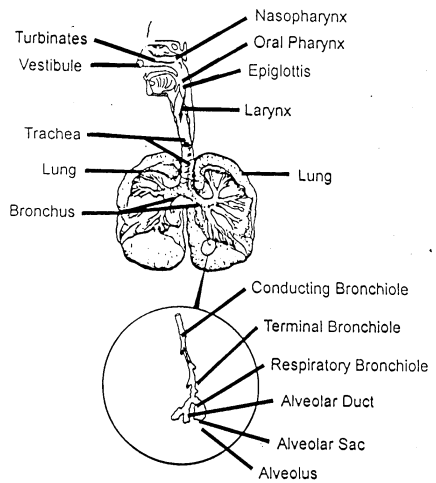
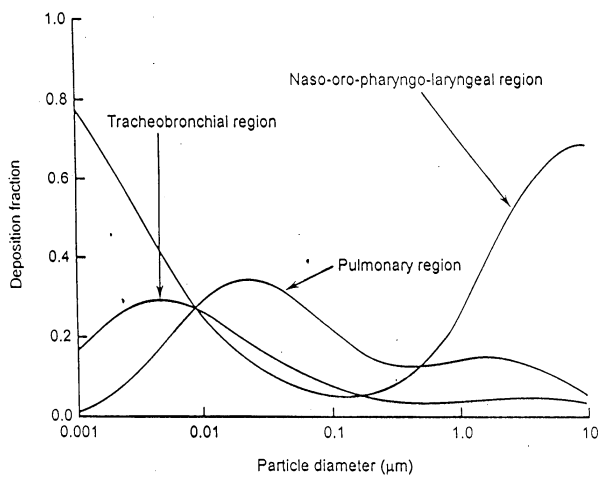


FIGURE 2.12 Schematic diagram of human respiratory tract. (From Hinds, W. C. *Aerosol Technology*. Copyright © 1982 John Wiley & Sons, Inc. Reprinted by permission of John Wiley & Sons, Inc.)



HUMAN PATHOLOGY—VOLUME 9, NUMBER 3 *May 1978*

THE $^{13}C/^{12}C$ RATIO IN BLACK PULMONARY PIGMENT: A MASS SPECTROMETRIC STUDY*

Daniel N. Slatkin, M.D.,† Lewis Friedman, Ph.D.,‡ Adolph P. Irsa, M.S.,§ and Jeffrey S. Gaffney, Ph.D.‖

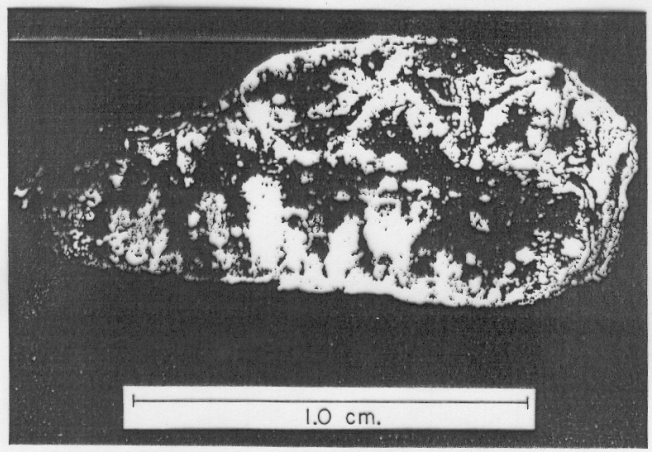
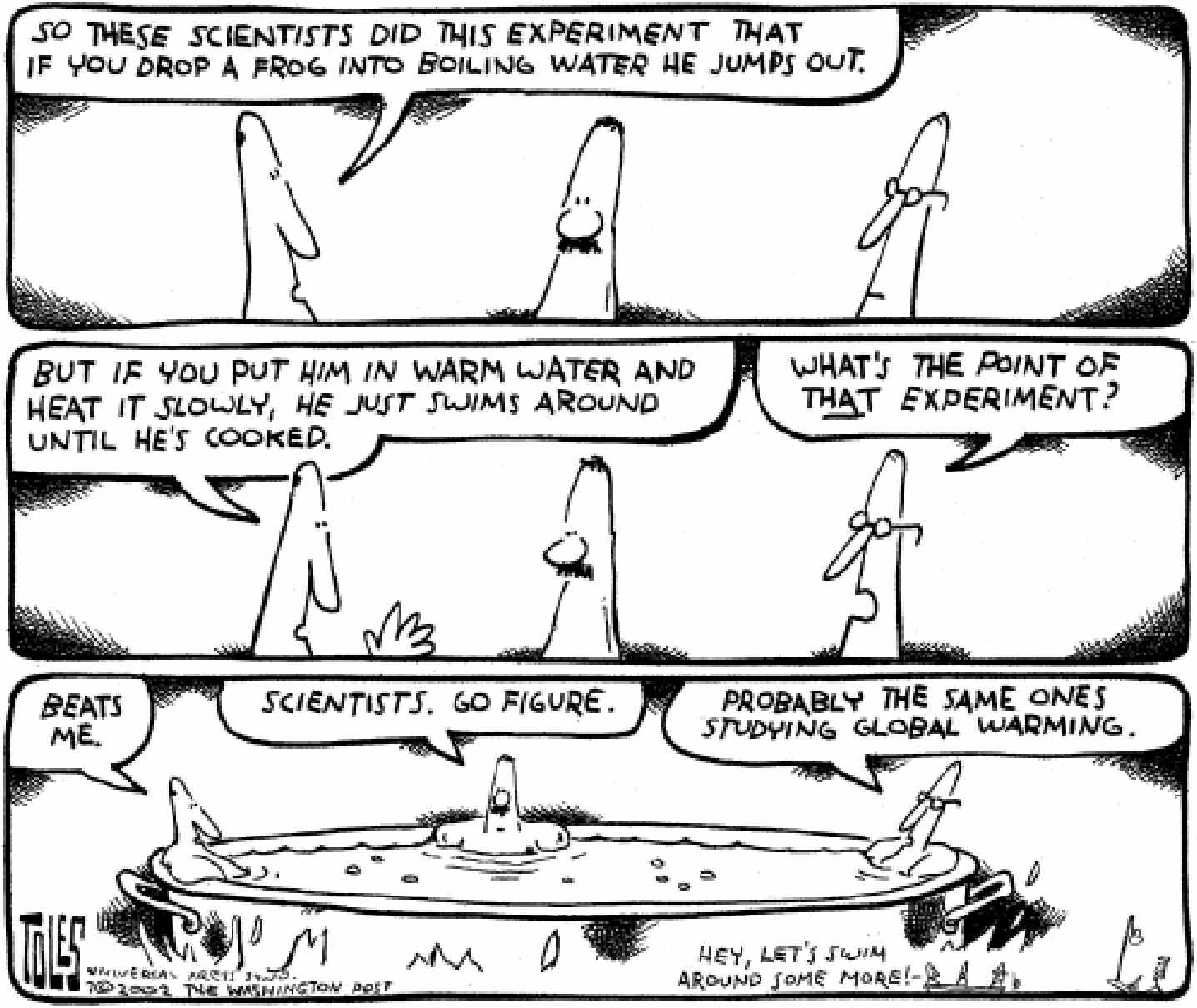


Figure 1. Longitudinal section through a typical carinal lymph node. Although overall black pigmentation is moderate, focal zones of the node are intensely pigmented, particularly in medullary sinuses and in connective tissue surrounding nutrient blood vessels.

RATE OF CHANGE IMPORTANT – Timing!



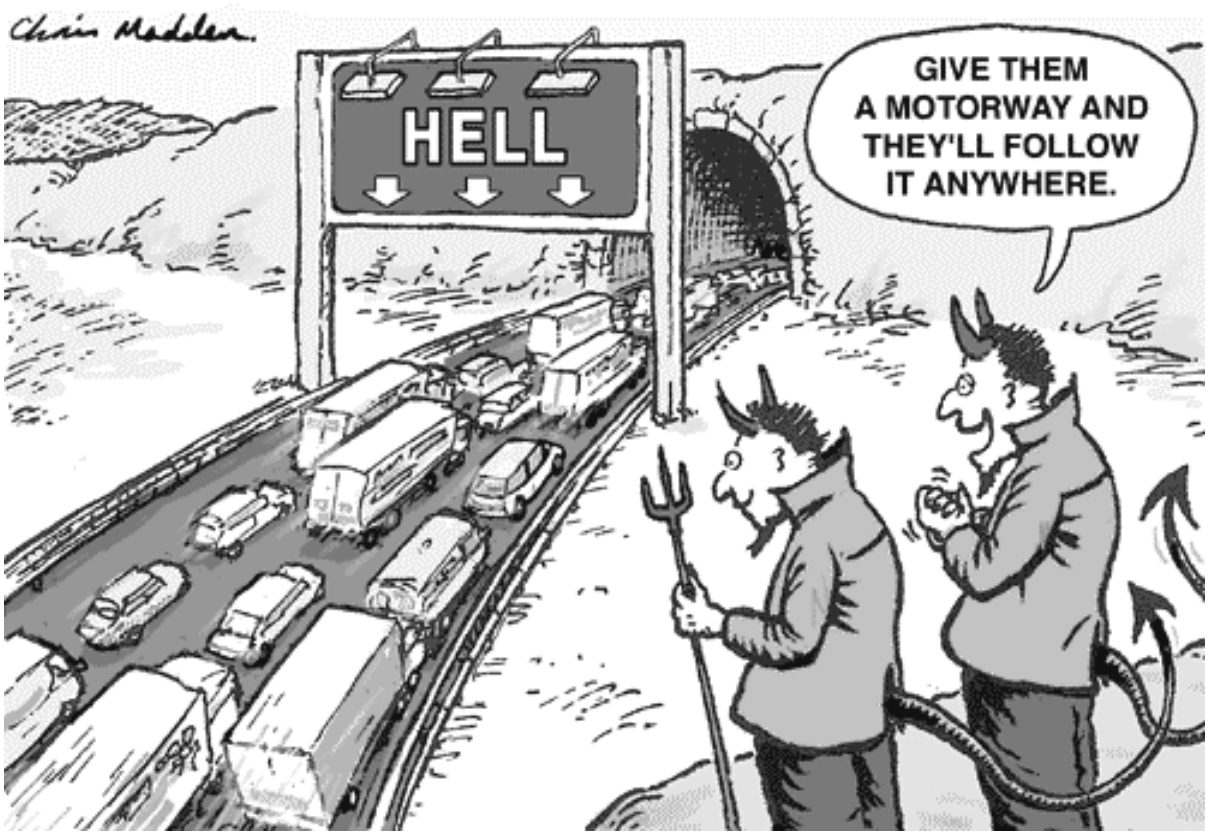
7-31-02

Increases in Severe Weather – EXTREMES!

RATE of CHANGE – Will Determine How We ADAPT!

THIS IS YOUR PLANET ON GREENHOUSE GASES

Of Course, Some Habits May be Hard to Change!



Global Change Scientists Must Also Adapt!

ITS BIG..

But Resources Still have LIMITS

AIR

WATER (FRESH)

FUELS

RISE AND FALL OF PETROLEUM BASED ECONOMIES..

ASSUMPTIONS…

OIL – ENDLESS SUPPLY? NO ---- Obvious impacts

FOOD SUPPLY – TIED TO OIL – YES – Strongly

Irrigation\Fertilization– Mechanization – PROCESSING, Transportation

Example: Breakfast Cereal – Grind Corn, Milling, Wetting, Drying and Baking – Costs 4 calories for every calorie of food.

Two pounds of Corn Flakes – one half a gallon of gasoline just to make it.. Not counting transportation to the store – and you driving to the store to get the food. Very Energy Intensive…

BEEF, PORK, CHICKEN – Even more Energy Costs.

LAND USE CHANGES ---- CAN WE MAINTAIN THIS?

SHORT TERM..

$$$$$$$$$$$$ - HOW TO KEEP GROWTH UP..

Vs.

LONG TERM

SUSTAINABILITY and QUALITY OF LIFE

SHORT TERM APPROACH – QUICK FIX?

LONG TERM Options:

Solar/Wind/Hydro/Geothermal….(local sources/power needs?)

Hydrogen – (Fresh Water)

Fusion, Fission, etc. – Electricity – Electric Vehicles/Hybrids

Conservation – Increased efficiency (there is a limit..)

MASS TRANSIT (Need Capital Investment- commitment

ENERGY PORTFOLIO

REVISIT LAND USE – BACK TO LOCAL FOOD PRODUCTION?

COAL/CLIMATE?

TRADEOFFS – TOO MANY OF US.. DEMAND HUGE

NEED TO UNDERSTAND THE GLOBAL SYSTEMS

IDENTIFY PITFALLS IN ENERGY STRATEGIES BEFORE WE HAVE MAJOR PROBLEM…

CFC's – Ozone Depletion and Global Warming

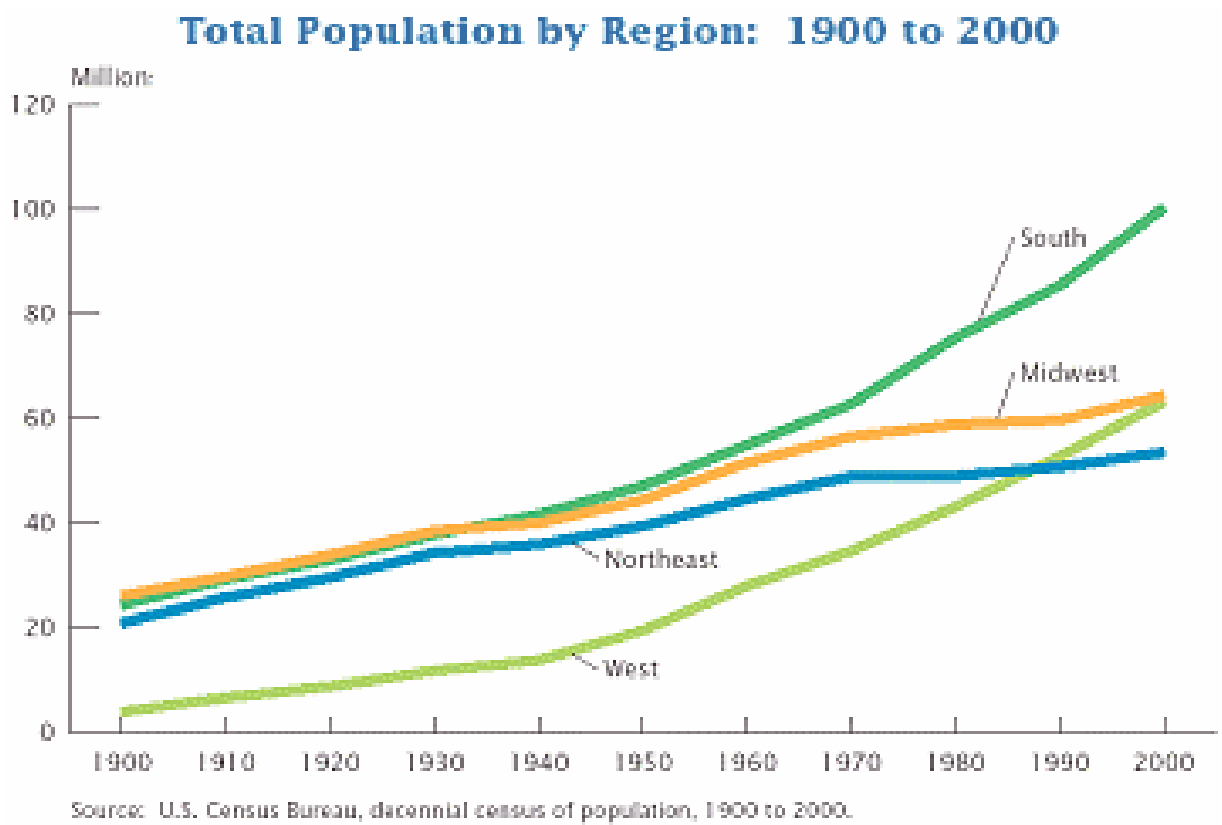
MTBE – Water Supply contamination

Tall Stacks – Acid Rain

YOUR GENERATION WILL NEED TO LEAD THE WAY

WILL REQUIRE A WORKING KNOWLEDGE OF THE SYSTEMS TO ADDRESS CRADLE TO GRAVE IMPACTS OF ENERGY STRATEGIES.. And TRADEOFFS

U.S.A.

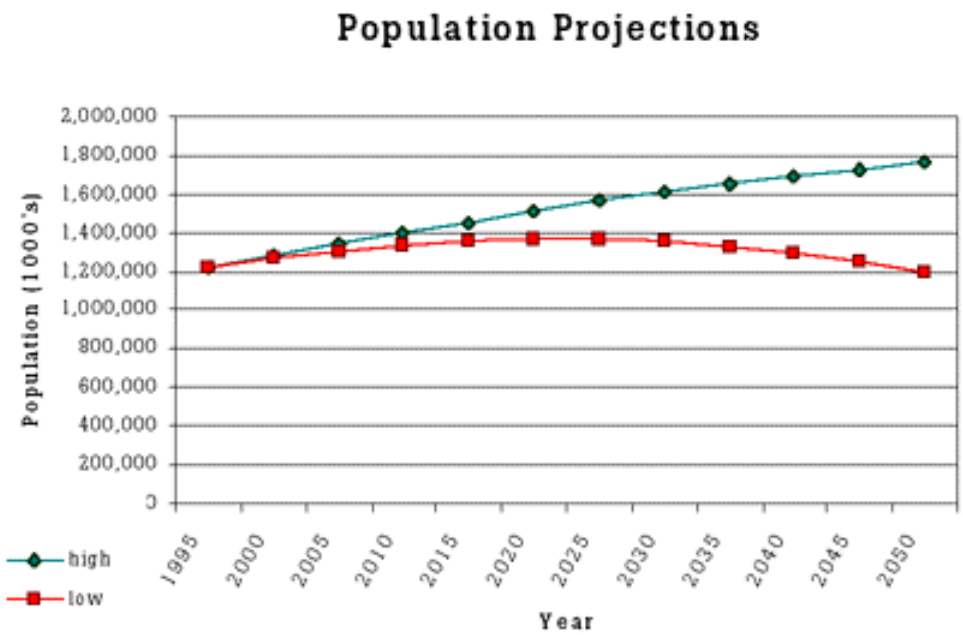


Census 2000 in United States, counted 281 million people. 33 million people added to the U.S. population between 1990 and 2000 is the largest census-to-census increase ever. The growth rate during the 1990's was 13 percent more than the rate in the 1980's at 10 percent, but significantly less than the rate experienced during the 1950's, baby boom contributed to an 18 percent gain.

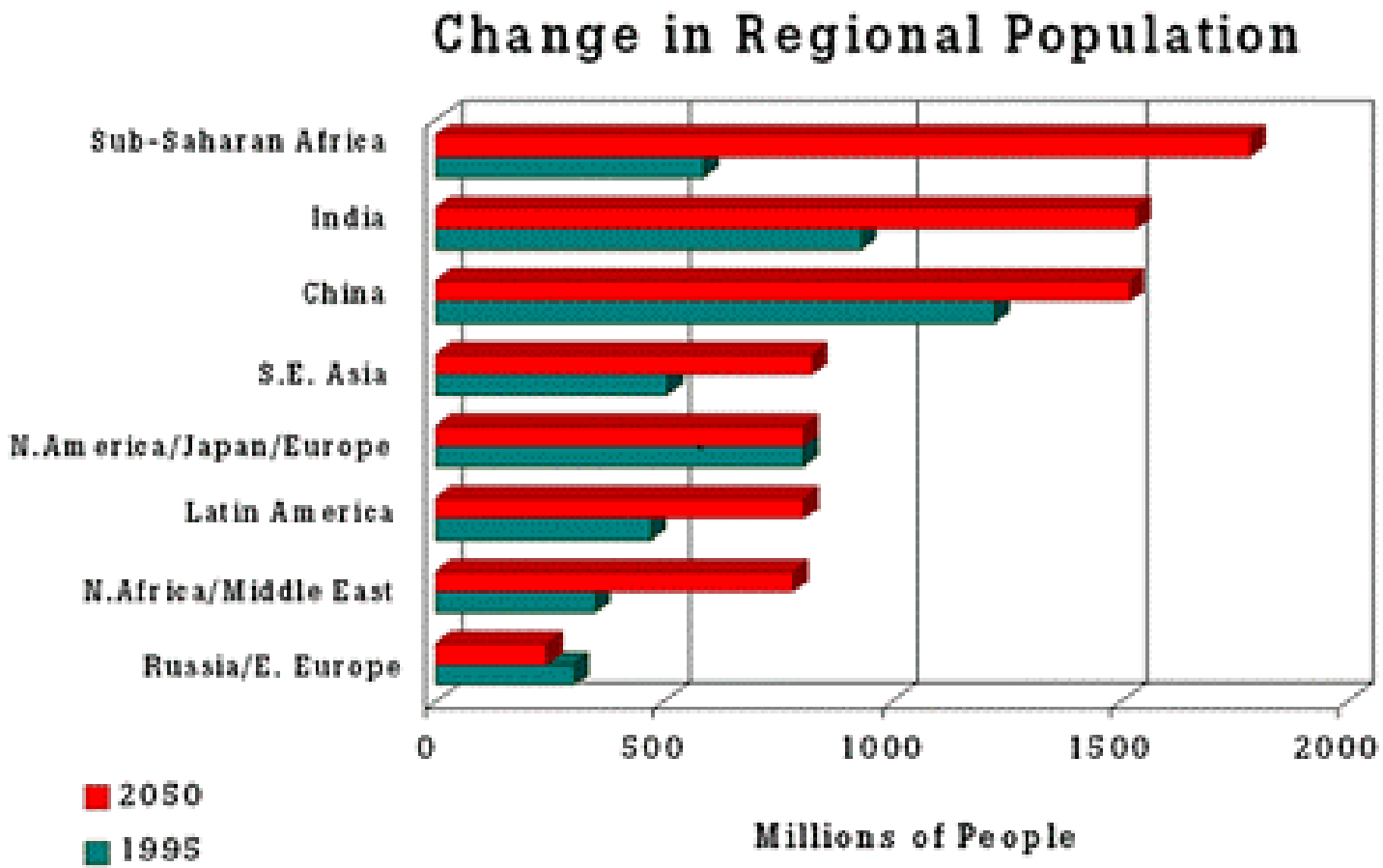
In 2003- U.S. Topped 290 Million (1% increase in a year).

Better health care impacts

Longer life expectancy



Over the past half century, the world's population growth is at 2% each year, doubling in 37 years and increasing from about 2.5 billion in 1950 to 6 billion by 2000. The growth rate is slowing, so the world's population may not double again by 2050. Even so, the population will probably be 9.4 billion (7.7-12.4 range) considering declining birth rates and AIDS or other epidemics. The Future Globe Will Be a More Crowded Place.



And most of the Change will be in Africa, Asia, and South America

FUTURE WILL REQUIRE GLOBAL CHANGE TO ADAPT TO THE POPULATION DISTRIBUTIONS FOR FOOD, WATER AND ENERGY

WILL NEED GLOBAL COOPERATION AND PLANNING AND A REAL UNDERSTANDING OF THE GLOBAL SYSTEMS.

IMPROVED TECHNOLOGY WILL PLAY A ROLE

SO WILL INFORMED LAND AND RESOURCE MANAGEMENT

ENVIRONMENT AND ENERGY USE WILL NEED TO BE EXAMINED JOINTLY FOR LONG TERM SOLUTIONS!

REAL NEED FOR BETTER SCIENCE IN ENVIRONMENTAL SCIENCE AND GLOBAL CHANGE RESEARCH – AND WELL TRAINED SCIENTISTS – YOU (SURE AND GREF)

GOOD LUCK WITH YOUR RESEARCH EFFORTS IN SURE AND GREF – IT ALL ADDS UP TO BETTER KNOWLEDGE BASE!