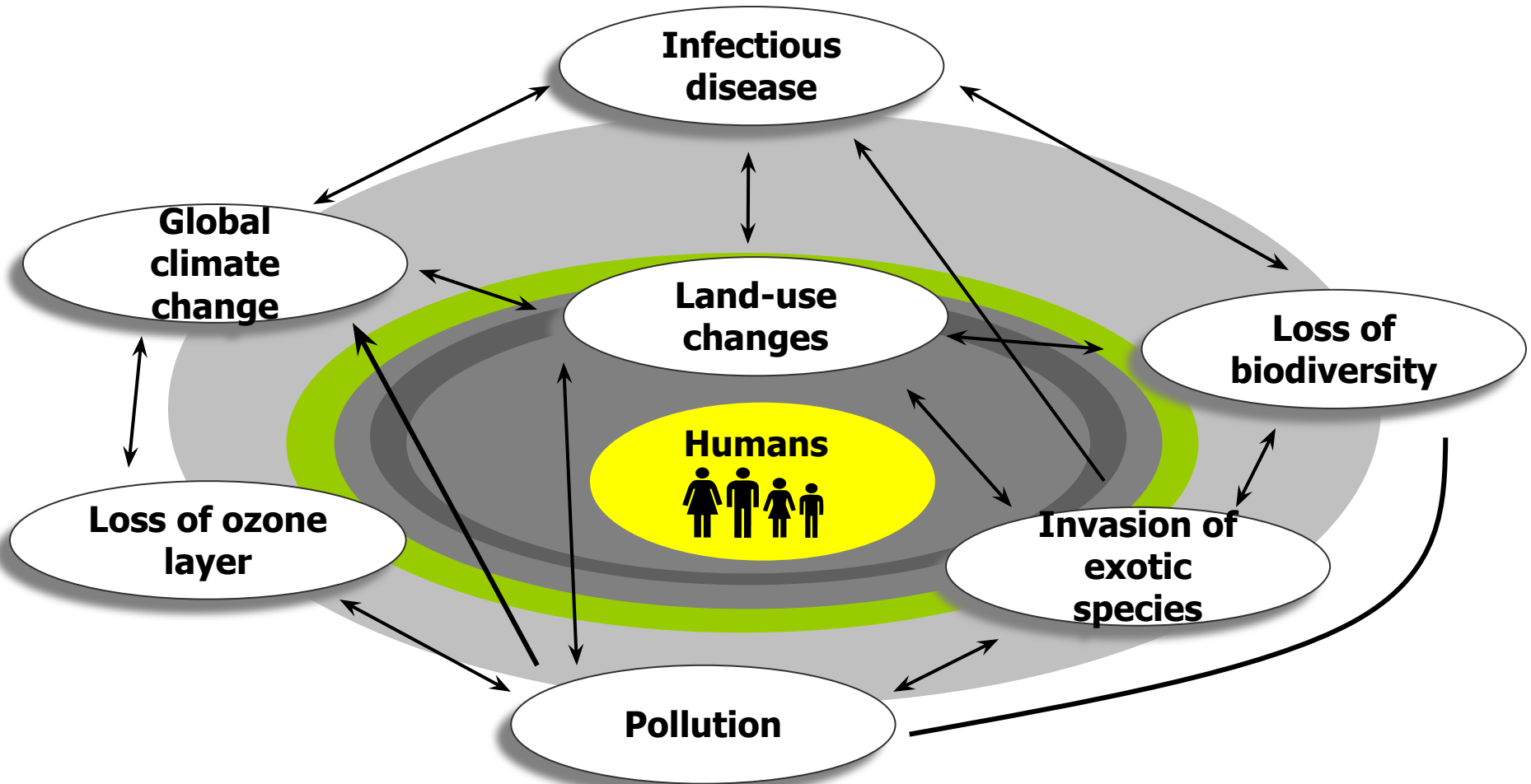


Human Accelerated Environmental Change



Photo: Heather Malcom

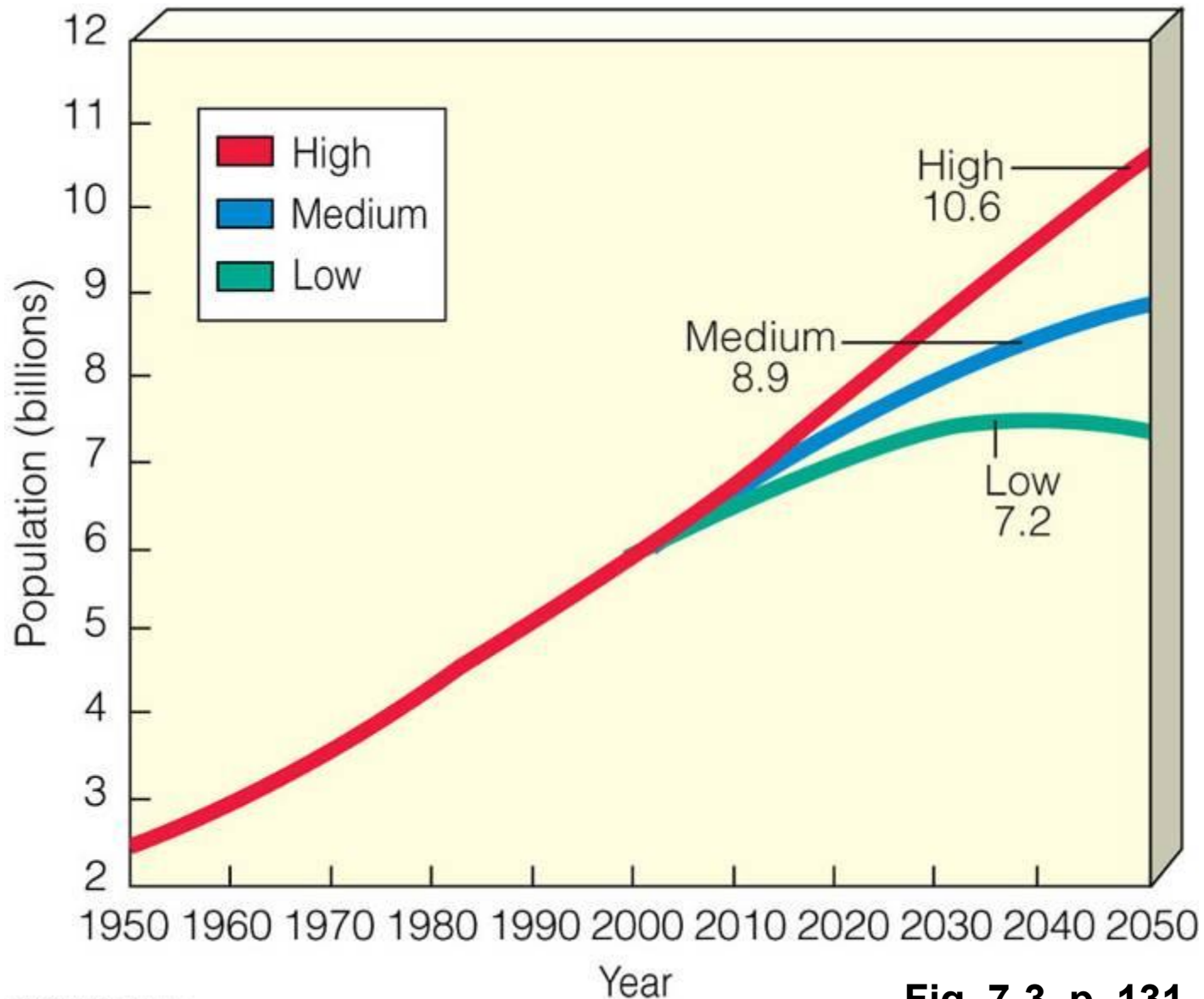
HUMAN-ACCELERATED ENVIRONMENTAL CHANGE



Likens 2004, Water, Air & Soil Pollution

More people means...?

World Population Projections

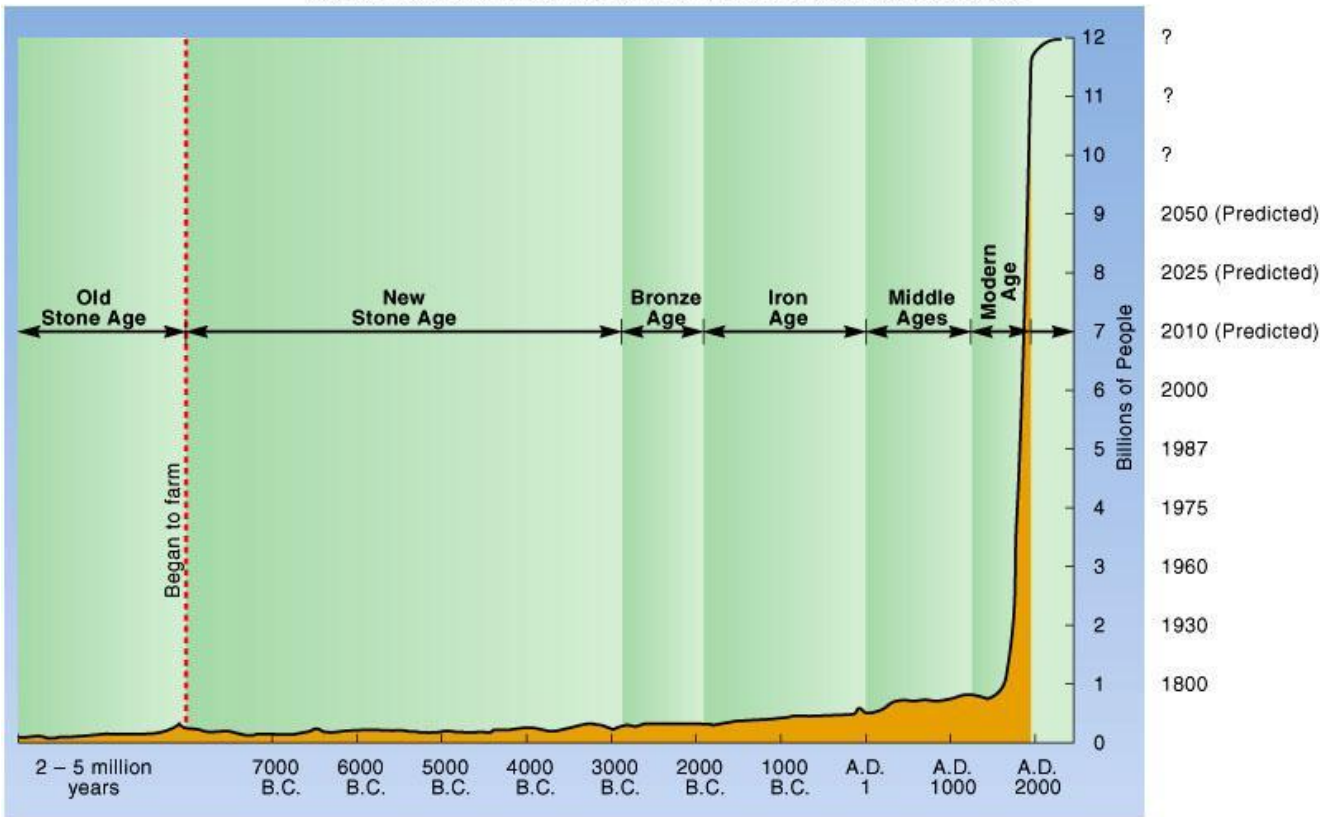


Global Trend #1:

Increasing human population

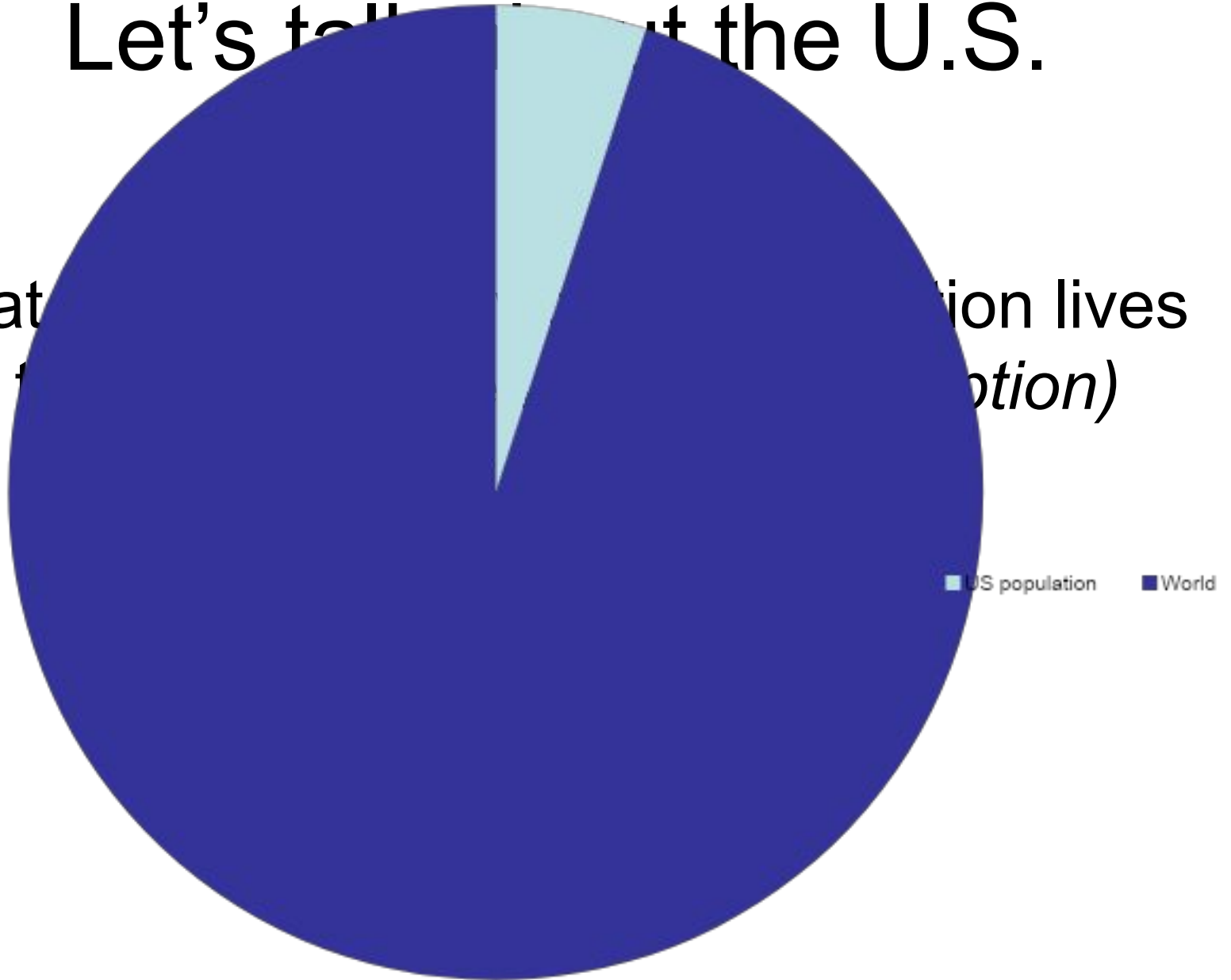


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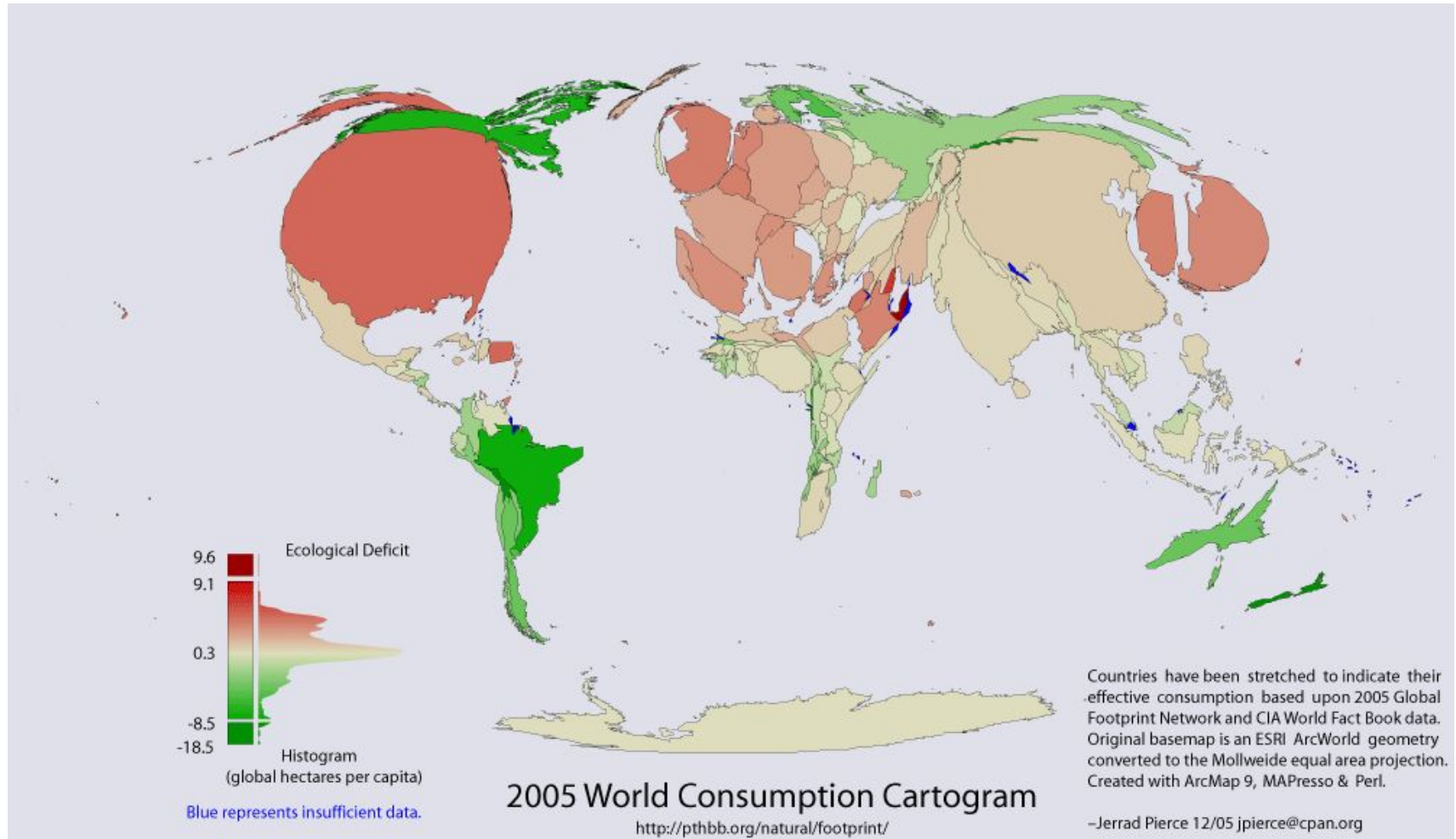


Let's talk about the U.S.

What percentage of the world's population lives in the U.S. (1.3 billion people)?



How much do we (the US) consume?



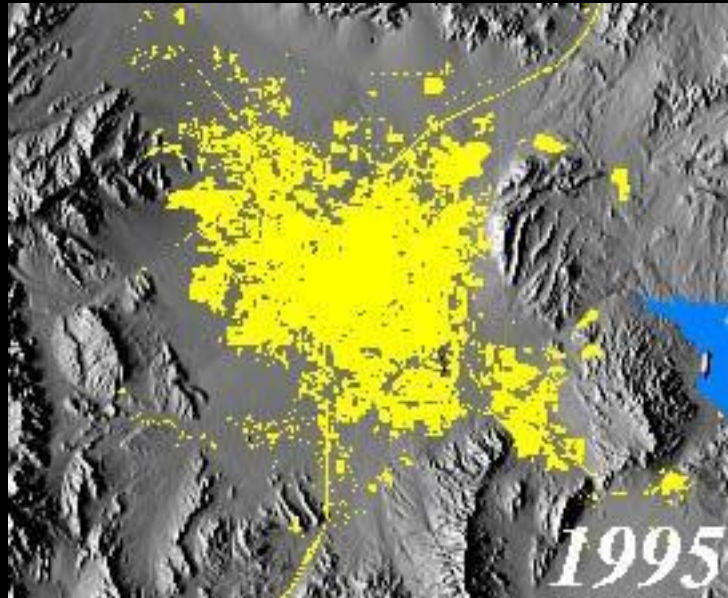
~ 25% of the world's resources



Las Vegas – Fastest growing metropolitan area in the United States



- 1973: A small settlement
- 2000-2006: The landscape is now dramatically modified



Images courtesy USGS

Global Trend #2: More People...More Land Use Change

Paraguay



Near Ootsa Lake, Canada

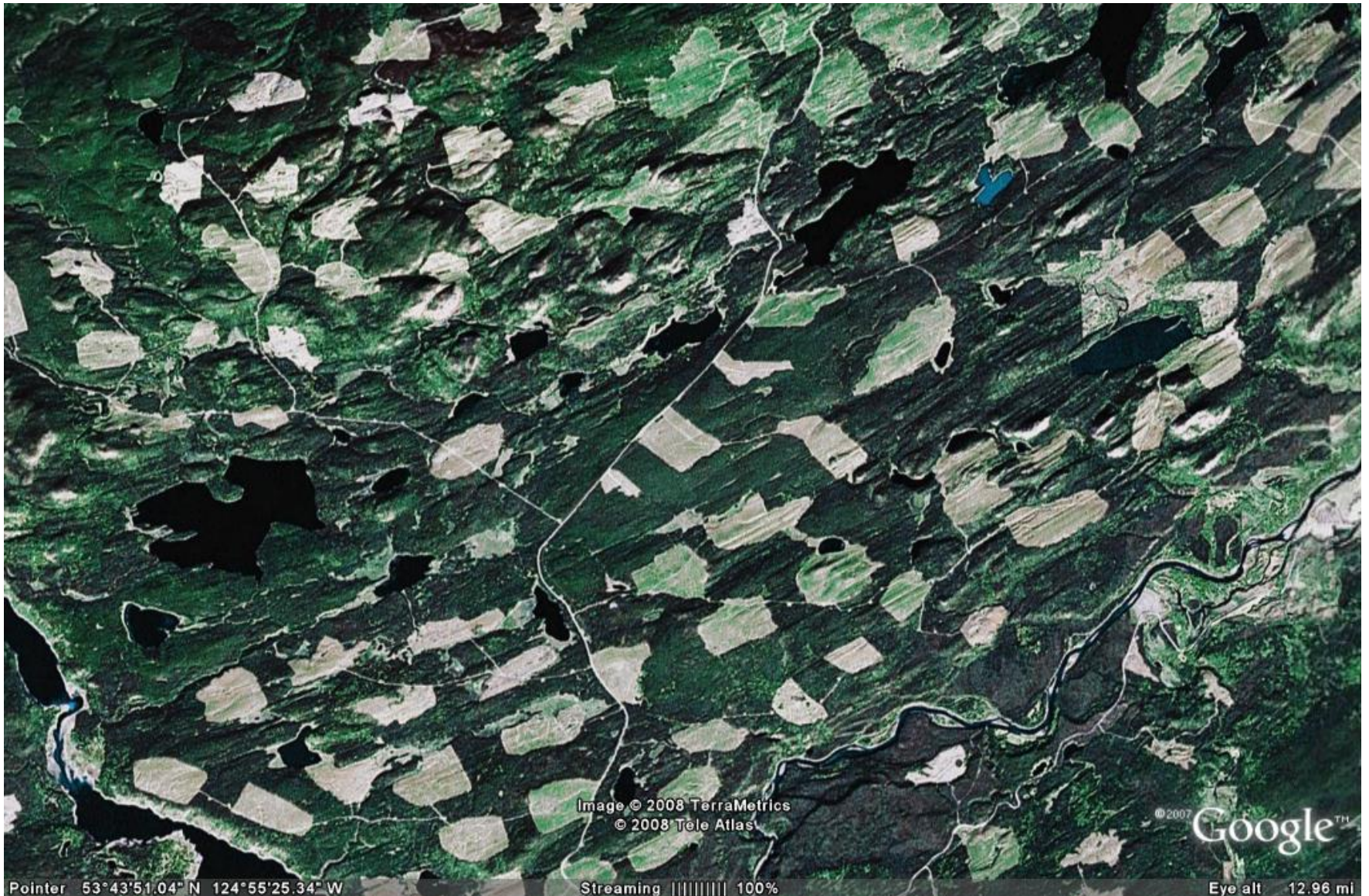


Image © 2008 TerraMetrics
© 2008 Tele Atlas

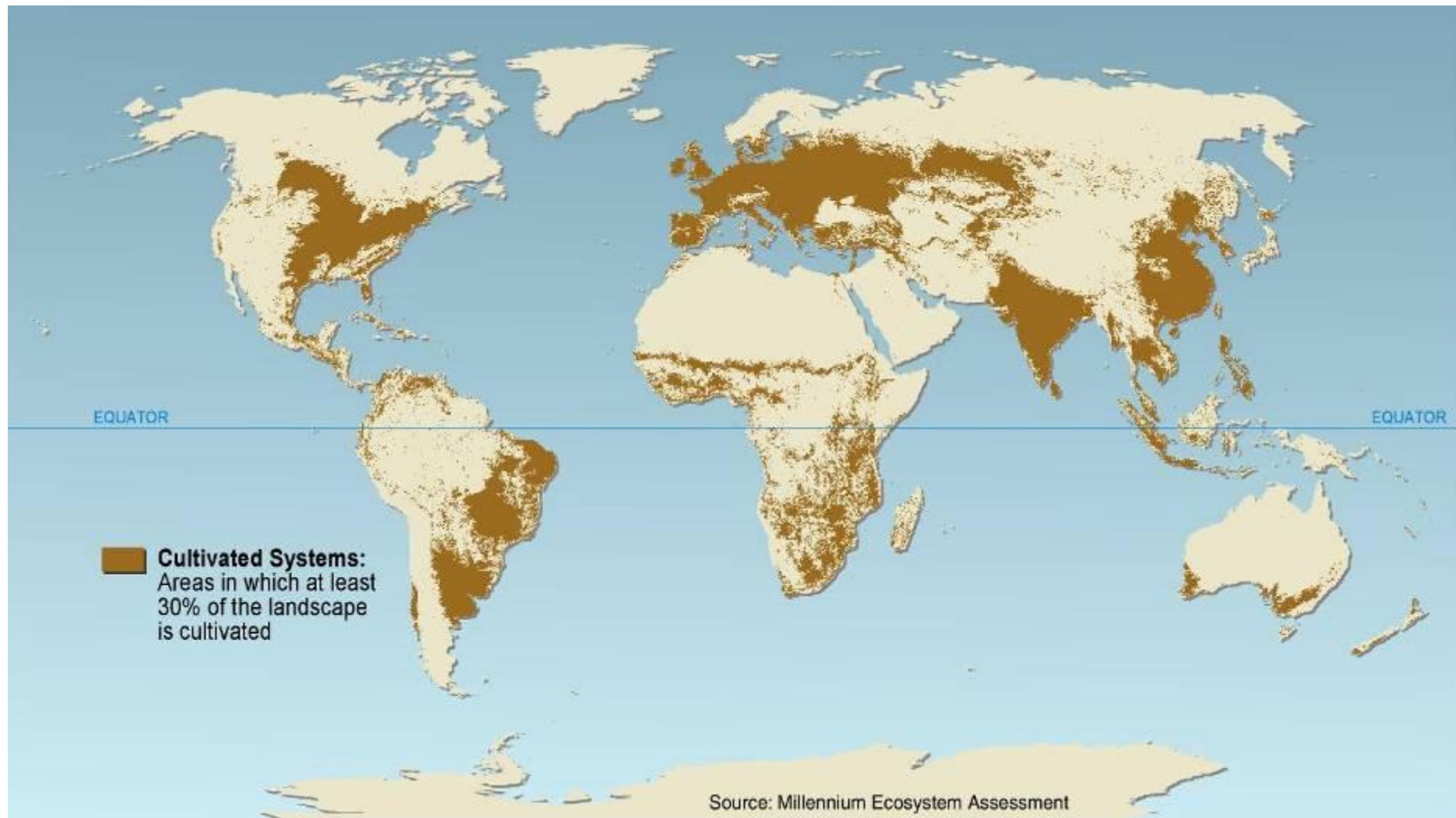
© 2007 Google™

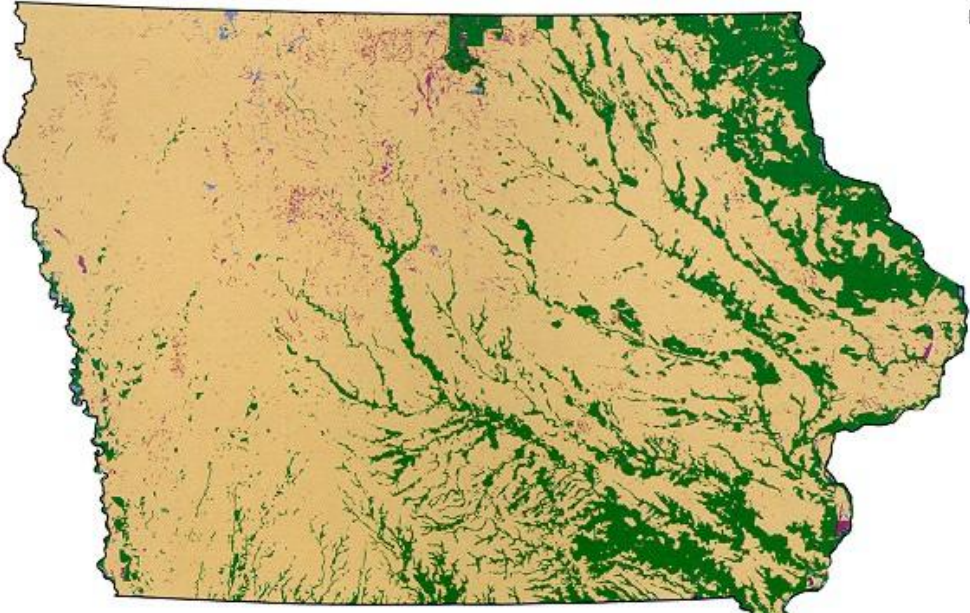
Pointer 53°43'51.04" N 124°55'25.34" W

Streaming ||||| 100%

Eye alt 12.96 mi

More land was converted to cropland in the 30 years after 1950 than in the 150 years between 1700 and 1850.





1850s Landcover Map of Iowa

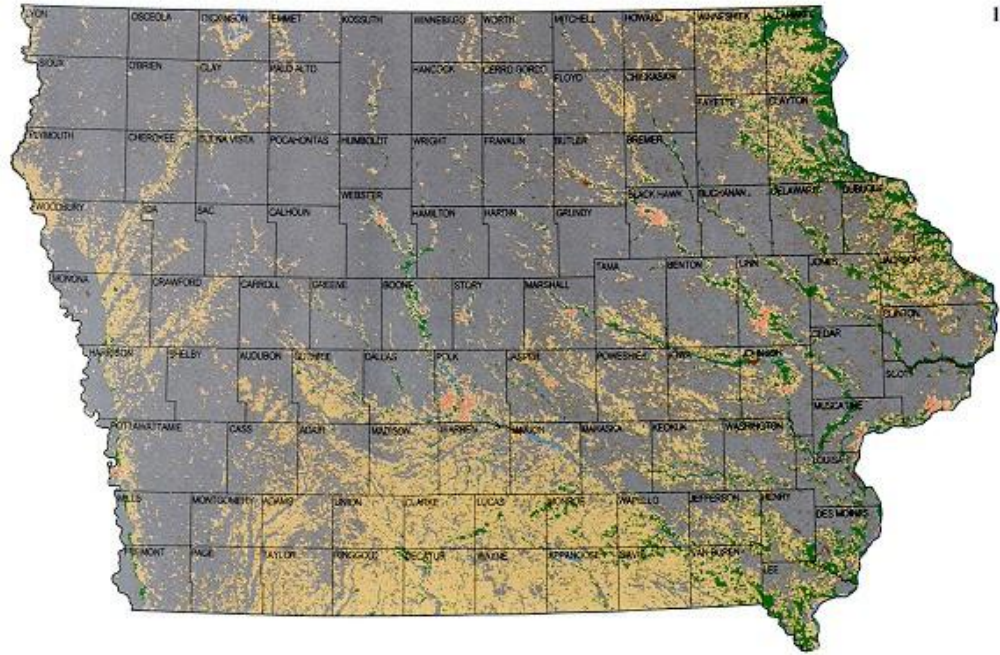
- Prairie
- Forest
- Wetland
- Water

Iowa, 1850s

Yellow: Prairie

Iowa, 1990s

Gray: Row Crops



1990s Landcover Map of Iowa

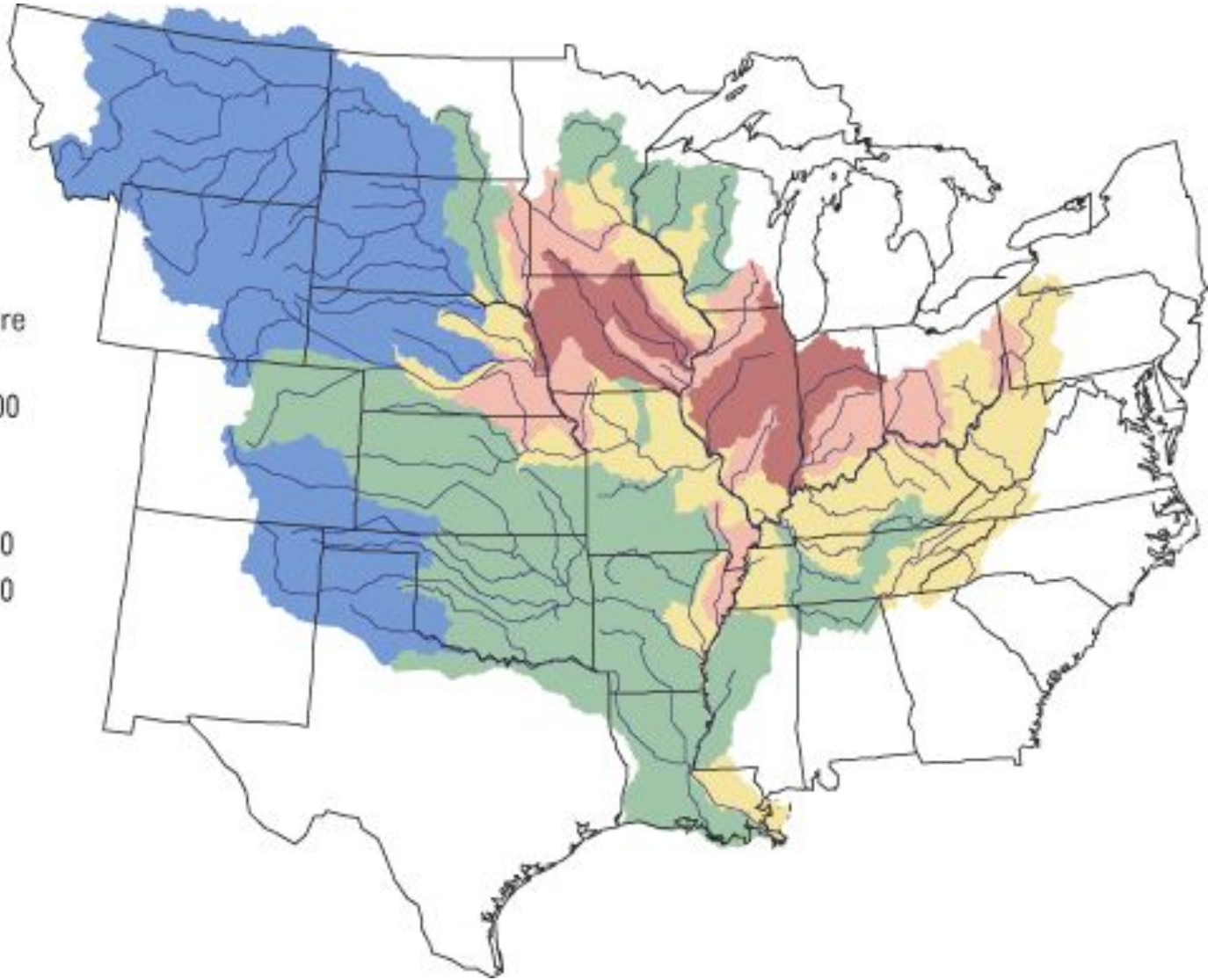
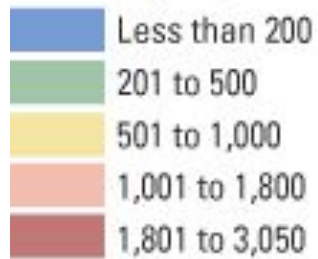
- Urban / r
- Grassland
- Forest
- Row crop
- Barren
- Water

Source: Compiled from Landsat Thematic Mapper satellite imagery, Iowa Dept. of Natural Resources.

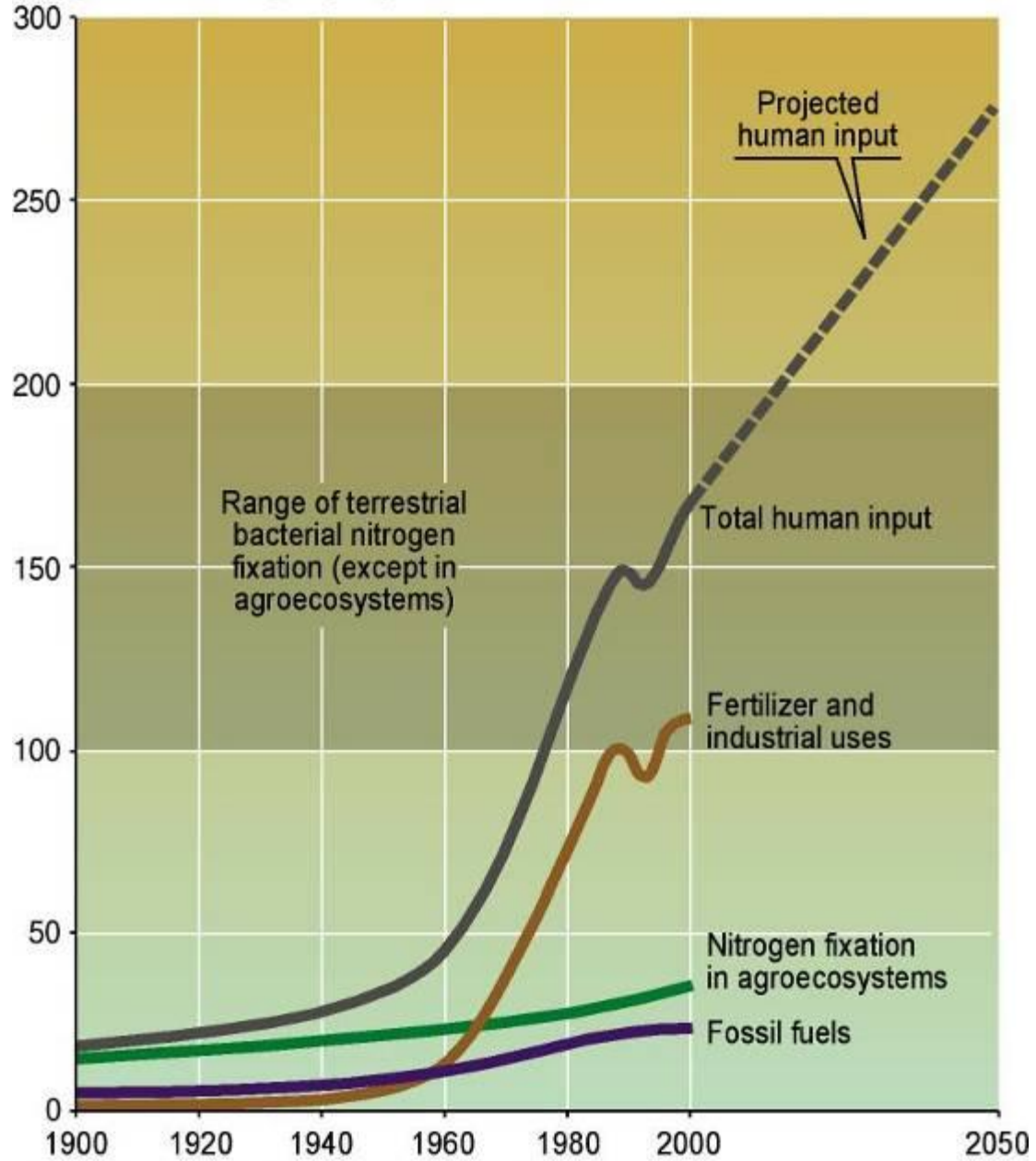
Consequences of Increasing Cropland

EXPLANATION

Nitrogen yield, in kilograms per square kilometer per year



Teragrams of nitrogen per year

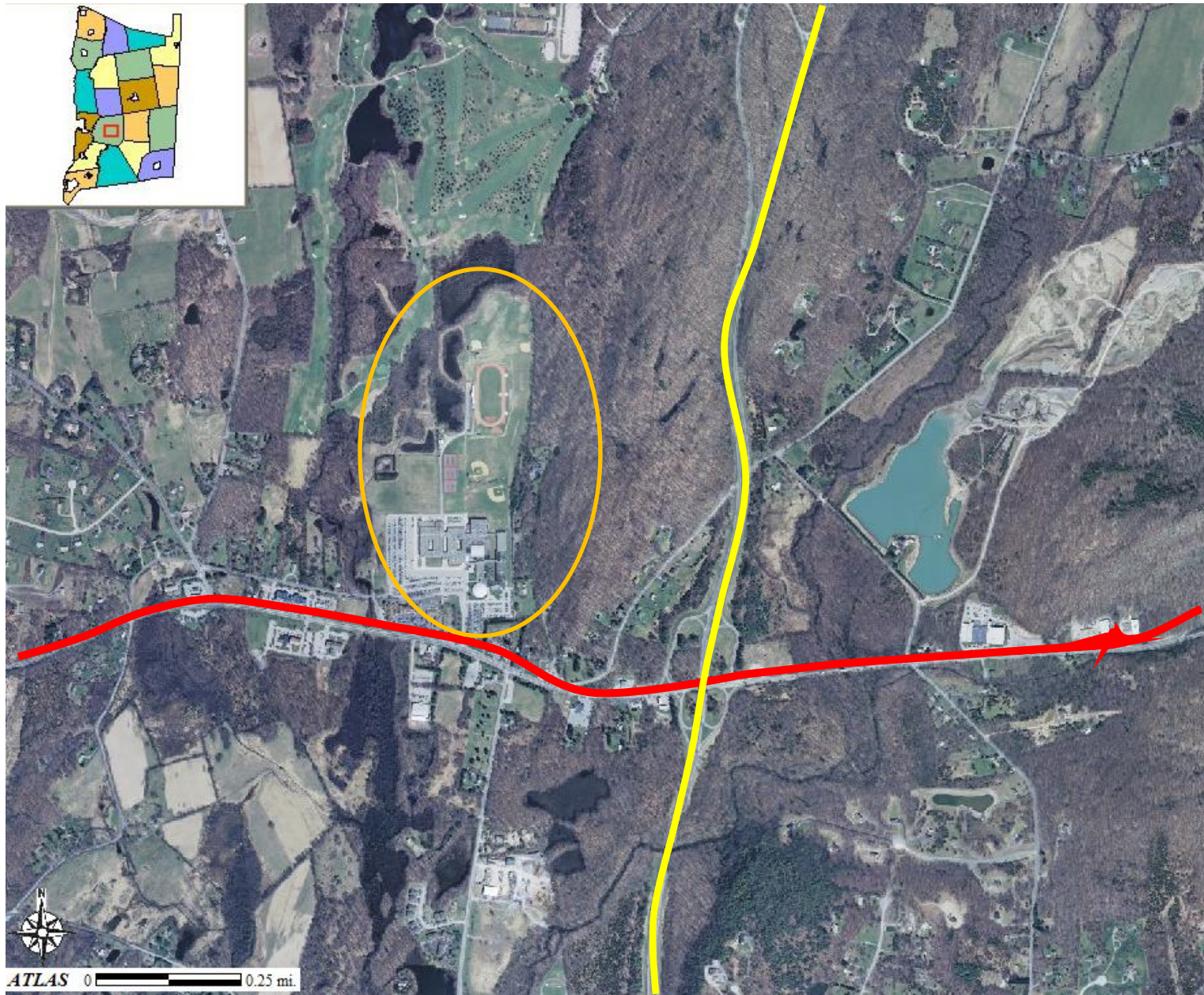


Source: Millennium Ecosystem Assessment

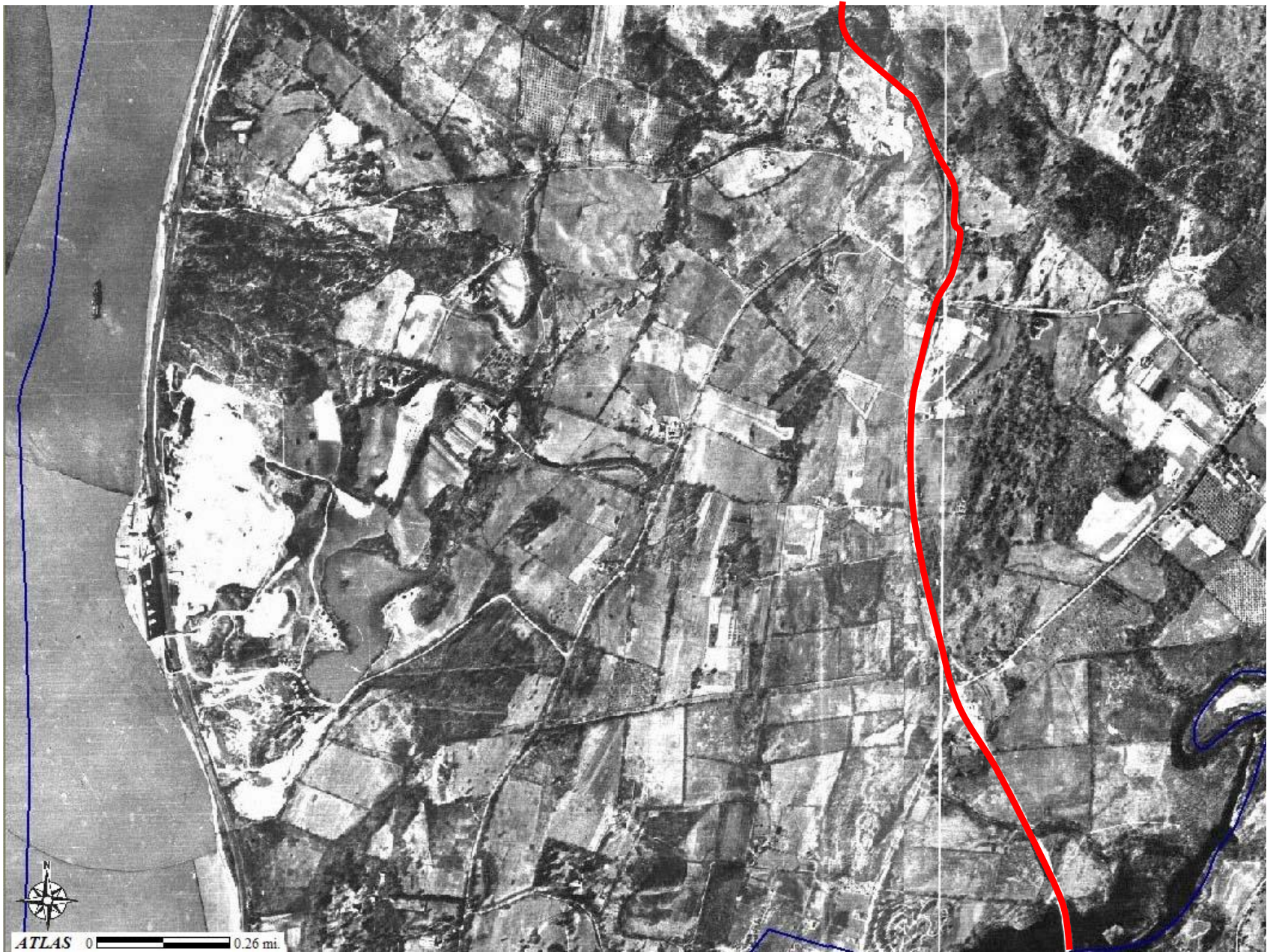
What about us?

What do you think was here
70 years ago?

How do you think it has
changed?



2004: Arlington High School in middle left, Taconic Parkway runs north/south, Rt 55 runs east/west



1936: Rt 9, site of current Galleria mall,
small quarry visible next to river

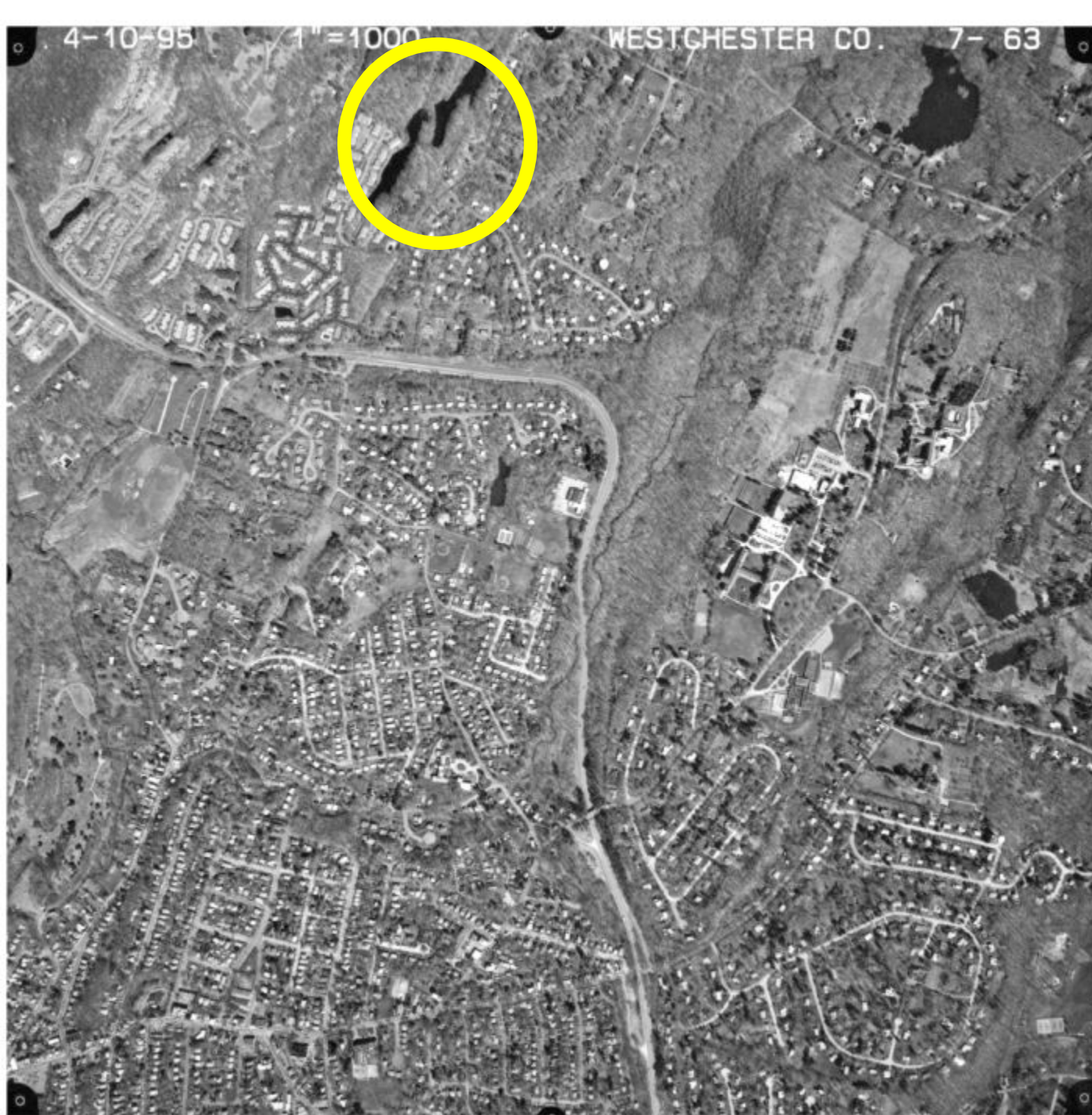


2004: Poughkeepsie Galleria on right hand side,
gravel quarry next to river



Ossining, 1925

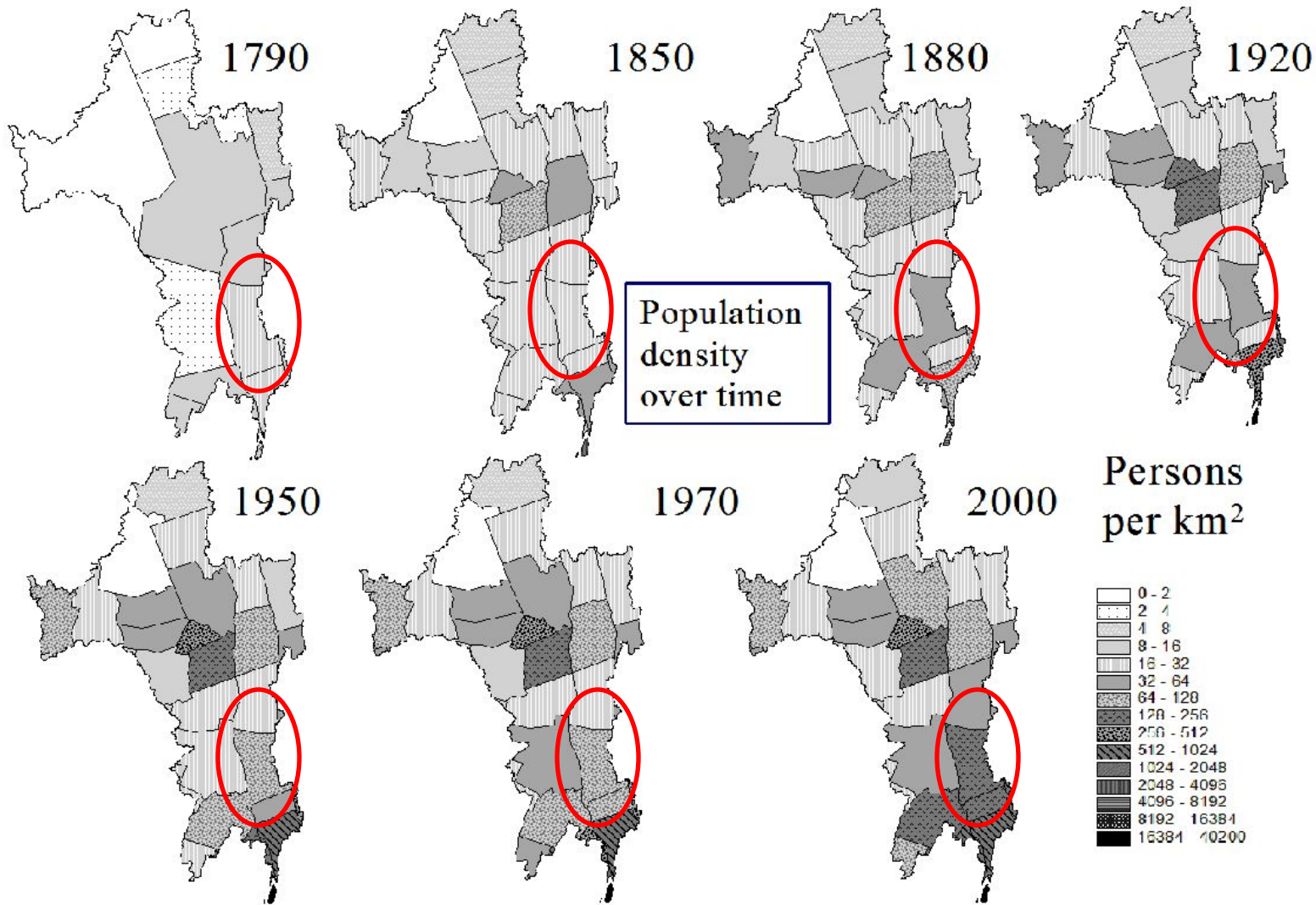
Use the small lakes in
the upper left hand
corner as reference.



Ossining,
1995

You live in: The Hudson River Watershed





Population



THE GLENS FALLS BOOM.
AT GLENS FALLS, WARREN COUNTY, N. Y.

Why did they cut down all those trees?

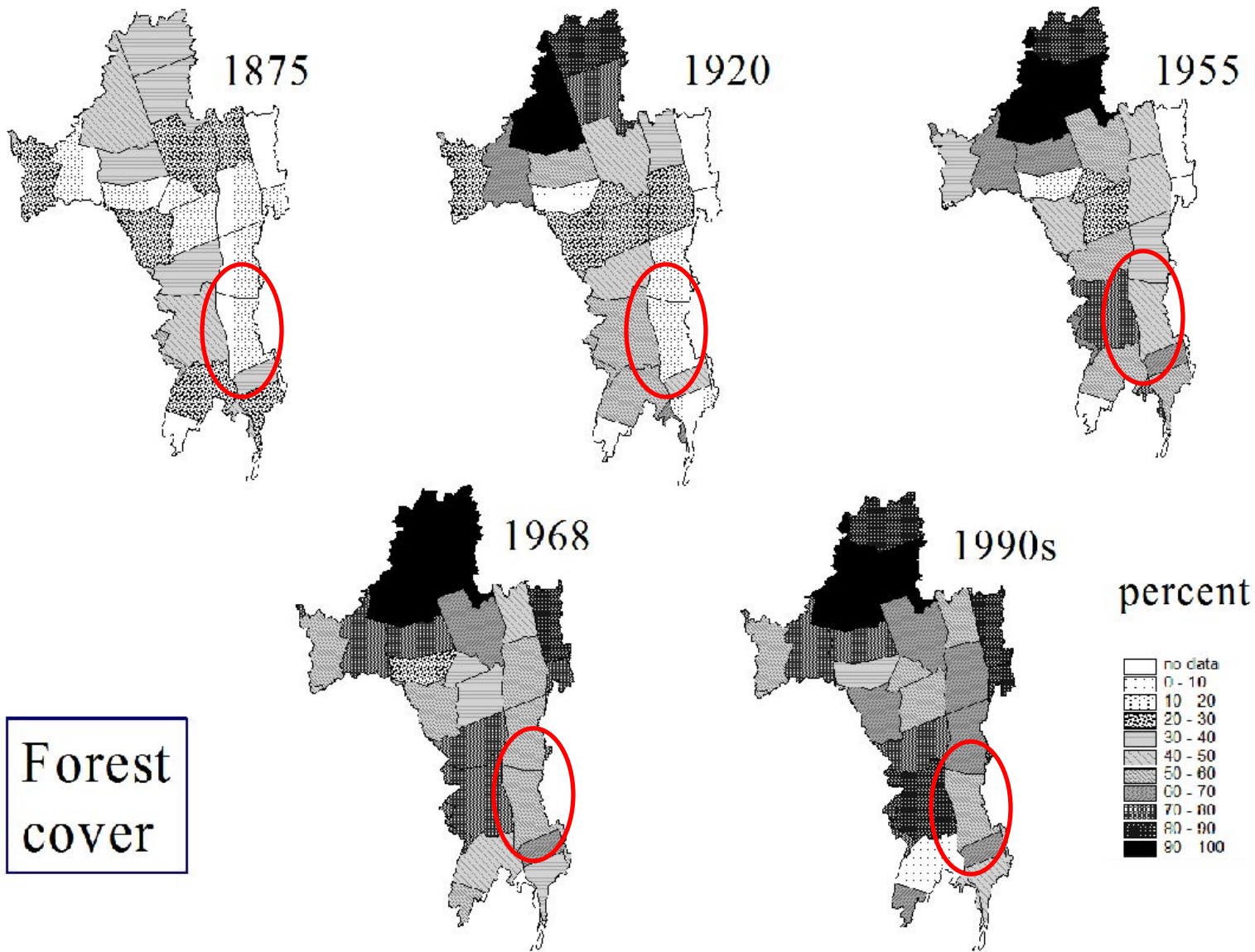
-ship masts & wood for Europe

-tanning

-paper process

INDUSTRY
COLLAPSE:

late 1800s



Source: Swaney et.al 2006

Mid Hudson Valley counties are growing in population, and forest fragmentation is a big problem.



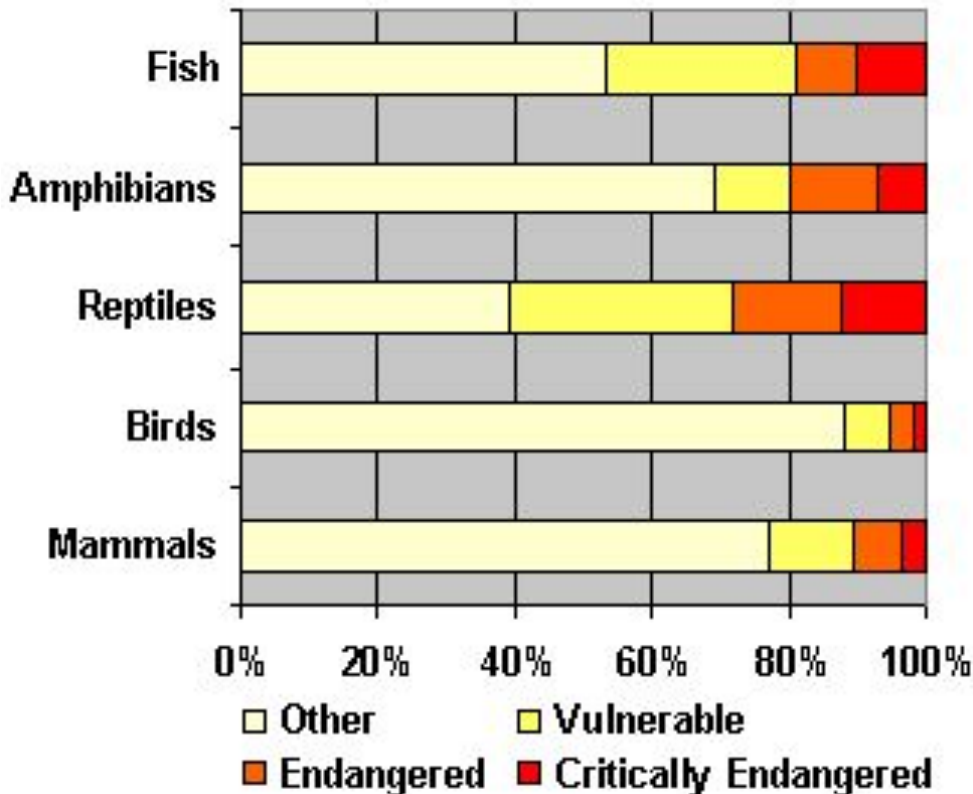
Source: Scenic Hudson

Global Trend #3: Species Changes



Photo courtesy of DEC, NYS

Endangered Species by class



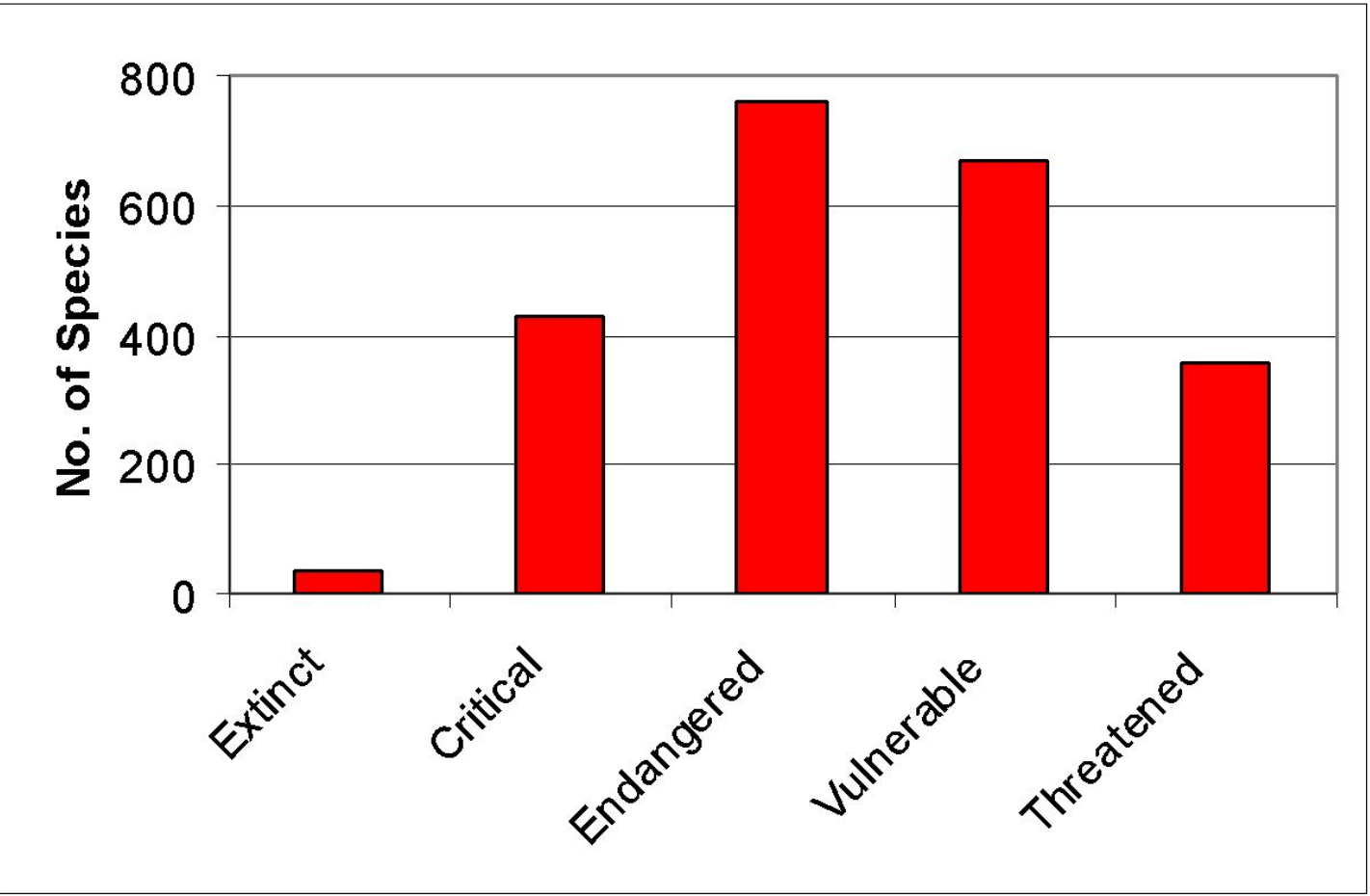
International Union for Conservation of Nature **Red List**

Taxa	% Threatened
Mammals	22
Birds	12
Reptiles	30
Amphibians	31
Fishes	39
Invertebrates	51



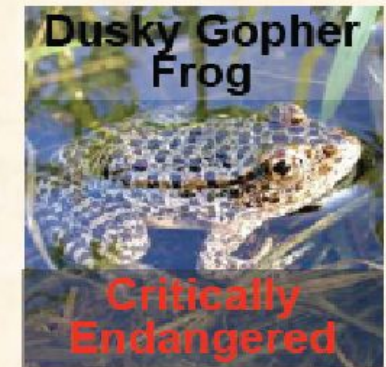
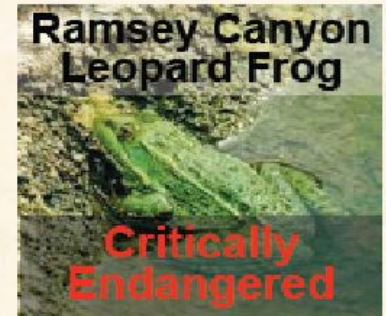
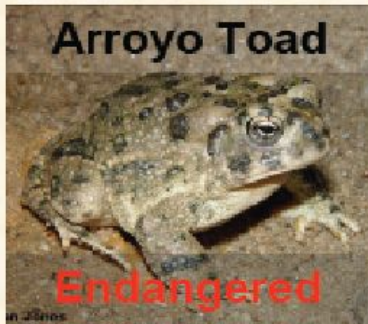
Threatened = Critically endangered, endangered, vulnerable
Less than 0.3% of invertebrates have even been evaluated!

Amphibians (Frogs, Toads, Newts, Salamanders, Caecilians) Are Declining Globally



Total Species 5 Categories = 2250
Total Number of Species = 5743

North American frogs



Global change – global warming



Global warming moves cloud banks higher, compressing cloud forest habitat

- 1) Facilitates invasion by lower elevation species
- 2) "Stresses" individual frogs
- 3) Leads to fewer pools and crowded populations...

ideal conditions for epidemic disease

Causes

- Habitat destruction
- Exploitation
- Disease
- Climate change
- Exotic species
- UV radiation
- Chemical contamination
- Synergisms



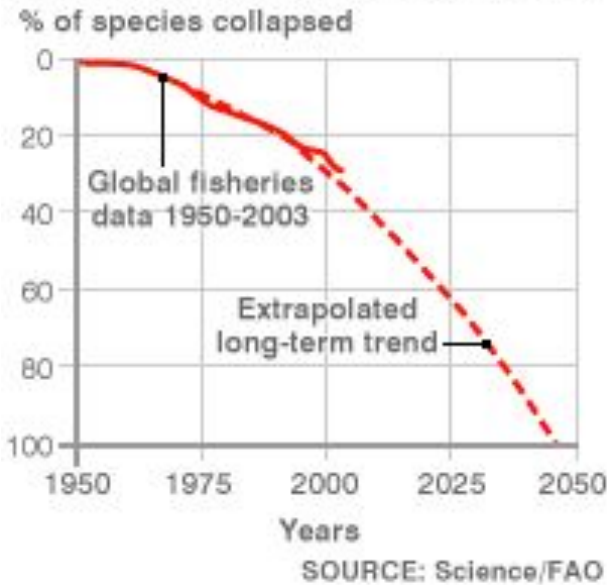
Fish Declines

Causes

- invasive species
- global warming
- overfishing
- pollution (erosion, eutrophication)



GLOBAL LOSS OF SEAFOOD SPECIES



Coral Reef Decline

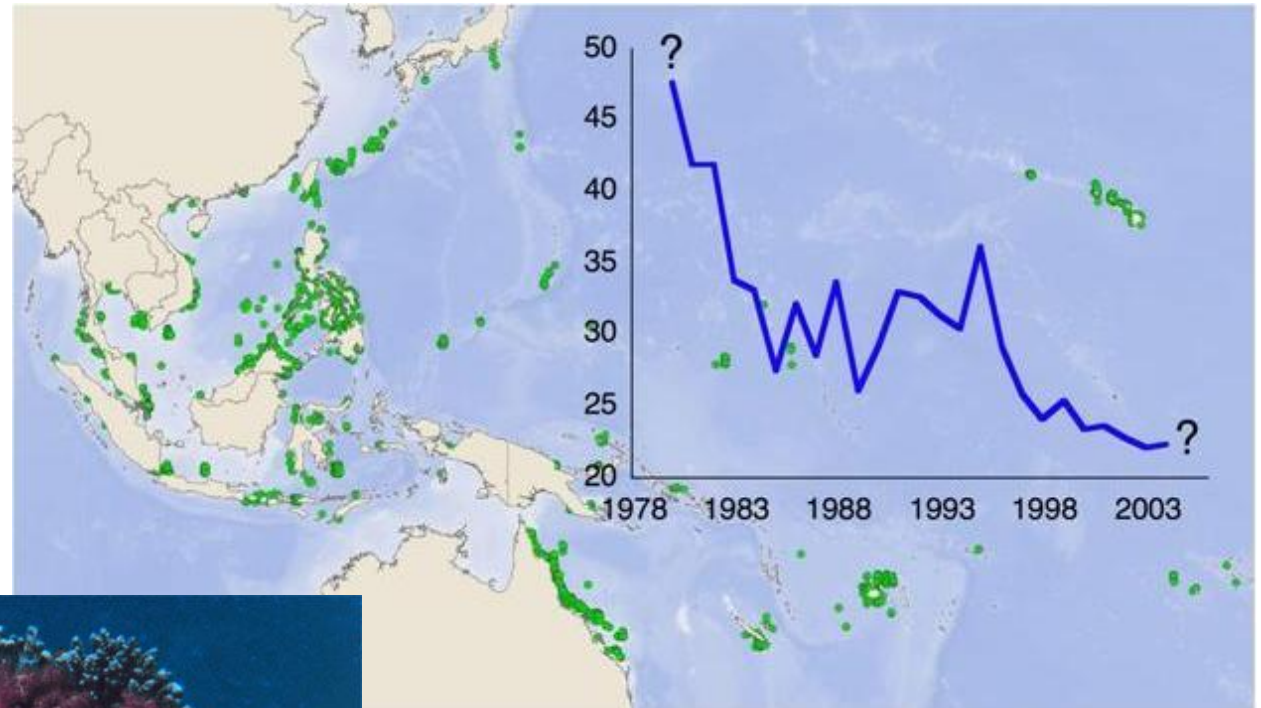
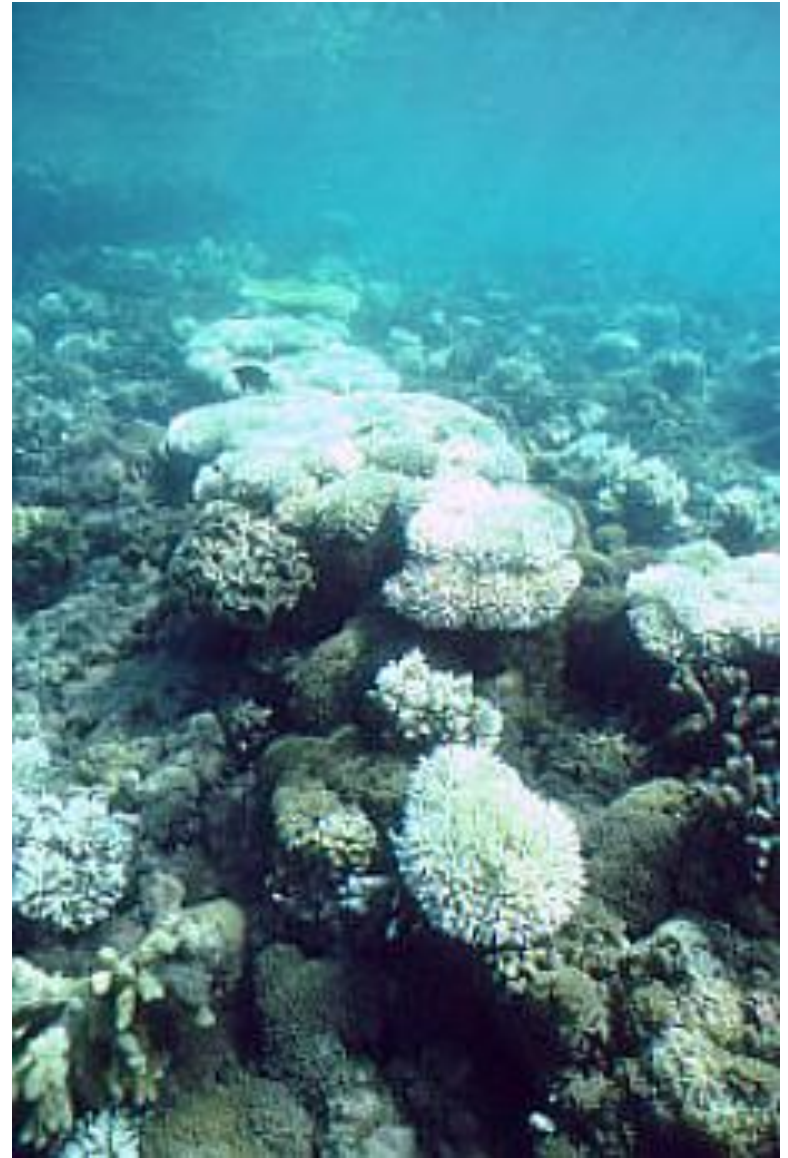


Figure: Map of the Indo-Pacific study region. Green dots are the reefs that were surveyed between 1980 and 2004. Inset graphic illustrates the loss of coral (left axis is the percentage of the bottom covered by living corals) over a 25 year period. There is substantial uncertainty about regional reef health in the 1970s and about the historical baseline of coral cover before humans began altering reefs across the region in the 20th century. There is also no way to know what the near-term future of reefs will be. Credit for graphic: J. Bruno and E. Selig. Data are based on Bruno and Selig 2007

Causes:

- Climate change (bleaching)
- Toxification (ocean acidification)
- Land use change (sedimentation)
- Exotics (disease)
- Loss of biodiversity (Exploitation)



Source: www.aims.gov.au

Species Changes at Home: Invasions



Carp from the Hudson River

Photo: C. Harris



Source: www.clearwater.org



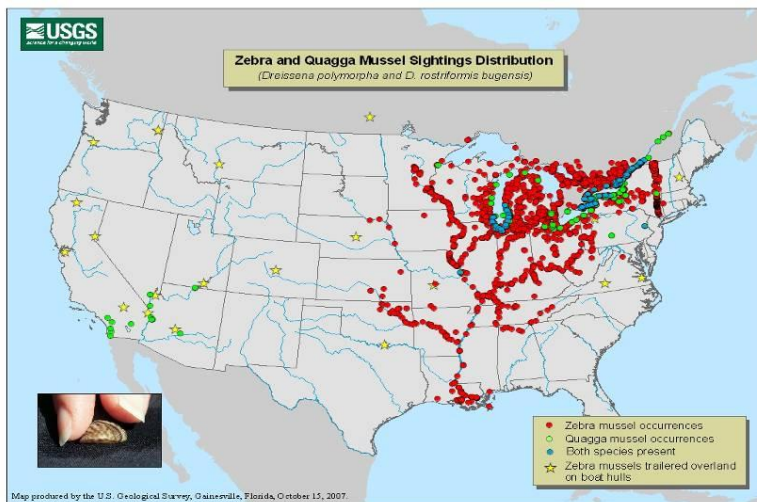
Inbocht Bay, south of Catskill on the Hudson River, covered in water chestnut (*Trapa natans*)



<http://www.dgif.state.va.us/zebramussels/>

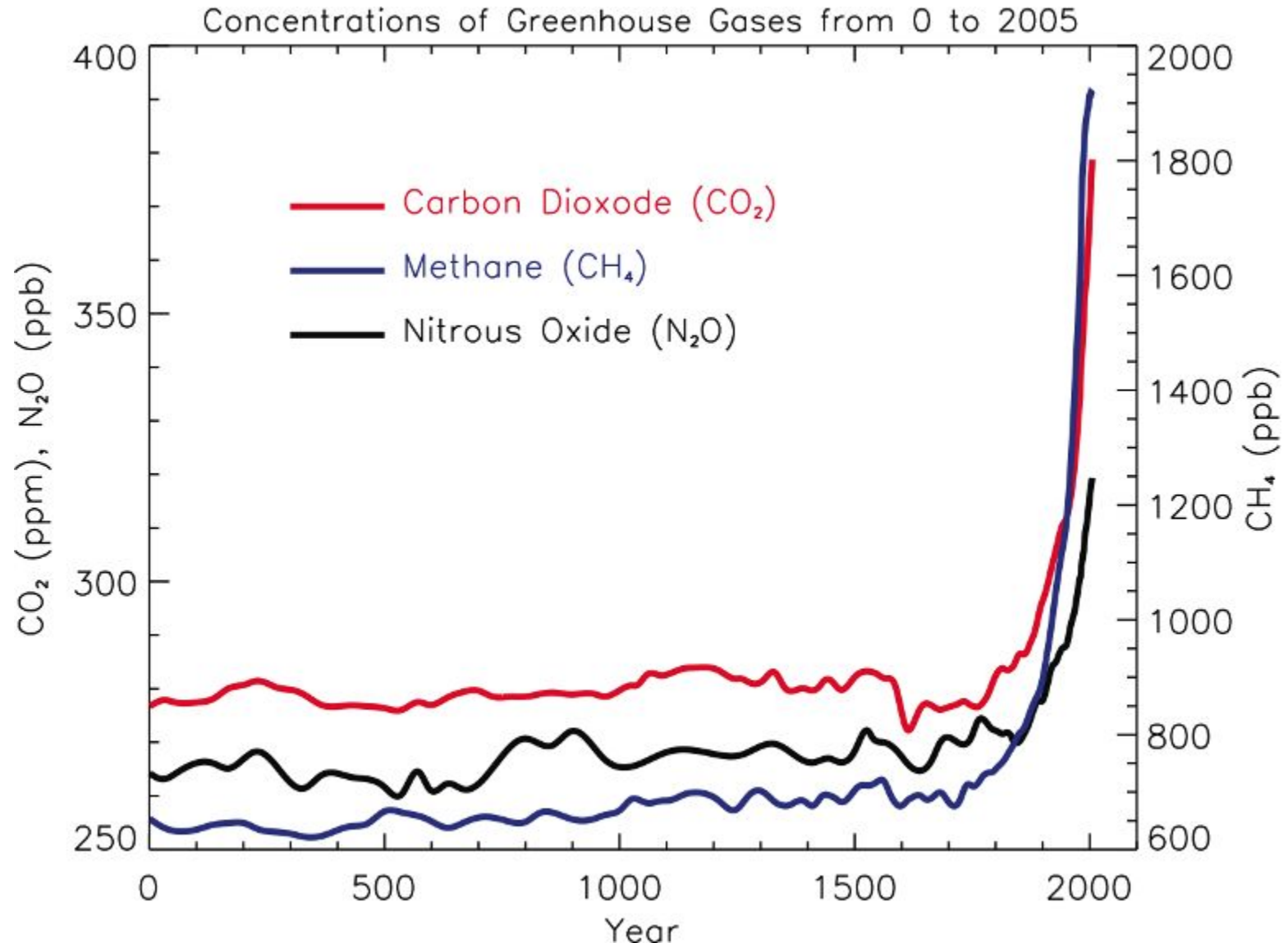


www.zeestop.com



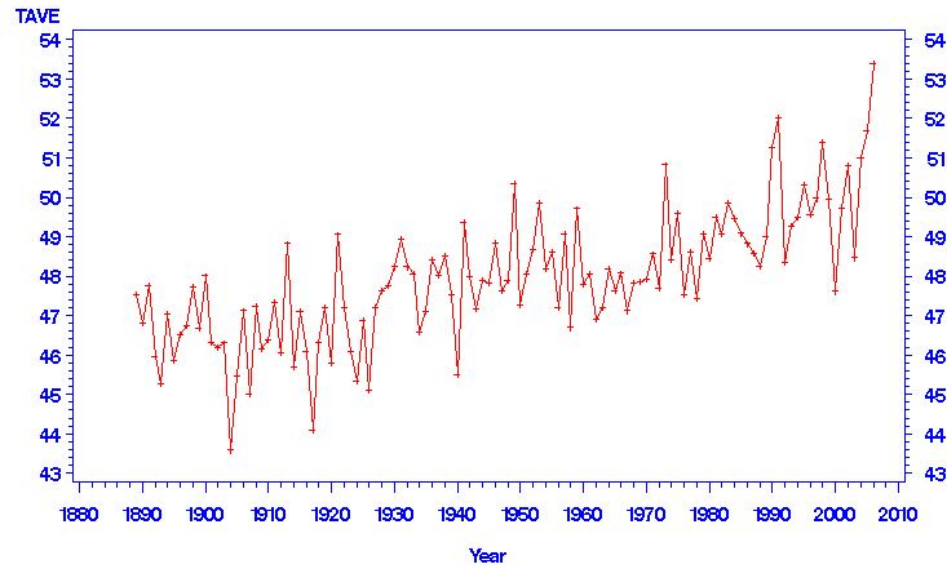
A map showing the distribution of zebra mussels and quagga mussels, another invasive. (USGS, 2007. Zebra Mussel Information: U.S. Distribution Maps, <http://nas.er.usgs.gov/zebra.mussel/>).

Global Trend #4: Increasing Greenhouse Gases

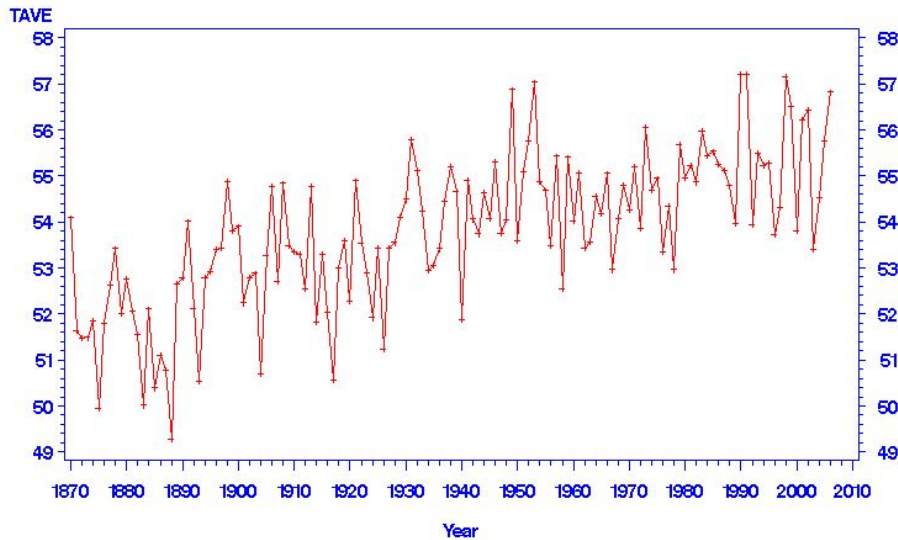


Increasing Temperatures

USHCN 306820, POUGHKEEPSIE, NY
Annual mean of Monthly mean temperature (F) 1830 – 2006



USHCN 305801, NEW YORK CENTRAL PARK, NY
Annual mean of Monthly mean temperature (F) 1835 – 2006



Source: CN Williams Jr., MJ Menne, RS Vose, DR Easterling, NOAA, National Climatic Data Center, Asheville, NC



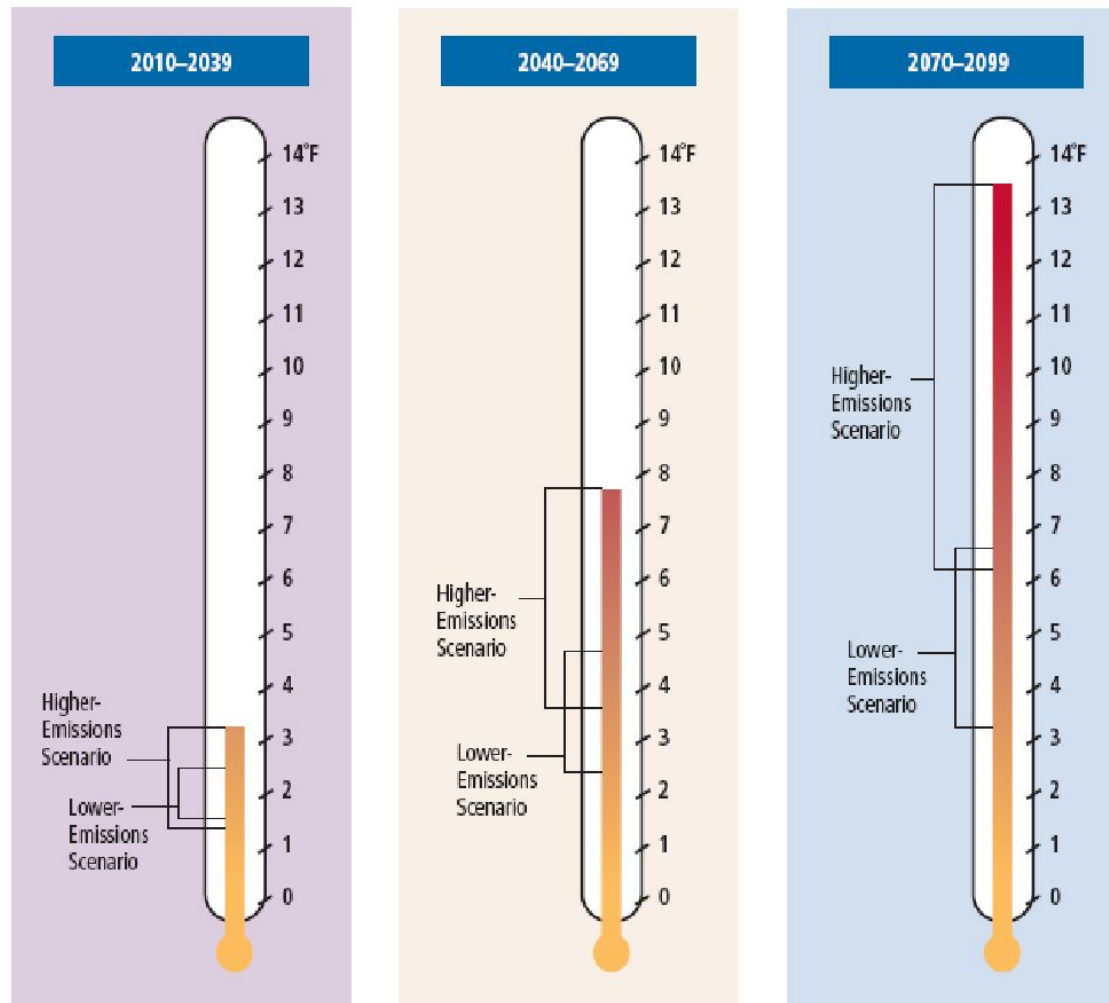
Pasterze Glacier 1875



Pasterze Glacier (site), Austria

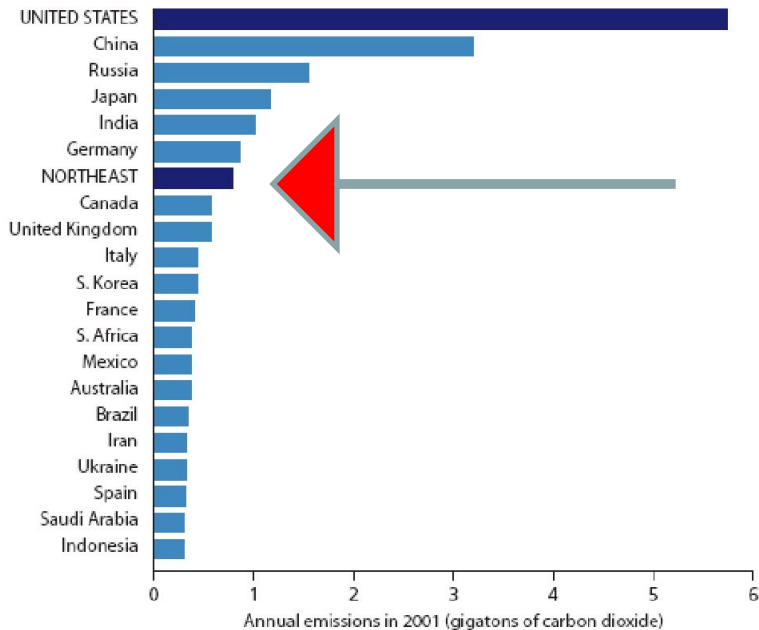
Northeast Climate Report: 2007

FIGURE 1: Changes in Regional Average Summer Temperature

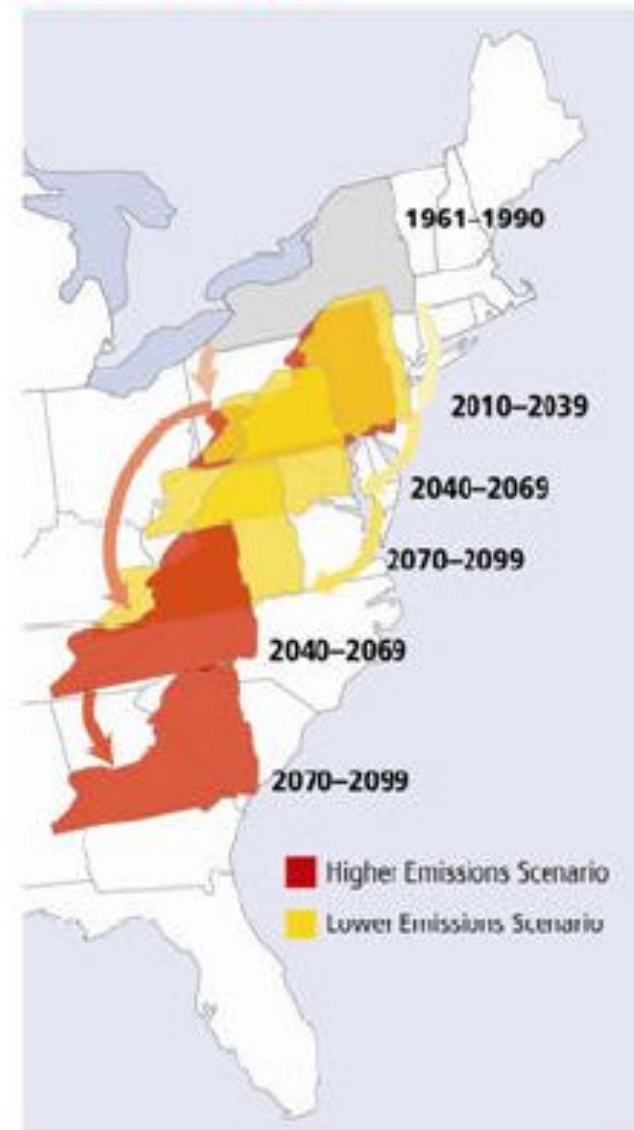


Two Emissions Scenarios

FIGURE 14: Northeast U.S. Emissions: Significant on a Global Scale



Upstate New York



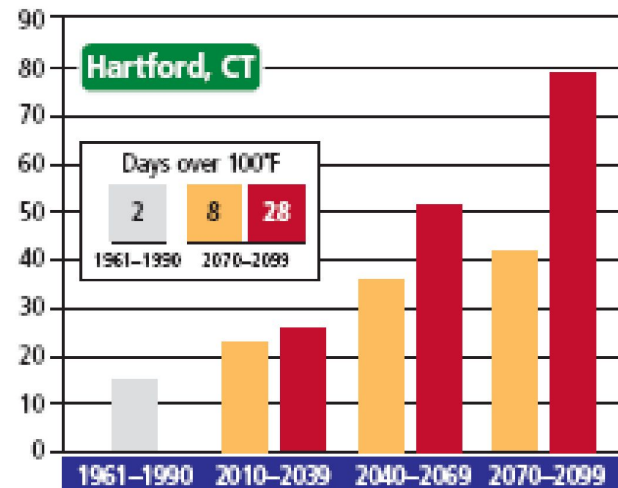
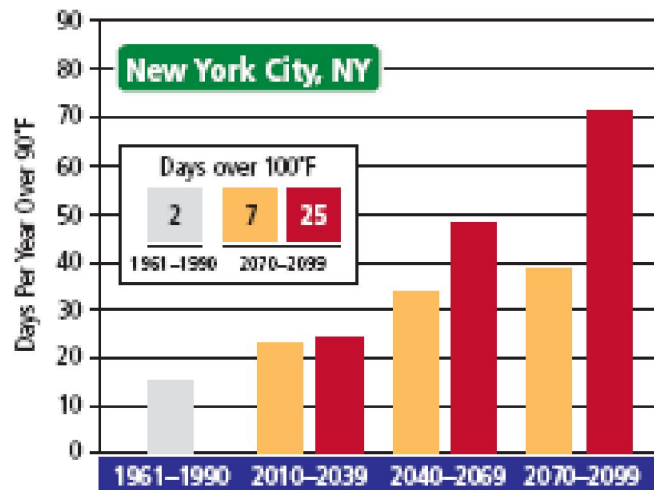


NYC: Today's 100-Year Flood Could Occur Every 10 Years under the Higher-Emissions Scenario⁴⁰

The light blue area in these maps depicts today's FEMA 100-year flood zone for New York City (i.e., the area of the city that is expected to be flooded once every 100 years). With additional sea-level rise by 2100 under the higher-emissions scenario, this approximate area is projected to have a 10 percent chance of flooding in any given year; under the lower-emissions scenario, a 5 percent chance. As the close-up shows, critical transportation infrastructure located in the Battery could be flooded far more frequently unless protected. The 100-year flood at the end of the century (not mapped here) is projected to inundate a far larger area of New York City, especially under the higher-emissions scenario.

Human Health

- Increased number of 100+ degree days
- Increased pollen-based allergies (trees in spring, grasses in summer, ragweed in fall)
- Mosquito born diseases increase



Your Turn

- Summarize the major changes in the environment
- How does each problem affect the others?
- What might be some possible solutions?

