



Changing Environment Changing Health

North Carolina IOM Task Force on Prevention

14 January 2009, Raleigh

Katherine M. Shea MD, MPH

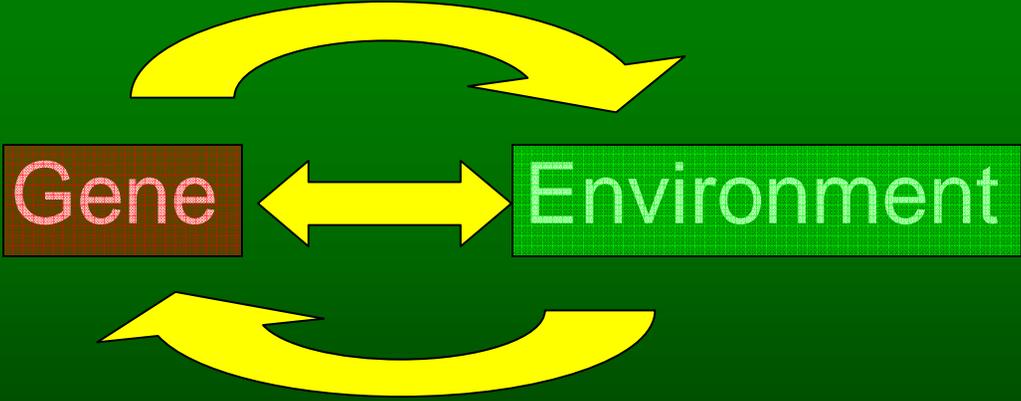
Guiding Principles

- I. Public health requires environmental sustainability**
- II. Protection of the most vulnerable groups should drive public health policy**
- III. Precaution should be the default paradigm for policy and action**
- IV. People from all groups must be involved in developing and evaluating solutions**

Health is

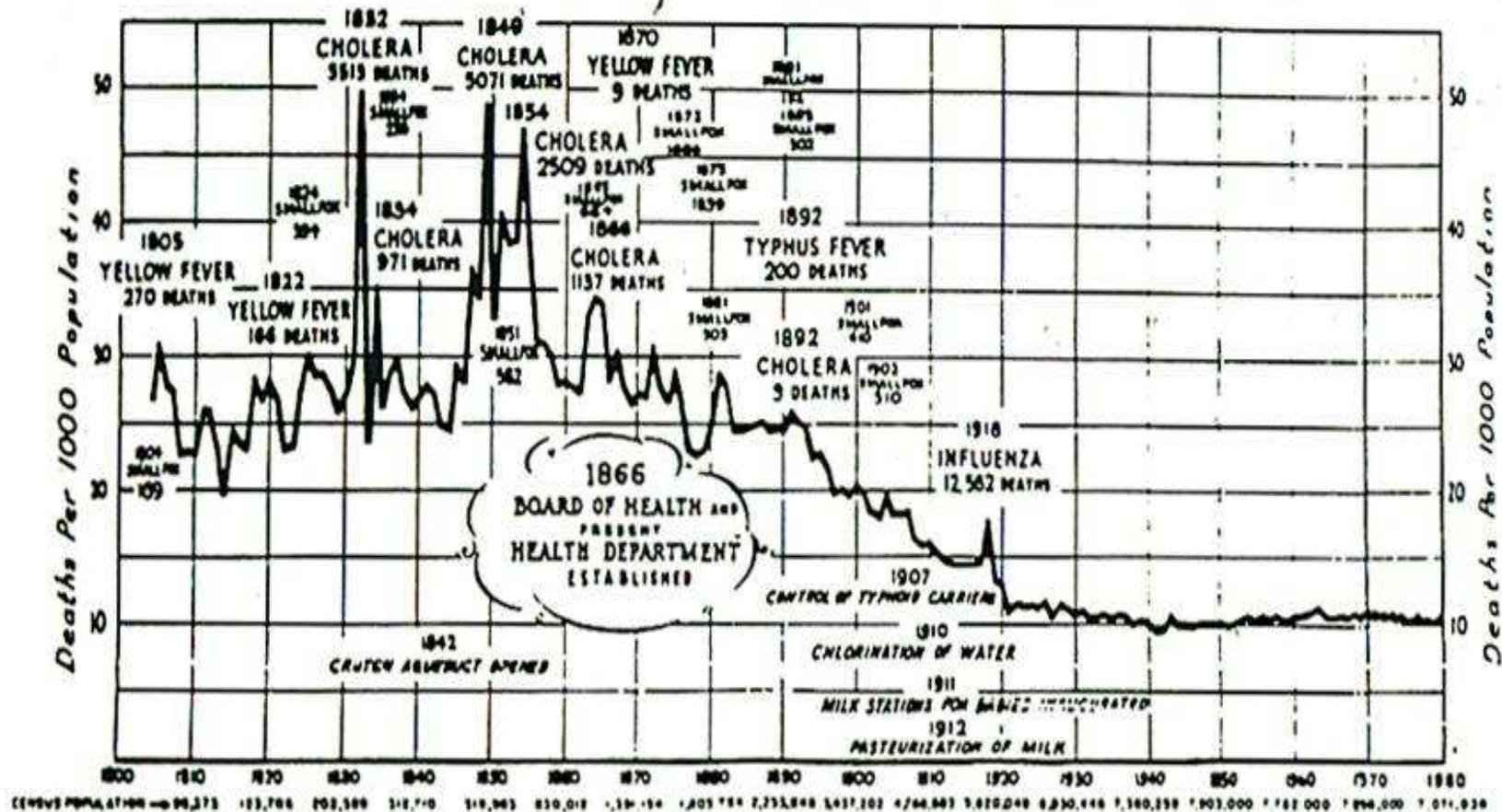
- “... a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”

WHO

- produced by 

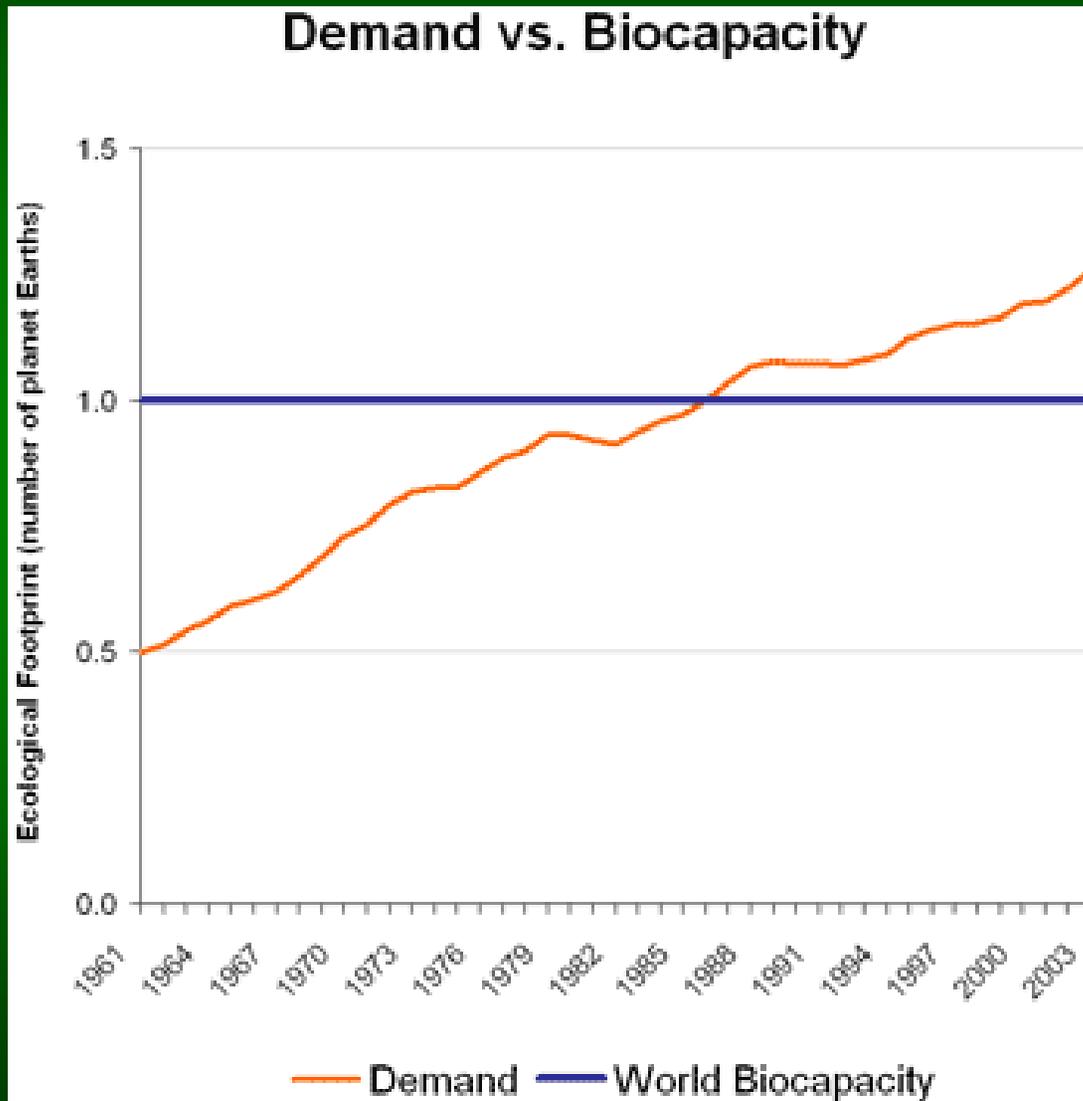
The CONQUEST OF PESTILENCE in NEW YORK CITY ~

... As Shown by the Death Rate as Recorded in the Official Records of the Department of Health.



Courtesy of Dr. Phil Landrigan, Mt Sinai Medical Center, NYC

We have a problem!



- As of 2003 demand exceeded biocapacity by 25% per year
- **It takes 15 months to regenerate all the resources we use in 12 months**

Human Numbers Through Time: A.D. 0



300 M

www.pbs.org/wgbh/nova/worldbalance/numbers.html

Human Numbers Through Time: 1000



Human Numbers Through Time: 1800

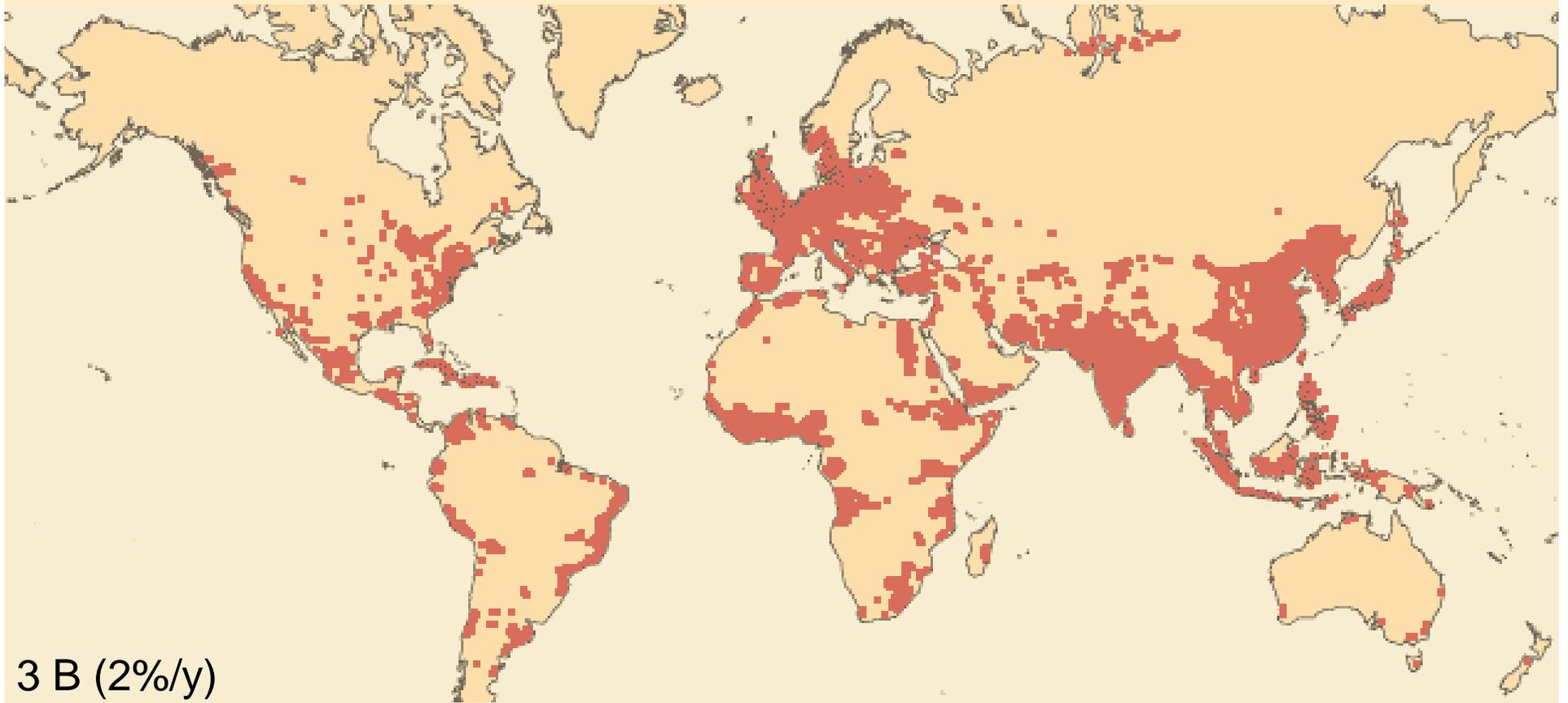


1 B

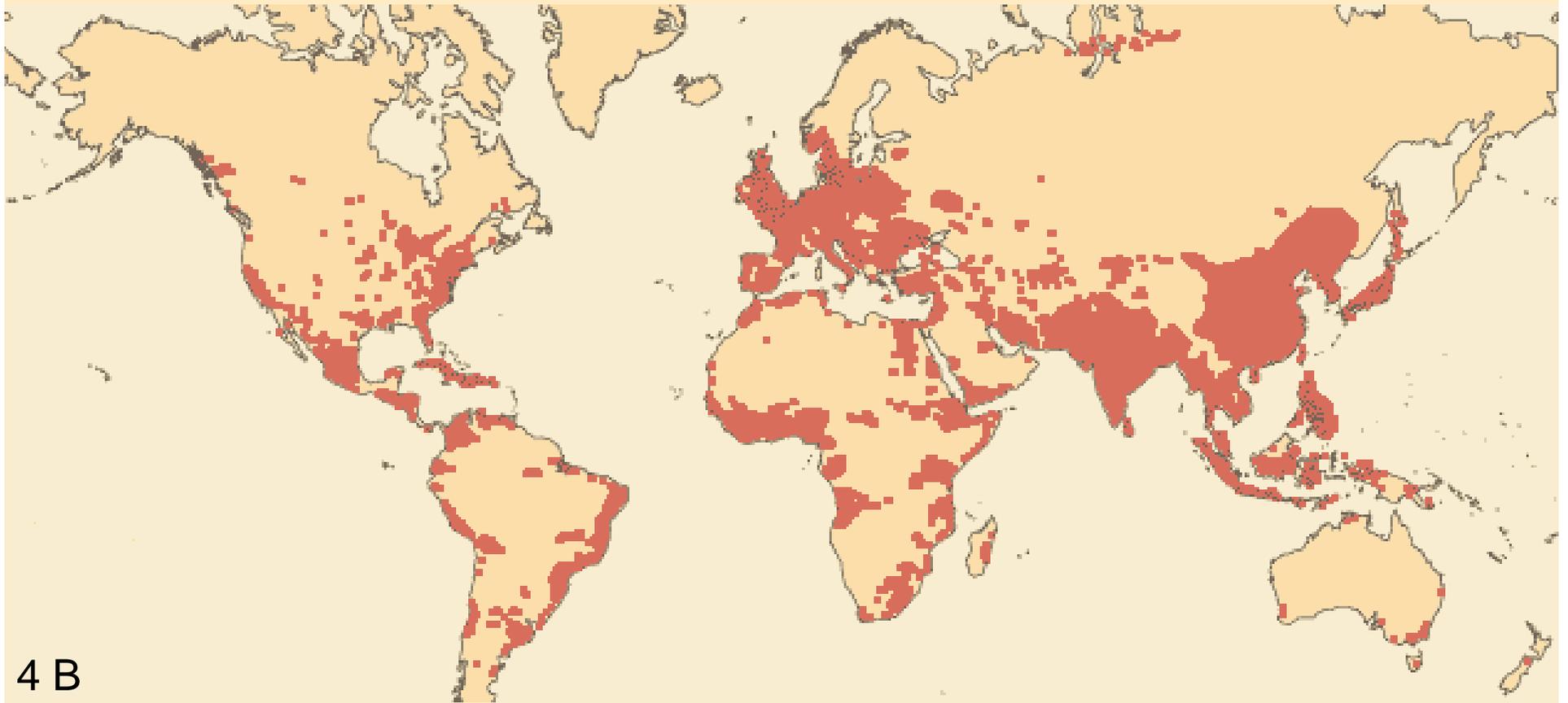
Human Numbers Through Time: 1927



Human Numbers Through Time: 1960

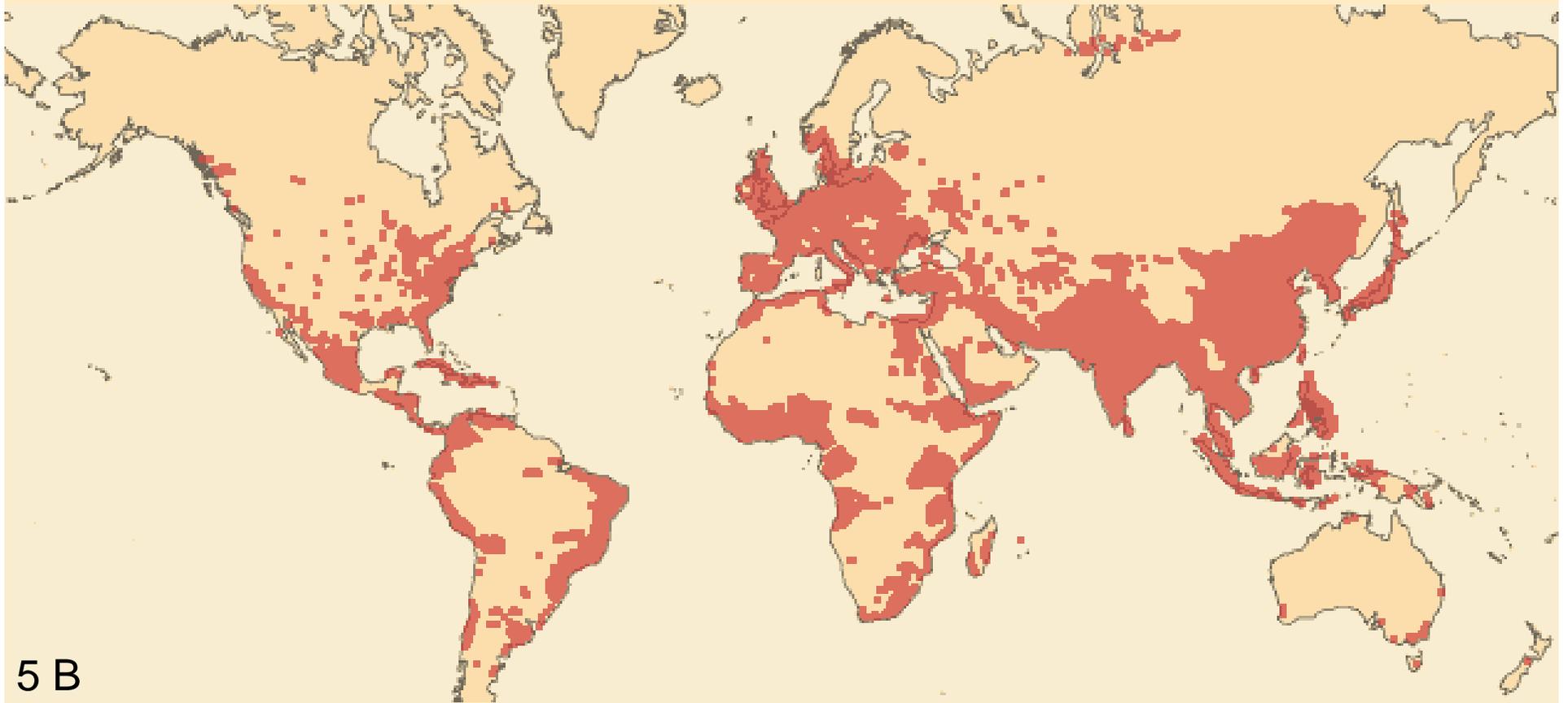


Human Numbers Through Time: 1974



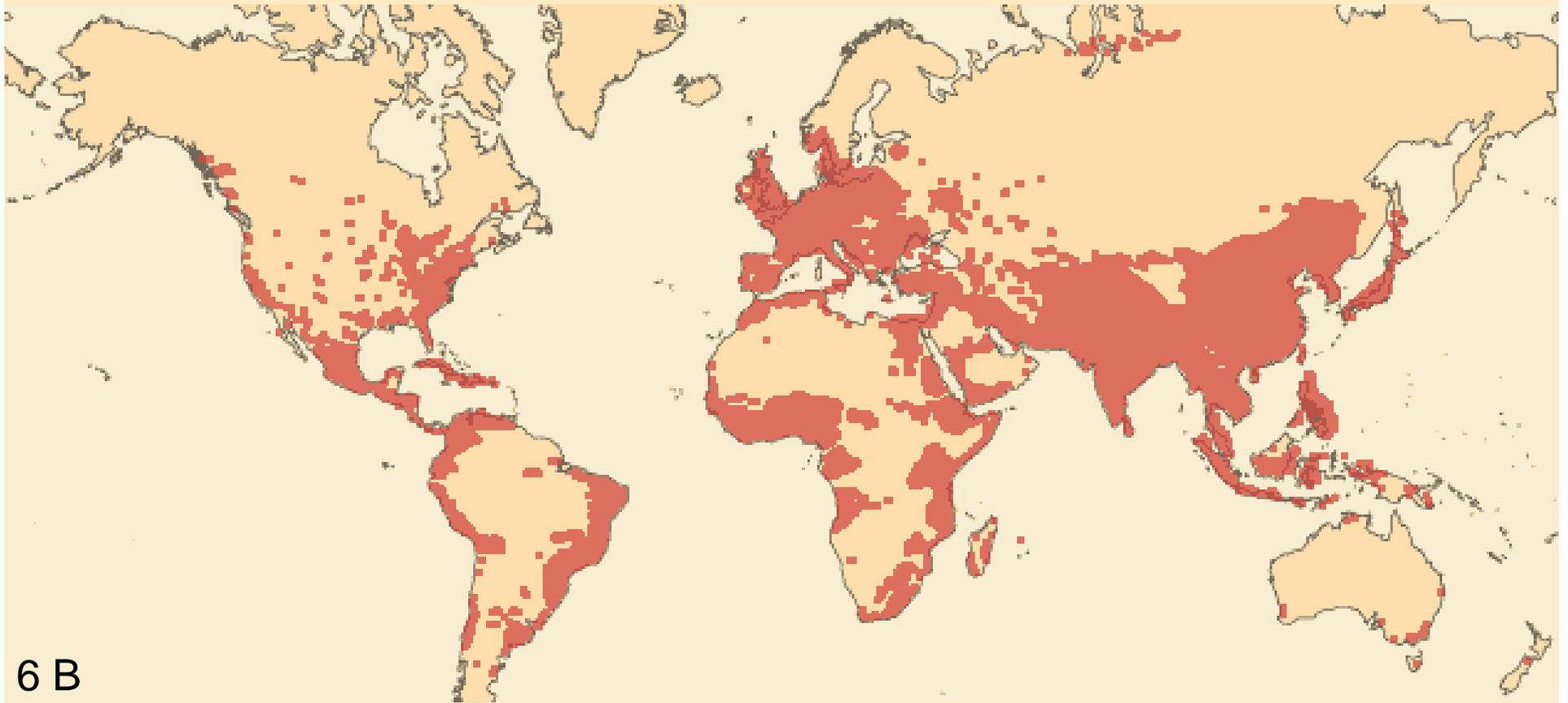
4 B

Human Numbers Through Time: 1987



5 B

Human Numbers Through Time: 1999



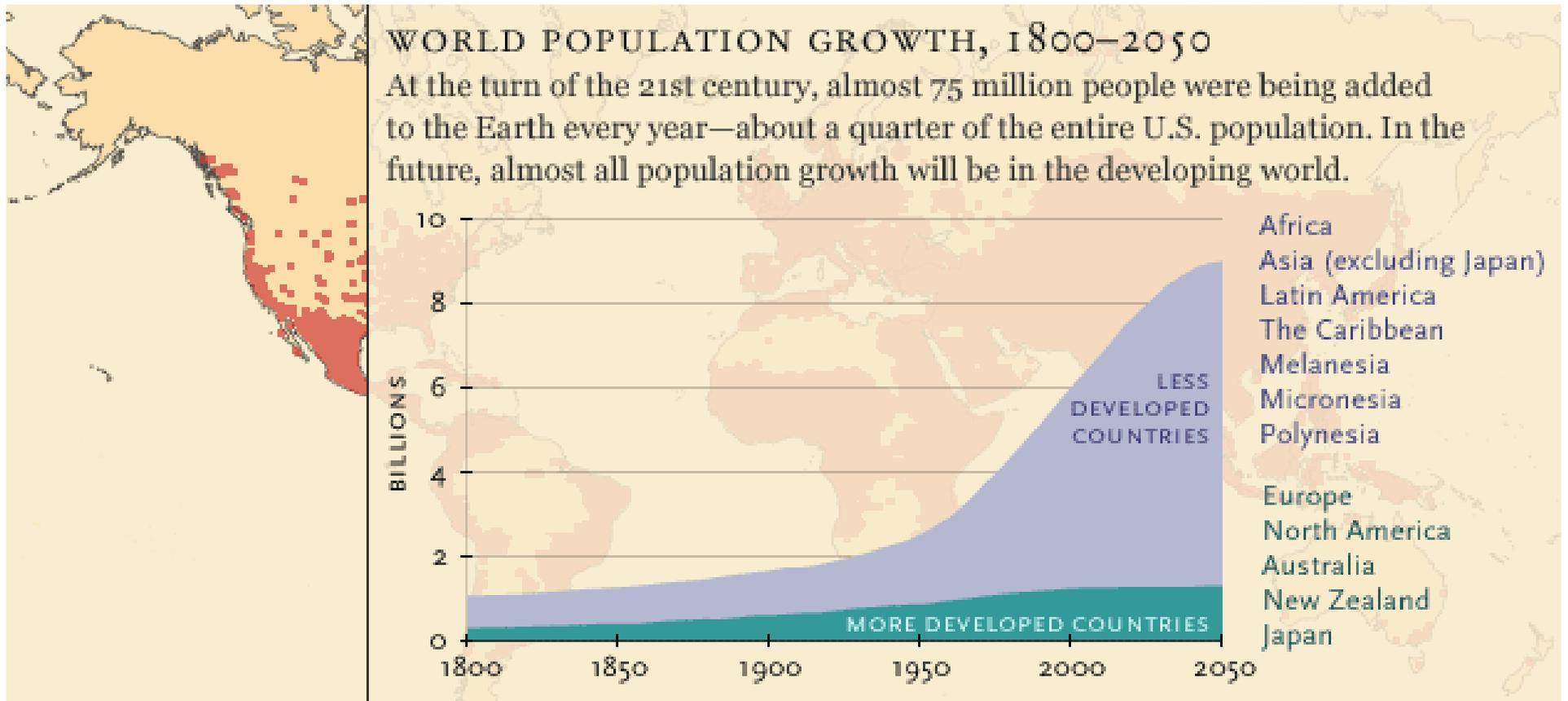
6 B



6.75 B

*Not just how
many, but
HOW
are humans
living on
earth....*

“Overpopulation” from the Millennium Series
by Victor Cauduro Rojas *With permission from the artist*



- Most Growth in **Urban Areas** less than 3 million
- **Industrialization** and Technology Transfer
- **Globalization** of Food, Goods, Services, Finance, Information, Culture, Risks and Costs

Unprecedented Changes



Massive loss of summer Arctic ice opens Northwest Passage in 2007!

Photo: NASA Earth Observatory

- Planetary Life Support Systems
 - Climate Change
 - Stratospheric Ozone
- Distribution & Abundance of Life
 - Land Transformation
 - Over Hunting/Fishing
 - Invasive/Exotics
 - Extinction
- Acceleration of Genetic Change
 - Creation/Use of Chemicals
 - Bioengineering

Changing Environment: *Anthropocene Epoch*



City Lights

Visible Earth NASA

- **Scale of Change**
 - Microscopic → Planetary
 - Air
 - Water
 - Food
 - Fiber
- **Rate of Change**
 - Decades not Millennia
- **Inequity**
 - Within & Among Nations/Regions
 - Across Generations

Changing Health



My daughter with my father, 1986

Epidemiologic Transition

- Decreasing
 - Infant mortality
 - Infectious disease
- Increasing Lifetimes
 - Chronic Diseases
 - Mental health disorders
 - Obesity
- Are we reaching the point of diminishing returns?

Changing Health

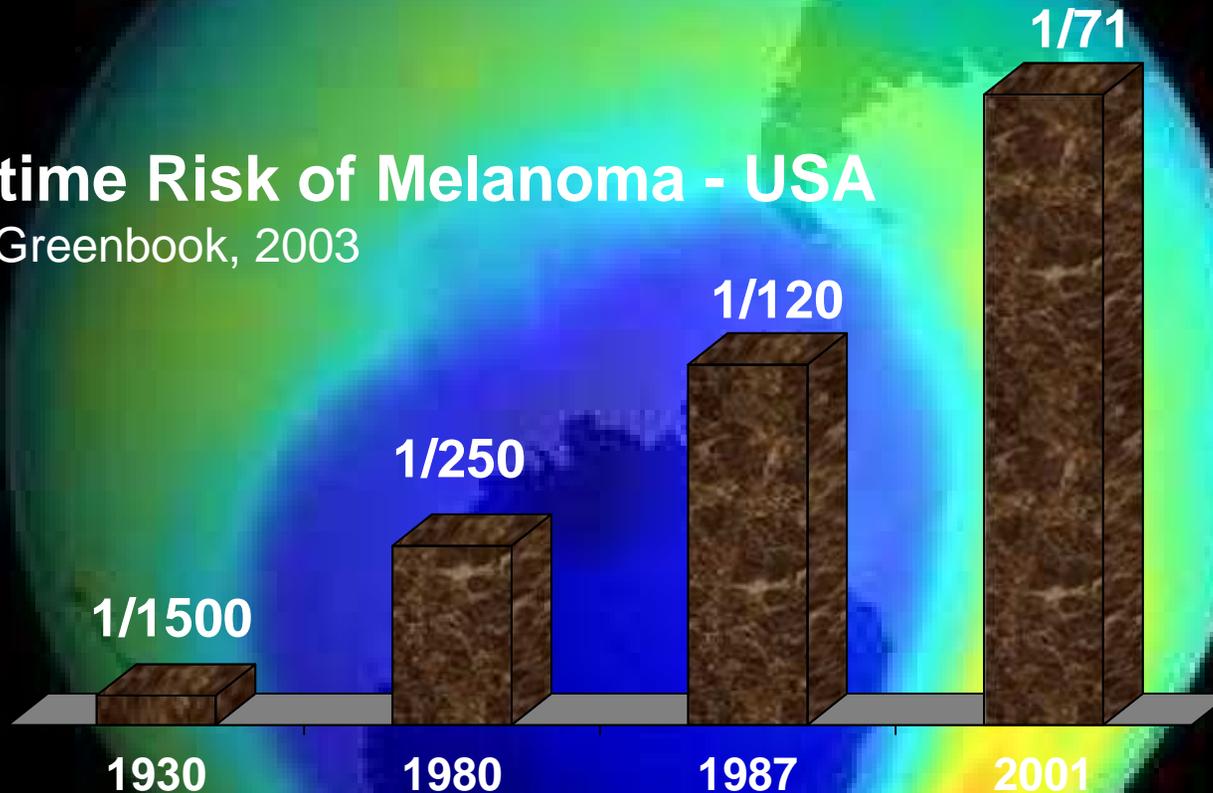


- We are measuring direct adverse health effects linked to our changing physical environmental.
 - Stratospheric Ozone Depletion
 - Global Warming
 - Globalization
 - Chemical Toxicities

Stratospheric Ozone Depletion

Lifetime Risk of Melanoma - USA

AAP Greenbook, 2003



- CMM in 15-19 yo increased 2.6%/yr from 1973-95
 - 1 in 5 Americans gets Non-Melanoma Skin Cancer
- More cataracts, immune deficiencies?

Global Warming:



- **Increased Heat Related Deaths**
- **Increased Air Pollution Related Illness and Death**
- **Injury, Death and PTSD from more frequent and severe Extreme Weather Events**
- **Increased Waterborne Diseases**
- **Increased Foodborne Disease**
- **Changes in distribution and frequency of Vector-borne Disease**

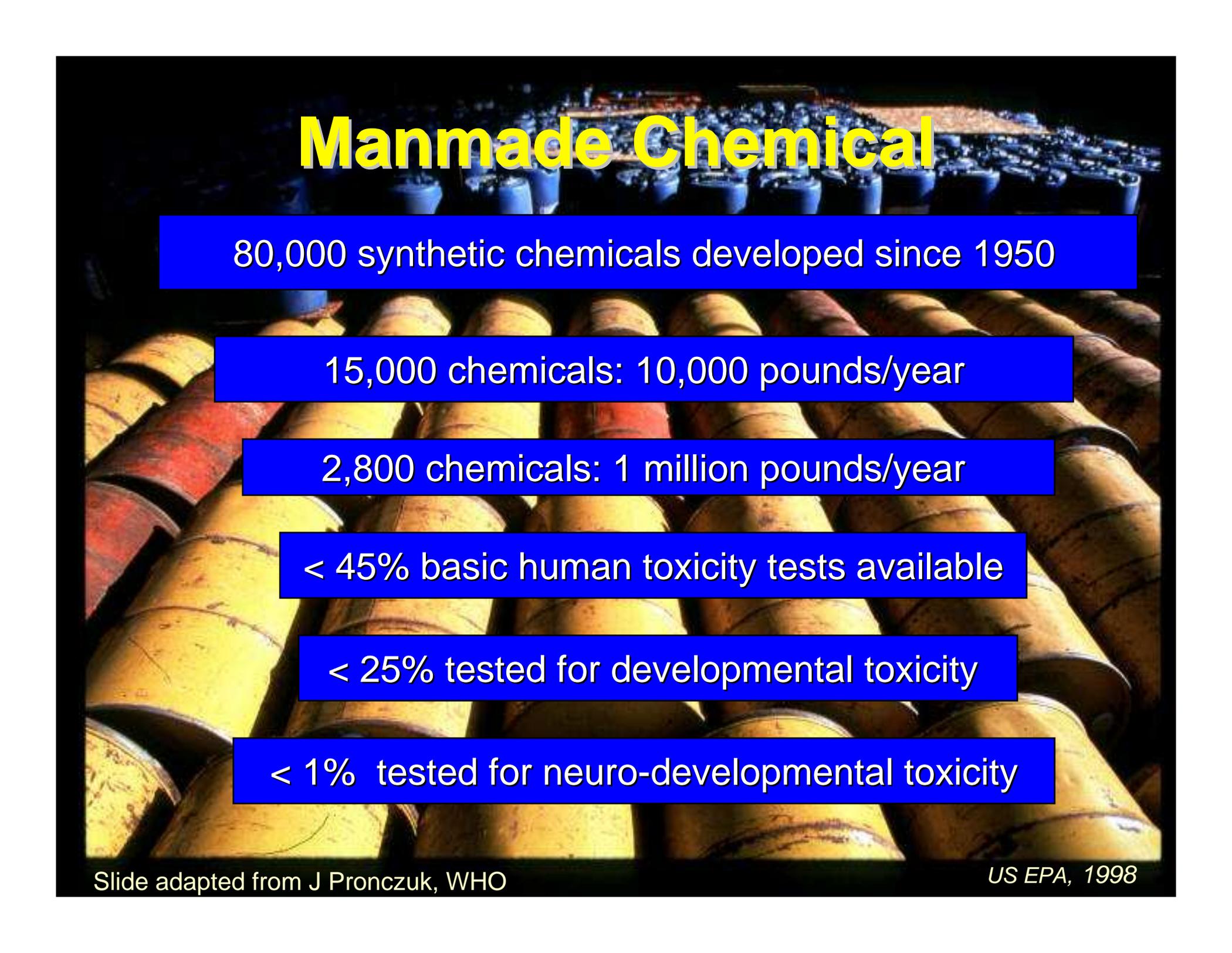
Globalization

Emerging, Re-Emerging Infections

- **Emerging Infections**
 - HIV, SARS, Prion diseases, looming bird flu
 - West Nile Virus in North America
- **Re-Emerging Infections**
 - TB
 - Multidrug Resistant
 - Malaria
 - Multidrug Resistant
 - Insecticide Resistant
 - MDR Pathogens



Manmade Chemical



80,000 synthetic chemicals developed since 1950

15,000 chemicals: 10,000 pounds/year

2,800 chemicals: 1 million pounds/year

< 45% basic human toxicity tests available

< 25% tested for developmental toxicity

< 1% tested for neuro-developmental toxicity

Chemical Toxicities

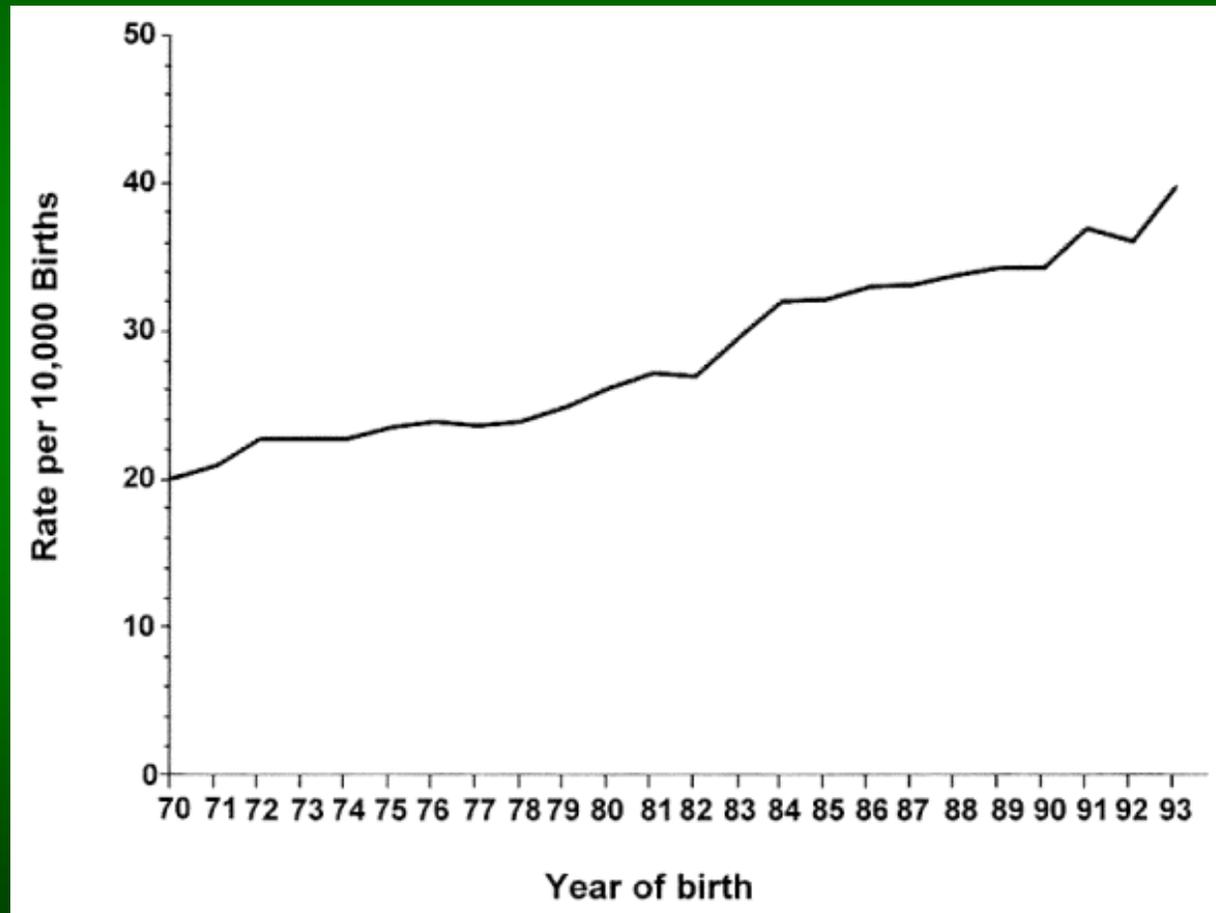
“...vast uncontrolled experiment with our children as the subjects?” Herb Needleman

- **1940-1960 F₀**
 - First Generation Exposed Postnatally
- **1960-1980 F₁**
 - First Generation Exposed Prenatally
- **1980-2000 F₂**
 - Second Generation Exposed Prenatally

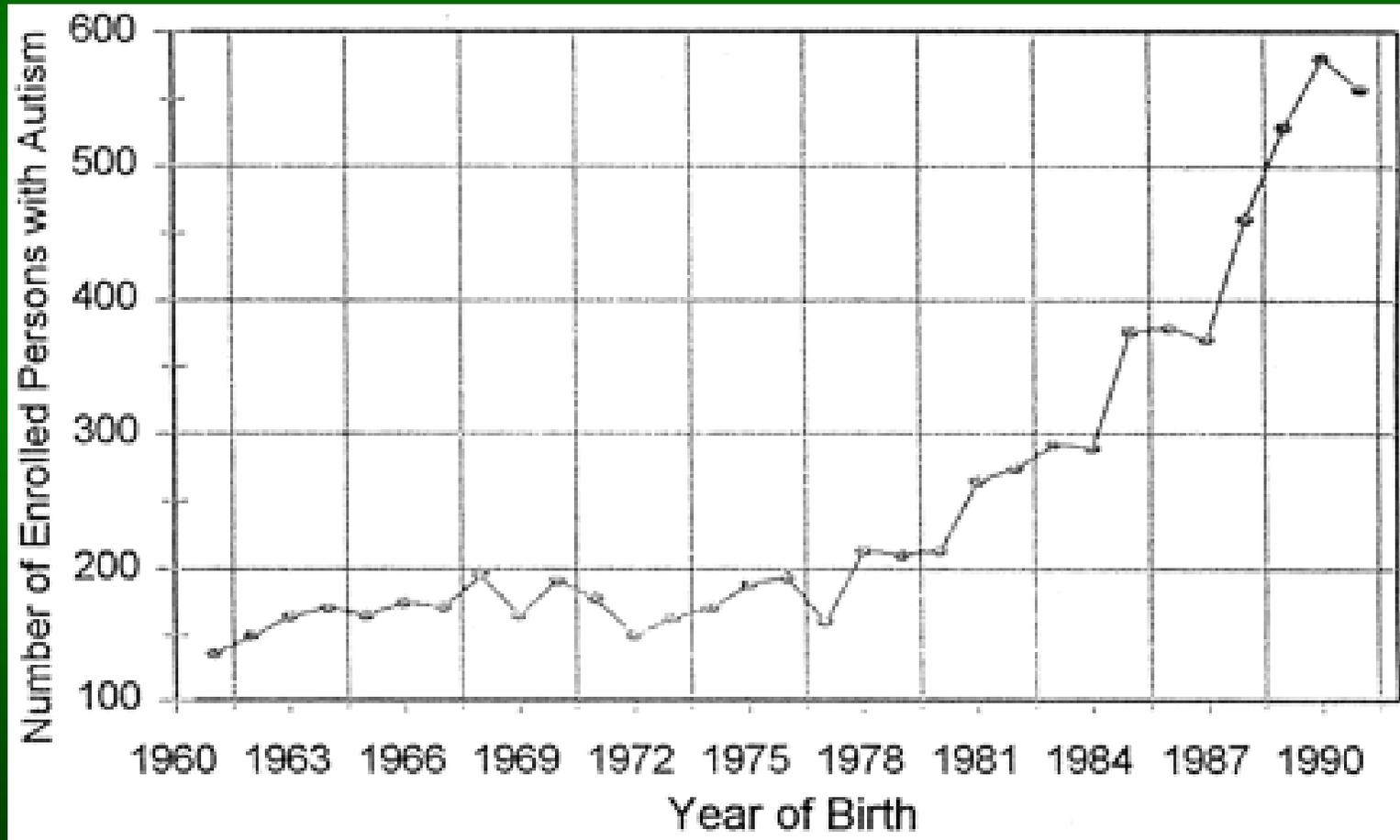


Adapted from Theo Colburn, WWF

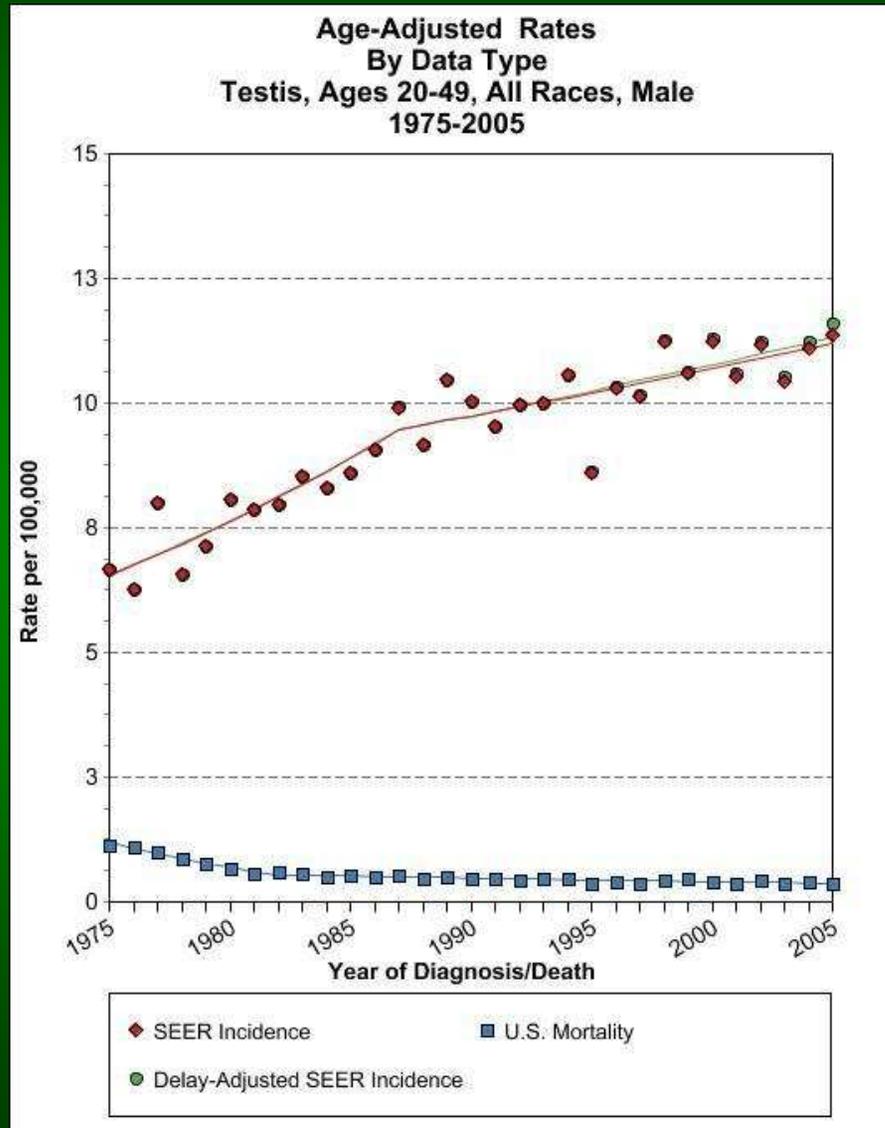
Toxic Chemicals: ??Hypospadias??



Toxic Chemicals: ??Autism??

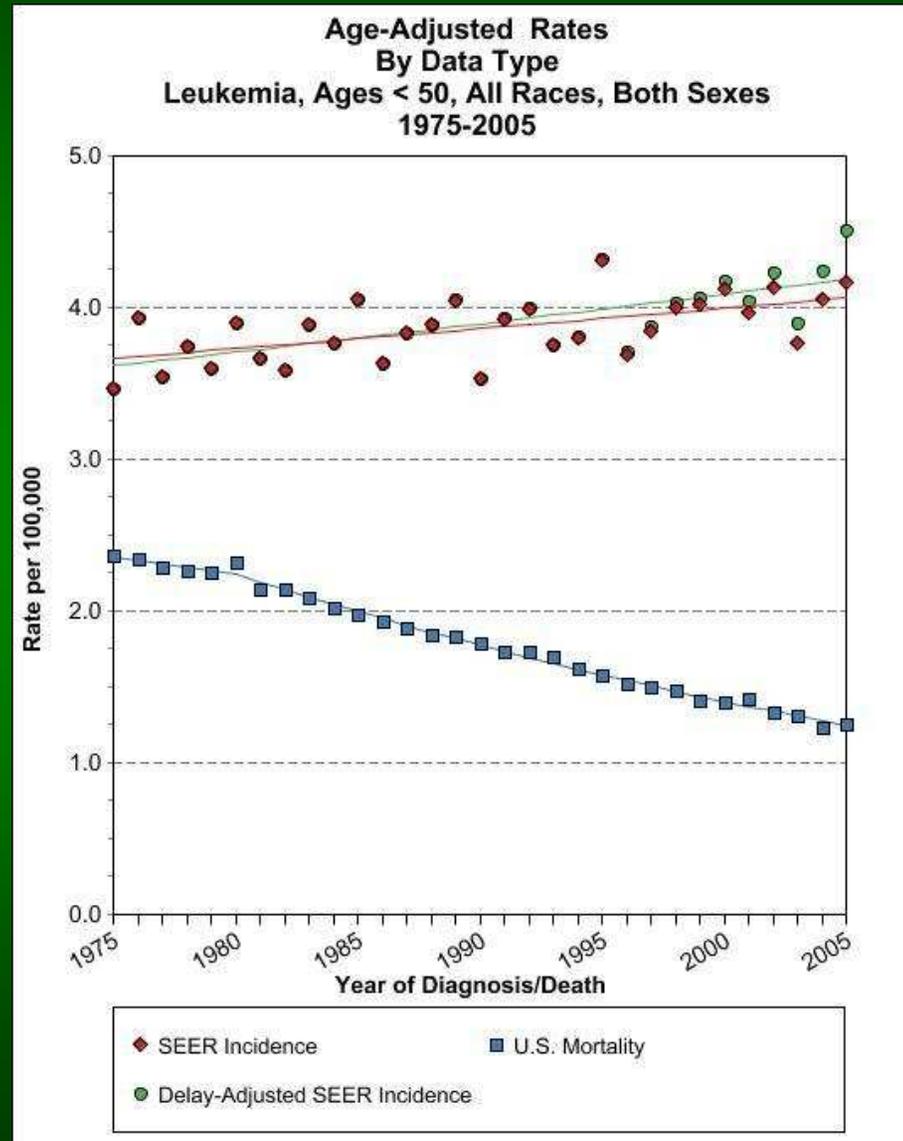


Toxic Chemicals: ??Cancers??



<http://seer.cancer.gov/faststats/selections.php#Output>

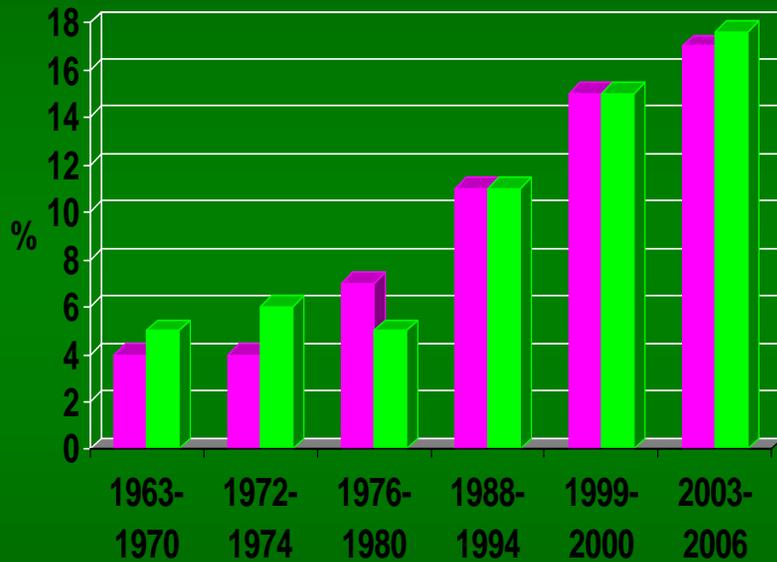
Toxic Chemicals: ??Cancers??



seer.cancer.gov/faststats/selections.php#Output

Big Health Trends in Children

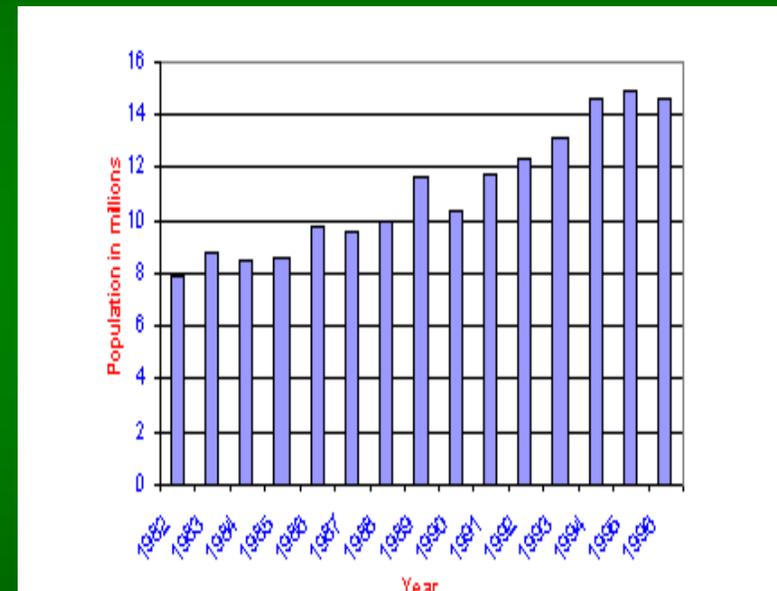
Childhood Obesity



CDC

■ 6-11 years ■ 12-19 years

Increasing Asthma



Rapid Changes → Environment

The most vulnerable suffer first- “Human canaries”



CDC



CDC



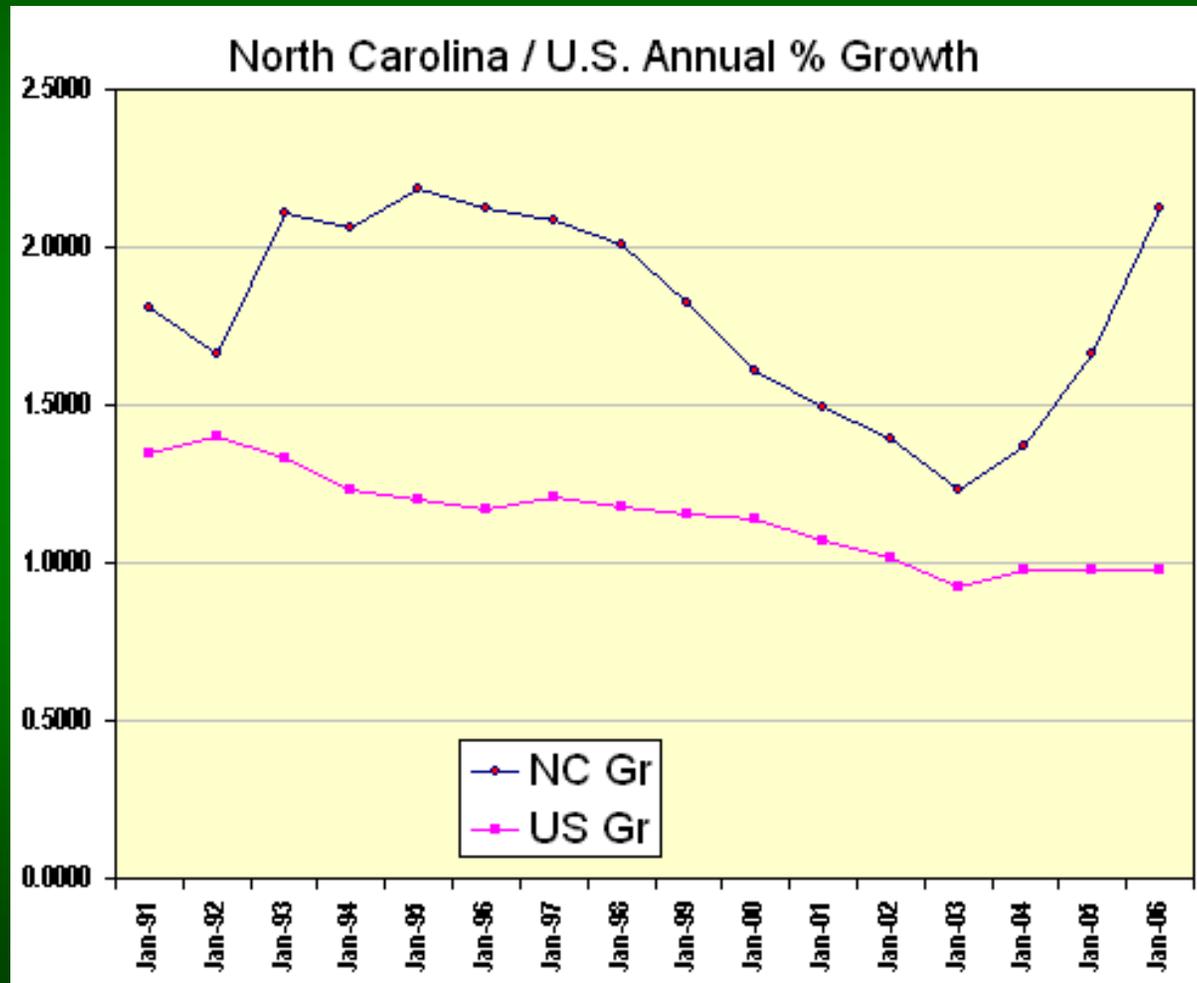
EPA

- Intrinsic characteristics
 - Extremes of age
 - Very young, very old
 - Poor health status
- Extrinsic characteristics
 - Low SES
 - Low Education
 - Geography
 - Proximity to toxic waste
 - High risk/exposure occupation
 - Farm workers
 - Cultural practices
 - Local fish consumption
 - Limited access to health care



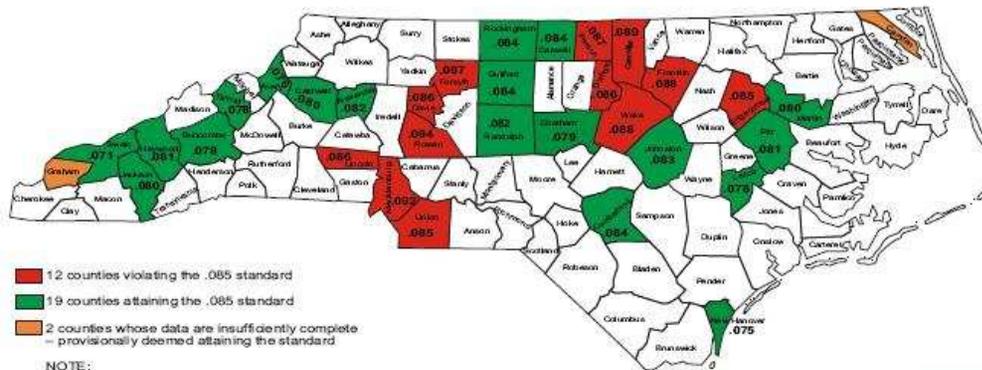
*Redbuds in Bloom, Great Smoky Mountains National Park
Photo credit: NPS*

Changing Environment – NC Population



Changing Environment – NC Air Quality

North Carolina Counties with 8-Hour Ozone Violations 2002-2004



NOTE:
 - additional counties may be involved in emission reduction strategies
 - nonattainment designations may differ from county boundaries

North Carolina PM2.5 Design Values, 2002 - 2004



Summary of 31 Counties
■ 11 well below annual standard
■ 15 moderately below annual standard
■ 3 slightly below annual standard
■ 2 above annual standard

<http://daq.state.nc.us/planning/attainment.shtml>

Worsening likely due to

- Population Growth
- Vehicles
- Power Plants
- Climate Change

Changing Health – NC Vulnerable Groups

Children under 18	2,205,000 ⁺
Seniors 65 and up	1,027,000 ⁺
Pediatric Asthma	392,500 [*]
Adult Asthma	642,000 [*]
Chronic Bronchitis	393,800 [#]
Emphysema	111,000 [#]
CV Disease	2,098,000 [#]
Diabetes	479,000 [#]
<i>Total State Population</i>	<i>8,561,000⁺</i>

*Burden of Asthma NC 2006 NCDHHS, +US Census 2006 estimates

#<http://www.stateoftheair.org/2008/states/north-carolina/groups-at-risk.html>

Changing Environment – NC Water Availability

Worsening Likely

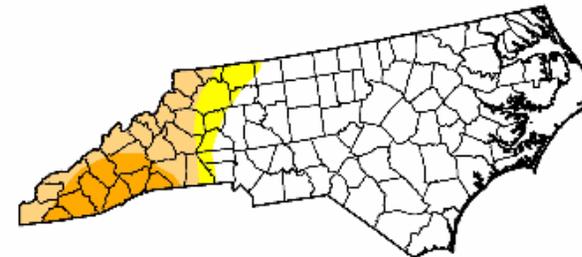
- Population Growth
- Climate Change

U.S. Drought Monitor North Carolina

January 6, 2009
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	76.7	23.3	18.4	7.2	0.0	0.0
Last Week (12/30/2008 map)	76.7	23.3	18.4	7.2	0.0	0.0
3 Months Ago (10/14/2008 map)	40.3	59.8	46.3	20.7	11.1	0.0
Start of Calendar Year (01/06/2009 map)	76.7	23.3	18.4	7.2	0.0	0.0
Start of Water Year (10/07/2008 map)	40.2	59.8	46.1	20.5	10.9	0.0
One Year Ago (01/08/2008 map)	0.0	100.0	100.0	100.0	83.7	51.3



Intensity:



The Drought Monitor focuses on broad-scale conditions.
Local conditions may vary. See accompanying text summary
for forecast statements

<http://drought.unl.edu/dm>



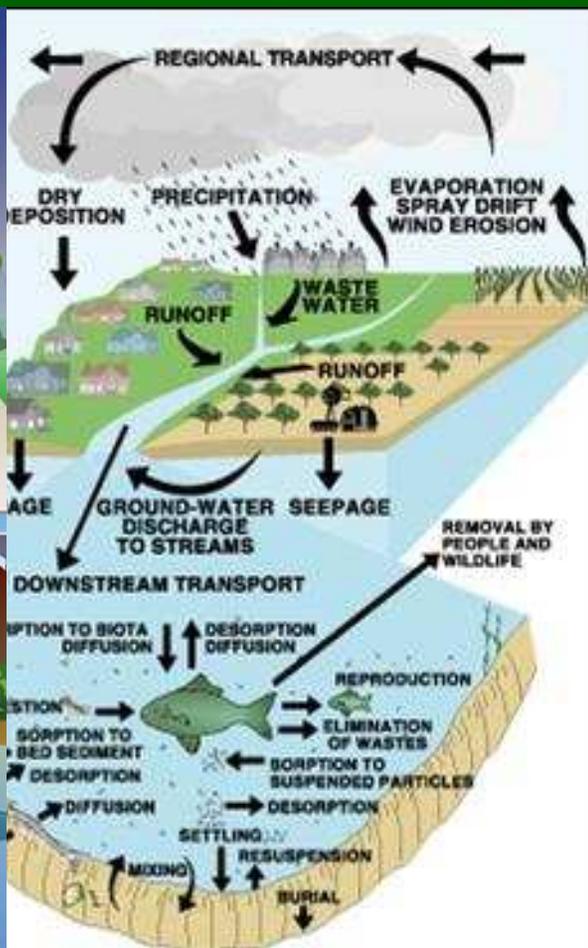
Released Thursday, January 8, 2009

Author: Brian Fuchs, National Drought Mitigation Center

Changing Environment – NC Water Quality



NC DENR



USGS

Worsening likely due to

- Population growth
- Land Development
- Chemical Use

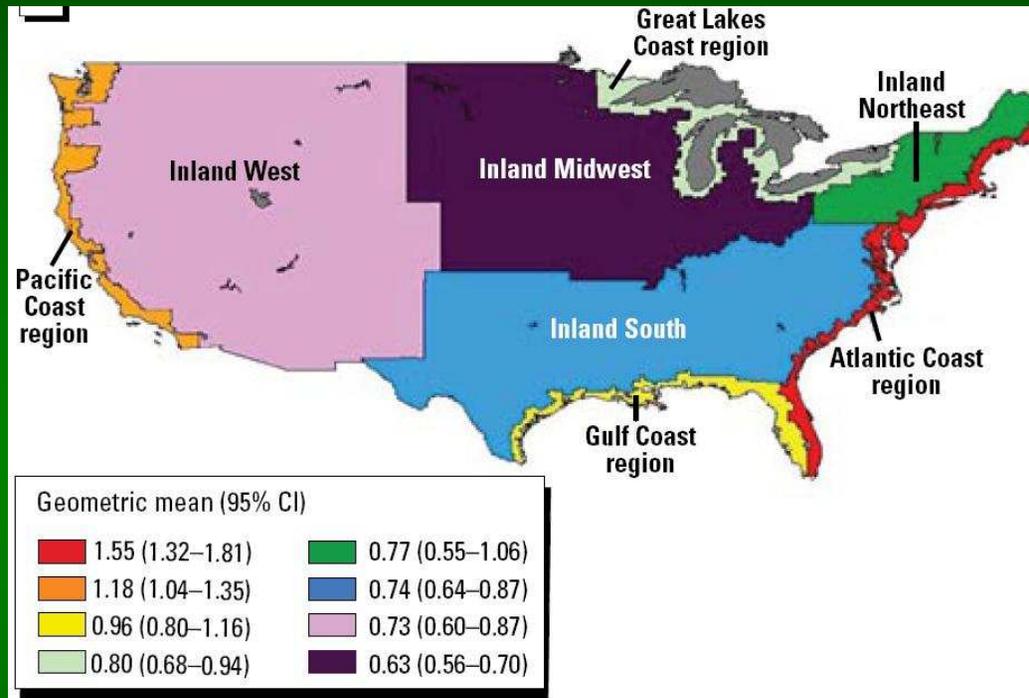
Changing Health – NC Vulnerable groups

- Geography
 - 1/3 NC on private wells, many in Eastern counties
 - Sandy, porous, soil
 - Shallow water table
- SES
 - 1.1 million NC below poverty
 - 400,000 children
 - 123,000 seniors
 - ~2 million NC below 150% poverty line
- Extremes of Age
 - 620,000 under 5
 - 121,000 under age 1
 - 1,027,000 over 65



EPA

Changing Environment – NC Food



Mahaffey. EHP Jan 2009

Will worsen with more coal power plants

Advice for Women of Childbearing Age and Young Children

One Fish

Two Fish

Don't Fish

Due to High Mercury Levels,
Women of Childbearing Age and Children
Should Not Eat:
Shark • Swordfish • King Mackerel • Tilefish

Do Fish

Eat 2 Meals per Week
of a Variety of Seafood Lower in Mercury,
such as:
Canned Light Tuna • Catfish • Pollock • Salmon • Shrimp
Eat Albacore (white) Tuna only once per week.

For more information, visit
www.epa.gov/waterscience/fish

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Revised to new product of the State Department of the Environment, December 19, 2001.
EPA 823-F-06-001, December 2006

Changing Health – NC Vulnerable groups

- 1,200,000 women
20-40 yrs
 - ~25% college or higher degree*
 - ~3-7% earn >\$100,000*
- 620,000 children
under 5

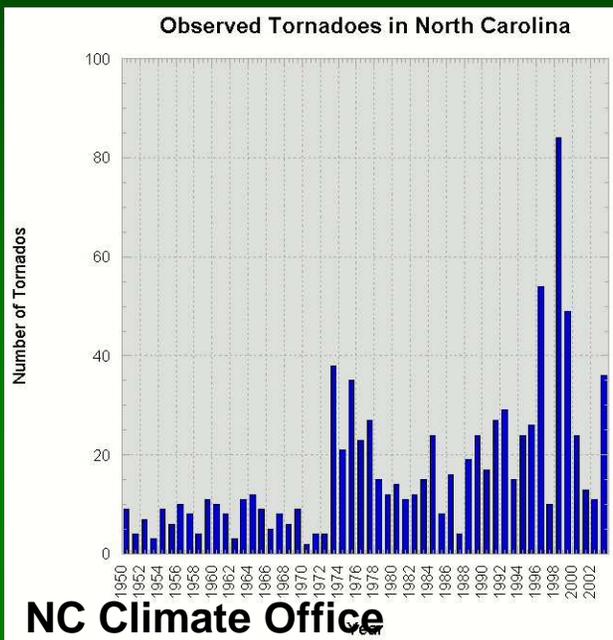


Little brother, Big sister, Yale Graduation
2008

*direct proportion calculated from US Census estimates

http://factfinder.census.gov/servlet/STTable?_bm=y&-geo_id=04000US37&-qr_name=ACS_2007_3YR_G00_S1501&-ds_name=ACS_2007_3YR_G00_-redoLog=false&-CONTEXT=st

Changing Environment – NC Shelter



EPA



Statesville 2006, NOAA NWS



Inspect-ny.com

Changing Health – NC Vulnerable groups

- 600,000 mobile homes*
- Houses built**
 - 1970 to 1979 - 641,117
 - 1960 to 1969 - 447,988
 - 1940 to 1959 - 536,608
 - before 1940 - 255,613(about 50% of houses)

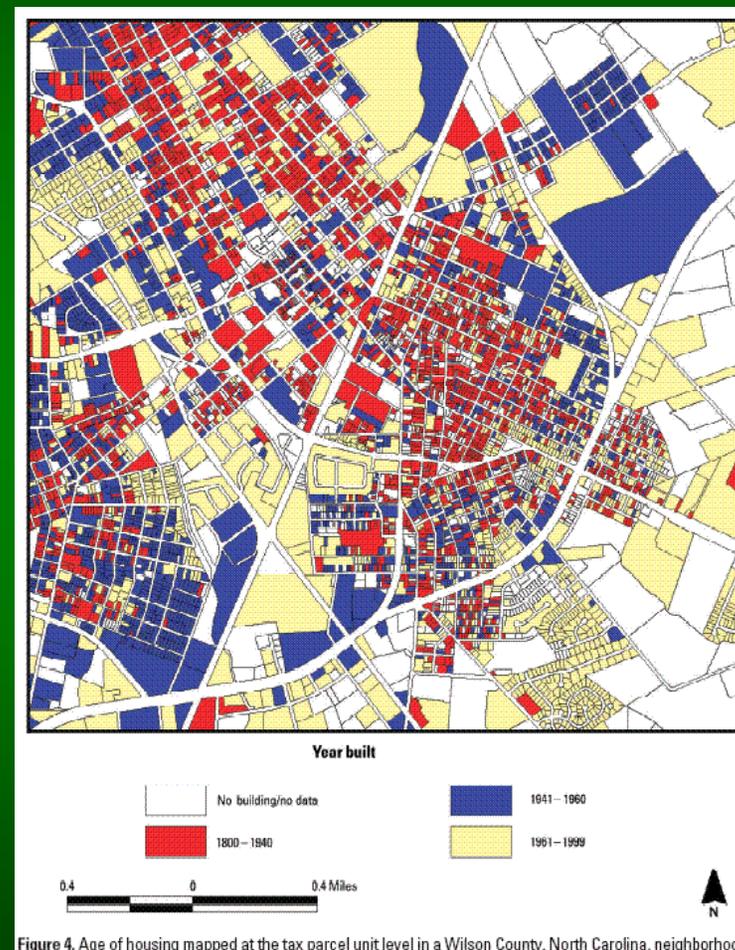


Figure 4. Age of housing mapped at the tax parcel unit level in a Wilson County, North Carolina, neighborhood.

*US Census, 2006 estimates

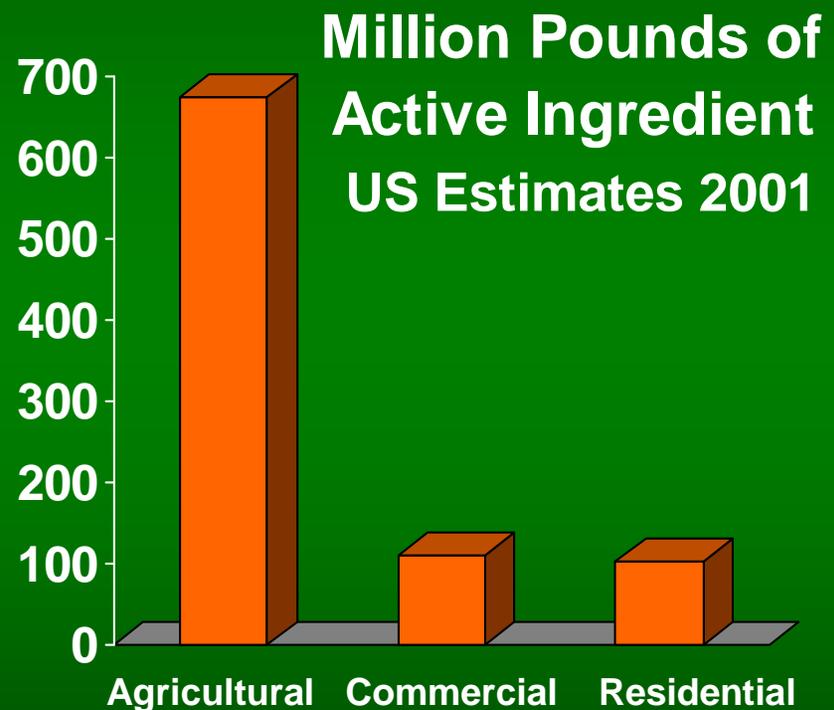
**2000 Census per Miranda

Miranda, EHP 2002

Changing Environment -- NC Chemical Toxicities

Pesticides are poisons

- Acute Exposures
 - Where used/stored
- Chronic Exposures
 - Food
 - Domestic
 - Imported
 - Water
 - 90% streams
 - 50% wells
 - Air
 - Spray-drift
 - Revolatilization
 - Surfaces
- Early Life-stage Exposures



http://www.epa.gov/oppbead1/pestsales/01pestsales/table_of_contents2001.htm

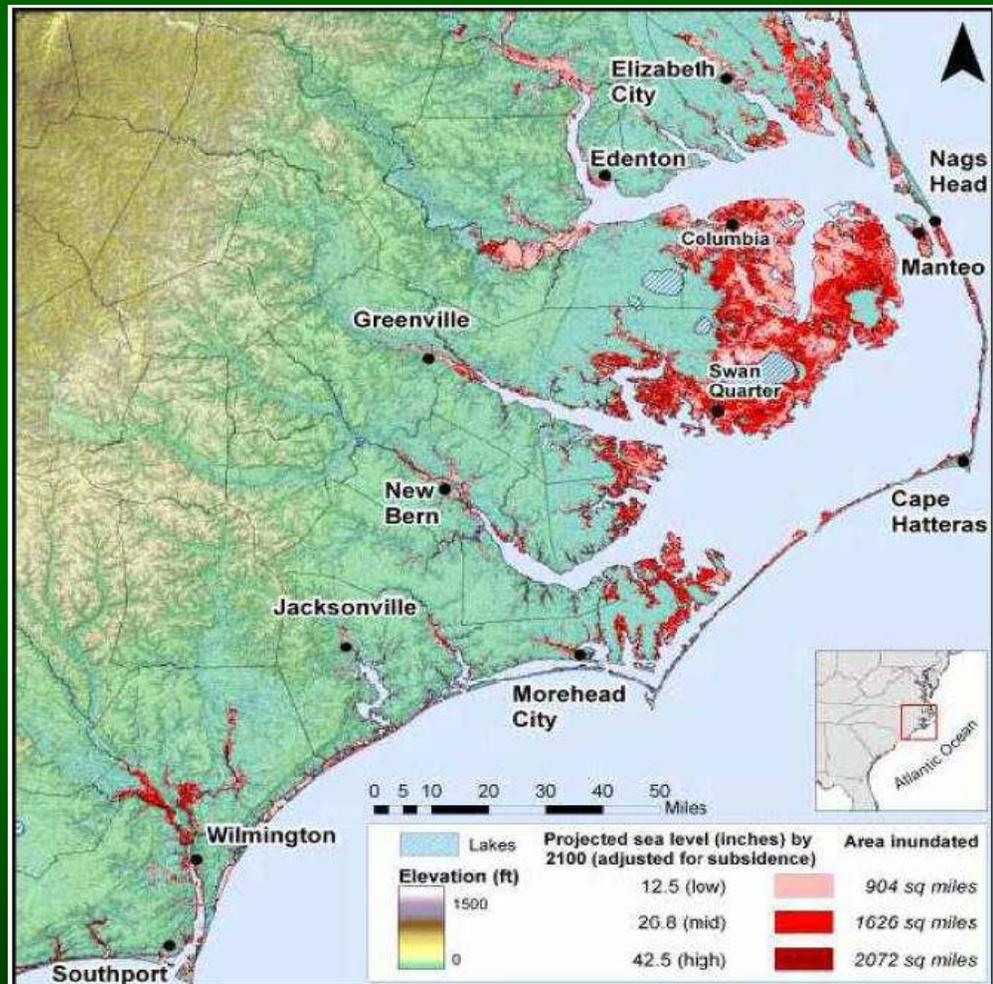
Changing Health – NC Vulnerable Groups



- Farm Workers (100-150,000 during season??)
 - Farm working women of childbearing age (#??)
 - Farm workers' children (#??)
- Pesticide Applicators and their families
- Infants and small children (620,000 under 5 y)
 - Women of child-bearing age (1.2 million 20-40 y)
- Elders (1 million over 65)

Changing Environment – NC Climate Change

- Land in RED at risk of loss by 2100 due to sea-level rise
 - 14 of 17 beaches studied GONE by 2080
- Lost wetlands
- Damaged fisheries
- Salt water intrusion
- Stronger storms
- More infections
- Worse air quality



Changing Health – NC Vulnerable groups



Manteo, NC (photo thecoastalexplorers.com)



Great Egret NPS NC National Sea Shore

Guiding Principles

- I. Public health requires environmental sustainability**
- II. Protection of the most vulnerable groups should drive public health policy**
- III. Precaution should be the default paradigm for policy and action**
- IV. People from all groups must be involved in developing and evaluating solutions**

I. Public health requires environmental sustainability

The ability of the current generation to satisfy all its needs while preserving the ability of future generations to do the same.

- “Enough” - needs not wants
- “Equity” – across place and time

II. Protection of the most vulnerable groups should drive public health policy

- Practical because all are protected
 - Canaries in the Mine Shaft
- Ethical because often most vulnerable have little voice – a matter of justice
 - Infants and children
 - Politically disenfranchised
 - Poor, poorly educated, communities of color
 - Future generations

III. Precaution should be the default paradigm for policy and action

Allows for taking action without complete information when there is a reasonable likelihood of potentially serious or irreversible threats to health or the environment.

- Analogous to Primary Prevention
- Common Sense – avoid unnecessary exposures
- Process requires considering alternatives, consulting wide range of stakeholders, transparency, iterative evaluation & research

IV. People from all groups must be involved in developing and evaluating solutions

High stakes game with civilization or species survival potentially on the line.

- Some solutions known, others not yet developed
- Experts must work together with policymakers
 - Triple bottom line – health, environment, economy
- Non-traditional partners must be recruited
 - High risk communities and groups, lawyers, religious leaders, artists, writers, children....

Sustainability

Precaution



Equity

Inclusiveness

Poster Contest by HRIDAY with support from WHO SEARO